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AMPHIBIANS AND LAND REPTILES OF PORTO RICO

With a List of Those Reported from the Virgin Islands

BY KARL PATTERSON SCHMIDT

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INTRODUCTION

The new account of the amphibians and reptiles of Porto Rico and its dependent islands here attempted, while based on the fundamental work of Stejneger (1904), has an independent source in the collections made in the course of the Scientific Survey of Porto Rico and the Virgin Islands undertaken by the New York Academy of Sciences, in cooperation with the Porto Rican government and The American Museum of Natural History. These collections consist of a total of 1435 specimens, representing 33 of the 42 forms in the area covered by this report.

In the course of investigations on other groups of animals, 103 specimens of amphibians and reptiles were collected by F. E. Lutz, J. T. Nichols, R. W. Miner, H. E. Anthony and T. H. Jones previous to 1919.

It was my good fortune to conduct the first specifically herpetological field-work for this Survey in the summer of 1919, and for this opportunity I am indebted primarily to Miss Mary C. Dickerson, then Curator of Herpetology at The American Museum of Natural History, and to Dr. Henry C. Crampton, Dr. N. L. Britton and Dr. Ralph W. Tower, of the Porto Rico Committee of the New York Academy of Sciences. In carrying out this field-work, Mrs. Schmidt and I spent the period from August 3 to October 8 in investigations on Porto Rico and in making visits to the adjacent islands—Mona, Vieques and Culebra. Our collections amounted to 1253 specimens.

These collections were considerably enriched in 1926, by Messrs. H. E. Anthony and G. G. Goodwin, who collected 74 specimens on Mona Island, and 5 on Caja de Muertos, southeast of Ponce. This material includes a fine series of *Eleutherodactylus monensis*, which was wanting in my Mona Island collection, and the first herpetological specimens from Muertos Island.

ITINERARY AND COLLECTIONS MADE

Mrs. Schmidt and I arrived at San Juan on August 3rd, 1919. The first week of our stay was spent at Santurce, which provided a convenient base for the necessary official visits in San Juan. There we were able also to do some introductory collecting, with our interest stimulated by a tree frog new to Porto Rico that was abundant in the hotel grounds. Rio Piedras and Cataño were also visited from Santurce. The next two weeks (August 11-24) we sojourned at Aibonito, at an altitude of about 2000 feet, in the heart of the coffee-belt. Daily excursions were made in this vicinity. Four days were spent at Coamo Springs, a truly delightful collecting locality, affording numerous species new to our collections.

On August 29 we returned to Santurce for a fresh start. With Mona Island as objective I went alone to Mayagüez (September 3). There I learned that it would be impossible to sail for Mona until September 6. This delay enabled me to make a productive trip to Maricao. The week of September 7-13 was spent in the trip to Mona Island, on which I was accompanied by E. M. Brunner, Forester of Porto Rico.

Returning to Santurce, where specimens were meanwhile accumulating, thanks to the interest of B. A. Wall, of Bayamon, we packed and stored the collection. On September 18 we left by rail for Ensenada, where we enjoyed the hospitality of Superintendent Boyd, of the Guanica Central, at "Canary Cottage."

Again returning to Santurce (September 28) I set forth on a three-days trip to El Yunque, where I camped in the Forester's Cabin at 1200 feet altitude, climbing to the peak on September 30. This was followed by a brief trip to Vieques and Culebra islands by means of a sloop chartered at Fajardo. On October 8 we sailed from San Juan for New York.

OTHER MATERIAL EXAMINED

Besides the material collected by the Survey of Porto Rico and the Virgin Islands, all of which is deposited in The American Museum of Natural History, I have had the privilege of examining, thanks to the courtesy of Dr. W. C. F. McClure, the Porto Rican collection preserved at Princeton University.

Dr. Stuart T. Danforth, of the University of Porto Rico, at Mayagüez, kindly sent me both his personal collections and those of the University for examination in connection with this report.

PLAN OF WORK

"The Herpetology of Porto Rico" by Dr. Leonhard Stejneger (1904) is a work of exceptional merit. It remains a model for the exact and complete description of an insular fauna, and sets a high standard for systematic zoology in general. It is a pleasure to record here the usefulness of this volume. A copy accompanied me to Porto Rico in 1919 and proved most serviceable as a field manual, making possible the identification of most of the species and thus facilitating all phases of field study.

It was my first plan to prepare merely a supplement to Dr. Stejneger's report, embodying only the additions to our knowledge of the Porto Rican herpetological fauna since 1904. After a review of the necessary additions, in conference with Dr. H. C. Crampton, it was decided, however, to enlarge the scope of the work and present a renewed "complete account" both for the sake of increased usefulness to future students and to bring it into better accord with the similarly complete reports of other contributors to the Survey. The existence of Stejneger's report has greatly simplified the preparation of the present one. In the case of the numerous species whose definition has required no change, I have followed Stejneger's descriptions closely or quoted them verbatim, and I have availed myself of a large number of his text figures, especially for the illustration of key characters. The figures drawn for the present paper are designed to present the habitus of a number of species, and thus supplement Stejneger's otherwise complete illustration of the fauna. These figures are the work of Mrs. E. L. Beutenmüller, whose drawings have embellished so many herpetological papers. The half-tone figure of *Eleutherodactylus unicolor* was supplied through the courtesy of Dr. Stejneger.

I have adopted a conservative position on one phase of nomenclature. Excellent arguments might be advanced for treating several of the Porto Rican forms as subspecies rather than as full species. Such a nomenclature would reflect more information as to the actual relations of the forms concerned than binomial treatment. The species of *Typhlops* allied to *jamaicensis*, the fresh water turtle, and the Mona Island *Ameiva* and *Cyclura* are cases in point. It is very difficult, however, to draw a line between insular subspecies and insular species, and our knowledge of many forms is manifestly imperfect. Any attempt at a trinomial arrangement of *Eleutherodactylus* is obviously impossible. I have accordingly left the matter for future consideration, preferably in connection with a new list of the West Indian fauna as a whole.

So much work still remains to be done on the herpetological fauna of Porto Rico by some resident naturalist, especially with reference to the discrimination of the small tree frogs and their life histories, that the present account of the fauna is hardly more likely to be "final" than was that of Dr. Stejneger more than twenty years previously.

ACKNOWLEDGMENTS

It is a pleasure to acknowledge the cordial furtherance of the present work by the members of the Porto Rico Committee of the New York Academy of Sciences, by my various sometime colleagues of The American Museum of Natural History who took part in the Survey of Porto Rico and the Virgin Islands, and by nearly everyone with whom we came in contact in the course of the herpetological field-work.

We were especially indebted, when in Porto Rico, to Mr. and Mrs. B. A. Wall, of Bayamon; to Mr. E. M. Bruner, Forester of Porto Rico; to Mr. Marc Lejeune, of Mayagüez, to whom I owe the visit to Mona Island; and to Colonel George A. Shanton, Chief of the Insular Police.

In the course of the preparation of the report I have had the most cordial aid from various herpetologists. I have applied for information, for specimens or for advice to Dr. Leonhard Stejneger and Miss Doris Cochran, of the United States National Museum; to Dr. Thomas Barbour and Mr. Arthur Loveridge, of the Museum of Comparative Zoology; to Dr. G. K. Noble and Mr. Clifford H. Pope, of The American Museum of Natural History; to Dr. Emmett Reid Dunn, of Smith College; to Dr. Stuart T. Danforth, of the University of Porto Rico; and to Mr. H. W. Parker, of the British Museum (Natural History).

The friendly criticism and interest of Mr. Herbert F. Schwarz, now editor of the reports of the Survey of Porto Rico, have improved the present paper at innumerable points, both in minor details and in more important matters. My thanks (and still more those of the reader) are due to him for great patience with a difficult manuscript.

PORTO RICAN HERPETOLOGY SINCE 1904

Stejneger presents an excellent historical review of the growth of our knowledge of the amphibians and reptiles of Porto Rico (1904, pp. 553-559). The small but interesting collection secured by W. W. Brown, Jr., on Mona Island in February, 1892, has since come to light and was reported on by myself (1926).

Subsequent to the collections made for the United States National Museum in 1899-1901, no mention of Porto Rican herpetology appeared

until 1913, when Stejneger described the unusually interesting and extremely distinct *Ameiva wetmorei* from Rio Loco, near Guanica. The type was collected by Dr. Alexander Wetmore in the course of his investigations of the Porto Rican bird fauna.

The collections made by Mr. Charles F. Silvester, while on the staff of the expedition of the Carnegie Institution to Porto Rico in 1915, were reported upon by Fowler in 1918. Fowler figures *Ameiva wetmorei* and discusses variation in other species.

The discovery of bones referable to an extinct species of *Cyclura* in a cave near Ciales by Dr. Glover M. Allen and James Lee Peters, in 1917, filled an important gap in the distribution of this typically Greater Antillean genus. The species was described by Barbour (1919), the type being the extremities of a left humerus, with numerous additional limb-bones, jaws and vertebrae. Similar material was collected for the Scientific Survey of Porto Rico and the Virgin Islands by H. E. Anthony in 1916.

The herpetological collecting of the various workers who have taken part in the Scientific Survey of Porto Rico and the Virgin Islands has been described above.

Dr. E. Greywood Smyth, Entomologist for the Porto Rican Agricultural Experiment Station at Rio Piedras, has paid some attention to the amphibians and reptiles and in 1920 published a brief account of the food habits of the Anoles.

The food habits of Porto Rican lizards were subsequently analyzed in some detail by George N. Wolcott, in a paper published in 1924 in the Journal of the Department of Agriculture of Porto Rico.

A small collection made in the course of ornithological investigations in 1924-1925 was reported upon by Stuart T. Danforth (1925 and 1926). This material was subsequently purchased by the Field Museum of Natural History. Mr. Danforth has also collected on Desecheo Island, adding *Ameiva exsul* to the list from that island in 1926.

LISTS OF THE AMPHIBIANS AND LAND REPTILES OF PORTO RICO AND THE ADJACENT ISLANDS

I. PORTO RICO

- | | |
|---|---|
| 1. <i>Bufo lemur</i> | 5. <i>Eleutherodactylus gryllus</i> |
| 2. <i>Bufo marinus</i> * | 6. <i>Eleutherodactylus locustus</i> |
| 3. <i>Leptodactylus albilabris</i> | 7. <i>Eleutherodactylus cramptoni</i> |
| 4. <i>Eleutherodactylus portoricensis</i> | 8. <i>Eleutherodactylus antillensis</i> |

* Introduced.

- | | |
|--|------------------------------------|
| 9. <i>Eleutherodactylus brittoni</i> | 23. † <i>Cyclura portoricensis</i> |
| 10. <i>Eleutherodactylus wrightmanae</i> | 24. <i>Celestus pleii</i> |
| 11. <i>Eleutherodactylus richmondi</i> | 25. <i>Ameiva exsul</i> |
| 12. <i>Eleutherodactylus unicolor</i> | 26. <i>Ameiva wetmorei</i> |
| 13. <i>Hemidactylus mabouia</i> | 27. <i>Amphisbaena caeca</i> |
| 14. <i>Sphaerodactylus macrolepis</i> | 28. <i>Amphisbaena bakeri</i> |
| 15. <i>Anolis cuvieri</i> | 29. <i>Mabuya sloanii</i> |
| 16. <i>Anolis cristatellus</i> | 30. <i>Typhlops platycephalus</i> |
| 17. <i>Anolis gundlachi</i> | 31. <i>Typhlops rostellatus</i> |
| 18. <i>Anolis evermanni</i> | 32. <i>Epicrates inornatus</i> |
| 19. <i>Anolis stratulus</i> | 33. <i>Dromicus stahli</i> |
| 20. <i>Anolis krugi</i> | 34. <i>Alsophis portoricensis</i> |
| 21. <i>Anolis pulchellus</i> | 35. <i>Alsophis antillensis</i> |
| 22. <i>Anolis pouceusis</i> | 36. <i>Pseudemys stejnegeri</i> |

II. MONA ISLAND

The fauna of Mona Island, which adds six species to the above list, is as follows:

- | | |
|--------------------------------------|-------------------------------|
| 1. <i>Eleutherodactylus monensis</i> | 6. <i>Mabuya sloanii</i> |
| 2. <i>Sphaerodactylus macrolepis</i> | 7. <i>Typhlops monensis</i> |
| 3. <i>Anolis cristatellus</i> | 8. <i>Epicrates monensis</i> |
| 4. <i>Cyclura stejnegeri</i> | 9. <i>Alsophis variegatus</i> |
| 5. <i>Ameiva albo guttata</i> | |

III. DESECHEO ISLAND

Desecheo Island is rarely visited. Herpetological specimens were secured by Bowdish in 1901, by Lutz in 1914 and by Danforth in 1926. The species known are:

- | | |
|-------------------------------|----------------------------------|
| 1. <i>Anolis cristatellus</i> | 3. <i>Alsophis portoricensis</i> |
| 2. <i>Ameiva exsul</i> | |

IV. VIEQUES ISLAND

Ten species, all of them identical with Porto Rican forms, are known from the island of Vieques. These are:

- | | |
|---|---------------------------------|
| 1. <i>Leptodactylus albilabris</i> | 6. <i>Anolis pulchellus</i> |
| 2. <i>Eleutherodactylus antillensis</i> | 7. <i>Anolis cuvieri</i> |
| 3. <i>Sphaerodactylus macrolepis</i> | 8. <i>Ameiva exsul</i> |
| 4. <i>Anolis cristatellus</i> | 9. <i>Mabuya sloanii</i> |
| 5. <i>Anolis stratulus</i> | 10. <i>Alsophis antillensis</i> |

V. CULEBRA ISLAND

The Culebra fauna lacks *Sphaerodactylus*, which has doubtless merely been overlooked. It adds a Virgin Island form, *Dromicus exiguus*, to the fauna under consideration. Its species are:

<i>Leptodactylus albilabris</i>	<i>Ameiva exsul</i>
<i>Eleutherodactylus antilleensis</i>	<i>Mabuya sloanii</i>
<i>Anolis cristatellus</i>	<i>Dromicus exiguus</i>
<i>Anolis stratulus</i>	<i>Alsophis antilleensis</i>
<i>Anolis pulchellus</i>	

VI. CAJA DE MUERTOS ISLAND

Anthony and Goodwin secured four lizards and a snake from this island during their field-work in 1926. These represent three species:

<i>Anolis cristatellus</i>	<i>Alsophis portoricensis</i>
<i>Ameiva wetmorei</i>	

HABITAT ASSOCIATIONS AND FAUNAL SUBDIVISIONS

Porto Rico includes a wide range of habitat conditions, from the extremely wet mountain rain forest of the Luquillo, where mountain palms and hardwoods are hung with lianas and draped with moss that never dries out, to the opposite extreme of aridity on the southwest corner of the island (near Guanica and Ensenada), where a cactus flora predominates. Some of the types of habitat, with distinct associations of reptiles and amphibians, appear to be the following:

- I. Northern Coastal Plain (Collections secured from Santurce, Rio Piedras, Bayamon and Mayagüez).
- II. Coffee Belt, 900-2000 ft. (Collections from Aibonito and Maricao).
- III. Deforested Hilltops, above 2000 ft. (Collections secured at Aibonito and Maricao).
- IV. High Rain Forest, 1200-3485 ft. (Collections secured from El Yunque, Luquillo Forest Reserve).
- V. Pepino Limestones (Collection from Cataño).
- VI. Arid Limestones, southwestern Porto Rico (Collections from Coamo Springs, Ensenada and Salinas).

This list is quite inadequate from an ecological standpoint and in it only II, III and IV approach the definition of Biotopes, with recognizable Biocoenoses.

Turning first to the distribution of the fauna in Porto Rico itself, a

number of corrections are necessary in the account of the vertical distribution given by Stejneger. These will be presented in detail below, in the systematic discussion of the species. In general, recent observations show that altitude in itself has played a relatively small part in determining the distribution of the fauna. Thus *Anolis pulchellus*, which Stejneger believed to be confined to the coastal plain, below 500 feet, is present at all altitudes, at least up to 2000 feet, in open fields; and *Anolis krugi*, for the most part confined to the coffee belt, is found as far down as Coamo Springs (500 ft. alt.) where the conditions of moisture and shade are suitable. The species which are abundant at the lower altitudes (i. e., on the coastal plain) and extend in varying degrees into the higher are the following:

- | | |
|---|-------------------------------------|
| 1. <i>Bufo lemur</i> * | 12. <i>Ameiva exsul</i> * |
| 2. <i>Leptodactylus albilabris</i> | 13. <i>Ameiva wetmorei</i> * |
| 3. <i>Eleutherodactylus portoricensis</i> | 14. <i>Amphisbaena caeca</i> |
| 4. <i>Eleutherodactylus antillensis</i> | 15. <i>Mabuya sloanii</i> * |
| 5. <i>Hemidactylus mabouia</i> * | 16. <i>Typhlops platycephalus</i> * |
| 6. <i>Sphaerodactylus macrolepis</i> | 17. <i>Typhlops rostellatus</i> |
| 7. <i>Anolis cuvieri</i> | 18. <i>Epicrates inornatus</i> |
| 8. <i>Anolis cristatellus</i> | 19. <i>Dromicus stahli</i> |
| 9. <i>Anolis stratulus</i> | 20. <i>Alsophis portoricensis</i> |
| 10. <i>Anolis pulchellus</i> | 21. <i>Alsophis antillensis</i> * |
| 11. <i>Anolis poncensis</i> * | 22. <i>Pseudemys stejnegeri</i> * |

Of these only nine (marked with an asterisk) are, so far as known, confined to the coastal plain, or to altitudes below 500 feet. *Bufo marinus* may now be added to this list.

The species, on the other hand, which do not occur on the coastal plain or at least only as stragglers, are the following:

- | | |
|--|--------------------------------------|
| 1. <i>Eleutherodactylus gryllus</i> | 7. <i>Eleutherodactylus unicolor</i> |
| 2. <i>Eleutherodactylus locustus</i> | 8. <i>Anolis gundlachi</i> |
| 3. <i>Eleutherodactylus cramptoni</i> | 9. <i>Anolis evermanni</i> |
| 5. <i>Eleutherodactylus brittoni</i> | 10. <i>Anolis krugi</i> |
| 5. <i>Eleutherodactylus richmondi</i> | 11. <i>Celestus pleii</i> |
| 6. <i>Eleutherodactylus wightmanae</i> | 12. <i>Amphisbaena bakeri</i> |

Of these *Eleutherodactylus cramptoni*, *E. unicolor* and *E. richmondi* and *E. locustus* are confined, so far as known, to the peak of El Yunque: the others are probably most abundant in the coffee belt. Since nearly two-thirds of the coastal-plain species overlap the coffee belt in dis-

tribution, it seems obvious that the distribution in altitude offers little basis for a faunal division. The changes due to cultivation, it may be assumed, have played an important part in the present distribution. The clearing of lowland forests, for example, has undoubtedly driven species to the coffee belt and to the residual forests, while the clearing of the hills has probably afforded access to the higher altitudes in the case of species originally confined to the more open spaces in the coastal plain.

The coastal-plain fauna, however, is not a homogeneous one. *Anolis poncensis* and *Ameiva wetmorei* and possibly *Alsophis antillensis* are confined to the arid or semiarid southwestern part of the island, and *Eleutherodactylus antillensis*, *Anolis cuvieri*, *Typhlops platycephalus* and *Typhlops rostellatus* have not been recorded from that part of the island. *Anolis poncensis* and *Ameiva wetmorei* are two of the most peculiar and striking species in the entire fauna, the latter being more closely related to species in Hispaniola and St. Croix than to other Porto Rican forms. I propose, then, to divide Porto Rico faunally into a humid district, comprising the greater part of the island, characterized by the presence of *Eleutherodactylus antillensis*, *Anolis cuvieri* and *Typhlops rostellatus* (besides the species of *Eleutherodactylus* confined to El Yunque); and an arid district, including the southwestern corner, characterized by the presence of *Anolis poncensis* and *Ameiva wetmorei*. Various cacti form the most characteristic element in the flora of the arid district (Plate I), while the humid district was probably originally a forested area (Plates II and III), bordered by open spaces along the coast.

The contrast in habitat conditions between the arid area to the southwest and the dripping cloud forest of the Luquillo is extreme. The cloud forest affords ideal conditions for the tree frogs, and these are extraordinarily abundant in the moister belt above 1200 feet altitude.

The amphibian chorus in the rain forest on El Yunque is the most extraordinary I have heard. As one stands at the Forester's Cabin, at about 1300 ft. altitude, a roar of sound comes from the wooded ravine adjoining, and from the slopes above, making a veritable Babel of frog notes. One by one the individual voices can be dissociated from the general confusion. Those of *Leptodactylus albilabris* and *Eleutherodactylus portoricensis*, become separated first, since these are already familiar from the first night in Porto Rico. *E. portoricensis* here appears to have added several variations to its lowland notes, but in general its voice proves readily distinguishable. Next to these, the most insistent element in the chorus is a rapid click-clicking not unlike that of a telegraphic instrument, with a very insect-like quality. This proves to be

the note of the tiny *Eleutherodactylus gryllus*, and it was undoubtedly this note which Stejneger ascribed to the young of *E. portoricensis*. This clicking note comes also from the lower branches of the trees, probably up to a height of twenty feet. A fourth note, carefully run down, proves to be that of a large, green, long-horned grasshopper, and to the surprise of the collector another succession of sounds, even more characteristically grasshopper-like, beginning with a shrill prolonged note and ending with a series of clicks, proves to issue from the distended throat of still another *Eleutherodactylus*. Directing the attention, now, as much as possible away from the known elements of the chorus, one may distinguish a strikingly different element. A sad little series of whistles descending in the scale and becoming successively fainter proves to belong to a very distinct species of small *Eleutherodactylus* (*E. wightmanae*), which sits on the ground or on the lower leaves of plants, and is certainly a most difficult species to discern, even when it is singing a foot away from the collector's ear. Another tiny species has a slow clicking note,—the sixth to be distinguished. There is still an undifferentiated chorus awaiting investigation, and three species of tree frogs (*E. richmondi*, *E. unicolor* and *E. cramptoni*) are known from El Yunque, whose notes I did not trace.

In the arid southwestern section there is no such wealth of amphibians and, while this is obviously due to the lack of moisture and hence is primarily an ecological difference, the differentiation of very distinct species confined to this area bears witness to so long a history of similar relations between topography and moisture that here habitat conditions have dominated the faunal history. The fact that this section of Porto Rico appears to be intimately related to the island of St. Croix, figures in my argument below on the relations of the faunae.

ORIGIN AND RELATIONS OF THE PORTO RICAN HERPETOLOGICAL FAUNA

I. THE WEST INDIAN FAUNA

The origin of the West Indian fauna, specifically of the Greater Antillean fauna, has been a controversial topic among zoogeographers for a generation. Arguing from herpetological evidence, Stejneger (1904) and Barbour (1910, 1914, 1916) have maintained that the fauna is derived from the mainland by migration over land connections, and Anthony (1918) supports the same view from the standpoint of mammalogy. Matthew (1915, 1919) has been the chief exponent of the alternative theory that the Antilles have received their fauna through fortuitous dispersal without such connection.

Anthony (1925), in summarizing the evidence from the mammalian fauna in an earlier volume of the present series, adopts a modified form of the "land-connection" hypothesis, and Matthew himself (1919), has agreed that the Greater Antillean islands may at some time have been united. The West Indian amphibians and reptiles appear to me to afford evidence supporting Anthony's conclusions, at least in a general way.

Comparison between the distribution of amphibians and reptiles and the distribution of mammals is made difficult by the much greater age of amphibian and reptile stocks. The arrival of the bulk of the West Indian reptile fauna may be contemporary with that of the earliest of the mammals, the insectivores, whose mammalian contemporaries are extinct. Reptilian distribution frequently affords clues to pre-mammalian faunal history. Thus Madagascar and New Zealand may be allowed to be oceanic islands so far as their mammalian faunae are concerned, while their Pre-Tertiary contacts with continental faunae are reflected in their amphibians and reptiles.

From a general review of the distribution of the reptiles I am convinced that they support the general theses of Matthew regarding the trend of dispersal from Holarctic centers and the want of evidence for Antarctic connections. I am equally convinced that reptilian distribution fails to support some of his secondary theses, especially with regard to the oceanic nature of the faunae of Madagascar and the West Indies. It is embarrassing to be so thoroughly an eclectic zoogeographer, and one finds oneself exposed to the fire of both schools.

My own general conclusions with regard to the West Indian fauna, based primarily on the herpetological evidence, are:

1. That the Greater Antilles received their fauna from Central America at a time so early that the continental fauna has subsequently undergone great changes, probably in Eocene or even in Pre-Tertiary time.

2. That the Greater Antillean fauna gives us a somewhat obscure representation of this earlier Central American fauna, most of which, in accordance with Matthew's general hypothesis, has moved on to South America.

3. That there has been a union of the larger islands during part of their existence, which has produced the uniformities in their faunae.

4. That the Lesser Antillean fauna is derived from South America, that it is a genuinely fortuitous one and that no land-bridge has existed through this chain in Tertiary time.

By way of general review of the Greater Antillean herpetological fauna, I have drawn up a list of the genera in tabular form.



List of Genera	Number of species native on the Greater Antillean Islands				
	Cuba	Jamaica	Hispaniola	Porto Rico	Virgin Islands
AMPHIBIANS					
1. <i>Bufo</i> *†	5	0	1	1	1
2. <i>Hyla</i> *†	1	4	4	0	0
3. <i>Leptodactylus</i> *†	0	0	1	1	1
4. <i>Eleutherodactylus</i> *†	16	8	9	10	2
5. <i>Sminthillus</i> †	1	0	0	0	0
REPTILES					
1. <i>Gonatodes</i> *†	1	1	1	0	0
2. <i>Sphaerodactylus</i> *†	5	6	5	1	1
3. <i>Hemidactylus</i> †	1	1	2	1	1
4. <i>Aristelliger</i> *	1	1	1	0	0
5. <i>Tarentola</i>	1	0	0	0	0
6. <i>Thecadactylus</i> *†	0	0	0	0	1
7. <i>Anolis</i> *†	25	6	13	8	6
8. <i>Norops</i> *†	1	0	0	0	0
9. <i>Deiropyx</i>	1	0	0	0	0
10. <i>Chamaeleolis</i>	1	0	0	0	0
11. <i>Chamaelinorops</i>	0	0	2	0	0
12. <i>Xiphocercus</i>	0	1	0	0	0
13. <i>Iguana</i>	0	0	0	0	1
14. <i>Cyclura</i> *†	1	1	3	1	1
15. <i>Leiocephalus</i> †	5	0	8	0	0
16. <i>Hispaniolus</i>	0	0	1	0	0
17. <i>Celestus</i> *	1	2	3	1	0
18. <i>Sauresia</i>	0	0	1	0	0
19. <i>Wetmorena</i>	0	0	1	0	0
20. <i>Cricosaura</i>	1	0	0	0	0
21. <i>Ameiva</i> *†	1	1	8	3	2
22. <i>Amphisbaena</i> †	1	0	3	2	1
23. <i>Cadea</i>	2	0	0	0	0
24. <i>Mabuya</i> *†	0	1	1	1	1
25. <i>Typhlops</i> †	1	1	2	3	1
26. <i>Tropidophis</i> *†	4	1	2	0	0
27. <i>Epicrates</i> †	1	1	3	2	0
28. <i>Tretanorhinus</i> *	2	0	0	0	0
29. <i>Arrhyton</i>	3	0	0	0	0
30. <i>Alsophis</i> †	3	0	3	3	2
31. <i>Dromicus</i> ?†	2	2	5	2	1
32. <i>Uromacer</i>	0	0	5	0	0
33. <i>Hypsirynchus</i>	0	0	1	0	0
34. <i>Ialtris</i>	0	0	1	0	0
35. <i>Pseudemys</i> *	1	1	1	1	0
36. <i>Crocodylus</i> *†	2	1	1	0	0
Total species	91	40	92	41	23
Total genera	29	18	29	16	15
Endemic genera	5	1	7	0	0
Non - endemic genera not found in other islands	5	0	0	0	2

* Central American.

† South American.

The number of species in this table is somewhat unsatisfactory for comparison on account of the inclusion of vicarious forms from outlying islands—the Cayman Islands with Cuba; Tortuga, Gonaives, Navassa and Beata with Hispaniola, and Mona with Porto Rico.

The Amphibians and Reptiles of the Greater Antilles represent 41 genera. Two of these, *Iguana* and *Thecadactylus* enter the region only in the Virgin Islands, and are present in the Lesser Antilles. They are consequently an alien element in the fauna, the more so as they are not specifically differentiated; it is extremely likely that *Iguana* was introduced by the Indians in the course of their wanderings, while the gecko is probably fortuitous through non-human agencies. A third genus, *Tarentola*, is represented only in Cuba and is otherwise African, specifically Mediterranean, in distribution. This still more alien form is well differentiated from its congeners and represents one of the most curious of genuinely discontinuous distributions. I suppose it to be an ancient “flotsam-jetsam” arrival.

Of the remaining 37 genera, 14 are endemic; 11 are generally distributed on the four larger islands, and 20 are represented on three or more of the islands. It is a curious fact that the endemic genera, with the exception of *Cyclura*, are confined to single islands, and thus do not contribute to the hypothesis of a former union. The 20 more widely distributed genera, however, all have vicariating forms from island to island, and a number of sections of genera, such as the giant Anoles, come near to being widely distributed endemic genera, like *Cyclura*. The endemic forms are chiefly minor end-stages or divergent branches which have arisen by local evolution, such as *Chamaeleolis*, *Deiropyx*, *Chamaelinorops*, *Xiphocercus*, *Hispaniolus*, *Sauresia*, *Wetmorena* and *Arrhyton*. A few, however, are plainly relict forms, notably the Xantusid *Cricosaura*, the Iguanid *Cyclura*, the Hispaniolan snakes *Uromacer* and *Ialtris*, the Brachycephalid frog *Sminthillus*. Five genera, *Leptodactylus*, *Sminthillus*, *Norops*, *Leiocephalus* and *Tretanorhinus*, are neither endemic nor widely distributed, and this is a very heterogenous list, with no appreciable parallelism in distribution.

Eighteen genera occur both in the Greater Antilles and Central America, but 14 of these are likewise represented in South America, and these, with the 7 genera common to South America and the larger West Indian islands but absent in Central America, make the faunal relation with South America appreciably more intimate than with Central America. This very fact seems to me to accord best with the theory of the Central American origin of the fauna, on the supposi-

tion that the South American fauna is mainly of northern origin, as pointed out by Matthew in his general scheme of dispersal.

The degree of differentiation between the continental and West Indian representatives varies greatly, and at first glance appears to indicate varying ages of origin. Some of this variation, however, may be due to other factors than time of separation. Such an archaic-looking relict as *Cricosaura*, widely distinct from its continental allies, may perhaps represent about the same amount of evolution as has occurred in *Anolis* and its derived genera, the difference being the contrast between a declining group and an expanding one. The crocodiles, on the other hand, seem to belong to quite different invasions, *C. rhombifer* and *moreletii* being assignable to an earlier arrival, their ranges now entirely circumscribed by that of the modern wide-ranging, semi-marine *Crocodylus acutus*, whose wide distribution evidently has little bearing on the problem of land connections.

In a more detailed discussion of the genera I shall try to show that the faunal picture presented accords with a derivation from Central America at an early date, on the hypothesis of a southward trend in the migrations of the world as a whole, and that it is direct faunal relations with Central America, such as that of the Xantusiidae, which require explanation rather than the discontinuity in range of *Amphisbaena* or *Leiocephalus*.

Of the genera of Amphibians, *Bufo*, *Hyla*, *Eleutherodactylus* and *Leptodactylus* have a wide Neotropical distribution. The anomalous nature of the distribution of *Leptodactylus* will be discussed below. *Sminthillus* has a single Cuban species, and two others, Peruvian and Brazilian, have since been described. The discovery of additional species in this genus (originally described as monotypic) contributes to the likelihood that it is a natural group.

Among the reptiles, geckos are notable for erratic distributions, though when critically examined their ranges are often found to be closely parallel to those of other groups. The Antillean geckos, however, are really heterogeneous in distribution. *Tarentola* and *Thecadactylus* have already been mentioned. *Gonatodes* is widely distributed in Central and South America, apparently ranging into the Antilles from the west. *Sphaerodactylus* has a wide neotropical distribution, but its wealth of Antillean species distinguishes it as an autochthonous genus, and its development is very like the other characteristically West Indian forms, such as *Ameiva*, *Dromicus* or *Eleutherodactylus*. *Hemidactylus*, with *H. mabouia* on all the islands, appears to be a house-gecko, and human

agency may well have played a part in its distribution. It is somewhat remarkable that the genus *Hemidactylus* is unknown in Central America. I am not at all convinced that the African geckos commonly referred to *mabouia* are con-specific with the Antillean form. The East African and Madagascan species does not seem to me to be identical even with the West African one! *Hemidactylus brookii*, on the other hand, in Hispaniola, would appear to be an African form introduced by the slave-trade. *Aristelliger* is confined to Central America, Jamaica and Hispaniola. It is included in my list as Cuban because it reaches the Cayman Islands, whose faunal affinity is primarily Cuban. On the coast of Yucatan this species is characteristic of the fringe of cays, and its occurrence in the West Indies offers no anomaly.

The Iguanid genera include the monotypic and endemic *Deiroplyx*, *Chamaeleolis*, *Chamaelinorops* and *Xiphocercus*, *Iguana*, already mentioned, and *Anolis*, *Norops*, *Cyclura*, *Leiocephalus* and *Hispaniolus*. *Norops* seems to be a more primitive form than *Anolis*, with three continental species, and is a declining group in contrast with the expanding *Anolis*. The Cuban species is thus plainly a relict. *Leiocephalus*, with a number of species in Cuba and Hispaniola, is otherwise best developed in western South America, and is absent in Central America. I regard this also as a relict distribution, but of a group that is holding its own. *Cyclura* is even more interesting. The curious "combs" on its toes, though rather a trivial character, quite definitely ally its species more closely to the Galapagan *Conolophus* and *Amblyrhynchus* (and the other Pacific genus as well, the Fijian *Brachylophus*) than to the Central American *Ctenosaura*. *Ctenosaura* extends southward as a wedge separating these allied forms, and I have endeavored elsewhere* to show that the *Ctenosaura* have spread southward from the great Southwestern shield in North America. *Leiocephalus* lends itself to this interpretation if it be visualized as retreating before more advanced Iguanid genera, such as *Sceloporus*. *Anolis*, in the full flower of expansion, obscures distributional argument by its wealth of forms and closely-knit ranges. The only species of *Anolis* that is supposed to be common to Central America and Cuba is *A. sagrei*, an inhabitant, like *Aristelliger*, of the off-shore cays in the Bay of Honduras. The endemic genera require no comment except that *Xiphocercus* is represented in Colombia by a related or parallel form.

The Anguidae are represented in all four islands by *Celestus*. Two additional genera, *Sauresia* and *Wetmorena*, monotypic "end-stage"

* 1922. Bull. Amer. Mus. Nat. Hist., XLVI, p. 611.

forms, are confined to Hispaniola. *Celestus* also occurs in Central America and its close ally, *Diploglossus*, is found in both Central and South America. *Celestus* and *Diploglossus* are plainly primitive genera, and the modern representatives of the family, the plated lizards (*Gerrhonotus*), have the same spatial relations with them as exist between *Ctenosaura* and *Cyclura*, or *Sceloporus* and *Leiocephalus*.

The Xantusiidae are a declining group composed of the North American genus *Xantusia*, the Central American *Lepidophyma* and the Cuban *Cricosaura*. This distribution is not in accord with the above-cited southward migrations, but this is a recurrent anomaly which requires a modification of the Matthewsian hypothesis of the dispersal of primitive forms. It must be recognized that evolution in the direction of habitat restriction may strictly parallel an evolution in which the primitive forms become peripheral by retreat in space. This is an obvious phenomenon among the *Xantusids*, which inhabit areas adjacent to what I have regarded as the probable center of dispersal of American lizards, but are plainly relicts among more modern and progressive forms. The species of *Xantusia* are curiously restricted as to habitat—*X. vigilis* by its association with the *Yucca*, *X. henshawi* by its rock-dwelling habit—while both are doubtless nocturnal, as is *Lepidophyma*. The mainland *Xantusids* have retreated owing to habitat restriction, while the Cuban genus represents the other alternative, that of actual retreat, and appears as a true relict, though also rigidly confined to a single habitat. The case is directly comparable to that of the Central African lemurs, which escape their modern competitors by their nocturnal habits, while the Madagascan lemurs have survived through actual migration and the timely separation of their retreat.

The Teiidae are represented only by *Ameiva*, though the West Indian species are divisible into two rather distinct sections. *Ameivas* are widely distributed on the South and Central American mainland, but the continental species are fewer than the West Indian. I suspect that the genus *Cnemidophorus* bears the same relation to *Ameiva* as *Sceloporus* does to *Leiocephalus*, namely, that it is a more modern group of species, with *Ameiva* more or less in retreat.

The Amphisbaenidae are well represented in the Antilles, with both *Cadea* and *Amphisbaena* in Cuba and *Amphisbaena* extending out to the Virgin Islands. Except for *Bipes*, which is present in west Mexico, the family is wanting in Central America, and the Antillean forms are thus relicts of a former type of dispersal. The evidence for the southward migration of the Amphisbaenians seems to me ample, even

without the direct evidence of the Oligocene fossil forms. *Rhineura*, confined to Florida, is quite obviously one of the many curious forms accumulated in the southeastern United States as a result of divergent migration from holarctic dispersal centers. The nearest relative of *Cadea* seems to be Venezuelan, while *Amphisbaena* itself is well represented almost throughout South America.

The only Scincoid genus is *Mabuya*, generally distributed in the tropics of the world, but nowhere speciating in the Americas as it does in the Old World. Its range in both hemispheres is nearly exclusive of that of the more northern and obviously more recent *Eumeces*.

Among snakes the Typhlopidae afford no especial evidence of faunal relation. The Antillean *Typhlops lumbricalis* was long supposed to be a widespread species occurring also in South America. Cochran (1924) and I (1920) have brought the distribution of the West Indian forms into harmony with that of other groups. The most notably primitive genus, *Anomalepis*, is Central and South American (or at least Panamanian and Peruvian), and *not* Antillean.

The Boidae are represented by two genera. *Epicrates* has a species on each of the larger islands and has split into three species in Hispaniola, with a separate species on Mona Island and another distinct form in the Bahamas (confined to Turk's Islands). *Tropidophis* fails to reach Porto Rico, and its principal radiation occurs in Cuba. *Epicrates* is wanting in northern Central America, but it reappears in South America. *Tropidophis* is said to have both South and Central American allies, but they are little known.

The relationship of the Colubrine genera are vague, but their nearest allies seem to be South American, with the exception of *Tretuorhinus*, which is found in Cuba and Central America.

Pseudemys, the single genus of fresh-water turtles, is quite as easily derivable from the Central American representatives as from the Floridian, and the existence of insular differentiation, which I am able to show for the Porto Rican specimens, makes it unnecessary to regard *Pseudemys* as a strictly recent arrival. The absence of other fresh-water turtles is highly remarkable, in view of the ancient character and great diversity of the American turtle fauna. It is no less anomalous to find in Cuba a fossil *Testudo* related to the Galapagan species, though its presence adds to the faunal relations between the Antilles and the Galapagos.

Crocodylus, finally, adds a distinctively Central American form to the West Indian fauna. The broad-snouted Cuban *Crocodylus rhombifer* is directly allied to *C. moreletii* of the adjacent parts of Mexico and the Yucatan peninsula. The wide-ranging, undifferentiated *C. acutus*

floods over the ranges of these earlier forms. Crocodiles do not range beyond the Orinoco basin in South America, and evidently are more recent arrivals than the caimans or the alligators.

In support of my proposition (2) above, I have contrasted the distribution of such a group as *Sceloporus*, an essentially modern genus, with that of a more ancient Iguanid genus, *Leiocephalus*. *Sceloporus* is essentially Sonoran, with a wealth of North American species, and a broad overflow into Central America. *Leiocephalus* is West Indian and South American. Allowing for discrepancies and irregularities such as those I have discussed for the Xantusiidae, the list of such pairs of genera is impressive:

Ancient, West Indian	Modern, Sonoran
<i>Leiocephalus</i>	<i>Sceloporus</i>
<i>Cyclura</i>	<i>Ctenosaura</i>
<i>Celestus</i>	<i>Gerrhonotus</i>
<i>Ameiva</i>	<i>Cnemidophorus</i>
<i>Mabuia</i>	<i>Eumeces</i>

Cnemidophorus, among the genera listed as Sonoran, ranges widely into South America. Otherwise its development is so closely similar to that of the other Sonoran genera that I am disposed to search for an explanation of this anomaly rather than remove it from the Modern, Sonoran list.

I am fully convinced that the fauna of the Greater Antilles reached these islands from Central America, and that the majority of the endemic forms represent a nearly contemporary faunal invasion. That an actual landbridge existed over which the migration took place, is my somewhat more hesitant belief. The existence of mammals and amphibians, even as a depauperate fauna, is evidence in favor of continental connection. The amphibian and reptile fauna exhibits a relatively greater diversity than does the mammalian. The sixteen families represented are:

Amphibians

Bufonidae

Hylidae

Brachycephalidae

Reptiles

Gekkonidae

Amphisbaenidae

Boigidae

Iguanidae

Scincidae

Emydidae

Anguillidae

Typhlopidae

Crocodylidae

Xantusiidae

Boidae

Teiidae

Colubridae

The Central American fauna has thirty-two families, but several of these are isolated groups which could scarcely be expected in the West Indies,—the Helodermatidae and Xenosauridae, for example. Others are obviously more recent arrivals and for this reason their presence is not to be expected; instances in point are the Ranidae, Plethodontidae and Crocotalidae. The disproportion between the continental and Antillean faunas in number of families is accordingly much reduced, perhaps about 26:16. It is a striking and important fact that the South American fauna is actually poorer in families of amphibians and reptiles than the Central American by four or five. If the Chelydridae, Crocodilidae and Plethodontidae, which are essentially Central American and only enter South America at the northwest, are also excluded, the genuinely South American families number only twenty-five.

If the date of the supposed continental connection of the West Indies be placed at the close of the Mesozoic, the relative wealth of amphibians and reptiles and the poverty in mammals are completely explained. Unfortunately, a connection so early in geological history does not account for the more recent members of the mammalian fauna, for which a Miocene date of arrival is indicated. The two families of insectivores agree with the reptiles as to early date of entry, while the remaining mammals appear to represent at least two later immigrations. One is tempted to suppose a very early continental connection for amphibians and reptiles, insectivores, etc., and to recognize Matthew's argument that the remaining mammals are accidental. Geological conclusions based on zoogeographic evidence so fragmentary and contradictory are evidently of little real value.

One set of conclusions, however, from a general consideration of the fauna, seems well founded. This is my proposition (3), that the larger islands were connected at an early stage in the development of their fauna: that they have subsequently been separated, more probably by block-faulting than by any great change of level, that Porto Rico and the Virgin Islands were the last to be cut off, and that the Virgin Islands were connected with Porto Rico as recently as the Pleistocene.

The evidence of long isolation of the three western islands is plainly to be seen in the independent radiation which has taken place in the elements of their fauna. *Bufo* has evolved 5 species in Cuba, while Jamaica with no native toad, and Hispaniola with a single *Bufo*, have each produced 4 species of *Hyla*, independently, in the opinion of Dunn, who has lately examined the Jamaican species in detail. Dunn's conclusions are somewhat hesitatingly accepted by Noble (1927). Whether or

not the radiation in *Hyla* has been independent, the fact that both Jamaica and Cuba have only a single species of *Ameiva* while Hispaniola has 8, and 4 on the main island alone, certainly illustrates an independent evolution. Long separation is equally evident in the wealth of Cuban *Anolis* with no less than 3 related genera represented, *Norops*, *Chamaeleolis* and *Deiroptyx*, equalling the number of species on the other three islands together. The Jamaican fauna, poor in some genera, has no less than 6 well-established species of *Spharodactylus*, surely a sharp contrast with the 2 in all Central America!

Among the snake genera, *Tropidophis* has developed 4 species in Cuba, while *Epicrates* has 3 in Hispaniola, and an extra species on Mona. The Hispaniolan *Dromicus*, *Alsophis* and *Uromacer* fall in line with the other genera. The total impression of the herpetological fauna is plainly one of a fundamental unity, obscured only by the long evolution during subsequent isolation.

The fauna of the Lesser Antilles has been effectively contrasted by Anthony with that of the larger islands. His argument from the mammals that the animal population of the Lesser Antilles is fortuitous from South America and of relatively recent origin agrees exactly with my impression based upon the herpetological fauna. The fauna of Trinidad itself is far from rich in comparison with that of the mainland. Its reptiles and amphibians amount to about 80 species—almost all of them specifically identical with those of northern South America. This South American fauna disappears rather in proportion to distance from the mainland than in relation to size of landmass, for Tobago has 24 species with little endemism, Grenada 17 with about 4 endemic forms, St. Vincent 10 with 6 endemic. In the next four islands the fauna ranges only from 10 to 14 species, with 5 to 10 endemic forms. Endemic forms in the whole chain are very slightly differentiated from their very obvious relatives. The species may be grouped as mainland forms, with a haphazard distribution on the islands, endemic species of mainland genera, slightly differentiated, and endemic species of genera which range throughout the chain with vicariating forms from island to island. There is little or no "radiation," which is so marked a characteristic of the Greater Antilles. Examples of the haphazard distribution are afforded by *Leptodactylus* and *Iguana*, probably transported by the Indians as food animals, and by the snakes in general, though the fauna in question may be imperfectly known, *Leptotyphlops bilineatus*, for example, occurring on Barbados and St. Lucia, *Cloelia clelia* on Grenada, St. Lucia and Dominica, although not recorded from the intervening

islands, St. Vincent and Martinique. The fer-de-lance skips Tobago, Grenada and St. Vincent, to appear only on St. Lucia and Martinique.

The northern group of twelve small islands, from Anguilla to Montserrat, has a fauna impoverished in genera, but rich in endemic species. *Leptodactylus pentadactylus* and *Iguana iguana* appear to represent Pre-Columbian introduction by natives. *Eleutherodactylus martinicensis* is recorded from five islands. Its status requires re-investigation. *Typhlops* is known from St. Kitts and Antigua, the species doubtless undescribed. *Leptotyphlops albifrons* is reported only from Antigua. Its wide range and apparently haphazard arrangement seems to indicate a facility for fortuitous dispersal. *Thecadactylus rapicaudus*, widespread in the Lesser Antilles, is recorded from five of the northern islands. These irregular distributions contrast strongly with 3 endemic species of *Sphaerodactylus* on three islands, 7 *Anolis* on nine islands, and 8 *Ameiva* on ten islands. This portion of the fauna, which perhaps should include *Alsophis*, appears to represent an older nucleus, and I interpret its relations as representative of the uniformity of a typically oceanic fauna plus endemism induced by a considerable lapse of time.

The most obvious differences theoretically to be expected between continental and oceanic insular faunæ are (1) heterogeneity and (2) impoverishment in the oceanic islands. The presence of relict forms seems to me to be strong evidence of a land connection remote in time. Impoverishment may obviously occur in a continental fauna by extinction; and "fortuitous dispersal" may act as a screen allowing only certain forms to pass, so that extreme uniformity of fauna, instead of heterogeneity, may be a result of truly oceanic dispersal, as is to be seen in Polynesia, where island after island is inhabited by the same five species of lizards. Such uniformity is complicated by the age of the islands. It is thus curiously difficult to frame criteria whereby an insular fauna derived from land connection may be distinguished from one produced by "fortuitous dispersal."

II. THE PORTO RICAN AND VIRGIN ISLAND FAUNA

Turning to the more detailed consideration of the Porto Rican fauna, it is interesting to note that important advances have been made in our knowledge of the amphibians and reptiles of this area since Stejneger's discussion of their origin and relations in 1904. The herpetological discoveries bearing directly on this problem have been (1) the description of *Ameiva wetmorei*, (2) the finding of *Bufo* and *Cyclura* on the outer Virgin Islands, (3) the discovery of fossil remains of *Cyclura* on St.

Thomas and Porto Rico, (4) additions to the fauna of Hispaniola, especially the discovery of *Leptodactylus dominicensis*, (5) additions to the fauna of Porto Rico, especially *Alsophis antilleusis* and *Eleuthero-dactylus antilleusis*, which ally it more intimately to the fauna of the Virgin Islands, and (6) the elucidation of the relations of the Greater Antillean *Typhlops*. All of this new information has tended to emphasize the essentially Greater Antillean character of the Porto Rican fauna.

Stejneger divides the Porto Rican herpetological fauna into South American and Central American elements, including in the former the genera *Ameiva*, *Amphisbaena*, *Typhlops*, *Alsophis* and *Dromicus*. These genera are all represented in Hispaniola, and their immediate presence in Porto Rico is amply accounted for by a union with Hispaniola. I have endeavored to show above that this apparent relation of the West Indian fauna with the South American is best explained by a land connection with Central America, when the time relations and larger outlines of faunal migration are considered.

Vaughan (1919, Bull. U. S. Nation. Mus., No. 103, pp. 547-612) has given an excellent résumé of the geological history of the West Indian area as far as known. In advocating the existence of former land connections with South and Central America, his paper cuts incisively into the more speculative maze of zoogeographic controversy. The only flaw is the fact that he appears to base his conclusions in part on zoogeographical data (p. 610), whereas I should like to accept them as a basis for zoogeography. For the present purpose however,—an examination of the immediate origin of the Porto Rican reptile and amphibian fauna,—the outline of the geologic history advanced by Vaughan is highly satisfactory, and it is possible to crystalize conclusions on the relations between Porto Rico and the Virgin Islands with each other and with Hispaniola into a more definite statement than has hitherto been possible.

According to Vaughan's physiographic history of the area in question, the Greater Antilles were joined to one another in late Miocene time, the resulting landmass including Porto Rico and the Virgin Islands as its easternmost extension. The scanty zoogeographic ties between the Virgin Islands and the Lesser Antilles exclude the presence of a contemporaneous land bridge to South America, or at least the continuation of any such bridge for a time commensurable with that of the union of the Greater Antilles. During the period of this uplift, the genera of reptiles and amphibians which may properly be regarded as "Greater Antillean" (through presence on three or more of the larger islands) acquired their distribution.

In order to connect the Virgin Islands with Porto Rico, no great degree of emergence is necessary, as they are separated by water not exceeding twenty fathoms in depth. St. Croix is included in the same way, with no greater amount of emergence, because its present separation by greater depths of water is believed to be due to faulting. The water between Porto Rico and Santo Domingo is much deeper (reaching 318 fathoms), but still shallow in comparison with the depths to the north and south. Even for this connection, however, the amount of emergence necessary is no greater, for there is important evidence of faulting, as I have shown elsewhere (1926). The earthquakes of October, 1918, which caused great damage to the cities of Mayagüez and Aguadilla, on the west coast of Porto Rico, were probably caused by adjustments in this faulted area. The sharp truncation of the eastern end of Santo Domingo doubtless represents another fault line. Point Jiguero and Desecheo Island appear to represent the older period of mountain-making of the general Hispaniolan-Porto Rican axis, (i. e., an Eocene or Lower Oligocene connection) while Mona Island, almost exactly half way between the southwest corner of Porto Rico and Saona Island, and topographically almost exactly similar to Saona, may be a remnant of the Upper Miocene (or later?) land bridge itself. The rapid undercutting of the north and east sides of Mona now in progress indicates a considerable recent reduction of its area. The date of the faulting which separated Porto Rico from Santo Domingo is placed in the Pliocene by Vaughan (p. 611), and the separation of St. Croix from Porto Rico probably took place during the same period, but perhaps at a later date. It is likely that Porto Rico and the remaining Virgin Islands were separated by a submergence in the Pliocene, but they were reunited in the Pleistocene, perhaps by the withdrawal of the water for the continental ice sheets, to form a "Greater Porto Rico" to which the common fauna of the islands now separated corresponds. The present configuration of Porto Rico and the Virgin Islands is (geologically) extremely recent. The very evident peneplanation of the greater part of the mountain area at a height between 1500 and 2000 feet appears to date at least from the early Tertiary, and implies long-continued existence as a land area.

The interpretation of the existing faunal relations of Porto Rico, in the light of the geological hypothesis, becomes relatively simple. The fauna of the Virgin Islands stands in the same relation to the Porto Rican as does that of Porto Rico to the Hispaniolan. The degree of difference in each case corresponds to the relative length of time since their

respective separations, and the degree of impoverishment to their relative areas.

The fauna of the Virgin Islands consists of 22 species, of which 2, *Iguana iguana rhinolopha* and *Thecadactylus rapicaudus*, belong to genera foreign to Porto Rico. The iguana was probably introduced by man; the gecko probably is a fortuitous arrival. Of the remaining 20 species, 11 are identical with Porto Rican forms:

- | | |
|---|---------------------------------|
| 1. <i>Leptodactylus albilabris</i> | 7. <i>Anolis stratulus</i> |
| 2. <i>Eleutherodactylus antillensis</i> | 8. <i>Anolis pulchellus</i> |
| 3. <i>Sphaerodactylus macrolepis</i> | 9. <i>Ameiva exsul</i> |
| 4. <i>Hemidactylus mabouia</i> | 10. <i>Mabuya sloanii</i> |
| 5. <i>Anolis cuvieri</i> | 11. <i>Alsophis antillensis</i> |
| 6. <i>Anolis cristatellus</i> | |

The remaining 9 species are directly related to Porto Rican species and are for the most part simply vicariating forms:

Virgin Islands	Porto Rico
1. <i>Bufo turpis</i>	<i>Bufo lemur</i>
2. <i>Eleutherodactylus lentus</i>	<i>Eleutherodactylus richmondi</i>
3. <i>Anolis acutus</i>	<i>Anolis poncensis</i> (?)
4. <i>Cyclura pinguis</i>	† <i>Cyclura portoricensis</i> (?)
5. <i>Ameiva polops</i>	<i>Ameiva wetmorei</i>
6. <i>Amphisbaena fenestrata</i>	<i>Amphisbaena caeca</i>
7. <i>Typhlops richardii</i>	• <i>Typhlops platycephalus</i>
8. <i>Dromicus exiguus</i>	<i>Dromicus stahli</i>
9. <i>Alsophis sancti-crucis</i>	<i>Alsophis portoricensis</i>

Examined more in detail the chief questions which require discussion are: (1) the impoverishment of the Virgin Island fauna, in which many species of Porto Rican *Eleutherodactylus* and *Anolis* are unrepresented, while *Celestus*, *Epicrates* and *Pseudemys* are entirely wanting; (2) the apparently haphazard distribution of *Bufo*, *Anolis cuvieri* and *Cyclura*; (3) the position of St. Croix in relation to the other islands and Porto Rico, and (4) the origin of the species common to several of the Virgin Islands but absent in Porto Rico.

The absence of forms may be explained as original or secondary. The discovery of the remains of recently extinct *Cyclura* in both Porto Rico and St. Thomas, coupled with the presence of living *Cyclura* on Mona and Anegada, obviously indicates that in this genus a process of extinction is taking place. The same factor probably accounts for the isolated

occurrence of a *Bufo* on Virgin Gorda and of *Anolis cuvieri* on Tortola. The absence of *Celestus* and of *Anolis gundlachi* and *Anolis krugi*, may indicate, on the other hand, that these forms never reached the Virgin Islands. There is no reason to believe that, if the whole land area were elevated 150 or 200 feet and so reunited, the species which now avoid the coastal plain in Porto Rico would be able to reach the Virgin Islands. The fact that of the entire Virgin Island fauna only *Eleutherodactylus lentus* is related to "coffee belt" species in Porto Rico indicates that this factor has probably operated as an important one in the past.

The mere fluctuation in size of these islands has an important influence on the rain fall and humidity (and evaporation), i. e., the most important climatic factors affecting the fauna. The complete submergence of an islet would not be necessary to exterminate the greater part of its fauna, and it is a differential extermination of this nature which I believe to be the chief cause of the impoverishment of the Virgin Island fauna, and possibly of the West Indian fauna in general.

St. Croix presents something of a problem. The *Amphisbaena fenestrata* from that island should be compared again with specimens from St. Thomas, and with *A. caeca*. *Anolis acutus*, *Ameiva polops* and *Alsophis sancti-crucis* are decidedly less closely allied to Porto Rican species than are the species from St. Thomas and even the outermost of the northern Virgin Islands. On the other hand, *Ameiva polops* indicates a relationship with the arid district of Porto Rico. If the "Greater Porto Rico" at any time included St. Croix, that area must have belonged to the extended arid district, which influenced distribution in the "Greater Porto Rico" exactly as it does in the present. The separation of St. Croix in Pliocene time by faulting (as suggested by Vaughan) doubtless excluded it from union with Porto Rico in the Pleistocene, while a Pleistocene (Glacial period) connection of the other Virgin Islands with Porto Rico seems highly probable.

Three species—*Eleutherodactylus lentus*, *Amphisbaena fenestrata* and *Dromicus exiguus*—are common to two or more of the Virgin Islands and are absent from Porto Rico. Their development may be explained as due to a differentiation of the fauna of the lower-lying eastern end of the "Greater Porto Rico," or to differentiation during the hypothetical Pliocene separation.

The Porto Rican herpetological fauna differs from that of Hispaniola chiefly in the absence of the following genera.*

* *Oedipus* is excluded from the Hispaniolan fauna pending verification of its occurrence. Dunn regards the Haitian origin of Peter's *Oedipus infuscatus* as mythical.

- | | |
|--------------------------|--------------------------|
| 1. <i>Hyla</i> | 8. <i>Sauresia</i> |
| 2. <i>Gonatodes</i> | 9. <i>Tropidophis</i> |
| 3. <i>Aristelliger</i> | 10. <i>Uromacer</i> |
| 4. <i>Leiocephalus</i> | 11. <i>Hypsirhynchus</i> |
| 5. <i>Hispaniolus</i> | 12. <i>Ialtris</i> |
| 6. <i>Chamaelinorops</i> | 13. <i>Crocodylus</i> |
| 7. <i>Wetmorena</i> | |

Seven of these, *Chamaelinorops*, *Hispaniolus*, *Wetmorena*, *Sauresia*, *Uromacer*, *Hypsirhynchus* and *Ialtris* are confined to Hispaniola, while the other six are found in Cuba and Jamaica and for the most part in Central America. An extensive impoverishment of the fauna of Porto Rico is obviously its most conspicuous characteristic. Recent extinction may well be admitted as a considerable factor in this impoverishment, in view of the discovery of the remains of an extinct Porto Rican *Gyclura* as well as by analogy with the extinction of the mammalian fauna. This may be due to two factors, the restriction of habitat formations due to increased cultivation, and the changes in climate due to past emergence and submergence. On the other hand, the much greater altitudes of the mountains of Hispaniola, and the great diversity of habitat conditions of that island, of which perhaps the most remarkable is the stratification of the vegetation on the mountains, makes it highly probable that a number of forms have developed *in situ*, and had not acquired a sufficient range before the separation of Porto Rico to reach it, even if the habitat conditions of the intervening area were not unfavorable. If the late Miocene uplift was not extensive, and if Mona Island is a remnant of the actual land connection via Saona and southwest Porto Rico, the habitat conditions of the land-bridge must have been such as to prevent the spread of many forms. It is more difficult to explain the differences in the development of such genera as *Sphaerodactylus*, *Celestus*, *Ameiva* and *Epicrates*, which have several species on Hispaniola and only one on Porto Rico.

It is possible that Hispaniola was broken up into several islands during the Miocene, as is indicated by the Miocene deposits which compose the plain between the Central Sierra and the Monte Cristi Range, and by the "through valley" of the saline lakes to the southwest.

Only two species are common to Porto Rico and Hispaniola, one of which, *Hemidactylus mabouia*, is a house-gecko and plainly fortuitous, while the other, *Mabuya sloanii*, requires critical study. I have seen no Hispaniolan specimens. The number of species which are closely related on the two islands is large:

Porto Rico	Hispaniola
1. <i>Bufo lemur</i>	<i>Bufo gutturosus</i>
2. <i>Leptodactylus albilabris</i>	<i>Leptodactylus dominicensis</i>
3. <i>Eleutherodactylus portoricensis</i>	<i>Eleutherodactylus auriculatoides</i>
4. <i>Eleutherodactylus richmondi</i>	<i>Eleutherodactylus weinlandi</i>
5. <i>Sphaerodactylus macrolepis</i>	<i>Sphaerodactylus difficilis</i>
6. <i>Anolis curieri</i>	<i>Anolis ricordii</i>
7. <i>Anolis cristatellus</i>	<i>Anolis cybotes</i>
8. <i>Anolis pulchellus</i>	<i>Anolis semilineatus</i>
9. † <i>Cyclura portoricensis</i>	<i>Cyclura cornuta</i>
10. <i>Celestus pleii</i>	<i>Celestus</i> sp.
11. <i>Ameiva ersul</i>	<i>Ameiva vittipunctata</i>
12. <i>Ameiva wetmorei</i>	<i>Ameiva lineolata</i>
13. <i>Amphisbaena caeca</i>	<i>Amphisbaena weinlandi</i>
14. <i>Typhlops platycephalus</i>	<i>Typhlops</i> sp.
15. <i>Epicrates inornatus</i>	<i>Epicrates striatus</i>
16. <i>Dromicus stahli</i>	<i>Dromicus parvifrons</i>
17. <i>Alsophis portoricensis</i>	<i>Alsophis melanichneus</i>
18. <i>Pseudemys stejnegeri</i>	<i>Pseudemys palustris</i>

The Mona Island species, especially *Cyclura stejnegeri* and *Epicrates monensis*, add important links to this relation.

The remaining Porto Rican species, mostly *Eleutherodactylus* and *Anolis*, which are clearly more closely related to other forms in the Greater Antilles than to South American or Lesser Antillean species, may be regarded as the individual development of the Greater Antillean fauna on Porto Rico, whose mountains occupied a relatively isolated position during any land connections that may have existed, certainly since the early Tertiary.

The general conclusion is that the herpetological fauna of the "Greater Porto Rico" is simply an impoverished Greater Antillean fauna. Its resemblances to the fauna of Hispaniola are due to land connection, the date of which is placed by geologists in the Upper Miocene. The differences between the Porto Rican and Hispaniolan faunas are due: (1) to a process of extinction still continuing; (2) to the isolated position of Porto Rico at the eastern end of the land mass, the habitat conditions of the supposed land-bridge being unsuited to the spread of many forms; (3) to the differentiation of specifically Porto Rican forms, (a) throughout the Tertiary, the mountains of Porto Rico being a center of differentiation for autochthonous forms, as I suppose those of Hispaniola to have been, and (b) during post-Pliocene time, since the separation of Porto Rico from Hispaniola.

SYSTEMATIC ACCOUNT OF THE SPECIES

Class AMPHIBIA

Order SALIENTIA

Family BUFONIDAE¹

KEY TO THE GENERA OF PORTO RICAN FROGS AND TOADS

A. No teeth; a large parotoid gland on each side of the neck; skin very rough and warty.....*Bufo*



FIG. 1.—Head of toad (left) contrasted with *Leptodactylus* (right). (From Stejneger.)

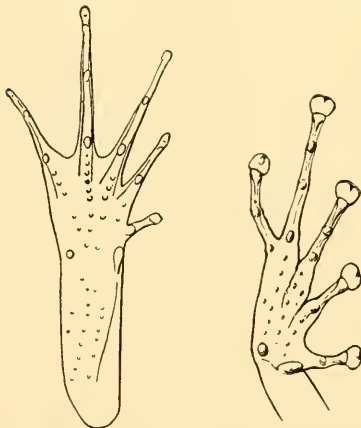


FIG. 2.—Foot of *Leptodactylus* (left) contrasted with foot of *Eleutherodactylus* (right). Compare slender and expanded tips of digits. (From Stejneger.)

AA. Maxillary and vomerine teeth present; no parotoid gland; skin relatively smooth.

¹The Bufonidae in the broad sense of Noble's revision of the families of Salientia (Noble, 1922, p. 22) includes the family Leptodactylidae, which, defined in contrast with the Bufonidae in the restricted sense of older authors, will be found in Stejneger, 1904, p. 569.

- B. Tips of fingers not dilated, tapering.....*Leptodactylus*
 BB. Tips of fingers dilated into adhesive disks.....*Eleutherodactylus*

Bufo Laurenti

KEY TO THE PORTO RICAN SPECIES OF TRUE TOADS

- A. Head with prominent bony crests; parotoid gland small and rounded—
Bufo lemur
 AA. Head without long bony crests; parotoid glands enormous, subtriangular—
Bufo marinus

Bufo lemur (Cope)

Sapo Concho

Text Figs. 3-4.

Peltaphryne lemur Cope, 1868, Proc. Acad. Nat. Sci. Phila., p. 311.

Bufo lemur Stejneger, 1904, Rept. U. S. Nat. Mus., 1902, p. 570, Figs. 1-5.—
 Barbour, 1914, Mem. Mus. Comp. Zool., Vol. XLIV, p. 242; 1917, Proc.
 Biol. Soc. Wash., Vol. XXX, p. 102.—Schmidt, 1920, Ann. N. Y. Acad. Sci.,
 Vol. XXVIII, p. 168.

Bufo (Peltaphryne) gutturosus Peters, 1876, Mon. Ber. Akad. Wiss. Berlin, p.
 709.

Bufo gutturosus Gundlach, 1881, Anales Soc. Españ. Hist. Nat., Vol. X, p.
 314.—Stahl, 1882, Fauna Puerto-Rico, p. 71, p. 161.—Garman, 1887, Bull.
 Essex Inst., Vol. XIX, p. 16 (part).

The native name, Sapo concho, referring to the ridged head of the adults of this species, is an appropriate one. Unfortunately, due to the rarity of the form, it is practically unknown to the majority of Porto Ricans and the native boys apply the name indifferently to large specimens of the frog-like *Leptodactylus* or even of the tree frog.

Type locality.—Porto Rico.

Distribution.—Previous to 1919, this species was known from the north side of Porto Rico, the only exact localities given being Arecibo, Bayamon and Vega Baja. Its occurrence at Coamo Springs, nearly at the opposite side of the island, proves that it is widely distributed. Its rarity is perhaps due to the mongoose. The close relations of *Bufo turpis* Barbour, from Virgin Gorda (British Virgin Islands), with *Bufo lemur* constitute important evidence for the close faunal affinity of the Virgin group with Porto Rico. The relations with the Hispaniolan *Bufo gutturosus* are evidently close, and the three species *gutturosus*, *lemur* and *turpis* are much more closely allied among themselves than any one of them is to *Bufo peltacephalus* of Cuba, although *peltacephalus* must be considered their Cuban representative.

Specimens collected.—5: Coamo Springs.

Diagnosis.—A true toad with rough skin, rounded parotoid glands on the shoulders, and high bony ridges on the head.

Original description.—“This is a toad of singular aspect, owing to the extraordinary development of the bony crests of the cranium and the large size of its eyes.

“The muzzle is short and very much flattened, projecting much beyond the mouth. The upper lip forms indeed a strongly projecting bony rim all round the mouth. Loreal region very concave, canthus concave and very close together. The superciliary crests are extraordinarily elevated, having an arched outline, and descending steeply to the loreal region. It is angulate posteriorly, joining the almost equally developed supratympanic ridge. The crown of the head is thus a deep basin, widened above the tympana, and obstructed by a cross-elevation in front. Strong ridges behind and before the orbit; nostrils vertical, a short bony longitudinal ridge below them. According to the characters of the genus



FIG. 3.—Head of *Bufo lemur*. (From Stejneger.)

there is no derm on the head. Tympanum vertically oval. Parotoids broad oval, directed obliquely downwards, covered like the remainder of the upper surfaces of the body and limbs, with numerous closely set subround tubercles, with rugose surfaces. Feet rather short, with small tubercles, and only one remarkably weak metatarsal tubercle, the inner. A strong corneous ridge on the inner margin of the tarsus. The heel reaches the middle of the parotoid. The toes are about half webbed, and have a strong dermal margin. Two strong carpal tubercles. Under surfaces studded with small tubercles, with acute points. Tongue obovate, largely free.

“The color above is a blackish-brown, the top of the head yellow shaded; two longitudinal brown spots on the frontal region. A light vertebral line disappears on the back and reappears on the coccyx, and another light line passes round the inside of the parotoids and diverges on the scapular region. Limbs yellowish cross-banded, below dirty white, below the vent blackish.

“This curious animal was found by George Latimer, the correspondent of the Smithsonian Institution in Porto Rico, W. I.”

The bony crests of the head of this toad distinguish it from the intro-

duced marine toad at a glance, and indeed from all of the remaining tailless amphibians of Porto Rico.

*Coloration in life**—"Iris pale brassy, sprinkled with black. General color above dull clay-colored with a strong olive wash; blackish brown markings and an ill-defined hourglass-shaped mark between shoulders; also a larger blackish spot on each side of the coccyx, which is marked by a pale streak; indications of blackish cross bands on legs; underside dirty white, becoming flesh-colored behind and strongly reddish flesh color on underside of femur and nearest portion of belly; tips of toes



FIG. 4.—Habitus of juvenile *Bufo lemur* (A), with side view of head (B). A. M. N. H. No. 10151. Natural size.

dark brown; tips of warts on back black, those between shoulders particularly large.

"Another specimen was colored as follows: Upper side olive, strongly suffused with 'gallstone yellow,' which is particularly noticeable over the insertion of the fore limbs; very few traces of dusky markings, but the pustules are black, especially anteriorly; an intensely ochraceous-rufous spot on the middle of the back; on the underside the yellow suffusion invades the white ground-color on the portion nearest to the flanks.

"The third large specimen was quite similar to the last, though without any rufous spot on the back, which seems to be an anomaly. Whole upper surface darker olive, and flanks, including space at base of fore

* Quoted from Sejneger, 1904, p. 572.

limb and below the ear, more intensely and more well-defined yellow; underside dirty yellowish white.

"A young specimen was colored as follows: General color above drab, more isabella-colored on head; dark markings blackish, those on shoulders pale-edged externally; flanks with a purplish suffusion and indications of a broad longitudinal band, well-defined and pale-edged above, but gradually fading below into the pale isabella color of the belly; underside with a network of coarse dark-gray mottlings and marblings."

Remarks.—The five half-grown specimens (collected by myself) are so nearly uniform and were found in so circumscribed an area that they probably are members of a single brood. They agree in coloration with the juvenile specimen described by Stejneger. All show the dark mark of hour-glass shape on the shoulders. The dimensions of one of these specimens may be compared with those of an adult recorded by Stejneger.

Parts measured	A. M. N. H. U. S. N. M.	
	No. 10151	No. 27148
Tip of snout to vent.....	37 mm.	83 mm.
Tip of snout to posterior edge of tympanum.....	12	12
Greatest width of head.....	13	32
Foreleg from axilla.....	21	51
Hind leg from vent.....	37	99

These five specimens were found under limestone boulders on the artificial terrace in the moist gorge immediately behind the bath houses of the Coamo Springs Hotel. When exposed, they relied on immobility and their resemblance to the soil for protection, and they were, in fact, extremely difficult to see. The first one was discovered accidentally while I was catching a *Leptodactylus* under the stone beneath which it was secreted. A large boulder sheltered three toads and one *Leptodactylus*. The stomach contents of these specimens included ant remains, beetle wings, an insect larva and segments of a small millipede. Nothing is known of the breeding habits of this species.

Bufo marinus (Linné)

Marine Toad

Fig. 5

Rana marina Linné, 1758, Syst. Nat., I, p. 211.

Bufo marinus Schneider, 1799, Hist. Amphib., Fasc. I, p. 219.—Danforth, 1925, Copeia, No. 147, p. 77.

Type locality.—America.

Distribution.—Central America, northern South America. Native in Trinidad, introduced in several of the Lesser Antillean islands and in Porto Rico and Jamaica.



FIG. 5.—*Bufo marinus* ♀. Mayagüez. (Danforth Collection.)

During my stay in Porto Rico in 1919 I heard reports of the introduction of this species, but I did not see any specimens. Danforth's record

from Mayagüez seems to be the only reference in herpetological literature to the occurrence of the species on Porto Rico.

With certain reservations as to the need for revisionary studies, *Bufo marinus* has an extremely wide range, extending from southern Mexico to southern Brazil and the northern Argentine.

Diagnosis.—A large toad with unusually large parotoid glands; bony ridges of head well developed but low, not higher than the eyelid; no horizontal labial ridge.

Original description.—“A frog with swollen shoulder glands and warty hinder parts; hands with four digits, completely divided; feet with five digits, partly divided.”

Description of a Porto Rican specimen.—(S. T. Danforth collection, ♂, Mayagüez.) Top of head bony, with well developed crests, the height of the supraorbital crest about 2 mm. above the interorbital space, not higher than the eyelid; orbital crests continued toward the snout by well-defined ridges on the canthi; an anteorbital and postorbital ridge from the supraorbital ridge about half way to the labial border; no true labial ridge; a short supratympanic branch connects the supraorbital ridge with the parotoid gland; no parietal branches from the orbital crests; snout prominent, lores well-defined by the pre-orbital and canthal ridges; eyes prominent; tympanum large, subcircular; parotoid large, distinctly outlined, its lower edge in line with the labial border; a postriental gland; first finger longer than second, second as long as the fourth; toes about one-third webbed; subarticular tubercles single; metatarsal tubercles small, rounded; a sharp ridge on the tarsus continuous with the outer web of the inner toe; no tibial gland; back and sides densely covered with warts of varying size; the warts, the parotoid glands, and even the skin between the warts are densely covered with small black spines; ventral surfaces nearly smooth; upper sides of first and second fingers covered with nuptial asperities forming a fine rugose pad. Brownish gray above; venter gray with a faint tinge of yellow, with numerous round darker spots; throat dark gray.

A female specimen from the same locality has larger and fewer warts, which are entirely smooth, as are the deeply pitted parotoid glands; cranial crests somewhat lower; ventral surfaces finely granular, the granulation finely spinose; parotoid gland more sharply outlined; forelimb much more slender than in the male.

MEASUREMENTS OF MALE AND FEMALE

	♂	♀
Snout to vent.....	103 mm.	95 mm.
Snout to posterior edge of tympanum.....	31	29
Greatest width of head.....	40	37
Foreleg from axilla.....	67	55
Hindleg from vent.....	134	121
Tibia.....	42	38

These two specimens are the only ones I have seen from Porto Rico. They are widely different from the *Bufo marinus* of the southern half of the South American continent. Lutz, in describing *Bufo paracnemis*, suggests the composite nature of the wide-spread *Bufo marinus* of authors. There can be no doubt, however, that the toad here described is the one introduced in Porto Rico, and *marinus* probably applies best to the marine toad of northern South America.

The marine toad is stated, by Wolcott (1924, p. 35), to have been introduced about 1920 at Mayagüez, by Dr. D. W. May. By 1924 it had spread over a radius of about four miles and is apparently securely established. A second introduction was made in 1924 at Rio Piedras, at the suggestion of Sr. Menéndez Ramos, former director of the Insular Experiment Station.

Leptodactylus Fitzinger

Rana : Sapo

Text Figs. 6-9

Leptodactylus albilabris (Günther)

- Cystignathus albilabris* Günther, 1859, Ann. Mag. Nat. Hist., (3), Vol. IV, p. 217.—Reinhardt and Luetken, 1863, Vid. Meddel. Naturh. Foren. Copenhagen, 1862, p. 205.—Cope, 1868, Proc. Acad. Nat. Sci. Phila., 1868, p. 311.
- Leptodactylus albilabris* Boulenger, 1882, Cat. Batr. Sal. Brit. Mus., p. 245, Pl. 16, Fig. 4.—Boettger, 1892, Kat. Batr. Samml. Mus. Senckenberg, p. 31.—Stejneger, 1904, Rept. U. S. Nation. Mus., 1902, p. 574, Figs. 6-14.—Barbour, 1914, Mem. Mus. Comp. Zool., Vol. XLIV, p. 253, 255; 1915, Proc. Biol. Soc. Wash., Vol. XXVIII, p. 72; 1917, idem, Vol. XXX, p. 103.—Fowler, 1918, Papers Dept. Mar. Biol., Carnegie Inst., Vol. XII, p. 3, Fig. 1.—Schmidt, 1920, Ann. N. Y. Acad. Sci., Vol. XXVIII, p. 168.—Danforth, 1925, Copeia, No. 147, p. 77.—Noble, 1927, Ann. N. Y. Acad. Sci., Vol. XXX, p. 87, p. 116, Fig. 18.
- Cystignathus typhonius* Peters, 1876, Monatsber. Akad. Wiss. Berlin, p. 709 (not of Daudin).—Gundlach, 1881, Anales Soc. Espan. Hist. Nat., Vol. X, p. 313.—Stahl, 1882, Fauna Puerto-Rico, p. 71, p. 161.

The writer did not hear the name "rana" applied to this species while in Porto Rico, "sapo" being invariably used. There is a true toad in

Porto Rico and, as the *Leptodactylus* is a decidedly frog-like animal, it is highly unfortunate that this confusion of popular names has taken place, since "sapo" is the Spanish equivalent of the English "toad" and "rana" of "frog." The word "rana," left without definite object, is applied to various unnamed animals. At Aibonito it was used for the ground geckos.

Type locality.—St. Thomas, Virgin Islands.

Distribution.—This species occurs almost everywhere on Porto Rico where suitable moisture conditions exist. It is recorded from the following localities:

Adjuntas	Catalina Plantation	Mayagüez
Aguas Buenas	Coamo Springs	Ponce
Aibonito	Hucares	Pueblo Viejo
Anasco	Humacao	Rio Piedras
Arecibo	Lares	Santurce
Arroyo	Luquillo	Utuado
Bayamon	Mameyes	El Yunque
Caguas	Maricao	

The loud chorus of this species on the side of the Moro can be heard distinctly from the steamer entering San Juan harbor at dawn. In addition to the localities mentioned above, its characteristic note was heard on Vieques Island and at Ensenada.

The record from Culebra¹ appears to be the first definite one from that island. The species occurs also in several of the Virgin Islands (St. Thomas, St. Croix, Jost Van Dyke, Tortola, and Anegada).

Stejneger (1904, p. 651) regards the presence of this species as due to accidental introduction by man. The genus was unknown from other parts of the Greater Antilles until 1924, when Cochran described *Leptodactylus dominicensis* from eastern Santo Domingo. Barbour (1914, p. 253, and 1917, p. 103) dissents from Stejneger's view, chiefly on account of the number of islands included in its range. He regards the Mexican *L. labialis*, which is nearly identical with this species, as an example of chance convergence. It would be interesting to hear the voice of the Mexican form, and to compare its life-history and larval characters with those of the Porto Rican species.

I am unable to agree with Stejneger and Noble, who have compared the Central American *L. labialis* with this species, that they are identical. In a series consisting of many hundreds of specimens from Nica-

¹ A. M. N. H. No. 10320, Culebra Island, October 5, 1919, Karl P. Schmidt.

ragua in The American Museum of Natural History, there is no approach to the adult size of the Porto Rican specimens; other differences have been pointed out by Noble (1918, Bull. Amer. Mus. Nat. Hist.,



FIG. 6.—*Leptodactylus albilabris*, to show variation in color pattern and in form of snout. A. M. N. H. No. 10125 (A and B); A. M. N. H. No. 10143 (C and D). Natural size.

FIG. 7.—*Leptodactylus dominicensis*. A. M. N. H. No. 20952 for comparison with *L. albilabris*. Three-fourths natural size.



Vol. XXXVIII, p. 323); and a comparison of the voices and breeding habits of the two species remains to be made. They are so closely related, however, that the problem of distribution is scarcely altered by this view.

Leptodactylus dominicensis is quite as closely allied to *albiabris* as is the Central American form. It is certainly remarkable that this form should have remained undiscovered in Santo Domingo until 1924.

Specimens collected.—63: Adjuntas, Aibonito, Bayamon, Caguas, Coamo Springs, Maricao, Santurce, Utuado, El Yunque and Culebra Island.

Diagnosis.—A smooth-skinned frog, with longitudinal glandular ridges on the back, toes with vestigial webs, and digits tapering to a point, without adhesive disks.

Original description.—"Tympanum distinct, one half the size of the eye. Vomerine teeth in two short series, behind the level of the interior nostrils. Tongue very slightly nicked posteriorly. Skin smooth, with an indistinct longitudinal fold on each side; a transverse fold between the fore-legs, another across the posterior third of the belly. Snout moderately produced. Tarsus was a longitudinal fold; interarticular tubercles prominent. Male with two vocal sacs, communicating with each other, each with a separate slit. A white or whitish streak round the snout to the axil.

"Colour of the adult:—Above uniform dark bluish-black; the upper leg with some black cross bars superiorly, and some whitish spots posteriorly. The lower parts white, the throat speckled with brown. The labial streak whitish, indistinct below the eye.

"Colour of the young:—Brownish olive marbled with darker; uniform white inferiorly; the labial streak white, very distinct.

"These descriptions of the colours are taken from quite fresh specimens in spirits.

Hab. St. Thomas. The specimens are now in the British Museum."

There is no question of the specific identity of the St. Thomas *Leptodactylus* with that on Porto Rico. To Günther's description may be added the following—the vomerine teeth are in curved; slightly oblique series; nostrils nearer the tip of the snout than the eye; tympanum about two-thirds the diameter of the eye; first finger much longer than second, and second and fourth fingers equal; toes slightly webbed at base; two metatarsal tubercles, the inner connected with the slight tarsal fold; heels overlapping when the limbs are placed at right angles to the body.

Coloration of a living specimen.*—"General color above olive, the dusky markings dark grayish brown, nearly blackish brown below the dorso-lateral fold and on femur; the dorso-lateral fold and narrow edges around the dark markings pale olive gray: the transocular band

* Quoted from Stejneger, 1904, p. 576.

and cutting edge of lip dark grayish brown; the supra-labial light band pale straw yellow; underside whitish; throat finely sprinkled with dark chocolate brown; iris olive silvery, overlaid with blackish."

The form of the snout exhibits a striking variation, some specimens having a decidedly flattened and sharp-sided snout. The possibility that this snout form is correlated with a tendency to burrow more or less offers an interesting problem for observation in the field.

This species exhibits a great variability in coloration with a relative uniformity in structural characters. Fowler (1918, p. 3, Fig. 1) has figured the extremes of color pattern in Porto Rican specimens. Seven of the fifty specimens of the present series have the broad median stripe on the back, the others varying chiefly in the distinctness of the dorsal V-shaped markings. The measurements of the largest specimen and of one of apparently recent transformation are as follows:

Parts measured	A. M. N. H. No. 10182	A. M. N. H. No. 10036
Tip of snout to vent.....	49 mm.†	16 mm.
Tip of snout to posterior edge of tympanum.....	18	7.5
Greatest width of head.....	17	7
Foreleg from axilla.....	29	10
Hind leg from vent to tip of longest toe.....	78	24

Leptodactylus albilabris is partial to moist situations, from sea level to an altitude of at least two thousand feet. In towns and villages it is found in the drains and gutters, regardless of filth, wherever a little muddy water accumulates. It is especially abundant in moist meadows or in irrigated cane fields. In the coffee plantations, the adults are found concealed beneath logs or stones, while the young hop about everywhere on the ground, apparently feeding.

Of 25 stomachs examined 8 were empty. Of the remainder, 4 contained land snails; 2 contained spiders (1 a large Lycosid spider and egg sac); 2 contained ants; 2 contained beetles; 2 contained bugs; 2 contained flies (Muscidae); 1 a small moth; 1 a large caterpillar; 1 a medium-sized cockroach, and 7 unidentified insect remains.

The nest of this species was observed by Stejneger (1904, p. 579) under a flat stone in a stream. Peters (1877, Monatsber. Akad. Wiss. Berlin, 1876, p. 709) records one observed by Gundlach in a "wet burrow." At Coamo Springs, on the terrace behind the bathhouses of the hotel, the water of some of the springs forms a permanent rivulet at the base of the cliff. *Leptodactylus albilabris* was abundant on the terrace, beneath loose stones, and under a large stone at the edge of the creek.

† 144 mm., given by Stejneger (1904, pp. 576, 578) is obviously a misprint.

the writer found, on August 27, 1919, a shallow, rounded excavation, 6 or 7 cm. in diameter and about 3 cm. deep, filled with a mass of white foam, in which were the small tadpoles of this species (12 mm. in length, body 3-4 mm.). There were between 75 and 100 tadpoles in the mass, by no means confined to the central hollow, which was present, as in the foam-mass described by Stejneger. The bottom of the excavation was about 3 cm. above the water level. Two similar excavations were discovered in the immediate vicinity, in the same relative position with reference to the water, but empty. On August 29, near Bayamon, a small mass of foam, between 3 and 4 cm. in diameter, containing similar tadpoles was noted under a stone on a hilltop, with no water whatever in the neighborhood. On October 1, near the Forester's Cabin on El Yunque, at about 1200 feet, a nest of this species was observed beside a pool of standing water (also at a slightly higher level than that of the



FIG. 8.—Lateral view of tadpole of *Leptodactylus albitabris*. (After Noble.)

water) under a rotten log. This nest contained between 150 and 200 eggs, uniformly distributed through the foam, and with no central hollow. It was somewhat larger than those previously observed, measuring 8 cm. in diameter. The eggs are light yellow, and measure 2.5 mm. to 3 mm. in diameter. The smallest tadpoles taken swimming at large measured 6 mm. in body length, which probably represents their size at the time they escape from the foam. It is evident that the tadpoles usually will be washed from the nest into the adjacent water by a flood or heavy rain. The location of the small nest away from water was probably a mistake on the part of the frog, and the nest described by Stejneger under water probably had been covered by a rise in the creek after the deposition of the eggs. The largest larvae, nearly ready to transform, measure 13 mm. from snout to vent. The V-shaped dorsal markings are already evident in the tadpoles at this stage. The median dorsal white line is probably an adult character.

*Description of tadpole.**—"Length of body about once and one-third its width and slightly less than one-half the length of the tail; nostrils nearer the eyes than the end of of the snout; distance between eyes one-fifth more than distance between the nostrils, and considerably less than

* Quoted from Stejneger, 1904, p. 577.

width of mouth; distance between nostrils equals their distance from eyes, as well as the diameter of the eyes; spiraculum on left side, directed backward and upward, situated above a line drawn between the base of the muscular part of the tail and the mouth, and nearer to the posterior extremity of the body, being about halfway between anterior border of eye and insertion of hind legs; anus a long tube, median and larger than the spiraculum; tail about four times as long as deep, ending in an obtuse point; both upper and lower crests confined to the tail and nearly equal in depth, their edges being nearly parallel until the terminal third; the depth of the muscular part of the tail at its base about two-thirds the greatest total depth."

The chorus of this species is one of the most insistent notes heard in Porto Rico, both by day and night, though somewhat stronger by night. Stejneger compares the note to a rapidly repeated "pink-pink-pink"; it is comparable in quality with that of the North American

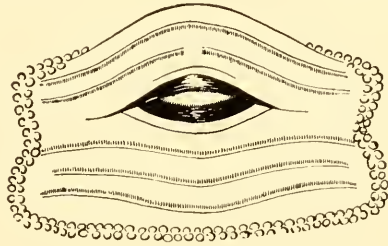


FIG. 9.—Mouth parts of tadpole of *Lepidodactylus albilabris*. (After Stejneger.)

Acris. The interval between notes is variable, but usually very short and regular. There is an occasional somewhat guttural trill. The note ceases on the near approach of a person, and it is exceedingly difficult to discover the singing individual, for the creature may be concealed beneath the edge of a rock or stick, or be flat on the ground between the roots of the vegetation.

Eleutherodactylus Fitzinger

The present state of our knowledge of the Porto Rican species of *Eleutherodactylus* does not justify the attempt to draw up a synopsis of the species in key form. Four of the ten species are imperfectly known,—*unicolor* and *locustus* based on single specimens, *brittoni* and *cramptoni* on small series,—and the most useful of all characteristics in life, the voice, is known for only six of the species, the breeding habits for only a single species! The difficulty in distinguishing species of this genus does not, however, vanish completely, even with the accumulation of large series. *Eleutherodactylus* is plainly one of the groups in which

speciation is notably active, and like *Sceloporus* among the lizards, its study may be recommended "as an excellent *pièce de resistance* for those persons who do not believe in the doctrine of derivation of species."

The genus falls into two groups in Porto Rico,—on the one hand *E. richmondi* and *E. monensis*, having long transverse series of vomerine teeth, and on the other, species in which these series of teeth are short and oblique. In the latter group, *E. unicolor* occupies an isolated position by reason of its posteriorly placed nostrils and widely separated vomerine teeth.

***Eleutherodactylus portoricensis* Schmidt**

Coquí

Text Figs. 10-13

Hylodes martinicensis Peters, 1876, Monatsber. Akad. Wiss. Berlin, p. 709, Pl. I, Figs. 1-5, 7-9 (not of Tschudi).—Gundlach, 1881, Anales Soc. Españ. Hist. Nat., Vol. X, p. 315.—Stahl, 1882, Fauna Puerto-Rico, p. 71, p. 161.—Garman, 1887, Bull. Essex Inst., Vol. XIX, p. 13.—Boettger, 1892, Kat. Batr. Mus. Senckenberg., p. 29.

Eleutherodactylus auriculatus Stejneger, 1904, Rep. U. S. Nation. Mus., 1902, p. 583, Figs. 15-19 (not of Cope).—Fowler, 1918, Carnegie Inst. Wash. Publ. 252, p. 4, Fig. 2.—Schmidt, 1920, Ann. N. Y. Acad. Sci., Vol. XXVIII, p. 170, Figs. 1-2.—Danforth, 1925, Copeia, No. 147, p. 77.

Eleutherodactylus portoricensis Schmidt, 1927, Amer. Mus. Novit., No. 279, p. 2.

The native name, coquí, expresses the repeated element in the call of this species very satisfactorily.

Type locality.—El Yunque, 2000 feet altitude.

Distribution.—This is the common Porto Rican tree frog, recorded from very many localities. The places where it occurs, compiled from my list and Stejneger's records, are as follows:

Adjuntas	Coamo Springs	Ponce
Aguas Buenas	Humacao	Rio Piedras
Aibonito	Jayuya	Santurce
Alto Manzano	Lares	Utuaado
Arecibo	Luquillo	Vega Baja
Caguas	Mameyes	El Yunque
Catalina Plantation	Maricao	
Cataño	Mayagüez	

There seems to be no record from southwestern Porto Rico.

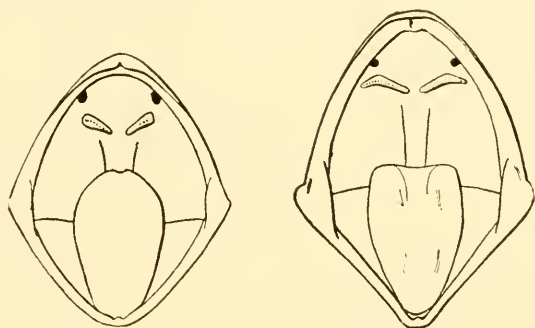
Specimens collected.—207: Adjuntas, Aibonito, Alto Manzano, Cataño.

Coamo Springs, Jayuya, Maricao, Rio Piedras, Santurce, Vega Baja and El Yunque.

Diagnosis.—An *Eleutherodactylus* of moderate size and stocky habitus; vomerine teeth in two short oblique series, behind the choanæ; nostrils near the tip of the snout; tympanum about half the diameter of the eye; disks of toes about equal to those of fingers, about three times as broad as the narrowest part of the corresponding phalanges; no trace of web; ventral disk faintly indicated; tibia less than half the length from snout to anus; concealed parts of thighs immaculate, reddish in life.

Original description.—“Head broader than body, its width slightly greater than the distance from tip of snout to the posterior border of the tympanum; nostril twice more distant from the eye than from tip to snout; diameter of eye equal to its distance from the nostril; tympanum nearly half the diameter of the eye, a little broader than its distance from

FIG. 10.—Inside of mouth of *Eleutherodactylus portoricensis* (left) and of *E. richmondi* (right), showing different arrangement of the vomerine teeth. (After Stejneger.)



the eye; heels broadly overlapping; heel reaching the eye when the limb is laid forward along the body; canthus rostralis rounded but well defined; lores sloping, slightly concave; disks of fingers subequal; disks of toes subequal, very little smaller than those of the fingers; first and second fingers equal in length; first and second toes subequal; skin finely rugose above, with a narrow median raised line, the general effect smooth; belly and thigh granulate; a fold across the chest; ventral disk faintly indicated by an impressed lateral line; vomerine teeth in straight, short, oblique series, their distance from the choanæ, in line with their outer borders, a little less than their length, the distance between them about half the length of one series.

“Color dark brownish gray: a light canthal line over the edge of the eyelid, broadening over the tympanum into a dorsolateral light band, which merges into the light belly color posteriorly; concealed surfaces of thighs and tibiæ immaculate (reddish in life).”

MEASUREMENTS OF TYPE

Length of Body.....	36 mm.
Width of Head.....	15
Tip of Snout to Posterior Border of Tympanum.....	14
Length of Arm.....	21
Length of Leg.....	52
Tibia	17
Tympanum	2
Eye	4.5
Largest Finger Disk.....	2

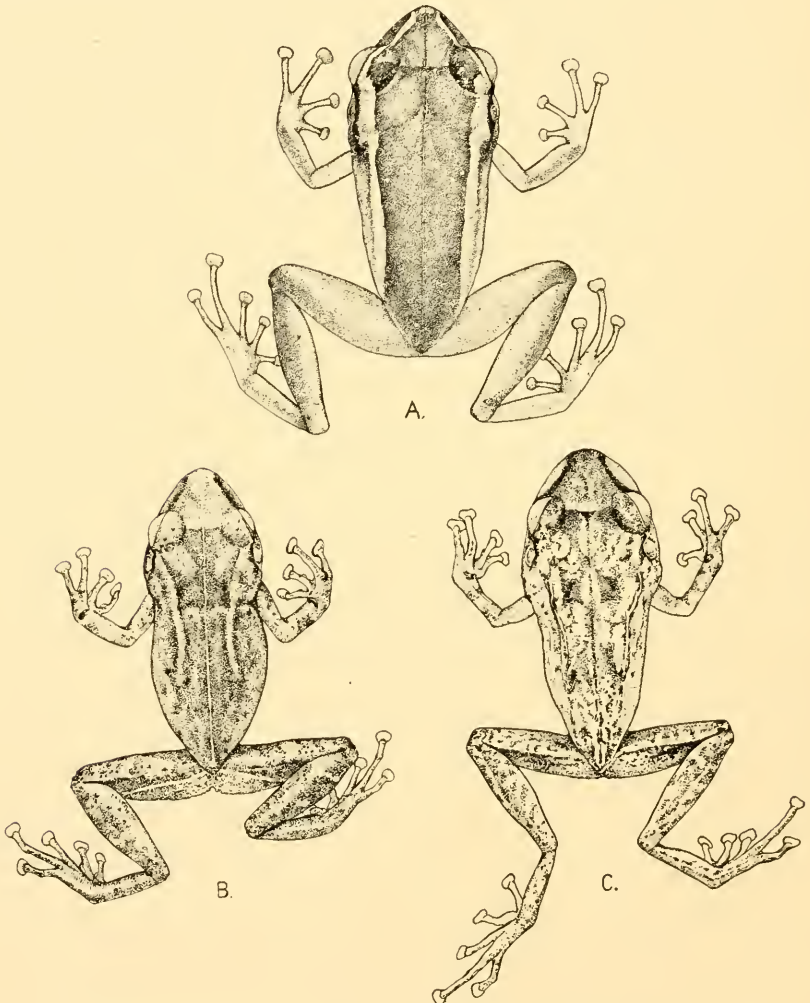


FIG. 11.—Three common color variants of *Eleutherodactylus portoricensis*. A, A. M. N. H. No. 10139; B, No. 10243; and C, No. 10249. Natural size.

Remarks.—The only noteworthy discrepancy between my description, quoted above, and the detailed description of a Porto Rican specimen by Stejneger (1904, p. 585) is in the size of the disks of the toes, which I find to be nearly as large as those of the fingers, but which are stated by Stejneger to be smaller, and are figured by him as only about half the size of the finger disks. I am convinced that this difference rests on a different preservation of material or possibly on actual variation. Fowler's figures exhibit a good deal of variation in this respect. The ventral disk in the specimen described is very faintly marked, and the difference in this character is probably merely one of opinion.

*Coloration in life.**—“Above dusky fawn color with a very narrow vertebral line, a narrow canthal line and a broad lateral line in continuation of the latter, pale buffy pink, all the light lines and bands more or less edged with dusky; triangle on top of head forward of a line through the center of the eyes distinctly paler, a dusky cross-line at middle of eyes defining the triangular space behind; below pale, greenish on belly; underside of femur dull ferruginous; iris golden, shaded with reddish and brownish and reticulated with blackish.”

A specimen of *Eleutherodactylus auriculatus* from El Perú, Monte Libano, Guantanamo, Cuba, loaned for examination by Dr. Thomas Barbour, is much smoother above than *E. portoricensis*, notably on the eyelids and snout.

E. portoricensis is remarkable for its color variation, with a comparatively stable structure, but a considerable variation in measurements. A specimen in the collection of Professor G. E. Johnson of the University of Porto Rico, collected by him in the Luquillo Forest, is noteworthy for its size, being apparently a giant individual. The maximum size in more than three hundred specimens in the National Museum and the present collection is 44 mm. from snout to vent, while Professor Johnson's specimen measures 52 mm. Its measurements compared with the largest in the present series are as follows:

Parts measured	A. M. N. H. Johnson	
	No. 10241 specimen	
Tip of snout to vent.....	44 mm.	52 mm.
Tip of snout to posterior edge of tympanum.....	18	20
Greatest breadth of head.....	19	23
Foreleg from axilla.....	29	35
Hind leg from vent.....	69	80

The most frequent coloration is a grayish brown of varying shade, sometimes reddish, sometimes nearly black. This may be uniform or

* Quoted from Stejneger, 1904, p. 585.

mottled with darker. In the lighter specimens there is nearly always a dark interorbital mark, and in a few the snout is white in front of this either with a broad transverse white band or completely light to the tip of the snout. There is usually also a dark sub-canthal mark, interrupted by the eye, and continued over the ear for a short distance. In a few cases the dorsum is spotted irregularly with vivid white spots. In 18 out of 194 specimens a light line, beginning at the snout and passing over the edge of the eyelid to the ear, continues as a broader light dorso-lateral band to the thigh. In 19 specimens there is a sharp median white stripe (compare Fowler, 1918, Fig. 2). In 5 there is a broad median light band, about four times as broad as the more common narrow line. The hind legs are occasionally distinctly barred, more usually indistinctly barred or uniform. The concealed surfaces of the thighs are often



FIG. 12.—Embryo of *Eleutherodactylus portoricensis*. A. M. N. H. No. 10302. Six times natural size.

bright pink or red. The venter is usually light and unspotted, occasionally it is spotted with groups of dark-brown punctations. In no specimen were the concealed surfaces of the thighs reticulated with the fine or coarse dark network of *E. antillensis*. The color variation has also been noted by Stejneger, but I am sure that the juvenile variant described by him from El Yunque must refer to the dwarf species, *E. gryllus*.

The majority of the specimens collected were taken at night, either singing or merely sitting about on vegetation, sometimes several feet from the ground. Others were found concealed under logs and stones, especially in coffee plantations. The most usual hiding place of this species in the daytime is beneath the sheaths of the outer leaves of the banana. Specimens in this situation are almost without exception uniformly colored and nearly black. About every third banana plant examined was inhabited by one or more of these tree frogs.

Persistent search about the banana plants failed to discover the eggs of this species, and it was not until the writer visited the Luquillo

Forest that a single egg-mass was discovered in a basal leaf of an air plant, just at the surface of the water in the lower part of the leaf. A large *E. auriculatus* in the same plant, but not on the same leaf as the eggs, escaped. There were thirty-six eggs, with well-advanced embryos, adhering in an oval mass from which individual eggs could easily be detached. The eggs measure 6-8 mm. in greater diameter, being somewhat elongated in the axis of the embryo.

The young of this species are extraordinarily abundant, and it is difficult to understand why the eggs are so infrequently observed. It is possible that at the time of the writer's visit (August-October) the height of the breeding season was past. The only date of breeding previously recorded is that noted by Gundlach, May 24 (Peters, 1877, Monatsber. Akad. Wiss. Berlin, 1876, p. 709). Professor Johnson found a mass of eggs, with embryos at about the stage of those observed by the writer, in the same bunch of moss in which the giant female specimen, men-



FIG. 13.—Peter's figures of the embryo of *Eleutherodactylus portoricensis*.

tioned above, was collected, July 8, 1919. Gundlach (loc. cit) also observed a female sitting on the egg-mass received by him, while Bello y Espinosa (Martens, 1871, Zool. Garten, Vol. XII, p. 351) records that in the case noted by him the parent frog remained in the neighborhood of the eggs "as if to guard them." From these several observations it appears not unlikely that the female does remain in the neighborhood of the eggs until they are hatched, but further observations on this point are desirable. Ruthven (1915, Occ. Papers Mus. Zool. Univ. Michigan, No. 11), observing the breeding habits of *E. cruentus* Peters, in Colombia, found no evidence of such a habit.

The chorus of this species, or the isolated notes of single males, are among the most familiar and insistent sounds in Porto Rico. The call is a clear, whistled co-quí, co-quí, varied by co-quí-quí-quí-quí. Two males often call alternately from neighboring stations. A favorite situation for the singing male is the base of the leaf of a lillaceous plant or the center of a whorl of leaves on shrubs, etc., which appears to magnify the sound and thus increase its ventriloquial character.

For its relations with other West Indian *Eleutherodactylus*, and the history of the species, I may quote my remarks when proposing a name for this species:

"It is paradoxical to write of the most abundant species of tree-frog of Porto Rico as new to science, for this form is one of the best known in the genus, represented in many museums by large series of specimens. It is really famous, for its eggs and embryos were the basis for the article by Peters, describing the direct development, with suppression of the tadpole stage, which is a general character of the genus *Eleutherodactylus*. Peter's figures have found their way into great numbers of textbooks, usually under the original designation, *Hylodes martinicensis*.

"The name now proposed for this well-known and well-characterized species is, nevertheless, the first to be based on Porto Rican specimens. The confusion of this form with other Antillean species has been due to the weight of authority that has identified it first with the Lesser Antillean *Eleutherodactylus martinicensis* (Tschudi)—Peters, Gundlach, Garman, and Boettger—and, later, with the Cuban *Eleutherodactylus auriculatus* (Cope)—Boulenger, Stejneger, and Barbour. In dealing with this species in 1920, I accepted the identification with *auriculatus* without question.

"Stejneger, in 1902, accepted Boulenger's record of *auriculatus* from Santo Domingo, and its occurrence on that island would of course make its presence in Porto Rico much more probable. The Nobles secured an allied species in the Dominican Republic, described by Dr. Noble as *Eleutherodactylus auriculatoides* (1923, Amer. Mus. Novitates, No. 61, p. 3) and it is probable that this species represents *auriculatus* in Santo Domingo.

"The renewed and more intensive study of the Greater Antillean amphibian faunæ was, to some extent, initiated by my field work in Porto Rico in 1919, which added six species of *Eleutherodactylus* to the supposedly well-known herpetological fauna of that island. This was followed by the work of Dr. and Mrs. G. K. Noble in the Dominican Republic in 1922, which added five new *Eleutherodactylus* and a new *Hyla* to the Hispaniolan fauna. The recent additions to the Cuban tree-frogs (eight species) and to the Jamaican fauna (six *Eleutherodactylus* and a *Hyla*) by the field work of Dr. Emmett R. Dunn in 1924 and 1925 were, consequently, scarcely surprising, though it may be emphasized that all of these islands were supposed to be well explored herpetologically. The new crop of novel species was due to the application of a simple technique of collecting by voice at night, using an electric flashlight.

"A better knowledge of the old species has inevitably accompanied the recognition of the new forms, and it is now evident that there are no native species of this genus generally distributed in the Greater Antilles. The Cuban *Eleutherodactylus auriculatus* is now well known through Dr. Dunn's field work. He writes me that this species does NOT breed in bromeliads, and that its cry resembles the syllables "chi-leén." The repeated "coquí" of the Porto Rican species, which gives it its native name, is one of the most characteristic sounds of the nocturnal chorus in Porto Rico.

"All of this contributes little by little to the certainty that the common Porto Rican tree-frog is specifically distinct from any other West Indian form."

***Eleutherodactylus gryllus* Schmidt**

Text Fig. 14

Eleutherodactylus gryllus Schmidt, 1920. Ann. N. Y. Acad. Sci., Vol. XXVIII, p. 172, Fig. 3.

There is no native name for this species.

Type locality.—El Yunque, near the Forester's Cabin, about 1300 feet altitude.



FIG. 14.—*Eleutherodactylus gryllus*. A. M. N. H. No. 10226. Twice natural size.

Distribution.—*Eleutherodactylus gryllus* is confined to Porto Rico, where it is known from the Luquillo Forest and from Maricao. It is probably confined to the more humid higher parts of the island.

Specimens collected.—16: Maricao and El Yunque.

Diagnosis.—Distinguished from *Eleutherodactylus portoricensis* by its shorter snout, less granulate venter, and its minute size.

Description of type.—"Habitus of *Eleutherodactylus portoricensis*, but with a distinctly shorter snout, its length equal to the diameter of the eye (in *E. portoricensis* the diameter of the eye equals its distance from

the nostril), and to the interorbital space; canthus rostralis rounded; nostril one-third the distance from tip of snout to eye; tympanum scarcely distinct, one-fourth the diameter of the eye, its distance from the eye equal to its diameter; toes without vestige of web; digital disks well-developed; first toe as long as the second; an inner and outer metatarsal fold; vomerine teeth in two oblique patches behind and within the choanae; tongue large, slightly nicked behind; skin smooth above, but apparently much more glandular than in *E. portoricensis*; venter strongly granulate; a large subgular vocal sac.

"Middle of the back, beginning with an interorbital line, dark gray, enclosing a light spot on the occiput; sides and snout lighter, the darker color everywhere consisting of minute black punctations, especially evident on the limbs and throat; venter light."

MEASUREMENTS

Tip of snout to vent.....	16 mm.
Tip of snout to posterior border to tympanum.....	5.5
Greatest breadth of head.....	6
Foreleg from axilla.....	11
Hind leg from vent.....	24
Tibia	8.5

Remarks.—The type is a male, taken singing at night, with the usual pale night coloration. Specimens taken in the daytime (concealed under moss) are very dark in color and exhibit considerable variation in pattern, two having a light median dorsal line. In a specimen taken in an air plant (No. 10291) the dorsal dark area is cinnamon brown and the sides bright pale green, the legs with dark bars; this coloration has been described by Stejneger (1904, Rept. U. S. Nat. Mus., 1902, p. 586) as a variant coloration of juvenile *E. auriculatus* (= *portoricensis*). The darker specimens have narrow light crossbands on the limbs. The granulation of the venter in the female specimens is faint, though still evident.

This species was very numerous at Maricao and on El Yunque, singing frequently from trees, at least ten feet from the ground. On El Yunque specimens were collected in air plants, near the peak, and under moss on the rocks of the peak itself.

The song is a rapid succession of shrill clicks, very insect-like, the chorus sounding not unlike the rapid clicking of a telegraphic instrument.

Were it not for the minute size of the singers, and the extremely distinct note, this species might well be considered the young of *E. portori-*

ensis; I am unable to agree with Stejneger's supposition that its note is made by juvenile males of the latter species. The gonads, at any rate, appear to be those of an adult in the specimens examined, differing in form and pigmentation from those of young *E. portoricensis* of similar size.

Nothing has been added to the knowledge of this species since its description in 1920.

***Eleutherodactylus locustus* Schmidt**

Text Fig. 15

Eleutherodactylus locustus Schmidt, 1920, Ann. N. Y. Acad. Sci., Vol XXVIII, p. 174, Fig. 4.

No native name is known for this species.

Type locality.—El Yunque, near the Forester's cabin, about 1300 feet altitude, Luquillo Forest Reserve, Porto Rico.

Distribution.—Known only from the type locality.

Specimens collected.—1: El Yunque.

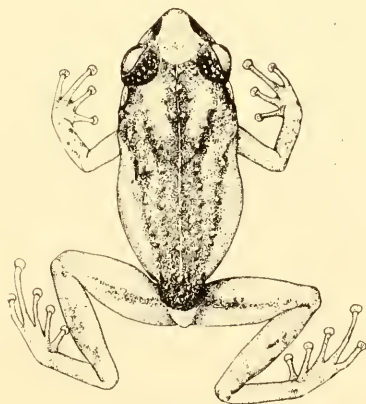


FIG. 15.—*Eleutherodactylus locustus*. A. M. N. H. No. 10240. Twice natural size.

Diagnosis.—Size small; snout obtuse; nostril much nearer to the end of the snout than to the eye; tympanum small, indistinct, one-fourth the diameter of the eye, separated from the eye by a little more than its diameter; vomerine teeth in two oblique series, behind and within the choanæ; toes free; digital disks well-developed; tibiotarsal articulation reaching the posterior border of the eye; heels overlapping when the legs are placed at right angles to the body; skin rugose above, with scattered round tubercles, especially on the eyelid; venter smooth; inner face of thighs finely rugose.

Original description.—"Head slightly longer than broad, slightly nar-

rower than the body; snout moderately obtuse, its length anterior to the eye exceeding the interorbital space; nostrils one-fourth the distance between eye and tip of snout from the latter; tympanum scarcely distinct, one-fourth the diameter of the eye, separated from the eye by a little more than its diameter; canthus rostralis rounded; elbow and knee pressed along the side, overlap; heels overlap when the legs are placed vertically to the axis of the body; tibiotarsal articulation reaching the posterior border of the eye; disks of fingers and toes well-developed; toes without vestige of web; inner and outer metatarsal tubercles present; no tarsal fold; first toe as long as the second; vomerine teeth in two linear oblique patches, converging posteriorly, well-separated on the median line, behind and within the choanae by about the diameter of the choana; tongue large, slightly nicked behind; skin rugose above, with rounded tubercles; a well-marked mid-dorsal ridge from snout to vent; eyelid strongly rugose; venter smooth (faintly rugose under the lens) thighs slightly rugose; male with a large subgular vocal sac.

“Dorsum gray mottled with grayish brown; a well-defined interorbital dark band; sides of canthus with a dark mark, interrupted by the eye, extending over the tympanum; legs not barred, with dusky markings; venter uniform, light.”

MEASUREMENTS

Tip of snout to vent.....	19 mm.
Tip of snout to posterior edge of tympanum.....	7
Greatest breadth of head.....	6.5
Foreleg from axilla.....	12
Hind leg from vent.....	29
Tibia	9

Remarks.—This species was discovered by accident, singing on a leaf some three feet from the ground. Its song is the most distinctive of any noted in Porto Rico, beginning with a shrill continuous note almost at the limit of audibility, which is followed by a succession of clicks. So closely does this note resemble a familiar type of note produced by long-horned grasshoppers that the writer neglected to search for the author of the sound, and watched the present specimen repeat the song several times before being convinced that it really proceeded from an *Eleutherodactylus*.

Eleutherodactylus locustus is closely related to *E. portoricensis*, from which it is distinguished by its small size and smooth venter. Even more closely related to the still smaller new species *E. gryllus*, it is nevertheless readily distinguished by its smooth venter and more rugose dorsum, as well as by its remarkable voice.

This species has not been rediscovered since its description in 1920. I might entertain a doubt as to its validity, in view of its being based on a single specimen, had not Dr. and Mrs. Noble since observed an *Eleutherodactylus* with a similarly peculiar note in Hispaniola.

***Eleutherodactylus cramptoni** Schmidt**

Text Fig. 16

Eleutherodactylus cramptoni Schmidt, 1920, Ann. N. Y. Acad. Sci., Vol. XXVIII, p. 176, Fig. 5.

No native name is available for this species.

Type locality.—Peak of El Yunque, 3485 feet altitude, Luquillo Forest Reserve, Porto Rico.

Distribution.—Known only from the type locality.

Specimens collected.—3: El Yunque.



FIG. 16.—*Eleutherodactylus cramptoni*. A.
M. N. H. No. 10305. Twice natural size.

Diagnosis.—Size small; habitus stout; hind legs short; snout very obtuse, canthus rostralis rounded; dorsum very rugose with rounded tubercles; vomerine teeth in two oblique linear series, extending laterally as far as the inner border to the choanae; digital disks large; uniform dark brown above, light brown beneath.

Original description.—"Habitus stout, compact; snout short, obtuse, canthus rostralis rounded; nostril one-third the distance from tip of snout to eye; heel reaching the anterior border of the orbit; heels meet but do not overlap when the legs are placed at right angles to the body; both anterior and posterior limbs notably stout, nearly twice as thick as

* Named for Professor Henry E. Crampton, whose active interest and investigation have greatly furthered the zoological work of the Scientific Survey of Porto Rico and the Virgin Islands.

those of *E. portoricensis* of the same body length; vomerine teeth in two linear, oblique series, extending laterally as far as the choanae; tympanum small, distinct; dorsum covered with rounded tubercles, extending onto the eyelids and snout; venter finely granular; digital disks large, first toe as long as the second; no subgular vocal sac.

"Color uniform brown above, lighter brown below, slightly variegated with lighter punctation."

MEASUREMENTS

Tip of snout to vent.....	19 mm.
Tip of snout to posterior edge of tympanum.....	6.5
Greatest breadth of head.....	7
Foreleg from axilla.....	12
Hind leg from vent.....	29
Tibia	9

Remarks.—The two paratypes are similar in every respect to the type, with the single exception that one of them is slightly more mottled with light, and has the hind legs indistinctly barred.

All three specimens were taken under moss in the crevices of the rocks on the peak of El Yunque.

The species is a well-differentiated one, characterized by the stoutness of its limbs, the obtuseness of the snout and the extreme rugosity of the dorsum.

Like the other novelties in my collection of 1919, this species awaits the verification of further field-study.

***Eleutherodactylus antillensis* (Reinhardt & Luetken)**

Coquí

Text Fig. 17

Hylodes antillensis Reinhardt and Luetken, 1863, Vidensk. Med. naturh. For. Kjöbenhavn, 1862, p. 209.

Eleutherodactylus antillensis Stejneger, 1904, Rept. U. S. Nat. Mus., 1902, p. 591, Figs. 20-24.—Barbour, 1914, Mem. Mus. Comp. Zool., Vol. XLIV, p. 247; 1917, Proc. Biol. Soc. Wash., Vol. XXX, p. 102.—Schmidt, 1920, Ann. N. Y. Acad. Sci., Vol. XXVIII, p. 178, Fig. 6.

Hylodes martinicensis Peters, 1876, Monatsber. Akad. Wiss. Berlin, 1876, Pl. I, Fig. 6.

This species is not distinguished by the Porto Ricans from the *E. portoricensis*, and when observed at all is called a "coquí."

Type locality.—St. Thomas, Virgin Islands.

Distribution.—This species was long known only from the Virgin Islands, St. Thomas and Tortola, and from Vieques Island. It is

doubtfully reported from St. John and St. Croix. I collected it on Porto Rico and Culebra in 1919.

Specimens collected.—30: Aibonito, Bayamon, Maricao, Santurce and Culebra Island.

Diagnosis.—Limbs shorter than in *Eleutherodactylus portoricensis*, the heels just meeting when the legs are bent at right angles to the body. Posterior surfaces of the thighs with a dark reticulation. Venter more coarsely granulated and digital disks smaller than in *portoricensis*.

Original description.—"An *Hylodes* with a verrucose venter, palatine

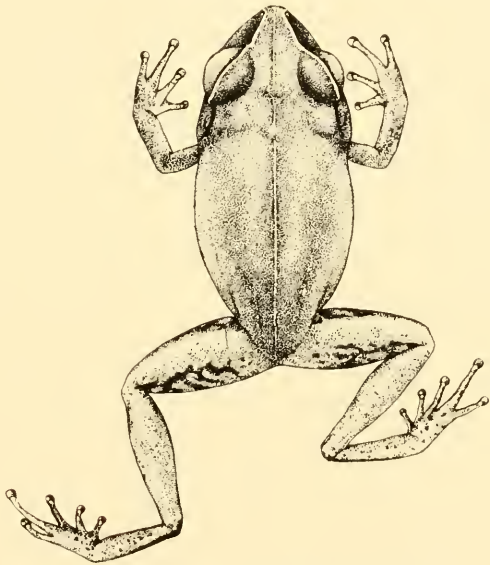


FIG. 17.—*Eleutherodactylus antilleanus*. A. M. N. H. No. 10019. Twice natural size.

teeth moderately separated, each series wedge-shaped, the two forming an angle open forward; [palatine teeth] widely separated from the border of the lip; digital disks rather large."

Remarks.—Stejneger* gives a detailed description of this species, based on a Vieques Island specimen:

"Tongue rather broad, heart-shaped, slightly nicked behind; vomerine teeth in two club-shaped oblique series, some distance behind but not laterally beyond the choanæ, converging backward and well separated; nostril much nearer the tip of snout than the eyes, their distance from the eye less than the diameter of the latter; upper eyelids narrower than the interorbital space; tympanum a little less than one-half the diameter of the eye, its distance from the eye less than one-half its diam-

* Stejneger, 1904, p. 592.



eter; fingers with rather small disks, first equalling second; disks of toes not smaller than those of the fingers; tip of first toe reaching disk of second; two metatarsal tubercles, the outer being rather small and obscure; series of plantar tubercles corresponding to metatarsals; no tarsal fold; the bent limbs being pressed along the side, knee and elbow, fail to meet; hind limb being extended along the side, heel reaches the eye; hind limbs being placed vertically to the axis of the body, the heels barely meet; skin above with scattered granules and a very narrow raised median line from tip of snout to vent; throat and chest smooth, belly and posterior aspect of femur strongly granular; a strong fold across the breast between the axilla."

The original description is sufficiently diagnostic as the only other species on St. Thomas is the smooth-skinned *E. lentus*, which has the vomerine teeth in long transverse series.

Color.—In coloration this species is less variable than *E. portoricensis* but the median white dorsal line may be present or absent. It is developed in twelve of the present specimens. The usual color is grayish brown, with faint dusky markings, and a sharply defined black canthal line which extends over the ear and a short distance beyond it, outlined above in most cases by a very narrow white line on the canthus extending over the eyelid. The concealed surfaces of the legs are reticulated with black, which affords a fairly good character for distinguishing this species in the field from *E. portoricensis*. One specimen, No. 10001, a male, is violet-red above, has a very heavy black canthal and supra-auricular mark, and the concealed surfaces of the legs black with sharply defined white spots.

The measurements of the largest specimens of each sex follow:

Parts measured	No. 10117 ♂	10082 ♀
Tip of snout to vent.....	24 mm.	33 mm.
Tip of snout to posterior edge of tympanum.....	10	13
Greatest breadth of head.....	11	14
Foreleg from axilla.....	16	19
Hind leg from vent.....	38	48

Habits.—This species prefers slightly lower herbage and slightly wetter situations than *E. portoricensis*, which is often associated with it. It ranges to an altitude of nearly 2000 feet at Aibonito.

Nothing is known of the breeding habits of this species.

The song of *E. antillensis* may be readily distinguished from that of *E. portoricensis* by its more metallic quality, and the frequent series of uniform notes ki-ki-ki-ki-ki ---. The males conceal themselves more

carefully when calling, making it exasperatingly difficult to locate the singer. They often sing from a position in the axils of the leaves of liliaceous plants. In Santurce along the railroad and trolley embankments north of the Hotel Eureka, I found this species more abundant than *E. portoricensis*. The single specimen from Culebra agrees closely with the Porto Rican series.

The discovery of this form in Porto Rico proper greatly reduces the differentiation of the Virgin Island fauna.

***Eleutherodactylus brittoni** Schmidt**

Text Fig. 18

Eleutherodactylus brittoni Schmidt, 1920, Ann. N. Y. Acad. Sci. Vol. XXVIII, p. 179, Fig. 7.

No native name is available for this species.

Type locality.—El Yunque, near the Forester's Cabin, about 1300 feet altitude, Luquillo Forest Reserve, Porto Rico.

Distribution.—Known only from El Yunque and Maricao.

Specimens collected.—4: El Yunque and Maricao.

Diagnosis.—Derived from *Eleutherodactylus antillensis*, from which it is distinguished by its small size, its sharp canthus rostralis, which is continued as a dorso-lateral angle some distance behind the ear, and its more posteriorly placed nostril.

Original description.—"Habitus slender, head narrower than the body, legs rather short, snout sharp-pointed; nostril two-fifths the distance from the end of the snout to the orbit; canthus rostralis sharp; inter-orbital space broader than the eyelid; heel reaching the anterior border of the orbit; heels meeting but not overlapping when the legs are at right angles to the body; top of snout flat, as is the anterior half of the back behind the eyes, the side of the body being vertical anteriorly; vomerine teeth in two small rounded patches, behind and within the choana; tympanum indistinct, separated from the eye by less than its diameter; dorsum smooth, venter coarsely granulate; digital disks small, as long as wide; a well-defined tarsal fold; a well-developed subgular vocal sac.

"Dorsum light grayish brown, venter lighter. Two black spots between the eyes, one on the middle of the back, and three posteriorly on the back, above the groin; legs with a single faint darker bar on the femur; concealed surfaces of the femur not reticulated; a black subcanthal streak, continued below the dorso-lateral angle behind the eye."

* Named for Dr. Nathaniel L. Britton, Chairman of the Committee for the Scientific Survey of Porto Rico and the Virgin Islands, New York Academy of Sciences.

MEASUREMENTS

Tip of snout to vent.....	16 mm.
Tip of snout to posterior edge of tympanum.....	6
Greatest breadth of head.....	6
Foreleg from axilla.....	9
Hind leg from vent.....	23
Tibia	8

Remarks.—The three paratypes are closely similar in size and structural characters to the type. Two have the black subcanthal and shoulder mark outlined with white above. One lacks the dorsal black spots.

The single specimen from Maricao was taken singing in herbage along the roadside, together with *E. portoricensis* and *E. antillensis*. Two



FIG. 18.—*Eleutherodactylus brittoni*. A. M. N. H. No. 10318. Twice natural size.

were taken singing on El Yunque, likewise in low herbage, and the last was found by accident in collecting *E. wightmanae*.

The song of this species is a succession of clicks, less shrill and less rapid than in *E. gryllus*.

This species stands in the same relation to *E. antillensis* as *E. gr̄ȳllus* does to *E. portoricensis*.

***Eleutherodactylus wightmanae** Schmidt**

Text Fig. 19

Eleutherodactylus wightmanae Schmidt, 1920, Ann. N. Y. Acad. Sci., Vol. XXVIII, p. 181, Fig. 8.

No native name exists for this species.

Type locality.—El Yunque, near the Forester's Cabin, about 1300 feet altitude, Luquillo Forest Reserve, Porto Rico.

* Named for the author's wife, Margaret Wightman Schmidt, whose loyal assistance contributed largely to the success of the work in Porto Rico in 1919.

Distribution.—Known from El Yunque and Maricao, at opposite ends of the island.

Specimens collected.—13: El Yunque and Maricao.

Diagnosis.—Size small; snout pointed; nostril much nearer to the tip of the snout than to the eye; tympanum small, distinct, separated from the eye by about its own diameter; vomerine teeth in two straight series, in the same line, extending as far laterally as the choanæ, and about the diameter of a choana behind them; toes free, digital disks well-developed; tibio-tarsal articulation reaching the anterior border of the eye; heels overlapping when the legs are placed at right angles to the body; skin rugose above, with elongate folds and ridges; venter rugose; thighs granular.

Original description.—“Head as long as broad, narrower than the body; snout pointed, its length anterior to the eyes once and a half the

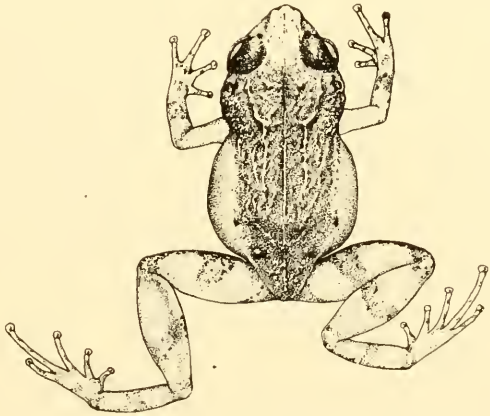


FIG. 19.—*Eleutherodactylus wightmanae*. A. M. N. H. No. 10220.
Twice natural size.

interorbital width; nostrils one-third the distance between eye and tip of snout from the latter; tympanum distinct, small, about one-third the diameter of the eye, separated from the eye by a little more than its own diameter; canthus rostralis sharp; elbow and knee pressed along sides overlap; heels overlap when the legs are placed at right angles to the body; tibio-tarsal articulation reaching the anterior border of the eye; disks of fingers and toes well-developed; digits slender, free; first toe distinctly shorter than the second; no tarsal folds; vomerine teeth in two straight series, separated in the median line, extending laterally as far as the outer border of the choanæ, and about the diameter of a choana behind them; tongue large, slightly nicked behind; skin rugose above, with longitudinal lines or folds, the most distinct of which originate behind the orbits and extend backward about two-thirds the length

of the back; a less distinct mid-dorsal ridge from snout to vent; venter and outer face of the thighs moderately rugose; a subgular vocal sac.

“Brown above, with a black subcanthal line, extending over the ear half way along the sides; a black spot on each side of the back over the groin; venter uniformly light; a single dark crossband on the radius; one on the femur, tibia, and tarsus (in line when the legs are folded), and a dark spot on the metatarsus; anterior and posterior faces of the thigh dusky.”

MEASUREMENTS

Tip of snout to vent.....	20 mm.
Tip of snout to posterior edge of tympanum.....	7.5
Greatest breadth of head.....	7.5
Foreleg from axilla	11
Hind leg from vent.....	30
Tibia	10

Remarks.—In structural characters the twelve paratypes agree closely with the type. Two specimens are light gray, instead of brown, with only indications of the black spots; in most specimens the postocular dark streak is broken up into a series of spots; one specimen is light brownish gray on each side, the area between sharply darker; the bars on the legs are distinct in all specimens.

The plaintive, diminuendo note of this small species is one of the most characteristic sounds in the amphibian chorus of the Luquillo Forest. Its song consists of a series of six or eight whistled notes, each slightly lower in pitch and a little fainter than the previous one. The creature sings habitually on the ground or in the lowest leaves of plants. To locate its position from its song it is particularly difficult, partly because it is usually well concealed, partly on account of the peculiar ventriloquy of its voice.

Nothing has been added to our knowledge of this species since its discovery.

***Eleutherodactylus richmondi* Stejneger**

Text Figs. 10 and 20

Eleutherodactylus richmondi Stejneger, 1904, Rept. U. S. Nation. Mus., 1902, p. 593, Figs. 25-29.—Barbour, 1914, Mem. Mus. Comp. Zool., Vol. XLIV, p. 247.—Schmidt, 1920, Ann. N. Y. Acad. Sci., Vol. XXVIII, p. 183, Fig. 9.

No native name exists for this species.

Type locality.—Catalina Plantation, about 890 feet altitude, eastern slope of El Yunque, Porto Rico.

Distribution.—Known only from Porto Rico and apparently confined to El Yunque.

Specimens collected.—11: El Yunque, from 1300 feet to the peak.

Diagnosis.—"Toes free without a vestige of web; belly smooth; tympanum distinct, less than one-half the diameter of the eye; vomerine teeth in two long angular transverse series, extending beyond the external border of the inner nares and some distance behind them; digital disks small; nostril much nearer tip of snout than eye; hind limbs not cross-barred."

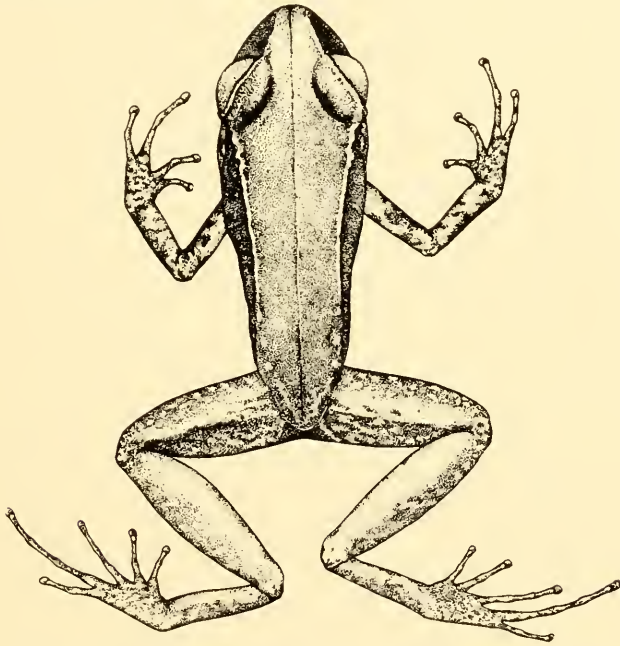


FIG. 20.—*Eleutherodactylus richmondi*. A. M. N. H. No. 10237. Twice natural size.

Original description.—"Tongue narrow, somewhat emarginate behind; vomerine teeth in two angular series behind the choanae, their distance from the choanae greater than the diameter of the latter; inner arm of each vomerine series longer, outer extending laterally beyond the choanae; nostril much nearer the tip of the snout than the eye, the distance from the eye slightly less than the diameter of the latter; upper eyelids somewhat narrower than interorbital space, tympanum slightly less than one-half the diameter of the eye, its distance from the latter slightly less than its diameter; disks of fingers rather small, first finger shorter than second; disks of toes small, first toe short, only reaching

subarticular tubercle of second; subarticular tubercles well developed; two well developed metatarsal tubercles; no plantar tubercles; no tarsal fold; the bent limbs being pressed along the sides, knee and elbow overlap; hind limb being extended along the side, heel reaches center of eye; hind limbs being placed vertically to the axis of the body, the heels overlap; skin above and on flanks granular, underside smooth; posterior aspect of femur areolate."

Remarks.—The coloration in life has been described by Stejneger as follows:—"Back dusky chestnut, lighter on sacrum; from each nostril along canthus rostralis, edge of eyebrow and sides of back a narrow dirty bluish-white stripe somewhat wider on sides of back than on canthus rostralis; sides of face and flanks below this stripe blackish, legs blackish; fore legs marbled with pale drab, hind legs with dull pale chestnut; under side dull greenish gray, with an ill-defined yellow spot in each groin, and marbled with dusky brown on throat and under side of hind legs. Iris blackish, brassy above pupil."

Like the larger series examined by Stejneger, the specimens collected on El Yunque by myself are extremely uniform in structural characters and in coloration. The only variation noted is the occasional lightening of the chestnut color of the dorsal area between the light dorso-lateral lines. The proportions are quite different in this species from the other Porto Rican species of the genus:—

Parts measured	A.M.N.H.	U.S.N.M.
	No. 19233	No. 26884
Tip of snout to vent.....	32 mm.	38 mm.
Tip of snout to posterior edge of tympanum.....	13	15
Greatest breadth of head.....	12	15
Foreleg from axilla.....	21	24
Hind leg from vent.....	51	62

Two extremely small specimens, measuring 9 and 11 mm., respectively, probably are recently transformed. They are colored like the adults.

All of the specimens known were found under stones or palm leaves on the trail or on damp ground, associated with *E. portoricensis*. The males of this species were not discovered singing and its voice is unknown. The slender digits and small adhesive disks probably indicate that it is more terrestrial in its habits, and the eggs may prove to be laid on the ground, like those of *E. luteolus* of Jamaica.

This species is allied by the form of its vomerine teeth to *E. lentus* of the Virgin Islands, *E. monensis* of Mona Island, *E. weinlandi* of Hispaniola and perhaps to *E. jamaicensis* of Jamaica. This group of species thus composes an interesting series of vicariating forms.

Eleutherodactylus monensis (Meerwarth)

Text Fig. 21

Hylodes monensis Meerwarth, 1901, Mitt. Naturh. Mus. Hamburg, Vol. XVIII, p. 39, Pl. 1 (Fig. 11), Pl. 2 (Figs. 4-5).

Eleutherodactylus monensis Stejneger, 1904, Rept. U. S. Nation. Mus., 1902, p. 595, Figs. 30-34.—Barbour, 1914, Mem. Mus. Comp. Zool., Vol. XLIV, p. 247.—Schmidt, 1926, Publ. Field Mus. Nat. Hist., Zool., Vol. XII, p. 154.

No native name exists for this species other than "coquí."

Type locality.—Mona Island, West Indies.

Distribution.—Confined to Mona Island.

Specimens collected.—41: Mona Island.

Diagnosis.—Vomerine teeth in long arched transverse series behind the choana; belly smooth; soles of feet tubercular; hind foot nearly as long

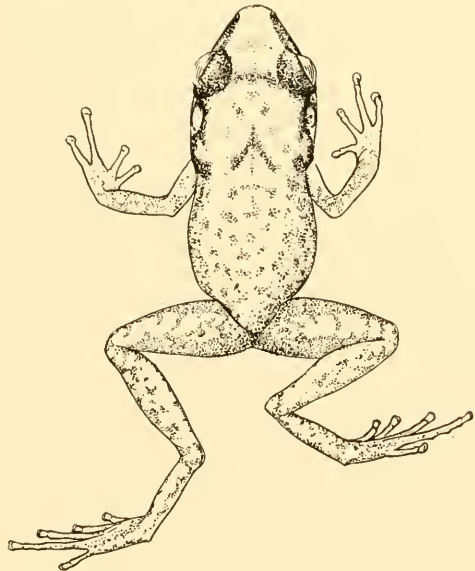


FIG. 21.—*Eleutherodactylus monensis*. A. M. N. H. No. 24463.

as fore leg; color of back and sides pale, with brownish markings.

Original description.—"This species is closely allied to the previous one [*Hylodes lentus* Cope] and differs from it in the following features: in *H. lentus* the femur, measured from the ischio-pubic crest to the edge of the knee is shorter than the tibia and at most as long as the distance from axilla to groin, while in *H. monensis* it is as long as the tibia and longer than the distance from axilla to groin; the tongue is wedge-shaped; the vomerine teeth are also in two rows behind the choana, but

the angle in each row is more obtuse, and the outer portion (beyond the ankle) is about half as long as the inner, instead of subequal, as in *H. lentus*.

"The color of the belly is uniform whitish yellow, that of the upper side a grayish flesh-color with small brown spots sparsely distributed on the back, sides, and limbs, and a more or less well-defined star-shaped figure formed from larger brown spots between the shoulders. A brown line extends from the nostril to the eye."

Remarks.—This species is well characterized in the original description and figures. The series of specimens secured by Anthony in 1926 agrees with the Hamburg originals and the single specimen in the National Museum described in detail by Stejneger.

Eleutherodactylus unicolor Stejneger

Text Figs. 22 and 23

Eleutherodactylus unicolor Stejneger, 1904, Rept. U. S. Nation. Mus., 1902, p. 597, Figs. 35-39.

No native name.

Type locality.—Camp on El Yunque at 2978 feet altitude, Luquillo Forest Reserve, Porto Rico.

Distribution.—Known only from the type locality.

Diagnosis.—"Toes free without a vestige of web; belly granular; tympanum distinct, one-third the diameter of eye; vomerine teeth in

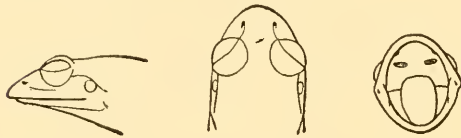


FIG. 22.—*Eleutherodactylus unicolor*. Side of head (left), top of head (center), and inside of mouth (right) of type. (After Stejneger.)

two short, straight series, not extending beyond the inner nares; head not broader than body; interorbital space equals upper eyelid; upper surface smooth; second finger longer than first; inner metatarsal tubercle large; digital disks small; nostrils intermediate between eye and tip of snout; hind limbs not cross barred."

Original description.—"Tongue medium, oval, entire behind; vomerine teeth in two short straight series behind the choanae, but not extending laterally beyond them, widely separated in the middle; snout declining rapidly from the eyes to the tip; nostril situated about halfway between eyes and tip of snout, their distance from the eyes one-half the diameter of the eye; upper eyelids as wide as interorbital space; tympanum small,

about one-third the diameter of the eye and distance from the latter more than its own diameter; fingers with exceedingly small disks, first slightly shorter than second; disks of toes better developed, first toe much shorter than second; subarticular tubercles well developed; no plantar tubercles; two well-developed metatarsal tubercles; no tarsal fold; hind limbs being bent forward, heels reach the ears, bent vertically to the axis of the body, the heels do not touch; skin above, throat, chest, and anterior aspect of femurs smooth; belly and sides granular."



FIG. 23.—*Eleutherodaectylus unicolor*. U. S. N. M. No. 26963, type. Twice natural size. (Courtesy of Dr. Leonhard Stejneger.)

Remarks.—Stejneger describes the coloration in life as follows: "Uniformly dusky chestnut above and below, with scattered, scarcely visible pale dots; a short postocular dusky band descending behind the tympanum."

MEASUREMENTS OF THE TYPE

Tip of snout to vent.....	16.5 mm.
Width of head	6
Diameter of eye.....	2.5
Diameter of tympanum.....	0.8
Length of arm.....	7
Length of leg.....	22

This species is still known only from the type. Its characters are so peculiar that additional specimens are much to be desired. Its pectoral girdle should be examined.

Class REPTILIA

Order SQUAMATA

The Squamata comprise the lizards and snakes, corresponding to the two suborders Sauria and Serpentes. The necessity of associating these two groups as a single order is reflected by the difficulty in framing a non-technical distinction between them. Anatomically they may best be distinguished by the separation of the mandibles anteriorly in the snakes, while in the lizards the mandibles are united by a suture. The limbless lizards of the family Amphisbaenidae and the blind snakes of the family Typhlopidae offer the chief difficulty in distinguishing the lizards and snakes in Porto Rico. The Amphisbaenidae, however, are immediately distinguishable by the absence of ordinary overlapping scales, the skin being divided into rectangular segments in regular rows and rings.

Suborder SAURIA

KEY TO THE GENERA OF PORTO RICAN LIZARDS

- A. Four limbs present.
 B. Top of head covered with numerous small scales or granules.
 C. Eyelids vestigial, not closing; pupil vertical.....(Gekkonidae)
 D. Toes dilated at the base, the terminal joints free, claw-shaped (see Fig. 24, left).....*Hemidactylus*
 DD. Toes dilated only at the tip, which is provided with a circular plate beneath (see Fig. 24, right).....*Sphaerodactylus*

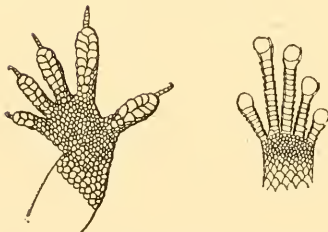


FIG. 24.—Digits of *Hemidactylus mabouia* (left) and *Sphaerodactylus macrolepis* (right) contrasted. (From Stejneger.)

- CC. Eyelids well-developed, functional.....Iguanidae
 D. Toes dilated at base, tip claw-shaped, as in *Hemidactylus*; no "combs" on toes; an extensible throat fan in the male, indicated in the female.....*Anolis*
 DD. Toes not dilated, "combs" present; no throat fan.....*Cyclura*

BB. Head with large regular shields above.

C. Occipital shield present; limbs relatively small (Anguidae) . . . *Celestus*

CC. Occipital shield absent, limbs moderate or well-developed.

D. Ventral scales not imbricate, in regular longitudinal and transverse rows (Teiidae) *Ameiva*

DD. Ventral scales imbricate, in oblique rows (Scincidae) *Mabuya*

AA. No limbs; eyes merely indicated by a dark spot beneath the skin, which is divided into small rectangular areas on the body (Amphisbaenidae)

Amphisbaena

GEKKONIDAE

Hemidactylus Oken

Hemidactylus mabouia (Moreau de Jonnès)

Text Figs. 24 and 25

Gecko mabouia Moreau de Jonnès, 1818, Bull. Soc. Philom., Paris, 1818, p. 138; 1821, Monogr. du *Gecko mabouia*, p. 1.

Hemidactylus mabouia Duméril & Bibron, 1836, Erpét. Gén., Vol. III, p. 362.—Duméril, 1851, Cat. Method. Rept. Mus. Paris, Vol. I, p. 39.—Reinhardt and Luetken, 1863, Vid. Meddel. Naturh. Foren., Copenhagen, 1862, p. 174, p. 275.—Cope, 1868, Proc. Acad. Nat. Sci., Phila., p. 311.—Boulenger, 1885, Cat. Lizards Brit. Mus., Vol. I, p. 122.—Strauch, 1887, Mem. Acad. Sci. St. Petersburg, (7), Vol. XXXV, No. 2, p. 31.—Garman, 1887, Bull. Essex Inst., Vol. XIX, p. 18.—Meerwarth, 1901, Mitt. Naturh. Mus. Hamburg, Vol. XVIII, p. 17.—Stejneger, 1904, Ann. Rept. U. S. Nation² Mus., 1902, p. 599, Figs. 40-45.—Wolcott, 1924, Journ. Rept. Agric. Pto. Rico, Vol. VII, p. 13.

Hemidactylus mabuya Fitzinger, 1843, Syst. Rept., p. 105.

Hemidactylus mabuia Cocteau, 1843, in Sagra, Hist. Fis. Pol. Nat. Cuba, Hist. Nat., Vol. IV, p. 95, Pl. 16.—Gundlach, 1867, Rept. Físico-Nat. Cuba, Vol. II, No. 5, p. 12; 1875; An. Soc. Españ. Hist. Nat., Vol. IV, p. 358; 1881, idem. Vol. X, p. 308.—Boettger, 1893, Kat. Rept. Mus. Senckenberg, Vol. I, p. 28.

Type locality.—St. Vincent, West Indies.

Distribution.—The West Indies, except perhaps the northern Lesser Antilles; northern South America. As I have remarked above, I do not consider the African geckos usually referred to this species as conspecific with the West Indian form.

Diagnosis.—A gecko of moderate size, the basal half of each digit expanded and provided beneath with pairs of lamellae, the distal half compressed, arising from within the tip of the expanded portion, curved, and provided with a claw at the tip; enlarged dorsal tubercles rather widely spaced, convex, not distinctly keeled; a long series of femoral pores, scarcely interrupted on the mid-line.

Original description.—"Digits expanded throughout their length, with two rows of transverse lamellae beneath; each terminating in a hooked claw; the back studded with tubercles and the tail with spinose scales; transverse plates on the under side of the tail; femora with pores beneath."

Remarks.—This species is the only one of the larger geckos found in Porto Rico. It is curiously scarce in collections and, if as rare in fact as this scarcity would seem to indicate, it may not be an indigenous member of the Porto Rican fauna.

Nothing is known of the habits of this species in Porto Rico beyond the fact that it has been taken in San Juan and that it was reported by

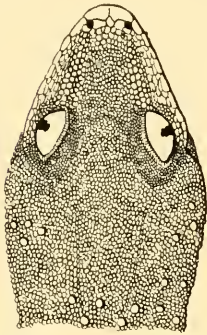


FIG. 25.—Head of *Hemidactylus mabouia*. (From Stejneger.)

Dr. E. Graywood Smyth of the Agricultural Experiment Station at Rio Piedras to frequent the vicinity of the arc-lights in Rio Piedras at night to prey upon the insects.

Beyond this meagre information nothing is known of its distribution on the island. In the West Indies as a whole it is widespread—from Trinidad and Barbadoes to Cuba and Jamaica. It is curious that it has not been recorded from the northern group of smaller islands in the Lesser Antilles. I have little doubt of its identity as a species throughout this range. A West African species, *Hemidactylus brookii*, occurs in Hispaniola (Port-au-Prince), where it was doubtless introduced by the slave-ships. The Mediterranean *Hemidactylus turcicus*, it is said, has become established at Key West.

Sphaerodactylus Wagler

Sphaerodactylus macrolepis Günther

Text Figs. 24 and 26

Salamandra, Salamandrita; Salamanqua, Salamanquita; Lucia (?); Ranita; Lagartija cabeza de muerte

- Sphaerodactylus macrolepis* Günther, 1859, Ann. Mag. Nat. Hist., (3), Vol. IV, p. 215, Pl. 4, Fig. B.—Barbour, 1914, Mem. Mus. Comp. Zool., Vol. XLIV, p. 270; 1915, Proc. Biol. Soc. Wash., Vol. XXVII, p. 72; 1917, Vol. XXX, p. 98.—Schmidt, 1920, Ann. N. Y. Acad. Sci., Vol. XXVIII, p. 184.—Barbour, 1921, Mem. Mus. Comp. Zool., Vol. XLVII, p. 253, Pl. 6, Figs. 2-3, Pl. 19, Figs. 5-8.—Wolcott, 1924, Journ. Dept. Agric. Pto. Rico, Vol. VII, p. 13.
- Sphaerodactylus macrolepis mouensis* Meerwarth, 1901, Mitt. Naturh. Mus. Hamburg, Vol. XVIII, p. 20.
- Sphaerodactylus mouensis* Stejneger, 1904, Rept. U. S. Nat. Mus., 1902, p. 607.—Barbour, 1914, Mem. Mus. Comp. Zool., Vol. XLIV, p. 270.
- Sphaerodactylus grandisquamis* Stejneger, 1904, Rept. U. S. Nat. Mus., 1902, p. 602, Figs. 46-52.—Barbour, 1914, Mem. Mus. Comp. Zool., Vol. XLIV, p. 270.—Fowler, 1918, Publ. Carnegie Inst. Wash., No. 252, p. 7.

The species of this genus are usually known as Salamandritas (or Salamanquitas) to the Spanish-speaking West Indians. The wriggling mode of progression of these tiny geckos is quite salamander-like and the name is to that extent appropriate. Stejneger found that the name "Lucia" or "Santa Lucia" was applied to this species by the children in Luquillo. This, however, must have been an unfortunate localism, as these names are used everywhere in Porto Rico for the *Mabuya*, a totally different creature. The equally local use of the name "Ranita" at Aibonito illustrates the tendency to apply a name which exists in the language to any unidentified species.

Type locality.—St. Thomas, Virgin Islands.

Distribution.—Widespread on Porto Rico, where it is recorded from Aibonito, Bayamon, Cantaño, Coamo Springs, Ensenada, Luquillo, Maricao, Ponce and El Yunque. It is evidently not confined to the coastal plain as supposed by Stejneger. On the outlying islands it is known from Mona and Vieques and occurs on most of the Virgin Islands.

Specimens collected.—45, from Aibonito, Bayamon, Cataño, Coamo Springs, Ensenada, Maricao, El Yunque and Mona Island.

Diagnosis.—A small geckoid lizard with unexpanded digits which are provided with an enlarged flat circular scale beneath the tip; dorsal scales keeled, imbricate, somewhat variable in size; no vertebral series of small scales.

Original description.—"Body surrounded by about forty longitudinal series of scales of rather large size; no vertebral streak of smaller ones, those of the back keeled, of the belly smooth. Trunk and tail uniform blackish brown, in younger individuals some scales with blackish tips; head greyish brown, marbled with black; jaws and throat striolated with blackish.

"The snout is of moderate extent, and slightly pointed; all the upper surface of the head and the sides are covered with scales of moderate size; there is an exceedingly small horn-like spine above the middle of the orbit. The rostral shield is low, and bent backwards on the upper surface of the snout; the sides of the jaw are margined with three elongate labials; the nostril is situated above the posterior extremity of the rostral shield and first labial, and exceedingly small. The anterior lower labial is single; a series of three other shields covers the lateral margin of the lower jaw. The scales of the throat are small, those of the breast and of the extremities keeled. The ear-opening is very small, one-third only of the width of the eye. The fingers and toes have an en-

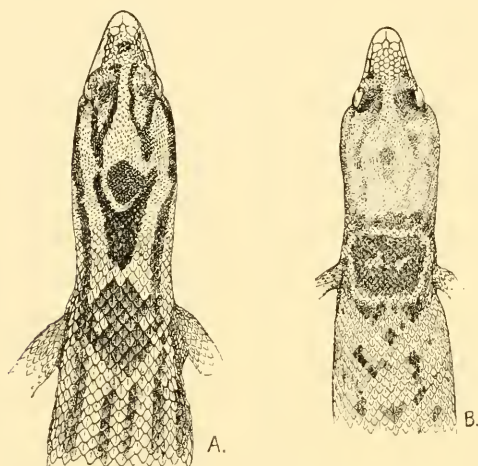


FIG. 26.—Head and shoulders of *Sphacrodactylus macrolepis*. A. M. N. H. No. 13037 (A) and No. 13697 (B), showing two common types of pattern. Two and a half times natural size.

tire and unarmed disk. The tail is covered with smooth scales, rather smaller than those of the trunk; there is a series of larger ones, plate-like, along the lower medial line. No femoral or anal pores.

"I add to the statement of the coloration given above that the belly is uniform dirty white, and the tail minutely dotted with blackish. Two specimens were in the collection."

Remarks.—Barbour (1917, p. 98), after examining a considerable series of *Sphaerodactylus macrolepis* from the Virgin Islands, expressed a measure of doubt as to the distinctness of *S. grandisquamis*. Both Barbour and I have subsequently reached the conclusion that it is untenable. Stejneger separated *S. grandisquamis* and *S. monensis* from *S. macrolepis* solely on the size of the scales, which he gives as 34-38 about the body in *S. grandisquamis*, 46-48 in *S. monensis*. In the series from Porto Rico collected by myself the variation is as follows:

Scales about the body	32	36	40	44	48	52	56
Number of specimens	2	8	3	4	5	6	2

In five specimens from Mona Island the number of scales varies from 44 to 52; as *S. macrolepis* is intermediate between *S. grandisquamis* and *S. monensis*, it is evident that the variation in the present series includes all three supposed forms. There is probably a somewhat different range of variation on the several islands but the extremes are certainly included in that of the Porto Rican series.

Reproduced tails have a much widened series of median ventral scales.

MEASUREMENT OF A. M. N. H. No. 13324

Total length	66 mm.
Tail	34
Tip of snout to posterior edge of ear.....	8
Breadth of head.....	5.5
Foreleg from axilla.....	7.5
Hind leg from groin.....	10

The smallest specimen measures 12 mm. from snout to vent.

This species is highly variable in coloration. The absence of the elaborate head pattern appears to be due to the general darkening of the coloration, as all of the lighter specimens have it in some form or other. Only two specimens are without a trace of the black shoulder band with its two white spots. In the remaining specimens its development is very irregular, the white spots persisting even when the black band is indistinguishable. The darker dorsal spots are usually in rows, and in some specimens form longitudinal lines. The throat is uniform or heavily dotted with dark spots. Juvenile specimens are usually dark in color, with the white spots of the scapular band distinct. One specimen (No. 13811) is light brown in ground color with five light gray longitudinal stripes; one, median from between the eyes to the base of the tail; two, dorso-lateral from the upper posterior corner of the eye to the base of the tail, and two, lateral from the eye through the ear to the groin, the latter only narrowly separated from the light venter. In specimens from Mona Island, the scapular black band is larger, outlined with light color, the brilliant white spots transverse, forming a continuous line in one specimen.

Habits.—The usual habitat of this species is the ground cover of dead leaves in coffee plantations and forest. Elsewhere it is found under stones and logs. Along the base of the limestone cliffs on the hills back of Cataño, *Sphaerodactylus* were numerous, scurrying for the crevices at the base of the cliff when alarmed. One specimen was found under a leaf

sheath, and others on the trunks, of banana plants. The specimens from Bayamon were found in picking up rubbish on freshly cleared land. These reptiles frequently venture forth in broad daylight, but are probably essentially crepuscular or nocturnal.

Four of the specimens collected on Mona Island were taken among the limestone boulders on the west side of the island, and of these three were secured at night with the hand lamp. Two were taken beneath pieces of coral on the flat terrace on the south side.

Their extreme agility makes them difficult to catch, and the tail is often broken or the skin torn. When caught, they frequently turn a uniform light gray, becoming brown again in the collecting bag.

An egg, probably of this species, was found under a log at Aibonito, August 21, 1919. It is white, discolored by stains, with a hard and smooth shell, 6 x 4.5 mm.

IGUANIDAE

Anolis Daudin

The lizards of the genus *Anolis*, characterized by expanded digits that have a raised terminal claw-like portion, and by the presence of a throat-fan, usually brightly colored, which may be distended vertically, are the most ubiquitous of West Indian lizards. The multitude of species in the West Indies is paralleled in Central America and in northwestern South America. Wherever lizards of the genus *Anolis* occur, a few species are usually extremely abundant—thus *Anolis cristatellus* on Porto Rico, *A. cybotes* on Hispaniola, *A. sagrei* on Cuba and at Belize.

The power of color change is highly developed in the Anoles, and they are frequently miscalled "chamaeleons" or "cameleones." As Stejneger remarks, "Anolis" might well be adopted as a vernacular name. In spite of their color-change, the species are almost invariably distinguishable by some feature of their coloration, and I have drawn up a key to the males of the species on this basis to supplement the synopsis based on structural characters devised by Stejneger, which must be referred to when the color characters fail.

KEY TO THE SPECIES OF ANOLIS RECORDED FROM PORTO RICO

- A. Dorsal scales entirely separated from each other by several circles of granules; size large; male with tail crest.....*A. cuvieri*
- AA. Dorsal scales juxtaposed or imbricated; size moderate or small.
- B. Dorsal scales (all, or with the exception of two rows on the median line) granular or tubercular, differing but little, if at all, from laterals, but very much from the much larger ventrals, which are smooth or feebly keeled.

- C. Two, or more, shields or scales between the superciliaries and the supraocular semicircle bordering the supraocular granules anteriorly. Tail of male crested.
- D. Supraocular semicircles separated by at least two scale rows; occipital shield separated from supraocular semicircles by at least five scale rows (Fig. —).....*A. gundlachi*
- DD. Supraocular semicircles in contact or with at most a single series of scales between; occipital shield separated from supraocular semicircles by at most four scale rows.....
A. cristatellus
- CC. One shield between the superciliaries and the supraocular semicircle bordering the supraocular granules anteriorly.
- D. Width of head as great, or greater than distance from tip of snout to center of eye; anterior femoral scales keeled, gradually diminishing; color greenish.....*A. evermanni*
- DD. Width of head less than distance from tip of snout to center of eye; anterior femoral scales smooth, abruptly larger than the others; color brownish or grayish.....*A. stratulus*
- BB. Dorsal scales large, flat, keeled, imbricate, very much like the ventrals, which are very strongly keeled, the keels forming continuous ridges.
- C. Lateral scales granular.
- D. Width of head much more than half the distance from tip of snout to ear-opening; four to six median dorsal scale rows more or less abruptly larger than the others; skin of dewlap in male, orange.....*A. krugi*
- DD. Width of head about one-half the distance from tip of snout to ear-opening; dorsal scales gradually increasing in size from the laterals toward the median rows; skin or dewlap in male, crimson.....*A. pulchellus*
- CC. Lateral scales imbricated, keeled.....*A. poncensis*

COLOR KEY TO PORTO RICAN ANOLES

- A. No longitudinal stripes.
- B. Color brown or gray, never bright green.
- C. No short transverse saddle-shaped vertebral spots.
- D. Iris dark brown; skin of dewlap greenish yellow, its edge brownish orange.....*A. cristatellus*
- DD. Iris metallic blue; skin of dewlap orange olive, with distant yellow scales.....*A. gundlachi*
- CC. Short black saddle-shaped spots on the mid-line of the back; dewlap bright orange.....*A. stratulus*
- BB. Color bright green (if not green, no transverse bands or spots).
- C. Size large, front of head flat, bony.....*A. curieri*
- CC. Size moderate, front of head concave.....*A. evermanni*
- AA. Light longitudinal stripes present.
- B. Throat-fan white.....*A. poncensis*
- BB. Throat-fan crimson.....*A. pulchellus*
- BBB. Throat-fan orange.....*A. krugi*

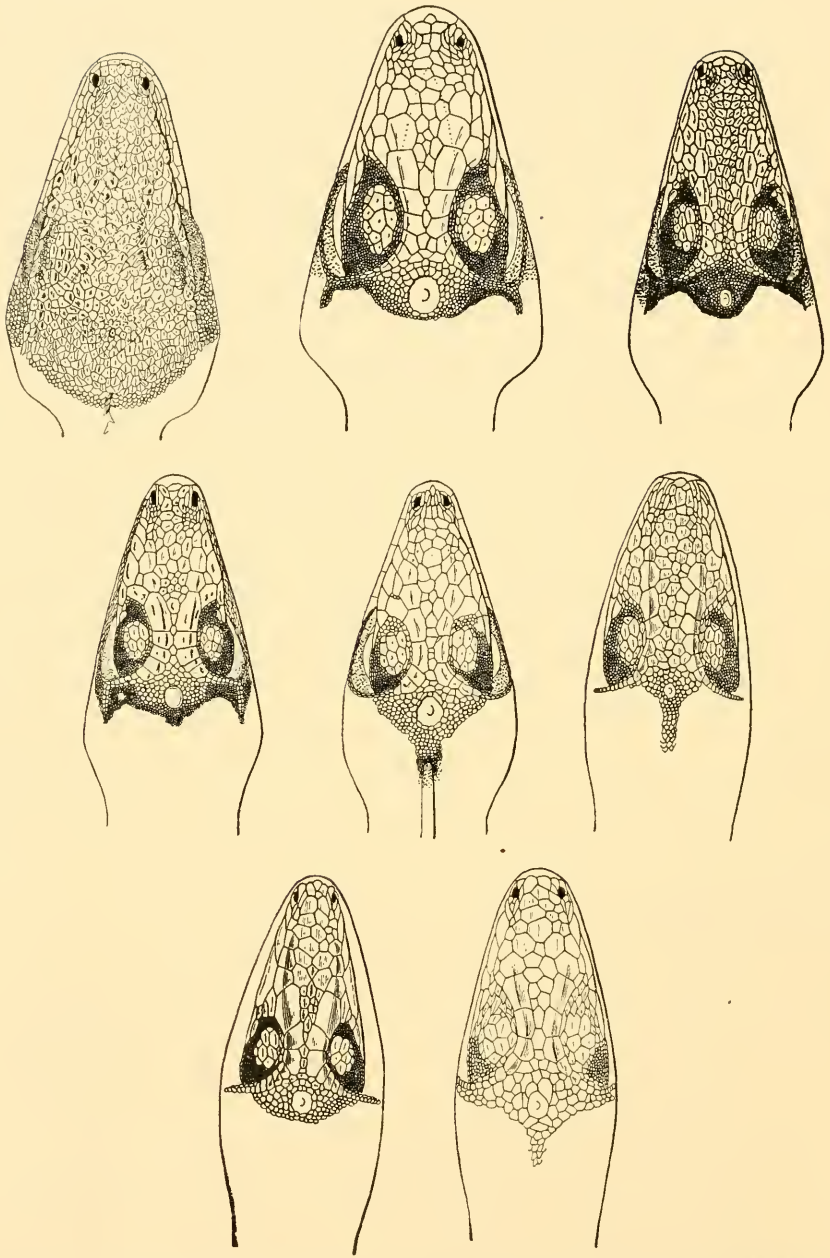


FIG. 27.—Heads of Porto Rican *Anolis*. *Anolis curieri* (left of top row), *Anolis cristatellus* (center of top row), *Anolis gundlachi* (right of top row); *Anolis evermanni* (left of middle row), *Anolis stratulus* (center of middle row), *Anolis krugi* (right of middle row); *Anolis pulchellus* (left of bottom row), *Anolis poucensis* (right of bottom row). (From Stejneger.)

Anolis cuvieri Merrem

Lagarto, Chipajo

Text Figs. 27 and 28

- Anolis cuvieri* Merrem, 1820, Syst. Amphib., p. 45.—Boulenger, 1885, Cat. Lizards, Brit. Mus., Vol. II, p. 23.—Garman, 1887, Bull. Essex Inst., Vol. XIX, p. 27.—Stejneger, 1904, Rept. U. S. Nation. Mus. 1902, p. 627, Figs. 81-84, 87.—Barbour, 1914, Mem. Mus. Comp. Zool., Vol. XLIV, p. 273.—Fowler, 1918, Papers Dept. Marine Biol., Carnegie Inst., Vol. XII, p. 7.—Schmidt, 1920, Ann. N. Y. Acad. Sci., Vol. XXVIII, p. 185.—Smyth, 1920, Rev. Agric. Pto. Rico, Vol. IV, p. 19.—Wolcott, 1924, Journ. Dept. Agric. Pto. Rico, Vol. VII, p. 14.
- Anolius velifer* Cuvier, 1829, Règne Anim., 2nd Ed., Vol. II, p. 29, Pl. 5, Fig. 1.—Guerin, 1830, Icon. Règne Anim., Rept., Pl. 12, Fig. 1.
- Anolis velifer* Duméril and Bibron, 1837, Erpét. Gén., Vol. IV, p. 164.—Duméril, 1851, Cat. Method. Rept. Mus. Paris, Vol. I, p. 59.—Reinhardt and Luetken, 1863, Vid. Meddel. Naturh. Foren., Copenhagen, 1862, p. 260.—Cope, 1868, Proc. Acad. Nat. Sci. Phila., p. 312.—Peters, 1876, Monatsber. Akad. Wiss. Berlin, p. 705.—Gundlach, 1881, Anales Soc. Españ. Hist. Nat., Vol. X, p. 308.—Stahl, 1882, Fauna Puerto-Rico, p. 69, p. 159.
- Xiphosurus velifer* Cope, 1861, Proc. Acad. Nat. Sci. Phila., p. 208.

Type locality.—Jamaica (erroneously).

Distribution.—*Anolis cuvieri* has been taken at Aibonito, Catalina Plantation (El Yunque), Ciales, Humacao, Luquillo, Mayagüez and Utuado. It is probably not found in the arid southwestern corner of the island, but ranges quite generally over the remaining part of Porto Rico. It is recorded from Vieques and Tortola of the Virgin Islands. Its absence from the other Virgin Islands is perhaps due to difference in the habitat conditions or perhaps to extinction. It is nearly allied to *Anolis ricordii* of Hispaniola.

Specimens collected.—11. Aibonito.

Original description.—"The rayed fin extending from the base to the middle of the tail, with twelve to fifteen rays. Throat fan extending to the breast."

Remarks.—Stejneger's discussion of the historical aspect of the taxonomy of this species, and of its relations with the Hispaniolan *Anolis ricordii* is a model of completeness and clarity. His description of a male specimen follows:

"Top of head flat, with only shallow depressions on prefrontal and occipital region, the scales being rather small and roughly keeled and tuberculated, even those on top of the snout, but especially those of the supraorbital semicircle and frontal ridges; about nine enlarged supraoculars. flat, keeled, and in contact with the semicirculars; supraorbital

semicircles separated by about three scale rows from each other and from the occipital, which is barely noticeable; scales surrounding the occipital depression on the sides and behind rather large, flat, polygonous, each with a strong keel; six loreal rows, the scales composing the lower row next to the supralabials largest; one row of large keeled suboculars; 7-8 supralabials to under the center of the eye; temporals flat, with a low tubercle, all the scales of the sides of the head being more or less rugose or wrinkled; ear-opening rather small, upright, oval; back and

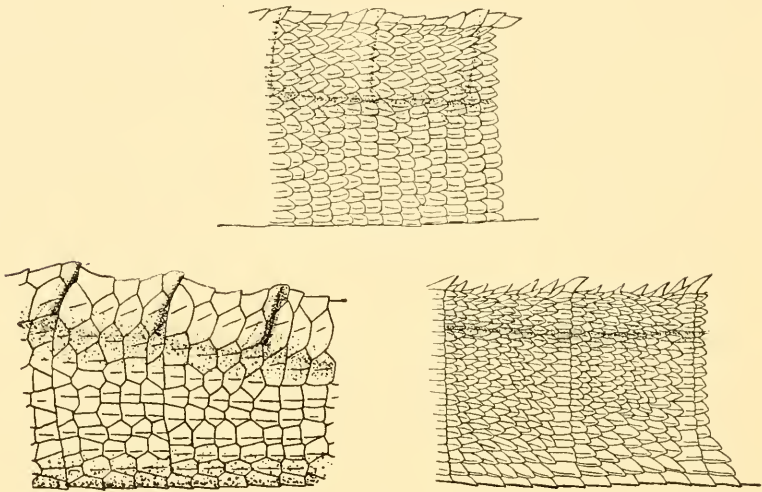


FIG. 28.—Caudal crest of *Anolis curvieri* (left), of *A. gundlachi* (center), and *A. cristatellus* (right).

sides covered with uniform scales tuberculated or keeled, separated from each other by one or more rings of minute granules; on the median line of the neck and back a series of about fifty triangular spines forming a saw-tooth ridge scarcely connected with the caudal crest; ventral scales about same size as dorsals, though more closely set, but not keeled or distinctly tuberculated except on the flanks; scales on chin and throat more elongate, distinctly keeled or tuberculated; scales on upper side of fore limbs larger than dorsals, juxtaposed or imbricate, keeled, becoming larger and multicarinate toward the hand; scales on upper side of hind limb similar, though less sharply keeled; scales on under side of femur slightly larger than ventrals, indistinctly tuberculate; digital expansion well developed, about thirty-three lamellæ under second and third phalanges of the fourth toe; tail strongly compressed, basal half with a high fin-like crest supported by about fourteen bony "rays," the

elongations of the neural spines of the caudal vertebræ; scales covering sides of tail flat, keeled, those on the fin between the "rays" elongate, three to four rows between rays, about fourteen longitudinal rows on side of tail at the level of the fifth ray from the base; gular appendage very large, with distant rows of small tuberculate scales on the naked skin, the edge being rounded, thickened, and scaly; large postanal plates."

Female specimens lack the caudal "fin" and have a smaller dewlap with the scales set more closely. Stejneger's description of the coloration in life is as follows:

"Iris hazel, with a bright brassy ring bordering the pupil; general color above greenish gray; back clouded with brownish and sides with blackish dots, the dusky of the back and the black spots on the sides arranged in four perceptible, though indistinct, cross-bands; eyelids blackish, with a citron-yellowish spot above and behind the eye and a smaller one in front; under the eye a long semilunar white spot barely invading the posterior supralabials; several whitish spots on temples and sides of neck; underside white with dark-gray mottlings and spots; dewlap delicately Naples-yellow, scales on the edge white; legs indistinctly crossbarred with dusky bands more or less spotted with blackish. Tongue pale cadmium orange, whole interior of mouth of same color, but duller."

Stejneger records only a single specimen as being emerald green, while ten of the eleven collected by me were a uniform green. The eleventh was gray mottled with brown and black as described above. It lay closely pressed to a small branch of which it seemed an integral part until the continued pointing of my small boy assistant enabled me to distinguish it. As a protective coloration this pattern is an extraordinary success. Color-change is evidently very complete in this species.

There is little variation in the Porto Rico Survey series. In A. M. N. H. No. 13234 the tail crest is unusually high, fully as high as in *A. ricordii* of Hispaniola, but the scale characters which distinguish *cuvieri* from *ricordii* are perfectly constant.

The measurements of the largest and smallest specimens are as follows:

Parts measured	A. M. N. H.	A. M. N. H.
	No. 13236	No. 13138
Total length	418 mm.	304 mm.
Body	135	100
Tail	283	204
Length of head	43	32
Breadth of head	26	19
Arm	60	39
Leg	100	73

Habits.—At Aibonito the giant *Anolis* was found in the coffee plantations, usually on the larger shade trees, but occasionally on the coffee bushes. It was never seen lower than eight feet from the ground. Taking into consideration its size, it is fairly abundant, but it is difficult to see and still more difficult to secure without shooting.

Seven out of eight stomachs examined contained the remains of large beetles; one, a large phasmid; one, remains of Heteroptera; one, a mass of skin of *Anolis cuvieri* (doubtless its own). The boys say that this lizard eats berries and fruits, and in the coffee plantations it is accused of eating coffee berries. It seems probable that vegetable matter forms only a small proportion of its food, as in *Anolis cristallus*. Wolcott found snails in stomach contents examined by him.

***Anolis cristatellus* Duméril and Bibron**

Lagartija comun

Text Figs. 27 and 28

Anolis cristatellus Duméril and Bibron, 1837, *Erpét. Gén.*, Vol. IV, p. 143.—Duméril, 1851, *Cat. Method. Rept. Mus. Paris*, Vol. I, p. 58.—Reinhardt and Luetken, 1863, *Vid. Medal. Naturh. Foren.*, Copenhagen, 1862, p. 249.—Bocourt, 1873, *Miss. Sci. Mex., Zool. Rept.*, Livr. 2, Pl. 14, Fig. 12.—Peters, 1876, *Monatsber. Akad. Wiss. Berlin*, p. 706.—Gundlach, 1881, *Anales Soc. Españ. Hist. Nat.*, Vol. X, p. 309.—Stahl, 1882, *Fauna Puerto-Rico*, p. 69, p. 159.—Boulenger, 1885, *Cat. Lizards Brit. Mus.*, Vol. II, p. 26.—Garman, 1887, *Bull. Essex Inst.*, Vol. XIX, p. 27.—Meerwarth, 1901, *Mitt. Naturh. Mus. Hamburg*, Vol. XVIII, p. 21.—Stejneger, 1904, *Rept. U. S. Nation. Mus.*, 1902, p. 638, Figs. 92-97.—Barbour, 1914, *Mem. Mus. Comp. Zool.*, Vol. XLIV, p. 274; 1917, *Proc. Biol. Soc. Wash.*, Vol. XXX, p. 99.—Fowler, 1918, *Papers Dept. Marine Biol., Carnegie Inst.*, Vol. XII, p. 10, Fig. 5.—Schmidt, 1920, *Ann. N. Y. Acad. Sci.*, Vol. XXVIII, p. 186.—Smyth, 1920, *Rev. Agric. Pto. Rico*, Vol. IV, p. 18.—Wolcott, 1924, *Journ. Dept. Agric. Pto. Rico*, Vol. VII, p. 27.—Danforth, 1925, *Copeia*, No. 147, p. 77.—Schmidt, 1926, *Publ. Field Mus. Nat. Hist., Zool.*, Vol. XII, p. 155.

Xiphosurus cristatellus Cope, 1861, *Proc. Acad. Nat. Sci. Phila.*, p. 208.

Anolis monensis Stejneger, 1904, *Ann. Rept. U. S. Nation. Mus.*, 1902, p. 646.

Figs. 98-101.—Barbour, 1914, *Mem. Mus. Comp. Zool.*, Vol. XLIV, p. 273.

Type locality.—Martinique (erroneously).

Distribution.—This species may be found in all parts of Porto Rico except the more densely forested areas. Combining the localities in the Porto Rico Survey collection with those in Stejneger's list and those given by Wolcott, *Anolis cristatellus* is recorded from Adjuntas, Aguas Buenas, Aibonito, Añasco, Arroyo, Bayamon, Boqueron, Caguas, Cata-

lina Plantation, Cataño, Cayey, Coamo, Coamo Springs, Condado, Ciales, Ensenada, Hucares, Humacao, Juncos, Lares, Maneyes, Maricao, Mayagüez, Ponce, Pueblo Viejo, Rio Loco (near Yanco), Rio Piedras, Salinas, San Antonio, San Juan, Santurce, Utuado and Vannina.

On the neighboring islands it is found on Desecheo, Mona, Caja de Muertos (Anthony, 1926), and is the most abundant lizard on Vieques and Culebra. The records from Hispaniola are evidently erroneous as to locality or identification. It is curious that no crested-tailed *Anolis* (except the large *A. ricordii*) occurs in Hispaniola.

Specimens collected.—316: Adjuntas, Aibonito, Bayamon, Cataño, Coamo Springs, Ensenada, Maricao, Mayagüez, Salinas, Santurce and Desecheo, Mona, Caja de Muertos, Culebra and Vieques Islands.

Diagnosis.—Dorsal scales small, nearly uniform, juxtaposed; ventrals larger, smooth; supraocular semicircles in contact; two scales between the superciliaries and the supraocular semicircles anterior to the supraocular granules; tail of male usually with a high crest or fin, supported by bony rays.

Original description.—“The little crested anolis has a rather thick-set form; its head is a four-sided pyramid with subequal sides; the middle of the occipital region has a rhomboidal depression not apparent in young specimens; the two anterior borders of this depression are formed by the two supraorbital ridges, which extend forward in the direction of the nostrils to a point about opposite the second upper labial. The space between these ridges forms a hollow with the shape of an isosceles triangle. The tip of the snout is swollen. The small circular nostrils are placed close to the rostral, and directed sideward. Four or five elongate oblong hexagonal plates cover the canthus between the nostril and the superciliary border. The occipital plate is small and round, situated at the posterior extremity of the rhomboidal depression. It is separated from the supraorbital ridges by flattened plates. Behind and on each side of the occipital the head is covered with small sub-oval slightly convex scales. The scales of the supraorbital ridges are composed of seven to nine scales each, increasing in size to the third, which is the largest, and then diminishing gradually to the last. These ridges meet in the interorbital region. The triangular frontal depression is covered with the small, angular, flat scales, half the size of those of the ridges which border the depression. The scales of the top of the snout and especially of the postnasal region are still smaller. Each supraocular area has a disk of about fifteen angular scales surrounded by small granules. The center of these scales may be feebly keeled. The loreal

area is covered with small, smooth, rectangular scales in six or seven rows. There are sixteen rectangular upper labials. The rostral is very broad, with a V-shaped or semicircular notch in its upper border, on each side of which is a more or less rounded point. The mental scales are pentagonal, subtriangular. There are about twenty-four compressed, tricuspid teeth and thirty-five or forty simple ones both above and below. The auricular hollow is oval, with the tympanic membrane slightly depressed. The throat-fan, whose border is rounded extends from the middle of the lower side of the head well down on the breast. The temples are covered with granular scales. The back is tectiform, the neck thick. Neck and back have a mid-dorsal fold of skin covered by a few rows of slightly enlarged scales. Extended along the body, the fore-limbs reach the base of the thigh, the hind-limbs the anterior border of the eye. The tail is a half longer than head and body; it is compressed and the upper edge is sharp. In the males the apophyses on the first two-thirds of the tail are heightened to twice the width of the tail, supporting the skin of this curious crest, which is so thin the bony rays may be seen through it. The granular scales of the back and sides are so fine as to give the skin a silk-like appearance. The skin above and behind the thighs, of the front of the arm and of part of the forearm, is similar. The external faces of the arms and thighs as well as the calves, have large imbricate, sub-hexagonal and feebly keeled scales. The underside of the head is covered with longitudinal rows of oval granules, not imbricate. The breast is covered with smooth, subrhomboidal scales. The ventral scales are similar but subhexagonal and almost round posteriorly. The sides of the tail are covered with imbricate, keeled, rhomboidal scales; its lower side is covered by large quadrilateral scales, with strong keels."

Remarks.—The above description is sufficiently accurate to connect it definitely with the Porto Rican and Virgin Island species, since no such form is found in Martinique.

Stejneger regarded the *Anolis* of Mona Island as a species distinct from *A. cristatellus*, from which it differed in having larger scales on the head, hence fewer loreals and fewer scales between the occipitals and the semicircles, and in having a much higher tail crest and a somewhat peculiar coloration. I cannot agree to this separation. Specimens from Ensenada and Coamo Springs agree exactly with those from Mona, while *A. cristatellus* from Culebra Island has an even higher caudal crest than those from Mona. The coloration of the Mona specimens taken on limestone is not ordinarily seen in Porto Rican *cristatellus*, but specimens

taken on limestones at Ensenada, Salinas and Coamo Springs are similarly colored. Ordinary *crisatellus* with low tail crests occur in the same area, and it is obviously impossible to separate them. The species does differ somewhat on the various islands, but the variation curves overlap too greatly to warrant even subspecific distinction. The number of scales between the occipital and the semicircles varies as follows in eighty specimens, forty of which are from Vieques and forty from Mona Island:

Number of scales between occipital and semicircles	1	2	3	4
Number of specimens, Mona Island.....	14	18	8	0
Number of specimens, Vieques.....	5	16	12	7

The vertical rows of loreals in the same series are as follows:

Loreals	5	6	7
Number of specimens, Mona Island	27	11	2
Number of specimens, Vieques	12	22	8

In the present series of Porto Rican specimens adult males which wholly lack the tail "fin" are frequent, and such specimens are even more frequent in Vieques. Thus of thirty-nine males collected in Vieques none have a high continuous tail "fin" like those of Culebra or Mona, twenty-seven have a low serrated crest, about one-third as high as the diameter of the tail, and twelve lack the crest entirely, having merely a compressed tail with a denticulate row of dorsal scales. This is evidently the condition referred to by Reinhardt and Luetken (1863, Vidensk. Med. Naturh. For., Kjöbenhavn, p. 249), whose comment was inexplicable to Stejneger (1904, p. 640) because he lacked a sufficient series from Vieques. In going from Vieques to Culebra the difference between the tail crests of the males is very striking and, if these males were not linked by Porto Rican specimens, they would certainly be regarded as distinct forms. Thus out of twenty Culebra males only four have a tail "fin" as low as the highest found in the Vieques specimens, and in the remaining sixteen the "fin" varies from a height equal to the vertical diameter of the tail to twice the diameter. Evidently we have an excellent example in this plastic species of the beginning of the process of differentiation through isolation on islands. The specimens from Desecheo present no peculiarities, but have the pale "monensis" coloration.

Injuries to the tail and hence reproduced tails are very common in this species. It is possible that some of them occur during the fights of the males, and in such encounters the injuries to the dewlap, which are occasional in very old males, doubtless also take place. The scales of the reproduced tail are larger, longer and more heavily keeled than nor-

mally, and there is frequently an enlargement of the tip. The crest is never reproduced.

The measurements of a large male and of a specimen just hatched are as follows:

Parts measured	A. M. N. H.	
	No. 13221	No. 12908
Total length	43 mm.	186 mm.
Body	16	65
Tail	27	121
Length of head.....	6	20
Breadth of head.....	4	14
Arm	8	32
Leg	14	56

Recently hatched specimens have a crossbanded coloration. In No. 13221, hatched in captivity, the dorsal ground color is gray, crossed by a sharp transverse chocolate-colored band, with a wavy margin over the eyes; a horseshoe-shaped band from the upper posterior corner of the eye over the occiput behind the occipital; a diagonal streak of the same color from the lower posterior corner of the eye to the shoulder; eyelid with seven radial bands (including those above mentioned); five dark crossbands on the back to the base of the tail, widest at the sides; tail with about eight crossbands. This pattern is evidently the foundation of the crossbanded phase of the adult. Females nearly always have a broad light mid-dorsal band.

Stejneger describes the coloration in life as follows:

"Iris dark brown; edge of eyelids light yellowish; general color above bronzy greenish gray; head and several faint longitudinal irregular spots on the sides of the back more brownish; on each side of the median dorsal line between the insertion of the hind legs a better defined and larger spot of irregular outline, pale brownish edged with brownish black and a light line outside the dark margin; on the middle line of the tail a series of dusky spots located at the base of the largest spines; throat whitish; rest of underside suffused with greenish yellow, most intensely in the preanal region; dewlap greenish yellow verging into brownish orange toward the edge."

Habits.—It is evident that the differences in distribution between this species and *A. gundlachi* are not due to altitude preference, as supposed by Stejneger, but to habitat conditions, of which light seems to be one of the determining factors, *A. cristatellus* being the species of open fields and roadsides, *A. gundlachi* of the thickly planted coffee plantations and of the forests. This species is the one most frequently seen on fence

posts, where it rests head down on the shady side, usually a single specimen to a post. We have it from the deforested hills above Maricao, taken at an altitude of 2500 feet.

The examination of 100 stomachs yields the following information as to food habits: empty, 22; unidentified insect remains, 15; beetle remains, 20 (larvae and adults; a species of weevil, *Diaprepes*, very abundant); Orthoptera, 16 (cockroaches, grasshoppers, a single cricket and a mantis); ants, 10; caterpillars, 9; bugs, 5 (mostly Heteroptera: one large cicada); flies, 3; spiders, 3; vegetable matter, 9 (mostly bright-colored seeds); vertebrates, 2 (*Anolis* sp.). Wolcott, 1924, p. 27, gives a more detailed account of the food of this lizard.

The eggs are two or three in number, about 10 x 6 mm., uniformly oval, the surface white and striate. They are frequently found under the edges of logs or stones, or in debris about the base of banana plants.

Anolis gundlachi Peters

Text Figs. 27 and 28

Anolis gundlachi Peters, 1876, Monatsber. Akad. Wiss. Berlin, p. 705.—Gundlach, 1881, Anales Soc. Españ. Hist. Nat., Vol. X, p. 308.—Stahl, 1882, Fauna Puerto-Rico, p. 69, p. 159.—Stejneger, 1904, Rept. U. S. Nation. Mus., 1902, p. 633, Figs. 89-91.—Barbour, 1914, Mem. Mus. Comp. Zool., Vol. XLIV, p. 273.—Fowler, 1918, Papers Dept. Marine Biol., Carnegie Inst., Vol. XII, p. 9.—Schmidt, 1920, Ann. N. Y. Acad. Sci., Vol. XXVIII, p. 188.—Wolcott, 1924, Journ. Dept. Agric. Pto. Rico, Vol. VII, p. 33.

Anolis gundlachi Boulenger, 1885, Cat. Lizards, Brit. Mus., Vol. II, p. 25.—Garman, 1887, Bull. Essex Inst., Vol. XIX, p. 27.

Type locality.—Utuado, Porto Rico.

Distribution.—Recorded from Adjuntas, Aibonito, 18 km. south of Ciales, between Lares and Rio Blanco, Maricao, Santa Catalina, Utuado and El Yunque.

The parallel with *A. krugi* is emphasized by the fact that both species are strictly confined to Porto Rico, while both *pulchellus* and *crisatellus* range widely through the Virgin Islands.

Specimens collected.—48: Adjuntas, Aibonito, Maricao and El Yunque.

Diagnosis.—Dorsal scales granular, like laterals; ventrals larger, imbricate and keeled; supraocular semicircles separated by two rows of scales, widely separated from the occipital; tail of male with a high fin-like crest.

Original description.—"Ventral scales convex or weakly keeled, lateral and dorsal scales small, granular, those of the two median dorsal and

nuchal rows enlarged and forming a low double keel; a high fin on the basal half of the tail, supported by the dorsal vertebral processes, continuous with a fold of skin beginning on the neck. The supraorbital semicircles separated by two or three scale rows. Supraocular area composed of fifteen to seventeen keeled scales. The supraocular semicircles are continued to the middle of the snout as sharply diverging supra-rostral keels. Scales of the upper surface of the snout polygonal, mostly keeled. Nostrils lateral. Distance of the ear-opening from the eye little less than the length of the snout. Occipital large, somewhat smaller than the ear-opening, separated from the semicircles by four or five rows of small flat scales. Length of head to ear-opening as long as the tibia. Throat-fan moderately large, covered with widely separated, rather large keeled scales. Lower and posterior faces of upper arm and thigh finely granular. Tail with larger scales arranged in rings, and the tail-fin covered with similar scales.

“Grayish green, with small black spots forming three or four irregular cross-bands on the body; a few rounded dark-edged, white spots on the sides of the body and the base of the tail. Snout and tail-fin blackish-green, each scale with a yellowish green spot. Scales of the throat-fan lemon-yellow, its skin blackish; belly and under surface of head greenish yellow.”

Remarks.—Stejneger remarks on the discrepancies between Peters' description and his own, but these are due in part to variation and in part to a different method of description. The ventrals are normally sharply keeled. The occipital may be separated from the supraocular semicircles by as many as nine small scales. The keeled scales of the supraorbital disk are normally somewhat fewer than in Peters' specimens, ten in Stejneger's description.

The coloration in life is described by Stejneger as follows:

“General color dark olive above, with five wide lateral nearly black cross bands, which barely meet on the median line, while on the sides they are very close together, being only separated by an oblique series of small yellowish spots; a wide postocular blackish-brown band passes above the ear and joins its fellow of the other side on the back of the neck; top of head densely marbled with indistinct spots of brown edged with dusky; edge of eyelids, semicircular line formed by the keels of the suboculars, as well as alternating spots on the supralabial sutures lemon-yellow; underside dull olive-yellow, chin bright lemon-yellow, the entire under surface densely marbled with blackish; underside of limbs similar, but paler; limbs above cross-barréd olive and blackish, like back;

tail similarly crossbarred, but slightly browner in the basal half or a little beyond the compressed elevated portion, followed by a median uniform blackish portion and a terminal part which is uniform pale brownish olive; feet nearly uniform dusky; dewlap very large, with thickened edge, the color of the skin being a dull orange-olive, the distant scales straw yellow; iris blackish brown; tongue plumbeous."

This species is very distinct from *A. cristatellus*, but obviously directly related to that species. Its range and habitat are much more restricted, and the amount of variation is accordingly smaller. In the Survey of Porto Rico Series, the height of the tail crest (at its highest point) reaches a maximum of three times the diameter of the tail at the same point. The measurements of an adult male and female and of the type are as follows:

Parts measured	A. M. N. H.	A. M. N. H.	Type ♂
	No. 13126 ♂	No. 13029 ♀	
Total length	161 mm.	121 mm.	165 mm.
Body	60	45	55
Tail	101	76	110
Length of head.....	19	13.5	16.5
Breadth of head.....	11.5	8.5	—
Arm	30	21	30
Leg	51	36	50

Habits.—Beyond the interesting facts concerning its habitat preference, nothing is known of the habits of this species. It is most abundant in the coffee-belt and in the higher forested areas, but reaches the coastal plain at Utuado (Stejneger, 1904, p. 537) and Arecibo (Fowler, 1918, p. 9). It replaces *Anolis cristatellus* in the more shaded situations, and these two species thus form a dovetailing pair exactly like *Anolis pulchellus* and *Anolis krugi*.

Stejneger records an egg-measurement as 11 by 5 mm.

Anolis stratulus Cope

Lagartija manchada

Text Fig. 27

Anolis striatulus (misprint) Cope, 1861, Proc. Acad. Nat. Sci. Phila., p. 209.—Garman, 1887, Bull. Essex Inst., Vol. XIX, p. 29.

Anolis stratulus Reinhardt and Luetken, 1863, Vid. Meddel. Naturh. Foren., Copenhagen, 1862, p. 255.—Bocourt, 1873, Miss. Sci. Mex., Zool. Rept., Livr. 2, Pl. 14, Fig. 11.—Peters, 1876, Monatsber. Akad. Wiss. Berlin, 1876, p. 706.—Gundlach, 1881.—Anales Soc. Españ. Hist. Nat., Vol. X, p. 310.—Stahl, 1882, Fauna Puerto-Rico, p. 69, p. 159.—Boulenger, 1885, Cat. Lizards Brit. Mus., Vol. II, p. 27.—Meerwarth, 1901, Mitt. Naturh.

Mus. Hamburg. Vol. XVIII, p. 22.—Stejneger, 1904, Rept. U. S. Nation. Mus., 1902, p. 651, Figs. 105-107.—Barbour, 1914, Mem. Mus. Comp. Zool., Vol. XLIV, p. 274; 1917, Proc. Biol. Soc. Wash., Vol. XXX, p. 99.—Fowler, 1918, Papers Dept. Marine Biol., Carnegie Inst., Vol. XII, p. 11.—Schmidt, 1920, Ann. N. Y. Acad. Sci., Vol. XXVIII, p. 188.—Smyth, 1920, Rev. Agric. Pto. Rico, Vol. IV, p. 18.—Danforth, 1925, Copeia, No. 147, p. 77.—Wolcott, 1924, Journ. Dept. Agric. Pto. Rico, Vol. VII, p. 24.

Anolis dorsomaculatus Reinhardt and Luetken, 1863, Vid. Meddel. Naturh. Foren., Copenhagen, 1862, p. 255.

Type locality.—St. Thomas, Virgin Island.

Distribution.—On Porto Rico proper this species is recorded from Adjuntas, Aibonito, Arroyo, Caguas, Catalina Plantation, Cayey, Coamo Springs, Condado, Ensenada, Humacao, Maricao, Manatí, Ponce, Rio Piedras, San Juan, Utuado and El Yunque.

It is absent on Mona Island, but otherwise its range closely parallels that of *Anolis cristatellus*. It is recorded from Culebra and Vieques, St. Thomas, Tortola and Jost Van Dyke.

Specimens collected.—58: Aibonito, Coamo Springs, Ensenada, Maricao, El Yunque, Vieques and Culebra islands.

Diagnosis.—Dorsal scales juxtaposed, granular, like the laterals; one shield bordering the supraocular granules anteriorly between the superciliaries and the supraocular semicircle; width of head less than distance from tip of snout to center of eye; anterior femoral scales smooth, abruptly larger than the others; color brownish or grayish, with four or five dark spots along the vertebral line.

Original description.—"Size small; form elongate. Head rather elongate, depressed, much as in *A. alligator* Dumér. & Bibr. Tail once and two-thirds the length of the body, moderately compressed, weakly verticillate, irregularly serrate. No dorsal dermal fold; an imperfect fold upon the nape, where two or three rows of scales appear to be a little larger than those upon the dorsal and lateral regions of the body. Anterior femoral and anti-brachial scales large, smooth, similar to those of the belly. Superior humeral, antibrachial, femoral and tibial similar to those of the back. Occipital shield separated from the superciliaries by small scales; the latter usually in contact medially, four or five in number on each side. Palpebral disc rather round in outline, composed of nine smooth scales. Facial rugae weak, soon obsolete, covered by three scales anterior to the last superciliary. The space between these as far as the end of the muzzle, covered with small smooth scales. Rostral plate bordered by five scales, the median one fitting into an emargination between two mucronations. Nostrils lateral. Canthus rostralis slightly

concave, very obtuse anteriorly. Superior labials eight. Loreal rows five. Anterior half of inferior labials in contact with an inferior series of plates, which are longer than broad, the anterior smaller than the first inferior labial. Goitre rather large. Two or three small plates behind the vent; scales at the base of the tail smooth. Extended posterior extremity not reaching beyond the posterior border of orbit. Total length 4 in. 7 lin.; tail 2 in. 11 lin.; head from shoulder 8 lin.

"From alcoholic specimens it appears that the color is greenish gray above, with very numerous darker marblings. The head and chin are darker. The medial dorsal line is crossed by four deep brown spots bordered with white. The anterior of these, on the interscapular region, is narrow and more transverse. There is a fifth spot at the base of the tail. The latter is clouded with brown superiorly, and the extremities are cross-banded with the same. Thighs dark, varied posteriorly. Goitre red-orange, abdomen greenish, femora and vent golden."

Remarks.—Stejneger found that about half of this specimens had the supraocular semicircles in contact, and half separated by a single scale-row. In our series of twenty-six specimens the majority have the semicircles in contact. One (A. M. N. H. No. 13282) has only a single row of scales between the occipital and the semicircles. In recently hatched specimens the dorsal markings are invariably very distinct. Stejneger describes the color of a male specimen in life as follows:

"Iris dark brown; general color above light yellowish gray, much lighter below; the saddle-shaped spots on back very pronounced blackish brown bordered by whitish; on sides an irregular series of burnt-umber brown spots, also with white margins; throat and adjacent portions of underside of neck of a delicate pale bluish green; skin of the dewlap deep orange, the distant scales canary yellow, those on anterior edge more whitish."

Habits.—*Anolis stratulus*, while frequently found in the same situations as *Anolis cristatellus*, is noticeably more frequent on trees. In Vieques and Culebra it was found only in trees, and at Coamo Springs and Ensenada it was much more common on the Ceiba or Almacigo trees than on the fence posts which are the chief resort of *A. cristatellus*.

An examination of twenty-five stomachs indicates that ants form a much larger proportion of the food than in *A. cristatellus*. The contents are classified as follows: empty, 3; unidentifiable insect remains, 4; ant remains, 12; beetle remains, 5; spiders, 2; cockroach, 1; earwig, 1; flies, 1; lizard skin (doubtless its own), 1. Wolcott (1924, p. 24) gives a more detailed analysis of the stomach contents of this species.

Anolis evermanni Stejneger

Lagartija verde. Green Anolis

Text Fig. 27

Anolis evermanni Stejneger, 1904, Rept. U. S. Nat. Mus., 1902, p. 647, Figs. 102-104.—Barbour, 1914, Mem. Mus. Comp. Zool., Vol. XLIV, p. 284.—Schmidt, 1920, Ann. N. Y. Acad. Sci., Vol. XXVIII, p. 188.—Smyth, 1920, Rev. Agric. Pto. Ric. Vol. IV, p. 18.—Wolcott, 1924, Journ. Dept. Agric. Pto. Rico, Vol. VII, p. 14.

Type locality.—Catalina Plantation, east slope of El Yunque, Porto Rico, 890 feet altitude.

Distribution.—Confined to northeastern Porto Rico, and usually to the more humid higher altitudes. Occasional on the northern coastal plain. Recorded from Adjuntas, Aibonito, Jajome Alto, Maricao, Utuado and on El Yunque from 890 feet to 2978 feet.

Specimens collected.—37: Adjuntas, Aibonito, Maricao and El Yunque.

Diagnosis.—Dorsal scales granular or tuberculated, juxtaposed, slightly larger than the laterals, all much smaller than the ventrals; superciliary ridge not defined on the posterior half of the eyelid; a single shield between the superciliaries and the supraorbital semicircle bordering the supraocular granules anteriorly; width of head as great or greater than distance from tip of snout to center of eye; anterior femoral scales keeled, gradually diminishing; usual color in life vivid green.

Original description.*—"Top of head with two diverging frontal ridges, disappearing before reaching the nostrils, and inclosing a frontal hollow; head scales keeled or wrinkled; rostral low, much narrower than the mentals; seven narrow scales in a row between the nostrils; one shield of each supraocular semicircle in contact, the others separated by one scale; occipital somewhat smaller than ear-opening, separated from the supraocular semicircles by three or four rows of scales; supraocular disk consisting of ten or twelve polygonal keeled shields, separated from the semicircle by one row of granules; one large shield in front of the supraocular granules between the superciliaries and the supraocular semicircle; canthus rostralis sharp, consisting of five elongated shields increasing gradually in size posteriorly, superciliary ridge consisting of one narrow elongated shield and one similar but very small one, but not followed by a differentiated series of small scales, the granules of the supraocular disk continuing uninterruptedly into the granules surround-

* U. S. N. M. No. 26855: Catalina plantation, about 890 feet altitude; February 21, 1900.

ing the eye; loreal rows five or six; subocular semicircle keeled, broadly in contact with the supralabials; supralabials nine, the suture between seventh and eighth being under the center of the eye; temporal granules about the size of dorsals, a well-marked double series of small scales forming the supratemporal line; dorsals coarse, keeled granules, without any median enlarged series, laterals smaller but similar; ventral scales rather small, slightly imbricate, rounded behind, flat, those on the throat granular; fore legs above with small keeled scales, about three series on the anterior face of the lower arm being greatly enlarged, more than twice as large as the ventrals; anterior scales of femur enlarged, keeled, gradually diminishing posteriorly and below; scales covering hands and feet above multicarinate; digital expansion wide, about twenty-eight lamellæ under phalanges ii and iii of fourth toe; tail moderate, slightly compressed, with fairly well-marked verticils, every eighth or ninth vertical row being somewhat enlarged and surmounted by a strongly serrated edge of enlarged triangular spines, the fourth or fifth corresponding to the enlarged vertical scale row being larger than the others; dewlap naked, with distant series of scales, edge not thickened; postanal scales slightly developed.

"The dermal folds on upper neck and back are very low, especially the latter, but there is a distinct depression between them on the shoulder region."

Remarks.—This species is so adequately characterized in Stejneger's description that little remains to be added from an examination of the 37 specimens in the collection made by the Survey of Porto Rico.

As in *A. stratulus*, the scale between the supraciliaries and supra-orbital semicircles, anterior to the supraorbital granules, is remarkably constant. It is double on one side in only 1 specimen out of 31 examined. The semicircles may be broadly in contact (3 specimens), narrowly in contact (9), or separated by a single row of scales (19). The scales between the semicircles and the occipital vary from two to four, as in Stejneger's series.

The coloration in life has been described by Stejneger as follows:

"Iris, dark brown; eyelids, abruptly flesh-colored; general color, bright emerald green without markings; abdomen, underside of hind legs, and thick basal portion of tail below, pale glaucous green; terminal third of tail, black, tip, pale; dewlap, gamboge yellow; scales, pale yellow, no thickened edge.

"When handled the animal changed from green to wax-yellow with numerous dusky spots and marblings on body and crossbars on tail.

as well as longitudinal dusky stripes on throat; when reassuming its normal color the dusky markings disappeared before it turned green."

The measurements of a representative of each sex are as follows:

Parts measured	A. M. N. U.	A. M. N. H.
	No. 13218 ♂	No. 13388 ♀
Total length	175 mm.	114 mm.
Body	70	45
Tail	105	69
Length of head.....	21	13
Breadth of head	13	7.5
Arm	32	20
Leg	51	33

Habits.—Beyond the fact that it is more or less restricted to the more humid higher parts of Porto Rico by habitat preference, almost nothing is known of the habits of this species. Specimens of this species were extremely abundant on the slopes of El Yunque, and specimens were taken from within the Forester's Cabin. Elsewhere, this species was one of the less common forms, found more often on larger trees, and at a considerable height from the ground.

The results of the examination of the contents of twenty stomachs are as follows: empty, 3; beetle remains, 11; wasps, 2; ants, 1; caterpillars, 1; spiders, 1; skin of *Anolis*, 2 (doubtless their own); juvenile *Anolis evermanni*, 1.

Anolis pulchellus Duméril and Bibron

Lagartija Rayon

Text Figs. 27 and 29

- Anolis pulchellus* Duméril and Bibron, 1837, *Erpét. Gen.*, Vol. IV, p. 97.—Duméril, 1851, *Cat. Méthod. Rept. Mus. Paris*, Vol. I, p. 56.—Reinhardt and Luetken, 1863, *Vid. Meddel. Naturh. Foren.*, Copenhagen, 1862, p. 257.—Bocourt, 1874, *Miss. Sci. Mex.*, *Zool. Rept.*, Livr. 3, Pl. 16, Fig. 28.—Peters, 1876, *Monatsber. Akad. Wiss. Berlin*, 1876, p. 706.—Gundlach, 1881, *Anales Soc. Españ. Hist. Nat.*, Vol. X, p. 310.—Stahl, 1882, *Fauna Puerto-Rico*, p. 69, p. 159.—Boulenger, 1885, *Cat. Lizards Brit. Mus.*, Vol. II, p. 67.—Garman, 1887, *Bull. Essex Inst.*, Vol. XIX, p. 48.—Meerwarth, 1901, *Mitt. Naturh. Mus. Hamburg*, Vol. XVIII, p. 25.—Stejneger, 1904, *Rept. U. S. Nation. Mus.*, 1902, p. 660, Figs. 112-116.—Barbour, 1914, *Mem. Mus. Comp. Zool.*, Vol. XLIV, p. 295; 1917, *Proc. Biol. Soc. Wash.*, Vol. XXX, p. 99.—Fowler, 1918, *Papers Dept. Marine Biol., Carnegie Inst.*, Vol. XII, p. 12.—Schmidt, 1920, *Ann. N. Y. Acad. Sci.*, Vol. XXVIII, p. 189.—Smyth, 1920, *Rev. Agric. Pto. Rico*, Vol. IV, p. 17.—Danforth, 1925, *Copeia*, No. 147, p. 78.—Wolcott, 1924, *Journ. Dept. Agric. Pto. Rico*, Vol. VII, p. 15.

Type locality.—Martinique (erroneously).

Distribution.—If the localities of Stejneger's list be combined with those of the Porto Rico Survey, and those given by Wolcott, this species is known from Aibonito, Añasco, Boqueron, Caguas, Camuy, Cataño, Cataxo, Coamo Springs, Ensenada, Hucares, Juncos, Mameyes, Manatí, Maricao, Mayagüez, Ponce, San Antonio, San German, San Juan, Santurce, Toa Baja and Utuado.

Anolis pulchellus is recorded from nearly all of the Virgin Islands, including Anegada and St. Croix. Except for its absence from Mona Island, it has therefore the same distribution as *Anolis cristatellus*.

Specimens collected.—87: Aibonito, Cataño, Coamo Springs, Ensenada, Maricao, Mayagüez, Santurce, Culebra and Vieques Islands.

Diagnosis.—Dorsal scales large, flat, keeled and imbricate, like the ventrals; the lateral scales granular; width of head about half the distance from snout to ear-opening; dorsal scales gradually increasing in size from the laterals; skin of throat-fan crimson.

Original description.—"The length of the head is double its width behind, which is little more than the height of the occiput; the head, viewed from above, has the form of an isosceles triangle; the upper surface of the head slopes forward, but is not a plane: a swelling between the nostrils borders a hollow which extends to the tip of the snout; this hollow is bordered on either side by a rounded ridge representing the continuation of the supraorbital ridge, outside of which is a longitudinal groove; the nostrils, suboval, and directed obliquely backward, are situated at each side of the tip of the muzzle; each nostril is bordered above by an oblong arched scale in contact with the rostral, with a similar scale below, and three or four small granules behind it. The canthus rostralis is well-marked, continuous with the superciliary border; all the upper head scales are slightly keeled; six or eight equal, irregularly polygonal scales on the tip of the snout, disposed in pairs; behind these are four to six without any symmetrical arrangement; of these the middle one is perhaps the largest; a double row of several-sided small plates paves the frontal hollow; a single scale separates the supraorbital ridges; the polygonal scales which form these two ridges are twice as large as the other head shields; each supraocular area exhibits a disk of eight or nine small polygonal scales, the rest of it being covered with small granular scales; the triangular loreal region is slightly depressed; its scales are quadrilateral, disposed in three longitudinal rows; the rostral is wider than high, its lower border straight, its upper border arched; the two mental scales are equilateral, three sided; one counts six oblong

scales on each lip; the posterior part of the head is covered with small swollen and keeled scales in the midst of which is the enlarged circular occipital scale; the temples are granular, as are the eyelids, which have a double row of small tubercles on their edges; the tympanic membrane

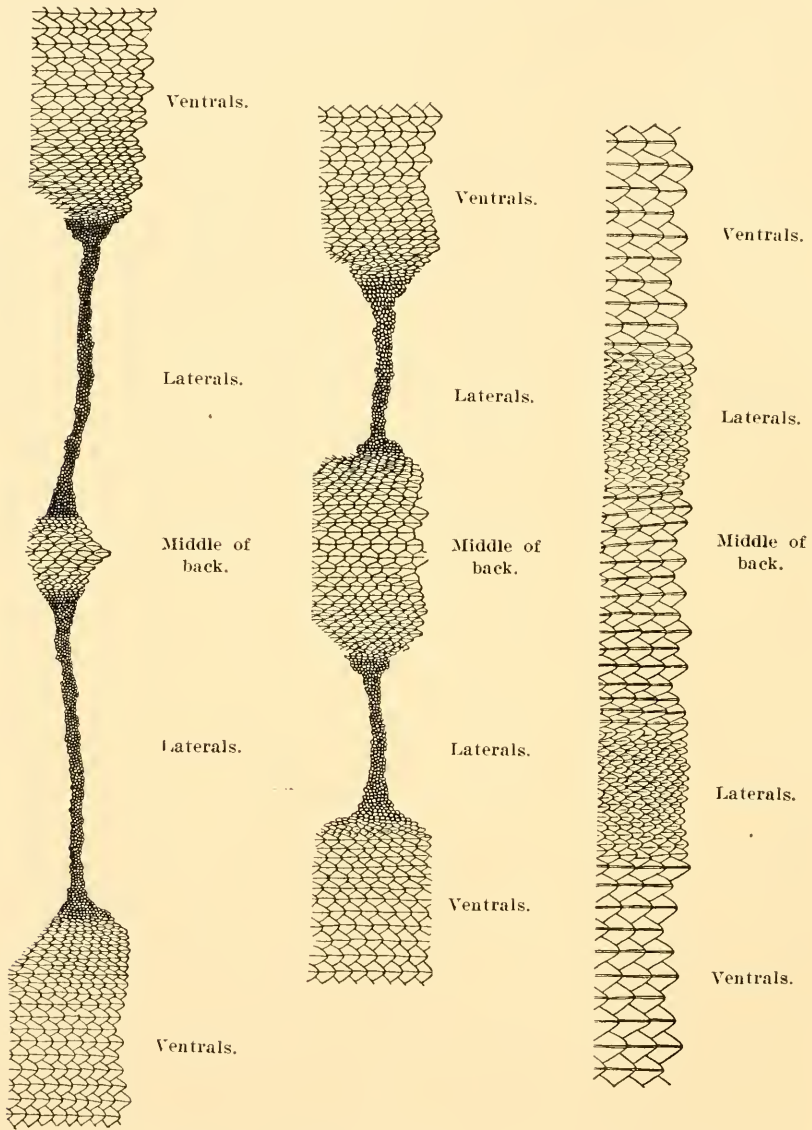


FIG. 29.—Dorsal scales of Porto Rican Anoles related to *Anolis pulchellus*. Left to right: *A. krugi*, *A. pulchellus*, and *A. poncensis*.

is set a little within the auricular hollow, which is sub-oval and entirely without denticulation: the skin forms a large throat-fan, which extends as far as the middle of the breast; the body is compressed, the back somewhat roof-shaped; laid along the body the fore-limbs reach almost to the groin, the hind-limbs to the back of the eye; the tail is compressed enough to have a sharp upper edge; it is a third longer than head and body, with a low denticulated crest its entire length; the upper and lateral sides of the tail are covered with small granular scales; the scales of the upper part of the back are imbricate and appear circular, though actually polygonal; they are in about twenty-four longitudinal rows; they are not positively keeled, but one might say they have their sides depressed and center raised; the sides of the body are covered with small, smooth, imbricate suboval or subcircular scales, smaller than those of back and belly: the under side of the head is covered with rounded, thickened scales, subimbricate, and smooth or feebly keeled; scales of the throat fan rather large, keeled, and rhomboidal; the ventral scales are imbricate, slightly keeled, and lozenge-shaped, with rounded angles; the limbs are covered with sub-hexagonal keeled scales; the thighs are granular; rhomboidal scales, strongly keeled, and arranged in longitudinal rows extend the whole length of the tail."

Remarks.—Stejneger comments on the vagueness of this original description, but there can be little doubt that it is correctly assigned to this most slenderly-built of the Porto Rican Anoles.

The number of loreal scales in a vertical row is usually four (five or six in *A. krugi*); in 85 specimens, 69 have four loreal rows, 15 have five, 1 has six. The scales separating the occipital from the supraorbital semicircles number one in 1 specimen, two in 29 specimens, three in 51 specimens, four in 4 specimens. The semicircles are in contact in 17 specimens, separated by one scale row in 66 specimens, by two scale rows in 2 specimens. I find no important variation in my series of 17 specimens from Culebra Island and 8 from Vieques.

The measurements of a specimen of each sex are as follows:

	A. M. N. H. No. 13988 ♂	A. M. N. H. No. 13186 ♀
Length	182 mm.	136 mm.
Body	47	36
Length of head	15.5	11.5
Breadth of head	8	6
Foreleg	19	14
Hind leg	33	27

Color.—Stejneger describes the variation in coloration of this species.

An adult male in life was colored as follows: "Iris dark brown; upper surface dull clay-colored, more dusky along the median line; head darker; more brownish; from eye to half way down the side of neck a broad black line, and another on the edge of the lower lip; a third blackish line, but considerably fainter, on lower edge of mandible, being more distinct between ear and shoulder; flanks and underside Naples-yellow, a stripe on upper labials over ear to shoulder more primrose-yellow; on flanks a series of oblique, elongated spots of brightest gamboge-yellow narrowly margined with black; skin of dewlap bright crimson anteriorly verging into dark rose-pink, posteriorly into orange, the distant scales arranged in rows and colored gamboge-yellow."

Habits.—Little is known of the habits of this species. I have seen juvenile specimens perched at the extreme ends of dry branches, where they were perhaps waiting for small insects to alight.

Stejneger supposed that *Anolis pulchellus* was confined to the coastal-plain area, rarely going above 500 feet in altitude. In the course of the present survey, it was found to be everywhere abundant, up to an altitude of at least 2,000 feet, but strictly confined to open fields. It is usually associated with *Anolis cristatellus*, but probably does not as a rule range so high.

Wolcott gives a detailed analysis of the food of this species. In two series ants formed, respectively, 11.2 per cent and 20 per cent of the total. Only *Anolis stratulus* eats a larger proportion of ants.

Anolis krugi Peters

Text Fig. 29

Anolis krugi Peters, 1876, Monatsber. Akad. Wiss. Berlin, 1876, p. 707.—Gundlach, 1881, Anales Soc. Españ. Hist. Nat., Vol. X, p. 310.—Stahl, 1882, Fauna Puerto-Rico, p. 69, p. 159.—Boulenger, 1885, Cat. Lizards Brit. Mus., Vol. II, p. 37.—Stejneger, 1904, Rept. U. S. Nation. Mus., 1902, p. 655, Figs. 108-111.—Barbour, 1914, Mem. Mus. Comp. Zool., Vol. XLIV, p. 284.—Schmidt, 1920, Ann. N. Y. Acad. Sci., Vol. XXVIII, p. 190.—Danforth, 1925, Copeia, No. 147, p. 78.—Wolcott, 1924, Journ. Dept. Agric. Pto. Rico, Vol. VII, p. 22.

Anolis brugii [misprint] Smyth, 1920, Rev. Agric. Pto. Rico, Vol. IV, p. 18.

Type locality.—Porto Rico.

Distribution.—This species is confined to Porto Rico. It has been recorded from Adjuntas, Aibonito, Catalina Plantation, Cayey, Ciales, Coamo Springs, Lares, Mameyes, Maricao, Utuado and El Yunque. I have examined the specimens from Ensenada referred to *krugi* by Fowler and find them to be *pulchellus*.

Specimens collected.—62: Adjuntas, Aibonito, Coamo Springs, Maricao and El Yunque.

Diagnosis.—Dorsal scales imbricate, keeled, like ventrals; lateral scales granular; width of head much more than half the distance from tip of snout to ear-opening; loreal scales in five to seven rows; skin of throat-fan in male orange.

Original description.—"Ventral scales strongly keeled, lateral and dorsal scales granular, with the exception of four median distinctly keeled rows which appear on a longitudinal dermal fold. A row of large, hexagonal keeled scales on the upper side of the tail.

"The supraorbital semicircles almost completely separated by a row of intermediate scales. The supraorbital ridges extend on the snout as two keels placed twice as far apart as their distance from the canthus rostralis. Supraocular area composed of four to six larger keeled scales and a few smaller ones. The distinct occipital is larger than the transverse ear-opening and separated from the semicircles by two or three rows of scales. The loreal area has five rows of scales at its middle. Length of head to ear-opening a little longer than the tibia.

"Olive green; punctate and vermiculate with black on the back and on the sides below a lateral yellow longitudinal line; white dots on the neck; ventral surface greenish yellow."

Remarks.—Peter's description requires modification principally with reference to the rows of keeled scales on the middle of the back, which are six rather than four, with two or three rows of small keeled scales adjoining them, so that the transition to the granular laterals is not quite so sharp as would seem to be indicated.

Among sixty specimens the number of loreal scales in a vertical row is as follows: four in 1 specimen, five in 34, six in 23, seven in 2. The number of scales between the occipital and the supraorbital semicircles varies from one to six, one in 1 specimen, two in 18, three in 25, four in 13, five in 2, six in 1. The supraorbital semicircles are in contact in 2 specimens, separated by a single scale row in 34, by two scale rows in 19, by three in 5.

Color.—The coloration of an adult male in life is described by Stejneger as follows:

"General color bright yellowish olive-green, sides of back and flanks with minute black spots, larger on back, but none along the median area occupied by the enlarged scales; from under eye through ear to groin a broad and very distinct line of canary yellow; brightest, nearly lemon yellow, on middle of flanks: a black spot immediately behind eye, but

no postocular band; underside paler, more buffy; immediately below the lateral yellow band the color is more olive, with minute black specks; hind legs posteriorly suffused with ferruginous; tail crossbarred with dusky; dewlap yellowish, gradually deepening to orange toward the edge; eye dark brown, nearly black, with a faint silvery edge to the iris; eyelids edged with whitish."

This species is often difficult to distinguish from *A. pulchellus* without direct comparison; the color of the dewlap, which in life is orange instead of crimson, is distinctive. In alcoholic specimens of *A. krugi* the narrower band of enlarged dorsal scales is the most satisfactory character for separating it from *A. pulchellus*. Other characters are at best comparative, useful only for a series of specimens.

The measurements of a representative specimen of each sex of *A. krugi* and of the type are as follows:

Parts measured	A. M. N. H. No. 13360 ♂	A. M. N. H. No. 13207 ♀	Type
Length	203 mm.	134 mm.	170 mm.
Body	51	36	46
Length of head	16	11	18
Breadth of head	10.5	6	—
Foreleg	21	15	20
Hind leg	39	29	38

Habits.—Little is known of the habits of this species. Stejneger had the impression that *Anolis krugi* is characteristic of the intermediate altitudes, from 500 to 1500 feet. The specimens in the present series from Coamo Springs are from an altitude of less than 300 feet, while specimens from Aibonito reach an altitude of at least 2000 feet. The specimens from Coamo Springs supply the clue as to the determining factor in the distribution of the species, for at that locality *A. krugi* was abundant among the ferns and vines of the moist dark gorge back of the bath houses, but was seen nowhere else. At Aibonito and Maricao *Anolis pulchellus* was noted on the bare hilltops or in open fields, while a few steps within the borders of the coffee plantations only *A. krugi* was to be found. Moisture and shade, therefore, are the habitat requirements of *Anolis krugi*. *Anolis cristatellus* and *Anolis gundlachi* have an exactly parallel distribution.

The males of this species are inveterate fighters, and it is not uncommon to find specimens with injured dewlaps and often with injured mouths, probably due to their habit of locking jaws. When the lizards are fighting, the dermal folds of the neck and back are raised to the highest degree. A pair so engaged on a tree at Maricao was quite ob-

livious of the approaching collector. They manœvered especially to gain the superior position and finally fell to the ground with jaws locked.

Anolis poncensis Stejneger

Lagartija

Text Fig. 29

Anolis poncensis Stejneger, 1904, Rept. U. S. Nation. Mus., 1902, p. 655, Figs. 117-121.—Barbour, 1914, Mem. Mus. Comp. Zool., Vol. XLIV, p. 284.—Fowler, 1918, Papers Dept. Marine Biol., Carnegie Inst., Vol. XII, p. 12.
Anolis pensensis Schmidt, 1920, Ann. N. Y. Acad. Sci., Vol. XXVIII, p. 191 (misprint).

Type locality.—Hills three miles east of Ponce.

Distribution. Confined to Porto Rico, and on Porto Rico confined to the southwestern arid section. It is known from Coamo Springs, Ensenada, Guanica and Ponce.

Specimens collected.—38: Coamo Springs and Ensenada.

Diagnosis.—Dorsal scales imbricate, large, flat, keeled, much like the ventrals, which are very strongly keeled, the keels forming continuous ridges; laterals smaller than dorsals and ventrals, but imbricate and keeled, much larger than the laterals of *krugi* or *pulchellus*; dewlap small, white, covered with large keeled scales.

Original description.—"Top of head with two slightly curved and low frontal ridges; frontal hollow very shallow: head scales more or less wrinkled or keeled: four scales in a row between the nostrils; supraocular semicircles broadly in contact; occipital slightly larger than the ear-opening, separated from the supraocular semicircles by one row of flat scales; supraocular disk consisting of five or six polygonal keeled shields conspicuously larger than the surrounding scales, which are also keeled, and of which one row separates the disk from the semicircle; two scales in front of the supraocular scales between the superciliaries and the supraocular semicircle; canthus rostralis consisting of four elongate narrow shields, the first one very small, the third longest; the superciliary ridge consisting of an anterior long and narrow shield and a series of scales contrasting in size with the granules surrounding the eye, but not with the small scales of the supraorbital region; loreal rows three or four; subocular semicircle keeled, broadly in contact with the supralabials, not bending upward behind the orbit; supralabials seven, the suture between fifth and sixth being under the center of the eye; central temporals large granules; a well-developed double row of scales forming a supratemporal line; dorsal scales rhomboidal, imbricate,

sharply keeled, the keels forming continuous parallel ridges, large, much larger than the laterals and nearly as large as the ventrals; laterals similar to the dorsals, but much smaller and less sharply keeled; ventrals like the dorsals, only more pointed and slightly larger; scales on throat and chin similar, keeled, only considerably smaller, though larger than the laterals; arms and legs covered with similar imbricated, keeled scales nearly as large as the ventrals; hands and feet above with pluricarinata scales; digits long and slender, expansion moderate; 18 lamellæ under phalanges ii and iii of fourth toe; tail very long, more than twice head and body, moderately compressed, covered with large keeled scales forming continuous ridges, with scarcely any indications of verticillation, the upper edge being but faintly serrated; dewlap entirely covered with imbricated, pointed, and keeled scales nearly as large as the ventrals, edge not thickened; postanal plates very small."

Remarks.—*Anolis poncensis* is a highly unique species, not only in its lepidosis, but in the extremely small size of its throat-fan, which is scarcely one-third as large as that of *A. pulchellus* or *A. krugi* when fully extended. There is little variation in the series of 38 specimens collected by myself. The loreal rows in a vertical line are three in 18 specimens, four in 20. The scales between the occipital and the supraorbital semicircles are none in 2 specimens, one in 21 and two in 14. The supraorbital semicircles meet in 32 specimens and are separated by a single scale in 6. Thus the type comes much closer to being a fully normal specimen than was supposed by Stejneger from the variation in the 6 specimens before him. The females invariably have a broad mid-dorsal light band.

*Color of living specimen.**—"Ground color above drab verging on tawny-olive on the tail and strongly washed with cinnamon on the sides, middle portion of back about five scales wide, uniform without spots, but on the sides of back and on flanks there are three longitudinal series of dusky spots on each side, about seven spots in each series from axilla to groin; these spots are not permanent, but appear and disappear at intervals; a pale supratemporal line, washed with pale rufous, from posterior edge of supraocular disk; below this an elongate blackish spot involving the eye and part of loreal triangle strongly tinged with tawny on the latter and on temples; edge of eyelids deep rufous; below the dark spot a pure white line on the lower row of scales of loreal triangle, suboculars and lower temporals to above the ear; several oblique whitish lines, which proceeding from the throat join on side of neck under the

* Stejneger, 1904, p. 668.

ear, and a short line behind the shoulder form a lateral whitish stripe which disappears at the anterior third of the distance between shoulder and groin; a dusky line below the white one, involving the upper and lower labials and continued to a little beyond the lower edge of the ear; a faint dusky stripe across upper arm and on side behind the axilla bordering the pale lateral neck stripe below; underside whitish, washed faintly with tawny, the throat with several longitudinal series of narrow, disconnected, dusky stripes; a faint dusky stripe along the median line of the belly; tail underneath whitish, strongly washed with tawny-olive, the pale color anteriorly extending upward on the sides of the tail so as to form a series of numerous pale crossbands which do not reach the median line above: the posterior half of tail regularly barred with wide dark and pale rings; limbs above like the back, the hind limbs with indistinct dusky markings washed with rufous; a small dewlap perfectly covered with large white scales, so as to entirely hide the skin underneath, even when highly distended, the color of which, however, appears to be whitish; iris blackish brown."

The measurements of a specimen of each sex are as follows:

Parts measured	A. M. N. H. No. 13784 ♂	A. M. N. H. No. 13845 ♀
Length	160 mm.	112 mm.
Body	44	40
Tail	116	72
Length of head	13.5	11
Breadth of head	8.0	6.5
Foreleg	18	14
Hind leg	31	27

Habits.—This species was found associated with *Anolis cristatellus* and with an occasional *A. pulchellus* at both Coamo Springs and Ensenada. Broadly speaking, it replaces *A. pulchellus* in the southwestern part of the Porto Rico, inhabiting fences and grazing land much as *A. pulchellus* does in the remaining portion of the island. A few specimens were noted on the arid cactus-covered hilltops about Ensenada. Near Coamo Springs this species occurred in colonies, sometimes a mile or more apart. Nothing more is known of its habits.

Cyclura Harlan

The "Rock Iguanas" of the West Indies are one of the most conspicuous elements in their endemic fauna. They appear to me to be a very archaic group of lizards, veritable relics from the "Age of Reptiles."

The genus is extinct on Porto Rico proper, but the bones of a fossil

species are abundant in cave deposits. The fossil form (*Cyclura portoricensis* Barbour) will not be described here. Another extinct form (*Cyclura mattea* Miller) is known from St. Thomas, and the living *C. pinguis* from Anegada shows that the existence of these fossil species might have been predicted.

***Cyclura stejnegeri* Barbour and Noble**

Rock Iguana

Text Fig. 30

Metopoceros cornutus Meerwarth, 1901, Mitt. Naturh. Mus. Hamburg, Vol. XVIII, p. 26 (part).

Cyclura cornuta Stejneger, 1904, Rept. U. S. Nation. Mus., 1902, p. 670, Figs 122-126.—Barbour, 1914, Mem. Mus. Comp. Zool., Vol. XLIV, p. 299 (part).

Cyclura stejnegeri Barbour and Noble, 1916, Bull. Mus. Comp. Zool. Vol. LX, p. 163, Pl. 12.—Schmidt, 1920, Ann. N. Y. Acad. Sci., Vol. XXVIII, p. 191; 1926, Publ. Field Mus. Nat. Hist., Zool., Vol. XII, p. 153.

Type locality.—Mona Island.

Distribution.—Confined to Mona Island.

Specimens collected.—2: Mona Island.

Diagnosis.—A large lizard with a dorsal crest of spine-like scales; an enlarged conical scale or low horn on the frontal region; other head scales variously enlarged; second and third toes with a curious comb-like scale.

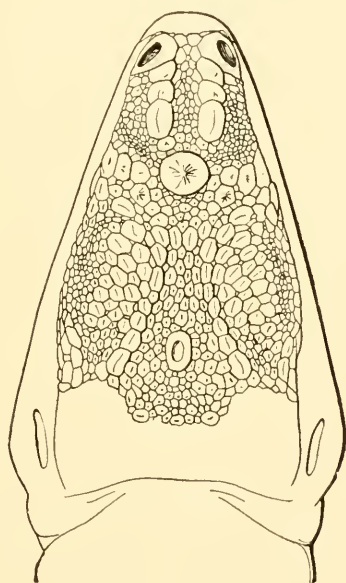
Original description.—"Very similar to *C. cornuta* from which it may be distinguished by the following characters: nasals in contact with the rostral; two, and in part three rows of scales between the nasals. Pre-frontals separated from the enlarged median frontal scale by two rows of scales. A single large elongate canthal scale preceded by three small precanthals. Dorsal crest much reduced between the shoulders, absolutely interrupted on the rump, fifty-one scales in the crest from shoulder to rump. Limiting row of each verticil not much wider than the other rows of the verticils. Color somewhat faded, uniform dark olive-green."

Remarks.—The original description is comparative, and for the present paper may be supplemented by Stejneger's earlier description, which refers to the same specimen later made the type by Barbour and Noble:—

"Rostral wide, as wide as mental, broadly in contact with nasals; nasal large, ovoid, perforated by a large nostril of the same shape; on each side of the top of the snout, immediately behind and adjoining the nasal, a series of three large shields, strongly convex, the posterior pair particularly so, and almost keeled; the series are separated by numerous

small scales anteriorly about three in a row, posteriorly four; the anterior pairs subequal, the posterior one nearly as long as the two others together, those of each series broadly in contact without any intervening scales; separated from these prefrontal series by two rows of scales there is a large rounded, median, frontal shield, its center on a line with the anterior edge of the orbit, convex and wrinkled radially from the center; supraocular semicircles evident, though the component keeled scales hardly exceed the similar scales which form the supraorbital disk; semicircles separated by about four rows of smaller keeled scales; occipital located well forward between the semicircles, from which it is separated

FIG. 30.—Head of *Cyclura stejnegeri* (type).
(From Stejneger.)



by three rows of scales, on a line between the posterior borders of the orbits, smaller than the nasals; one large keeled canthal scale nearest the orbit, the anterior ones but slightly developed; a well-developed series of strongly keeled suboculars continued backward as a supratympanic series to above the ear; ten supralabials, the suture between the last two under the center of the eye; a series of small scales separating the suboculars and the supralabials; above the angle of the mouth and in front of the lower edge of the ear a large tubercular shield and above it about the middle of the front edge of the ear another shield, convex and almost as large; tympanum elliptical, erect, large; eleven lower labials to the center of the eye; a series of enlarged malar scales, the posterior ones

strongly keeled and separated from the lower labials by several rows of small scales; dorsal and ventral scales small, about eleven contained in the vertical diameter of the tympanum, rhomboidal, obliquely keeled, the keels pointing toward the median line; from the occiput along the median line of the neck and back a series of enlarged strongly keeled scales forming a low serrated crest, which is much reduced between the shoulders, absolutely interrupted on the rump, and consequently not continuous with the caudal crest; length of the crest scales on the middle of the back three to the vertical diameter of the tympanum, 51 in the dorsal crest from shoulder to rump; throat covered with scales similar to the ventrals but smaller; sides and underside of neck with numerous folds, a large median one almost large enough to be called a dewlap, joining posteriorly a strong transverse fold; upper surface of limbs with slightly imbricated, keeled, posteriorly pointed scales, somewhat larger than the dorsals, on the lower arm about seven, on the tibia about four to the vertical diameter of the tympanum; a single series of about eighteen femoral pores; inner side of second toe with one 'comb,' of third toe with two 'combs' (see fig. 125); tail compressed, covered with obliquely keeled scales in vertical rows forming faintly indicated verticils, about four rows of the larger scales to a verticil; tail surmounted by a crest of enlarged, pointed triangular scales forming a strongly serrated edge."

The single very old male specimen collected by myself has the irregular development of the large tubercular scales of the head characteristic of old individuals of this group. The nasal is separated from the rostral on one side by a space filled with very small scales, on the other by a large tubercular shield. The smaller head shields are widely separated by very small intervening scales. There are 3 prefrontals on one side, 4 on the other: 3 large tubercular shields in front of the tympanum on one side, 1 on the other. There is a large fleshy fold on the neck, surmounted by a low crest, which passes into the higher dorsal crest. There is an additional fleshy lobe on one side behind the ear and others grow out of the irregular subgular folds. The cheeks are enormously swollen below the angle of the jaws. The 21 low spines on the nuchal fold are followed by 51 higher dorsal spines, the highest 20 mm., and after an interspace on the rump there are 50 spines on the base of the tail gradually becoming smaller to a point where the height of the spine equals its length. The highest spines on the tail measure 21 mm. The frontal tubercle measures 14 mm. in width and 9 mm. in height. There are 3 rows of femoral pores, 18 in the anterior row on each side. A

third "comb" is plainly distinguishable on the third toe. The scales of the reproduced tip of the tail are not arranged in verticils.

The measurements of this old male are as follows:

Parts measured	A. M. N. H. No. 13775
Length	910 mm. (tail reproduced)
Body	470
Length of head	127
Breadth of head	79
Foreleg	173
Hind leg	260

In spite of the separation of the nasal shield from the rostral in this old individual, I have retained the name *stejnegeri*, as it may well be that, although the young of the three related species, *cornuta*, *nigerrima* and *stejnegeri*, are clearly distinguishable, in the adults the characters are obscured. In other respects this individual accords well with the previously described specimens from Mona. Additional material of *cornuta*, however, is required to establish satisfactorily the status of the forms on Mona and Navassa.

Habits.—The Rock Iguana is confined to the table land on Mona Island, descending occasionally to the tillable area to feed on the young corn and cotton. The extreme rockiness of the habitat of this species is scarcely conceivable unless one has visited the region or the similar areas in Porto Rico, Santo Domingo and Cuba. The limestone is weathered into cup-like hollows bounded by knife edges and spear points; the handfuls of soil in the hollows are largely occupied by cactus, and a single day's tramp demolishes a pair of shoes. The natives of the island who engage in hunting the wild goats, pigs and cattle, wear several pieces of pigskin strapped to the soles of their feet, and even so, their ability to thread their way through the cactus is little short of marvelous. The specimen taken was the only one seen by our party of seven men in an eleven hours' tramp, and was caught and wounded by the dogs. The native hunters report that the rock iguanas take refuge in the cracks and holes in the rocks, and that they are somewhat more abundant than would be inferred from our experience.

Celestus Gray

Celestus pleii Duméril and Bibron

Culebra de cuatro patas

Text Fig. 31

Diploglossus pleii Duméril and Bibron, 1839, Erpétol. Gén., Vol. V, p. 605.—Duméril, 1851, Cat. Method. Rept. Mus. Paris, Vol. I, p. 154.—Boulenger, 1885, Cat. Lizards Brit. Mus., Vol. II, p. 294 (part).



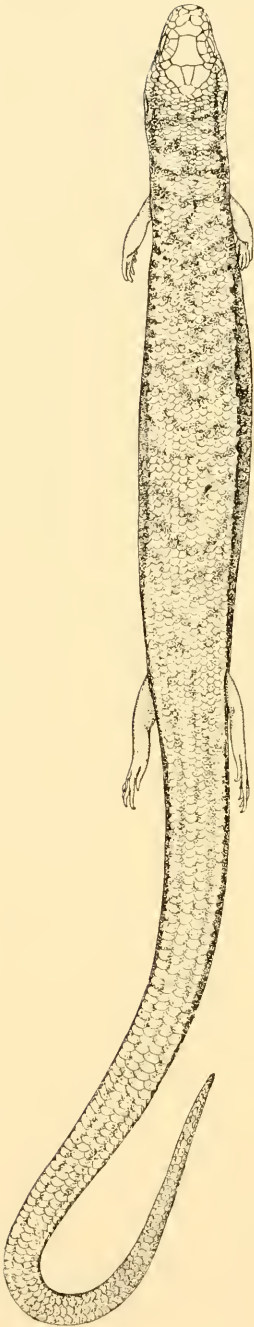


FIG. 31.—*Celestus pleii*. A. M. N. H. No. 13133. Natural size.

Celestus pleii Cope, 1868, Proc. Acad. Nat. Sci. Phila., p. 124.—Stejneger, 1904, Rept. U. S. Nation. Mus., 1902, p. 622, Figs. 74-79.—Barbour, 1914, Mem. Mus. Comp. Zool., Vol. XLIV, p. 304; 1919, Proc. New England Zool. Club, Vol. VII, p. 13.—Schmidt, 1920, Ann. N. Y. Acad. Sci., Vol. XXVIII, p. 192.

Diploglossus (Celestus) pleii Bocourt, 1879, Miss. Sci. Mex., Zool., Livr. 6, p. 351, Pl. 22, Fig. 4.

Celestus degener Cope, 1868, Proc. Acad. Nat. Sci. Phila., 1868, p. 124.

Diploglossus plei Peters, 1876, Monatsber. Akad. Wiss. Berlin, 1876, p. 708—Gundlach, 1881, Anales Soc. Españ. Hist. Nat., Vol. X, p. 511.—Stahl, 1882, Fauna Puerto-Rico, p. 69.

Type locality.—Martinique (erroneously).

Distribution.—Confined to Porto Rico, where it has been recorded only from Adjuntas, Aibonito, Catalina Plantation and Lares. The seven specimens secured at Aibonito all came from a single hilltop in a coffee plantation.

Specimens collected.—7: Aibonito.

Diagnosis.—An elongate lizard with short weak limbs, smooth skinklike scales, and with four median shields on the head, a very large frontal, broad prefrontal, narrow interparietal and small occipital.

Original description.—"Nasal plates very small, entirely lateral; two pairs of supranasals in contact; an octagonal inter-nasal, transversely widened; no fronto-nasals; six supra-oculars on each side; frontal large, subquadrangular, oblong; two very small fronto-parietals, not in contact; an interparietal in the form of an isosceles triangle; two oblong parietals; a triangular occipital with rounded posterior border; a very small freno-nasl (=postnasal); two loreals, the first higher than long; two freno-orbitals

(= preorbitals); a triangular suborbital; ear rather large, sub-circular, exposed, with entire border; body anguiform; limbs short, stout; tail cyclo-tetragonal; lower eyelid scaly; scales with six to eight striae; back with wavy brown markings on a fawn-colored ground, with a brown band on each side.

"This species is most closely allied to *Diploglossus sagrae*, but differs in having a much larger ear opening, by the more strongly marked and fewer striae of the dorsal scales, which do not exceed ten, while there are fifteen in that species."

Remarks.—There is no possibility of confusing this species with any other Porto Rican lizard. Stejneger gives a more exact description and effectively clears up the identity of the species, which was described from the Plée collection as coming from Martinique. He describes the color as follows:

"Color above (living and in alcohol) walnut brown, with numerous more or less interrupted and anastomosing dusky cross bands which do not reach the lateral longitudinal band. The latter is of a dark brownish gray with a sharply defined crenelated upper edge, gradually fading into the pale color of the underside which is clay colored washed with orange; lower lips and throat spotted with dark brownish gray."

The series of seven specimens in the Porto Rico Survey Collection is so uniform in scale characters as to suggest that the individuals are members of a single family. The proportion of the length of the forelimb to that of the body varies from .12 to .15. The scales about the body are 34 in one, 35 in one, 36 in four, 38 in one.

The measurements of the largest specimen are as follows:

	A. M. N. H. No. 13133
Parts measured	
Length	210 mm.
Body	91
Length of head.....	13
Breadth of head	10
Foreleg	12
Hind leg	16

All of the specimens found by me were under logs in a coffee plantation. When they were uncovered, their attempt to escape consisted of burrowing in the loose leaf mold. When grasped, they squirm violently, and because of their very muscular and smooth body it is difficult to hold them.

The two female specimens contain respectively one and three well-advanced embryos. The egg measures 18 by 11 mm. The completely

formed embryo rests on a very large yolk mass. The head and legs of the embryo are proportionately larger than in the adult, while the tail is shorter.

TEIDAE

Ameiva Meyer

The Ameivas are typical representatives of the family Teidae, readily distinguishable from all other Porto Rican forms in having the rectangular plates of the belly arranged in both longitudinal and transverse rows, while the dorsal scales are minute and granular. Although this genus is well represented on the mainland (by *Ameiva ameiva*, *A. bifrontata*, *A. undulata*, *A. festiva* and their allies), the West Indies have the maximum number of species and also exhibit the greatest amount of differentiation. Hispaniola alone, including Navassa and Beata islands, has eight species. The Ameivas are apparently especially adapted to insular conditions, for on a number of the smaller islets they occur alone or almost alone (Sombbrero, Redonda).

SYNOPSIS OF THE PORTO RICAN AMEIVAS

- A. Ventral plates in eight rows; caudal scales oblique, smooth; fronto-parietals united.....*A. wetmorei*
 AA. Ventral plates in ten or twelve rows; caudal scales straight, keeled; fronto-parietals distinct.
 B. Generally white-spotted only on the posterior half of the back...*A. exsul*
 BB. Back with white spots to the neck.....*A. alboguttata*

Ameiva wetmorei Stejneger

Text Figs. 32 and 33

Ameiva wetmorei Stejneger, 1913, Proc. Biol. Soc. Wash., Vol. XXVI, p. 69.—Barbour, 1914, Bull. Mus. Comp. Zool., Vol. XLIV, p. 311.—Fowler, 1918, Papers Dept. Marine Biol., Carnegie Inst., Vol. XII, p. 12, Fig. 6, Pl. 1.—Schmidt, 1920, Ann. N. Y. Acad. Sci., Vol. XXVIII, p. 193.—Danforth, 1925, Copeia, No. 147, p. 78.

Type locality.—Above Rio Loco, Guanica, Porto Rico.

Distribution.—*Ameiva wetmorei* appears to be confined to the region near Ensenada and to Caja de Muertos Island. It probably ranges westward toward Cabo Rojo and eastward toward Ponce on the limestone hills. It was secured on Caja de Muertos by H. E. Anthony in 1926. *Ameiva lineolata*, its relative in Hispaniola, appears to be similarly confined to the more arid parts of that island, and arid or semi-arid conditions prevail also on Great Inagua and St. Croix, each of

which is inhabited by a related species. These four species form a highly interesting group of *Ameiva*, characterized by the oblique scales of the tail, a distinctive habitus and a lineolate type of coloration.

Specimens collected.—30: Ensenada and Caja de Muertos Island.

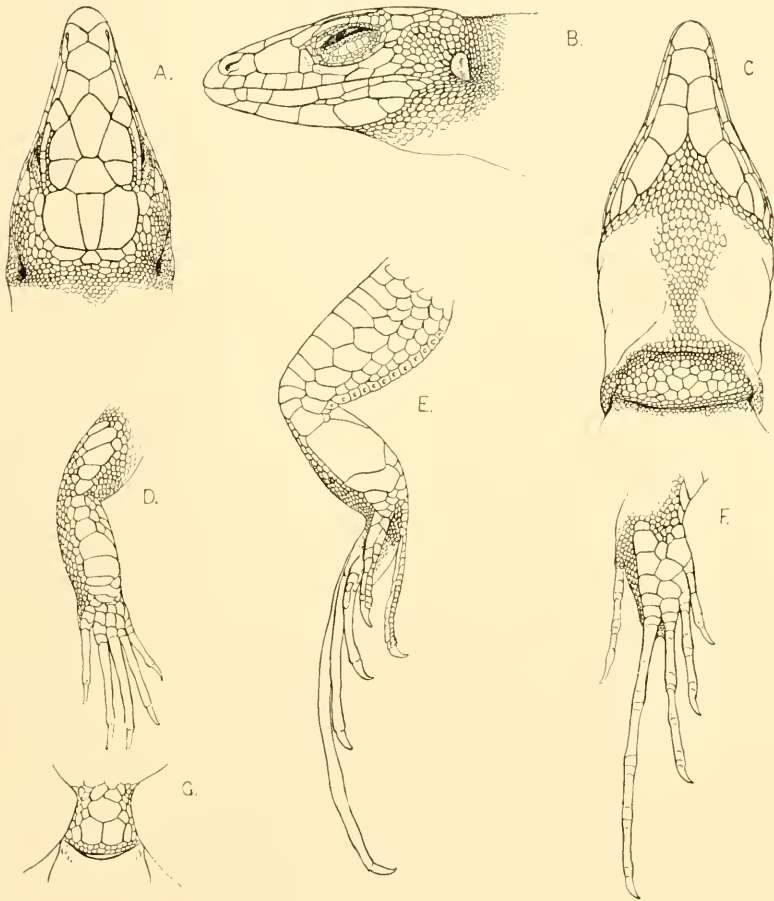


FIG. 32.—*Ameiva wetmorei*. A. M. N. H. No. 13820. A. Head from above. B. Head from side. C. Head from below. D. Arm from in front. E. Posterior face of head. F. Foot from above. G. Preanal scales. Three times natural size.

Diagnosis.—An *Ameiva* with eight rows of ventral plates; caudal scales oblique, smooth; fronto-parietals united; seven distinct longitudinal light lines, the median beginning on the snout.

*Original description.**—“Nostril between the two nasals; anterior

* Type from Guanica, above Rio Loco. U. S. N. M. No. 49731.

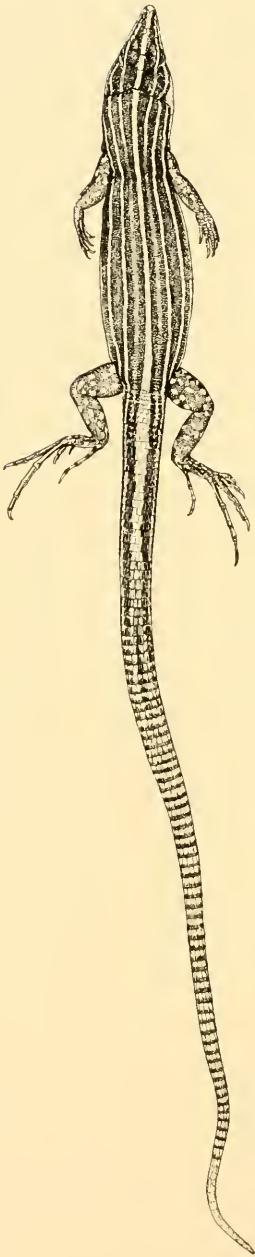


FIG. 33. — *Ameiva wctmorei*.
A. M. N. H. No. 13821.
Natural size.

nasals broadly in contact behind rostral; fronto-nasal broader than long, in contact with nasals, loreal, and prefrontals; prefrontals pentagonal, broadly in contact; frontal pentagonal, in contact with first and second supraoculars, not touching the third; a single hexagonal fronto-parietal broadly in contact with the third and very narrowly with second supraocular; three occipitals, the outer two very large, squarish, the median one long and narrow, almost rectangular; five superciliaries; three supraoculars, the first in contact with the first superciliary, the others separated from the superciliaries by a single row of fine granules; loreal undivided; seven supralabials, first in contact with posterior nasal only, second with posterior nasal and loreal, third largest, fifth and sixth in contact with a long subocular; temples with small flat irregular scales; mental followed by a large, unpaired postmental; six large infralabials, third largest; four pairs of chin-shields, first pair in contact, second pair half separated by granules of chin; between infralabials and chin-shields posteriorly a single line of flat scales, the two posterior ones large, the anterior small, not reaching first pair of chin-shields; chin and throat covered with small scales or granules diminishing in size posteriorly; mesoptychium with a median patch of enlarged scales, the larger ones about four times the size of the chin granules; back, sides, and upper surface of limbs covered with granules which are slightly enlarged into small hexagonal scales on the median line of the back; underside of body with eight longitudinal and thirty-five transverse rows of rectangular plates; the outer row less than one half the size of the next one; one large preanal plate, preceded by one much smaller, and this by two still smaller placed trans-

versely; on the lower arm two rows of large antebraçials, separated from the much smaller single row of brachials by small scales, on the lower edge of the upper arm a single series of enlarged plates; underside of thigh covered with two series of large scales or plates and three smaller ones; thirteen or fourteen femoral pores; underside of tibia covered entirely across by three plates, of which the upper is the largest and larger than the other two together; upper side of wrist with three series of enlarged plates; fifth (outer) toe extending far beyond the first (inner), almost to the claw of the second; tail covered with smooth scales in rings, the scales being oblique with parallel sides except the median row, which is wedge-shaped; about twenty-two scales in the fifteenth ring from the base. Coloration (in alcohol) above dark brownish olive with seven distinct greenish white longitudinal lines, the median one somewhat wider than the others and starting from the tip of the snout while the others originate in front of the eye, and continuing some distance on the tail, except the outer row, which terminates in the groin; upper sides of limbs also dark olive brown with very distinct round greenish-white spots; underside greenish-white darkening on tail."

Remarks.—Little need be added to Stejneger's description. Fowler describes and figures the second specimen known. His color plate represents the alcoholic coloration rather than that of the living reptile.

In the series of 27 specimens in the Porto Rican Survey collection the prefrontals are broadly in contact in 21 specimens, meet at a point in 1 and are separated by a suture between the frontal and frontonasal in 3. The number of supraciliaries varies from five to seven, normally six. The interparietal is horizontally divided in 1 specimen. There are usually two or three transversely enlarged postoccipitals. On the whole, there is a remarkably small degree of variation.

The measurements of a male and female specimen:

Parts measured	A. M. N. U.	A. M. N. H.
	No. 13821 ♂	No. 13828 ♀
Length	169 mm. (tail reproduced at tip)	147 mm.
Body	52	45
Length of head	12.5	11
Breadth of head	8.5	6.5
Foreleg	16	14
Hind leg	30	26

Habits.—Almost nothing is known of the habits of this species. It was found only on or near the tops of the limestone hills back of Ensenada, associated with a few *Ameiva exsul*.

The extreme fragility of the tail (25 out of 27 specimens having broken or regenerated tails) seems to be correlated with its brilliant color and the capacity for violent contortion of the separate member. It has frequently been suggested that the fragile tails of lizards might serve as a protective device, the broken and active tail occupying the pursuer while the owner escapes. In this case the assumption is made more than usually plausible by the combination of color, motion and noise—the tail making a noticeable rattling in the dead leaves of the ground cover, while the lizard moves quite silently.

Ameiva exsul Cope

Iguana

- Ameiva plei* var. *exsul* Cope, 1862, Proc. Acad. Nat. Sci. Phila., p. 66.
Ameiva exul Stejneger, 1904, Rept. U. S. Nat. Mus., 1902, p. 612, Figs. 59-66.—Barbour, 1914, Mem. Mus. Comp. Zool., Vol. XLIV, p. 310; 1917, Proc. Biol. Soc. Wash., Vol. XXX, p. 99.—Fowler, 1918, Papers Dept. Marine Biol., Carnegie Inst., Vol. XII, p. 12.—Danforth, 1925, Copeia, No. 147, p. 78.
Ameiva exsul Barbour and Noble, 1915, Bull. Mus. Comp. Zool., Vol. LIX, p. 439.—Schmidt, 1920, Ann. N. Y. Acad. Sci., Vol. XXVIII, p. 192.—Wolcott, 1924, Journ. Dept. Agric. Porto Rico, Vol. VII, p. 10.
Ameiva plei Cope, 1862, Proc. Acad. Nat. Sci. Phila., p. 65 (not of Duméril and Bibron).—Peters, 1876, Monatsber. Akad. Wiss. Berlin, 1876, p. 708.—Gundlach, 1881, Anales Soc. Españ. Hist. Nat., Vol. X, p. 311.—Stahl, 1882, Fauna Puerto-Rico, p. 69, p. 158.
Ameiva riisei Reinhardt and Luetken, 1863, Vid. Meddel. Foren., Copenhagen, 1862, p. 232.—Bocourt, 1874, Miss. Sci. Mex., Zool. Rept., livr. 4, Pl. 20 B, Fig. 3.
Ameiva riisei Boulenger, 1885, Cat. Lizards Brit. Mus., Vol. II, p. 354—Garman, 1887, Bull. Essex Inst., Vol. XIX, p. 11.—Meerwarth, 1901, Mitt. Naturh. Mus. Hamburg, Vol. XVIII, p. 30, Pl. 2, Figs. 7-9.
Ameiva vittipunctata Baettger, 1893, Kat. Rept. Mus. Senck., Vol. I, p. 74 (not of Cope).

The transfer of the common name "iguana" to this species illustrates the usual fate of vernacular names when they become incorporated into the language—they are transferred to any convenient animal without reference to zoological relationship.

Type locality.—Water Island, near St. Thomas, Virgin Islands.

Distribution.—Recorded from Arecibo, Arroyo, Caguas, Cataño, Cangrejos Pt., Caya Santiago, Coamo Springs, Ensenada, off Humacao, Luquillo, Palo Seco Point, Ponce, Rio Piedras, San Juan, Santurce and Utuado.

Neither Stejneger nor I secured this species in Vieques. My record

from Culebra appears to be the first from that island. In the Virgin Islands it is recorded from St. Thomas, St. John, Tortola, Virgin Gorda, Anegada and St. Croix.

Specimens collected.—57: Coamo Springs, Ensenada, Palo Seco Point, Santuree and Culebra Island.

Diagnosis.—An *Ameiva* of moderate size, with ventral plates in ten longitudinal rows; generally white-spotted only on the posterior half of the back; femoral pores averaging 15.5 on each side; number of scales in fifteenth tail segment averaging 45; median gulars forming a group of slightly enlarged scales; plates on upper arm much wider than long.

Original description.—“This form differs in possessing a narrow bright yellow band on each side, extending from the superciliary ridge to a point on the anterior part of the tail. The anterior extremity extended backward exceeds the extremity of the appressed femur. Total length 7 in. 6 lin.; exclusive of tail, 2 in. 1 lin. (Probably young).”

Remarks.—Cope's inadequate description accompanies remarks on the Virgin Island and Porto Rican *Ameivas*, which he refers to *A. plei* Duméril and Bibron. A number of points in the description of *A. plei* seem to exclude the possibility that it is based on Porto Rican specimens, as were so many of the other species collected by Plée, and Cope's varietal name has priority over the name *riisei* proposed by Reinhardt and Luetken.

Stejneger gives a very detailed description of the species. His description of the coloration in life is as follows:

“Ground color above of old skin (the specimen was shedding) ‘pea green,’ of new skin more olive green, the difference being slight, however; underside pale ‘pearl gray’ with a decided wash of ‘turquoise blue’ on the groin and tail; dark markings blackish; eyelids edged with whitish; iris very dark brown.

“A somewhat larger specimen had the ground color above tawny olive becoming olive gray on the tail; head not colored differently from back; lower back with a broken network of black meshes; flanks with a series of vertical black spots on a slightly browner ground alternating with a double or triple series of pale dots, which continue indistinctly on hind legs and sides of tail; tip of snout and of lower jaw pink flesh color; sides of head pale drab; underside whitish with a bluish cast, which is strongest on the sides and under hind legs and tail.

“A young specimen had head and neck uniform tawny olive; ground color of back similar, but becoming duller toward the tail, which is drab above; ground color of flanks similar, though more russet near the light lateral line, especially anteriorly; sides of head and neck nearly uniform

pale cinnamon; a narrow pale cream-buff line from superciliaries slightly broadening on the back and fading out at about the posterior third of the back, margined with blackish on both sides; on back and flanks a series of narrow blackish crossbars becoming obsolete on the lower back, the interspaces filled with roundish isabella-colored spots; lower back similarly spotted, as are also the upper side of the legs; tail above with these spots more faintly indicated; underside whitish with a turquoise-blue suffusion on both sides of abdomen and under the tail; underside of thighs pale gray dappled with white round spots like those on the back."

This species attains a large size, apparently much exceeding half a meter, but the larger individuals are exceptionally wary and I was unable to secure them. The largest seen were on Culebra Island. In nearly all the specimens examined an additional row of ventral plates on each side is enlarged to a varying degree, in some cases to such an extent that there are distinctly twelve longitudinal rows of ventrals.

Habits.—*Ameiva exsul* distinctly prefers a sandy soil, and is everywhere more abundant on sand. The reptiles frequently make shallow burrows under stones or other loose objects. Near Santurce they were especially abundant along a disused tramway, burrowing under the ties. At Ensenada they occasionally made burrows under the concrete sidewalks.

This species is almost entirely confined to the coastal plain, but it follows the river bottoms into the interior of the island. It is found on the tops of the limestone hills of southwestern Porto Rico, but not on those of the northern side of the island. It was very abundant on Culebra, where the mongoose has not been introduced, while on Vieques the inhabitants informed me that the "aldea" had exterminated the "iguana" as well as the "lucia" and the snakes.

The common report in Porto Rico that the "iguana" eats the shoots of young corn appears to be supported to a degree by an examination of stomach contents. Of 20 stomachs examined, one was empty; 11 contained vegetable matter, chiefly large numbers of red-coated seeds; 5 had unidentifiable insect remains; 2 had crickets; 3 had small crabs; 3 had eggs of a lizard; 1 had the tail of a large *Anolis cristatellus*; 6 had parasitic worms. Wolcott, in a much more detailed examination of stomach contents, finds only 6.7% of vegetable matter, consisting of mushrooms.

Wolcott found two batches of eggs, numbering 4 and 7 respectively, buried four or five inches deep in a pile of humus in the garden of the Experiment Station at Rio Piedras. The eggs were faint pink to bright

pink in color, measuring 20 to 22 mm. in length and 13 to 15.5 mm. in short diameter.

***Ameiva alboguttata* Boulenger**

· Text Figs. 34 and 35

Ameiva alboguttata Boulenger, 1896, Jahresber. Naturw. Ver. Magdeburg, 1894-1896, p. 112.—Meerwarth, 1901, Mitt. Naturh. Mus. Hamburg, Vol. XVIII, p. 32, Pl. 2, Figs. 6-8.—Stejneger, 1904, Rept. U. S. Nation. Mus., 1902, p. 618, Figs. 67-72.—Barbour, 1914, Mem. Mus. Comp. Zool., Vol. XLIV, p. 311.—Barbour and Noble, 1915, Bull. Mus. Comp. Zool., Vol. LIX, p. 440.—Schmidt, 1920, Ann. N. Y. Acad. Sci., Vol. XXVIII, p. 193; 1926, Publ. Field Mus. Nat. Hist., Zool., Vol. XII, p. 156.

Type locality.—Mona Island.

Distribution.—Confined to Mona Island.

Specimens collected.—46: Mona Island.

Diagnosis.—Closely allied to the Porto Rican *Ameiva ersul*, but back with white spots to the neck; femoral pores averaging 13.2 on each side; number of scales in fifteenth tail segment 34; median gular group of scales less differentiated, often confluent with the adjoining scales; plates on upper arm slightly wider than long.

Original description.—"Nostril between two shields; five or six occipital shields in a transverse row, bordered behind by small, irregular scales; three or four supraoculars, the fourth, when present, very small; seven or eight supraciliaries; loreal undivided; six supralabials; five infralabials; an unpaired and four or five paired chin-shields; a broad middle zone of slightly enlarged gulars; mesoptychial scales larger; body scales finely granular, smooth; ventrals in ten longitudinal rows, the outer very small, and in thirty-two or thirty-three transverse rows; three large anals; brachial plates in a single row, completely separated from the antebrachials; four or five rows of femoral scales; a row of very large tibial shields with two smaller rows on the inner side; twelve to fifteen femoral pores on each side; scales of the tail straight, the upper ones keeled. Dorsal side light grayish-brown, with a dark brown lateral band extending from the shoulder to the base of the tail, outlined above by a light line and spotted with black; the back and sides with the exception of the head and neck are thickly spotted with white; underparts white, throat of male red."

Remarks.—*Ameiva alboguttata* is extremely close to *Ameiva ersul*, but may be distinguished by the more spotted dorsum. The femoral pores in forty specimens average 13.2, in forty *A. ersul* the average is 15.3, almost exactly as in the smaller series examined by Stejneger. The Mona

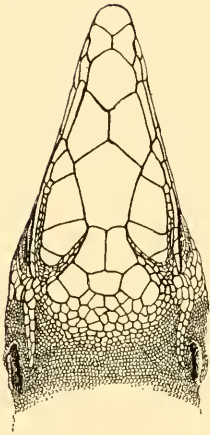


FIG. 34.—*Ameiva alboguttata*. A. M. N. H. No. 14003. Mona Island. Natural size.

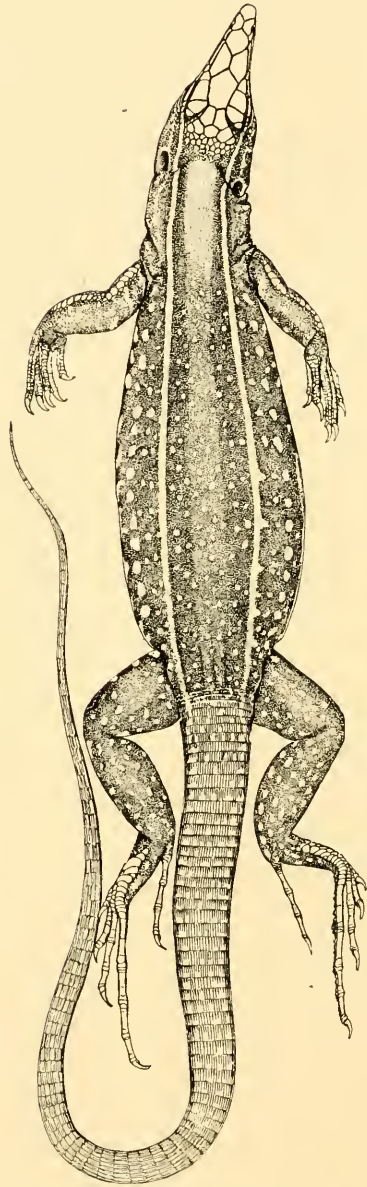


FIG. 35.—*Ameiva alboguttata*. A. M. N. H. No. 14003, Mona Island. Natural size.

Island form does not exhibit the tendency to enlargement of an additional row of ventral plates, one specimen having only eight longitudinal rows of ventrals (No. 13739).

Habits.—Like the Porto Rican species, the Mona Island *Ameiva* is found chiefly on the sandy land of the terraces on the west and south sides of the island. An occasional specimen, however, may be seen on the rocky table land.

The results of the examination of 20 stomachs are as follows: empty, 4; vegetable matter (chiefly red coated seeds), 8; unidentifiable insect remains, 3; beetles, 3; crickets, 2; land snails, 2; *Anolis cristatellus* (juv.), 1.

This species is preyed upon by *Alsophis variegatus*.

AMPHISBAENIDAE

Amphisbaena Linnaeus

The limbless lizards of this genus are immediately distinguishable by their soft skin, which is marked off into rectangular scale-like areas. The two species in Porto Rico may be distinguished as follows:

- A. Body rings 220-230; suture between nasal shields very short, one-fifth or less of the prefrontal suture; one temporal.....A. *caeca*.
 AA. Body rings about 250; nasal suture long, more than one-third of the prefrontal suture; no temporal.....A. *bakeri*.

Amphisbaena caeca Cuvier

Culebra ciega; vibora

Text Fig. 36

Amphisbaena caeca Cuvier, 1829, Règne Anim., 2nd Ed., Vol. II, p. 73.—Duméril and Bibron, 1839, Erpét. Gén., Vol. V, p. 492.—Duméril, 1851, Cat. Method. Rept. Mus. Paris, Vol. I, p. 148.—Peters, 1876, Monatsber. Akad. Wiss. Berlin, p. 708.—Gundlach, 1881, Anales Soc. Españ. Hist. Nat., Vol. X, p. 312.—Stahl, 1882, Fauna Puerto-Rico, p. 70, p. 160.—Strauch, 1883, Mém. Biol. Acad. Sci. St. Pétersburg, Vol. XI, p. 405.—Boulenger, 1890, Proc. Zool. Soc. London, p. 79.—Stejneger, 1904, Rept. U. S. Nation. Mus., 1902, p. 676, Figs. 129-132.—Barbour, 1914, Mem. Mus. Comp. Zool., Vol. XLIV, p. 319.—Fowler, 1918, Papers Dept. Marine Biol. Carnegie Inst., Vol. XII, p. 14.—Schmidt, 1920, Ann. N. Y. Acad. Sci., Vol. XXVIII, p. 194.—Camp, Bull. Amer. Mus. Nat. Hist., Vol. XLVIII, p. 317, Fig. F.

Amphisbaena bakeri Danforth, 1925, Copeia, No. 147, p. 78 (not of Stejneger).

Type locality.—Martinique (erroneously).

Distribution.—Confined to Porto Rico, where it has been found at

Aibonito, Bayamon, Catalina Plantation, Lares, Luquillo, Mayagüez, Rio Piedras and Utuado.

Specimens collected.—18: Aibonito, Bayamon and Rio Piedras.

Diagnosis.—An *Amphisbaena* with 220 to 230 body rings; one temporal scute; suture between the nasals very short, 16-19 rings on tail.

Original description.—"There is one in Martinique, entirely blind (*Amphisbaena caeca*, Cuv.). May not this be *A. vermicularis* Spix, XXV, 2? He says eyes conspicuous, while I do not find any at all. He uses the same expression for his *A. oxyura*."

Remarks.—The original description is evidently quite useless, and this species might more justly be cited as described by Duméril and Bibron, who redescribed the typical material. However, I follow them and Stejneger in ascribing the species to Cuvier. Stejneger's description is much the most useful and may be quoted in full:

"Rostral small, triangular, the portion visible from above short, about

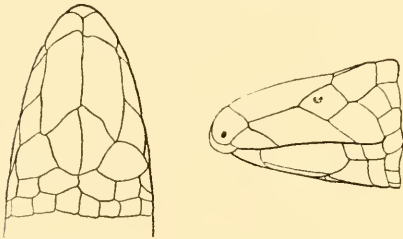


FIG. 36.—Head of *Amphisbaena caeca* from above and from side. (After Stejneger.)

equaling the suture between the nasals; prefrontals very long, the suture between them longer than the one between the frontals and five times as long as the nasal suture; ocular moderate, quadrangular, smaller than the postocular and the third supralabial; in the angle shields a well-developed temporal, between and behind the latter two only slightly smaller than the ocular; eye plainly visible through ocular; a pair of occipitals, broader than long, in contact behind the frontals; three supralabials, the second as long as the other two together; three lower labials, the second longer than the other two together; mental followed by a large median postmental, twice as long as broad; behind the second lower labial a large malar shield; just behind the postmental and between the malars three scales in a transverse row (postgenaeals); 226 rings on the body and 17 on the tail; the segments of each ring longer than broad on the back, broader than long on the under side, 16 above and 18 below the lateral line; anal shields, 6; preanal pores, 4. Color, flesh color, with a squarish brown spot, darkest on the back, occupying the middle of each segment, these spots being absent on many of the ventral

segments of the posterior half of the body; top of head uniform brownish, except rostral and nasals, which are colorless."

Stejneger's discussion of the history and relations of this species is a model of exact taxonomy.

The variation in the series of eighteen specimens in the Porto Rico Survey collection falls well within the limits established by Stejneger, who examined nineteen. One specimen has a small supraocular plate on each side.

It is consequently extremely surprising to find that the specimens listed by Danforth from Mayagüez as *A. bakeri* are intermediate between *bakeri* and *caeca*. One of these specimens (now F. M. N. H. No. 12473) has the nasal suture about one-fourth that of the prefrontals, temporal present, and 238 body-rings. The two other specimens have 234 body rings, nasal suture about one-half that of the prefrontals, and one of them lacks the temporal on one side. The three specimens are thus somewhat closer to *A. caeca* than to *bakeri*, but it is very evident that examination of adequate series from Mayagüez and Lares and the intervening area may alter our conception of the Porto Rican *Amphisbaena* radically.

It is curious that no *Amphisbaena* is known from southwestern Porto Rico.

The largest specimen measures 233 mm., tail 18 mm.

Habits.—All of the specimens were found burrowing in the ground, most of them uncovered by cultivation. One was located about three inches beneath an ant's nest under a log, in the course of digging up the eggs of *Leimadophis*. When the creature is killed in formalin, the head is bent abruptly to one side, indicating apparently a special development of the muscles of the neck, which doubtless is of advantage to the *Amphisbaena* in burrowing.

Three eggs were obtained,—one beneath a termite nest, the other two under the log where the above-mentioned adult was dug up. The largest egg measured 42 mm. by 11 mm.

Amphisbaena bakeri Stejneger

Text Fig. 37

Amphisbaena bakeri Stejneger, 1904, Ann. Rept. U. S. Nation. Mus., 1902, p. 681, Figs. 133-137.

Type locality.—Lares, Porto Rico.

Distribution.—Confined to Porto Rico, where it is known only from Lares.

Diagnosis.—An *Amphisbaena* with about 250 body rings; nasal suture long, more than one-third the prefrontal suture; no temporal.

Original description.—“Rostral small, triangular, the portion visible from above short, nearly one-third the suture between the nasals; prefrontals long, the suture between them slightly longer than the one between the frontals and but slightly more than twice the nasal suture; ocular moderate, quadrangular, the anterior angle very long and pointed; eye not visible; a pair of occipitals, longer than broad (the one on the left side abnormally divided), broadly in contact behind the frontals; three supralabials, the second longer than the other two together; three lower labials, the second longer than the other two together; mental followed by a large median postmental, much longer than broad; behind

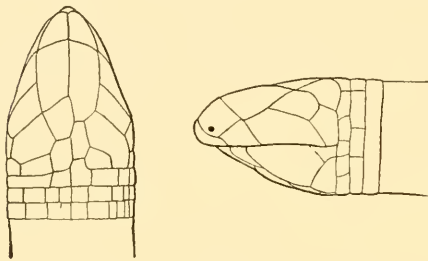


FIG. 37.—Head of *Amphisbaena bakeri* from above and from side. (After Stejneger.)

the second lower labial a large triangular malar shield; behind the postmental and between the malars 3 scales in a transverse row (postgenials); 249 rings on the body and 16 on the tail; the segments square, slightly longer than broad on the back, the 6 median rows on the abdomen broader than long, especially the middle pair; 16 above and 16 below the lateral line; anal shields or segments, 6; preanal pores, 4. Color light flesh, with a brownish spot in the center of each segment, rather indistinct, especially on the lower surface.

DIMENSIONS

Tip of snout to vent.....	260 mm.
Tail	18
Diameter of body.....	9

“Apart from a slight oscillation in the relative length of the sutures on the head the variability is insignificant. As in *A. caca*, the occipitals appear most subject to variation, but they seem to be longer than broad, as a rule, even in the clearly abnormal specimen (No. 25537) as shown in Fig. 134. The number of rings varies only between 249 and 251 in the three specimens at hand.”

Remarks.—I have discussed above under *cæca* the unexpected variations of *A. cæca* in the direction of *bakeri*. I am fully convinced of the specific validity of *bakeri*.

Habits.—Nothing is known of the habits of this species.

SCINCIDÆ

Mabuya Fitzinger**Mabuya sloanii** (Daudin)

Text Figs. 38 and 39

Lucia; Santa Lucia

- Scincus sloanii* Daudin, 1903, Hist. Nat. Rept., Vol. IV, p. 287, Pl. 55, Fig. 2.
Eumeces sloanii Duméril and Bibron, 1839, Erpét. Gén., Vol. V, p. 639.—
 Duméril, 1851, Cat. Method. Rept. Mus. Paris, Vol. I, p. 156.
Mabuya sloanii Bocourt, 1879, Miss. Sci. Mex., Rept., p. 401, Pl. 22 B, Fig. 3.—
 Stejneger, 1904, Ann. Rept. U. S. Nation. Mus., 1902, p. 608, Figs. 56-58.—
 Barbour, 1914, Mem. Mus. Comp. Zool., Vol. XLIV, p. 320; 1916, Proc.
 Biol. Soc. Wash., Vol. XXIX, p. 219.—Fowler, 1918, Papers Dept. Marine
 Biol., Carnegie Inst., Vol. XII, p. 7.—Schmidt, 1920, Ann. N. Y. Acad.
 Sci., Vol. XXVIII, p. 194.—Wolcott, 1924, Journ. Dept. Agric. Pto. Rico.,
 Vol. VII, p. 13.—Schmidt, 1926, Publ. Field Mus. Nat. Hist., Zool., Vol.
 XII, p. 156.
Mabuia sloanii Boulenger, 1887., Cat. Lizards Brit. Mus., Vol. III, p. 193
 (part); 1896, Jahresber. Naturw. Ver. Magdeburg, 1894-1896. p. 113.—
 Meerwarth, 1901, Mitt. Naturh. Mus. Hamburg, Vol. III, p. 135.
Euprepes semitaeniatus Wiegmann, 1937, Arch. Naturg., Vol. III, p. 135.
Tiliqua richardi Gray, 1838, Ann. Nat. Hist., Vol. II, p. 292.
Mabouya sloanei Gray, 1845, Cat. Lizards. Brit. Mus., p. 94.
Mabouia aenea Günther, 1859, Am. Mag. Nat. Hist. (3), Vol. IV, p. 212 (not
 of Gray).
Mabuia euprescens Cope, 1862, Proc. Acad. Nat. Sci. Phila., p. 186.
Gongylus (Eumeces) agilis Reinhardt and Luetken, 1863, Vid. Middel.
 Naturh. Foren., Copenhagen, 1862, p. 229 (not *M. agilis*).
Mabuya fulgida Cope, 1868, Proc. Acad. Nat. Sci. Phila., p. 311 (not *M.*
fulgida Cope, 1862).
Euprepes (Mabuia) spilonotus Peters, 1876, Monatsber. Akad. Wiss. Berlin,
 1876, p. 708 (not of Wiegmann, 1837).—Stahl, 1882, Fauna Puerto-Rico,
 p. 159.
Euprepes spilonotus Gundlach, 1881, Anales Soc. Españ. Hist. Nat., Vol. X,
 p. 311.
Mabuia nitida Garman, 1887, Bull. Essex Inst., Vol. XIX, p. 51.

Type locality.—St. Thomas, Virgin Islands.

Distribution.—The Porto Rico Survey secured this species from Bayamon and Ensenada, on Porto Rico, and from Mona and Culebra islands.

No other definite localities have been recorded for Porto Rico. On Mona Island the species occurs on the low terrace as well as on the rocky plateau.

In the Virgin Islands this form is recorded from St. Thomas, St. Croix, St. John and Jost van Dyke. I am not at all convinced that the Hispaniolan skink is identical with this species. To avoid possible confusion I hereby restrict Garman's *Mabuia nitida* to the Porto Rican form.

Specimens collected.—♂: Bayamon, Ensenada, Mona Island and Culebra Island.

Diagnosis.—A typical lizard in body-form, with well-developed limbs, large plates on the top of the head, no occipital shield, ventral scales like the dorsals and laterals, all very smooth and shiny.

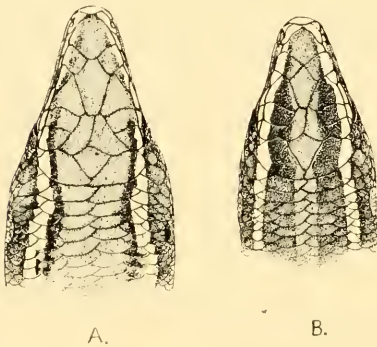


FIG. 38.—Head of *Mabuya sloanii* from above. A. M. N. H. No. 14007 (A) and A. M. N. H. No. 14006 (B). To show variation in pattern. Twice natural size.

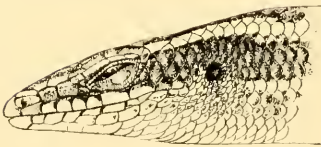


FIG. 39.—Head of *Mabuya sloanii* from side. A. M. N. H. No. 14007. Twice natural size.

Original description.—“Sloan's skink is a slender and slim-waisted form, resembling the five-lined skink of North America but differing from it in certain notable characters. The elongate head is covered with plates; the body is a little narrowed, and is covered, like the limbs and the anterior third of the tail, with small imbricate rounded scales; the rest of the tail is covered with rings or veritable verticils of scales. I have noticed under each thigh a row of small pores, but am unable to count them as some of the scales have been lost. The feet each have five slender clawed digits.

“This skink is brown above and whitish beneath and is easily recognized by means of the four black longitudinal lines which begin on the end of

the snout, namely a broader one passing above each arm and prolonged to the thigh, and two others, a little narrower, extending to the sides of the back."

Remarks.—Daudin's mention of "petits grains poreux" beneath the thighs may be explainable as referring to the tubular canals of the scales, which are frequently conspicuous, for no skink known has femoral pores. In other respects his description is vague, but the identity of the species is satisfactorily fixed by the fact that the origin of the type, collected by Richard on St. Thomas, is made known by Duméril and Bibron. Stejneger has satisfactorily cleared up the synonymy, and I am able to add Wiegmann's *Euprepes semitaeniatus*.

With seven specimens before me—three from Culebra, three from Porto Rico, and one from Mona—I am unable to find differences corresponding to the separate localities, other than the difference in color described below. In all specimens there are two pairs of chin-shields in contact behind the unpaired postmental. The supranasals form a suture in four specimens. The prefrontals are narrowly or widely separated by a suture between the frontal and the fronto-nasal. The supraoculars are three on one side in one specimen. Another specimen has three large occipitals on one side. The scales about the body are 32 in the specimens from Culebra and Mona, and in one from Porto Rico, 30 in the remaining two.

The coloration is highly interesting. The three specimens from Porto Rico agree with the description of Stejneger (1904, p. 611) in having a narrow black border above the dorso-lateral light line. In the specimens from Culebra, this is increased anteriorly to include the whole of the head, neck and shoulders, leaving, however, a sharply defined median light line from the frontal to the shoulders, where it merges into the dorsal color. This pattern is approximated also in the specimen from Mona Island. It is evident that the type of *Euprepes semitaeniatus* Wiegmann, described by Stejneger (1904, p. 610), corresponds accurately with the Culebra specimens. It is therefore possible that several insular forms may be distinguishable when adequate series become available. In view of the close approach of the Mona specimen to those from Culebra, I prefer to retain the use of *sloanii* for the entire series for the present.

The measurements of the only specimen with a complete tail are as follows:

Parts measured	A. M. N. H. No. 14007
Length	180 mm.
Body	67
Length of head	15
Breadth of head	10
Foreleg	17
Hind leg	25

The largest specimen (from Culebra) measures 90 mm. from snout to vent.

Habits.—This species is presumably viviparous like its American congeners. Nothing definite is known about its breeding habits.

The “Lucia” is everywhere reported to enter houses, where its presence is supposed to bring good luck. It is most abundant in the more arid localities, and its persistence on Mona and Culebra may be in part due to the favorable habitat conditions. It was not reported at Aibonito, and probably does not enter the coffee plantations. The specimens seen in life were found among rocks (3), on the base of a cocoanut palm (1), in a knot hole in a fence post (1), and in the cracks of a rotten log (1). The specimen taken on Mona was in a vertical rock-fissure on the tableland.

SERPENTES

Suborder

SYNOPSIS OF THE GENERA OF PORTO RICAN SNAKES

- A. Eyes covered by scales; ventral scales small like dorsals; tail extremely short (Typhlopidae).....*Typhlops*
- AA. Eyes well-developed; ventral scales transversely enlarged; tail elongate.
 - B. Subcaudals undivided (Boidæ).....*Epicrateris*
 - BB. Subcaudals in pairs (Colubridæ).
 - C. Dorsal scales with one pore at the tip or none.....*Dromicus*
 - CC. Dorsal scales with a pair of prominent pores at the tip.. *Alsophis*

TYPHLOPIDAE

Typhlops Oppel

KEY TO THE PORTO RICAN SPECIES OF TYPHLOPS

- A. Rostral very narrow, one-fifth to one-sixth the width of the head; a white spot beneath the head and another beneath the tail.....*T. rostellatus*.
- AA. Rostral wider, one-third to one-fourth the width of the head.
 - B. Scales on mid-line of back 365-420; venter light, with an angular notch or ring of the white color just in front of the tail.....*T. platycephalus*.
 - BB. Scales on mid-line of back 313-321; brown above, nearly white beneath, without a white caudal ring or notch.....*T. monensis*.

Typhlops platycephalus Duméril and Bibron

Culebra ciega

Text Figs. 40 and 41

- Typhlops platycephalus* Duméril and Bibron, 1844, *Erpét. Gén.*, Vol. VI, p. 293.
Typhlops lumbricalis (nec Linné) Peters, 1876, *Monatsber. Akad. Wiss. Berlin*, 1876, p. 708.—Gundlach, 1881, *Anales Soc. Españ. Hist. Nat.*, Vol. X, p. 312.—Stahl, 1882, *Fauna Puerto-Rico*, p. 70, p. 160.—Stejneger, 1904, *Rept. U. S. Nation. Mus.*, 1902, p. 684, Figs. 141-144 (part).—Barbour, 1914, *Mem. Mus. Comp. Zool.*, Vol. XLIV, p. 322 (part).
Typhlops richardii (nec Duméril and Bibron), Duméril, 1851, *Cat. Method. Rept. Mus. Paris*, p. 205, (part).—Schmidt, 1920, *Ann. N. Y. Acad. Sci.*, Vol. XXVIII, p. 195.—Danforth, 1925, *Copeia*, No. 147, p. 78.
Typhlops jamaicensis Cochran, 1924, *Journ. Wash. Acad. Sci.*, 14, p. 177 (part).

Type locality.—Martinique (erroneously).

Distribution.—Confined to Porto Rico, where it has been collected at Aguadilla, Bayamon, and Mayagüez.

Specimens collected.—19: Bayamon.

Diagnosis.—A *Typhlops* with body scales in 22 rows anteriorly and 20 at mid-body; 365 to 420 scales from head to tip of tail; tail with a white ring or notch.

Original description.—"This *Typhlops*, as its name indicates, has the head much more depressed than any of its congeners; the sides of the snout, in vertical profile, slope together at a subacute angle, rounded at the apex; the diameter of the body at the middle is contained almost forty-five times in the total length; the length of the tail is about one thirty-ninth of the total; the upper part of the rostral is narrower than in the preceding species; the angle made by the posterior sides of the fronto-nasals is more acute than in *T. lumbricalis* or in *T. richardii*; the preoculars are proportionately larger and the oculars narrower than in these latter species; the upper labials are also less developed and none of them extends upward on the side of the head; the tail is a moderately slender cone, but its terminal spine is distinctly longer and more compressed; the rostral is a longitudinal band whose lower portion is shorter than the upper; the upper portion is narrow and very obtuse behind; the lower part is wider in front than behind, angulate on each side, and with a small projection enclosed by the first pair of labials; the anterior frontal, (the true frontal), the interparietal, and the post-interparietal are similar, hexagonal, widened, and about one-half the size of the lower portion of the rostral; the supraoculars are a little larger than the frontal, hexagonal, and somewhat oblique to the trans-

verse line; the parietals have the same shape, but they are strictly transverse, and in large part behind the oculars; a pair of post-parietals parallels them; the nasals are scalene triangles rounded on their posterior angles. The fronto-nasals, which do not meet behind the rostral, each has the shape of a <, with rather wide branches which narrow rapidly posteriorly; the preoculars are a little shorter than the fronto-nasals, subequilateral, two of their sides fitting into the chevron-shaped fronto-nasal; the oculars are a little higher and much narrower than the preoculars; their peaks are acute and their bases rather enlarged and rounded behind; the four upper labials are oblong, the first very small, quadrilateral, higher posteriorly; the second is quadrangular, strongly rounded on its lower border, as are the third and fourth, which are triangular and increase gradually in size; the eyes are perfectly distinct, lateral, just beneath the surface; the body scales are in twenty longi-

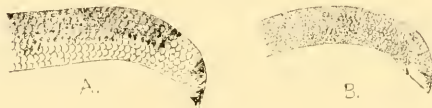


FIG. 40.—Pattern of tail of *Typhlops platycephalus* (left) contrasted with that of *T. rostellatus* (right). A. M. N. H. Nos. 13336 and 13179. Natural size.

tudinal and three hundred and fifty transverse rows, with twelve transverse rows on the tail.”

Remarks.—Cochran (1924, p. 176) has given reasons for attaching this description to the Porto Rican species. This extremely satisfactory allocation of *platycephalus* has against it only the slightly low scale count given by Duméril and Bibron, and the narrowness of the rostral. Examination of types in the Museum d’Histoire Naturelle in Paris may upset this arrangement, but such a result will not affect the interesting results of Cochran’s analysis of the West Indian *Typhlops*, which shows that the Virgin Island *richardii*, the Porto Rican *platycephalus* and the Jamaican *jamaicensis* constitute a series of related forms, united by her as *jamaicensis*. In view of their insularity and the gap due to the lack of an Hispaniolan species of this group, I prefer to retain the three forms as distinct. The appropriateness of a subspecific nomenclature for such a series is somewhat in dispute, but where a series of more than two forms inhabit a chain of islands and exhibits overlapping but not identical characters, I see no reason against the extension of the subspecific category to include them.

The scale rows are 22-20-20 in seven specimens, 22-20-18 in seven, the reduction to 20 rows occurring a little anterior to the middle of the body. The scales from head to tip of tail on the mid-dorsal line vary

from 365 to 415, and by including Cochran's counts of the U. S. National Museum specimens, this range is increased to 365-420.

The coloration of this species is characteristic. The color above is brown, each scale darker on its posterior two-thirds; the underside is whitish, the dividing line between the dorsal and ventral color being extremely irregular; the ventral color forms a notch or a complete ring about the level of the vent.

The total length in fourteen specimens varies from 216 to 310 mm., average 266 mm. The diameter of the body is contained in the total length from 34 to 44 times.

Habits.—The specimens of the present series were discovered in the course of cultivation on the farm of Mr. B. A. Wall. The single specimen secured by me personally was burrowing in the loose earth around

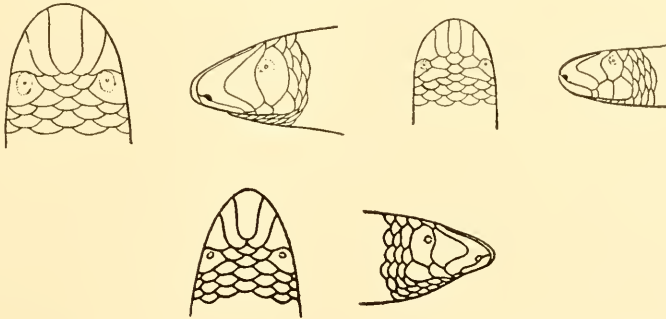


FIG. 41.—Heads of Porto Rican *Typhlops*. Left to right (upper), *T. platycephalus*, *T. rostellatus*; (lower), *T. monensis*. (First two species from Stejneger; last from Schmidt.)

an old stump, in which both *Typhlops* and *Leimadophis* eggs were found. The living specimen coiled tightly about my hand and was able to inflict a considerable prick with the sharp tail-spine. The tail is definitely maneuvered for this purpose, and this habit has probably given rise to the many superstitions about the existence of snakes with a tail sting.

Three eggs of this species, containing well-developed embryos, were removed from the soil about the same stump. The egg is elongated, like a slightly bent cylinder with rounded ends, and has a perfectly smooth, white surface. The embryo measures 98 mm. in length and 3 mm. in diameter. The smallest hatched specimens measure 114 mm.

Three of the smallest specimens in the collection are in every way like the adults except that they are pale grayish white. This appears on examination to be caused by the opacity of the skin, which is nearly

ready to be shed, probably for the first time. An adult Cuban specimen in the collection has the same appearance, and the underlying skin proves to be normally colored. A certain number of the cases of supposed albinism in *T. lumbricalis* may be due to this appearance.

***Typhlops rostellatus* Stejneger**

Text Figs 40 and 41

Typhlops rostellatus Stejneger, 1904, Rept. U. S. Nation. Mus., 1902, p. 686, Figs. 145-147.—Barbour, 1914, Mem. Mus. Comp., Zool., Vol. XLIV, p. 322.—Schmidt, Ann. N. Y. Acad. Sci., Vol. XXVIII, p. 197.

Type locality.—Lares, Porto Rico.

Distribution.—Confined to Porto Rico, where it has been collected at Aibonito, Bayamon and Lares.

Specimens collected.—11: Aibonito, Bayamon.

Diagnosis.—Snout rounded; nostrils lateral; preocular in contact with the third labial only; nasal completely divided; two post-oculars; rostral very narrow, one-fifth to one-sixth the width of the head; scale rows 18-20; a sharply defined white spot beneath the tail.

Original description.—"Head blunt, not depressed, snout projecting, rounded laterally; nostrils lateral; rostral narrow, about one-sixth the width of the head (1:6.4), not extending as far back as a line between the anterior edge of the eyes; nostril on a suture completely dividing the nasal, the lower anterior part in contact with first and second, the upper posterior nasal in contact with second and third; preocular wider than ocular, its anterior angle much produced and rather acute, in contact with third supralabial only; ocular with the anterior border strongly convex, in contact with third and fourth supralabials; supralabials four, the posterior two large and reaching high up on the side; prefrontal, frontal, and interparietal scale-like, subequal; supraoculars and parietals enlarged, especially the latter; eye distinctly visible; 18 scale rows round the body; about 333 scales on the middle line of the body underneath from chin to vent, and 13 under tail; tail ending in a spine. Color uniform dark brown, slightly paler underneath; through the dark ground color a distinct blackish network can be traced, the meshes of which anteriorly coincide with the outline of the scales, but becoming more and more discordant posteriorly; rostral and anterior nasal brown above, margined with whitish, underneath whitish; a very abrupt whitish spot occupying the anal region and the under side of the tail."

Remarks.—This species is readily distinguished from *T. platycephalus* by its nearly uniform coloration above and below, and the sharply defined

white subcaudal spot. There is little variation in the present series. The scales about the body number 20 in ten specimens, 18 in one. Stejneger had three specimens with 18 scales and only one with 20.

The measurements of the largest specimen are as follows:

	A. M. N. II. No. 13345
Parts measured	
Total length.....	205 mm.
Tail	5
Greatest diameter.....	4.5

Habits.—Nothing is known of the habits of this species, beyond the fact that it is subterranean like all *Typhlops*. The specimens taken by myself at Aibonito were found under fallen logs in a coffee plantation.

***Typhlops monensis* Schmidt**

Text Fig. 41

Typhlops lumbricalis Meerwarth, 1901, Mitt. Naturh. Mus. Hamburg, Vol. XVIII, p. 5.

Typhlops monensis Schmidt, 1926, Publ. Field Mus. Nat. Hist., Zool., Vol. XII, p. 157, Fig. 1.

Type locality.—Mona Island, West Indies.

Distribution.—Known only from Mona Island.

Diagnosis.—Allied to *Typhlops lumbricalis* Linné as defined by Cochran (1924, p. 174) by the number of scales from head to tail; distinguished by the more pointed snout, depressed head, and the successive increase in size of the three median scales behind the rostral.

Original description.—"Head depressed, snout strongly projecting, pointed when viewed from above; diameter contained in the total length about 40 times, varying from 3.8 mm. anteriorly, to 4.8 mm. near the tail. Rostral broader than the first median scale behind it, not extending as far back as a line drawn between the anterior borders of the eyes; nostril slightly below the rostral edge, on a suture which extends from the middle of the upper edge of the second upper labial to the rostral at the lateral angle; preocular a little wider than the ocular, in contact with the third labial; eye very distinct; ocular large, with a nearly straight anterior edge, in contact with the third and fourth upper labials; three median scales behind the rostral (prefrontal, frontal, and interparietal) successively larger, the last nearly as large as the "parietal" (or posterior supraocular) which separates it from the ocular; four upper labials, the last largest; nasals narrowly in contact behind the rostral.

"Scale rows 20 anteriorly, 20 at mid-body, and 18 posteriorly; 321 scales from rostral to tail-spine on the vertebral line.

"Color nearly uniform white, terminal part of each scale faintly dusky.
 "Total length 182 mm., tail 3 mm."

Remarks.—The single paratype, Hamburg Museum No. 2039, agrees with the type in number of scale rows and in the details of head-scales, except that the nasals are narrowly separated by a rostral-prefrontal suture. The color is brown above, nearly white beneath, the brown pigment confined to the distal two-thirds of each scale. There is no trace of a white caudal ring or notch. Scales from rostral to tail-spine 313. It is interesting to find the Mona Island *Typhlops* related to the Cuban and Hispaniolan forms rather than to the Porto Rican. These two specimens were loaned for study through the courtesy of the Naturhistorisches Museum of Hamburg. They are the only ones known.

BOIDAE

Epicrates Wagler

The snakes of this genus are principally Greater Antillean, with relatives in South America rather than in Central America. There is a single species on each island, with the exception of Hispaniola, which has no less than three species. An anomaly of its distribution lies in the fact that the Bahaman specimens are conspecific with the Hispaniolan *E. striatus*.

As in other boas, the snakes of this genus exhibit the claws at the sides of the vent which are the only external indication of the vestigial hind limbs.

SYNOPSIS OF THE PORTO RICAN AND MONA ISLAND EPICRATES

- A. Indistinct dark dorsal markings 70-80; supraoculars about one-third as broad as the frontal.....*E. inornatus*.
 AA. Distinct dorso-lateral spots 51-57; supraoculars about one-half as broad as the frontal.....*E. monensis*.

Epicrates inornatus (Reinhardt)

Culebron

Text Fig. 42

Boa inornata Reinhardt, 1843, Danske Vid. Selsk. Afhandl., Vol. X. p. 253, Pl. 1, Figs. 21-23.

Chilabothrus inornatus Jan., 1864, Icon. Ophid., Livr. 6, Pl. 5, Fig. B, 1865; idem, text, livr. 2, p. 65.—Cope, 1868, Proc. Acad. Nat. Sci. Phila., p. 312.—Peters, 1876, Monatsber. Akad. Wiss. Berlin, p. 708.—Stahl, 1882, Fauna Puerto Rico, p. 70, p. 126, p. 160.—Garman, 1883, N. Amer. Rept. I. Ophid., p. 132; 1887, Proc. Amer. Philos. Soc., Vol. XXIV, p. 279.

Chilobothrus inornatus Gundlach, 1881, Anales Soc. Españ. Hist. Nat., Vol. X, p. 312.

Epicrates inornatus Stejneger, 1901, Proc. U. S. Nation. Mus., Vol. XXIII, p. 470; 1904, Rept. U. S. Nation. Mus., 1902, p. 688, Figs. 148-150.—Fowler, 1918, Papers Dept. Marine Biol., Carnegie Inst., Vol. XII, p. 14.

Picsigaster boettgeri Seone, 1881, Abh. Senck. Ges., Vol. XII, p. 218, Pl. 1.

Type locality.—Porto Rico.

Distribution.—Confined to Porto Rico, where it is recorded from Bayamon, Caguas, Humacao and El Yunque.

Diagnosis.—More than nine shields on the top of the head; supraoculars about one-third as broad as the frontal; ventrals 261-271; sub-

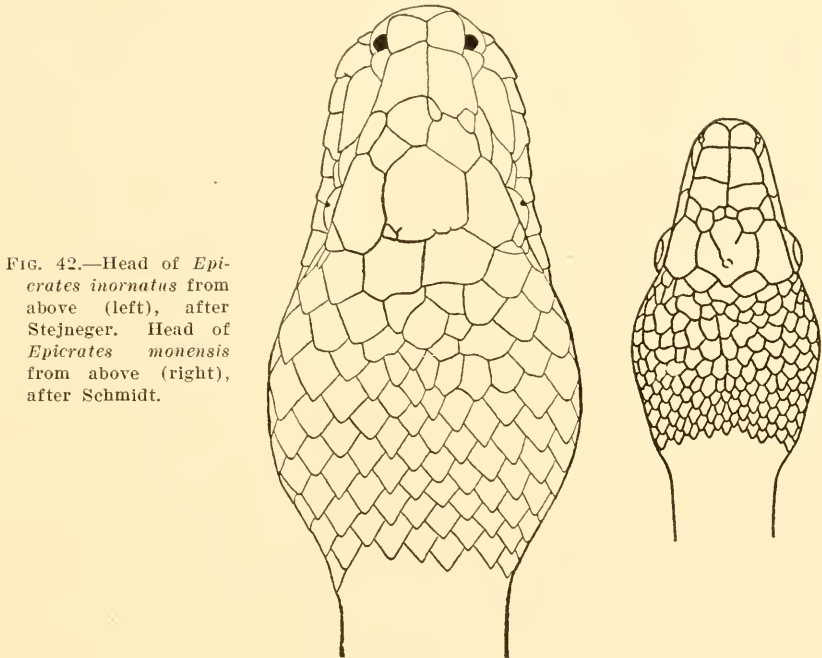


FIG. 42.—Head of *Epicrates inornatus* from above (left), after Stejneger. Head of *Epicrates monensis* from above (right), after Schmidt.

caudals 67-75; scale rows at mid-body 38-42; about 75 dark spots in the dorsal row from head to vent.

Original description.—"A boa with the head covered with irregular plates; eyes and nostrils lateral; labial scutes flat; dark in color (*obsolete fusca*) with irregular diffuse markings posteriorly; ventral plates 264-271, subcaudals 67-69; dorsal scales at mid-body 39-41."

Remarks.—Even the above brief description is entirely adequate, as there is only one boa in Porto Rico. In the twelve specimens known, the ventrals range from 261 to 271, the subcaudals from 67 to 75, the dorsal scale rows from 36 to 43.

I am indebted to Mr. B. A. Wall for the photograph reproduced as Plate IV, which constitutes a record of this species from El Yunque.

Color.—Stejneger describes the coloration in life as follows: "Nearly uniform 'bistre' with ventrals and subcaudals darker, narrowly pale-edged behind; above numerous indistinct crossbars (70-80 from neck to vent) of dusky color with one or two scales nearly black, thus emphasizing the spots, of which all the component rows (dorsal, dorso-lateral, lateral and ventrolateral) are recognizable; the crossbars increase in width posteriorly; a blackish postocular band indistinctly connected with a medio-lateral faint longitudinal line on the neck; supra-labials fading into pale brownish gray at the commissure; slight traces of rufous on rostral and other shields of face; iris silvery gray clouded with dusky.

"A somewhat smaller individual (1,500 mm. total length) brought home by Mr. Bowdish is very similar in coloration, only the underside is more slate color, and the pattern much more distinct, the crossbars showing paler centers with blackish margins; the spots of the lateral series show a tendency to form a lateral blackish line on the anterior third of the body.

"Another specimen showed hardly any traces of bars or spots; general color above, chestnut, darkest on the median region and tail, gradually becoming lighter toward the ventrals; the latter brownish-slate color with pale edges; throat and chin mottled dull rufous and brownish slate; scattered obscure dusky spots on flanks."

Habits.—Nothing is known of the habits of this species.

Distribution.—Confined to Porto Rico, where it is recorded from Bayamon, Caguas, Humacao and El Yunque.

***Epicrates monensis* Zenneck**

Epicrates monensis Zenneck, 1898, Zeitschr. Wiss. Zool., Vol. LXIV, p. 64, Pl. 3, Figs. 58-62.—Stejneger, 1904, Rept. U. S. Nation. Mus., 1902, p. 692, Figs. 153-157.—Schmidt, 1926, Publ. Field Mus. Nat. Hist., Zool., Vol. XII, p. 158, Figs. 2-3.

Epicrates fordii var. *monensis* Meerwarth, 1901, Mitt. Naturh. Mus. Hamb., Vol. XVIII, p. 8.

Type locality.—Mona Island.

Distribution.—Entirely confined to Mona Island, where, with *Cyclura*, it is a conspicuous link with the Hispaniolan fauna.

Diagnosis.—More than nine head shields on the top of the head; supraoculars about one-half as broad as the frontal; ventrals 259-267;

subcaudals 79-82; scale rows at mid-body 33-43; about 55 dark dorsal spots in the vertebral row on the body.

Original description.—"The dorsal pattern on the body consists of the two uppermost rows of spots, the individual spots almost all united transversely. These dorsolateral spots are more irregular in shape than in *E. fordii*. Their number ranges from 51 to 57. There is a single row of rather large spots on the sides, which frequently unite with the upper ones to form cross-bands. A faint postocular stripe seems to be a continuation of the lateral row of spots. The fact that the lateral spots extend far downward toward the belly may indicate that they include a component part of the lower lateral row, but such a row is nowhere indicated. The dorsal rows of spots continue on the tail, while the lateral rows break off at the anus. On the head the lateral stripe may be absent or only very weakly indicated. The first of the dorsolateral spots lie on the posterior part of the head, and there are very faint indications of a pair of stripes on the top of the head. The dorsal ground color is light yellowish brown in juvenile specimens, the markings dark brownish black. In older specimens the ground color is much darker, so that the pattern is less sharply defined.

"The distinctive peculiarities with reference to *E. fordii* are:

- a. Number of spots in the dorsolateral row 51-57, as compared with 69-78.
- b. A single row of lateral spots instead of two.
- c. The frequent union of the lateral and dorsolateral spots into crossbands.
- d. Head pattern very faint, except posteriorly.

"The ventrals, in four specimens range from 259 to 263, the subcaudals in two from 79 to 82. The dorsal scale rows range from 38 to 42."

Remarks.—I have recently redescribed this species from a specimen in Field Museum of Natural History, collected by W. W. Brown in 1892. It is consequently more than thirty years since a specimen has been collected.

Habits.—Nothing is known of the habits of this species. The tail of an *Anolis cristatellus* was found in the stomach of the specimen described by me.

COLUBRIDÆ

Dromicus Bibron

A word is necessary regarding the use of the generic names *Dromicus* and *Alsophis*. Stejneger shows that the type of *Dromicus* is *D. cursor* of

Cuba, but he employs *Leimadophis* for this snake and its allies because he regards *Dromicus* as preoccupied by *Dromica* Dejean, 1826. The International Commission has subsequently ruled that such a name as *Dromica* does not preoccupy *Dromicus*. It is therefore necessary to employ *Dromicus* for the snakes referred to *Leimadophis* by Stejneger in 1904.

Dunn, meanwhile (1922, p. 219), has shown that *Dromicus*, *Alsophis* and *Rhadinea* intergrade in such a confusing way that he proposes to unite them all under the oldest name, *Dromicus*. This results in a very large and very unwieldy group of snakes and, as the West Indian forms fall into two perfectly natural groups, I have in the present paper retained *Alsophis* as a distinct genus for the snakes with sharply defined scale-pits.

Unfortunately I have complicated the synonymy by using *Dromicus* in Dunn's inclusive sense in describing *Alsophis variegatus* from Mona Island.

***Dromicus Stahli* (Stejneger)**

Culebra

Text Figs. 43 and 44

Dromicus parvifrons (nec Cope). Peters, 1876, Monatsber. Akad. Wiss. Berlin, p. 708.—Gundlach, 1881, Anales Soc. Españ. Hist. Nat., Vol. X, p. 312.—Stahl, 1882, Fauna Puerto Rico, p. 70, p. 160.

Leimadophis stahli Stejneger, 1904, Rept. U. S. Nation. Mus., 1902, p. 695, Figs. 161-165.—Schmidt, 1920, Ann. N. Y. Acad. Sci., Vol. XXVIII, p. 198.

Type locality.—Bayamon, Porto Rico.

Distribution.—Confined to Porto Rico, where it is known from Adjuntas, Aibonito, Bayamon, Cagnas, Catalina Plantation, Ensenada, Humacao, Mayagüez and El Yunque.

Specimens collected.—24: Aibonito, Bayamon and Ensenada.

Diagnosis.—Tail less than one-fourth of the total length; eight supralabials, three entering orbit; scales in nineteen rows; ventrals 146-166; subcaudals 83-97.

Original description.—"Rostral much broader than high, scarcely visible from above; internasal suture shorter than prefrontal suture; frontal longer than its distance from end of snout, shorter than parietals, widely separated from preocular; supraocular narrower than frontal; nasal divided, longer than its distance from eye; loreal small, as high as broad, pentagonal; one large preocular; two postoculars; one large anterior temporal followed by two smaller ones; eight supralabials, second in contact with posterior nasal, loreal, and preocular; third, fourth, and

fifth supralabials in contact with eye; eight lower labials, four in contact with anterior chin-shield, two in contact with posterior; anterior chin-shields much shorter than posterior ones; scales smooth, without pores, in 19 rows; ventrals, 157; anal divided; 89 pairs of subcaudals.

"Color pattern: On a brownish ground a narrow dusky lateral line covering the adjacent edges of the fourth and fifth scale-rows; above this line a pale longitudinal band covering the remaining part of fifth, the whole of the sixth, and other * half of seventh rows; a median dorsal darker band of six scale-rows is thus set off, a series of elongated dusky spots on the seventh row, three scales apart, forming the limit as a line of dashes; head above with numerous dusky spots, and a longitudinal line on the middle of the frontal and the parietal suture which in combination with a spot on the posterior half of each supraocular, form a fleur-de-lis-shaped figure, the median line continuing some distance down

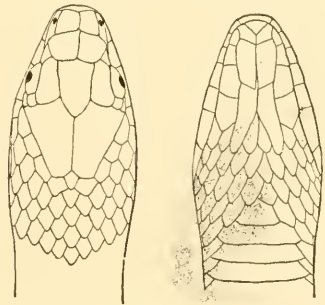


FIG. 43.—*Dromicus stahli*, head from above and from below. (After Stejneger.)

the back; a dusky, black-edged band on the side of the head from rostral through nostril and eye over temporals and connected with the continuous dark lateral line on fourth and fifth scale-rows; labials whitish with a dusky spot on the middle of each, and a dusky oblique band from the eye to the commissure crossing the suture between fourth and fifth supralabials; underside whitish, dusted over with minute dusky specks, which show a tendency to congregate near the ends of the ventrals so as to form a line of ill-defined spots on each side of the abdomen."

Remarks.—The Survey of Porto Rico collection contains twenty-four specimens of this species.

The range in number of ventral plates is slightly greater in this series than in Stejneger's series of 146-166 in twenty-three specimens. The subcaudals range from 83-94. The sexes are scarcely distinguishable by these characters. The tail-length varies from .29 to .34 of the total (.29-.31 in ♀, .32-.34 in ♂ specimens). The scales about the body are

* Probably "lower half."

uniformly 19-19-17. The lower labials are nine, (eight in the original description). Freshly hatched specimens show the color pattern most distinctly, especially the median black markings on the head. The largest specimen, a female, measures 580 mm., tail 178 mm.

Habits.—This species proves to be still fairly abundant in Porto Rico, but its secretive habits have preserved it from scientific collectors as well as from the mongoose. It was noted at Aibonito beneath a log in a pasture, at the base of an extremely rotten stump in a coffee plantation, and one was observed that had been killed on the road by an automobile. At Bayamon it was located by turning over stumps of trees which had been grubbed out, but which were quite firmly imbedded in the ground.

Only one specimen contained identifiable remains in its stomach—a tail and egg of *Anolis pulchellus*. The tail was so coiled about the egg

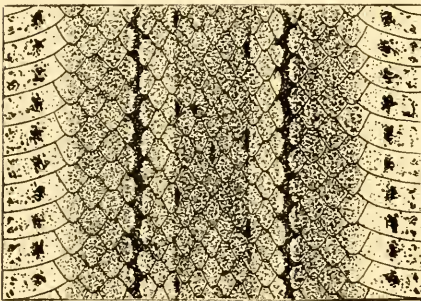


FIG. 44.—Color-pattern of *Dromicus stahli*. (From Stejneger.)

that it appears probable that the egg was forced out after or during the swallowing of the lizard. It is likely that the lizard had attempted egg-laying under the edge of the stump which concealed the snake.

Eggs of this species were found in three places: under a log in a pasture, and under an old termite nest in a coffee plantation, at Aibonito, and in the loose soil under a stump at Bayamon. One lot contained 7 eggs, another 13, and the third 40.

The adult female found with the largest number of eggs contained 6 well-developed eggs. The eggs in this place were in three lots—18 old and discolored, in two clusters; 6 loose, somewhat different in appearance; and two clusters of 6 and 10 eggs very fresh and white. Examination of the eggs showed that they contained embryos in at least three stages, the fresher eggs having scarcely begun development, the oldest containing embryos nearly ready to hatch. The eggs found under the termite nest were also in two clusters, one of 7 eggs with advanced embryos, the other of 6, with no apparent development. The

older eggs are slightly larger, ranging from 21 to 25 mm. in length and from 12 to 15 mm. in diameter. The surface is finely striate, very white in the fresher specimens. It appears that the adult females of this species take up a location from which they do not wander far, and in which they lay successive batches of eggs, from 6 to 18 (?) in number. The largest "nest" contained the remains of still older eggs which were either infertile or from which the young had hatched. The eggs are laid in clusters of 6 to 10, the individual eggs adhering firmly to the mass. The rate of reproduction is evidently fairly rapid.

***Dromicus exiguus* Cope**

Text Fig. 45

Dromicus exiguus Cope, 1862, Proc. Acad. Nat. Sci. Phila., p. 79.—Reinhardt and Luetken, 1863, Vid. Meddel. Naturh. Foren. Copenhagen, 1862, p. 216.—Garman, 1887, Proc. Amer. Philos. Soc., Vol. XXIV, p. 282.—Boulenger, 1894, Cat. Snakes Brit. Mus., Vol. II, p. 126.—Meerwarth, 1901, Mitt. Naturh. Mus. Hamburg, Vol. XVIII, p. 14.

Leimadophis exiguus Stejneger, 1904, Rept. U. S. Nation. Mus., 1902, p. 698, Figs. 167-169.—Barbour, 1914, Mem. Mus. Comp. Zool., Vol. XLIV, p. 339.

Type locality.—St. John and St. Thomas, Virgin Islands.

Distribution.—St. Thomas, St. John and Culebra islands.

Diagnosis.—Closely allied to *Dromicus stahli*, from which it differs in having fewer ventrals, 134-146 instead of 151-159.

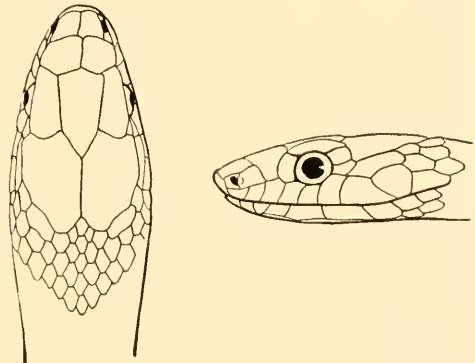


FIG. 45.—Head of *Dromicus exiguus* from above and from the side. (After Stejneger.)

Original description.—"Size small; body stout; head little distinct, flat above, muzzle prominent. Rostral plate broad, presenting no superior surface. Prefrontals well-developed. Vertical elongate, lateral borders straight, the posterior long, forming an acute angle. Occipitals

well developed, the median or common suture shorter than the vertical plate, obtuse posteriorly, bounded by one large and five small temporals on each side. Postoculars two; preocular one, rather broad; loreal small. Postnasal longer than prenasal. Eight superior labials, third, fourth, and fifth entering orbit. Nine inferior labials, fourth and fifth largest. Scales in nineteen longitudinal rows. Total length of largest of five specimens 17 in. 1 lin.; tail 5 in. 4 lin.

"Above light brown, sometimes yellowish, densely punctuated with darker. The median dorsal region is of a deeper shade; distant dark brown spots sometimes form two parallel series, one of each side of it. A dark brown band along the fourth row of scales nearly to the end of the tail; it is sharply defined only superiorly; it is continuous with a head band which passes through the eye. Beneath yellowish, punctuated with brown, especially toward the extremities of the gasterosteges."

Remarks.—This is the only species of snake on our list which has not passed through my hands. Stejneger's description of a *Culebra* specimen and his remarks on variation in this species are as follows:

"Rostral scarcely visible from above; internasal suture shorter than prefrontal suture; frontal long, longer than the parietal suture, but shorter than the parietals; loreal (abnormally) joined to prefrontals; one preocular; two postoculars; one long anterior temporal, and two smaller posterior ones; eight supralabials, third, fourth, and fifth entering eye (on left side nine, fourth, fifth, and sixth entering eye); posterior chin-shields longer than anterior ones; 19 rows of smooth scales without pores; 144 ventrals; anal divided; subcaudals, 82 pairs. Color as described under *Leimadophis stahli*, p. 695, but paler.

DIMENSIONS

Tip of snout to tip of tail.....	310 mm.
Vent to tip of tail.....	100

"The above specimen is abnormal in having no loreal. Ordinarily the loreal is very small, sometimes even rudimentary, and Reinhardt and Luetken mention a specimen having none on the left side, preocular and postnasal being in contact. Garman mentions a specimen in the museum at Cambridge, Massachusetts, having the prefrontals fused on the median line. The normal number of supralabials is 8, but the *Culebra* specimen described has 9 on one side. Meerwarth describes a similar specimen from St. Thomas. Ventrals (in 19 specimens recorded) vary between 134 and 146, subcaudals between 79 and 86 pairs.

"The only essential difference between *L. exiguus* and *L. stahli* seems to be the lower number of ventrals in the former. Altogether 29 speci-

mens of both species have been examined and recorded, and in these the difference is marked and constant."

Habits.—Nothing is known of the habits of this species.

Alsophis Fitzinger

Alsophis antillensis (Schlegel)

Text Figs. 46 and 47

Psammophis antillensis Schlegel, 1837, Phys. Serp., Vol. II, p. 214.

Dromicus antillensis Duméril and Bibron, 1854, Erpét. Gén., Vol. VII, Part 1, p. 659.—Günther, 1858, Cat. Colubrine Snakes Brit. Mus., p. 129.—Cope, 1860, Proc. Acad. Nat. Sci. Phila., p. 560.—Jan., 1867, Icon. Ophid., livr. 25, Pl. 1, Fig. 1.—Boulenger, 1894, Cat. Snakes Brit. Mus., Vol. II, p. 123.—Meerwarth, 1901, Mitth. Naturh. Mus. Hamburg, Vol. XVIII, p. 12, Pl. 1, Fig. 13.

Alsophis antillensis Cope, 1862, Proc. Acad. Nat. Sci. Phila., p. 76.—Reinhardt and Luetken, 1863, Vid Meddel. Naturh. Foren., 1862, p. 218.—Garman, 1887, Proc. Amer. Philos. Soc., Vol. XXIV, p. 282.—Stejneger, 1904, Rept. U. S. Nation. Mus., 1902, p. 704, Figs. 171-174.—Barbour, 1914, Mem. Mus. Comp. Zool., Vol XLIV, p. 336; 1917, Proc. Biol. Soc. Wash., Vol. XXX, p. 101.—Fowler, 1918, Papers Dept. Marine Biol., Carnegie Inst. Wash., Vol. XII, p. 14.—Schmidt, 1920, Am. N. Y. Acad. Sci., Vol. XXVIII, p. 199.

Alsophis anegadæ Barbour, 1917, Proc. Biol. Soc. Wash., Vol. XXX, p. 102 (type locality, Anegada, outer Virgin Ids.).

Type locality.—St. Thomas, Guadeloupe, Martinique and Cuba. Restricted to St. Thomas by Günther.

Distribution.—Virgin Islands and Porto Rico. It is known from St. Thomas, St. John, Virgin Gorda and Anegada, from Vieques and Culebra, and from Coamo Springs on Porto Rico.

Specimens collected.—2: Coamo Springs.

Diagnosis.—Dorsal scales usually in nineteen, occasionally in seventeen, rows; a pair of pits present at the tip of each scale; a row of black spots on the lower half of the fifth scale-row; ventral plates 170-189, caudals 116-144.

Original description.—"This species has the habitus of *Psammophis moniliger*, to which it is also somewhat allied by its color pattern, but its head is much wider at the base and sharply conical; the narrow snout ends in a blunt point; the head-shields are almost like those of *Psammophis moniliger*, with the exception of the frontal, which is usually less elongate.

"The Antillean *Psammophis* has all its teeth equal in length; it reaches a length of three feet; three specimens of diverse ages measure

respectively (in mm.): $760 + 290$, $490 + 180$, and $180 + 80$; the ventrals vary from $178 + 100$ to $204 + 144$; there are seventeen to nineteen rows of smooth, lanceolate scales.

"The lower parts are yellow; upper parts yellowish brown; back with three narrow black bands, the median composed of two fine serrated

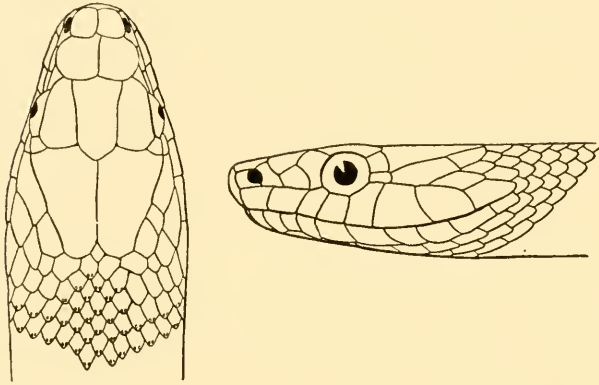


FIG. 46. — *Alsophis antillensis*, head from above and from side. (After Stejneger.)

lines, the two on the sides of a great number of small dots; the lateral lines pass through the eye to the sides of the snout; this pattern is most distinct in young specimens; in older specimens the lines are obscure or converted into a network formed by the black borders of the scales."

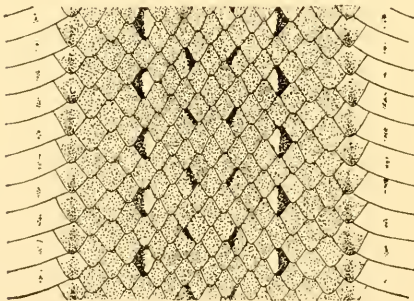


FIG. 47.—Color-pattern of *Alsophis antillensis*. (From Stejneger.)

Remarks.—The original description, based on specimens from St. Thomas, Guadeloupe, Martinique and Cuba, is a "composite species." The name has come to be restricted to the Virgin Island form by the consensus of opinion among herpetologists. Lidth de Jeude records *Dromicus antillensis* from Curaçao, and this is repeated by Ruthven (1923, p. 9). This can scarcely be the Virgin Island species.

The identification of the two specimens collected by me at Coamo Springs as this species removes the element of geographical distinctness from the allied *A. portoricensis*. The male specimen has only seventeen scale rows, and so might be identified with *A. portoricensis*, were it not that the coloration of both specimens is nearly typical of *A. antillensis*, while the female has nineteen scale rows at mid-body. In view of the higher number of ventral plates and the distinct coloration, I prefer to retain *portoricensis* and *antillensis* as distinct species.

The two specimens agree closely in coloration with the color variety described by Barbour from Anegada and, as I do not wish to admit of a discontinuous distribution of *A. anegadae*, it seems best to include both Porto Rican and Anegadian specimens with *A. antillensis*.

The measurements and scale characters of the two Porto Rican specimens are as follows:

Parts measured	AM. N. H.	
	No. 13305 ♂	13306 ♀
Length	707 mm.	820 mm.
Tail	245 "	270 "
Tail length35	.33
Ventral plates	184	185
Subcaudals	134	132
Dorsal scales	17-17-15	17-19-15

Much the best description extant is that of Stejneger, based on a *Culebra* specimen, which I quote in full:

"Rostral much broader than high, barely visible from above; internasal suture scarcely shorter than the prefrontal suture; frontal broader than supraocular, about equaling its distance from the tip of the snout and the parietal suture; nostril between two nasals; loreal moderate, trapezoid, the posterior border being strongly convex; one preocular separated from frontal; two postoculars, the lower one very narrow; temporals 1 + 2; 8 supralabials, third, fourth, and fifth entering eye, the fifth and following ones abruptly much higher than the anterior ones; 5 lower labials in contact with anterior chin-shield, which is much shorter than the posterior; 19 rows of smooth scales with two conspicuous apical pores; 183 ventrals; anal double; 118 pairs of subcaudals. Color (in alcohol) above brownish drab, the individual scales irregularly tipped and edged with dusky; underneath whitish with dark drab mottlings on chin and throat and a series of similarly colored dots on the lateral canthus of each ventral shield, forming a dotted line on each side of the abdomen, each ventral, moreover, posteriorly more or less irregularly edged with brownish drab; a few brownish irregular spots on the labials and upper

head shields, with a double series of elongate brownish spots on the upper neck; from anterior nasal through eye a dark-brownish streak continuing on the sides of neck and body as a broken line of elongate spots; these spots which on the sides of the body occupy the lower half of every second or third scale in the fifth scale row, the upper half being whitish or decidedly paler than the ground color."

Habits.—Little is known of the habits of this species. One of my specimens was shot in an arroyo behind the Coamo Springs Hotel, the other was found at the base of the cliff behind the bath houses, beneath a stone. This specimen bit fiercely when captured. The stomach of one specimen contained the tail of an *Anolis*.

***Alsophis portoricensis* (Reinhardt and Luetken)**

Culebra

Text Figs. 48 and 49

Alsophis portoricensis Reinhardt and Luetken, 1863, Vid. Meddel. Naturh. Foren. Copenhagen, 1862, p. 221.—Peters, 1876, Monatsber. Akad. Wiss. Berlin, p. 708.—Gundlach, 1881, Anales Soc. Españ. Hist. Nat., Vol. X, p. 313.—Stejneger, 1904, Rept. U. S. Nation. Mus., 1902, p. 700, Fig. 170. (part).—Barbour, 1914, Mem. Mus. Comp. Zool., Vol. XLIV, p. 335.—Fowler, 1918, Papers Dept. Marine Biol. Carnegie Inst., Vol. XII, p. 14.—Schmidt, 1920, Am. N. Y. Acad. Sci., Vol. XXVIII, p. 199 (part).—Danforth, 1925, Copeia, No. 147, p. 79.

No common name other than "culebra."

Type locality.—Porto Rico.

Distribution.—Confined to Porto Rico, Desecheo Island and Caja de Muertos. On Porto Rico it is recorded from Adjuntas, Bayamon, Humacao, Mayagüez and Utuado.

Specimens collected.—3: Adjuntas and Caja de Muertos.

Diagnosis.—Nine large shields on top of head; dorsal scales in seventeen rows, usually 17-15-14; dorsal scales with a pair of distinct pits at the tip of each; dorsal scales dark brown outlined with black, ventrals each with black posterior border.

Original description.—"Color (in alcoholic specimen), rufous brown above, the individual scales black bordered; yellow beneath, the abdominal and subcaudal plates black bordered; scales in seventeen rows, ventral plates 175, subcaudals 122."

Remarks.—The N. Y. Academy's three specimens were secured by H. E. Anthony. Through the courtesy of Dr. Stuart T. Danforth, I have been enabled to examine the specimen of this species mentioned by him, and he also loaned for study a specimen secured by him on Desecheo

Island in 1926. Mr. M. Graham Netting of the Carnegie Museum kindly called my attention to the existence of two Porto Rican snakes of this species in the collections of the Carnegie Museum. I am further indebted to Miss Doris Cochran for information on the specimens in the U. S. National Museum, and to Mr. Arthur Loveridge for notes on the two specimens in the Museum of Comparative Zoology. In all I have notes on thirteen specimens from Porto Rico, on one from Caja de Muertos and on two from Desecheo Island.

My belief in the distinctness of the Mona Island species, which I distinguished in 1926 primarily on what appeared to be a constant differ-

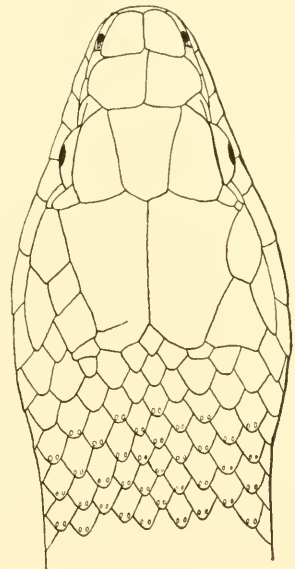


FIG. 48.—Head of *Alsophis portoricensis* from above, showing scale-pits in dorsal scales. (From Stejneger.)

ence in coloration, was rudely shaken by the discovery of pale colorations in Porto Rican specimens, especially Carnegie Museum No. 1333, from Adjuntas, and the Caja de Muertos specimen. An unexpected distinction turns up, however, in the fact that the normal scale reduction in Porto Rican specimens is 17-15-14 or 17-15-13. When I first observed this scale count in the two Adjuntas specimens, I supposed it to be an anomaly. Ten of the thirteen specimens have the formula 17-15-14, two have 17-15-13, and one has 17-15. The Caja de Muertos specimen reduces to 14 scale-rows, and in the Desecheo Island specimens one has the formula 17-15-14, the other 17-15. Eight Mona Island specimens have 15 scale rows anterior to the anus.



It is not unlikely that a pale form of true *portoricensis* formerly occurred in the arid district of southwestern Porto Rico, and the Muertos Island specimen is evidence to this effect.

The Desecheo Island specimens agree quite closely in coloration with the Mona Island species, and their relations are evenly divided by their scale counts. Additional specimens are evidently required to settle the principal affinities of the Desecheo population of this species.

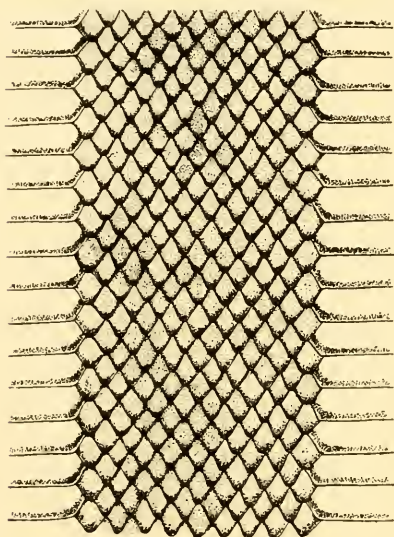


FIG. 49.—Color-pattern of *Alsophis portoricensis*. A. M. N. H. No. 8435. Twice natural size.

The range of ventrals and subcaudals in male specimens is 169-179 and 125-134. In females these counts are 175-183 and 115-128.

The typical coloration was described by Reinhardt and Luetken, and our Adjuntas specimens and Stejneger's Humacao specimens agree excellently. The dorsal scales are dark brown, each scale outlined with black, and all except the anterior ventrals are heavily margined with black at their free edges.

Habits.—Nothing is known of the habits of this species.

***Alsophis variegatus* (Schmidt)**

Text Fig. 50

Dromicus sanctae-crucis var. *portoricensis* Boulenger, 1896, Jahresb. Naturw. Ver. Magdeburg, 1894-1896, p. 113; Meerwarth, 1901, Mitt. Naturh. Mus. Hamburg, Vol. XVIII, p. 11.

Dromicus sanctae-crucis Boulenger, 1896, Cat. Snakes Brit. Mus., Vol. III p. 634 (not of Günther).

Alsophis portoricensis Stejneger, 1904, Rept. U. S. Nation. Mus., 1902, p. 700, Fig. 170, (part).—Schmidt, 1920, Ann. N. Y. Acad. Sci., Vol. XXVIII, p. 199 (part).

Dromicus variegatus Schmidt, 1926, Publ. Field Mus. Nat. Hist., Zool., Vol. XII, p. 160, Figs. 4-5.

Type locality.—Mona Island.

Distribution.—Confined to Mona Island.

Specimens collected.—3: Mona Island.

Diagnosis.—Allied to *Dromicus portoricensis* in scale characters, and distinguished chiefly by its coloration, in which the regular reticulation of black of the dorsal scales and the black borders of the ventrals are absent. Dorsal scale formula 17-15.

Original description.—"Habitus unspecialized; venter weakly angulate; head large and well distinguished from the neck, somewhat de-

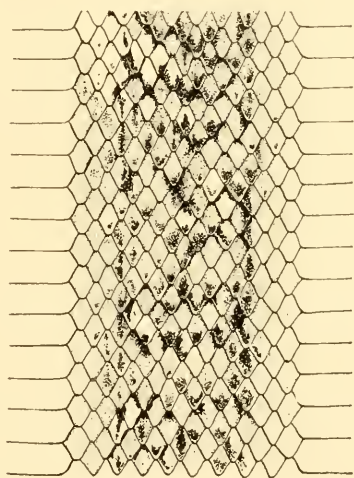


FIG. 50.—Color-pattern of *Alsophis variegatus*. A. M. N. H. No. 13774.

pressed; body rather slender. Rostral wider than high, just visible from above; internasal suture two-thirds that of the prefrontals; frontal longer than its distance from the end of the snout, as long as the parietal suture; parietals large; nasal divided; loreal small, 5-sided; a single large preocular, extending to the upper side of the head, not in contact with the frontal; two postoculars, the lower much the smaller; temporals $\frac{1}{2}$, with a well marked groove between them and the labials; upper labials eight, the third, fourth and fifth entering the eye; lower labials ten; chin shields slender, the posterior pair much longer than the anterior.

"Dorsal scales 17-17-15; ventrals 173; tail incomplete.

"Top of head with a few brown spots on a lighter ground color; a black lateral line from the nostril through the eye, extending some distance on the neck; a short nuchal black line from the parietal suture to the constriction of the neck; upper and lower labials and chin light, punctulate with brown dots; venter immaculate anteriorly, with slight brown markings on the angle and on the posterior margins of the ventrals toward the tail; subcaudals with narrow brown markings parallel to but not at the rear border; posterior margins of the dorsal scales with irregular black markings, tending to form zig-zag cross-bands."

Remarks.—The two specimens collected on Mona Island and mentioned in my paper in the Annals of the New York Academy of Sciences, A. M. N. H. Nos. 13773 and 13774, may be named as paratypes of this species. They agree with the type described above, with the wavy dorsal cross-bands somewhat better developed. They show no approach to the coloration of the specimens of *portoricensis* examined by me, and Stejneger (loc. cit.) contrasts his Porto Rican specimens in the same way with one from Desecheo Island. The ventrals, caudals, and measurements of the two male paratypes are as follows: ventrals 177, 179; caudals 125, 113; total length 661 mm., 780 mm.; length of tail 213 mm., 248 mm. Another specimen, a female, collected by Anthony in 1926, agrees with the coloration described above. It has 179 ventrals.

Meerwarth's notes on the coloration of the twenty-five Mona Island specimens examined by him confirm the constancy of this character.

The extremes and averages of the ventral and caudal counts on record are as follows:

	No. of specimens	Extremes	Average
Ventrals	41	170-181	176
Caudals	30	112-126	120

There is certainly an average difference in both caudals and ventrals in the two sexes, but the extremes appear nearly to coincide.

Mr. H. W. Parker writes me that the four Mona Island specimens in the British Museum have the scale formula 17-15, and this agrees with that of the four specimens examined by me and affords the most constant distinction from *Alsophis portoricensis*.

Habits.—The two specimens secured by myself on Mona Island were found hidden beneath rubbish on the low terrace of cultivated land on the south side of the island.

The stomach of one specimen contained the remains of two *Ameiva* tails, and that of the other one tail of the same lizard.

Order TESTUDINATA

EMYDIDAE

Pseudemys Gray

Each of the islands of the Greater Antilles is inhabited by a species of fresh-water turtle belonging to the genus *Pseudemys*. This genus has a large development in Eastern North America and in Central America.

Pseudemys stejnegeri, sp. nov.

Text Figs. 51 and 52

Emys rugosa Stahl, 1882, Fauna Puerto-Rico, p. 68.—Garman, 1887, Proc. Amer. Philos. Soc., Vol. XXIV, p. 286.

* *Clemmys ducussata* Peters, 1876, Monatsber. Akad. Wiss. Berlin, p. 705.—Gundlach, 1881, Anales Soc. Españ. Hist. Nat., Vol. X, p. 307.

Pseudemys palustris Stejneger, 1904, Rept. U. S. Nation. Mus., 1902, p. 710, Figs. 179-186.

Type locality.—San Juan, Porto Rico.

Distribution.—Recorded only from Caguas, San Juan, Desengaño (Cartagena Lagoon) and Guanica Lake.

Diagnosis.—A *Pseudemys* closely allied to the *Pseudemys palustris* of Jamaica and Hispaniola, from which it is distinguished by smaller size and by having the axillary and fifth marginal shields usually not in contact.

Type.—U. S. N. M. No. 25642, San Juan, Porto Rico. Adult female collected by the U. S. Fish Commission "Fish Hawk" Expedition.

Description of type.—¹ "Shell moderately convex, the height being more than one-half the greatest width; length of carapace less than two and a half times the height of the shell and about one and one-third times its greatest width; carapace faintly keeled and with longitudinal wrinkles crossed by radiating ridges, which are especially strong on the anterior costals; nuchal narrow; first vertebral shield urceolate, anterior and posterior sutures of same length; lateral sutures of second, third, and fourth vertebrae much longer than the anterior and posterior sutures; vertebrae much narrower than costals; posterior margin of carapace slightly serrate, each of four posterior marginals on each side being faintly emarginate; carapace broader behind than in front, the posterior marginals flaring out considerably; plastron less than two-thirds and more than one-half the greatest width of the carapace; the posterior lobe a trifle wider than the anterior, its length much less than

¹ Quoted from Stejneger, 1904, p. 711.

the width of the bridge; abdominal suture longest, equaling those of the pectorals and femorals together; humeral suture shortest; gulars projecting, cut off square anteriorly; plastron slightly emarginate behind; axillars and inguinals large, latter largest; head moderate; snout short, pointed, feebly projecting; upper jaw with a very slight median notch, no cusps; jaws feebly denticulated; alveolar surface broad, with a deep notch behind on the median line; symphysis of mandible as broad as one-half the longest diameter of the orbit; digits connected with broad webs. Color (in alcohol) of carapace above nearly uniform tawny olive; plastron yellowish, with obscure dusky symmetrical sinuous markings all over; top of head without markings; yellowish lines narrowly

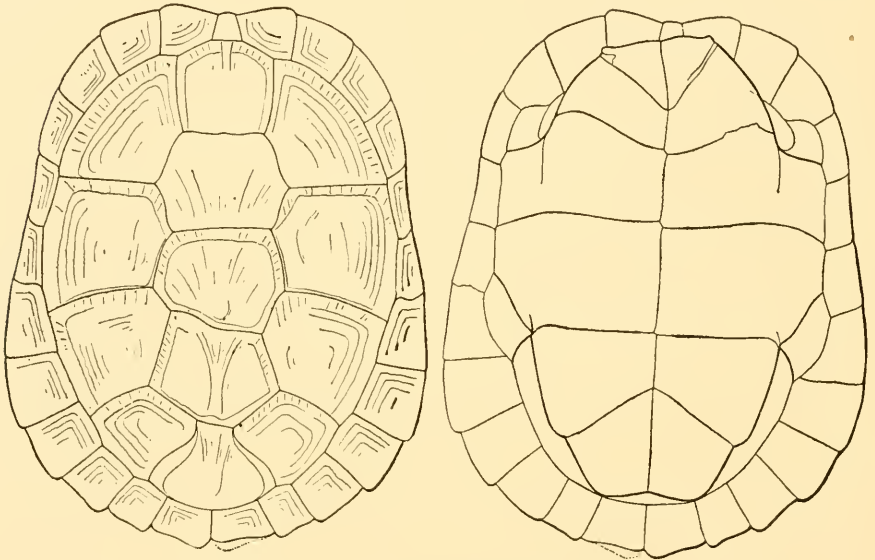


FIG. 51.—Carapace and plastron of *Pseudemys stejnegeri*. (From Stejneger.)
One-half natural size.

edged with blackish on sides and under surface of head and neck, one from the nostrils crossing the upper jaw obliquely and ending abruptly at the posterior angle of the mandible, another from above the nostrils, crossing the eye of the lower posterior edge of the orbit, and thence obliquely down and backward to the corner of the mouth, continuing backward under the tympanum down the side of the neck; two fainter lines, one between the two just described and one above the transocular line, crossing the tympanum; a line on the symphysis of the mandible bifurcating on the chin and a third median line originating on the chin a short distance behind the fork, the three continuing parallel

down the under side of the neck; two similar but wider lines on the upper side of the fore legs and two on the under side of the hind legs."

DIMENSIONS

	mm.
Length of carapace.....	232
Width of carapace anteriorly.....	150
Width of carapace posteriorly.....	170
Height of shell.....	95
Width of anterior plastral lobe.....	90
Width of posterior plastral lobe.....	93
Width of bridge.....	88
Width of head.....	31

It must be added that the relation between the axillary and fifth marginal shields in this specimen is the normal one, i. e., that they are widely separated by a suture of the fourth marginal with the pectoral, as is illustrated in Stejneger's figure of another specimen, reproduced here (Fig. 51).

Remarks.—Stejneger makes the comment with reference to this turtle that "There are indications at hand that there may be some constant differences between those inhabiting the different islands, but the material at my disposal is not sufficient to warrant an attempt to separate them." I have seen nineteen Porto Rican specimens and thirteen Hispaniolan, but I have nevertheless hesitated at separating the Porto Rican specimens as a distinct species. I feel that there are now certain indications at hand that there are two forms of this turtle in Hispaniola, which lack of material prevents me from distinguishing; and this uncertainty as to the Hispaniolan forms does not clarify the relations of the Porto Rican species. The character chosen as distinctive, the contact of the axillary shield with the fifth marginal or its exclusion from the fifth marginal by a contact of the fourth marginal with the pectoral shield is a trivial one. The specimens examined vary in this respect as follows:

Localities	Axillary reaching 5th marginal	Not reaching 5th marginal
Porto Rico.....	3	15
Hispaniola	11	2
Cuba	11	1
Jamaica	2	0

In the series of paratypes—U. S. N. M. No. 25643, 25644 and 25653, A. M. N. H. No. 15186, and F. M. N. H. No. 12476-12489 inclusive (the latter ex Danforth collection)—the length of the carapace of the type is not exceeded. The extremes of the Danforth series are

100-179 mm., the average 124 mm. Three Hispaniolan specimens measure 232, 234 and 241 mm., and I have seen much larger specimens at Monte Cristi. Additional information as to the adult size of Porto Rican specimens is, however, much to be desired.

Fowler has discussed the color dimorphism in this species in some detail, and Danforth comments on it as follows: "There is a popular idea that there are two species, a green and a black one, but I have seen intergrades between the two." This feature of the Porto Rican species is unknown in the Hispaniolan *Pseudemys*.

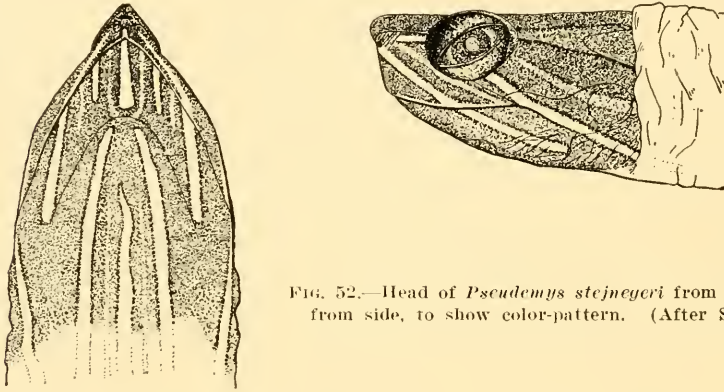


FIG. 52.—Head of *Pseudemys stejnegeri* from below and from side, to show color-pattern. (After Stejneger.)

Habits.—Nothing is known of the habits of this species except for the observations of Danforth (1925), which I quote: "By April they were laying eggs. For that purpose they come out on land at night, and the natives choose that time to hunt them with the aid of lights. They are sold in the markets for food. These turtles are only rarely seen sunning themselves."

A HAND-LIST OF THE AMPHIBIANS AND REPTILES OF THE VIRGIN ISLANDS

In view of the fact that the Virgin Islands are frequently visited by naturalists en route for other localities, I have drawn up a table of the known distribution of the species, and added artificial keys and notes on some of the questions of interest which remain for investigation, in the hope that they may be found useful.

DISTRIBUTIONAL LIST OF THE AMPHIBIANS AND REPTILES OF THE VIRGIN ISLANDS

	Porto Rico.	Vieques.	Culebra.	St. Thomas.	St. John.	Tortola.	Jost Van Dyke.	Virgin Gorda.	Anegada.	St. Croix.
<i>Bufo turpis</i>								x		
<i>Leptodactylus albilabris</i>	x	x	x	x		x	x		x	x
<i>Eleutherodactylus antillensis</i>	x	x	x	x		x				
<i>Eleutherodactylus lentus</i>				x						x
<i>Hemidactylus mabouia</i>	x			x						
<i>Thecadactylus rapicaudus</i>				x						x
<i>Sphaerodactylus macrolepis</i>	x	x	x	x		x		x	x	x
<i>Anolis cuvieri</i>	x	x				x				
<i>Anolis cristatellus</i>	x	x	x	x	x	x	x	x	x	x
<i>Anolis stratulus</i>	x	x	x	x		x	x			
<i>Anolis pulchellus</i>	x	x	x	x		x	x	x	x	x
<i>Anolis acutus</i>										x
<i>Iguana iguana</i>				x						
<i>Cyclura pinguis</i>									x	
<i>Ameiva exsul</i>	x	x	x	x	x	x		x	x	x
<i>Ameiva polops</i>										x
<i>Amphisbaena fenestrata</i>				x	x					x
<i>Mabuya sloanii</i>	x		x	x	x		x			x
<i>Typhlops richardii</i>	x			x						x
<i>Dromicus exiguus</i>		x	x	x	x					
<i>Alsophis antillensis</i>	x	x	x	x	x			x	x	
<i>Alsophis sancti-crucis</i>										x
Total No. Species 22	12	10	10	16	6	8	5	6	7	13

NOTES ON HERPETOLOGY OF THE VIRGIN ISLANDS

I. Amphibians.

1. *Bufo turpis* Barbour. Readily recognized as the only toad in the islands. Known only from a single specimen collected on Virgin Gorda by James Lee Peters in 1915. Additional specimens for further comparison with the Porto Rican toad are much to be desired.

2. *Leptodactylus albilabris* (Günther). General aspect frog-like. Barbour has called attention to apparent differences in specimens from St. Croix, and suggests that the species is adapting itself to burrowing habits there.

3. *Eleutherodactylus antillensis* (Reinhardt & Luetken). Coloration variable, usually uniform grayish brown, the concealed surface of the thighs reticulated with black.

4. *Eleutherodactylus lentus* (Cope). The uniformly mottled color-

tion and the light dorsolateral lines readily distinguish this species. Its note is undescribed, and its breeding habits are quite unknown.

II. Reptiles.

1. *Hemidactylus mabouia* (Moreau de Jonnès). It is difficult to understand why this introduced form has not become more common. It may be looked for at night on the walls of buildings near electric lights.

2. *Thecadactylus rapicaudus* (Houttuyn). It is not known whether this species has become established in St. Thomas and St. Croix.

3. *Sphaerodactylus macrolepis* Günther. The range of variation in size of dorsal scales should be determined for Virgin Island specimens, for comparison with the data given above for the Porto Rican series.

4. *Anolis cuvieri* Merrem. The giant *Anolis* is recorded only from Tortola. It may be extinct even there, as there is no recent record. It might be looked for on St. John.

5. *Anolis cristatellus* Duméril & Bibron. The common *Anolis* of fence posts and open brush.

6. *Anolis stratulus* Cope. Often associated with *A. cristatellus* but a little more arboreal in its habits in Porto Rico. It should be looked for on St. Croix.

7. *Anolis pulchellus* Duméril & Bibron. Also associated with *A. cristatellus*, this species is readily recognized by its more slender body and longer tail. Another species (*Anolis richardii* Duméril & Bibron) with a slender body, keeled ventral scales and the occipital scale in contact with the scales bordering the orbits, was described from Tortola. Special search by Mr. Peters, who explored the outer Virgin Islands for the Museum of Comparative Zoology, failed to re-discover this species. *Anolis krugi*, another closely allied species, might be looked for in the more shaded and moist localities on St. John.

8. *Anolis acutus* Hallowell. Related to *Anolis pulchellus* but confined to St. Croix, this species has not recently been recorded. It should be compared with *Anolis poncensis* of the arid district in Porto Rico for possible relationship.

9. *Iguana iguana* (Linné). This species is much used for food in many localities, which probably accounts for its introduction in St. Thomas. It does not appear to have become well established, but Barbour records a specimen of *iguana* from Water Island, near St. Thomas, in 1917.

10. *Cyclura pinguis* Barbour. Known from a single specimen secured on Anegada by Mr. Peters. It should be further compared with the extinct *Cyclura mattea* Miller, from St. Thomas.

11. *Ameiva exsul* (Cope). Apparently exterminated in St. Thomas by the mongoose, the ground lizard is still found on the adjacent Water Island.

12. *Ameiva polops* Cope. Known only from the type from St. Croix. It should be looked for on the tops of the limestone hills, in the same habitat as that of *A. wetmorei* of Porto Rico.

13. *Amphisbaena fenestrata* Cope. This species may be looked for wherever there is tillable soil. Specimens from St. Croix should be compared with those from St. Thomas for possible differences.

14. *Mabuia sloanii* (Daudin). A rare species. Virgin Island specimens have a somewhat different coloration from those of Porto Rico.

15. *Typhlops richardii* Duméril and Bibron. This burrowing blind snake can usually be secured through people who are cultivating or plowing. A series from both St. Thomas and St. Croix would be of interest for comparison with the Porto Rican specimens described above.

16. *Dromicus exiguus* Cope. This species like *L. stahli* of Porto Rico, may prove more abundant than is believed to be the case. It probably is found in similar situations.

17. *Alsophis antillensis* (Schlegel). Formerly abundant on St. Thomas, now apparently rare.

18. *Alsophis sancti-crucis* (Cope). The present status of this species on St. Croix is unknown. It was not found by Noble or Ruthven, who visited the island in 1914.

ARTIFICIAL KEYS TO THE SPECIES

I. Frogs and Toads

1. { Skin rough; head with bony ridges.....*Bufo turpis*
 { Skin smooth; head without bony ridges... 2
2. { Tips of digits not at all dilated; thigh with
 { dark crossbars.....*Lepodactylus albilabris*
 { Tips of digits slightly or considerably di-
 { lated; thighs mottled, not barred..... 3
3. { Tips of digits slightly dilated; belly
 { smooth; back mottled.....*Eleutherodactylus lentus*
 { Tips of digits well dilated; belly granular;
 { back usually uniform or with narrow
 { light line in the middle.....*Eleutherodactylus antillen-*
sis

II. Lizards and Snakes

- | | | | |
|----|---|--|-----------------------------------|
| 1. | { | Limbs well developed..... | 2 |
| | } | Limbs absent..... | 14 |
| 2. | { | No eyelids; skin soft, often broken in catching; digits more or less dilated.... | 3 |
| | } | Eyelids present; skin firm; digits dilated or not..... | 5 |
| 3. | { | Digits dilated only at tip, with circular plate beneath; skin covered with overlapping scales; size small, less than three inches..... | <i>Sphaerodactylus macrolepis</i> |
| | } | Digits broadly dilated, with transverse lamellae beneath; skin of back covered with granular scales not overlapping; adults larger, exceeding three inches.... | 4 |
| 4. | { | Slender terminal joint bearing claw beyond the expanded portion of digits.... | <i>Hemidactylus mabouia</i> |
| | } | No slender terminal joint on digits; claw concealed in slit between expanded sides of digits..... | <i>Thecadactylus rapicaudus</i> |
| 5. | { | Digits dilated, with slender terminal joint beyond dilation..... | (<i>Anolis</i>).... 6 |
| | } | Digits not dilated..... | 10 |
| 6. | { | Scales on back (closely examined) consist of larger scales entirely surrounded by smaller granules..... | <i>Anolis cuvieri</i> |
| | } | Scales on back not as above..... | 7 |
| 7. | { | Ventral scales keeled; dorsal scales more or less enlarged in vertebral region.... | 8 |
| | } | Ventral scales smooth..... | 9 |
| 8. | { | Enlarged occipital scale (largest median scale on head behind orbits) separated from enlarged scales bordering orbits by one or more scales..... | <i>Anolis pulchellus</i> |
| | } | Occipital scale in contact with scales bordering orbits..... | <i>Anolis acutus</i> |
| 9. | { | Back with four or five well-defined transverse spots; throat fan of male uniform orange | <i>Anolis stratulus</i> |
| | } | Coloration extremely variable; female usually with light longitudinal mid-dorsal stripe; throat fan of male greenish yellow, brownish orange at edge..... | <i>Anolis cristatellus</i> |

10. { Under side of body covered with large plates in regular longitudinal and transverse series.....11
 { Under side of body covered with overlapping scales like those of sides and back..12
11. { Eight rows of ventral plates.....*Ancira polops*
 { Ten or twelve rows of ventral plates.....*Ancira exsul*
12. { No dorsal fold or crest.....*Mabuza stouanii*
 { Well-defined dorsal crest of spines.....13
13. { Dorsal crest continuous.....*Iguana iguana*
 { Dorsal crest interrupted on rump.....*Cyclura pinguis*
14. { Eye concealed beneath skin.....15
 { Eye distinct.....16
15. { Body covered with overlapping scales.....*Typhlops richardii*
 { Skin divided into small rectangular segments, arranged in regular rings.....*Amphisbaena fenestrata*
16. { No pits at tips of scales; dorsal scales in 19 rows; ventral plates 134-146; subcaudals 79-86.....*Dromicus eriguus*
 { A pair of distinct pits or pores near tip of each scale.....17
17. { Dorsal scales in 17 rows; ventral plates 191-195; subcaudals 145-147.....*Alsophis sancti-crucis*
 { Dorsal scales in 19 rows; ventral plates 170-189; subcaudals 116-144.....*Alsophis antillensis*

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THE FISHES OF PORTO RICO AND THE VIRGIN ISLANDS

BRANCHIOSTOMIDAE TO SCIAENIDAE

BY J. T. NICHOLS

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INTRODUCTION

FIELD WORK IN PORTO RICO

During the writer's visit to Porto Rico, July 8 to August 5, 1914, he was interested in making a reconnaissance, under the auspices of the Porto Rico Government and The New York Academy of Sciences, of the island's fish life, to be of service in interpreting, faunally and otherwise, ichthyological data from there already recorded; and he was also interested in finding and adding to the Porto Rican list as many species overlooked by earlier observers as time would permit. No attempt was made to assemble a large or exhaustive collection of fishes, and various familiar species, which it seemed unnecessary to collect, were merely noted in the markets or elsewhere. Now, after fifteen years have elapsed, it becomes desirable to make definite record of this month's work, which forms an intrinsic part of the Scientific Survey of Porto Rico and the Virgin Islands undertaken by the New York Academy of Sciences. The entries under the recurring paragraphs headed "Specimens collected" are compiled at this late date from the catalogue of the Department of Fishes of the American Museum of Natural History. Though complete as to species, they are doubtless somewhat incomplete as regards individuals. They are supplemented from the writer's notes by records of "Specimens seen" in the case of species which are not represented in the collections made at that time.

Most of the field work was in the vicinity of San Juan. A few trips were made to other parts of the island to compare conditions there with those about San Juan, the two principal trips being to Ponce and Guantanamo. A short and very productive trip to the mouth of the

Loiza River was undertaken primarily to look for the shepherd-fish (*Nomeus*). This member of the pelagic fauna had not been recorded from Porto Rican waters, but it seemed only reasonable to suppose that it occurred there commonly, as the Portuguese-man-of-war, with which it is associated, is abundant. Standing on the shore, the writer waited for one of these jelly-fishes to come drifting in from the open sea. He then swam out to meet it with a dip net, scooped it up, and brought it ashore. When the jelly-fish had been lifted out of the net by its sail, care being taken to avoid the long dangerous stinging tentacles, sure enough there was a little shepherd-fish which had sought refuge beneath it!

ACKNOWLEDGMENTS

One or two species (so designated) were obtained by Dr. F. E. Lutz while collecting insects in connection with the New York Academy's work in Porto Rico, otherwise records of specimens seen or collected all apply to the writer's work in the summer of 1914. This was mostly in the vicinity of San Juan, particularly at Santurce. Much of the field work here was carried on in close cooperation with Dr. R. W. Miner of the New York Academy of Sciences and the American Museum, who was then studying Porto Rico's marine invertebrates. To Dr. Miner's assistance in many ways credit is due for what could otherwise not have been accomplished in so short a time. It is also appropriate to speak with gratitude of helpful courtesies received from various gentlemen associated with the Porto Rican Government.

Acknowledgment is due to the New York Zoological Society, and to the contributors to its publications, for the greater number of the figures with which this work is illustrated. Some 50 of these appeared for the first time in "Marine Fishes of New York," Nichols and Breder, 1927, and 78 more in "Fishes of Port-au-Prince Bay, Haiti," Beebe and Tee Van, 1928, published respectively in Vols. IX and X of *Zoologica*. Duplicate plates of these figures were kindly made available through Mr. Elwin R. Sanborn, editor of the New York Zoological Society. Six pictures have been included with the assent of the publishers from *Field Book of Marine Fishes* by C. M. Breder, Jr., issued by G. P. Putnam's Sons. The author is indebted for courteous advice and assistance in the arrangement of his material to Mr. Herbert F. Schwarz, editor of the publications of the New York Academy.

PREVIOUS KNOWLEDGE OF PORTO RICAN FISHES

Porto Rican waters are a very small part of a very large area where fish life is varied and profuse but with comparatively few local differences. The fishes of this area in general, the West Indian fauna, have been the subject of considerable investigation and are comparatively well known. Of the fishes of Porto Rico in particular there has been only one thorough survey. This was made by the United States Bureau of Fisheries, and formed the basis for an adequate treatment of the subject: Evermann and Marsh, 1902, *The Fishes of Porto Rico*, Bull. U. S. Fish Comm. for 1900, XX, Pt. 1, pp. 49 to 350, 49 colored pls., 112 figs., 3 maps.

In the three decades which have elapsed since its appearance, that book has become comparatively inaccessible, there have been trifling additions to our knowledge of the fishes of Porto Rico and the adjacent islands, and there has been considerable scattered work on North American fishes which renders nomenclature then used more or less out of date. Unfortunately there has been no comprehensive standard revision of such nomenclature which can be followed here.

PLAN OF WORK

It is the writer's aim to make knowledge of his subject more accessible and to bring it more nearly up to date. To aid the reader in identifying the many species he relies on outline sketches supplemented by a few descriptive details. For a fuller treatment he refers the reader to the above-mentioned publication of the U. S. Bureau of Fisheries, which should be procurable in most libraries. His interest in the fishes of Porto Rican waters goes back to the time when the writer was pursuing field work in Porto Rico in 1914. The results of this field work are embodied in this paper.

The island of St. Croix to the south is included in the area covered. It is relatively close to Porto Rican waters, and such species as are recorded from St. Croix probably occur also about the larger island, even when not as yet recorded from there. Cope reported on a considerable collection of fishes from St. Croix in 1871. The species included in the present list are those of which there is definite record from Porto Rico and the Virgin Islands, including St. Croix.

By drawing on all available sources a fairly complete series of figures of the species of fishes is presented. Those which are lacking show only slight differences (noted in the descriptions) from related figured species, may be readily identified from the description alone, or (in a few cases) are

not sufficiently well known as to their structure to justify the preparation of figures that would almost necessarily be inaccurate.

EXPLANATION OF TECHNICAL TERMS

Some explanation is necessary to enable one who may not be versed in ichthyology to understand the technical terms used in the descriptive paragraphs under the respective species. This explanation may be imparted in the form of a glossary:

adnate. Coalescent or joined (to surrounding structures), as opposed to free.

anal. (1) The single fin posteriorly in the midline of the lower surface. (2) The number of rays in this fin, written as for the dorsal (to which the reader is referred).

axil. The backwardly directed angle, or corner between a fin and the body to which the fin is joined.

caducous. Easily lost (scales).

canine teeth, canines. Enlarged, pointed teeth.

caudal. The fin at the end of the tail; tail-fin.

caudal peduncle. See peduncle.

cheeks. Sides of the head in front of the preopercle.

cirrus, cirri. A threadlike process or processes.

compressed. Flattened from side to side.

ctenoid. (1) Comblike. (2) Rough; with a more or less comblike, serrate or spinous edge (scales).

cusp. A secondary point (teeth).

cylindrical. More or less rounded in cross-section.

deciduous. Easily lost (scales).

depressed. Flattened, up and down.

depth. (1) The greatest vertical diameter of the fish's body exclusive of fins. (2) The number of times this distance is contained in the standard length (see standard length).

disk. The body and pectoral fins of skates and rays are flattened and coalescent, spoken of collectively as the disk.

dorsal. (1) The single or duplicated fin in the midline of the back (back-fin). When two fins are present, the anterior is the first, and the posterior the second dorsal. (2) The number of rays in the dorsal fin or fins, such as are spinous being written in Roman. Thus, dorsal X, 10 means a dorsal of ten spines followed by ten soft fin-rays; dorsal X-10 means two dorsals, the first of ten spines, the second of ten rays.

Isolated one-rayed finlets when present are also written in Roman,—X-12-VIII,—a spinous fin, a soft fin, followed by eight finlets.

entire. Without serrations, cusps or lobes.

exserted. Projecting.

eye. The number of times the greatest diameter of the eye is contained in the length of the head (see head).

falcate. With a high pointed lobe (fins) in front (vertical fins).

filamentous. Threadlike.

free. See adnate.

gill-cleft, gill-opening. The opening back of the head, communicating with the gills.

gill-cover. The platelike sides of the head covering the gills, free behind and adnate in front.

gill-rakers. A series of horny processes on the concave side of the first (outer) gill-arch, opposite the gills. The gill-arch has a lower (horizontal) and an ascending limb, and it is the gill rakers on the lower limb that are usually counted.

gills. Red, feathery structures for aerating the blood, arranged in bands on several bony arches within the sides of the neck region.

head. (1) Measured from the end of the snout or front of the upper jaw to the most posterior point of the gill-cover, exclusive of spines. (2) The number of times this distance is contained in the standard length (see standard length).

included. Not extending so far forward as the upper jaw or snout (lower jaw).

inferior. With included lower jaw (mouth).

interhaemal spines. Spinelike bones between the vertebral processes and the base of the anal fin, supporting the anal rays.

keel. A raised ridge.

lateral-line. A line of pores or grooves traceable along the side from near the upper corner of the gill-cleft, usually to the base of the caudal or beyond.

lunate. Broadly crescent shaped; slightly forked (caudal fin).

maxillary. (1) The movable bone with a free end behind above the side of the mouth. (2) The distance from the end of snout to the end of this bone. (3) The number of times this distance is contained in the length of the head.

naked. Scaleless.

oblique. Slanting.

occiput. Back of the head.

opercle. The posterior plate of the gill-cover, which borders the gill-opening.

orbit. The eye.

pectorals. The paired fins back of the head on either side, placed more or less up on the fish's side.

peduncle. The narrow posterior or tail end of the body, just in front of the caudal, and behind the other fins.

pores. See scales.

post-orbital. Behind the eye.

premaxillary groove. A groove left on the upper midline of the front of the head, when the protractile upper jaw is thrust forward.

preopercle. The anterior plate making up the gill-cover, usually with a more or less free edge, half way or thereabouts between the gill-opening and the eye.

preorbital. (1) The area, plate or bone between the eye and the maxillary. (2) The distance from the eye to the maxillary.

procumbent. Lying horizontal, directed forward (spines).

projecting. Extending beyond corresponding structures: thus lower jaw projecting, longer than upper; upper jaw projecting, longer than lower.

protractile. Capable of being thrust forward (upper jaw).

rings. (1) The differentiable bony segments of trunk and tail in pipefishes. (2) The number of these segments, trunk+tail.

rudimentary. Little developed, not quite entirely absent.

scales. The number of rows of scales in the length of the body, counted from the upper corner of the gill-cleft to the base of the caudal fin. Usually this equals the number of scales or pores in the lateral line. The pores are sometimes fewer and, when the scales are irregular, the count of pores is sometimes given instead of the count of scales.

scutes. (1) Enlarged scales, particularly those on the posterior part of the lateral line of *Caranx* and related fishes. (2) The number of such scutes.

serrate. Saw-edged: with sawlike teeth.

simple. Unbranched (fin-rays).

snout. Measured from the front of the eye to the end of the snout or front of the upper jaw.

soft fin. A fin with soft rays, that is rays which are flexible, articulated and usually branched.

spinous fin. A fin with spinous rays, that is rays which are more or less stiff, pointed and not articulated.

standard length. Distance from the tip of the snout or front of the upper jaw to the end of the most posterior vertebra or base of the caudal fin.

tail. The body behind the vent (eels, etc.).

terete. Rounded in cross-section.

truncate. Square behind, not concave or convex (caudal fin).

trunk. The body between the head and vent (eels, etc.)

unarmed. Without spines, scutes or bony plates.

ventrals. The paired fins close to the midline of the lower surface usually below and more or less behind the pectorals.

vertical fins. The dorsals, anal and caudal.

vomer. A bone in the middle of the roof of the mouth, sometimes with teeth.

FAUNAL DISCUSSION

THE FAUNAE REPRESENTED IN PORTO RICAN WATERS

In analyzing from a zoo-geographical viewpoint the fishes of Porto Rico and adjacent waters the world's three main fish faunae, namely, fresh water, shore and deep-sea fishes, come under consideration. We may as well dismiss the last-named from this discussion, for the deep-sea fishes have been little investigated and few species are known from the region. The probabilities are that the deep-sea fauna in these waters is essentially the same as that found over a wide area.

Fresh-water fishes are here very limited, as is inevitable due to the restricted habitat for them, and they represent the West Indian subdivision of the fresh-water fauna which occupies tropical oceanic islands the world over. They are less West Indian and more oceanic than in other of the Greater Antilles, which may be cited as evidence for the comparative isolation of Porto Rico, or may be merely a function of its present more restricted habitat opportunities for fresh-water fishes.

Shore fishes make up by far the major part of the species known from Porto Rico, representing two divisions of the primary marine tropical shore-fish fauna of world distribution: (1) the pelagic, which is cosmopolitan, off shore; (2) the West Indian, of coasts, islands and reefs from the Capes of the Carolinas to Brazil.

LIMITS AND RELATIONSHIPS OF THE WEST INDIAN SHORE FAUNA

The writer has not sufficient familiarity with the fishes of the southern borders of the West Indian fauna to delimit it with precision in the South Atlantic. The shore fishes of South Trinidad Islet off Brazil are

very closely allied to those of the West Indies, as for that matter are those of Ascension Island. Passing around the Cape of Good Hope, one finds the still more widely distributed Indo-Pacific fauna, comparable with the West Indian, each being one of the two main divisions of the primary tropical shore-fish fauna. Across the Atlantic to the eastward, the Mediterranean fauna is less closely allied; and we have not sufficient familiarity with the fishes of the islands of the eastern Atlantic, and those of the west coast of Africa, to be satisfied as to their faunal affinities. A number of distinctly West Indian fishes occur on the West Coast of tropical America, thus making this a transition area between the West Indian and the Indo-Pacific. The greater ocean distances to the west have been a barrier to distribution comparable to the more or less recent though now complete land barrier in the middle Americas. The close relationship of the West Indian and Indo-Pacific faunas seems to be due to free access around Africa, which extends only to about 36° S. lat. at the Cape of Good Hope, rather than to any historic breaks between North and South America.

THE TROPICAL PELAGIC FAUNA

As regards the cosmopolitan tropical pelagic fauna, this consists of wide-ranging surface fishes which approach tropical island shores rather freely, and evidently had their origin from tropical shore forms. Certain Scombriformes, including the dolphin (*Coryphaena*) and oceanic bonito (*Gymnosarda pelamys*), and various flying fishes (Exocoetidae) are its most conspicuous members. Shore-fishes, the young of which drift widely in ocean currents, serve, as it were, an apprenticeship in this fauna, being one factor which necessitates subdividing it for the different oceans. The North Atlantic pelagic sub-fauna is complicated by a large amount of drifting gulf-weed, which carries a characteristic fish and invertebrate association with it. The so-called Sargasso Sea, where the weed abounds, is dominated by the mouse fish (*Histrio*), a West Indian element, to the west, and by the pelagic pipe-fish (*Syngnathus pelagicus*), a Mediterranean element, to the east. In fact, the tropical pelagic fauna is nowhere very clearly defined from that of the shores which it borders. Surprisingly few pelagic species have been recorded on the Porto Rican list, but this is presumably due to lack of investigation of off-shore waters in the neighborhood rather than to the absence of such forms. Among those which are on the list may be mentioned *Parexocoetus*, *Auxis*, *Nomeus*, *Histrio*.

TABULAR ORIENTATION OF FAUNAE REPRESENTED

To make the above discussion somewhat clearer, a partial table of the analysis of fish faunae which it follows is given, with terminal elements, present on our list, italicized.

I. Fresh-water fishes

1. Continental (introduced *goldfish*)
2. Peripheral
 - A. Boreal
 - B. Austral
 - C. Insular and Australian
 - a. Australian
 - b. Insular
 - (1) Oceanic
 - (2) *West Indian*

II. Shore Fishes

1. Boreal
2. North Pacific
3. Warm Temperate (Mediterranean, etc.).
4. Tropical
 - A. Indo-Pacific
 - B. *West Indian*
 - C. Pelagic
 - a. *North Atlantic*
 - b. Other oceans

III. *Deep-sea Fishes*

THE GULF STREAM CURRENT SYSTEM

Let us examine the West Indian marine shore fauna more in detail, and with special reference to Porto Rican waters. Over a wide area, from Florida to Brazil, it is very uniform. This uniformity is probably due in a large measure to the Gulf Stream and the drifts from the east which feed it, directly or indirectly. This current system is an artery for the distribution of fishes, particularly young fishes, to all parts of the area, many species regularly, many others no doubt fortuitously. Furthermore, this agency carries dominance of the West Indian fauna, though not its full richness, north to the Capes of the Carolinas. Here, as it fans out into a drift, it bears a strong West Indian element north to Cape Cod in summer and autumn. Similarly, through the influence of the Brazil current, a West Indian element is carried south on the east coast of South America for an indefinite distance.

ANALYSIS OF RANGES OF MEMBERS OF THE WEST INDIAN
SHORE FAUNA

If we examine the ranges of primarily West Indian marine fishes listed from Porto Rican waters, it will be found that a very large number (a) are known from Carolina or Florida to Brazil. A second, much smaller group (b) does not extend northward to Florida. These last are for the most part replaced by closely allied forms to the north in what may be called a poorly defined Florida-Gulf Coast sub-fauna. Or again, an occasional species properly belonging to Florida or the Gulf Coast reaches our area. A few species (c) are also known from the eastern North Atlantic, (d) from the west coast of tropical America, and (e) from warm seas in general. There is nothing to fix the probable point of origin of the last mentioned, though it is sometimes obvious, as in the case of *Diodon*, that their wide distribution is correlated with their forming at some ontogenic stage an integral part of the tropical pelagic fauna.

ONTOGENIC ADAPTATION TO DIFFERENT FAUNAE

In studying fishes from the point of view of ecology, it is a significant fact that different ontogenic stages of the same species frequently form parts of different associations or fit different niches in the same association. Here we have a comparable zoo-geographic condition, different stages belonging to different faunae.

ORIGINS OF THE WEST INDIAN SHORE FAUNA

It is reasonable to assume that most species (group c) occurring in the eastern Atlantic as well as in the West Indian region are of West Indian origin. The strong West Indian fauna would seem to be in fact, as it is in theory, difficult for outside forms to penetrate. Thus we find outside forms that have overcome the distances involved and that occur on the outskirts of the region, but that have not been recorded in the West Indies. For instance, there are the pelagic pipefish (*Syngnathus pelagicus*), and *Caranx guara*, Mediterranean or Eastern Atlantic elements, which are known from Bermuda, but not from the West Indies. The genus *Kyphosus*, on the other hand, the young of which have the 'hover' habit of following bits of drift, could easily be brought across by the westerly currents, and the eastern North Atlantic therefore suggests itself as the point of origin of this genus. *K. sectatrix* is established as an abundant West Indian species. In *Callyonimus calliurus*

we have an undoubted Mediterranean element established as an insignificant and uncommon West Indian species.

West Indian species occur unchanged or essentially identical on the Pacific Coast of tropical America (group d) in sufficient numbers clearly to indicate the recent geological connection of Caribbean with Pacific waters. Various of these fishes are wide-ranging, swift-swimming, mackerel-like forms, as *Scomberomorus maculatus*, *Oligoplites saurus*, *Caranx hippos*; and perhaps *Paranthias furcifer* is to be considered an ecological parallel of such. On the other hand, we find *Diplctrum radiale* and *Xystaema cinereum*, with no greater distributional facility in evidence than that of the large number of West Indian forms confined to the Atlantic; and we may conclude with reasonable certainty that at the time of the last free water connection between the two oceans, the West Indian fauna had not attained its present development and its great number and variety of forms. In fact, its development is pretty authentically dated as having occurred since such a connection.

The nature of world winds and ocean currents is such as to spread tropical sea conditions over many degrees of latitude on east-facing continental shores, and to restrict them to a narrow compass on those shores that face an ocean to the west. Hence we find a very large area in the Atlantic occupied by the tropical West Indian fauna; and this fauna, taking advantage of the wide uniform area available, is itself a uniform, rich and strong one. There is no tropical Pacific faunal area or fauna on the coast of America in any way comparable with it. Were there a contemporary free connection with the Atlantic, the West Indian species which would be found in the Pacific would presumably be restricted by limited environmental opportunities, but should certainly include some of the abundant characteristic species which are lacking there, such as West Indian snappers of the genus *Lutianus*, grunts of the genus *Haemulon*, parrot-fish⁹, and so forth.

It is rather obvious that the close relationship of Indo-Pacific and West Indian faunae is due to the relatively low latitude of the Cape of Good Hope, about 36°, and consequent free connection between Indian Ocean and Atlantic around that Cape. The principal source of the West Indian fauna is presumably to be looked for in the westerly drift across the South Atlantic. Certain Porto Rican species which also occur about islands of the South Atlantic seem to mark a primary path of immigration. Such are for instance *Gymnothorax moringa*, *Holocentrus ascensionis*, *Epinephelus ascensionis*.

THE SLIGHT BERMUDIAN SUB-FAUNA

A minority of marine fishes recorded from Porto Rican waters as from any West Indian locality have a comparatively restricted known range. In most cases this is of no great significance. They are apt to be forms which are rare or poorly defined and which would be easily overlooked. On the other hand several peculiar forms known from Porto Rico or Haiti and Bermuda but not further south or west (for instance *Anchovia choerostoma*, *Pomacentrus chrysus*, *Monacanthus tuckeri*) indicate a certain isolation of waters north and east of the Gulf Stream system, and interesting correlation of their fishes. It would perhaps be possible to recognize a slight Bermudian sub-division of the West Indian fauna with influence extending south to Porto Rico.

SYSTEMATIC ACCOUNT OF THE SPECIES

BRANCHIOSTOMIDAE

Branchiostoma Costa**Branchiostoma caribaicum** Sundevall

West Indian lancelet

Branchiostoma caribaicum Sundevall, 1853, Ölfers, Vet. Akad. Forhandl., p. 12.
Branchiostoma caribaicum Evermann and Marsh, 1902, p. 59. Fig. 1.

FIG. 1.—*Branchiostoma caribaicum*

Type locality.—St. Thomas.

Distribution.—In shallow waters, buried in the sand, from Beaufort, N. C., to the mouth of the La Plata; abundant off the Carolina coast and in localities in Florida (Port Tampa), Jamaica, Brazil, etc. Fairly abundant at a depth of from 10 to 15 fathoms in the white coral sand at the east end of the island of Porto Rico.

Specimens seen.—Santurce.

Diagnosis.—Body elongate, lanceolate, compressed, pointed at both ends, translucent. Mouth a longitudinal fissure on the lower side of the head, surrounded by conspicuous cirri; no developed eyes. Dorsal and anal fin folds short, meeting around the tail; traces of anal fin-rays present. There are from 7 to 10 muscle bands behind the vent, the formula about $35 + 14 + 9 = 58$. Usually less than 2 inches long.

Asymmetron Andrews**Asymmetron lucayanum** Andrews

Bahama lancelet

Asymmetron lucayanum Andrews, 1893, Studies Biol. Lab. Johns Hopkins Univ., Vol. V, p. 237. Bimini, Bahamas.

Asymmetron lucayanum Evermann and Marsh, 1902, p. 60.

FIG. 2.—*Asymmetron lucayanum*
Johns Hopkins Univ. Studies,
Biol. Lab. V.



Type locality.—Bimini, Bahamas.

Distribution.—Bahaman and Porto Rican waters. Off Culebra and Humacao, P. R., in from 10 to 15 fathoms, rare.

Diagnosis.—Body elongate, lanceolate, compressed, pointed at both ends, translucent. Mouth a longitudinal fissure on the lower side of the head, surrounded by conspicuous cirri; no developed eyes. Anal fin without traces of fin rays; a long caudal process or tail, about as long as the head. Muscle band formula about $44 + 9 + 13$. The Bahama lancelet attains a length of about $\frac{3}{4}$ inch.

Habits.—In the Bahamas, where this lancelet was first found, it was observed buried in calcareous sand. In the same locality adults and young have also been observed swimming at the surface in the evening in June and July.

GINGLYMOSTOMIDAE

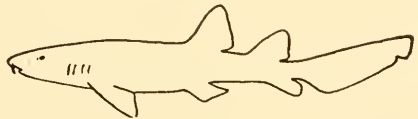
Ginglymostoma Müller and Henle**Ginglymostoma cirratum** (Gmelin)

Nurse shark; gata

Squalus cirratus Gmelin, 1788, Syst. Nat., Vol. I, p. 1492, after Broussonet.

Ginglymostoma cirratum Evermann and Marsh, 1902, p. 60, Fig. 2.

FIG. 3.—*Ginglymostoma cirratum*
From Zoologica, IX



Type locality.—"American Seas."

Distribution.—Capes of the Carolinas (casually off Rhode Island) south to Brazil (in numbers at least to Trinidad Islet, 20° S. lat.), abundant in most of the West Indies, Florida, and on the west coast of Mexico. Not common about Porto Rico.

Diagnosis.—A large, sluggish shark, with a blunt head, small mouth, a fleshy barbel at each corner of the mouth in front, and a very hard rough skin. Its two back fins are of about equal size and placed far back, the first above or behind the ventrals. The nurse shark reaches a total length of from 6 to 10 feet.

Remarks.—The eggs of the nurse shark are each about as large as a goose's egg, with a delicate horny shell; 28 have been taken from one female. It is believed that these eggs are retained within the mother shark's body for the entire incubation period, and that free young are released as in the requiem shark family, to which the next three or four species belong.

GALEIDAE

Galeocerdo Müller and Henle

Galeocerdo tigrinus Müller and Henle

Tiger shark

Galeocerdo tigrinus Müller and Henle, 1838, *Plagiostomen*, p. 59.

Galeocerdo tigrinus Nichols, 1915, p. 141. Porto Rico.

Galeocerdo arcticus Meek and Hildebrand, 1923, *Fishes of Panama*, Pt. 1.



FIG. 4.—*Galeocerdo tigrinus*
From *Zoologica*, IX

Type locality.—Uncertain.

Distribution.—Tropical seas, rather common, occasionally northward to Cape Cod and to San Diego. Probably not uncommon about Porto Rico.

Specimens collected.—San Juan (teeth).

Diagnosis.—A large shark with heavy, blunt head and tapering body, frequently striped or spotted in color. There is a low keel on the side of the peduncle somewhat like that in the mackerel sharks, but the tail fin is strongly heterocercal (upper lobe the longer). Teeth alike in both jaws, semicircular, with fluted or serrate edges; point of the tooth turned obliquely outward and subtended by a deep notch. The tiger shark attains a length of from 15 to 30 feet.

Habits.—This is a rather sluggish, omnivorous shark. It varies its diet of fish (menhaden, bonito, squid, etc.) with big sea turtles, smaller sharks, carrion and almost anything else. It is much feared in waters where it is common, and very likely is dangerous, though definite data of its having been harmful to man are lacking.

Carcharhinus Blainville**Carcharhinus falciformis** (Bibron)

Ground shark; cazon de playa

Carcharias falciformis Bibron, 1838, in Müller and Henle's Plagiostomen, p. 47.
Carcharhinus falciformis Evermann and Marsh, 1902, p. 62.

FIG. 5.—*Carcharhinus falciformis*
 From Zoologica, X



Type locality.—Cuba.

Distribution.—Two specimens recorded from San Juan, P. R., January 13, the largest 7 feet 4 inches in total length.

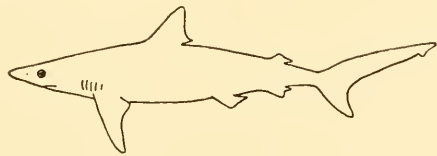
Diagnosis.—A large shark, with the upper teeth broader than the lower, oblique, well notched. Height of first dorsal fin three or more times in its distance from end of snout; pectoral rather short, not three times as long as broad; second dorsal a little smaller than, and placed over, the anal. Differences between the various species of this abundant genus are subtle, not easily described, and this species has not been seen by the writer.

Carcharhinus limbatus (Müller and Henle)

Black-tip shark; caconetta

Carcharias (Prionodon) limbatus Müller and Henle, 1838, Plagiostomen, p. 49.
Carcharhinus limbatus Evermann and Marsh, 1902, p. 62.

FIG. 6.—*Carcharhinus limbatus*
 From Zoologica, X



Type locality.—Martinique.

Distribution.—Tropical seas, north commonly to the capes of the Carolinas, rarely to Woods Hole, Mass., common in Brazil. Not uncommon in Porto Rican waters.

Specimens collected.—1: San Juan.

Diagnosis.—Upper teeth narrow, little broader than the lower; fins usually sharply black-tipped. The ground sharks (*Carcharhinus*) have the first back fin large, placed close behind the vertical from the pectoral base; the second back fin small, similar to the anal. Mouth moderate in size, with compressed, more or less finely serrate teeth, the upper teeth more or less triangular and the lower narrow. Females of this species in

the Bay of Florida range from 5 to 5½ feet in total length and are called "mackerel sharks,"—a misnomer. Males grow larger, to at least 6 feet.

Habits.—Ground sharks make up the bulk of the shark population on tropical and warm temperate shores. Females of a given species appear in certain inshore waters at rather regular dates to give birth to their young. They are not at this time accompanied by males of the same species. Males seem to wander more widely, being not infrequent hundreds of miles from any known nursery ground. The food of ground sharks is mostly fish, but they are indiscriminate as to diet and may usually be found concentrating about slaughter houses in the tropics.

SPHYRNIDAE

Sphyrna Rafinesque

Sphyrna zygaena (Linnaeus)

Hammer-head shark; cornuda

Squalus zygaena Linnaeus, 1758, Syst. Nat., ed. 10, p. 234.

Sphyrna zygaena Evermann and Marsh, 1902, p. 63.

Cestracion zygaena Meek and Hildebrand, 1923, Fishes of Panama, Pt. 1

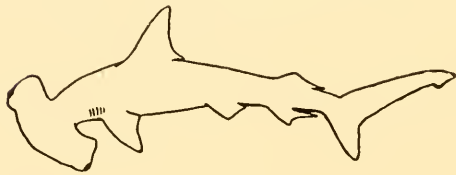


FIG. 7.—*Sphyrna zygaena*
From Zoologica, 1X

Type localities.—Europe: America.

Distribution.—Occurs in all warm seas, from Cape Cod southward on our coast. Apparently rare in Porto Rican waters.

Diagnosis.—Head depressed and expanded laterally, the eyes situated at the apices of the lateral expansion, which has somewhat the outline of a double-headed hammer. In other respects essentially like a ground shark, with teeth very oblique and notched. Attains a total length of 17 feet and an estimated weight of 1500 pounds.

Habits.—The hammer-head is a slender, active and swift-swimming shark. The most reasonable function that has been attributed to its

peculiar head, is that of a bow rudder, to increase its dexterity of motion. It feeds almost exclusively on fish and squid. The young of this species occur in large number; 37 have been taken from a female 11 feet long. Hammer-heads are occasionally seen swimming slowly at the surface with back and tail fins projecting above the water.

PRISTIDAE

Pristis Latham**Pristis pectinatus** Latham

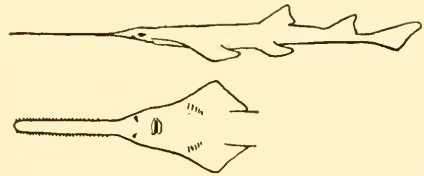
Common saw-fish; pez sierra

Pristis pectinatus Latham, 1794, Trans. Linn. Soc., Vol. II. p. 278.

Pristis pectinatus Evermann and Marsh, 1902, p. 64, Fig. 3.

FIG. 8.—*Pristis pectinatus*

Breder's Field Book of Marine
Fishes (Putnam).



Type locality.—"In the ocean."

Distribution.—Tropical seas, north to the West Indies and Florida; abundant in the Gulf of Mexico, ascending the lower Mississippi. Included in the Porto Rican fauna on the authority of Poey.

Diagnosis.—A large shark-like fish, flattened below, with the mouth on the under side of the head. Two back fins of about equal size placed posteriorly. The snout produced as a long flat bony blade, with prongs on the sides; 24 to 32 pairs of prongs in the present species. Reported up to 17 feet, and probably reaches 20 feet in total length.

Habits.—The sawfish frequents shallow water, swimming slowly over sand and bars. It is said that it disables small fishes by striking from side to side with its peculiar weapon, and it very probably also uses this implement to rake shelly creatures from the sand, if one may judge from indications of wear on the teeth of its saw, and the character of the teeth in its mouth, which are adapted to such food. When a sawfish is attacked, the saw becomes an efficient, dangerous weapon of defence.

DASYATIDAE

Dasyatis Rafinesque**Dasyatis americana** Hildebrand and Schroeder

Sting ray; raya

Dasyatis americana Hildebrand and Schroeder, 1928, Bull. Bur. Fish., XLIII, Pt. 1, p. 64, Fig. 35.

Dasyatis hastata Evermann and Marsh, 1902, p. 65.

Dasybatus hastatus Meek and Hildebrand, 1923, Fishes of Panama, Pt. 1.

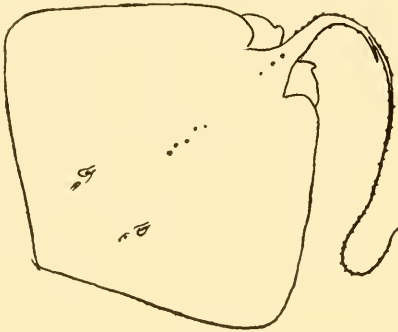


FIG. 9.—*Dasyatis americana*

Breder's Field Book of Marine Fishes (Putnam).

Type locality.—Chesapeake Bay.

Distribution.—West Indies to Brazil, north commonly to Florida and rarely to Maryland. Uncommon in Porto Rican waters.

Diagnosis.—Tail with a keel above and free finlike fold below. Snout not notably produced beyond the antero-lateral margins of the disk. Tail about $1\frac{1}{2}$ to $1\frac{3}{4}$ times the length of the disk. Sting rays are flattened, bottom fishes, with body and pectoral fins coalescent in a rhomboidal disk, and a long whiplike tail with a strong saw-edged spine at its base. Sting rays may reach a total length of 7 feet or more.

Remarks.—Southern sting rays of this type are commonly considered to represent two species, *Dasyatis hastata* and *Dasyatis say*. The individual variation of each is such, however, that the feasibility of separating the two is somewhat open to question. Furthermore, there is no reason to suppose that *Trygon hastata* of De Kay from Rhode Island is other than the common northern species, *Dasyatis centrura*.

Habits.—Sting rays work about singly on sandy or muddy bottoms, picking up small crabs, worms and the like, rarely capturing a more active squid or fish. When lying quietly at rest, they are easily overlooked; when disturbed, they thrash their long tail from side to side and may inflict a serious wound with its basal spine. Nevertheless, sharks must sometimes feed on sting rays, for their spines are not infrequently found imbedded in the mouths and stomachs of sharks.

Dasyatis say (Le Sueur)

Southern sting ray; raya

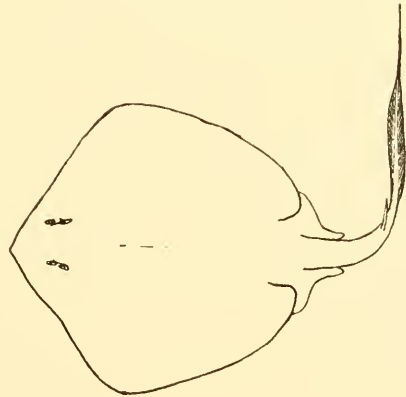
Raja say Le Sueur, 1817, Journ. Ac. Nat. Sci., Phila., Vol. I, p. 42.

Dasyatis say Evermann and Marsh, 1902, p. 65.

Dasybatus say Meek and Hildebrand, 1923, Fishes of Panama, Pt. 1.

FIG. 10.—*Dasyatis say*

Breder's Field Book of Marine Fishes (Putnam).



Type locality.—New Jersey.

Distribution.—Carolina to Brazil, occasionally north to New Jersey. Included in the Porto Rican fauna on the authority of Poey.

Diagnosis.—Tail rather more than $1\frac{1}{2}$ times the length of the disk; with a wing-like expansion above and a larger one below. Disk quadrangular, its antero-lateral margins straight; snout blunt, not exerted.

MYLIOBATIDAE

Aëtobatus Blainville**Aëtobatus narinari** (Euphrasen)

Spotted whip ray; obispo

Raja narinari Euphrasen, 1790, Vet. Ak. Nya. Handl., Vol. XI, p. 217. After
Narinari of Maregrave.

Aëtobatus narinari Evermann and Marsh, 1902, p. 67, Figs. 4 and 5.

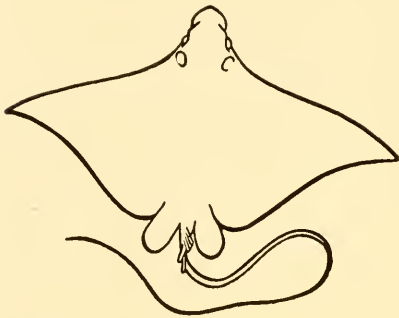


FIG. 11.—*Aëtobatus narinari*
From Zoologica, X

Type locality.—Brazil.

Distribution.—Tropical seas, north on the Atlantic coast to Virginia, common in Florida. Rather uncommon about Porto Rico.

Diagnosis.—Snout pointed; upper surfaces thickly ornamented with regular, rounded white spots, forming rings in large individuals. This is one of the eagle rays, flattened species which have secondarily re-assumed the free-swimming habit, the sides of the disk, or wings, being pointed, and flapping in an almost birdlike manner. Head elevated, squarish in section; tail long and lashlike with one or more small serrate spines at its base. This species reaches a breadth of from 7 to 8 feet. The tail is usually equal to or greater than the breadth, considerably greater than the body length.

Habits.—The whip ray feeds upon clams, rooting them from the sand or mud with its snout, crushing the shell with its pavement-like teeth, and extracting the soft part so dexterously that it is swallowed free from shell fragments. The young are from about 6 to 10 inches wide when born, and have been observed to be thrown from the body of the mother fish while she was leaping above the surface of the water.

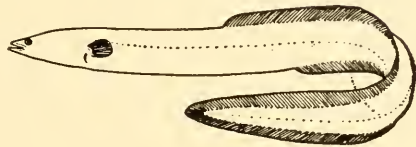
ANGUILLIDAE

Anguilla Shaw*Anguilla rostrata* (Le Sueur)

Common eel; anguilla

Muraena rostrata Le Sueur, 1871, Jour. Ac. Nat. Sci., Phila., Vol. I, p. 81.*Anguilla chryssypa* Evermann and Marsh, 1902, p. 68, Pl. 1.

FIG. 12.—*Anguilla rostrata*
From Zoologica, IX

*Type locality*.—New York.

Distribution.—Atlantic coast of the United States from Maine to Mexico, ascending rivers; common in the West Indies. Caught in considerable numbers in Porto Rico in the small bamboo traps or “nasas” set in the small rivers.

Diagnosis.—A plain-colored eel, its body covered with small imbedded linear scales arranged in groups, at right angles to one another. These scales can be made out clearly with a hand magnifying glass. Pectoral fin well developed; dorsal commencing on the back a little further forward than the anal begins below, with which it is continuous around the tail. Common eels reach a maximum length of from 4 to 5 feet.

Habits.—The common eel is found in both salt and fresh water, penetrating to almost any muddy little pond or stream inland. It spawns, nevertheless, only in the deep sea. The minute eggs hatch into uneel-like larvae, which are flat and transparent. When these young eels reach shore waters, they are still more or less transparent but have assumed the approximate form of the adult. The males remain near the shore in salt or brackish water, only the females making their way inland.

LEPTOCEPHALIDAE

Leptocephalus Scopoli*Leptocephalus conger* (Linnaeus)

Conger eel; congrio

Muraena conger Linnaeus, 1758, Syst. Nat., ed. 10, p. 245. Based on Artedi.*Leptocephalus conger* Evermann and Marsh, 1902, p. 70, Fig. 6.

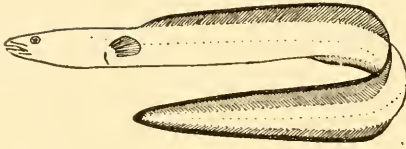


FIG. 13.—*Leptocephalus conger*
From Zoologica, X

Type locality.—Mediterranean Sea.

Distribution.—Almost cosmopolitan in temperate and warm seas, but not found in the eastern Pacific. Common off our Atlantic coast from Cape Cod to Brazil. Recorded at Porto Rico by Stahl.

Diagnosis.—Resembles the common eel in appearance, but lacks scales. The dorsal fin commences further forward, immediately behind the pectoral; fins conspicuously edged with black. No canine teeth, tongue free in front. The conger eel may attain a length of 8 feet.

Habits.—Exclusively marine, usually found in rather deep water. Moves off shore and into deeper water to spawn. It passes through a flat, transparent larval stage, as does the common eel. It spawns but once and then dies.

Mayerina Silvester

Mayerina mayeri Silvester

Mayer's eel

Mayerina mayeri Silvester, 1916, Yearbook Carn. Inst. Wash. for 1915, Vol. XIV, p. 214.

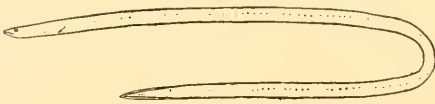


FIG. 14.—*Mayerina mayeri*

Type locality.—Guanica Harbor, Porto Rico.

Distribution.—Known only from the type locality.

Diagnosis.—Head 9.5 in body, 4.3 in tail; depth about 65 in total. Fins rudimentary, caudal better developed, pectoral less than $\frac{1}{2}$ width of gill-opening; no scales. Lower jaw projecting. Orange yellow, more or less slate-blue below. About 12 inches long.

Remarks.—The type material consists of 2 specimens.

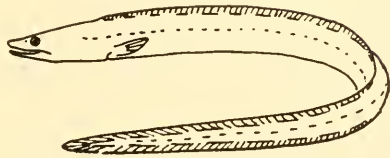
Habits.—From sand flats around mangrove swamps at very low tide.

MURAENESOCIDAE

Muraenesox McClelland**Muraenesox savanna** (Cuvier)

Pike-headed eel

Muraena savanna Cuvier, 1829, Règne Animal, ed. 2, Vol. II, p. 350.
Muraenesox savanna Evermann and Marsh, 1902, p. 71.

FIG. 15.—*Muraenesox savanna*

Type locality.—Martinique.

Distribution.—Cuba to Rio Janeiro, not common; occasional in the Mediterranean. Included in the Porto Rican fauna on the authority of Poey.

Diagnosis.—Resembles the conger eel in appearance; tongue largely adnate; vomer with canine teeth. Dorsal inserted over gill opening; fins edged with black. Diameter of eye contained 2 times in the length of the snout, which is contained 4.5 times in the length of the head. A moderate-sized eel (attaining 2 feet or more in length).

Habits.—Usually found in rather deep water.

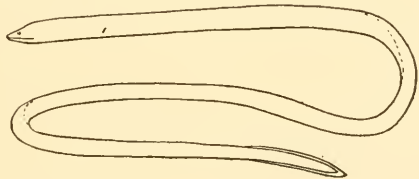
MORINGUIDAE

Aphthalmichthys Kaup**Aphthalmichthys caribbeus** Gill and Smith

Porto Rican whip eel

Aphthalmichthys caribbeus Gill and Smith, 1900, Science, N. S., Vol. XI, No. 286, June 22, 1900, p. 973.

Aphthalmichthys caribbeus Evermann and Marsh, 1902, p. 71.

FIG. 16.—*Aphthalmichthys caribbeus*

Type locality.—San Geronimo, Porto Rico.

Distribution.—Known only from the type locality.

Diagnosis.—An excessively elongate cylindrical eel, with the trunk much longer than the tail. Depth of body 54 times in total length, 4.2 times in head. Eye small, rudimentary, 3 times in snout, over 20 times in length of head. Pectoral a mere rudiment. Color uniform grayish olive, without markings. The type is about 10 inches long.

Habits.—The type was collected among coral.

MYRIDAE

Myrophis Lütken

Myrophis longleii Silvester

Longley's eel

Myrophis longleii Silvester. 1916, Year-book Carn. Inst. Wash. for 1915, Vol. XIV, p. 214.

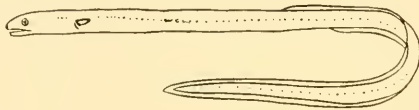


FIG. 17.—*Myrophis longleii*

Type locality.—West of Guanica Harbor, P. R.

Distribution.—Known only from the type locality.

Diagnosis.—Head 3.5 in trunk, 5.5 in tail; depth at gill opening 3.3 in head; eye 2. in width of snout between anterior nostrils. Vertical fins continuous around the tail: dorsal beginning $\frac{2}{3}$ length of head in front of vent. Color light olive green with very fine punctation above, lighter below. Body elongate, subterete; pectorals present. About 5 inches long.

Habits.—Dug from sand flats.

Chilorhinus Lütken

Chilorhinus suensonii Lütken

Suenson's worm eel

Chilorhinus suensonii Lütken, 1851, Vid. Med. Naturg. Foren. Kjöben.

Chilorhinus suensonii Evermann and Marsh, 1902, p. 72.

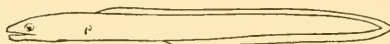


FIG. 18.—*Chilorhinus suensonii*

Type locality.—St. Croix.

Distribution.—Known from the waters about Porto Rico and the Virgin Islands, where it is not uncommon.

Diagnosis.—End of the tail surrounded by the confluent vertical fins; posterior nostril in or very near the upper lip; tongue more or less fully adnate to the floor of the mouth. Body short, much compressed; pectoral almost invisible; dorsal beginning behind gill opening. Head 5; depth 14.4; eye 8. Color dark brown, more or less white below. A small species, from 4 to 5 inches long.

OPHICHTHYIDAE

Sphagebranchus Bloch**Sphagebranchus ophioneus** Evermann and Marsh

Snake eel

Sphagebranchus ophioneus Evermann and Marsh, 1902, p. 73, Fig. 7.

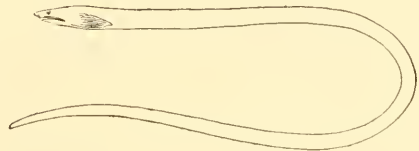


FIG. 19.—*Sphagebranchus ophioneus*

Type locality.—The type from off Mayagüez, Porto Rico.

Distribution.—Known only from the type locality.

Body without trace of fins anywhere. Gill slits inferior, converging forward; snout projecting beyond the mouth. Head little more than 4 times in the trunk; color greenish, without mottlings. Head 12.5 in total length; depth of head 36, of trunk 48. Body cylindrical, tail tapering. Length 11¼ inches.

Habits.—Taken in 4 fathoms on January 20.

Myrichthys Girard**Myrichthys oculatus** (Kaup)

Black-spotted snake eel

Pisodonophis oculatus Kaup, 1856, Apodes, p. 22.

Myrichthys oculatus Everman and Marsh, 1902, p. 74.

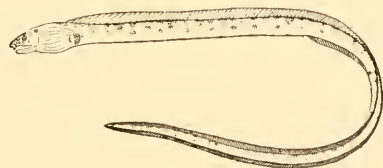


FIG. 20.—*Myrichthys oculatus*
From Zoologica, X

Type locality.—Curaçao.

Distribution.—Tropical Atlantic, Cuba to Surinam; and Cape Verde Islands. One collected at Hucars, P. R.

Diagnosis.—End of the tail projecting beyond the end of the dorsal fin, without rudiment of a caudal; dorsal and anal fins well developed; dorsal rather high, beginning on the head, before gill opening; a small pectoral fin present. Teeth blunt. Spots on body large, black, most of them with a distinct pale center, the ground color paler. Head 4.2 in trunk (tip of snout to vent); eye 2.5 in snout. Length 2 feet or more.

***Myrichthys acuminatus* (Gronow)**

Yellow-spotted snake eel

Muraena acuminata Gronow, 1854, Fishes Brit. Mus., p. 21.

Myrichthys acuminatus Nichols, 1915, Bull. Amer. Mus. Nat. Hist., Vol. XXXIV, p. 141. Porto Rico.

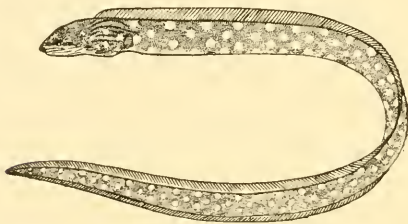


FIG. 21.—*Myrichthys acuminatus*
From Zoologica, X

Type locality.—Insula Div. Eustachii.

Distribution.—West Indies, occasionally northward to the Florida Keys. Rare in Porto Rican waters, a single specimen recorded from Condado Bay, P. R.

Specimens collected.—1: Condado Bay, San Juan.

Diagnosis.—A slender spotted eel with small but distinct pectoral fin; dorsal beginning on the head before the gill opening; tip of the tail finless. Spotting pale on a darker ground color. May attain a length of 29 inches.

***Myrichthys keckii* Silvester**

Keck's eel

Myrichthys keckii Silvester, 1916, Year-book Carn. Inst. Wash. for 1915, Vol. XIV, p. 214.

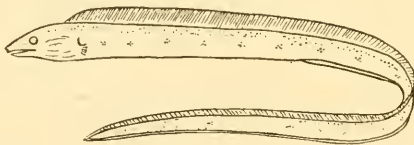


FIG. 22.—*Myrichthys keckii*

Type locality.—West of Guanica Harbor, P. R.

Distribution.—Known only from the type locality.

Diagnosis.—Head 4 in trunk, 9.5 in total length; eye 3 in snout, which is 2.6 in head. Pectoral small, as wide as gill opening but very short; dorsal well developed, beginning at the nape; anal very low; no caudal. No scales. Color light transparent green, darker above, about 20 darker spots along side, hardly distinguishable in life. Length of type 3 inches.

Remarks.—Known only from type.

Habits.—Dug from mud flats near a mangrove island.

Ophichthus Thunberg and Ahl

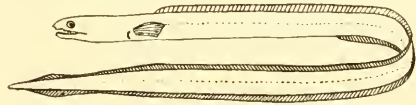
Ophichthus gomesii (Castelnaud)

Sea serpent

Ophisurus gomesii Castelnaud, 1855, Anim. Amer. Sud., p. 84, Pl. 44, Fig. 2.

Ophichthus gomesii Evermann and Marsh, 1902, p. 75.

FIG. 23.—*Ophichthus gomesii*



Type locality.—Rio Janeiro.

Distribution.—South Carolina to Rio Janeiro, common about the Florida Keys and Cuba. Rare about Porto Rico, one collected at Mayagüez.

Diagnosis.—Dorsal and anal fins well developed, end of the tail projecting beyond them, without rudiment of a caudal; teeth all pointed; dorsal fin beginning more or less behind the gill opening; pectoral well developed, $\frac{1}{3}$ the length of head, or more. Teeth of both jaws and of the vomer biserial, sub-equal. Eye large, more than half the length of the snout; head rather short, 2.5 to 3 in trunk. Color plain brownish. Length 8 or 9 inches.

MURAENIDAE

Gymnothorax Bloch

Gymnothorax moringa (Cuvier)

Common spotted moray; hamlet; morena

Muraena moringa Cuvier, 1829, Règne Animal, ed. 2, Vol. II, p. 352. After Catesby.

Lycodontis moringa Evermann and Marsh, 1902, p. 77, Fig. 8.

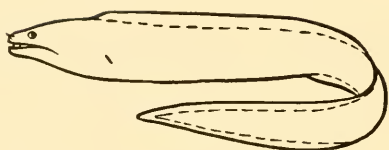


FIG. 24.—*Gymnothorax moringa*
From Zoologica, X

Type locality.—Bahamas.

Distribution.—Pensacola, Florida, to Rio Janeiro and St. Helena, common in the West Indies. Uncommon in Porto Rican waters.

Specimens seen.—San Juan Market.

Diagnosis.—Gill opening small. No trace of pectoral fins; dorsal and anal well developed, continuous around the end of the tail; dorsal beginning on the nape. Teeth sharp, all of them entire, without serrations or basal lobes. Color on body and fins everywhere with small irregular dark marks, sometimes so closely placed as to obscure the paler ground-color. May attain 3 feet or more in total length and a weight of at least 3 pounds.

Habits.—This is one of the most generally abundant of the morays, active, voracious eels of shallow water about rocks and reefs in the tropics.

***Gymnothorax funebris* Ranzani**

Black moray; morena verde

Gymnothorax funebris Ranzani, 1840, Nov. Comm. Ac. Sc. Bonon., Vol. IV.
p. 76.

Lycodontis funebris Evermann and Marsh, 1902, p. 77.

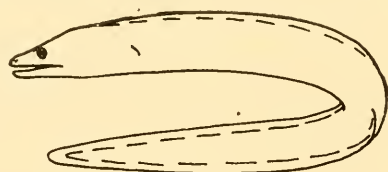


FIG. 25.—*Gymnothorax funebris*
From Zoologica, X

Type locality.—Brazil.

Distribution.—Both coasts of tropical America, Florida Keys to Rio Janeiro, and Gulf of California to Panama. Uncommon in Porto Rican waters.

Specimens seen.—San Juan market.

Diagnosis.—Gill opening small. No trace of pectoral fins; dorsal and anal well developed, continuous around the end of the tail; dorsal beginning on the nape. Teeth sharp, all of them entire, without serrations or basal cusps. Color dark brown, dark green, or blackish,

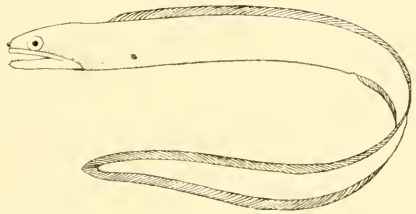
either plain or with faint markings; dorsal and anal with dark longitudinal streaks; chin pale but not white. The largest of our eels, attaining a length of from 5 to 6 feet or more. One of 5 ft. 2 in. in total length weighed, according to Gudger, 27 pounds.

Gymnothorax albimentis (Evermann and Marsh)

White-chinned moray

Lycodontis albimentis Evermann and Marsh, 1902, p. 78, Fig. 9.

FIG. 26.—*Gymnothorax albimentis*



Type locality.—Off Culebra Island, P. R.

Distribution.—Known only from the type locality.

Diagnosis.—Gill opening small. No trace of pectoral fins; dorsal and anal well developed, continuous around the end of the tail; dorsal beginning on the nape. Teeth sharp, all of them entire, without serrations or basal cusps. Color dark brown, upper lip, lower jaw and chin contrastingly white. Length 2 inches.

Remarks.—Known only from the type, which was taken on February 8. Possibly it is the young of some other species.

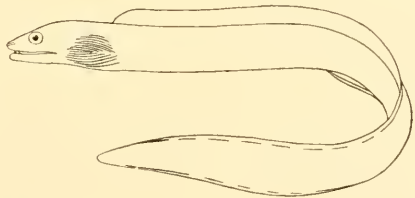
Habits.—The fish was caught in 15 fathoms.

Gymnothorax jordani (Evermann and Marsh)

Jordan's moray

Lycodontis jordani Evermann and Marsh, 1902, p. 78, Pl. II.

FIG. 27.—*Gymnothorax jordani*



Type locality.—Mayagüez, P. R.

Distribution.—Known only from the type locality.

Diagnosis.—Gill opening small. No trace of pectoral fins; dorsal and anal well developed, continuous around the end of the tail; dorsal

beginning on the nape. Teeth sharp, all of them entire; without serrations or basal cusps. Color tawny, with pale spots, and black edges to the fins. Length about 15 inches.

Remarks.—This species is known only from the type, which was taken on January 20.

Echidna Forster

Echidna catenata (Bloch)

Little banded eel; morena

Gymnothorax catenatus Bloch, 1795, *Ausl. Fische*, and *Ichth.*, Pl. 415, Fig. 1.
Echidna catenata Evermann and Marsh, 1902, p. 79.

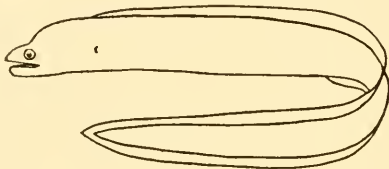


FIG. 28.—*Echidna catenata*

Type locality.—Erroneously recorded as Coromandel.

Distribution.—Bermuda to Surinam, generally common in the West Indies. Not uncommon in Porto Rican waters.

Diagnosis.—Gill opening small. No trace of pectoral fins; dorsal and anal well developed, dorsal beginning on the nape. Teeth mostly blunt, more or less molar-like; mouth comparatively small. Color pale, with some 30 irregular heavy dark cross-bars, broken into spots below; the pale ground color between the bars spotted. A small species.

ELOPIDAE

Tarpon Jordan and Evermann

Tarpon atlanticus (Cuvier and Valenciennes)

Tarpon; grand ecaille; sabalo

Megalops atlanticus Cuvier and Valenciennes, 1846, *Hist. Nat. Poiss.*, Vol. XIX, p. 398.

Tarpon atlanticus Evermann and Marsh, 1902, p. 80, Fig. 10.

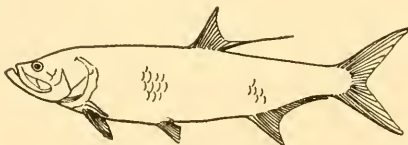


FIG. 29.—*Tarpon atlanticus*
From *Zoologica*, IX

Type localities.—Guadeloupe, Santo Domingo, Martinique and Porto Rico.

Distribution.—Found from Long Island to Brazil; common on southern coasts, especially about Florida. Common about Porto Rico, where numerous small individuals (rare in most localities) have been taken at Hucares and Fajardo.

Diagnosis.—Head 4; depth 3.7 to 3.8; eye 4.4 to 4.5. Dorsal 12; anal 19 or 20; scales 42. A large, compressed, herring-like fish, with projecting lower jaw and the last dorsal ray exerted, filamentous.

Habits.—This gigantic, silvery, herring-like fish, commonly enters the mouths of semi-tropical rivers, and is much sought by anglers for sport. Its strength, speed and vigor when hooked, test the sportsman's endurance. It is a spectacular fighter, leaping clear of the water again and again and, unless skillfully handled, is likely to shake the hook from its hard jaws. The life history of the tarpon still remains a mystery. Its eggs, which are exceedingly small and exceedingly numerous (estimated at 12,000,000 in an 142 lb. female), ripen in summer in Florida. Young a few inches long have been found in numbers in shallow water at Porto Rico and the Island of Haiti, but tarpons less than a foot long are almost everywhere rare. Those a foot or two in length are most frequently found pretty well up the rivers.

Elops Linnaeus

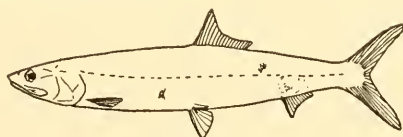
Elops saurus Linnaeus

Big-eyed herring; piojo; chiro; Lisa francesa

Elops saurus Linnaeus, 1766, Syst. Nat., ed. 12, p. 518.

Elops saurus Evermann and Marsh, 1902, p. 81, Fig. 11.

FIG. 30.—*Elops saurus*
From Zoologica, IX



Type locality.—Carolina.

Distribution.—Abundant and widely distributed in tropical seas. Probably not uncommon in Porto Rican waters, though there are few records from that region.

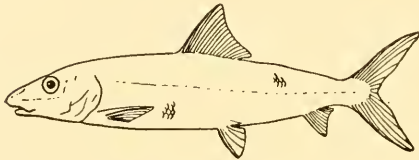
Diagnosis.—Head 4.3; depth 5 to 6; eye 5. Dorsal 20; anal 13; scales 110. Lateral line conspicuous; mouth very large, the maxillary reaching beyond the eye; jaws subequal. Ordinarily not more than 15 inches long.

Remarks.—This small relative of the tarpon furnishes excellent sport when taken on light tackle.

ALBULIDAE

Albula Bloch and Schneider**Albula vulpes** (Linnaeus)

Bone-fish; banana-fish; macabi; piojo

Esox vulpes Linnaeus, 1758, Syst. Nat., ed. 10, p. 313; after Catesby.*Albula vulpes* Evermann and Marsh, 1902, p. 82, Fig. 12.FIG. 31.—*Albula vulpes*
From Zoologica, IX*Type locality*.—Bahamas.*Distribution*.—Tropical seas, almost universally distributed on sandy coasts and generally abundant, northward to San Diego and Massachusetts. Not uncommon in Porto Rican waters.*Specimens collected*.—1: Paloseco Point, San Juan.*Diagnosis*.—Head 3.4; depth 4.5; eye 7. Dorsal 15; anal 8; scales 70. Lateral line conspicuous. Snout projecting beyond the included lower jaw.*Habits*.—Bone-fish probably feed to a considerable extent on small, shelly animals which they suck out of the sand or mud; for they have hard, stony, pavement-like teeth in the back of the mouth. Such teeth have often been found as fossils, and from them we know that there were bone-fish in earlier seas as far back as the Eocene. Most fishes which subsist on so lowly a diet are sluggish, and are protected against their enemies by hard shells, strong spines or concealing resemblance to the mud or weeds where they hide. Not so the bone-fish. Big-eyed, alert, its long cylindrical body is endowed with phenomenal strength and speed, so that on account of its game qualities it ranks very high with sportsmen. Though generally common over a very wide range, and sometimes found associated in considerable numbers, this is not a schooling or gregarious species; each fish is comparatively solitary and self-sufficient. Its wide range in time as well as geographically would indicate that the bone-fish is one of nature's successes, with few competitors in the fish world.

CLUPEIDAE

Jenkinsia Jordan and Evermann

Jenkinsia lamprotaenia (Gosse)

Silverside herring

Clupea lamprotaenia Goose, 1851, Nat. Sojourn in Jamaica, p. 291, Pl. I, Fig. 2.

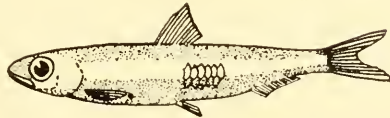
Jenkinsia lamprotaenia Evermann and Marsh, 1902, p. 84.

Dussumieria stolidifera Jordan and Gilbert, 1884, Proc. U. S. Nat. Mus., p. 25.

Key West. Synonymized with *lamprotaenia*, Beebe and Tee Van, 1928. Zoologica, Vol. X, p. 44.

Jenkinsia stolidifera Evermann and Marsh, 1902, p. 84.

FIG. 32.—*Jenkinsia lamprotaenia*
From Zoologica, X



Type locality.—Jamaica.

Distribution.—Common in the Gulf of Mexico from Key West to Yucatan, and locally in the West Indies. Plentiful about Culebra Island, P. R.

Diagnosis.—Head 3.7 to 3.8; depth 5.5 to 5.8; eye 2.5 to 3. Dorsal 11 to 14; and 15 to 17; scales about 36 (caducous). A silvery lateral band. Length about 2 inches.

Habits.—A small schooling herring.

Sardinella Cuvier and Valenciennes

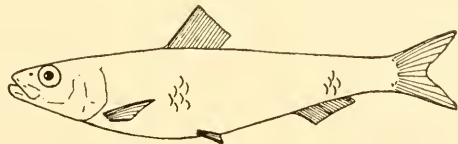
Sardinella anchovia Cuvier and Valenciennes

False sardine; sardina de España

Sardinella anchovia Cuvier and Valenciennes, 1847, Hist. Nat. Poiss., Vol. XX, p. 269.

Clupanodon pseudohispanicus Evermann and Marsh, 1902, p. 84.

FIG. 33.—*Sardinella anchovia*
From Zoologica, IX



Type locality.—Rio Janeiro; Martinique.

Distribution.—West Indian fauna, occasionally north to Woods Hole, Mass., south to Brazil. Not uncommon in Porto Rican waters.

Diagnosis.—Head 4; depth 3.7 to 4.5; eye 3.7 to 3.8. Dorsal 16; anal 16; scales about 45. A conspicuous striate area on either side of the

nape, the two adjacent behind and diverging forward. Attains a length of 8 inches.

Remarks.—Closely related to the scaled sardines (*Harengula*), which by some authors are not considered generically different. The European *Sardinella aurita* may be the same fish.

Habits.—Less abundant and regular coastwise than are the scaled sardines, and probably with a more off-shore habitat.

Harengula Cuvier and Valenciennes

Harengula sardina Poey

Loose-scaled sardine; sardina de ley

Harengula sardina Poey, 1860, *Memorias*, Vol. II, p. 310.

Sardinella sardina Nichols, 1915, *Bull. Amer. Nat. Hist.*, Vol. XXXIV, p. 141.
Porto Rico.

Sardinella sardina Meek and Hildebrand, 1923, *Fishes of Panama*, Pt. 1.

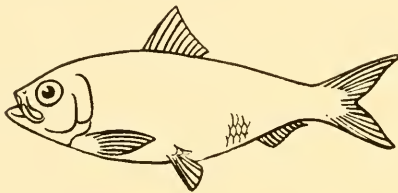


FIG. 34.—*Harengula sardina*
From *Zoologica*, X

Type locality.—Cuba.

Distribution.—West Indian fauna, abundant, north to Key West. The herring most prevalent in San Juan Harbor, P. R., in July.

Specimens collected.—22: San Antonio Bridge and Santurce, San Juan.

Diagnosis.—Head 3.6; depth 3.3 to 3.5; eye 2.5. Dorsal 15; anal 18; scales 36, loosely attached. Reaches a length of 8 inches.

Harengula macrophthalmia (Ranzani)

Firm-scaled sardine; white-bill; sardina escamuda

Clupea macrophthalmia Ranzani, 1842, *Nov. Comm. Ac. Sci. Bonon.*, Vol. V, p. 320.

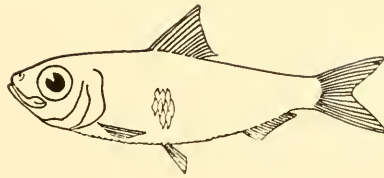
Sardinella macrophthalmia Evermann and Marsh, 1902, p. 85.

Sardinella humeralis Evermann and Marsh, 1902, p. 85.

Sardinella macrophthalmus Meek and Hildebrand, 1923, *Fishes of Panama*, Pt. 1.

Harengula pensacolae Goode and Bean, Fowler, 1928, *Proc. Ac. Sci. Phila.*, p. 462.

FIG. 35.—*Haregula macrophthalmia*
From Zoologica, X



Type locality.—Brazil.

Distribution.—West Indian fauna, Florida to Rio Janeiro, abundant. Very common about Porto Rico. Recorded from St. Croix.

Diagnosis.—Head 3.5; depth 3 to 3.4; eye 2.7 to 3. Dorsal 16; anal 17 or 18; scales 40, firmly attached. Length 6 or 8 inches.

Remarks.—Much used for food in Porto Rico, being captured with the cast net.

Habits.—This and the preceding are the two abundant coastwise schooling herrings of the West Indian fauna, wherever the writers has studied it. About Florida *H. macrophthalmia* outnumbered *H. sardina*, which may be of a somewhat more off-shore habitat.

Opisthonema Gill

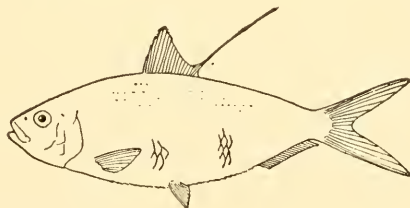
Opisthonema oglinum (Le Sueur)

Thread herring; machuelo

Megalops oglina Le Sueur, 1817, Journ. Ac. Nat. Sci. Phila., Vol. I, p. 359.

Opisthonema oglinum Evermann and Marsh, 1902, p. 86.

FIG. 36.—*Opisthonema oglinum*
From Zoologica, IX



Type locality.—Newport, Rhode Island.

Distribution.—West Indies, north to the Carolinas, occasionally to Massachusetts, common. Common and generally distributed in Porto Rican waters.

Diagnosis.—Head 4.7; depth 3.2; eye 3.6. Dorsal 17 to 19; anal 23; scales 50. Last dorsal ray exerted, filamentous. Grows to be from 8 to 10 inches long.

Remarks.—This herring is abundant in Florida, where it is sometimes mistaken for the young of the tarpon, on account of a similar exerted last ray in the dorsal fin.

Ilisha Gray**Ilisha bleekariana (Poey)**

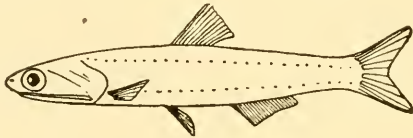
Manjua

Pellona bleekariana Poey, 1867, Repertorio, Vol. II, p. 242.*Ilisha bleekariana* Evermann and Marsh, 1902, p. 86.*Type locality*.—Matanzas, Cuba.*Distribution*.—Matanzas, Cuba, rare. Included in the Porto Rican fauna on the authority of Poey and Stahl.*Diagnosis*.—Depth 5.6 to 5.7 in length with caudal; eye 3.5. Dorsal 15; anal 43; scales moderate, very carducous.

ENGRAULIDIDAE

Anchovia Jordan and Evermann**Anchovia perfasciata (Poey)**

Flat anchovy

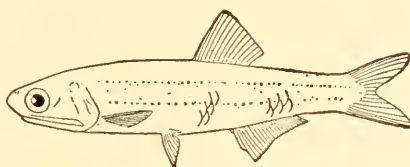
Engraulis perfasciatus Poey, 1861, Memorias, Vol. II, p. 313.*Stolephorus perfasciatus* Evermann and Marsh, 1902, p. 88.FIG. 37.—*Anchovia perfasciata*
From Zoologica, IX*Type locality*.—Cuba.*Distribution*.—Florida Keys to Cuba, Porto Rico and Jamaica, common. Not uncommon in Porto Rican waters.*Diagnosis*.—Head 4; depth 6; eye 3.7. Dorsal 12 to 15; anal 14 to 16; scales about 40. Attains a length of perhaps 5 inches.**Anchovia cubana (Poey)**

Cuban anchovy

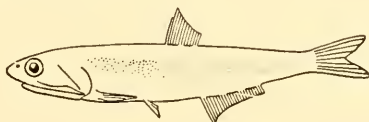
Engraulis cubanus Poey, 1868, Synopsis, p. 420.*Stolephorus cubanus* Evermann and Marsh, 1902, p. 88.*Type locality*.—Cuba.*Distribution*.—Cuba and Porto Rico. Included in the Porto Rican fauna on the authority of Poey and Stahl.*Diagnosis*.—Head 5 in length with caudal; depth 6.6 to 6.7; eye 4. Dorsal 14; anal 17. Length 2 or 3 inches.

Anchovia brownii (Gmelin)

Striped anchovy; manjua

Atherina brownii Gmelin, 1788, Syst. Nat., p. 1397; after Browne.*Stolephorus brownii* Evermann and Marsh, 1902, p. 88.*Anchoriella epsctus* Beebe and Tee Van, 1928, Zoologica, Vol. X, p. 46.FIG. 38.—*Anchovia brownii*
From Zoologica, IX.*Type locality*.—Jamaica.*Distribution*.—Cape Cod to Brazil, the most abundant of the American anchovies. Plentiful in Porto Rican waters.*Diagnosis*.—Head 3.7; depth 4.9; eye 3.5. Dorsal 13 to 15; anal 20 to 23; scales 38. Attains a length of from 6 to 7 inches.*Remarks*.—This and *Atherina* make up the bulk of the silvery bait-fishes which swarm about Florida wharves.**Anchovia choerostoma** (Goode)

Bermuda anchovy; hog-mouthed fry

Engrautis choerostomus Goode, 1874, Amer. Jour. Sci. Arts, August, p. 125.*Stolephorus choerostomus* Evermann and Marsh, 1902, p. 88.FIG. 39.—*Anchovia choerostoma*
From Zoologica, X*Type locality*.—Bermuda.*Distribution*.—For a quarter of a century after its discovery this fish was believed to be confined to the waters about Bermuda, where it is abundant. In 1902 Evermann and Marsh found that it was rather common also at Porto Rico. Beebe and Tee Van have recently (1928) recorded it from Haiti.*Specimens collected*.—26: Paloseco Point and San Antonio Bridge, San Juan, and Cataño.*Diagnosis*.—Head 3.5; depth 5.3; eye 4.6. Dorsal 13; anal 23; scales 38. Reaches a length of 2 to 3 inches.

Anchovia lyolepis (Evermann and Marsh)

Loose-scaled anchovy

Stolephorus lyolepis Evermann and Marsh, 1902, Bull. U. S. Fish. Comm. for 1900, Vol. XX, Pt. 1, p. 89, Fig. 13.

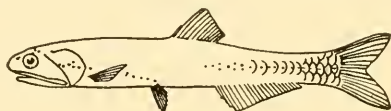


FIG. 40.—*Anchovia lyolepis*
From Zoologica, X

Type locality.—Culebra, Porto Rico.

Distribution.—Known from Porto Rico, where it is not plentiful, and from Haiti.

Diagnosis.—Head 4.3; depth 6.9; eye 4.6. Dorsal 12 to 16; anal 18 to 20; scales deciduous. Length about 1½ inches.

Habits.—Commonly comes to the surface at night, attracted by lights.

Anchovia producta (Poey)

Broad-head anchovy; hechudo

Engraulis productus Poey, 1866, Repertorio, Vol. I, p. 380.
Stolephorus productus Evermann and Marsh, 1902, p. 90.

Type locality.—Cuba.

Distribution.—Known from Cuba, Jamaica and Porto Rico. Not uncommon about Porto Rico.

Diagnosis.—Head 3.6; depth 3.7; eye 3.9. Dorsal 13; anal 31 to 33; scales 43. One of the largest of the anchovies, frequently 6 inches long.

Cetengraulis Günther**Cetengraulis edentulus** (Cuvier)

Whalebone anchovy

Engraulis edentulus Cuvier, 1829, Règne Animal, ed. 2, Vol. II, p. 323.
Stolephorus garmani Evermann and Marsh, 1902, p. 89, Fig. 14.
Stolephorus gilberti Evermann and Marsh, 1902, p. 90, Fig. 15.
? *Engraulis clupeioides* Fowler, 1928, Proc. Ac. Sci. Phila., p. 463.

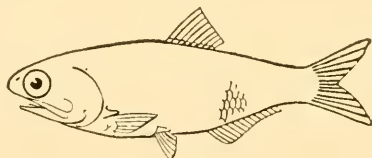


FIG. 41.—*Cetengraulis edentulus*
From Zoologica, X

Type locality.—Jamaica.

Distribution.—West Indian fauna, rather common about the Greater Antilles, but apparently not common in Porto Rican waters.

Diagnosis.—Head 3.2 to 3.3; depth 3.3 to 3.4; eye 3.5 to 4. Dorsal 14 to 15; anal 23; scales 42. Attains a length of 6 inches.

SYNODONTIDAE

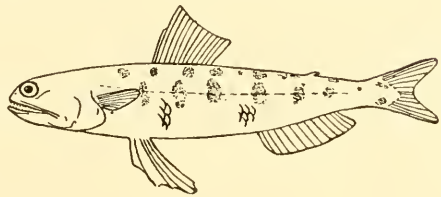
Trachinocephalus Gill

Trachinocephalus myops (Forster)

Ground spearing; lagarto

Salmo myops Forster, 1801, MS., Bloch and Schneider, Syst. Ichth., p. 421.
Trachinocephalus myops Evermann and Marsh, 1902, p. 91.

FIG. 42.—*Trachinocephalus myops*
 From Zoologica, IX



Type locality.—St. Helena.

Distribution.—West Indian fauna from South Carolina to Brazil, and southward, occasionally north to Massachusetts. Rare in Porto Rican waters.

Diagnosis.—Head 3.4; depth 5; eye 6.4. Dorsal 12; anal 14; scales 58. Attains a length of about 9 inches.

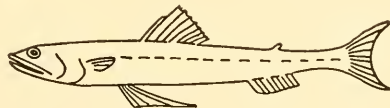
Synodus Bloch and Schneider

Synodus intermedius (Agassiz)

Sand diver; lizard-fish

Saurus intermedius Agassiz, 1829, in Spix, Piscium Brazil., p. 81, Pl. XLIV.
Synodus intermedius Evermann and Marsh, 1902, p. 92.

FIG. 43.—*Synodus intermedius*
 From Zoologica, X



Type locality.—Brazil.

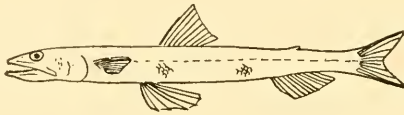
Distribution.—Southern Florida to Brazil, generally rather common. Fairly common in Porto Rican waters.

Diagnosis.—Head 3.8; depth, 7; eye 7. Dorsal 11; anal 11; scales 49. This species attains a length of from 10 to 12 inches.

Remarks.—Lizard-fishes have little or no food value.

Synodus foetens (Linnaeus)

Galliwasp; lizard-fish; lagarto

Salmo foetens Linnaeus, 1766, Syst. Nat., ed. 12, p. 513.*Synodus foetens* Evermann and Marsh, 1902, p. 92, Fig. 16.FIG. 44.—*Synodus foetens*
From Zoologica, IX*Type locality.*—South Carolina.*Distribution.*—West Indian fauna, Cape Cod to Brazil, very common from South Carolina southward. Not uncommon in Porto Rican waters.*Diagnosis.*—Head 4; depth 8; eye 8. Dorsal 10; anal 12; scales 60. This species grows to be a foot in total length.*Habits.*—The lizard-fish frequents sandy shores. It rests on the bottom, prepared to attack with lightning speed and devour any luckless smaller species that swims within range. Its mottled gray or brown color gives it a low visibility on the bottom, of aggressive rather than protective usefulness. Young an inch or two long are translucent, with pairs of oval pigment spots along the midline, and may have habits somewhat like those of the related lantern fishes.

AULOPIDAE

Chlorophthalmus Bonaparte**Chlorophthalmus chalybeius** (Goode)

Green-eye

Hyphalonedrus chalybeius Goode, 1881, Proc. U. S. Nat. Mus. for 1880, p. 484.*Chlorophthalmus chalybeius* Evermann and Marsh, 1902, p. 93.*Type locality.*—Gulf Stream, off Block Island.*Distribution.*—Off the Atlantic coast of America from Rhode Island to Porto Rico, at depths of from 85 to 220 fathoms. A single specimen (2½ inches long), Mayagüez Harbor, P. R., at a depth of 220 fathoms.*Diagnosis.*—Head 3; depth 6; eye 2.5. Dorsal 9; anal 6; scales 51.*Remarks.*—The Porto Rican specimen of this interesting fish is so identified by Evermann and Marsh, though showing slight differences from the type taken off Block Island.

CYPRINIDAE

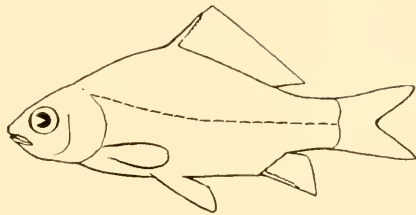
Carassius Nilsson**Carassius auratus (Linnaeus)**

Goldfish

Cyprinus auratus Linnaeus, 1758, Syst. Nat., ed. 10. Vol. I, p. 322.

Carassius auratus Nichols, 1915, Bull. Amer. Mus. Nat. Hist., Vol. XXXIV, p. 141.

FIG. 45.—*Carassius auratus*



Type locality.—China and Japan.

Distribution.—A native of eastern Asia, introduced cosmopolitan in temperate fresh waters. In 1914 the goldfish was said to be abundant at Isabella, P. R., in the northwest corner of the island. It had recently been placed in a small pond in the hills above Guayama, where it seemed to be doing well.

Specimens collected.—1: Governor's House near Guayama.

Diagnosis.—Head 3.6; depth 2.4; eye 3.4 (specimen of about 4 inches standard length). Dorsal II, 16 to 20; anal II, 5; scales 26 to 28. Dorsal in the middle of the back; last simple dorsal and anal rays spinous, serrate behind. No teeth in the mouth. The usual striking golden color is replaced by inconspicuous olivaceous shades in the very young and some grown feral individuals.

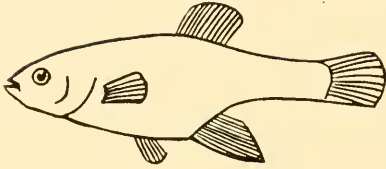
POECILIIDAE

Fundulus Lacepede**Fundulus fonticola Cuvier and Valenciennes**

Porto Rican killifish

Fundulus fonticola Cuvier and Valenciennes, 1846, Hist. Nat. Poiss., Vol. XVIII, p. 198.

Fundulus fonticola Evermann and Marsh, 1902, p. 96.

FIG. 46.—*Fundulus fonticola*

Type locality.—Porto Rico.

Distribution.—Known only from mountain springs in Porto Rico; rare.

Diagnosis.—Head broad, little depressed. Tail more slender and body deeper than in *Fundulus heteroclitus*. Body plump, with a long caudal peduncle. Dorsal 11; anal 12; scales 37.

Poecilia Bloch and Schneider

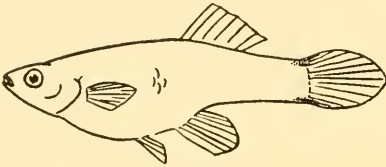
Poecilia vivipara Bloch and Schneider

Viviparous tooth-carp; top-minnow

Poecilia vivipara Bloch and Schneider, 1801, Syst. Ichth., p. 452, Pl. 86.

Fig. 2.

Poecilia vivipara Evermann and Marsh, 1902, p. 97.

FIG. 47.—*Poecilia vivipara*

Type locality.—Surinam.

Distribution.—Fresh waters in Brazil, Guiana, Martinique and Porto Rico. In Porto Rico found near Ponce and Fajardo, and at Arroyo and Hucares,—abundant.

Specimens collected.—20: Mouth of the Loiza River. 18: Guanica.

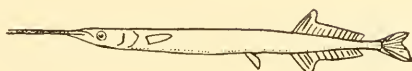
Diagnosis.—Head 3.6; depth 3.5; eye 3.5. Dorsal 7; anal 8; scales 25. Length 3 or 4 inches.

Habits.—This species belongs to that division of the tooth-carps or killifishes in which the eggs hatch within the body cavity of the mother fish, and young are brought forth "alive." Viviparous tooth-carps are very plentiful in the middle Americas in respect to individuals, species and genera. Their small size and the numerical abundance which they attain in restricted sluggish fresh waters renders them an effective factor in mosquito control. This is the only species of top-minnow that occurs in Porto Rico unless others have been recently introduced.

ESOCIDAE

Tylosurus Cocco**Tylosurus notatus** (Poey)

Needlefish; long-jaws; agujon

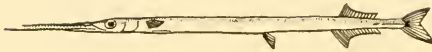
Belone notata Poey, 1860, *Memorias*, Vol. II, p. 293.*Tylosurus notatus* *Sitrester*, 1916, *Yearb-Carn. Inst. Wash.* for 1915, Vol. XIV, p. 215. Porto Rico.FIG. 48.—*Tylosurus notatus**Type locality*.—Havana.*Distribution*.—West Indies, north to Pensacola, Fla.*Diagnosis*.—Head 2; depth 5 (in head). Dorsal 13; anal 13 (counting developed rays only); scales 150, 85 before dorsal. Body robust, not compressed. Peduncle compressed, deeper than broad, without trace of a keel. Length about 20 inches.**Tylosurus timucu** (Walbaum)

Needlefish; agujon

Esox timucu Walbaum, 1792, *Artadi Piscium*, Vol. III, p. 295; after Marcgrave.*Tylosurus timucu* Evermann and Marsh, 1902, p. 99.*Type locality*.—Brazil.*Distribution*.—Florida Keys to Brazil. Not uncommon in Porto Rican waters.*Diagnosis*.—Head 2.7 to 2.8; depth 7 (in head); eye 2.3 to 2.8 in post-orbital part of head. Dorsal 15; anal 17; scales 225, about 150 before the dorsal. Caudal peduncle compressed, deeper than broad, without trace of a keel. Length about 18 inches.**Tylosurus ardeola** (Cuvier and Valenciennes)

Needlefish; agujon

Belone ardeola Cuvier and Valenciennes, 1846, *Hist. Nat. Poiss.*, Vol. XVIII, p. 425.*Tylosurus ardeola* Evermann and Marsh, 1902, p. 99.

FIG. 49.—*Tylosurus ardeola*

Type locality.—Martinique.

Distribution.—West Indian fauna, not common. Three or four records in Porto Rican waters.

Diagnosis.—Head 3.7 to 3.8; depth 8 (in head); eye 7. Dorsal 13; anal 17; scales moderate, about 150 before the dorsal. Caudal peduncle depressed, broader than deep, with a keel. Length a foot or more.

***Tylosurus euryops* Bean and Dresel**

Needlefish; long-jaw; agujon

Tylosurus euryops Bean and Dresel, 1884, Proc. U. S. Nat. Mus. for 1884, p. 168.

Tylosurus euryops Nichols, 1915, Bull. Amer. Mus. Nat. Hist., Vol. XXXIV, p. 142. Porto Rico.

Type locality.—Jamaica.

Distribution.—Cuba and Jamaica, not common. A few small ones recorded from San Juan Bay, P. R., in summer, possibly the young of *T. timucu*.

Specimens collected.—1: San Juan.

Diagnosis.—Head 3; depth in head 6; eye in postorbital part of head 2.2. Dorsal 15; anal 17; scales 200. Region above base of pectoral without a black spot; 140 to 150 scales before the dorsal fin; peduncle compressed, deeper than broad, without trace of a keel.

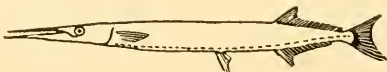
***Tylosurus raphidoma* (Ranzani)**

Needlefish; hound-fish; agujon

Belone raphidoma Ranzani, 1842, Nov. Comm. Ac. Nat. Sci. Inst. Bonon., Vol. V, p. 359, Pl. XXXVIII, Fig. 1.

Tylosurus raphidoma Evermann and Marsh, 1902, p. 99, Fig. 17.

S[tr]ongylura raphidoma Beebe and Tee Van, 1928, Zoologica, Vol. X, p. 63.

FIG. 50.—*Tylosurus raphidoma*
From Zoologica, X

Type locality.—Brazil.

Distribution.—Generally abundant in the West Indies, from the Florida Keys to Brazil. The young drift northward abundantly to the Capes of the Carolinas, and occasionally to New Jersey. *Tylosurus*

raphidoma is the most numerous species of the genus in Porto Rican waters, where it is generally distributed.

Diagnosis.—Head 3.3; depth 3.4 in head; eye 7 in snout, 2.66 in postorbital part of head. Dorsal I, 20 to 24; scales about 350. Caudal peduncle slightly depressed, with a slight black keel; caudal fin unequally lunate. Attains a length of from 3 to 5 feet.

Habits.—Much preyed upon by barracudas. The young found among broken drifting eel grass, to which they bear a concealing resemblance (E. W. Gudger).

Tylosurus acus (Lacepede)

Houndfish; agujon

Sphyraena acus Lacepede, 1803, Hist. Nat. Poiss., Vol. V, p. 6, Pl. I, Fig. 3.
Strongylura acus Fowler, 1928, Proc. Ac. Sci. Phila., p. 463. Porto Rico.

FIG. 51.—*Tylosurus acus*
From Zoologica, IX



Type locality.—Martinique.

Distribution.—West Indies, occasionally northward to Buzzards Bay. A Mediterranean species may be identical. Recorded from Porto Rico by Fowler.

Diagnosis.—Head 2.6; depth 18.5; eye about 2.5 in postorbital part of head. Dorsal 23; anal 21 to 22; scales 380 to 400. Keel on the peduncle strong, black; caudal deeply and unequally emarginate: no definite silvery lateral band. Reaches a length of $4\frac{1}{2}$ feet.

Habits.—Houndfishes swim near the surface, hovering on the outskirts of schools of smaller surface fishes, which seek to escape their periodic piratical raids by scattering in all directions, often leaping into the air. This and other big needle-fishes are themselves proficient in leaping. Their long bodies shoot out of the water and through the air as might a thrown spear or javelin, and there are said to be instances of their thus by chance striking and wounding fishermen in small boats.

HEMIRAMPHIDAE

Hyporhamphus Gill

Hyporhamphus unifasciatus (Ranzani)

Half-beak; escribano

Hemirhamphus unifasciatus Ranzani, 1842, Nov. Comm. Ac. Sci. Bonon., Vol. V, p. 326.

Hyporhamphus unifasciatus Evermann and Marsh, 1902, p. 101, Fig. 18.



FIG. 52.—*Hyporhamphus unifasciatus*
From Zoologica, X

Type locality.—Brazil.

Distribution.—West Indian fauna, Key West to Rio de Janeiro, common. Common in Porto Rican Waters.

Diagnosis.—Head 4.6; depth 6.8; eye 4. Dorsal 14 or 15; anal 14 to 16; scales 52. Caudal fin equally lunate. Attains a length of about a foot.

Remarks.—Extensively used for food.

Habits.—More numerous in shallow water near shore than is the following species, less given to leaping.

Hemiramphus Cuvier

Hemiramphus brasiliensis (Linnaeus)

Half-beak; ballyhoo; balao

Esox brasiliensis Linnaeus, 1758, Syst. Nat., ed. 10, p. 314; after Browne.

Hemiramphus brasiliensis Evermann and Marsh, 1902, p. 102, Fig. 19.

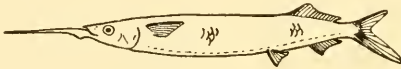


FIG. 53.—*Hemiramphus brasiliensis*
From Zoologica, IX

Type locality.—Jamaica.

Distribution.—West Indian fauna, common off shore. Generally distributed in Porto Rican waters. St. Croix.

Diagnosis.—Head 4.2; depth 6.2; eye 3.8. Dorsal 13 or 14; anal 12 or 13; scales 53. Caudal fin unequally forked, the lower lobe the longer. Attains a length of 15 inches.

Habits.—The Spanish name, "balao," refers to the habit of the fish to skitter over the surface of the water propelled by the strong lower lobe of the caudal fin. Some such fish was ancestral to the flying-fishes, and it is easy to understand how, given this habit, the pectoral fins, at first used only to raise and steady the half-beak's head, should have increased in size so as to lift the flying-fish into the air.

The ballyhoo feeds chiefly on algae, its peculiar spear-like lower jaw being presumably an adaptation for collecting small floating particles of food at the surface. This character of an elongate lower jaw is shared by certain young needlefish, ancestral to the half-beaks, and by certain young flying-fishes, to which the half-beaks are ancestral. According to our interpretation it is a character which serves a method of

feeding more favorable for small than for larger fishes, and hence has had greater permanence in the young than in the adults of this single evolutionary series.

EXOCOETIDAE

Parexocoetus Bleeker

Parexocoetus brachypterus (Solander)

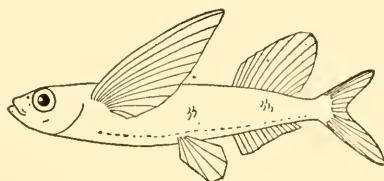
Short-winged flying-fish; volador

Exocoetus brachypterus Solander, 1846, in Richardson Ichthyol. Chin., Proc. Brit. Assoc., 1846, p. 265.

Parexocoetus mesogaster Evermann and Marsh, 1902, p. 103.

Parexocoetus brachypterus Meek and Hildebrand, 1923, Fishes of Panama, Pt. 1.

FIG. 54.—*Parexocoetus brachypterus*
From Zoologica, IX



Type locality.—Otaheite.

Distribution.—Common in tropical seas, East Indies, West Indies, Hawaiian Islands. Apparently the commonest flying-fish about Porto Rico.

Diagnosis.—Head 4.4; depth 5; eye 3. Dorsal 12; anal 13; scales about 38. Attains a length of 7 inches.

Cypselurus Swainson

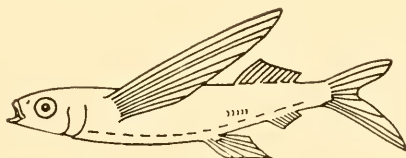
Cypselurus bahiensis (Ranzani)

Bahia flying-fish; volador

Exocoetus bahiensis Ranzani, 1842, Nov. Comm. Ac. Sci. Inst. Bonon., Vol. V, p. 362, Pl. XXXVIII.

Cypselurus bahiensis Evermann and Marsh, 1902, p. 104.

FIG. 55.—*Cypselurus bahiensis*
From Zoologica, X



Type locality.—Bahia.

Distribution.—Off tropical American coasts in both Atlantic and Pacific, plentiful. North to Cuba, and one Porto Rican record.

Diagnosis.—Head 4; depth 5; eye 3.1. Dorsal 13; anal 9; scales about 50. Attains a length of 8 to 12 inches.

AULOSTOMIDAE

Aulostomus Lacepede

Aulostomus maculatus Valenciennes

Trumpet-fish; trompetero

Aulostoma maculatum Valenciennes, abt. 1845, in Cuvier's *Illst. Poiss.*, Pl. XCII, Fig. 2.

Aulostomus maculatus Evermann and Marsh, 1902, p. 105, Fig. 20.

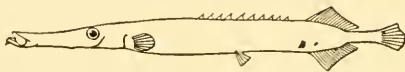


FIG. 56.—*Aulostomus maculatus*
From *Zoologica*, X

Type locality.—Uncertain.

Distribution.—Caribbean Sea, north to southern Florida. Apparently not common about Porto Rico. Recorded from St. Croix.

Diagnosis.—Head 3; depth 11; eye 2 to 2.5 in postorbital part of head. Dorsal X-23; anal 25; body covered with fine ctenoid scales. Attains a length of 2 feet.

FISTULARIIDAE

Fistularia Linnaeus

Fistularia tabacaria Linnaeus

Cornet-fish; trompetero

Fistularia tabacaria Linnaeus, 1758, *Sys. Nat.*, ed. 10, p. 312.

Fistularia tabacaria Evermann and Marsh, 1902, p. 106.



FIG. 57.—*Fistularia tabacaria*
From *Zoologica*, IX

Type locality.—"America."

Distribution.—West Indies and neighboring seas, generally common, occasionally northward to Florida and Carolina, casually to Massachusetts. Not common in Porto Rican waters.

Diagnosis.—Head 2.8. Dorsal 14; anal 13; scale-less, but with bony plates, mostly covered by skin. Attains a maximum length of 6 feet, usually much smaller.

SYNGNATHIDAE

Syngnathus Linnaeus

Syngnathus mackayi (Swain and Meek)

Mackay's pipe-fish

Siphostoma mackayi Swain and Meek, 1884, Proc. U. S. Nat. Mus. for 1884, p. 239.

Siphostoma mackayi Evermann and Marsh, 1902, p. 107.

FIG. 58.—*Syngnathus mackayi*
From Zoologica, X



Type locality.—Key West.

Distribution.—Gulf of Mexico and West Indies, known from off Pensacola, Key West, Haiti, Cozumel, Yukatan, etc. One of 7 inches recorded from Mayagüez, P. R.

Diagnosis.—Head 5.66 to 6.25 in total length. Dorsal 29 to 32; rings 18 + 33 to 36.

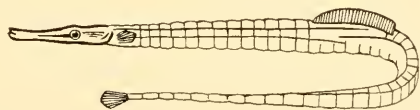
Syngnathus floridae (Jordan and Gilbert)

Florida pipe-fish

Siphostoma floridae Jordan and Gilbert, 1882, Proc. U. S. Nat. Mus. for 1882, p. 263.

Siphostoma floridae Evermann and Marsh, 1902, p. 107.

FIG. 59.—*Syngnathus floridae*



Type locality.—Pensacola, Fla.

Distribution.—North Carolina to Texas. Three specimens seined in Ensenada del Boqueron, P. R.

Diagnosis.—Head 6 to 6.5 in total length. Dorsal 27; rings 17 to 18 + 31 to 32.

Habits.—This is a rather common species on sandy continental shores.

Syngnathus elucens Poey

Pipe-fish

Syngnathus elucens Poey, 1867, Synopsis, p. 443. Havana.

Siphostoma elucens Evermann and Marsh, 1902, p. 108.



FIG. 60.—*Syngnathus etuceus*
From Zoologica, X

Type locality.—Havana.

Distribution.—Known from Havana, Haiti, and Porto Rico, whence one 6 inches long is recorded.

Diagnosis.—Head 7 in total length; depth 3.6 in head. Dorsal 23, on 1 + 4 rings; rings 17 + 32.

Syngnathus jonesi Günther

Jone's pipe-fish

Syngnathus jonesi Günther, 1874, Ann. Mag. Nat. Hist., (4), Vol. XIV, p. 8.
Siphostoma jonesi Evermann and Marsh, 1902, p. 108.

Type locality.—Bermuda.

Distribution.—Bermuda and Porto Rico.

Diagnosis.—Head and snout short, the latter somewhat bent upward, shorter than postorbital part of head. Dorsal 18, on 1 + 5 rings; rings 17 + 32.

Habits.—The pipefishes are small attenuate fishes, encased in rings of bony armature. They hide among weed and often drift considerable distances in ocean currents. Numerous species are plentiful on continental shores adjacent to the West Indies, and others are known only from the islands. The few species and individuals recorded from Porto Rican waters may have drifted there from distant centers of greater abundance. The male pipe-fish carries the eggs and small young in a pouch placed under his tail. Two small males of this species, their pouches with eggs, were taken in 14 fathoms of water between Vieques and Culebra.

Hippichthys Bleeker

Hippichthys cayorum (Evermann and Kendall)

Short-nosed pipe-fish

Corythoichthys cayorum Evermann and Kendall, 1898, Bull. U. S. Fish. Comm. for 1897, p. 128, Pl. VII, Fig. 7.

Corythoichthys cayorum Evermann and Marsh, 1902, p. 108, Fig. 21.



FIG. 61.—*Hippichthys cayorum*

Type locality.—Key West.

Distribution.—West Indian fauna, from Key West to Porto Rico, rare.

Diagnosis.—Head 8.6; depth 12.6; eye in head, 4.33. Dorsal 21, on 1½ + 3½ rings; anal 3; rings 17 + 26 = 43. Length from 4 to 5 inches.

Hippichthys ensenadae (Silvester)

Short-nosed pipe-fish

Corythoichthys ensenadae Silvester, 1916, Yearbook Carn. Inst. Wash. for 1915, Vol. XIV, p. 215.

FIG. 62.—*Hippichthys ensenadae*

Type locality.—Ballenas Point, P. R.

Distribution.—Known only from Porto Rico.

Diagnosis.—Head 9; eye 5. Dorsal 19, on 1 + 4 rings; anal 2; rings 18 + 33. Body with 22 yellow and 22 brown color rings, which break up on ventral surface of belly. Length about 4 inches.

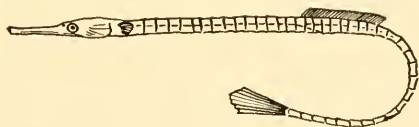
Remarks.—Known only from the type.

Habits.—The fish was secured from a bunch of coral.

Doryrhamphus Kaup**Doryrhamphus sierra** Nichols

Rough pipe-fish

Doryrhamphus sierra Nichols, 1915, Bull. Amer. Mus. Nat. Hist., Vol. XXXIV, p. 142, Fig. 1.

FIG. 63.—*Doryrhamphus sierra*

Type locality.—Mouth of Loiza River, Porto Rico.

Distribution.—Known only from the type locality, where several specimens were taken.

Specimens collected.—12: Mouth of the Loiza River.

Diagnosis.—Head in length to base of caudal 5.9; depth in head 5.6; eye in head, 8.8. Dorsal about 43, on $2\frac{1}{2}$ + $5\frac{1}{2}$ rings; rings 20 + 25. Snout 1.7 in head; caudal large, a little longer than head without snout (specimen 79 mm. standard length). Ridges on body high, sharp, serrate.

Remarks.—In pipe-fishes of this genus the brood-pouch of the male is located on the abdomen, not the tail. They are apt to frequent the mouths of rivers but are rare in West Indian waters. There is so much difference between young and adults that the number of good species is uncertain.

Hippocampus Rafinesque**Hippocampus punctulatus Guichenot**

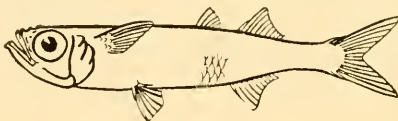
Sea-horse; cabalito del mar

Hippocampus punctulatus Guichenot, 1860, in Sagra's Cuba, Poiss., p. 174, Pl. V, Fig. 2.*Hippocampus punctulatus* Evermann and Marsh, 1902, p. 109.FIG. 64.—*Hippocampus punctulatus*
From Zoologica, X*Type locality.*—Cuba.*Distribution.*—Tropical parts of the Atlantic, common in southern Florida, the West Indies, Brazil and Western Africa. Uncommon in Porto Rican waters.*Specimens collected.*—1: San Juan.*Diagnosis.*—Snout about 2.6 in head; eye 2 in snout. Dorsal 18, covering $2\frac{1}{2} + 1$ rings; rings $12 + 30$. Length of this species from 3 to 5 inches.*Habits.*—The grotesque little sea horse, with head and shoulders like a knight in the game of chess, is related to the pipe-fishes, and shares with them their peculiar reproductive habits. It swims in an upright position and has a finless prehensile tail.

ATHERINIDAE

Atherina Linnaeus**Atherina stipes Müller and Troschel**

Broad-headed silverside; cabezote

Atherina stipes Müller and Troschel, 1848, in Schomburgk, Hist. Barb., p. 671.*Atherina stipes* Evermann and Marsh, 1902, Fig. 22.*Hepsetia stipes* Beebe and Tee Van, 1928, Zoologica, Vol. X, p. 88.*Atherina laticeps* Evermann and Marsh, 1902, p. 111.FIG. 65.—*Atherina stipes*
From Zoologica, X

Type locality.—Barbados.

Distribution.—West Indian fauna, north to Western Florida, abundant in Porto Rican waters as elsewhere.

Specimens collected.—2: San Juan.

Diagnosis.—Head 3.5 to 3.8; depth 4.6 to 5.2; eye 2.2 to 2.4. Dorsal IV or V-I, 8 to 10; anal I, 10 to 12; scales 36 to 38. Length about 3 inches.

Remarks.—A most important food of larger fishes.

Atherina araea Jordan and Gilbert

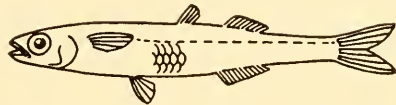
Silverside

Atherina araea Jordan and Gilbert, 1884, Proc. U. S. Nat. Mus. for 1884, p. 27.

Atherina araea Evermann and Marsh, 1902, p. 111, Fig. 23.

Atherina stipes Evermann and Marsh, p. 110, text, not the figure.

FIG. 66.—*Atherina araea*
From Zoologica, X



Type locality.—Key West, Fla.

Distribution.—West Indian fauna, north to Florida. Uncommon in Porto Rican waters.

Diagnosis.—Head 4. to 4.6; depth 5.3 to 6.6; eye 2.4 to 2.8. Dorsal V or VI-I, 9 to 10; anal I, 10 to 13; scales 41 to 45. Length 2 to 3 inches.

Remarks.—In most localities less plentiful than the preceding, but reported to be the most abundant species in Haiti. Probably only racially distinct from *A. harringtonensis* of Bermuda.

MUGILIDAE

Mugil Linnaeus

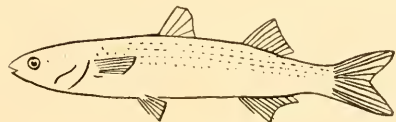
Mugil brasiliensis Agassiz

Southern mullet; liza; le brancho

Mugil brasiliensis Agassiz, 1829, in Spix, Pisc. Brasil., p. 234, Pl. LXXII.

Mugil brasiliensis Evermann and Marsh, 1902, p. 112.

FIG. 67.—*Mugil brasiliensis*



Type locality.—Atlantic Ocean off Brazil.

Distribution.—Cuba to Patagonia, common throughout the West Indies and along the coast of Brazil. Abundant in Porto Rican waters. St. Croix.

Diagnosis.—Head 4; depth 5; eye 5.75. Dorsal IV-I, 8; anal III, 8; scales 35. Vertical fins almost scaleless. Length from 16 to 18 inches.

Remarks.—An important and esteemed food fish abundant in the markets of Porto Rico.

Mugil curema Cuvier and Valenciennes

White mullet; liza; Josea

Mugil curema Cuvier and Valenciennes, 1836, Hist. Nat. Poiss., Vol. XI. p. 87. Brazil, Martinique and Cuba.

Mugil curema Evermann and Marsh, 1902, p. 113.

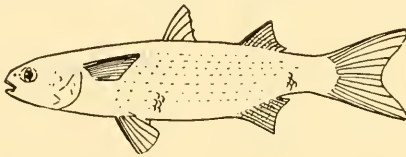


FIG. 68.—*Mugil curema*
From Zoologica, IX

Type localities.—Brazil, Martinique and Cuba.

Distribution.—West Indian fauna, north to Cape Cod; and tropical American Pacific waters, south to Chile; particularly common in the tropics. Plentiful about Porto Rico, where it enters the Rio Grande River to Caguas.

Specimens collected.—3: San Juan.

Diagnosis.—Head 4 to 4.4; depth 3.9 to 4.5; eye 4. Dorsal IV-I, 8; anal III, 9; scales 38. Soft dorsal and anal fins well scaled. Length a foot or less.

Remarks.—An important food fish.

Mugil trichodon Poey

Fan-tail mullet; liza

Mugil trichodon Poey, 1875, Ann. Lyc. Nat. Hist. N. Y., Vol. XI, p. 66, Pl. VIII, Figs. 4 to 8.

Mugil trichodon Evermann and Marsh, 1902, p. 113.

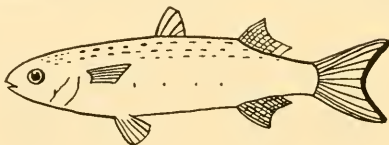


FIG. 69.—*Mugil trichodon*

Type locality.—Cuba.

Distribution.—Florida Keys to Brazil. Uncommon in Porto Rican waters.

Diagnosis.—Head 4.2; depth 3.6; eye 4. Dorsal IV-I, 8; anal III, 8; scales 33. Soft dorsal and anal fins well scaled. Attains a length of from 6 to 10 inches.

Habits.—This is a rather small species and a very active jumper. It seems to be more numerous on continental shores than in the West Indies.

Agonostomus Bennett

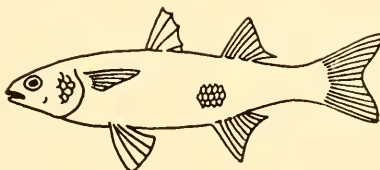
Agonostomus monticola (Baneroff)

Fresh-water mullet; dajao

Mugil monticola Bancroft, 1836, in Griffith's edition of Cuvier's Animal Kingdom, Fishes, p. 367, Pl. XXXVI.

Agonostomus monticola Evermann and Marsh, 1902, p. 114, Fig. 25.

FIG. 70.—*Agonostomus monticola*
From Zoologica, X



Type locality.—Uncertain.

Distribution.—Fresh waters of the West Indies and eastern Mexico. Abundant in the fresh-water streams of Porto Rico.

Diagnosis.—Head 3.5; depth 3.8; eye 6. Dorsal IV-I, 8; anal III, 9; scales 42. Attains a length of 11 inches; usually smaller.

Remarks.—Is used for food.

Habits.—A proficient jumper.

SPHYRAENIDAE

Sphyraena Bloch and Schneider

Sphyraena barracuda (Walbaum)

Great barracuda; picuda

Esox barracuda Walbaum, 1792, Artdi Piscium, Vol. III, p. 94; after Catesby.

Sphyraena barracuda Evermann and Marsh, 1902, p. 115, Fig. 26.

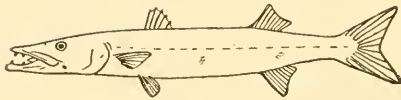


FIG. 71.—*Sphyraena barracuda*
From Zoologica, IX

Type locality.—Bahamas.

Distribution.—West Indian fauna, north to Charleston, S. C. and Bermuda, south to Brazil. Common and generally distributed in Porto Rican waters.

Specimen collected.—1: San Antonio Bridge, San Juan.

Diagnosis.—Head 3.3; depth 7 (2 in head); eye 6.6. Dorsal V-I, 10; anal I, 8; scales 83. Body compressed; maxillary reaching past front of orbit; teeth large. Irregular inky black spots on the flanks are a good distinguishing mark for this species of barracuda. Attains a very large size, commonly 3 feet or more long, sometimes 5 feet and perhaps even 10.

Remarks.—This fish is valued for food in Porto Rico, where the prejudice on the ground that it is unwholesome does not attach to it as in Cuba. There are well authenticated instances of poisoning as a result of eating large individuals, but no such case is known from Porto Rican waters.

Habits.—A fierce voracious fish, paralleling in the sea the habits and appearance of the fresh-water pikes. There are a few well authenticated instances of its attacking man in the water.

***Sphyraena guachancho* Cuvier and Valenciennes**

Small barracuda; Guachanche

Sphyraena guachancho Cuvier and Valenciennes, 1829, Hist. Nat. Poiss., Vol. III, p. 342.

Sphyraena guachancho Evermann and Marsh, 1902, p. 116.

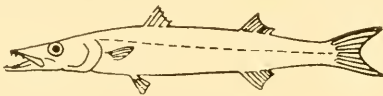


FIG. 72.—*Sphyraena guachancho*
From Zoologica, X

Type locality.—Havana.

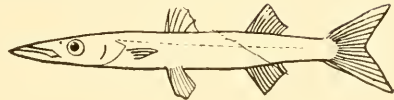
Distribution.—West Indian fauna, north to Florida; generally common, but rare in Porto Rican waters.

Diagnosis.—Head 3; depth 7; eye 5.4. Dorsal V-I, 9; anal I, 8; scales 115. Body little compressed or sub-terete; pectoral reaching front of spinous dorsal; maxillary reaching front of orbit. Length 2 feet.

Remarks.—Valued for food where abundant.

Sphyracna picudilla Poey

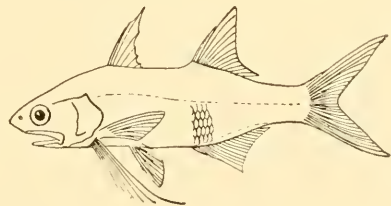
Small barracuda; picudilla

Sphyracna picudilla Poey, 1860, Memorias, Vol. II, p. 162.*Sphyracna picudilla* Evermann and Marsh, 1902, p. 116.FIG. 73.—*Sphyracna picudilla*
From Zoologica, X*Type locality*.—Havana.*Distribution*.—West Indian fauna from Cuba to Bahia. Included in the Porto Rican list on the authority of Dr. Stahl.*Diagnosis*.—Head 3.1 to 3.2; depth 2.2 to 2.3 in head; eye about 5. Dorsal V-I, 9; anal I, 9; scales 110. Body approaching sub-terete; pectoral not reaching front of first dorsal; maxillary not reaching front of orbit. Length 18 inches.*Remarks*.—Valued for food and, where abundant, of commercial importance.

POLYNEMIDAE

Polynemus Linnaeus**Polynemus virginicus** Linnaeus

Thread-fin; barbudo

Polynemus virginicus Linnaeus, 1758, Syst. Nat., ed. 10, p. 317.*Polynemus virginicus* Evermann and Marsh, 1902, p. 117.FIG. 74.—*Polynemus virginicus*
From Zoologica, X*Type locality*.—"America."*Distribution*.—West Indian fauna, north to the Florida Keys but not to Virginia. Rather common and generally distributed in Porto Rican waters.*Specimens seen*.—San Juan (peddled cooked).*Diagnosis*.—Head 3.3; depth 3.2 to 3.3; eye 5. Dorsal VIII-I, 12; anal III, 13; scales 60. Attains a length of about a foot.*Remarks*.—A useful food fish.

HOLOCENTRIDAE

Myripristis Cuvier**Myripristis jacobus** Cuvier and Valenciennes

Big-eyed squirrel-fish; Frère Jaques; candil

Myripristis jacobus Cuvier and Valenciennes, 1829, Hist. Nat. Poiss., Vol. III, p. 162.

Myripristis jacobus Nichols, 1915, Bull. Amer. Mus. Nat. Hist., Vol. XXXIV, p. 143. Porto Rico.

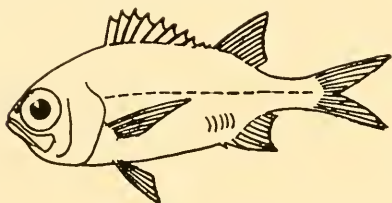


FIG. 75.—*Myripristis jacobus*
From Zoologica, X

Type locality.—Martinique.

Distribution.—West Indies to Brazil, generally common. Not common about Porto Rico.

Specimens collected.—2: San Juan.

Diagnosis.—Depth 3; head 4; eye large. Dorsal X-I, 14 or 15; anal IV, 13; scales 36 to 38. Preopercle without conspicuous spine at its angle; color red. Attains a length of about a foot.

Habits.—Seems to spend the daytime in hiding or in deeper water.

Holocentrus Scopoli**Holocentrus ascensionis** (Osbeck)

Common squirrel-fish; cartinau

Perca ascensionis Osbeck, 1771, Iter Chinensis, p. 388.

Holocentrus ascensionis Evermann and Marsh, 1902, p. 118, Pl. III.

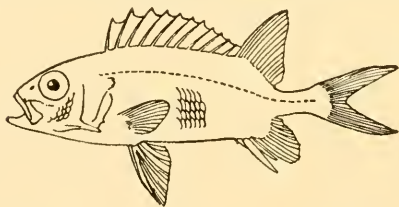


FIG. 76.—*Holocentrus ascensionis*
From Zoologica, X

Type locality.—Ascension Island.

Distribution.—Rocks and reefs of the tropical Atlantic, north to Florida, and numerous at Bermuda, generally common in the West Indies. Common about Porto Rico, and recorded from St. Croix.

Specimens seen.—San Juan Market.

Diagnosis.—Head 3 to 3.1; depth 3 to 3.3; eye 2.8 to 3.3. Dorsal XI, 15; anal IV, 10; scales 48. Attains a length of 1 to 2 feet.

Remarks.—About Porto Rico this fish is reputed to be unwholesome, but it is occasionally to be seen in the market.

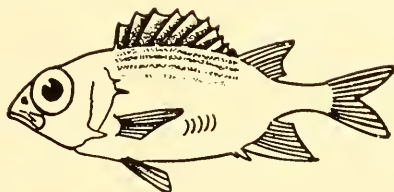
Holocentrus vexillarius Poey

Black-barred squirrel-fish

Holocentrum vexillarium Poey, 1860, *Memorias*, Vol. II, p. 158.

Holocentrus vexillarius Evermann and Marsh, 1902, p. 119.

FIG. 77.—*Holocentrus vexillarius*
From *Zoologica*, X



Type locality.—Cuba.

Distribution.—West Indies, not common, recorded from Porto Rico.

Diagnosis.—Head 2.8; depth 2.6; eye 2.7. Dorsal XI, 13; anal IV, 9; scales 40. Maxillary extending to below first third of eye; dorsal with black markings. Size small.

MULLIDAE

Upeneus Cuvier

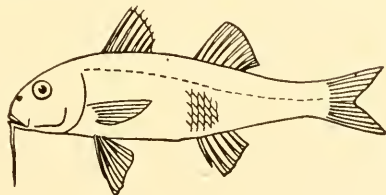
Upeneus maculatus (Bloch)

Red goat-fish; salmonete

Mullus maculatus Bloch, 1793, *Ausl. Fische*, and *Ichth.*, Pl. 348.

Upeneus maculatus Evermann and Marsh, 1902, p. 120, Pl. IV.

FIG. 78.—*Upeneus maculatus*
From *Zoologica*, X



Type locality.—Brazil.

Distribution.—West Indian fauna from the Florida Keys to Brazil. Abundant about Porto Rico. St. Croix.

Specimens collected.—2: Ponce Market.

Diagnosis.—Head 3.2; depth 3.7; eye 4 to 5. Dorsal VIII-I, 8; anal II, 7; scales 30. Teeth in both jaws uniserial; side with black blotches. Length 9 to 10 inches.

Remarks.—Extensively used and esteemed for food.

Upeneus parvus Poey

Small goat-fish

Upeneus parvus Poey, 1851, *Memorias*, Vol. I, p. 226.

Upeneus parvus Evermann and Marsh, 1902, p. 121.

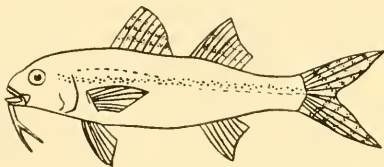


FIG. 79.—*Upeneus parvus*

Type locality.—Cuba.

Distribution.—Known only from the type, which was obtained by Poey in Cuba, and from a specimen recorded from Porto Rico by Stahl.

Diagnosis.—Dorsal VII-I, 8; anal II, 6; scales 40. Teeth of both jaws biserial, at least in front; dorsals and caudal with dark cross-bands.

Upeneus martinicus Cuvier and Valenciennes

Yellow goat-fish; salmonete amarilla

Upeneus martinicus Cuvier and Valenciennes, 1829, *Hist. Nat. Poiss.*, Vol. III, p. 483.

Upeneus martinicus Evermann and Marsh, 1902, p. 121, Pl. V.

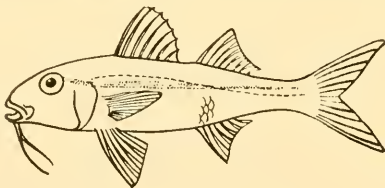


FIG. 80.—*Upeneus martinicus*
From *Zoologica*, X

Type locality.—Martinique.

Distribution.—West Indies, north to Florida. Less abundant in Porto Rico than is the red goatfish.

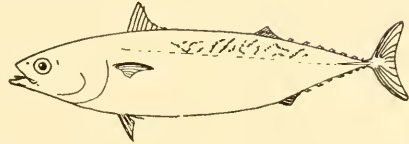
Specimens collected.—1: Condado Rocks, San Juan.

Diagnosis.—Head 3.3; depth 4; eye 3.4 to 3.5. Dorsal VIII-I, 8; anal II, 6; scales 37. Teeth of both jaws biserial, at least in front; dorsals and caudal plain yellow. Attains the length of a foot.

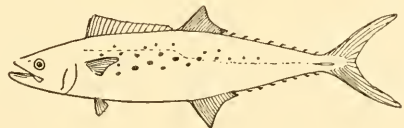
SCOMBRIDAE

Auxis Cuvier**Auxis thazard** (Lacepede)

Frigate mackerel; albacora

Scomber thazard Lacepede, 1802, Hist. Nat. Poiss., Vol. II, p. 9.*Auxis thazard* Evermann and Marsh, 1902, p. 122, Fig. 27.FIG. 81.—*Auxis thazard*
From Zoologica, IX*Type locality*.—Between 6° and 7° S. lat. off coast of New Guinea.*Distribution*.—All warm seas, occasionally northward to Cape Cod. Probably not rare about Porto Rico.*Diagnosis*.—Head 3.8; depth 4.4; eye 6. Dorsal X-12-VIII; anal 13-VII. Body mostly scaleless posteriorly; anteriorly covered with small scales, those of the pectoral region enlarged, forming a corselet. Attains a length of about 15 inches.*Habits*.—Frequently travels in large schools, and is very erratic as to presence or absence at a given locality.**Scomberomorus** Lacepede**Scomberomorus maculatus** (Mitchill)

Spanish mackerel; carita

Scomber maculatus Mitchill, 1815, Trans. Lit. and Philos. Soc. N. Y., Vol. I, p. 426.*Scomberomorus maculatus* Evermann and Marsh, 1902, p. 123, Pl. VI.FIG. 82.—*Scomberomorus maculatus*
From Zoologica, IX*Type locality*.—New York.*Distribution*.—West Indian fauna, and also adjacent Pacific waters. Occasionally north to Cape Ann in summer, south to Brazil. Abundant off southern Florida, rare in Cuban waters, but found about Jamaica and Porto Rico.*Diagnosis*.—Head 4.5; depth 4.5. Dorsal XVII-18-IX; anal II-17-IX; body covered with fine, rudimentary scales. Lateral line sloping

down rather gently; fins not densely scaled; body with yellow spots, not running into streaks or in definite rows. Reaches a length of from 3 to 4 feet, and a weight of 8 to 10 pounds.

Remarks.—A very excellent food fish.

***Scomberomorus regalis* Bloch**

Painted mackerel; sierra; pintado

Scomberomorus regalis Bloch, 1795, *Ausl. Fische*, and *Ichth.*, Pl. CCCXXXIII, after a drawing by Plumier.

Scomberomorus regalis Evermann and Marsh, 1902, p. 124, Fig. 28.

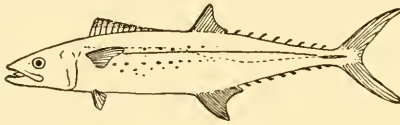


FIG. 83.—*Scomberomorus regalis*
From *Zoologica*, IX

Type locality.—Martinique.

Distribution.—West Indian fauna from Cape Cod to Brazil, not common on the southern coast of the United States, except irregularly in southern Florida; abundant about Cuba and known from other islands of the West Indies. Fairly common about Porto Rico.

Diagnosis.—Head 3.9 to 4.25; depth 5.2; eye 5.8. Dorsal XVI to XVIII-14 to 17-VIII to IX; anal II to III-14 to 15-VIII to IX; body covered with fine rudimentary scales. Lateral line sloping down rather gently; fins densely scaled; sides with yellow spots, running into streaks or in definite rows; attains a length of 4 to 6 feet and a weight of 20 to 35 pounds.

Remarks.—Not so good a food fish as the Spanish mackerel; sometimes considered unwholesome.

***Scomberomorus cavalla* (Cuvier)**

Kingfish; cero

Cybium cavalla Cuvier, 1829, *Règne Animal*, ed. 2, Vol. II, p. 200.

Scomberomorus cavalla Evermann and Marsh, 1902, p. 124.



FIG. 84.—*Scomberomorus cavalla*
From *Zoologica*, IX

Type locality.—Brazil.

Distribution.—Tropical Atlantic, north to Cape Cod and south to Brazil and Africa, abundant from Charleston, S. C., to the Florida Keys. Not common about Porto Rico.

Specimens seen.—Ponce market.

Diagnosis.—Head 4.1 to 5; depth 6; eye 2 in snout. Dorsal XV to XVI-I, 15-VIII; anal II, 15-VIII; body covered with fine, rudimentary scales. Lateral line sloping down abruptly near the middle of its course, then strongly waved. Adults plain silvery, young with yellowish spots on sides. Attains a length of about 5 feet, and sometimes a weight of 100 pounds; 40 pounds not unusual, though generally smaller.

Remarks.—Much sought as a game fish in Florida. It is also a good food fish, though with meat less rich and excellent than that of the Spanish mackerel.

TRICHIURIDAE

Trichiurus Linnaeus

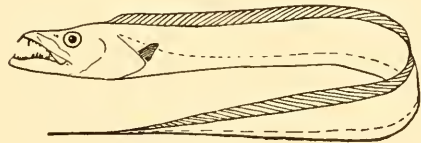
Cutlas-fish; machete

Trichiurus lepturus Linnaeus

Trichiurus lepturus Linnaeus, 1758, Syst. Nat., ed. 10, p. 246; after *Lepturus* of Artedi.

Trichiurus lepturus Evermann and Marsh, 1902, p. 125, Fig. 29.

FIG. 85.—*Trichiurus lepturus*
From Zoologica, IX



Type locality.—"America."

Distribution.—Warm sandy shores of America, chiefly in the Atlantic. Common in the West Indies, and straying north to Cape Cod. Probably not rare about Porto Rico.

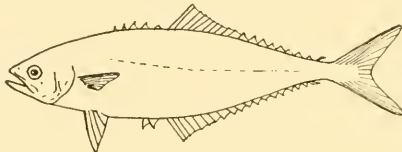
Diagnosis.—Head 8; depth 15.5; eye 6.3 (2.1 in snout). Dorsal about 135; anal about 100; body scaleless, silvery. Tail tapering to a fine, thread-like, finless point. It is said that it attains a length of about 5 feet, but it rarely exceeds 2 feet.

Remarks.—The cutlas-fish resembles and is related to certain fishes which frequent the depths of the ocean, with affinity to the surface-swimming mackerel group. It frequents, however, shallow shore waters, and resembles not at all any mackerel-like fishes to be found in a similar environment.

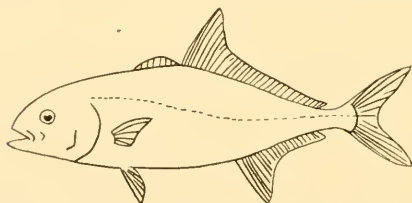
CARANGIDAE

Oligoplites Gill**Oligoplites saurus** (Bloch and Schneider)

Leather-jack; zapatero; quiebra

Scomber saurus Bloch and Schneider, 1801, Syst. Ichth., p. 321.*Oligoplites saurus* Evermann and Marsh, 1902, p. 127, Pl. VII.FIG. 86.—*Oligoplites saurus*
From Zoologica, IX*Type locality*.—Jamaica.*Distribution*.—Both coasts of tropical America, north to New York and Lower California, plentiful in the West Indies. Common and generally distributed in Porto Rican waters.*Specimens collected*.—1: Paloseco Point, San Juan.*Diagnosis*.—Head 4.8; depth 3.7 to 3.8; eye 3.6. Dorsal V-I, 20; anal II-I, 20; scales linear, embedded in the leathery skin. Reaches a length of a foot or more.**Seriola** Cuvier**Seriola falcata** Cuvier and Valenciennes

High-finned amber-jack; madregal

Seriola falcata Cuvier and Valenciennes, 1833, Hist. Nat. Poiss., Vol. IX, p. 210, Pl. DXV.*Seriola falcata* Evermann and Marsh, 1902, p. 128.FIG. 87.—*Seriola falcata**Type localities*.—Porto Rico, Jamaica and Mexico.*Distribution*.—West Indian fauna, north to Florida and the Carolinas. Included in the Porto Rican list on the authority of Valenciennes and Poey.

Diagnosis.—Head 3.8 (4.6 in total); depth 3.4 (4 in total); eye 5.2 to 5.3, 1.7 to 1.8 in snout. Head deeper than long, anterior profile steep. Dorsal VII-I, 29; anal II-I, 21; body covered with fine scales. Dorsal and anal falcate, their anterior lobes more than half depth of body. Nuchal band pale yellowish.

Decapterus Bleeker

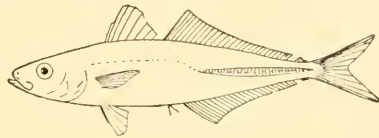
Decapterus punctatus (Agassiz),

Sead; round robin; cigar-fish; quia-quia

Cavans punctatus Agassiz, 1829, Spix, Pisc. Bras., p. 108.

Decapterus punctatus Evermann and Marsh, 1902, p. 129, Pl. VIII.

FIG. 88.—*Decapterus punctatus*
From Zoologica, IX



Type locality.—Brazil.

Distribution.—West Indian fauna, Cape Cod to Brazil, only occasional northward. Not uncommon about Porto Rico.

Diagnosis.—Head 4; depth 5.6; eye 3.3. Dorsal VIII-I, 30-I; anal II-I, 21-I; scutes 39. Common up to 6 inches long; rarely attains the maximum of 12 inches.

Trachurops Gill

Trachurops erumenophthalmus (Bloch)

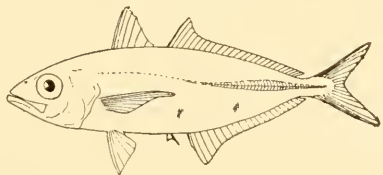
Goggle-eyed sead; chicharro

Scomber erumenophthalmus Bloch, 1793, Ausl. Fische, and Ichth., Pl. CCCXLIII.

Trachurops erumenophthalmus Evermann and Marsh, 1902, p. 129, Fig. 30.

Scler erumenophthalmus Meek and Hildebrand, 1925, Fishes of Panama, Pt. 2.

FIG. 89.—*Trachurops erumenophthalmus*
From Zoologica, IX



Type locality.—Acara in Guinea.

Distribution.—Cosmopolitan in tropical seas; found on both coasts of America; north to Cape Cod in the Atlantic. Common in Porto Rican waters.

Diagnosis.—Head 3.2; depth 3.8; eye 3.2. Dorsal VIII-I, 25 or 26; anal II-I, 22; scutes 35. Shoulder girdle with a deep cross furrow, and a fleshy projection above the furrow. Rarely attains a length of 2 feet, usually 10 inches or less in length.

Caranx Lacepede

Caranx ruber (Bloch)

Skip-jack; cibi mancho

Scomber ruber Bloch, 1793, *Ausl. Fische*, and *Ichth.*, Pl. CCCXLII.

Caranx ruber Evermann and Marsh, 1902, p. 130.

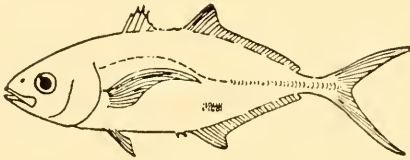


FIG. 90.—*Caranx ruber*
From *Zoologica*, X

Type locality.—St. Croix.

Distribution.—West Indies, casually north to North Carolina. Not plentiful about Porto Rico. St. Croix.

Specimens collected.—4: San Turce, San Juan.

Diagnosis.—Head 3.5; depth 3.5; eye 5.4. Dorsal VIII-I, 26 to 27; anal II-I, 23 to 24; scutes 25 to 30. Soft dorsal and anal little elevated in front. Gill-rakers on lower limb of first arch 31 to 33. Specimens down to 4 inches in length, have depth 3 times more or less, in length, with only slight tendency to become more slender with increasing size. Attains a length of about 15 inches.

Remarks.—*Ruber* is a misnomer for this fish, due to a wrongly colored figure; it is more or less blue, never red.

Habits.—An active, swift-swimming species, more plentiful about small islands and reefs than mainland shores.

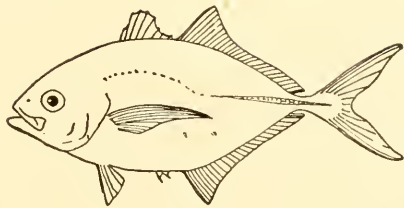
Caranx bartholomaei Cuvier and Valenciennes

Yellow-jack; cibi amarillo

Caranx bartholomaei Cuvier and Valenciennes, 1833, *Hist. Nat. Poiss.*, Vol. IX, p. 100.

Caranx bartholomaei, Evermann and Marsh, 1902, p. 131, Fig. 33 (mis-titled).

FIG. 91.—*Caranx bartholomaci*
From Zoologica, IX



Type locality.—St. Bartholomew.

Distribution.—West Indies, north to Florida and the Carolinas, rarely to Massachusetts. Common about Cuba, but not very common in Porto Rican waters.

Diagnosis.—Head 3.3; depth 2.8; eye 4.8. Dorsal VIII-I, 26 to 27; anal II-I, 22 to 23; scutes about 30. Soft dorsal and anal little elevated in front. Specimens under 6 inches in length (to base of caudal) have the depth 2.5 or less in this length: from six inches to a foot long, depth falls off very rapidly and at the length of a foot there is no depth difference between this species and the preceding. Gill rakers on lower limb of first arch, 17 to 19. Attains a length of about 15 inches.

Remarks.—The yellow-jack is closely related to the skip-jack, and occurs more or less in association with it in the West Indies. Its young, which are notably deeper-bodied, drift northward in the Gulf Stream, and have a prettily mottled concealing coloration among the gulf weed. Relative depth is a good criterion to separate small individuals of yellow-jack and skip-jack but, when a length of about a foot has been reached, there is no depth difference. The yellow-jack has decidedly coarser gill-rakers.

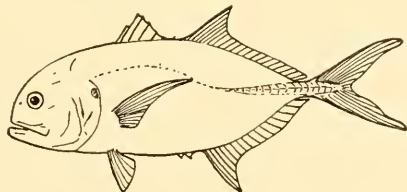
Caranx hippos (Linnaeus)

Common jack; crevallé

Scomber hippos Linnaeus, 1766, Syst. Nat., ed. 12, p. 494.

Caranx hippos Evermann and Marsh, 1902, p. 131, Fig. 31.

FIG. 92.—*Caranx hippos*
From Zoologica, IX



Type locality.—Charleston, S. C.

Distribution.—Tropical Atlantic and eastern Pacific, generally abundant, found on both coasts of America, north to Cape Cope and the Gulf

of California. Not common in Porto Rican waters. Recorded from St. Croix.

Specimens collected.—8: San Juan.

Diagnosis.—Head 3; depth 2.5; eye 3.8. Dorsal VIII-I, 20; anal II-I, 17; scutes about 30. Soft dorsal and anal more or less falcate in front. Canines well developed. Breast naked with a small rhombic scaled area before ventrals. Attains a length of about 2½ feet and a weight of 20 pounds.

Remarks.—A good game fish but does not rank high as a food fish.

Habits.—The commonest species of its kind on continental shores, frequently penetrating estuaries to fresh water. An active predaceous fish, hunting singly or in small, loosely organized companies.

Caranx crysos (Mitchill)

Hardtail-jack; runner; cojinuda

Scomber crysos Mitchill, 1815, Trans. Lit. and Phil. Soc. N. Y., Vol. I, p. 424.
Caranx crysos Evermann and Marsh, 1902, p. 132, Fig. 32, Pl. IX.

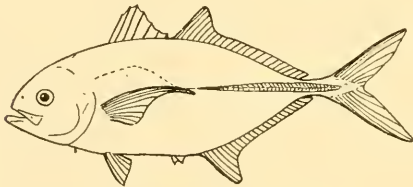


FIG. 93.—*Caranx crysos*
From Zoologica, IX

Type locality.—New York.

Distribution.—West Indian fauna, from Cape Cod to Brazil, generally abundant southward. Not very numerous at Porto Rico. A similar fish on the west coast of Middle America is very closely related if not the same.

Specimens collected.—5: Santurce and Fort San Geronemo, San Juan.

Diagnosis.—Head 3.5; depth 3.2; eye 5.6. Dorsal VIII-I, 24; anal II-I, 20; scutes about 45. Soft dorsal and anal more or less falcate in front, breast completely scaled. Attains a length of about 2 feet and a weight of 4 to 6 pounds.

Remarks.—A well-known food fish.

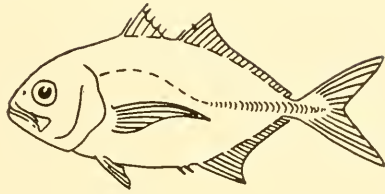
Caranx latus Agassiz

Horse-eyed jack; jurel

Caranx latus Agassiz, 1829, Pisc. Bras., p. 105.

Caranx latus Evermann and Marsh, 1902, p. 132, not Fig. 33 (mistitled).

FIG. 94.—*Caranx latus*
From Zoologica, X



Type locality.—Brazil.

Distribution.—All tropical seas, abundant in the West Indies. By far the commonest species of *Caranx* in Porto Rico.

Specimens collected.—1: San Juan.

Diagnosis.—Head 3.3 to 3.4; depth 2.7 (more than 3 at a standard length of 3 feet); eye 4. Dorsal VIII-I, 22; anal II-I, 18; scutes about 35. Soft dorsal and anal more or less falcate in front; breast completely scaled. Occasionally reaches a length of 3 feet or more. In such cases it is less deep-bodied than in the more usual, shorter representatives of the species.

Remarks.—Various species of *Caranx* named in different parts of the world are referable to *C. latus*, unless they be taken for the types of local races of it, which may prove differentiable.

Habits.—The preferred habitat of this species seems to be the shores of islands, and in the West Indies it more or less replaces the common jack, which it resembles in appearance.

Vomer Cuvier and Valenciennes

Vomer setapinnis setapinnis (Mitchill)

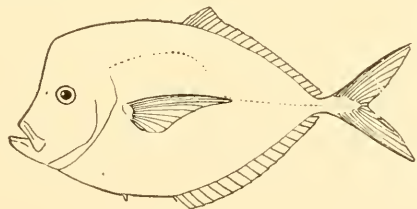
Moonfish: corcobado

Zeus setapinnis Mitchill, 1815, Trans. Lit. and Philos. Soc. N. Y. for 1815, p. 384.

Vomer setapinnis Cope, 1871, Trans. Amer. Phil. Soc., Vol. XIV, p. 472. St. Croix.

Vomer setapinnis setapinnis Nichols, 1918, Bull. Amer. Mus. Nat. Hist., Vol. XXXVIII, p. 669-676. Porto Rico.

FIG. 95.—*Vomer setapinnis*
From Zoologica, IX



Type locality.—New York.

Distribution.—Cape Cod (casually Maine) to the West Indies. Recorded from Porto Rico and St. Croix.

Diagnosis.—Head 3.2 to 3.3; depth 2 in adult, 1.2 to 1.8 in young. Dorsal VIII-I, 21 or 22; anal II-I, 19 or 20; scutes 20

Remarks.—There is doubt whether one or both forms of *Vomer setapinnis* occur in Porto Rican waters. In recording *V. setipinnis* from St. Croix, Cope, 1871, presumably did not differentiate between the races. Nichols, 1918, refers small specimens from Porto Rico to *V. s. setapinnis*, but there is a chance of error due to the small size of the specimens examined. Evermann and Marsh were correct in their reference of Porto Rican material to *V. gabonensis* Jordan and Evermann, if the measurements given are based on some of their larger specimens from that region. Both forms apparently occur in Cuba (Nichols, 1912, Bull. Amer. Mus. Nat. Hist., Vol. XXXI, p. 186), and probably also in Porto Rico.

***Vomer setapinnis cubensis* Nichols**

Deep moonfish; corcobado

Vomer setapinnis cubensis Nichols, 1918, Bull. Amer. Mus. Nat. Hist., Vol. XXXVIII, p. 672.

Vomer gabonensis Jordan and Evermann, 1896, Bull. U. S. Nat. Mus., Vol. XLVII, Pt. 1, p. 934, not of Guichenot.

Vomer gabonensis Evermann and Marsh, 1902, p. 133.

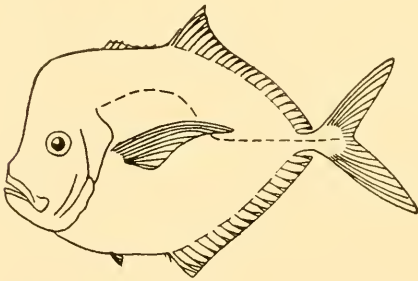


FIG. 96.—*Vomer setapinnis cubensis*
From Zoologica, X

Type locality.—Cuba.

Distribution.—West Indies, probably (this form) to Brazil. Common about Porto Rico.

Diagnosis.—Head 2.7 to 2.8; depth 1.5 to 1.6 (specimens 4 to 6 inches standard length); eye 3.8. Dorsal VIII-I, 22; anal I, 18; scales minute. In Porto Rico the moonfish attains the weight of a pound or more.

Remarks.—The moonfish is one of the compressed, silvery *Caranx*-like fishes, deep-bodied, particularly when young, at which stage it drifts widely in ocean currents. It is much used for food.

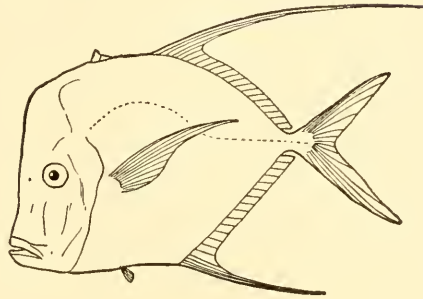
Selene Lacepede**Selene vomer** (Linnaeus)

Angel moonfish; silver angelfish; jorobado

Zeus vomer Linnaeus, 1758, Syst. Nat., ed. 10, p. 266.

Selene vomer Evermann and Marsh, 1902, p. 135, Fig. 34 and 35.

FIG. 97.—*Selene vomer*
From Zoologica, IX



Type locality.—"America."

Distribution.—Both coasts of tropical America, from Cape Cod to Brazil, and from Lower California to Peru. Included in the Porto Rican list on the authority of Poey and Stahl.

Diagnosis.—Head 3; depth 1.5 (the young much deeper); eye 2.5 in preorbital (4 in head, obliquely); scales minute, lateral line wholly unarmed. Dorsal VII-I, 23; anal II-I, 18. Soft dorsal and anal lobes produced, more or less filamentous.

Young have elongate ventrals and some of the dorsal spines filamentous, both fins becoming reduced with age; but the lobes of the dorsal and the anal are relatively longest in the adult. Attains a total length of about a foot and a weight of about 2 pounds.

Remarks.—A delicious panfish.

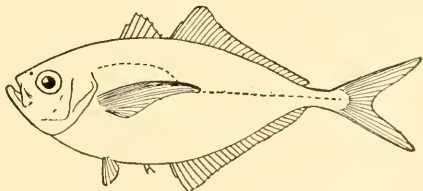
Chloroscombrus Girard**Chloroscombrus chrysurus** (Linnaeus)

bumper; casabe

Scomber chrysurus Linnaeus, 1766, Syst. Nat., ed. 12, p. 494.

Chloroscombrus chrysurus Evermann and Marsh, 1902, p. 136, Fig. 36.

FIG. 98.—*Chloroscombrus chrysurus*
From Zoologica, IX



Type locality.—Charleston, S. C.

Distribution.—West Indian fauna, Cape Cod to Brazil, common on the south Atlantic coast of the United States and about Cuba, apparently not common in Porto Rican waters.

Diagnosis.—Head 3.7 to 3.8; depth 2.3 to 2.4; eye about 3. Dorsal VIII-I, 26; anal II-I, 26; lateral line unarmed. Curve of the abdomen greater than that of the back. Attains a length of about 10 inches.

Remarks.—Not valued as food, the flesh being thin and dry, the bones large.

Trachinotus Lacepede

Trachinotus glaucus (Bloch)

Gaff-topsail pompano; palometa

Chaetodon glaucus Bloch, 1787, *Ausl. Fische*, and *Ichth.*, Pl. 210; based on a drawing by Plumier.

Trachinotus glaucus Evermann and Marsh, 1902, p. 137, Fig. 37.

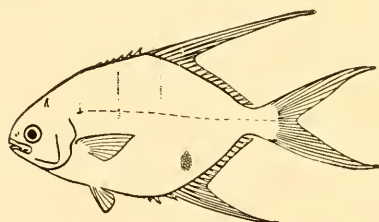


FIG. 99.—*Trachinotus glaucus*
From *Zoologica*, X

Type locality.—Martinique.

Distribution.—West Indian fauna, from Virginia to the Caribbean. Common from the Carolinas to Florida; common in Porto Rican waters. St. Croix.

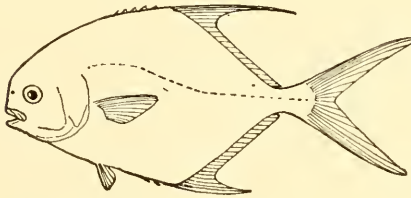
Specimens seen.—San Juan.

Diagnosis.—Head 4; depth 2 to 2.2; eye 3.6. Dorsal I (procumbent) VI-I, 19; anal II-I, 17 to 18; scales fine. Body much compressed; sides with narrow black cross-bars; lobes of vertical fins elongate, extending past middle of caudal fin in adult. Attains a length of a foot or more.

Remarks.—In Porto Rico the gaff-topsail pompano seems to rank with the species of *Caranx* in food value. It is not much prized for food elsewhere.

Trachinotus falcatus (Linnaeus)

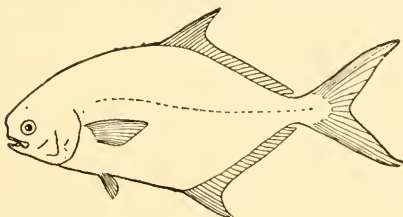
Round pompano; palometa

Labrus falcatus Linnaeus, 1758, Syst. Nat., ed. 10, p. 284.*Trachinotus falcatus* Evermann and Marsh, 1902, p. 138, Fig. 38.*Chaetodon rhomboides* Bloch, 1787, Ich., Pl. 209. Martinique.*Trachinotus rhomboides* Cope, 1871. Trans. Amer. Phil. Soc., Vol. XIV, p. 472. St. Croix.FIG. 100.—*Trachinotus falcatus*
From Zoologica, IX*Type locality*.—"America."*Distribution*.—West Indian fauna, Cape Cod to Brazil, common southward; apparently only the young are carried by the Gulf Stream as far north as Woods Hole, Massachusetts. Common in Porto Rican waters and about the Virgin Islands.*Specimens collected*.—1 young: Mouth of the Loiza River.*Diagnosis*.—Head 3.2 to 3.6; depth 1.6; eye 3.2 to 3.9. Dorsal VI-I, 19 to 20; anal II-I, 17 to 18; scales fine. Body moderately compressed; sides unmarked. Lobes of vertical fins extending not quite to base of caudal, or the dorsal lobe to middle of caudal. Attains a weight of about 3 pounds.*Remarks*.—A West Indian race, *T. f. rhomboides* (Bloch), with higher vertical fins, may be differentiable, in which case the Porto Rican fish should be referable to it.

Generally regarded as a fair food fish, and held in considerable esteem as such in Porto Rico.

Trachinotus carolinus (Linnaeus)

Common pompano

Gasterosteus carolinus Linnaeus, 1766, Syst. Nat., ed. 12, p. 490.*Trachinotus carolinus* Evermann and Marsh, 1902, p. 139.FIG. 101.—*Trachinotus carolinus*
From Zoologica, IX

Type locality.—Carolina.

Distribution.—South Atlantic and Gulf coasts of the United States, north on sandy shores as far as Cape Cod; rare in the West Indies and Brazil. Young plentiful in Porto Rican waters, but grown fish are rare.

Diagnosis.—Head 3.5; depth 2.3 to 2.4; eye 4.1. Dorsal VI-I, 24; anal II-I, 22; scales fine. Attains a total length of at least 18 inches and a weight of 2 pounds.

Remarks.—The common pompano is abundant in the southern United States, and is generally recognized as one of the choicest American food fishes.

The young are common much farther north along the coast, being doubtless carried northward in the Gulf Stream drift, than are grown fish. The occurrence of young fish in a similar manner about Porto Rico might be taken as evidence of Gulf Stream water eddying eastward north of the Greater Antilles.

NOMEIDAE

Nomeus Cuvier

Nomeus gronovii (Gmelin)

Man-of-war fish; pastor

Gobius gronovii Gmelin, 1788, Syst. Nat., ed. 13, p. 1205; after Gronow.

Nomeus gronovii Nichols, 1915, Bull. Amer. Mus. Nat. Hist., Vol. XXXIV, p. 143. Porto Rico.

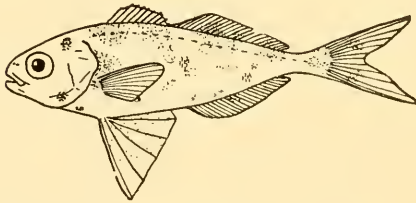


FIG. 102.—*Nomeus gronovii*
From Zoologica, IX

Type locality.—Tropical America.

Distribution.—Tropical Atlantic, north to Florida and Bermuda, occasionally to Woods Hole, Massachusetts. Probably common with the *Physalia* as they drift in upon Porto Rico and the Virgin Islands from the open sea.

Specimens collected.—1: off the mouth of the Loiza River.

Diagnosis.—Dept 3.8; head 3.4; eye 3.2. Dorsal X-I, 26; anal III, 26; scales fine, no scutes on peduncle. Dark bands on sides, which break up into spots or blotches in preservative; ventrals large and black. Attains a maximum total length of 6 or 8 inches.

Habits.—Almost always closely associated with the communal, stinging jellyfish, *Physalia*, the Portuguese man-of-war, finding shelter in proximity to its dangerous tentacles.

STROMATEIDAE

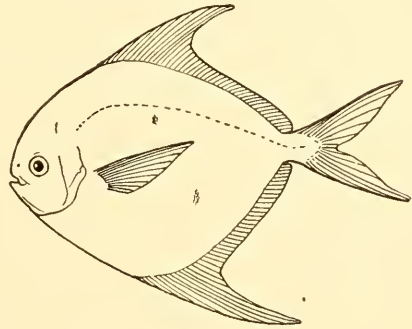
Peprilus Cuvier

Peprilus paru (Linnaeus)

Harvest-fish; palometa

Stromateus paru Linnaeus, 1758, Syst. Nat. ed. 10, p. 248; based on Sloane.
Peprilus paru Evermann and Marsh, 1902, p. 141, Fig. 39.

FIG. 103.—*Peprilus paru*
 From Zoologica, IX



Type locality.—Jamaica.

Distribution.—Cape Cod to Brazil. Apparently not common in Porto Rican waters.

Diagnosis.—Head 3.6; depth 1.5; eye 3. Dorsal III, 42; anal II, 39; scales about 90. Body sub-circular; dorsal and anal fins much elevated in front (falcate); caudal deeply forked. Attains a length of 8 inches and a weight of ½ pound or more.

Remarks.—A delicious pan-fish.

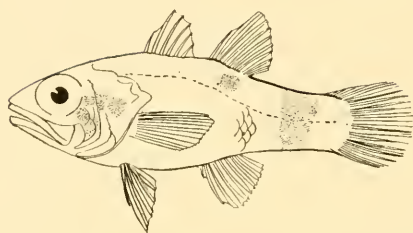
CHEILODIPTERIDAE

Apogon Lacepede

Apogon sellicauda Evermann and Marsh

Saddle-tailed cardinal-fish

Apogon sellicauda Evermann and Marsh, 1902, Bull. U. S. Fish Comm, for 1900, Vol. XX, Pt. 1, p. 143, Fig. 40.

FIG. 104.—*Apogon sellicauda*

Type locality.—Culebra Island, Porto Rico.

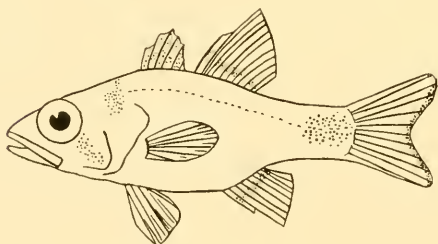
Distribution.—Known from Porto Rico, and the Tortugas, Fla.; few specimens recorded.

Diagnosis.—Head 2.6 to 2.9; depth 3 to 3.1; eye 2.7. Dorsal VI-I, 9; anal II, 7 to 8; scales 27 to 29. A broad, dark, saddle-like blotch on caudal peduncle, black spot below soft dorsal, and blackish band behind eye. Total length $1\frac{1}{2}$ to $3\frac{1}{2}$ inches.

Apogon conklini (Silvester)

Conklin's cardinal-fish

Amia conklini Silvester, 1916, Yearbook Carn. Inst. Wash., for 1915, Vol. XIV, p. 215.

FIG. 105.—*Apogon conklini*

Type locality.—Coral reef off Guanica Harbor, Porto Rico.

Distribution.—Known only from the type locality.

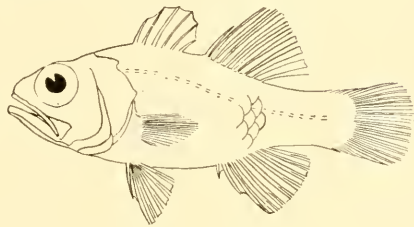
Diagnosis.—Head 2.6; depth 2.7; eye 2.6 (in specimen 2 inches long). Dorsal VI, I, 9; anal II, 8 to 10; scales 27. Orange red, with clusters of small black spots over entire body. Peduncle with a large oblong black spot; caudal edged with black; spinous dorsal, black; soft dorsal and anal with black bar on base; a black bar downward and backward on front of preopercle from eye; another transversely on nape and down on opercle. Length about 2 inches.

Remarks.—There are only two specimens known.

Apogonichthys Bleeker**Apogonichthys alutus** (Jordan and Gilbert)

Freckled cardinal-fish

Apogon alutus Jordan and Gilbert, 1882, Proc. U. S. Nat. Mus. for 1882, p. 279.
Apogonichthys alutus Evermann and Marsh, 1902, p. 144, Fig. 41.

FIG. 106.—*Apogonichthys alutus*

Type locality.—Snapper banks off west coast of Florida.

Distribution.—West coast of Florida at a depth of 20 to 50 fathoms. One record from Porto Rico in shallow water.

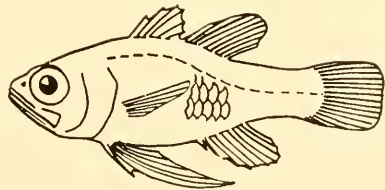
Diagnosis.—Head 2.4; depth 2.7 to 2.8; eye 3. Dorsal VI-I, 9; anal II, 9; scales 22. Ventrals short, not reaching vent. Length 2 inches.

Remarks.—Specimens of this fish were taken from the stomachs of red snappers in Florida.

Apogonichthys stellatus Cope

Spot-finned cardinal-fish

Apogonichthys stellatus Cope, 1866, Trans. Amer. Philos. Soc. for 1866, p. 400.
Apogonichthys stellatus Silvester, 1916, Yearb. Carn. Inst. Wash. for 1915, Vol. XIV, p. 215. Porto Rico.

FIG. 107.—*Apogonichthys stellatus*
From Zoologica, X

Type locality.—Nassau, Bahamas.

Distribution.—West Indies, Bahamas and Florida Keys; seldom met with though probably not rare. Almost every sea-urchin skeleton in a small muddy area west of Guanica Harbor, P. R., was inhabited by one of these fishes (Silvester).

Diagnosis.—Head 3; depth 3; eye 2.8. Dorsal VII. I, 9; anal II, 8; scales 23. Ventrals long, extending beyond front of anal. Reddish

brown, with dark brown and silvery spots on the scales. Length about 1 inch.

Habits.—Found living in the mantle cavity of conchs, and in the cavities of large sponges (Gudger). Also inhabits empty shells, etc.

CENTROPOMIDAE

Centropomus Lacepede

Centropomus undecimalis (Bloch)

Common snook; robalo

Sciæna undecimalis Bloch, 1792, *Ausl. Fische*, and *Ichth.*, Vol. VI, p. 60, Pl. 303.

Centropomus undecimalis Evermann and Marsh, 1902, p. 146, Fig. 42.

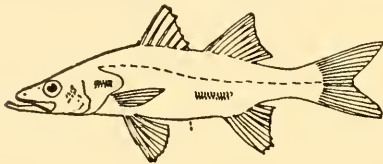


FIG. 108.—*Centropomus undecimalis*
From *Zoologica*, X

Type locality.—Jamaica.

Distribution.—Florida to the West Indies and South America. Common in Porto Rican waters.

Specimens seen.—San Juan Market.

Diagnosis.—Head 3; depth 4.2 to 4.3; eye 7.7 to 7.8. Dorsal VII or VIII-I, 10; anal III, 6; scales 75. Preorbital entire or very slightly serrated; second anal spine projecting beyond third, about 1.9 in head. Head pointed, forehead low, lower jaw much projecting; caudal moderately forked. Attains a length of 2 or 3 feet, or more.

Remarks.—An excellent food fish.

Centropomus parallelus Poey

River snook, robalo

Centropomus parallelus Poey, 1860, *Memorias*, Vol. II, p. 120.

Centropomus parallelus Evermann and Marsh, 1902, p. 146.

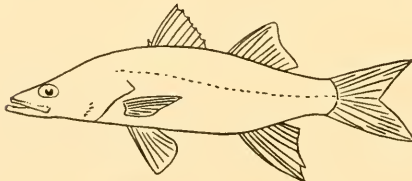


FIG. 109.—*Centropomus parallelus*

Type localities.—Havana and Ceinfuegos.

Distribution.—Found about Cuba, Santa Domingo, Porto Rico and at Pernambuco, Brazil, ascending rivers into fresh water. Rather com-

mon in Porto Rico, where it ascends the larger streams well towards the interior of the island.

Diagnosis.—Head 2.7; depth 3.3 to 3.4; eye 5.7. Dorsal VIII-I, 10; anal III, 7; scales 80. Preorbital with well developed retrose teeth; second anal spine longer than third, equal to depth of body. Rarely exceeds a foot in length.

Remarks.—With *Centropomus undecimalis* this fish possesses game qualities and is sought by local anglers. The best fishing is said to be in the lower portions of the Rio de la Plata, Monati and the Rio Grande de Arecibo.

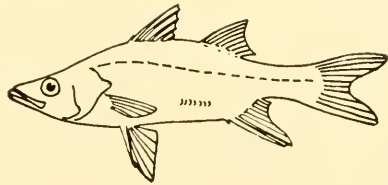
Centropomus pectinatus Poey

Comb-toothed snook; robalo

Centropomus pectinatus Poey, 1860, Memorias. Vol. II, p. 122.

Centropomus pectinatus Silvester, 1916, Yearb. Carn. Inst. Wash. for 1915, Vol. XIV, p. 216. Porto Rico.

FIG. 110.—*Centropomus pectinatus*
From Zoologica, X



Type localities.—Havana and Cienfuegos.

Distribution.—Cuba to Porto Rico and Pernambuco, Brazil, entering lakes and rivers; also the Pacific coast of tropical America. Recorded from Guanica Lake, P. R., by Silvester.

Diagnosis.—Head 2.5; depth 2.7 to 2.8; eye 6. Dorsal VIII-I, 10; anal III, 7; scales 68. Preorbital with well-developed retrose teeth; lateral line not in a dark streak; second and third anal spines about equal to depth of body; angle of preopercle with about 6 comblike teeth. Rarely more than a foot long.

SERRANIDAE

Petrometopon Gill

Petrometopon cruentatus cruentatus (Lacepede)

Red hind; coney; cabrilla; enjambre

Sparus cruentatus Lacepede, 1803, Hist. Nat. Poiss., Vol. IV, p. 157, Pl. 4,

Fig. 1; based on a copy of a drawing by Plumier.

Petrometopon cruentatus Evermann and Marsh, 1902, p. 149.

Type locality.—Martinique.

Distribution.—West Indian fauna, Florida to Brazil. Common about Jamaica and Cuba, but apparently uncommon in Porto Rican waters.

Specimens collected.—1: Santurce, San Juan.

Diagnosis.—Head 2.5; depth 2.8; eye 5.5. Dorsal IX, 14; anal III, 8; scales 85 to 95. Mandible without curved canines on its sides. Reddish gray in life, with small red spots nearly everywhere. Attains a length of about a foot.

Remarks.—The coney is of considerable importance as a food fish.

***Petrometopon eruentatus coronatus* (Cuvier and Valenciennes)**

Brown hind, petite negre

Serranus coronatus Cuvier and Valenciennes, 1928, Hist. Nat. Poiss., II, p. 371.

Serranus coronatus Cope, 1871, Trans. Amer. Phil. Soc., Vol. XIV, p. 466. St. Croix.

Petrometopon eruentatus coronatus Jordan and Evermann, 1896, Bull. U. S. Nat. Mus., Vol. XLVII, Pt. 1, p. 1142.

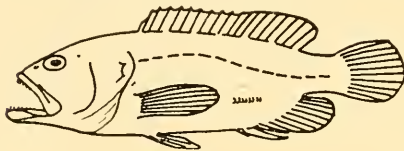


FIG. 111.—*Petrometopon eruentatus coronatus*

From Zoologica, X

Type locality.—Martinique.

Distribution.—Generally common in the West Indies, north to Key West. Not common in Porto Rican waters or recorded from the island of Porto Rico, but known from St. Croix.

Diagnosis.—A shallow water representative of the red hind or coney, differing from it in color. Pale or dusky olive with orange red spots, the head decidedly greenish.

***Cephalopholis* Bloch and Schneider**

***Cephalopholis fulvus ruber* (Bloch and Schneider)**

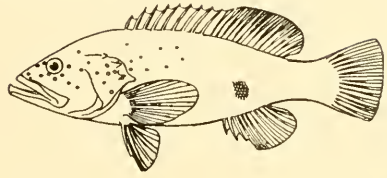
Red guativere; fino; ouatilibi

Gymnocephalus ruber Bloch and Schneider, 1801, Syst. Ichth., p. 346, Pl. 67; based on *Caranxa* of Maregrave.

Bodianus ruber Evermann and Marsh, 1902, p. 150.

Cephalopholis fulvus (*Labrus fulvus* Linnaeus, 1758, Syst. Nat., 10th ed., p. 287. Bahamas) Meek and Hildebrand, 1925, Fishes of Panama, Pt. 2.

FIG. 112.—*Cephalopholis fulvus ruber*
From Zoologica, X



Type locality.—Brazil.

Distribution.—West Indies to Brazil, usually at moderate depths. Not common in Porto Rican waters, but recorded from there and also from St. Croix.

Diagnosis.—Head 2.6; depth 3; eye 5.3. Dorsal IX, 15; anal III, 9; scales 90 to 110. Color in life, rich red, with small blue spots, especially in front. Length about a foot.

Remarks.—*Cephalopholis ruber* and *punctatus* are best considered races of *C. fulvus*; *fulvus* is probably the deepest water and *punctatus* the shore form. A good food-fish.

***Cephalopholis fulvus punctatus* (Linnaeus)**

Black guativere; nigger-fish

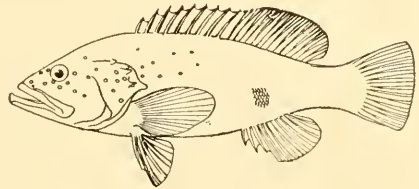
Perca punctata Linnaeus, 1758, Syst. Nat., ed. 10, p. 291; based on Catesby.

Bodianus punctatus Evermann and Marsh, 1902, p. 150, Fig. 106.

Cephalopholis fulvus (*Labrus fulvus* Linnaeus, 1758, Syst. Nat. ed. 10, p. 287.

Bahamas) Meek and Hildebrand, 1925, Fishes of Panama, Pt. 2.

FIG. 113.—*Cephalopholis fulvus punctatus*
From Zoologica, X



Type locality.—Bahamas.

Distribution.—West Indies, north to Florida, generally common. Not common in Porto Rican waters.

Diagnosis.—Brownish or blackish olive, with small blue spots, especially in front. Otherwise as in *C. f. ruber*. Length about a foot.

***Epinephelus* Bloch**

***Epinephelus adscensionis* (Osbeck)**

Rock-hind; cabra mora

Trachinus adscensionis Osbeck, 1757, Iter Chin., etc., English edition, 1771, p. 96.

Epinephelus adscensionis Evermann and Marsh, 1902, p. 152, Pl. 11.

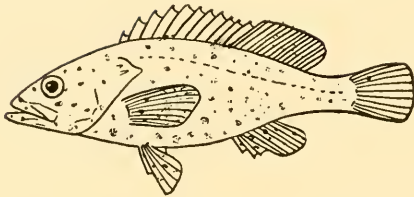


FIG. 114.—*Epinephelus adscensionis*
From Zoologica, IX

Type locality.—Ascension Island.

Distribution.—Southern Florida to Brazil, Ascension and St. Helena Island and the Cape of Good Hope. Should be common in Porto Rican waters, though there are not many records from there.

Diagnosis.—Head 2.4; depth 3.2; eye 6. Dorsal XI, 16 to 17; anal III, 8; scales about 100. Maxillary without scales; body and head in life covered with red or orange spots, and with larger pale spots also present on the body. May attain a maximum length of 2 feet or more and a weight of 15 or 16 pounds, but is usually much smaller and as a rule only 2 or 3 pounds in weight.

***Epinephelus striatus* (Bloch)**

Nassau grouper; cherna criolla

Anthias striatus Bloch, 1792, *Ausl. Fische. and Ichth.*, Pl. 324.
Epinephelus striatus Evermann and Marsh, 1902, p. 152, Pl. 12.

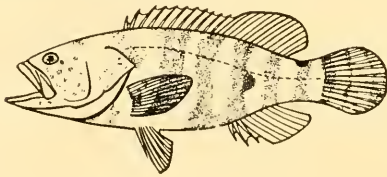


FIG. 115.—*Epinephelus striatus*
From Zoologica, X

Type locality.—Martinique.

Distribution.—West Indian fauna, Florida Keys to Brazil. Common in Porto Rican waters. St. Croix.

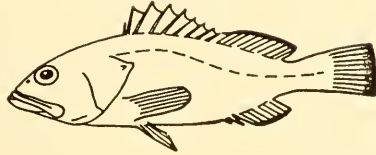
Specimens seen.—San Juan and Ponce Markets.

Diagnosis.—Head 2.5; depth 3; eye 5.5. Dorsal XI, 17; anal III, 8; scales about 110. Caudal peduncle with a large saddle-like black blotch above; eye surrounded by conspicuous dark brown points; lower jaw little projecting; maxillary more or less scaly. Attains a weight of 50 to 60 pounds, but Porto Rico specimens average less than 10 pounds.

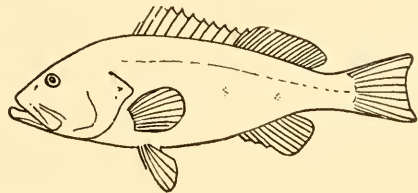
Remarks.—A common and very important food fish. In Porto Rico it is taken with hook and line.

Epinephelus guttatus (Linnaeus)

Red-hind; mero guajiro; cabrilla

Perca guttata Linnaeus, 1758, Syst. Nat., ed. 10, p. 292.*Epinephelus guttatus* Evermann and Marsh, 1902, p. 153, Pl. 13.FIG. 116.—*Epinephelus guttatus*
From Zoologica, X*Type locality*.—Brazil?*Distribution*.—West Indian fauna, from the Carolinas to Brazil. Generally distributed in Porto Rican waters.*Specimens seen*.—Ponce Market.*Diagnosis*.—Head 2.5; depth 3.2; eye 4.3. Dorsal XI, 16; anal III, 8; scales 100 to 120. Body covered with small dark-orange or brown spots; maxillary more or less scaly. Rarely attains a greater length than 18 inches.*Remarks*.—One of the smallest of the groupers but an important food fish.**Epinephelus morio** (Cuvier and Valenciennes)

Red grouper; cherna americana; jabouccillo

Serranus morio Cuvier and Valenciennes, 1828, Hist. Nat. Poiss., Vol. II, p. 285.*Epinephelus morio* Evermann and Marsh, 1902, p. 154, Pl. 14.FIG. 117.—*Epinephelus morio*
From Zoologica, IX*Type localities*.—New York and Santo Domingo.*Distribution*.—Atlantic coast of America from Virginia to Rio Janeiro. Probably common in Porto Rican waters.*Diagnosis*.—Head 2.5; depth 2.7; eye 5.5. Dorsal XI, 16; anal III, 9; scales 130 to 140. Second dorsal spine elevated, the longest. Gray or brown, blotched with whitish, with more or less salmon color or reddish shades about the lower part of the head and breast. Attains a length of 2 or 3 feet and a weight of from 20 to 25 pounds, or sometimes even 40 pounds. At Key West the average is 8 to 15 pounds.

Remarks.—An important food fish.

Habits.—A voracious fish; an individual 22 inches long is reported to have been taken with a 11½-inch snapper it had swallowed; 3½ inches of the tail of the snapper protruded from the oesophagus into the mouth of the grouper.

Alphestes Bloch and Schneider

Alphestes chloropterus (Cuvier and Valenciennes)

Guaseta

Plectropoma chloropteron Cuvier and Valenciennes, 1828, Hist. Nat. Poiss., Vol. II, p. 398.

Alphestes chloropterus Evermann and Marsh, 1902, p. 155, Fig. 44.

Alphestes afer Meek and Hildebrand, 1925, Fishes of Panama, Pt. 2.

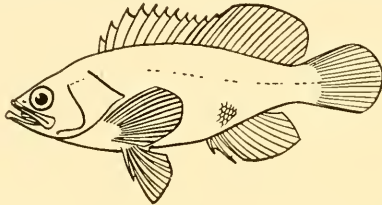


FIG. 118.—*Alphestes chloropterus*
From Zoologica, X

Type locality.—Santo Domingo and Martinique.

Distribution.—West Indian fauna from Cuba to Brazil, not known from Florida. Perhaps the same as an African species. Apparently not uncommon in Porto Rican waters.

Specimens collected.—1: Ponce Market.

Diagnosis.—Head 2.6; depth 2.7; eye 4.6. Dorsal XI, 18; anal III, 9; scales 75 to 85. Eye close to end of snout, over the mouth; lower jaw projecting. Grows to a foot or more in length.

Remarks.—A food fish of importance.

Myeteroperca Gill

Myeteroperca bonaci (Poey)

Black rockfish; black grouper; Bonaci acara; Aguaji

Serranus bonaci Poey, 1860, Memorias, Vol. II, p. 129.

Myeteroperca bonaci Evermann and Marsh, 1902, p. 157.

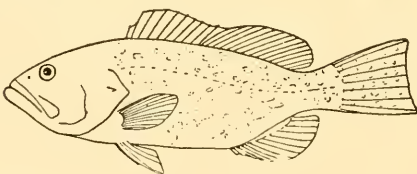


FIG. 119.—*Myeteroperca bonaci*
From Zoologica, IX

Type locality.—Cuba.

Distribution.—West Indian fauna, Florida to Brazil. Probably not uncommon in Porto Rican waters.

Diagnosis.—Head 2.7 to 2.8; depth 3.2 to 3.3; eye 6 (in young). Dorsal XI, 16 to 18; anal III, 11 or 12; scales 120 to 125. About 10 gill-rakers, besides several rudiments, on the lower limb of the first arch. Caudal subtruncate. Dark blotches on body rather large, often quadrate. Attains a length of from 2 to 3 feet and a weight of 50 pounds.

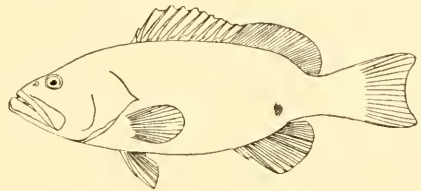
Remarks.—An important food fish.

***Mycteroperca bowersi* Evermann and Marsh**

Commissioner Bowers' rockfish

Mycteroperca bowersi Evermann and Marsh, 1902, Bull. U. S. Fish Comm. for 1900, Vol. XX, Pt. 1, p. 158, Fig. 45.

FIG. 120.—*Mycteroperca bowersi*



Type locality.—Culebra Island, P. R.

Distribution.—Porto Rico in the neighborhood of Culebra and Vieques islands. Also recorded from the Tortugas, Fla. (Gudger).

Diagnosis.—Head 2.4 to 2.8; depth 3.2 to 3.4; eye 7.5. Dorsal XI, 16; anal III, 11; scales about 140. Nostrils close together, the posterior decidedly the larger. About 12 gill-rakers on the lower limb of first arch.

Remarks.—This fish seems to be well known to the fisherman about Culebra and Vieques islands, and to be held in high esteem as a valuable food fish, though Evermann and Marsh had only the type specimen from which to describe the species. A somewhat larger specimen from the Tortugas was 2 feet 10 inches in total, and 2 feet 5 inches in standard length, and weighed 21 pounds (Gudger).

Hypoplectrus Gill**Hypoplectrus unicolor chlorurus** (Cuvier and Valenciennes)

Vaca ; petit-nègre

Plectropoma chlorurum Cuvier and Valenciennes, 1828, Hist. Nat. Poiss., Vol. II, p. 406.

Plectropoma chlorurum Cope, 1871, Trans. Amer. Phil. Soc. Vol. XIV, p. 466. St. Croix.

Hypoplectrus unicolor chlorurus Jordan and Evermann, 1896, Bull. U. S. Nat. Mus., Vol. XLVII, Pt. 1, p. 1193.

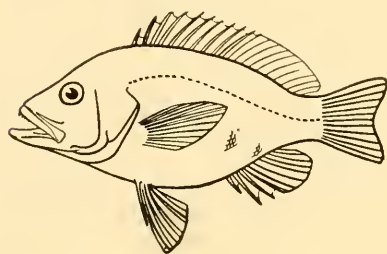


FIG. 121.—*Hypoplectrus unicolor*
From Zoologica, X

Type locality.—Martinique.

Distribution.—Range of *H. unicolor*: West Indies, north to the Florida Keys; known from St. Croix but not from Porto Rico.

Diagnosis.—Head 2.7 to 3; depth 2 to 2.3; eye 3.5 to 4. Dorsal X, 14 or 15; anal III, 8; scales 80 to 92 (pores 52 to 60). Black with violet shades, pectoral and caudal abruptly bright yellow. This species attains a length of about a foot, but is usually small.

Remarks.—There are several well-marked color-phases of *H. unicolor*, which may occur at different points in the range of the species. Some may be nothing but color-phases, others distinct species, others geographical races; but in our present state of knowledge it is best to regard them as ecological races and follow Jordan and Evermann in according them subspecific rank.

Hypoplectrus unicolor guttavarius (Poey)

Vaca ; petit-nègre

Plectropoma guttavarium Poey, 1851, Memorias, Vol. I, p. 70.

Plectropoma guttavarium Cope, 1871, Trans. Amer. Phil. Soc., Vol. XIV, p. 466, St. Croix.

Hypoplectrus unicolor guttavarius Jordan and Evermann, 1896, Bull. U. S. Nat. Mus., Vol. XLVII, Pt. 1, p. 1193.

Type locality.—Havana.

Distribution.—Range of *H. unicolor*: West Indies north to the Florida Keys, known from St. Croix but not from Porto Rico.

Diagnosis.—Body yellow anteriorly, black posteriorly; fins orange. A blue black stripe or spot in front of eye, ocellated with sky blue; caudal peduncle very dark above. Otherwise as in the preceding form, to which the reader is referred. This species may attain a length of about a foot, but is usually small.

Diplectrum Holbrook

Diplectrum radiale (Quoy and Gaimard)

Aguavina

Serranus radialis Quoy and Gaimard, 1824, Voyage Uranie, p. 316.

Diplectrum radiale Evermann and Marsh, 1902, p. 159.

Type locality.—Rio Janeiro.

Distribution.—Both coasts of tropical America, north to Havana and Guayamas, very common on the coast of Brazil and in the Gulf of California, usually in shallow bays. Apparently not common in Porto Rican waters.

Diagnosis.—Head 2.8; depth 3.8; eye 3.7 to 3.8. Dorsal X, 12; anal III, 7; scales 70. Ventrals inserted more or less in advance of the axil of the pectoral, well separated; caudal fin lunate, none of the dorsal spines elongate. Preopercle with numerous spines at its angle, diverging from a single center. About 10 gill-rakers on the lower limb of the first arch.

Prionodes Jenyns

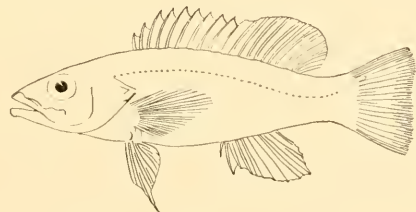
Prionodes baldwini Evermann and Marsh

Baldwin's serranid

Prionodes baldwini Evermann and Marsh, 1899, Report U. S. Fish Comm. for 1899, p. 353.

Prionodes baldwini Evermann and Marsh, 1902, p. 160, Pl. 15.

FIG. 122.—*Prionodes baldwini*



Type locality.—Off Culebra Island, Porto Rico.

Distribution.—Known only from Porto Rico. A number of specimens taken at the type locality, in about 15 fathoms of water.

Diagnosis.—Head 2.5; depth 3.2; eye 4. Dorsal X, 12; anal III, 7; scales 42. Eye longer than snout. About 6 gill-rakers on the lower limb of the first arch. Caudal truncate. Preopercle simply, and rather finely serrate; ventrals inserted more or less in advance of axil of pectoral; none of the dorsal spines elongate. Upper parts scarlet, lower parts bluish white; a yellow lateral band, under which are 4 quadrate black blotches. A small species, about 2 inches long so far as known.

Dules Cuvier

Dules dispilurus (Günther)

Mottled sea-basslet

Centropristis dispilurus Günther, 1867, Proc. Zool. Soc. Lond., p. 99.

Dules dispilurus Evermann and Marsh, 1902, p. 162.

Eudulus dispilurus Beebe and Tee Van, 1928, Zoologica, Vol. X (1), p. 142.

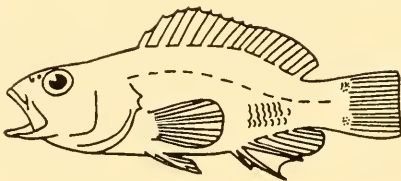


FIG. 123.—*Dules dispilurus*
From Zoologica, X

Type locality.—Trinidad.

Distribution.—West Indian fauna, Porto Rico to Trinidad. Apparently not plentiful about Porto Rico.

Diagnosis.—Head 2.4; depth 2.7 to 2.8; eye 4.2. Dorsal X, 12; anal III, 7; scales 44. Third dorsal spine not longer than fourth, its length contained 3 times in that of the head. Ventrals inserted more or less in advance of axil of pectoral; caudal fin truncate. A broad white area or bar before the anal fin; pectoral red; inky blotch on soft dorsal small or obsolete; dusky bars on body distinct. A small species, 2 or 3 inches long.

Habits.—Usually hiding about weed in shallow water, but also descending to considerable depths on rocky bottoms.

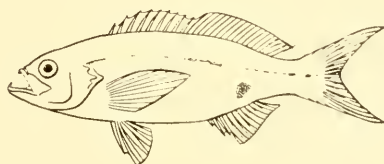
Paranthias Guichenot**Paranthias furcifer** (Cuvier and Valenciennes)

Creole fish; rabirubia de lo alto

Serranus furcifer Cuvier and Valenciennes, 1828, Hist. Nat. Poiss., Vol. II, p. 264.

Paranthias furcifer Jordan and Evermann, 1896, Bull. U. S. Nat. Mus., Vol. XLVII, Pt. 1, p. 1221.

Brachyrhinus creolus Cope, 1871, Trans. Amer. Phil. Soc., Vol. XIV, p. 465, St. Croix.

FIG. 124.—*Paranthias furcifer*

Type locality.—Brazil.

Distribution.—Both coasts of tropical America, Cuba to Brazil, Cape San Lucas to the Galapagos. Recorded from St. Croix by Cope.

Diagnosis.—Head 3.7; depth 3; eye about 4. Dorsal IX, 18 to 20; anal III, 9 or 10; scales 120 to 135. Spinous and soft portions of the dorsal fin united. Maxillary without a supplemental bone. Gill-rakers long, slender and close set. Lateral line complete and continuous. Caudal deeply forked. Adult red with a few small violet spots.

Remarks.—A very beautiful fish, usually uncommon.

Rypticus Cuvier**Rypticus saponaceus** (Bloch and Schneider)

Soapfish

Anthias saponaccus Bloch and Schneider, 1801, Syst. Ichth., p. 310; after Parra.

Rypticus saponaccus Evermann and Marsh, 1902, p. 163.

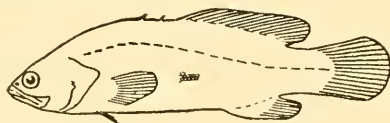
Type locality.—Havana.

Distribution.—Tropical Atlantic from Pensacola, Fla., to West Africa, and from the West Indies to Brazil. Included in the Porto Rican list on the authority of Poey; also recorded from St. Croix.

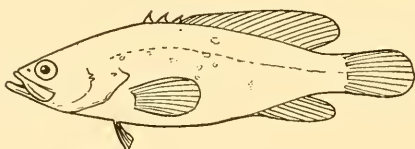
Diagnosis.—Head 3 to 3.4; depth 2.6 to 3.3; eye about 4.5. Dorsal III, 23 to 25; anal 16 or 17; scales fine, 85 to 90 pores. Preopercle with 2 spines only, lower scarcely the longer; 3 opercular spines well developed. Caudal rounded. Lower jaw projecting, eye placed anteriorly over the end of the long maxillary, not greater than snout in length. Color chiefly olivaceous, not red.

Rypticus coriaceus (Cope)

Black soap-fish

Eleutheractis coriaceus Cope, 1871, Trans. Amer. Phil. Soc., p. 467.*Rypticus coriaceus* Evermann and Marsh, 1902, p. 163.FIG. 125.—*Rypticus coriaceus*
From Zoologica, X*Type locality*.—St. Martins.*Distribution*.—A West Indian species, known from St. Martin's to Jamaica, not common about Porto Rico or elsewhere.*Diagnosis*.—Head 3.3; depth 3.5; eye 5. Dorsal III, 25; anal 15; scales 125. Preopercle with 2 spines only, the lower scarcely the longer; opercular spines 2, small, the uppermost the smaller. Color brown, dark on the back; fins dark; a white line from lower lip to occiput. Size small, from 5 to 6 inches long.**Rypticus bistrispinus** (Mitchill)

Northern soap-fish

Bodianus bistrispinus Mitchill, 1818, Amer. Month. Mag. and Crit. Rev., Vol. II, p. 247.*Rypticus bistrispinus* Evermann and Marsh, 1902, p. 163, Fig. 46.FIG. 126.—*Rypticus bistrispinus*
From Zoologica, IX*Type locality*.—Bahama Straits.*Distribution*.—West Indian fauna, north to South Carolina, and occasionally to Newport, R. I. Several small specimens recorded from the vicinity of Culebra Island, P. R.*Diagnosis*.—Head 3; depth 3.6; eye 4.5. Dorsal II, 26; anal 15; scales fine. Preopercle with 3 spines. Caudal rounded. Lower jaw projecting; eye placed anteriorly over the end of the long maxillary; about equal to the snout in length. Color brownish. Attains a length of about a foot.*Remarks*.—Usually found in rather deep water.

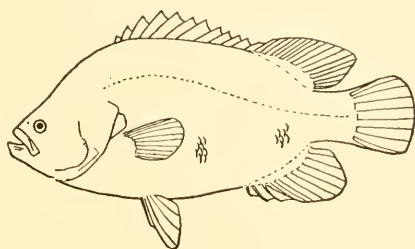
LOBOTIDAE

Lobotes Cuvier**Lobotes surinamensis** (Bloch)

Tripple-tail; sama

Holocentrus surinamensis Bloch, 1790, *Ausl. Fische*, and *Ichth.*, Pl. 243.*Lobotes surinamensis* Evermann and Marsh, 1902, p. 164, Fig. 47.

FIG. 127.—*Lobotes surinamensis*
From *Zoologica*, IX

*Type locality*.—Surinam.

Distribution.—Found in most warm seas; north to Cape Cod on our coast; usually not common. Two small specimens recorded from Porto Rico.

Diagnosis.—Head 2.8; depth 2; eye 6.5. Dorsal XI, I, 15; anal III, 11; scales 48. Mouth oblique with lower jaw projecting; eye placed far forward over its angle; profile slanting, slightly concave. Caudal rounded, and rounded soft dorsal and anal projecting backward. Said to attain a length of 3 feet and a weight of 50 pounds.

Remarks.—Is regarded as a good food fish.

PRIACANTHIDAE

Priacanthus Cuvier**Priacanthus arenatus** Cuvier and Valenciennes

Big-eye; catalufa; toro

Priacanthus arcuatus Cuvier and Valenciennes, 1829, *Hist. Nat. Poiss.*, Vol. III, p. 97.

Priacanthus arcuatus Evermann and Marsh, 1902, p. 166, Pl. 16.

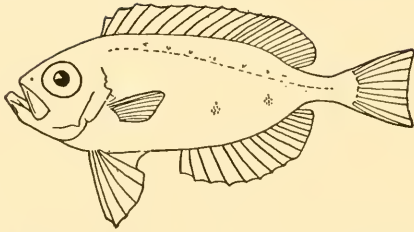


FIG. 128.—*Priacanthus arenatus*
From Zoologica, IX

Type localities.—Brazil and Atlantic.

Distribution.—West Indian fauna, south to Brazil, occasionally northward in the Gulf Stream drift to Massachusetts; also known from Madeira. Probably common about Porto Rico; also recorded from St. Croix.

Diagnosis.—Head 3.2 to 3.3; depth 2.8; eye 2.7. Dorsal X, 14, rarely 13; anal III, 15, rarely 16; scales about 94. Preopercular spine obsolete or nearly so, dorsal unspotted, color red. Does not usually exceed a foot to 15 inches in length.

Remarks.—A food-fish of some importance, with firm flaky flesh of good flavor.

***Priacanthus cruentatus* (Lacepede)**

Big-eye; catalufa; ojon

Labrus cruentatus Lacepede, 1800, Hist. Nat. Poiss., Vol. III, p. 522.

Priacanthus cruentatus Evermann and Marsh, 1902, p. 167.

Type locality.—Martinique.

Distribution.—West Indian fauna, south to St. Helena and east to the Canaries. Probably not common about Porto Rico, whence a single specimen is recorded.

Diagnosis.—Head 3 to 3.4; depth 2.5 to 2.6; eye 2.4 to 2.6. Dorsal X, 12 or 13; anal III, 13 or 14; scales about 90. Preopercular spine well developed; dorsal spotted; colors rosy. Attains a length of a foot or more.

Remarks.—A good food fish, common in the Havana market.

LUTIANIDAE

***Lutianus* Bloch**

***Lutianus cyanopterus* (Cuvier and Valenciennes)**

Black-finned snapper; cubera

Mesoprion cyanopterus Cuvier and Valenciennes, 1828, Hist. Nat. Poiss., Vol. II, p. 472.

Ncomacnis cyanopterus Evermann and Marsh, 1902, p. 169.

Type locality.—Brazil.

Distribution.—West Indian fauna, south to Brazil. Recorded by Cuvier and Valenciennes and by Poey from Porto Rico.

Diagnosis.—Head 2.7 to 2.8; depth 3; eye 5.6 to 5.7. Dorsal X, 14; anal III, 8; scales 50 (pores). Anal fin rounded, its middle rays less than half length of head; no black lateral spot. Developed gill-rakers 7 to 9 on lower limb of first arch. Mouth very large, length of maxillary contained less than 2.4 times in that of head; lower as well as upper canine teeth strong. Colors grayish and olivaceous. Attains a length of 2 to 4 feet.

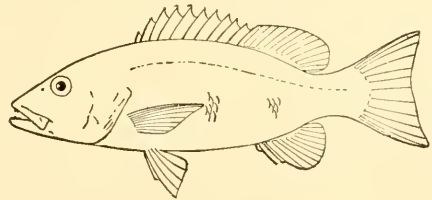
Remarks.—Inferior as a food fish to other snappers, and regarded as unwholesome by fishermen, probably without sufficient cause.

Lutianus griseus (Linnaeus)

Gray snapper; Mangrove snapper; Cabellerote; pargo prieto

Labrus griseus Linnaeus, 1758, Syst. Nat., ed. 10, p. 283; after Catesby.
Ncomacnus griseus Evermann and Marsh, 1902, p. 170, Pl. 17.

FIG. 129.—*Lutianus griseus*
From Zoologica, IX



Type locality.—Bahamas.

Distribution.—West Indian fauna, very common, south to Brazil, occasionally north to New Jersey. Plentiful about Porto Rico and recorded from St. Croix.

Specimens seen.—San Juan and Ponce Markets.

Diagnosis.—Head 2.7 to 3.0; depth 2.8 to 3.3; eye 4.6 to 6. Dorsal X, 14; anal III, 8; scales 50. Anal fin rounded, its middle rays less than half length of head; no black lateral spot. Developed gill-rakers 7 to 9; caudal lunate. Upper canine teeth strong, but lower moderate. Scales above lateral line arranged in series which are more or less oblique and irregular. Colors grayish and olivaceous. Individuals from comparatively deep water are redder, with body a trifle less elongate (*Lutjanus stearnsi*). May attain a length of 3 feet and a weight of 18 pounds, but usually weighs not more than 5 pounds.

Remarks.—The gray snapper is an important food fish about Porto Rico.

Habits.—Gudger writes of the intelligence and wary alertness of the gray snapper as observed at the Tortugas. Some two or three dozen used to hang around a dock and to feed on scraps thrown overboard by the cook, apparently recognizing this individual. “However, let anyone else walk out on the dock (which was about 8 feet above the water) and some of the snappers (generally those nearest) would turn slightly on one side, thus keeping a cool and wary eye on the intruder.” They were clever and quick in eluding the grains, and never taken by this means, very rarely hooked. They would swim parallel with pedestrians taking a customary stroll along the shore, and seize the frightened ghost crabs which frequently scuttled into the water. In the bands of snappers the fish were nearly all of approximately the same size.

***Lutianus jocu* (Bloch and Schneider)**

Dog snapper; *jocu*

Anthias jocu Bloch and Schneider, 1801, Syst. Ichth., p. 310; after Parra.
Neomaenis jocu Evermann and Marsh, 1902, p. 171, Pl. 18.

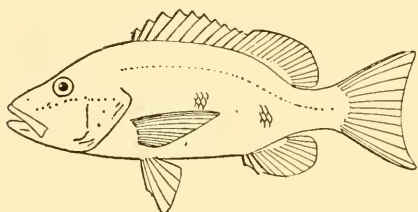


FIG. 130.—*Lutianus jocu*
 From Zoologica, IX

Type locality.—Cuba.

Distribution.—West Indian fauna, Florida Keys to Bahia, Brazil; young occasionally borne northward in the Gulf Stream drift to Massachusetts. Moderately plentiful about Porto Rico.

Diagnosis.—Head 2.5 to 2.6; depth 2.5 to 2.6; eye 4.7 to 4.8. Dorsal X, 13; anal III, 8; scales 50 to 56. Anal fin rounded, its middle rays less than half the length of the head; no black lateral spot. Developed gill-rakers 7 to 9. Caudal lunate. Upper canine teeth very strong but lower comparatively moderate. Scales above lateral line arranged in series which are more or less oblique and irregular. Colors more or less grayish and olivaceous, but the fins yellow and reddish; a whitish area below the eye. Attains a length of 2 feet, and may weigh about 20 pounds, though usually much smaller.

Remarks.—Sometimes reputed to be unwholesome, but frequently seen in the Porto Rico market.

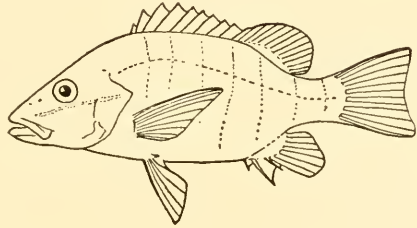
Lutianus apodus (Walbaum)

Schoolmaster snapper; pargo amarilla; caji

Perca apoda Walbaum, 1792. Artedi Piscium, p. 351; based on the *schoolmaster* of Catesby.

Neomacnis apodus Evermann and Marsh, 1902, p. 172, Pl. 19.

FIG. 131.—*Lutianus apodus*
From Zoologica, IX



Type locality.—Bahamas.

Distribution.—West Indian fauna, south to Bahia, Brazil, north to southern Florida, young occasionally borne north to Massachusetts in the Gulf Stream drift. The most abundant of the snappers about Porto Rico.

Specimens collected.—5; San Juan.

Diagnosis.—Head 2.5; depth 2.8 to 2.9; eye 4.3 to 4.4. Dorsal X, 14; anal III, 8; scales 42 to 45. Developed gill-rakers 7 to 9; caudal lunate. Anal fin rounded, its middle rays less than half length of head; no black lateral spot. Upper canines very strong, lower moderate. Colors more or less olivaceous, and the fins, especially, yellow. May attain a length of 18 inches and a weight of perhaps 7 or 8 pounds, but averages only about 3 pounds.

Remarks.—A valuable food fish.

Lutianus aya (Bloch)

West Indian red snapper; pargo colorado; pargo guachinango

Bodianus aya Bloch, 1790. Ausl. Fische, and Ichth., Pl. 227; after Maregrave.
Neomacnis aya Evermann and Marsh, 1902, p. 174, Pl. 20.

Mesoprion campechanus Poey, Memorias, Vol. II, 1860, p. 149.

Lutianus campechanus Hildebrand and Ginsburg, 1925, Bull. U. S. Bur. Fisheries for 1926, Vol. XLII, p. 82, Fig. 2. Caribbean Sea off Honduras.

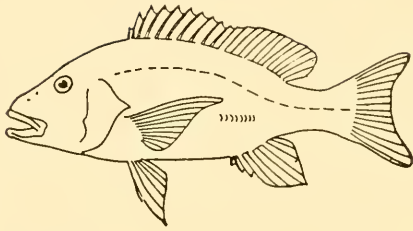


FIG. 132.—*Lutianus aya*
From Zoologica, X

Type locality.—Brazil.

Distribution.—West Indies to Brazil on rocky banks in rather deep water. Plentiful about Porto Rico. Represented in Florida waters by the closely related *Lutianus blackfordii*.

Specimens seen.—Ponce Market.

Diagnosis.—Head 2.8 to 3.1; depth 2.8; eye 5.3 to 5.5 (larger in young). Dorsal X, 14; anal III, 9; scales 69. Anal fin angulated, its median rays longest in the adult, at least half as long as head. Upper canine teeth rather long, lower small. Maxillary reaching front of eye, 2.4 in head. Color rose red, nearly uniform, the iris rose red in life: young with a black lateral mark. Attains a length of 30 inches and a weight of from 15 to 20 pounds.

***Lutianus vivanus* (Cuvier and Valenciennes)**

Silk snapper; pargo de lo alto

Mesoprion vivanus Cuvier and Valenciennes, 1828, Hist. Nat. Poiss., Vol. II, p. 454.

Neomaenis vivanus Evermann and Marsh, 1902, p. 175.

Type locality.—Martinique.

Distribution.—Found in comparatively deep water in the West Indies. Seasonally common about Porto Rico, where it is taken in some 60 fathoms of water. Also recorded from St. Croix.

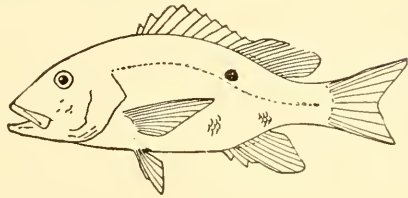
Specimens seen.—San Juan Market.

Diagnosis.—Head 2.7 or 2.8; depth 3; eye 4. Dorsal X, 14; anal III, 8; scales 72. Anal fin angulated; its median rays longest in the adult, at least half as long as head. Upper canines rather long, lower small. Maxillary reaching edge of pupil, its length contained 2.5 times in that of the head. Color rose red with golden streaks, iris golden yellow in life. Young with a black lateral blotch. Length about 18 inches.

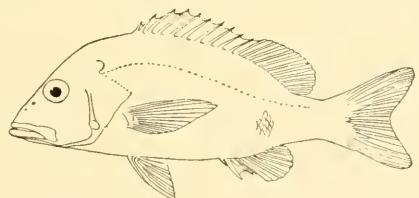
Remarks.—A highly valued food-fish.

Lutianus analis (Cuvier and Valenciennes)

Mutton-fish snapper; pargo criollo; sama

Mesoprion analis Cuvier and Valenciennes, 1828, Hist. Nat. Poiss., Vol. II, p. 452.*Neomaculis analis* Evermann and Marsh, 1902, p. 176, Pl. 21.FIG. 133.—*Lutianus analis*
From Zoologica, IX*Type locality*.—Santo Domingo.*Distribution*.—West Indian fauna, Florida to Brazil; young, borne northward in the Gulf Stream, occasionally drift to Massachusetts. Abundant in Porto Rico waters.*Specimens seen*.—San Juan Market.*Diagnosis*.—Head 2.7; depth 2.8 to 2.9; eye 5.6 to 5.7. Dorsal X, 14; anal III, 8; scales 70. Anal fin angulated, its median rays longest in the adult, at least half as long as head. Upper canine teeth rather long, lower small. Maxillary reaching edge of eye, 2.7 in head. Colors olivaceous; the fins more or less red; a small distinct black mark on the side below the soft dorsal, larger and more conspicuous in the young. Attains a maximum weight of 25 pounds, though individuals weighing more than 18 or even 15 pounds are uncommon. At 21 pounds weight, the length is about 27 inches.*Remarks*.—One of the most plentiful and important food fishes of Porto Rico, highly esteemed.**Lutianus megalophthalmus** (Evermann and Marsh)

Large-eyed snapper

Neomaculis megalophthalmus Evermann and Marsh, 1902, Bull. U. S. Fish Comm. for 1900, Vol. XX, Pt. 1, p. 177, Fig. 48.FIG. 134.—*Lutianus megalophthalmus**Type locality*.—Puerto Real, Porto Rico.

Distribution.—Known only from the description by Evermann and Marsh, based on a specimen 11½ inches long.

Diagnosis.—Head 2.6 or 2.7; depth 2.9; eye 4.7 or 4.8. Dorsal X, 12; anal III, 8; scales 64. Upper canine teeth moderate, lower small or obsolete. Scales above lateral line in very oblique series. Anal low, its outline rounded. Mouth moderate, maxillary length 2.6 to 2.8 in that of the head. There are 8 or 9 gill-rakers besides rudiments. Pectoral more than 2/3 the length of the head. A large black lateral spot. Differs from *Lutianus synagris* in having a larger eye and longer pectoral.

Lutianus synagris (Linnaeus)

Lane snapper; manchego; raiado

Sparus synagris Linnaeus, 1758, Syst. Nat., ed. 10, p. 280; after Catesby.
Neomacris synagris Evermann and Marsh, 1902, p. 178, Pl. 22.

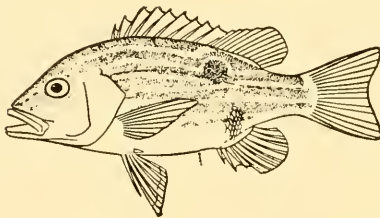


FIG. 135.—*Lutianus synagris*
From Zoologica, X

Type locality.—Bahamas.

Distribution.—West Indian fauna, southern Florida to Colon and Brazil, generally abundant. Next to the mutton-fish the most abundant snapper in Porto Rican waters.

Specimens collected.—1: Ponce Market.

Diagnosis.—Head 2.6 to 2.7; depth 2.7 to 3; eye 4.5 to 5. Dorsal X, 12; anal III, 8; scales 64 to 68. Upper canines moderate, lower small or obsolete. Scales above lateral line in very oblique series. Anal fin low, its outlines rounded. Mouth moderate, the length of the maxillary contained 2.4 to 2.7 times in that of the head. Pectoral long. Color with red shades; a large black lateral blotch. Maximum weight about 4 pounds; usually not more than 2 pounds in weight or more than 14 inches in length.

Remarks.—Though of small size, this species is valued for its food qualities and is plentiful in Porto Rican Markets.

Lutianus mahogoni (Cuvier and Valenciennes)

Mahogoni snapper: ojanco

Mesoprion mahogoni Cuvier and Valenciennes, 1828, Hist. Nat. Poiss., Vol. II, p. 447.

Ncomacnis mahogoni Evermann and Marsh, 1902, p. 179.

Type locality.—Martinique.

Distribution.—West Indies, not known to occur in Florida, not common, a single specimen 9 inches long recorded from Ponce, Porto Rico.

Diagnosis.—Head 2.5; depth 3; eye 3.7 to 3.8. Dorsal X, 12; anal III, 8; scales 63. Upper canine teeth moderate, lower small or obsolete. Scales above lateral line in very oblique series. Anal fin low, its outline rounded. Mouth large, length of maxillary contained 2.4 times in that of head. Color deep brown, shaded with red; narrow bronze streaks following the rows of scales; silvery below; eye and fins more or less bright red.

ÓCYURUS GILL

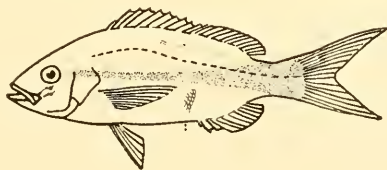
Ocyurus chrysurus (Bloch)

Yellow-tail: colirubia

Sparus chrysurus Bloch, 1790, Ausl. Fische, and Ichth., Pl. 262; after Marcgrave.

Ocyurus chrysurus Evermann and Marsh, 1902, p. 180, Pl. 23.

FIG. 136.—*Ocyurus chrysurus*
From Zoologica, X



Type locality.—Brazil.

Distribution.—West Indian fauna from southern Florida to Brazil, generally abundant. Plentiful in Porto Rican waters and also reported from St. Croix.

Specimens collected.—1: Santurce, San Juan.

Diagnosis.—Head 3; depth 2.9 to 3; eye 4.5 to 5. Dorsal X, 13; anal II to III, 9 to 10; scales 65. Gill-rakers long and numerous, about 25, or more. Lateral stripe, peduncular region, and caudal bright yellow. Attains a length of about 2 feet and a weight of 3 or 4 pounds; averages about a pound in weight.

Remarks.—This is an important food fish.

Rhomboplites Gill**Rhomboplites aurorubens** (Cuvier and Valenciennes)

Cagon de lo alto

Centropristis aurorubens Cuvier and Valenciennes, 1829, Hist. Nat. Poiss., Vol. III, p. 45.

Rhomboplites aurorubens Evermann and Marsh, 1902, p. 181, Fig. 49.

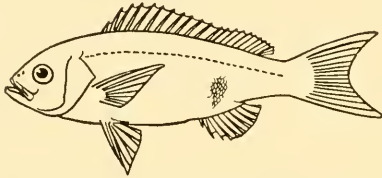


FIG. 137.—*Rhomboplites aurorubens*
From Zoologica, X

Type localities.—Brazil, Martinique, Santo Domingo.

Distribution.—West Indian fauna from Charleston, S. C. and Pensacola, Fla., south to Brazil. Uncommon in Porto Rican waters.

Specimens collected.—1: Ponce Market.

Diagnosis.—Head 3; depth 3; eye 3.4. Dorsal XII, 11; anal III, 8; scales 68. Teeth small, bands and patches of villiform teeth behind the outer row in the upper jaw, in the top of the mouth and on the tongue. Lower jaw projecting. Tail moderately forked. Gill-rakers 25 or a few more. Top of the head scaled to before the middle of eye. Color vermillion. Size small, length less than a foot.

Apsilus Cuvier and Valenciennes**Apsilus dentatus** Guichenot

Arnillo

Apsilus dentatus Guichenot, 1845, in Ramon de la Sagra, Hist. Cuba, Poiss., p. 29, Pl. I, Fig. 2.

Apsilus dentatus Jordan and Evermann, 1898, Bull. U. S. Nat. Mus., XLVII, Pt. 2, p. 1278.

Lutjanus arnillus Cope, 1871, Trans. Amer. Phil. Soc., Vol. XIV, p. 470. St. Croix.

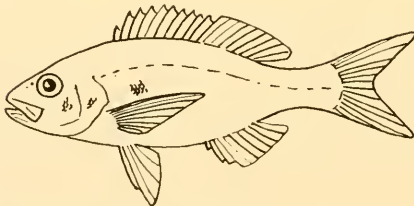


FIG. 138.—*Apsilus dentatus*

Type locality.—Havana.

Distribution.—West Indies; recorded from St. Croix by Cope.

Diagnosis.—Head 3; depth 2.7; eye 3.8 or 3.9. Dorsal X, 10; anal III, 8; scales 60. Soft dorsal and anal scaleless; caudal deeply forked. About 17 gill-rakers on the lower limb of the first arch. Color in life, dusky violet, paler below. Length about a foot.

Etelis Cuvier and Valenciennes

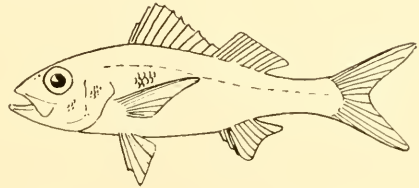
Etelis oculatus (Cuvier and Valenciennes)

Cachucho

Serranus oculatus Cuvier and Valenciennes, 1828, Hist. Nat. Poiss., Vol. II, p. 266.

Etelis oculatus Evermann and Marsh, 1902, p. 183, Fig. 50.

FIG. 139.—*Etelis oculatus*



Type locality.—Martinique.

Distribution.—Warmer waters of the North Atlantic, West Indies and Madeira, not yet known from the coast of the United States. Uncommon about Porto Rico.

Diagnosis.—Head 3.5; depth 3.8; eye 3.4. Dorsal X, 11; anal III, 8; scales 51. Maxillary scaly. Dorsal nearly or quite divided into 2 fins by a deep notch between spines and soft rays. Head scaleless above and on snout. Caudal deeply forked. Color red. Attains a length of from 2 to 3 feet.

Remarks.—A handsome as well as edible species.

Habits.—Found in rather deep water on rocky bottoms.

HAEMULIDAE

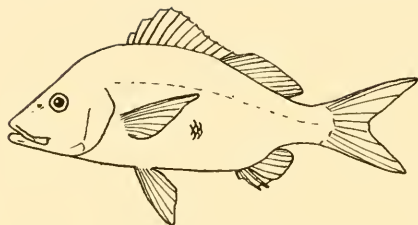
Haemulon Cuvier

Haemulon album Cuvier and Valenciennes

Margaret grunt; margate-fish; vallao

Haemulon album Cuvier and Valenciennes, 1830, Hist. Nat. Poiss., Vol. V, p. 241.

Haemulon album Evermann and Marsh, 1902, p. 185, Pl. 24.

FIG. 140.—*Haemulon album*

From Breder's Field Book of Marine Fishes (Putnam).

Type locality.—St. Thomas.

Distribution.—West Indian fauna, Florida Keys to Brazil. Not very common about Porto Rico and the Virgin Islands.

Diagnosis.—Head 2.7; depth 2.5; eye 6. Dorsal XII, 16; anal III, 8; scales 51. Scales on sides not particularly enlarged either above or below the lateral line. Length of the maxillary contained 2.3 to 2.8 in that of the head, not reaching center of eye in adult. There are 9 scales in an oblique series from first dorsal spine to lateral line; back elevated. Preorbital deep and the snout long and pointed. Back and sides without yellow or blue stripes; sides without dark bars. One of the largest of the grunts, attaining a length of from 8 to 10 pounds, the average from 4 to 6.

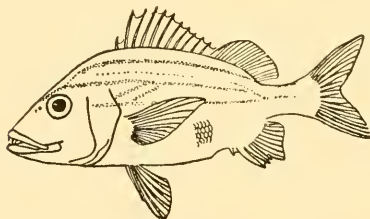
Remarks.—Highly esteemed as a food fish.

***Haemulon macrostomum* Günther**

Gray grunt; Corocoro

Haemulon macrostoma Günther, 1859, Cat., Vol. I, p. 308.

Haemulon macrostomum Evermann and Marsh, 1902, p. 106, Fig. 51.

FIG. 141.—*Haemulon macrostomum*
From Zoologica, X

Type locality.—Jamaica.

Distribution.—West Indian fauna, north to southern Florida. Probably not common in Porto Rican waters.

Diagnosis.—Head 2.7 to 2.8; depth 2.9; eye 4.3 to 5. Dorsal XII, 16; anal III, 8 to 9; scales 53. Scales on sides not particularly enlarged either above or below lateral line. Length of maxillary contained 2.3 to 2.8 in that of head, not reaching center of eye in adult. There are 9

scales in an oblique series from first dorsal spine to lateral line (7 or 8 in a vertical row). Mouth rather large, maxillary reaching to below front of pupil. Back and sides without yellow or blue stripes, but with 4 or 5 black longitudinal streaks which disappear only in very old examples. The young of various grunts have a similar pattern, much less persistent. Attains a length of a foot or more.

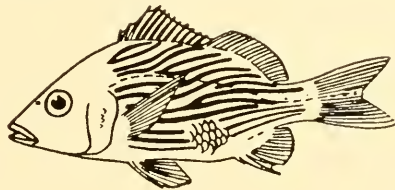
Haemulon bonariense Cuvier and Valenciennes

Black grunt; ronco prieto

Haemulon bonariense Cuvier and Valenciennes, 1830, Hist. Nat. Poiss., Vol. V, p. 254.

Haemulon bonariense Evermann and Marsh, 1902, p. 187.

FIG. 142.—*Haemulon bonariense*
From Zoologica, X



Type locality.—Buenos Ayres.

Distribution.—Not very common in the West Indies, but with a wide range south to Buenos Ayres. Not common about Porto Rico, though sometimes seen in the San Juan Market.

Diagnosis.—Head 2.8; depth 2.6; eye 4.6 to 4.7. Dorsal XII, 16; anal III, 8; scales 44. Scales on sides not particularly enlarged either above or below the lateral line. Length of maxillary contained in that of head 2.3 to 3 times, not reaching center of eye in adult. There are 5 or 6 scales in a vertical row from first dorsal spine to lateral line. Back and sides without yellow or blue stripes, but dark spots on the scales coalescing to form continuous dark stripes. Attains a length of a foot or less.

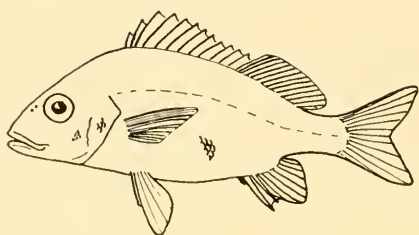
Remarks.—Has some value as a food fish.

Haemulon parra (Desmarest)

Sailor's choice; arrayado; ronco

Diabasis parra Desmarest, 1823, Prem. Déc. Ichth., p. 30, Pl. 2, Fig. 2.

Haemulon parra Evermann and Marsh, 1902, p. 187, Fig. 52.

FIG. 143.—*Haemulon parra*

Type locality.—Havana.

Distribution.—West Indian fauna, southern Florida to Brazil. Probably not uncommon at the west end of Porto Rico.

Specimens collected.—1: Santurce, San Juan.

Diagnosis.—Head 3; depth 2.6 to 3; eye 4.4. Dorsal XII, 17; anal III, 7 or 8; scales 50 to 54. Scales above or below lateral line anteriorly not especially enlarged. Maxillary not reaching center of eye in adult; its length 2.5 times in that of the head. Scales in a vertical row from first dorsal spine to lateral line, 5 or 6. Snout not very pointed. Back and sides without yellow or blue stripes, each scale above with a median blackish spot, the spots not coalescent into lines. Averages about $\frac{1}{2}$ pound in weight but may weigh up to 2 pounds.

Remarks.—A valuable food fish.

***Haemulon carbonarium* Poey**

Ronco carbonero

Haemulon carbonarium Poey, 1860, Memorias, Vol. II, p. 176.

Haemulon carbonarium Evermann and Marsh, 1902, p. 188.

Type locality.—Cuba.

Distribution.—West Indian fauna from Bermuda south to Brazil, very common at Havana, rare in the Florida Keys (recorded from Tortugas). Uncommon about Porto Rico (recorded from San Geronimo).

Specimens seen.—San Juan (peddled cooked).

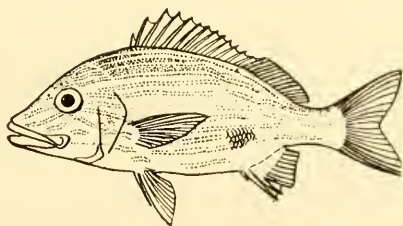
Diagnosis.—Head 3 to 3.1; depth 2.7 to 2.8; eye 3.6 to 3.7. Dorsal XII, 16; anal III, 8; scales 55. Scales above or below lateral line anteriorly not especially enlarged. Maxillary not reaching center of eye in adult, but extending about to under front of pupil, its length contained 2.3 to 2.4 in that of the head. Back and sides with distinct horizontal yellow stripes, no black spots anywhere. Length about 10 inches.

Haemulon melanurum (Linnaeus)

Black-tailed grunt; jeniguana

Perca melanura Linnaeus, 1758, Syst. Nat., ed. 10, p. 292; based on Catesby.*Haemulon melanurum* Cope, 1871, Trans. Amer. Phil. Soc., Vol. XIV, p. 471.
St. Croix.*Type locality*.—Bahamas.*Distribution*.—West Indies, rather common at Havana and southward. Not recorded from Porto Rico, but known from St. Croix.*Diagnosis*.—Head 3; depth 3; eye 5. Dorsal XII, 16; anal III, 8; scales 50 to 56. Maxillary reaching to below center of eye in adult, its length about half that of the head. Back and sides with continuous horizontal yellow stripes, which do not everywhere follow the direction of the row of scales. A blackish area on back and caudal, bounded below by a slanting line from first dorsal spine to tip of lower caudal lobe. Attains a length of about a foot.**Haemulon sciurus** (Shaw)

Yellow grunt; ronco amarillo; chachicata

Sparus sciurus Shaw, 1803, General Zoology, Vol. IV, Pl. 64; based on the description and figure of Bloch.*Haemulon sciurus* Evermann and Marsh, 1902, p. 189, Fig. 53.FIG. 144.—*Haemulon sciurus*
From Zoologica, X*Type locality*.—Antilles.*Distribution*.—West Indian fauna, Florida Keys to Brazil. Generally abundant in Porto Rican waters and also reported from St. Croix.*Specimens collected*.—1: Santurce Market, San Juan.*Diagnosis*.—Head 2.6 to 2.9; depth 2.8 to 3; eye 4 to 4.8. Dorsal XII, 16; anal III, 8 to 9; scales 50 to 53. Scales above or below lateral line anteriorly not especially enlarged. Maxillary nearly or quite half length of head, reaching center of eye in adult. Ground color bright yellow; back and sides of head and body with continuous horizontal blue stripes, not everywhere following rows of scales, one stripe forming an upward angle under eye. Attains a length of 18 inches and a weight of a pound or less.*Remarks*.—A common and important food fish.

Haemulon plumieri (Lacepede)

Common grunt; ronco arará; eachicata

Labrus plumieri Lacepede, 1802, Hist. Nat. Poiss., Vol. III, p. 480, Pl. 2, Fig. 2;
based on a copy of a drawing by Plumier

Haemulon plumieri Evermann and Marsh, 1902, p. 190, Fig. 54.

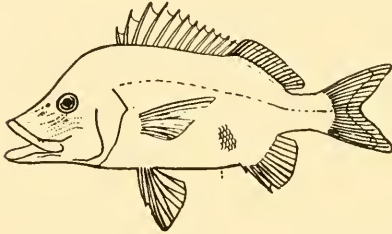


FIG. 145.—*Haemulon plumieri*
From Zoologica, X

Type locality.—Martinique.

Distribution.—West Indian fauna from Cape Hatteras to Brazil. Generally abundant in Porto Rican waters and also reported from St. Croix.

Specimens seen.—Ponce Market.

Diagnosis.—Head 2.5 to 2.8; depth 2.4 to 2.7; eye 4.5 to 5. Dorsal XII, 15 or 16; anal III, 8 or 9; scales 51. Scales above lateral line anteriorly much larger than the others, those below the lateral line not especially enlarged. Mouth large, maxillary about half length of head. Narrow blue, more or less horizontal lines on the head; the body with brown or brassy spotting. Grows to be about 18 inches long, with a maximum weight of 4 pounds, usually weighing 2 pounds or less.

Remarks.—An abundant and valuable food fish at Porto Rico as it is at Key West.

Haemulon flavolineatum (Desmarest)

French grunt; ronco condensado

Diabasis flavolineatus Desmarest, 1823, Prem. Décade Ichth., p. 35, Pl. 2, Fig. 1.

Haemulon flavolineatum Evermann and Marsh, 1902, p. 191.

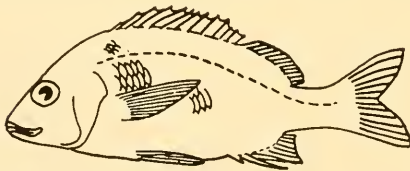


FIG. 146.—*Haemulon flavolineatum*
From Zoologica, X

Type locality.—Cuba.

Distribution.—West Indian fauna, from Bermuda and the Florida Keys to Brazil. Abundant about Porto Rico and also reported from St. Croix.

Specimens collected.—17: San Juan.

Diagnosis.—Head 2.8; depth 3; eye 3. Dorsal XII, 14; anal III, 8; scales 50. Scales below lateral line anteriorly much enlarged. Head, back and sides with continuous bright yellow stripes, those below undulating, following the direction of scale-rows. Attains a length of a foot.

Remarks.—A good food fish.

Habits.—This grunt has a preference for sandy shores

Bathystoma Scudder

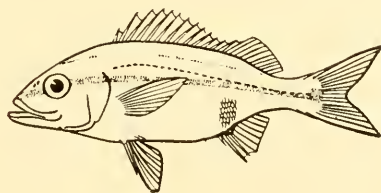
Bathystoma rimator (Jordan and Swain)

Red-mouth grunt: Tom-Tate

Haemulon rimator Jordan and Swain, 1884, Proc. U. S. Nat. Mus. for 1884, p. 308.

Bathystoma rimator Evermann and Marsh, 1902, p. 192, Fig. 55.

FIG. 147.—*Bathystoma rimator*
From Zoologica, X



Type localities.—Charleston, S. C., Key West, Pensacola, Fla.

Distribution.—West Indian fauna from Cape Hatteras to Trinidad, hardly known from Cuba. Not plentiful in Porto Rican waters.

Diagnosis.—Head 2.8; Depth 2.7 to 3; eye 4.2. Dorsal XIII, 15; anal III, 8; scales 56. Mouth large, maxillary reaching middle of eye. Colors pale; a yellowish streak from nape to axil of soft dorsal, and a broader one through the eye to caudal base, where it ends in a more or less oval black blotch. Usually about 6 inches long.

Remarks.—A good food fish except for its small size.

Bathystoma aurolineatum (Cuvier and Valenciennes)

Yellow-lined Tom Tate: jeniguana

Haemulon aurolineatum Cuvier and Valenciennes, 1830, Hist. Nat. Poiss., Vol. V, p. 237.

Bathystoma aurolineatum Nichols, 1915, Bull. Amer. Mus. Nat. Hist., Vol. XXXIV, p. 143. Ponce Market, P. R.

Type localities.—Brazil and San Domingo.

Distribution.—West Indian fauna, Florida Keys to Brazil; abundant at Havana. Uncommon in Porto Rican waters; noted in the Ponce Market in late July.

Specimens collected.—3: Ponce Market.

Diagnosis.—Head 3; depth 3.3 to 3.5; eye 3.7 to 3.8. Dorsal XIII, 15; anal III, 8; scales 51. Maxillary reaching to under middle of eye. Color whitish with light yellow lines, and two bolder continuous stripes, from head to end of soft dorsal, and from eye to middle of caudal. Traces of a black mark at base of caudal; inside of mouth red. Length from 6 to 8 inches.

Bathystoma striatum (Linnaeus)

Small-mouthed Tom-Tate; white grunt

Percu striata Linnaeus, 1758, Syst. Nat., p. 233.

Bathystoma striatum Evermann and Marsh, 1902, p. 193.

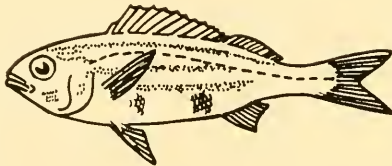


FIG. 14S.—*Bathystoma striatum*
From Zoologica, X

Type locality.—“North America.”

Distribution.—West Indian fauna, known from Cuba, Key West, and the Greater Antilles, apparently not common. Recorded from Porto Rico and also from St. Croix.

Diagnosis.—Head 2.8; depth 3.3 to 3.5; eye 3. Dorsal XIII, 13; anal III, 7; scales 70. Maxillary not reaching to opposite middle of eye. Colors pale, with a few continuous brownish or yellowish lengthwise streaks. Less than a foot in length.

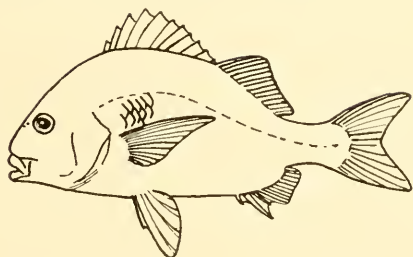
Anisotremus Gill

Anisotremus surinamensis (Bloch)

Pompon

Lutjanus surinamensis Bloch, 1791 Ausl. Fische, and Ichth., Pl. 253.

Anisotremus surinamensis Evermann and Marsh, 1902, p. 194, Fig. 56.

FIG. 149.—*Anisotremus surinamensis*

Type locality.—Surinam.

Distribution.—West Indian fauna, Indian River, Fla., to Brazil. Uncommon in Porto Rican waters.

Specimens seen.—Ponce Market.

Diagnosis.—Head 3.1 to 3.2; depth 2.2; eye 4.5. Dorsal XII, 16; anal III, 8 to 9; scales 50. Less than 9 scales in a vertical series between first dorsal spine and lateral line, about 9 in an oblique series; those above lateral line only slightly enlarged. Colors plain with dark marks on the bases of the scales. Attains a length of from 2 to 3 feet.

Remarks.—A good food fish.

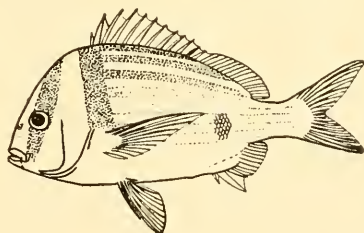
***Anisotremus virginicus* (Linnaeus)**

Pork-fish; catalineta

Sparus virginicus Linnaeus, 1758, Syst. Nat., ed. 10, p. 281.

Anistoremus virginicus Evermann and Marsh, 1902, p. 195, Fig. 57.

FIG. 150.—*Anisotremus virginicus*
From Zoologica, X



Type locality.—South America.

Distribution.—West Indian fauna, Florida to Brazil. Not very common about Porto Rico. Known from St. Croix.

Diagnosis.—Head 3 to 3.2; depth 2 to 2.3; eye 3.1 to 4. Dorsal XII, 16; anal III, 9 to 10; scales 57 to 60, more than 9 in a vertical series between first dorsal spine and lateral line. An oblique black band downward and forward through the eye, and a similar vertical band from front of spinous dorsal to front of pectoral; yellow lengthwise stripes on body, and fins yellow or orange. Attains a length of about a foot and a weight of 2 pounds, but is usually smaller and about 1/3 pound in weight.



Conodon Cuvier and Valenciennes**Conodon nobilis** (Linnaeus)

Bureteado

Perca nobilis Linnaeus, 1758, Syst. Nat., ed. 10, p. 191.

Conodon nobilis Evermann and Marsh, 1902, p. 196.

Type locality.—"North America."

Distribution.—West Indian fauna, Texas to Brazil. Not rare in Porto Rico.

Diagnosis.—Head 3.2 to 3.3; depth 3.2 to 3.3; eye 4.1. Dorsal X-I, 13; anal III, 7; scales 51. Outer teeth enlarged. Opercle sharply serrate, the serrae at the angle enlarged, those before the angle turned forward. Second anal spine large. Sides more or less banded vertically in color, and fins yellowish. Attains a maximum length of about a foot.

Pomadasys Lacepede**Pomadasys corvinaeformis** (Steindachner)

Croaker-like roughcheek

Haemulon corvinaeforme Steindachner, 1868, Ichth. Notizen, Vol. VII, p. 16.

Brachycentrus corvinaeformis Evermann and Marsh, 1902, p. 197.

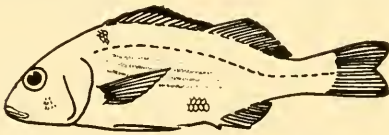


FIG. 151.—*Pomadasys corvinaeformis*
From Zoologica, X

Type locality.—Santos, Brazil.

Distribution.—West Indies, south to Brazil. Apparently common about Porto Rico.

Specimens collected.—1: Santurce Market, San Juan.

Diagnosis.—Head 3 to 3.3; depth 3.2 to 3.3; eye 3.7 to 3.8. Dorsal XII, 15; anal III, 7; scales 51. Scales above in series parallel with the lateral line; anal spines moderate. Attains a length of about a foot.

Remarks.—A good pan fish.

Pomadasys crocro (Cuvier and Valenciennes)

Crocro roughcheek; ronco blanco

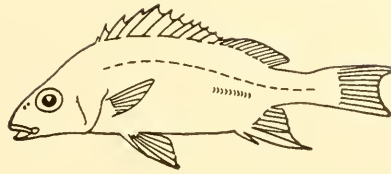
Pristipoma crocro Cuvier and Valenciennes, 1830, Hist. Nat. Poiss., Vol. V, p. 264.

Pomadasys crocro Evermann and Marsh, 1902, p. 198.

Pomadasys productus Evermann and Marsh, 1902, p. 198.

Pomadasys ramosus Evermann and Marsh, 1902, p. 198.

FIG. 152.—*Pomadasys croco*
From Zoologica, X



Type locality.—Martinique.

Distribution.—West Indian fauna, South to Brazil, ascending rivers; not known from the coast of the United States. Rather common in Porto Rican waters.

Specimens collected.—1: Santurce Market, San Juan.

Diagnosis.—Head 3 to 3.2; depth 2.6 to 3.7; eye 3.5 to 5. Dorsal XII to XIII, 11 to 12; anal III, 6 or 7; scales 54 to 65. Scales above in series parallel with the lateral line; second anal spine very strong. Length about a foot.

Remarks.—A good food fish, though of small size.

SPARIDAE

Calamus Swainson

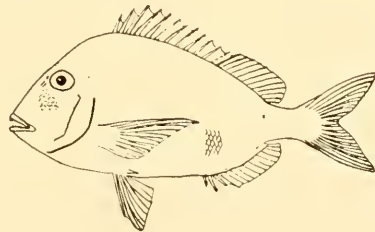
Calamus calamus (Cuvier and Valenciennes)

Saucer-eye porgy; pluma

Pagellus calamus Cuvier and Valenciennes, 1830, Hist. Nat. Poiss., Vol. VI, p. 206, Pl. 152.

Calamus calamus Evermann and Marsh, p. 201, Fig. 58.

FIG. 153.—*Calamus calamus*
From Zoologica, X



Type localities.—Martinique and Santo Domingo.

Distribution.—West Indian fauna, north to the Florida Keys. Rather common about Porto Rico and also known from St. Croix.

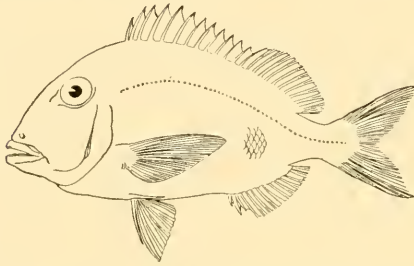
Diagnosis.—Head 3.1; depth 1.9 to 2.3; eye 3.4. Dorsal XII, 12; anal III, 10; scales 54. Depth of preorbital less than half length of head. Preorbital with reticulations of bluish ground color around bronze spots. Attains a length of about a foot and weight of a pound or more, though not averaging more than $\frac{1}{2}$ pound.

Calamus kendalli Evermann and Marsh

Kendall's porgy; pluma

Calamus kendalli Evermann and Marsh, 1899, Rept. U. S. Fish Comm. for
1899, p. 353.

Calamus kendalli Evermann and Marsh, 1902, p. 201, Fig. 59.

FIG. 154.—*Calamus kendalli*

Type locality.—Mayagüez, Porto Rico.

Distribution.—Probably not common about Porto Rico, where it is reported from Mayagüez and Arroyo. Not recognized from elsewhere.

Diagnosis.—Head 3.1; depth 2.1; eye 3.5. Dorsal XII, 12; anal III, 10; scales 53. Preorbital region and snout with wavy horizontal non-reticulating lines; iris yellow. Length 10 or 11 inches.

Calamus pennatula Guichenot

Porgy; pluma

Calamus pennatula Guichenot, 1868, Revision des Pagelets, Mem. Soc. Sci. Nat. Cherbourg for 1868, Vol. XIV, p. 116.

Calamus pennatula Nichols, 1915, Bull. Amer. Mus. Nat. Hist., XXXIV, p. 143. Ponce, P. R.

Type locality.—Martinique.

Distribution.—West Indies, rare. Three specimens so identified from Ponce, Porto Rico, July 31.

Specimens collected.—3: Ponce Market.

Diagnosis.—Close to *Calamus proridens* but more elongate, depth 2.7 to 2.8. Upper jaw with a strong antrose canine tooth on each side. Preorbital with blue wavy stripes; cheeks with anastomosing blue flexuous lines; spinous dorsal edged with black.

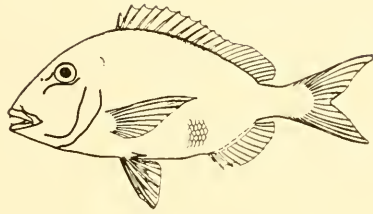
Calamus bajonado (Bloch and Schneider)

Jolt-head porgy; bajonado; pluma

Sparus bajonado Bloch and Schneider, 1801, Syst. Ichth., p. 284; after Parra.

Calamus bajonado Evermann and Marsh, 1902, p. 202, Pl. 25.

FIG. 155.—*Calamus bajonado*
From Zoologica, X



Type locality.—Havana.

Distribution.—West Indian fauna, north to southern Florida. Plentiful in Porto Rican waters.

Specimens seen.—Ponce Market.

Diagnosis.—Head 3.5 to 3.7; depth 2.2 to 2.3; eye 3 to 3.3. Dorsal XII, 12; anal III, 10; scales 54. Upper jaw without antrose canines; anterior teeth strong. Body comparatively elongate; snout long. Colors rather plain: usually a blue stripe below the eye. May attain a length of 2 feet and a weight of as much as 10 pounds. Common up to 5 or 6 pounds in weight.

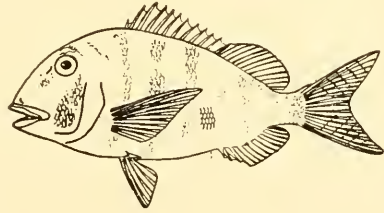
Calamus aretifrons Goode and Bean

Grass porgy; shad porgy

Calamus aretifrons Goode and Bean, 1882, Proc. U. S. Nat. Mus. for 1882, p. 425.

Calamus aretifrons Evermann and Marsh, 1902, p. 203, Fig. 60.

FIG. 156.—*Calamus aretifrons*
From Zoologica, X



Type locality.—Pensacola, Fla.

Distribution.—Florida waters, rare in the West Indies. One Porto Rican record: a specimen seined at San Antonio Bridge.

Diagnosis.—Head 3.3; depth 2.3 to 2.5; eye 3.4. Dorsal XII, 12; anal III, 10; scales 47. Pectoral fin short, its length contained about 3.5 times that of the body. Preorbital deep, its depth nearly twice the diameter of the eye. Preorbital brownish, usually with dashes of yellow: the cross-bars on the body usually better marked than in other species, and the fins much spotted and barred. A foot or less in length.

Remarks.—A good commercial fish wherever plentiful.

Habits.—This species frequents shallow water with an abundance of grass or sea-weed.

Archosargus Gill**Archosargus unimaculatus (Bloch)**

Tropical Sheepshead; chopá amarilla

Perca unimaculata Bloch, 1792, *Ausl. Fische*, and *Ichth.*, Pl. 308; based on a figure by Prince Maurice.

Archosargus unimaculatus Evermann and Marsh, 1902, p. 204, Pl. XXVI.

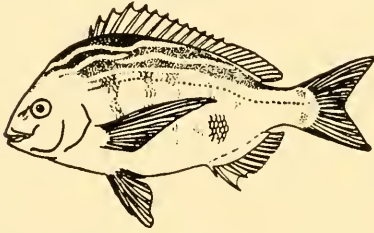


FIG. 157.—*Archosargus unimaculatus*
From *Zoologica*, X

Type locality.—Brazil.

Distribution.—West Indian fauna, from the Florida Keys (occasionally South Carolina) south to Rio Janeiro, Brazil. Plentiful in Porto Rican waters.

Specimens collected.—5: San Juan.

Diagnosis.—Head 3.4; depth 2.1 to 2.2; eye 4. Dorsal XIII, 10 to 12; anal III, 10 to 11; scales 45 to 50. Upper parts with golden longitudinal stripes alternating with bluish interspaces; a blackish shoulder spot, larger than eye. Attains a length of about a foot.

Remarks.—An excellent pan fish, of importance in Porto Rican markets.

Diplodus Rafinesque**Diplodus argenteus (Cuvier and Valenciennes)**

Silvery porgy

Sargus argenteus Cuvier and Valenciennes, 1830, *Hist. Nat. Poiss.*, Vol. VI, p. 60.

Diplodus argenteus Silvester, 1916, *Yearb. Carn. Inst. Wash.* for 1915, Vol. XIV, p. 216. Porto Rico.

Type locality.—Brazil.

Distribution.—Widely distributed in the warm waters of the Atlantic, from Florida and Bermuda south to Argentina. One Porto Rican record, off Guanica Harbor.

Diagnosis.—Head 3.5; depth 1.8 to 1.9; eye 3.5. Dorsal XII, 14; anal III, 13; scales 62. Second interhaemal spine normal, not pen shaped. Incisor teeth in front of jaw, broad, truncate, entire, a series of smaller teeth behind them; molar teeth in 2 or 3 rows. No antrose spine in front of dorsal.

GERRIDAE

Eucinostomus Baird and Girard**Eucinostomus pseudogula** Poey

Mojarra

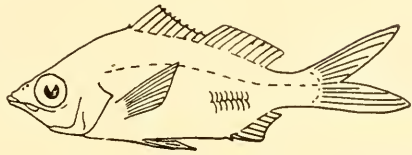
Eucinostomus pseudogula Poey, 1875, Enumeratio, p. 53, Pl. 1.

Eucinostomus pseudogula Evermann and Marsh, 1902, p. 205.

Eucinostomus harngulus Evermann and Marsh, 1902, p. 206.

Eucinostomus californiensis Meek and Hildebrand, 1925, Fishes of Panama, Pt. 2. Synonymized with this Pacific species.

FIG. 158.—*Eucinostomus pseudogula*
From Zoologica, X



Type locality.—Havana.

Distribution.—West Indian fauna, from Florida and Bermuda to Bahia, Brazil. Abundant in Porto Rican waters.

Specimens collected.—8: San Antonio Bridge, San Juan.

Diagnosis.—Head 3 to 3.2; depth 2.7 to 3.5; eye 3 to 3.2. Dorsal IX, 10; anal III, 7 to 8; scales 45 to 49. Posterior end of air-bladder entering a hollow cylinder formed by second interhaemal spine. Premaxillary groove wholly scaleless, linear. Length from 4 to 8 inches.

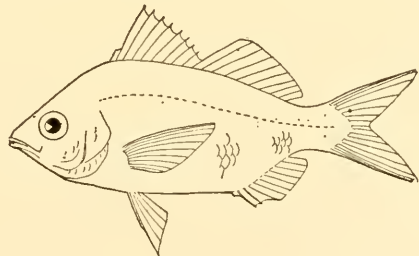
Eucinostomus gula (Cuvier and Valenciennes)

Mojarra

Gerres gula Cuvier and Valenciennes, 1830, Hist. Nat. Poiss., Vol. VI, p. 464.

Eucinostomus gula Evermann and Marsh, 1902, p. 206.

FIG. 159.—*Eucinostomus gula*
From Zoologica, IX



Type locality.—Martinique.

Distribution.—West Indian fauna, Carolinas to Brazil; young, borne north in the Gulf Stream, sometimes drift to Wood's Hole, Mass. Com-

mon and generally distributed in Porto Rican waters; also recorded from St. Croix.

Specimens collected.—15: San Antonio Bridge, San Juan.

Diagnosis.—Head 3 to 3.2; depth 2.4 to 2.5; eye 3. Dorsal IX, 10; anal III, 8; scales 45. Posterior end of air-bladder entering a hollow cylinder formed by second interhaemal spine. Premaxillary groove scaled in front, leaving a scaleless pit behind. Length from 4 to 5 inches.

Ulaema Jordan and Evermann

Ulaema lefroyi (Goode)

Lefroy's mojarra

Diapterus lefroyi Goode, 1874, Amer. Journ. Sci. Arts for 1874, p. 123.

Ulaema lefroyi Evermann and Marsh, 1902, p. 207.

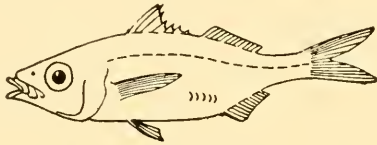


FIG. 160.—*Ulaema lefroyi*
From Zoologica, X

Type locality.—Bermuda.

Distribution.—West Indian fauna, north to Bermuda and the Florida Keys. Recorded from Culebra Island, Porto Rico.

Diagnosis.—Head 3.2; depth 3.1; eye 3. Dorsal IX, 10; anal II, 8; scales 46. Second interhaemal spine short and blunt, not hollow. Length from 4 to 5 inches.

Remarks.—Not very plentiful on sandy shores.

Xystaema Jordan and Evermann

Xystaema cinereum (Walbaum)

Barred mojarra; muniama

Mugil cinereus Walbaum, 1792, Artedi Piscium, p. 228; after Catesby.

Xystaema cinereum Evermann and Marsh, 1902, p. 207, Fig. 61.

Gerres cinereus Meek and Hildebrand, 1925, Fishes of Panama, Pt. 2.

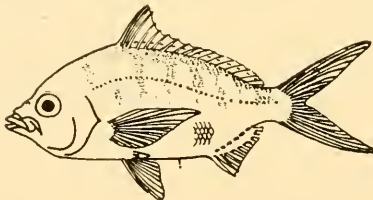


FIG. 161.—*Xystaema cinereum*
From Zoologica, X

Type locality.—Bahamas.

Distribution.—Both coasts of tropical America and in the West Indies, north to southern Florida, Bermuda and Lower California. Plentiful in Porto Rican waters.

Specimens collected.—9: Santurce and Fort San Geronimo, Sa Juan, and Cataño Market.

Diagnosis.—Head 3.2; depth 2.6 to 2.8; eye 3.4. Dorsal IX, 10; anal III, 7; scales 45. Second interhaemal spine long, spear-shaped, not hollow; preopercle entire; second anal spine moderately enlarged. Attains a length of more than a foot.

Remarks.—Commonly seen in the San Juan Market, Porto Rico.

Habits.—Generally common in waters of moderate depth within its range, entering rivers.

Xystaema havana Nichols

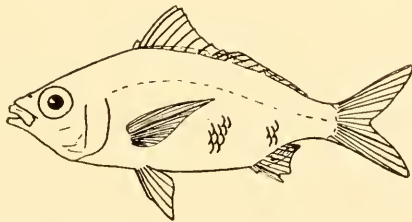
Large-eyed mojarra

Xystaema havana Nichols, 1912, Bull. Amer. Mus. Nat. Hist., Vol. XXXI, p. 189, Fig. 2.

Xystaema havana Nichols, 1915, Bull. Amer. Mus. Nat. Hist., Vol. XXXIV, p. 144. Porto Rico.

Gerris havana Meek and Hildebrand, 1925, Fishes of Panama, Pt. 2.

FIG. 162.—*Xystaema havana*



Type locality.—Havana.

Distribution.—West Indian fauna from Miami, Florida to Brazil, probably not uncommon, but seldom reported due to its resemblance to other species. Recorded from Fort San Geronimo, Porto Rico.

Specimens collected.—2: San Juan.

Diagnosis.—Head 3.1; depth 2.7; eye 2.9 (specimen of 5 inches standard length). Dorsal IX, 10; anal III, 7; scales 42. Second interhaemal spine spear shaped, not hollow; preopercle entire; second anal spine moderate. Color silvery, without cross-bars. Length from 5 to 6 inches.

Diapterus Ranzani**Diapterus rhombeus** (Cuvier and Valenciennes)

Rhomboid mojarra

Gerres rhombeus Cuvier and Valenciennes, 1830, Hist. Nat. Poiss., Vol. VI, p. 459.

Gerres rhombeus Evermann and Marsh, 1902, p. 208.

Diapterus rhombeus Meek and Hildebrand, 1925, Fishes of Panama, Pt. 2.

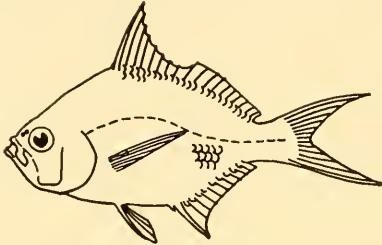


FIG. 163.—*Diapterus rhombeus*
From Zoologica, X

Type locality.—Martinique.

Distribution.—West Indian fauna. Common in Porto Rican waters.

Specimens collected.—1: Cataño.

Diagnosis.—Head 2.8; depth 2; eye 4. Dorsal IX, 10; anal II, 9; scales 38. Preorbital entire, preopercle serrate. Second interhaemal spine long and pointed, not hollow. No distinct dark streaks along the rows of scales. Length 10 inches or less.

Diapterus olisthostomus (Goode and Bean)

Irish pompano; mojarra

Gerres olisthostomus Goode and Bean, 1882, proc. U. S. Nat. Mus. for 1882, p. 423.

Gerres olisthostomus Evermann and Marsh, p. 209, Fig. 62.

Diapterus olisthostomus Meek and Hildebrand, 1925, Fishes of Panama, Pt. 2.

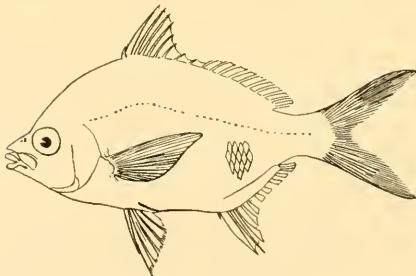


FIG. 164.—*Diapterus olisthostomus*

Type locality.—Indian River, Fla.

Distribution.—West Indian fauna, southern Florida to Brazil. Not common in Porto Rican waters. One noted in the San Juan market.

Diagnosis.—Head 3; depth 2.4; eye 3.4. Dorsal IX, 10; anal III, 8; scales 39. Preorbital entire, preopercle serrate; second interhaemal spine long and pointed, not hollow. No distinct dark streaks along the rows of scales. Length a foot or less.

Diapterus brasilianus (Cuvier and Valenciennes)

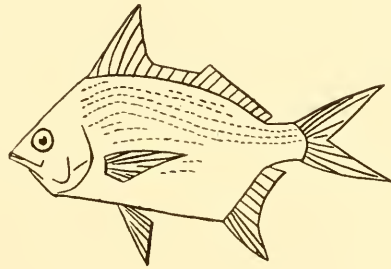
Streaked mojarra

Gerres brasilianus Cuvier and Valenciennes, 1830, Hist. Nat. Poiss., Vol. VI, p. 458.

Gerres brasilianus Evermann and Marsh, 1902, p. 209.

Diapterus brasilianus Meek and Hildebrand, 1925, Fishes of Panama, Pt. 2.

FIG. 165.—*Diapterus brasilianus*



Type locality.—Brazil.

Distribution.—West Indian fauna, Greater Antilles to Bahia, Brazil. Not common about Porto Rico.

Specimens seen.—San Juan Market.

Diagnosis.—Head 3.4; depth 2.3; eye 3.4. Dorsal IX, 10; anal III, 8; scales 36 to 38. Preorbital as well as preopercle serrate; second interhaemal spine long and pointed, not hollow; length of longest dorsal spine contained 1.4 times in that of the head. A distinct dark streak along each row of scales on the back and sides. Length a foot or less.

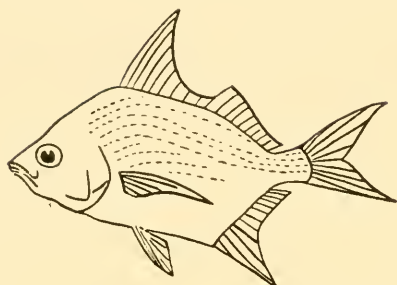
Diapterus plumieri (Cuvier and Valenciennes)

Plumier's mojarra

Gerres plumieri Cuvier and Valenciennes, 1830, Hist. Nat. Poiss., Vol. VI, p. 452.

Gerres plumieri Evermann and Marsh, 1902, p. 210.

Diapterus plumieri Meek and Hildebrand, 1925, Fishes of Panama, Pt. 2.

FIG. 166.—*Diapterus plumieri*

Type localities.—Antilles and Porto Rico.

Distribution.—West Indian fauna, and the Atlantic coast of tropical America. Generally not uncommon, but known from Porto Rico only on the authority of Cuvier and Valenciennes, and of Poey.

Diagnosis.—Head 3; depth 2.1 to 2.2; eye 3. Dorsal IX, 10; anal III, 8; scales 37. Preorbital as well as preopercle serrate; second interhaemal spine long and pointed, not hollow; longest dorsal spine equalling head in length, or longer. A distinct dark streak along each row of scales on back and sides. Length 10 inches.

KYPHOSIDAE

Kyphosus Lacepede

Kyphosus incisor (Cuvier and Valenciennes)

Chopa amarilla

Pimclepterus incisor Cuvier and Valenciennes, 1831, Hist. Nat. Poiss., Vol. VII, p. 266.

Kyphosus incisor Evermann and Marsh, 1902, p. 211.

Type locality.—Brazil.

Distribution.—Tropical Atlantic from Cuba to Brazil and the Canary Islands. Reported by Dr. Stahl from Porto Rico.

Diagnosis.—Head 4.5; depth 2.5; Dorsal XI, 14; anal III, 13; scales 65 to 66. Color grayish, with bright yellow streaks. Attains a length of $2\frac{1}{2}$ to 3 feet.

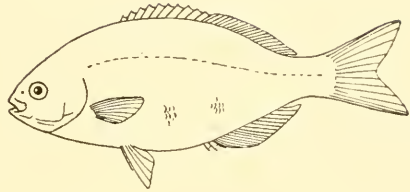
Kyphosus sectatrix (Linnaeus)

Rudder-fish; Bermuda chub; Chopa blanca

Perca saltatrix Linnaeus, 1758, Syst. Nat., ed. 10, p. 293; misprint, *sectatrix* of Catesby incorrectly copied.

Kyphosus sectatrix Evermann and Marsh, 1902, p. 211, Fig. 63.

FIG. 167.—*Kyphosus sectatrix*
From Zoologica, IX



Type locality.—Carolina.

Distribution.—Warm waters of the Atlantic from the West Indies to the Canary Islands, north in the Gulf Stream drift to Cape Cod; accidental in the Mediterranean. Not common about Porto Rico, from which it is recorded by Poey and Stahl.

Diagnosis.—Head 3.7 to 3.8; depth 2.1 to 2.2; eye about 4. Dorsal XI, 12; anal III, 11; scales 55. Dark grayish with paler gray or yellowish streaks. May attain a length of 18 inches or more and a maximum weight of 9, though usually it weighs between 3 and 4 pounds.

SCIAENIDAE

Cynoscion Gill

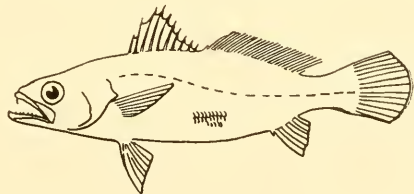
Cynoscion jamaicensis (Vaillant and Bocourt)

Mongolar drummer; corvina

Otolithus jamaicensis Vaillant and Bocourt, 1874, Miss. Sci. au Mexique, Poiss., p. 156.

Cynoscion jamaicensis Evermann and Marsh, 1902, p. 215.

FIG. 168.—*Cynoscion jamaicensis*
From Zoologica, X



Type locality.—Jamaica.

Distribution.—Known only from Jamaica and from Porto Rico, where it is not common.

Diagnosis.—Head 3.3; depth 4; eye 4.7. Dorsal X-I, 25; anal II, 10; scales 76. Vertical fins rather closely scaled; snout longer than eye, its length contained 3.7 to 3.8 times in that of head. Coloration nearly uniform silvery. Length about a foot.

Larimus Cuvier and Valenciennes**Larimus breviceps** Cuvier and Valenciennes

Corbino cabezon

Larimus breviceps Cuvier and Valenciennes, 1830, Hist. Nat. Poiss., Vol. V, p. 146.

Larimus breviceps Evermann and Marsh, 1902, p. 216.

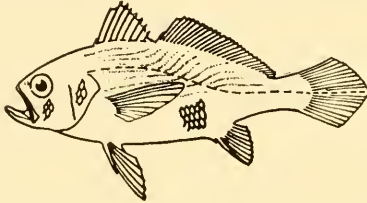


FIG. 169.—*Larimus breviceps*
From Zoologica, X

Type localities.—Santo Domingo and Brazil.

Distribution.—West Indian fauna, West Indies to Brazil. Not uncommon about Porto Rico.

Specimens collected.—3 Santurce Market, San Juan.

Diagnosis.—Head 3.2; depth 3; eye 3.8. Dorsal rays X-I, 27; anal II, 6; scales 50. Mouth large, very oblique. Indistinct dark streaks along the rows of scales on sides; inside of gill-cavity pale-colored. Attains a length of a foot or less.

Remarks.—A good food fish.

Odontoscion Gill**Odontoscion dentex** (Cuvier and Valenciennes)

Corvina

Corvina dentex Cuvier and Valenciennes, 1830, Hist. Nat. Poiss., Vol. V, p. 139.

Odontoscion dentex Evermann and Marsh, 1902, p. 216.

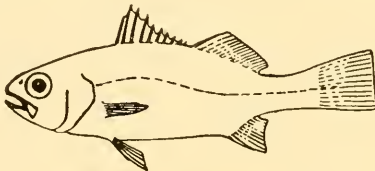


FIG. 170.—*Odontoscion dentex*
From Zoologica, X

Type locality.—Santo Domingo.

Distribution.—West Indies, generally common. Rather common in Porto Rican waters.

Diagnosis.—Head 3; depth 3.4; eye 3.7. Dorsal XI-I, 24; anal II, 9; scales 56. Canine teeth in front of lower jaw. Dark streaks along the rows of scales. Attains a length of about a foot.

Remarks.—A food fish of some commercial importance.

Corvula Jordan and Eigenmann**Corvula sanctae-luciae** Jordan

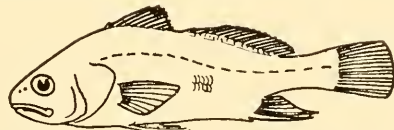
St. Lucian corvina

Corvula sanctae-luciae Jordan, 1889, Proc. U. S. Nat. Mus. for 1889, p. 649.*Corvula sanctae-luciae* Evermann and Marsh, 1902, p. 217.*Type locality*.—Port Castries, St. Lucia.*Distribution*.—Not uncommon in Porto Rico, otherwise known from the type only.*Diagnosis*.—Head 3.1; depth 3.2; eye 4.5 (3.5 in the young). Dorsal XI-I, 23; anal II, 8 or 9; scales 47. Maxillary reaching beyond vertical from middle of pupil; pectoral short. Rows of scales with dark stripes which bend upward in a characteristic manner under the notch separating the dorsals. Attains a length of 8 inches.**Corvula batabana** (Poey)

Barriga blanca

Johnius batubanus Poey, 1860, Memorias, Vol. II, p. 184.*Corvula batabana* Evermann and Marsh, 1902, p. 217.*Type locality*.—Batabano, Cuba.*Distribution*.—Known from Cuba and Porto Rico, where it is not common.*Diagnosis*.—Head 3.3 to 3.5; depth 3.2; eye 4. Dorsal XI-I, 28; anal II, 8; scales 45. Dusky, with dark streaks along the rows of scales. Attains a length of about a foot.**Bairdiella** Gill**Bairdiella ronchus** (Cuvier and Valenciennes)

Ground drummer; ronco

Corvinu ronchus Cuvier and Valenciennes, 1830, Hist. Nat. Poiss., Vol. V, p. 107.*Bairdiella ronchus* Evermann and Marsh, 1902, p. 218.FIG. 171.—*Bairdiella ronchus*
From Zoologica, X*Type localities*.—Maracaibo and Surinam.*Distribution*.—West Indies and the Atlantic coasts of tropical America to Brazil. Not uncommon in Porto Rican waters.*Specimens collected*.—2: San Juan markets.

Diagnosis.—Head 3.1; depth 3.2; eye 4.6. Dorsal X-I, 24; anal II, 8; scales 50. Second anal spine very long, $\frac{2}{3}$ the length of head. Preopercle with sharp bony teeth, the lowermost directed abruptly downward. Not exceeding 8 or 10 inches in length.

Remarks.—A good food fish though small.

Ophioscion Gill

Ophioscion adustus (Agassiz)

Snake croaker

Sciaena (Corrina) adusta Agassiz, 1892, in Spix, *Pisc. Brazil*, p. 126, Pl. 70.
Ophioscion adustus Evermann and Marsh, 1902, p. 219.

Type locality.—Montevideo.

Distribution.—Five small specimens from Vieques and Arroyo, P. R., are referred to this species by Evermann and Marsh.

Diagnosis.—Head 3.2 to 3.3; depth 3.3; eye 4.2. Dorsal XI-I, 22; anal, II, 7; scales 56. Preopercle with strong bony spines; middle caudal rays the longest. Attains a length of 10 inches.

Micropogon Cuvier and Valenciennes

Micropogon furnieri (Desmarest)

West Indian croaker; white-mouth drummer; verrugato

Umbrina furnieri Desmarest, 1822, *Première Décade Ichth.*, p. 22, Pl. 2, Fig. 3.
Micropogon furnieri Evermann and Marsh, 1902, p. 220.

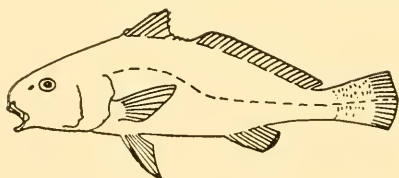


FIG. 172.—*Micropogon furnieri*
From *Zoologica*, X.

Type locality.—Havana.

Distribution.—West Indian fauna, Greater Antilles to Surinam. Probably not rare in Porto Rican waters.

Diagnosis.—Head 3.2 to 3.3; depth 3.7; eye 5.3 to 6. Dorsal X-I, 30; anal II, 8; scales 51 to 54. Second anal spine moderate, its length contained 5 times in that of the head. Preopercle with strong bony teeth; slender barbels along the sides of the lower jaw. Attains the length of a foot or more.

Remarks.—A good food fish.

Umbrina Cuvier**Umbrina coroides** Cuvier and Valenciennes

Umbrina

Umbrina coroides Cuvier and Valenciennes, 1830, Hist. Nat. Poiss., Vol. V, p. 187.
Umbrina coroides Evermann and Marsh, 1902, p. 220.

Type locality.—Brazil.

Distribution.—West Indian fauna, southern Florida to Brazil. Generally distributed and not uncommon in Porto Rican waters.

Diagnosis.—Head 3.5; depth 3.5; eye 4.2 to 4.3. Dorsal X-I, 26; anal II, 6; scales 48. Lower jaw with a single thickish barbel at its tip; edge of preopercle with bony crenation or serration. Length of second anal spine 2.3 times in that of the head; caudal truncate. Body with about 9 dark vertical cross-bands, besides narrow undulating streaks along the rows of scales. A small species, less than a foot long.

Menticirrhus Gill**Menticirrhus martinicensis** (Cuvier and Valenciennes)

Jewsharp drummer

Umbrina martinicensis Cuvier and Valenciennes, 1830, Hist. Nat. Poiss., Vol. V, p. 186.

Menticirrhus martinicensis Evermann and Marsh, 1902, p. 221.

Type locality.—Martinique.

Distribution.—West Indies to Patagonia, common on the Brazilian coast. Not rare in Porto Rican waters.

Diagnosis.—Head 3.3; depth 4; eye 7. Dorsal X-I, 22 to 24; anal I, 7; scales 54. Gill-rakers obsolete, reduced to tubercular prominences similar to those on the inner gill-arches. Outer teeth of the upper jaw decidedly enlarged; lower jaw with a single thickish barbel at its tip, overhung by the piglike snout; preopercle with membranous crenulations only.

Remarks.—A fair food fish.

Eques Bloch**Eques acuminatus** (Bloch and Schneider)

Streaked ribbon-fish; berdugo or bergudo

Grammistes acuminatus Bloch and Schneider, 1801, Syst. Ichth., p. 184; after Seba.

Eques acuminatus Evermann and Marsh, 1902, p. 222.

Type locality.—Not specified.

Distribution.—West Indian fauna, South Carolina to Brazil. Known from Porto Rico and also from St. Croix, but not common in Porto Rican waters.

Diagnosis.—Head 3.1; depth 2.6 to 2.8; eye 3.8. Dorsal X-I, 38 to 41; anal II, 7; scales about 50. Back much elevated, ventral outline nearly straight; body tapering backward to a narrow caudal peduncle; caudal fin rhombic.

Remarks.—Valued as a food fish, though not large.

***Eques pulcher* Steindachner**

Steindachner's ribbon-fish

Eques pulcher Steindachner, 1867, Ich. Notiz., Vol. VI, p. 43.

Eques pulcher Silvester, 1916, Yearb. Carn. Inst. Wash. for 1915, Vol. XIV, p. 216. Porto Rico.

Type locality.—Barbados.

Distribution.—Known from Barbados and Porto Rico in the West Indies. A specimen recorded in shallow water west of Guanica Harbor, P. R.

Diagnosis.—Head 3.5 to 3.7 (in total); depth the same; eye 3. Dorsal X-I, 37 or 38; anal II, 7; scale 50. Profile very steep; body deepest below first dorsal spine, then rapidly tapering to the narrow peduncle. Olivaceous; 3 dark lengthwise bands, the middle one reaching the tip of middle caudal rays. Length 6 inches.

***Eques punctatus* Bloch and Schneider**

Spotted ribbon-fish

Eques punctatus Bloch and Schneider, 1801, Syst. Ichth., p. 106; based on Parra.

Eques punctatus Cope, 1871, Trans. Amer. Phil. Soc., Vol. XIV, p. 471. St. Croix.

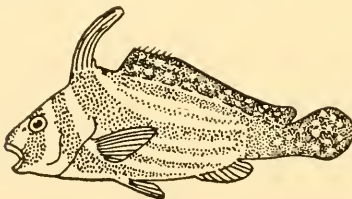


FIG. 173.—*Eques punctatus*
From Zoologica, X.

Type locality.—Cuba.

Distribution.—West Indies. Recorded from St. Croix but not from Porto Rico.

Diagnosis.—Head 3.7 to 3.8; depth 3; eye 3.7 to 3.8. Dorsal XI or XII-I, 46; anal II, 6 to 7; scales 55 to 59. Distance from snout to first dorsal spine about equal to depth of body; dorsal spines elevated, the length of the longest about $2\frac{3}{4}$ times in the length of body. Back elevated in front, the body rapidly tapering to a narrow caudal peduncle. Color dark brown; light bars on head and fore part of body, a light bar downward behind the elevated portion of the spinous dorsal, dividing in two, the branches running backward. Length 7 or 8 inches.

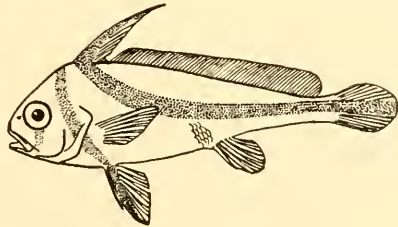
***Eques lanceolatus* Linnaeus**

Lance-shaped ribbon-fish; guapena

Chaetodon lanceolatus Linnaeus, 1758, Syst. Nat., ed. 10, p. 277; based on Edwards.

Eques lanceolatus Cope, 1871, Trans. Amer. Phil. Soc., Vol. XIV, p. 471. St. Croix.

FIG. 174.—*Eques lanceolatus*
From Zoologica, X



Type locality.—Caribes Islands.

Distribution.—West Indies, northward to Pensacola, Fla. Recorded from St. Croix but not from Porto Rico.

Diagnosis.—Head 4; depth 2.4; eye 4. Dorsal XIV to XVI-I, 53; anal II, 5; scales small, irregular. Profile almost vertical; back elevated in front, the body rapidly tapering to a narrow caudal peduncle. Body variegated with ribbon-like, oblique bands. Length from 6 to 8 inches.

THE FISHES OF PORTO RICO AND THE VIRGIN ISLANDS

POMACENTRIDAE TO OGCOCEPHALIDAE

BY J. T. NICHOLS

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POMACENTRIDAE

Pomacentrus Lacépède

Pomacentrus fuscus Cuvier and Valenciennes

Brown demoiselle; Maria molle

Pomacentrus fuscus Cuvier and Valenciennes, 1830, Hist. Nat. Poiss., Vol. V, p. 432.

Eupomacentrus fuscus Evermann and Marsh, 1902, p. 224, Pl. 27.

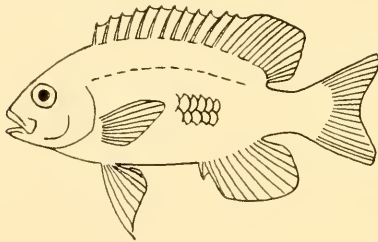


FIG. 175.—*Pomacentrus fuscus*
From Zoologica, X

Type locality.—Brazil.

Distribution.—West Indies, south to Brazil and north to Key West, Fla.

Diagnosis.—Head 3.5; depth 2.2 to 2.5; eye 3.4. Dorsal XII, 15; anal II, 13; scales 28. Upper anterior profile of head arched; body uniformly dark; caudal mostly dusky; opercle without a distinct dark spot; anal without a distinct blue spot in its posterior axil, except in the young; base of pectoral without a black spot or with but one. Head with few if any accessory scales. Attains a length of about six inches.

Remarks.—The least common of the three members of this genus recognized from Porto Rico by Evermann and Marsh.

The distinctness of this form from *Pomacentrus leucostictus* has been questioned. *P. leucostictus*, particularly in larger examples, is sometimes uniformly dark colored, and such dark-colored individuals are

doubtless often misidentified as *P. fuscus*. A *Pomacentrus* which the writer found abundant in somewhat brackish water along the water front at Matanzas, Cuba, in 1912, and identified as *P. fuscus*, was certainly not *P. leucostictus*. Color variations of the living fish were observed at close range and studied carefully. The caudal fins were varyingly dusky or yellowish, but none had the yellow color running forward on the underparts as it frequently does in *P. leucostictus*. Some small specimens were observed which were bright blue on the head and front part of the back and which had one or more dark lengthwise stripes on the head, somewhat different from any coloring of *P. leucostictus*. A few large ones swimming about actively had the back and the fore part of the sides pale ashen, but the same individuals became uniformly dusky when they ceased their activity. Their motions seemed less gliding and wrasse-like than those of *P. leucostictus*.

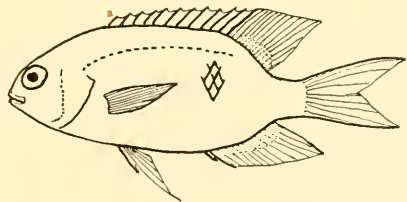
Pomacentrus atrocyaneus Poey

Blue-black demoiselle

Pomacentrus atrocyaneus Poey, 1860, *Memorias*, Vol. II, p. 190.

Eupomacentrus atrocyaneus Nichols, 1915, *Bull. Amer. Mus. Nat. Hist.*, Vol. XXXIV, p. 144. San Juan Bay, P. R.

FIG. 17C.—*Pomacentrus atrocyaneus*



Type locality.—Havana.

Distribution.—Cuba and Porto Rico, only recognized 2 or 3 times.

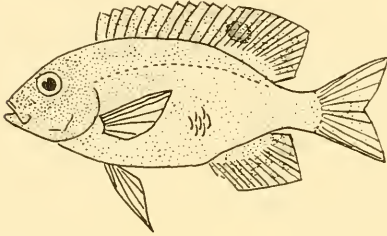
Specimens collected.—1: San Juan Bay.

Diagnosis.—Head 3.5 to 4.5; depth 2.5 to 3; eye 3 to 3.5. Dorsal XII, 13 to 16; anal II, 13; scales 28 to 30. Black or dark blue, with pale blue specks on sides of head and sometimes on back; a black spot at the top of the base of pectoral. Length from 4 to 5 inches.

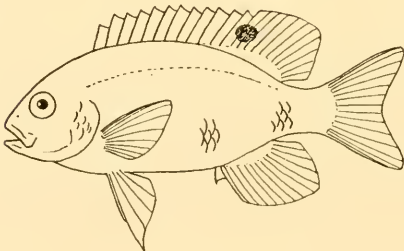
Remarks.—This species has sometimes been synonymized with *Pomacentrus fuscus*, but on the basis of our specimen is more slender, with different fin and body outlines.

Pomacentrus analis Poey

Blue-spotted demoiselle

Pomacentrus analis Poey, 1867, Synopsis, p. 327.*Eupomacentrus analis* Evermann and Marsh, 1902, p. 224.FIG. 177.—*Pomacentrus analis**Type locality*.—Havana.*Distribution*.—West Indies, north to Key West. The abundant species of the genus in Porto Rican waters according to Evermann and Marsh.*Specimens collected*.—5: Santurce, San Juan.*Diagnosis*.—Head 3.2 to 3.5; depth 2 to 2.4; eye 3.2 to 3.5. Dorsal XII, 15; anal II, 13; scales 28. Upper anterior profile of head arched; body uniformly dark; caudal mostly dusky; opercle without distinct dark spot; anal with a bluish spot at the base of its last ray; head and fins much spotted with blue. Up to 4 inches long. Questionably distinct from *Pomacentrus leucostictus*.**Pomacentrus leucostictus** Müller and Troschel

Blue Gregory; cockeye pilot; blue and yellow demoiselle

Pomacentrus leucostictus Müller and Troschel, 1848, in Schomburgk's Exc. Barbados, p. 674.*Eupomacentrus leucostictus* Evermann and Marsh, 1902, p. 226, Pl. 28.FIG. 178.—*Pomacentrus leucostictus*
From Zoologica, IX

Type locality.—Barbados.

Distribution.—West Indies, north to southern Florida, the generally abundant species of the genus. Fairly plentiful about Porto Rico and recorded from St. Croix.

Specimens collected.—7: Santurce and Fort San Geronemo, San Juan; Tallaboa, near Ponce.

Diagnosis.—Head 3.5; depth 2; eye 3. Dorsal XII, 15; anal II, 13; scales 29. Upper anterior profile of head arched. Lower posterior half of body more or less abruptly bright yellow; caudal bright yellow; usually a blue spot at base of last ray of anal; region below lateral line with many blue spots. Attains a length of about 6 inches.

Remarks.—A number of perfectly distinct though closely related species of this genus occur in the West Indian fauna, usually differing in color and in the ecological niche which they occupy. The ease with which specimens of the generally abundant and highly variable *P. leucostictus* may be misidentified confuses our knowledge of the group.

Habits.—Throughout its range one of the most abundant of the small, brightly colored fishes in shallow water among the reefs and tide pools along the shore. It is continually active and, when alarmed, darts to cover in some hole or niche, to reappear in a few moments when the alarm has passed.

Pomacentrus chrysus (Bean)

Yellow reef-pilot; yellow demoiselle

Eupomacentrus chrysus Bean, 1906, Proc. Biol. Soc. Wash., Vol. XIX, p. 32.

Eupomacentrus chrysus Nichols, 1915, Bull. Amer. Mus. Nat. Hist., Vol. XXXIV, p. 144. Porto Rico.

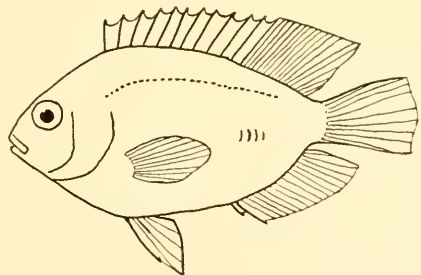


FIG. 179.—*Pomacentrus chrysus*.

Type locality.—Bermuda.

Distribution.—Bermuda and Porto Rico only; rare.

Specimens collected.—1: near San Antonio Bridge.

Diagnosis.—Head 3.2 to 3.3; depth 2; eye 2.2 (in a specimen $1\frac{5}{8}$ inches standard length). Dorsal XII, 16; anal II, 15; scales 28. Yel-

low or orange-yellow all around with few dark markings, usually with a blue ocellus on base of soft dorsal extending onto back, and a smaller ocellus on peduncle. Length from 2 to 3 inches.

Remarks.—The only Porto Rican specimen was captured near shore in shallow water beside an old iron hulk. This is one of 2 or 3 well marked species of shore fishes known only from Bermuda and Porto Rico, where they are rare. They may be taken as evidence that the corner of the West Indian faunal area lying north and east of the Gulf Stream current system has certain peculiarities that deserve further investigation.

Abudefduf Forskal

Abudefduf saxatilis (Linnaeus)

Cockeye pilot; demoiselle; chirivita; pintado

Chaetodon saxatilis Linnaeus, 1758, Syst. Nat., ed. 10, p. 276.

Abudefduf saxatilis Evermann and Marsh, 1902, p. 227, Fig. 64.

Abudefduf marginatus Fowler, 1928, Proc. Ac. Sci. Phila., p. 465.

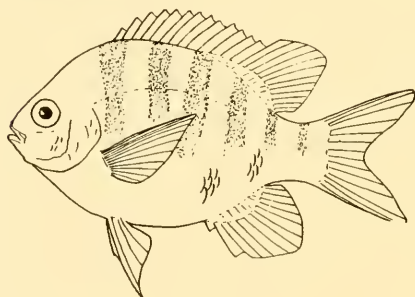


FIG. 180.—*Abudefduf saxatilis*
From Zoologica, IX

Type locality.—Not given.

Distribution.—Both coasts of the Americas, Florida to Uruguay, and Guaymas to Peru. Common in Porto Rican waters and about St. Croix.

Specimens collected.—6: San Juan.

Diagnosis.—Head 3.2; depth 1.8; eye 3.2. Dorsal XIII, 13; anal II, 12; scales 28. Color pale (looking yellowish in the water); sides with 5 or 6 conspicuous vertical dark bars, fading out on the belly. Attains a length of 6 inches.

Hbaitis.—Generally one of the most abundant and conspicuous fishes about coral reefs. Its bold color pattern gives it a high visibility, and places it with other highly colored species that lend variety and interest to the appearance of a coral reef. The colors of such fishes have been called immunity colors, implying that the interstices of their habitat afford such excellent chances to dodge and hide at the approach of danger,

that the fish can afford to be so conspicuous. Little schools of the young of *Abudefduf*, small replicas of the adults, are usually to be found swimming actively about in tide pools along shore in the company of *Pomacentrus leucostictus*.

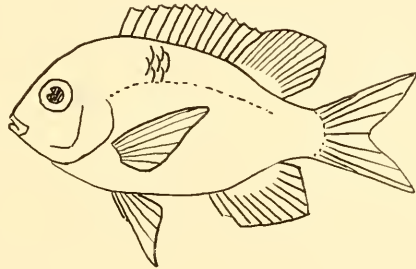
Abudefduf analogus (Gill)

Gray cockeye pilot

Euchistodus analogus Gill, 1863, Proc. Ac. Nat. Sci. Phila. for 1863, p. 219.

Abudefduf analogus Nichols, 1915, Bull. Amer. Mus. Nat. Hist., Vol. XXXIV, p. 144. Porto Rico.

FIG. 181.—*Abudefduf analogus*



Type locality.—Aspinwall.

Distribution.—Caribbean, apparently rare. One Porto Rican record.

Specimens collected.—1: Condado Rocks.

Diagnosis.—Head 3; depth 2. Dorsal XIII, 12; anal II, 10; scales 26 to 27. Preorbital breadth not less than width of pupil. Brownish with green dots, not distinctly banded.

Microspathodon Günther

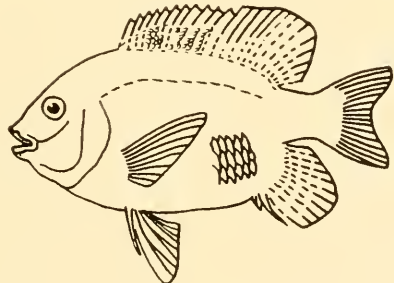
Microspathodon chrysurus (Cuvier and Valenciennes)

Yellow tailed soft-toothed demoiselle

Glyphidodon chrysurus Cuvier and Valenciennes, 1830, Hist. Nat. Poiss., Vol. V, p. 476.

Microspathodon chrysurus Cope, 1871, Trans. Amer. Phil. Soc., Vol. XIV, p. 461. St. Croix.

FIG. 182.—*Microspathodon chrysurus*
From Zoologica, X



Type locality.—St. Thomas.

Distribution.—West Indies, uncommon. Known from St. Thomas and St. Croix; but not from Porto Rico.

Diagnosis.—Head 3; depth 1.7 to 1.8; eye 3.5. Dorsal XI to XII, 15; anal II, 13; scales rather large. Teeth movable, incisor-like, in one row on front of each jaw. Vertical fins elevated and the caudal lobes falcate. Caudal golden yellow or orange in color; body dark, more or less spotted with blue on head and back. Length 6 inches.

Habits.—Beebe and Tee Van found this species common in Haitian waters, and it is often brought into the markets. They took it almost entirely with dynamite. Stomach contents consisted mostly of chewed algae and bottom debris.

***Microspathodon niveatus* (Poey)**

White-spotted, soft-toothed demoiselle

Pomacentrus niveatus Poey, 1875, Enumeratio, p. 102.

Microspathodon niveatus Silvester, 1916, Yearb. Carn. Inst. Wash. for 1915, Vol. XIV, p. 216. Porto Rico.

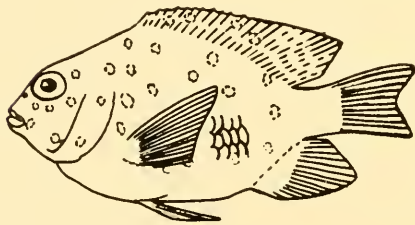


FIG. 183.—*Microspathodon niveatus*
From Zoologica, X

Type locality.—Havana.

Distribution.—Cuba, Haiti and Porto Rico, rare. Silvester saw several and obtained one at Guanica.

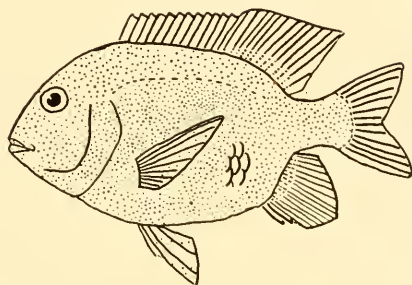
Diagnosis.—Head 2.7 to 2.8; depth about 2; eye 3.7 to 3.8. Caudal dark colored like the body, which is sprinkled with blue spots like flakes of snow. Vertical fins elevated, the caudal lobes falcate; teeth movable, incisor-like. Attains a length of 6 inches but is usually smaller. This may be the young or a color phase of *Microspathodon chrysurus*, from which it seems to differ only in color.

Habits.—Frequents reefs, where it may be seen swimming among the corals.

Microspathodon fowleri Silvester

Fowler's soft-toothed demoiselle

Microspathodon fowleri Silvester, 1916, Yearb. Carn. Inst. Wash. for 1915, Vol. XIV, p. 216.

FIG. 184.—*Microspathodon fowleri*

Type locality.—Coral reef off Guanica Harbor, P. R.

Distribution.—Known only from the type locality, whence 5 individuals were examined by Silvester.

Diagnosis.—Head 3; depth 1.9; eye 4.2 to 4.3 (specimen 7 or 8 inches long). Dorsal XII, 15; anal II, 13; scales 29. Color uniformly black with indications of a yellowish tinge under the scales, fins uniformly black. Length from 5 to 8 inches.

LABRIDAE

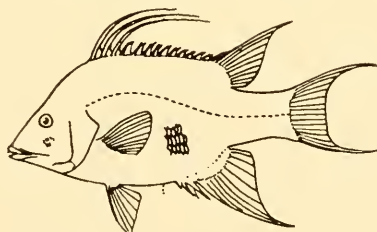
Lachnolaimus Cuvier and Valenciennes**Lachnolaimus maximus** (Walbaum)

Hogfish: capitan: perro perro

Labrus maximus Walbaum, 1792, Artdi Piscium, p. 261.

Lachnolaimus maximus Evermann and Marsh, 1902, p. 230, Fig. 65.

FIG. 185.—*Lachnolaimus maximus*
From Zoologica, X



Type locality.—Uncertain.

Distribution.—West Indies, north to Key West and Bermuda. Rather common in Porto Rican waters.

Specimens seen.—Ponce Market.

Diagnosis.—Head 3; depth 2.2; eye 5.4. Dorsal XIV, 11 to 12; anal III, 10; scales 38. Three or four anterior dorsal spines produced in streamers. Attains a weight of 10, 15 or even 20 pounds.

Remarks.—An important food fish, though at one time in ill-repute in Cuba, because it was thought to be unwholesome, especially when large.

Habits.—Abundant about reefs and rocks in most West Indian localities, a large, showy fish, variously marked with reds and yellows. The young hide in patches of weed, and have a mottled neutral concealing color.

Harpe Lacépède

Harpe rufa (Linnaeus)

Spanish hogfish; pudiano; pero colorado

Labrus rufus Linnaeus, 1758, Syst. Nat., ed. 10, p. 284.

Cossyphus rufus Cope, 1871, Trans. Amer. Phil. Soc., Vol. XIV, p. 463. St. Croix.

Bodianus rufus Meek and Hildebrand, 1928, Fishes of Panama, Pt. 3.

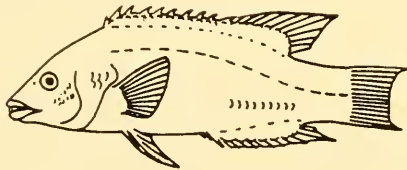


FIG. 186.—*Harpe rufa*
From Zoologica, X

Type locality.—Bahamas.

Distribution.—West Indies, north to Key West and Bermuda, south to Rio Janeiro. Known from St. Croix, but apparently only a single specimen recorded from Porto Rico, from off Guanica Harbor, by Silvester (1916).

Diagnosis.—Head about 3; depth 3 to 3.5 (including scaly dorsal sheath); eye a little less than 6. Dorsal XII, 11; anal III, 13; scales 33. Anterior canines strong, posterior canines present; soft dorsal and anal produced behind, with a scaly sheath at base. General color violet red above and in front, yellow or orange behind and below. Length 2 feet.

Remarks.—One of the largest and most brightly colored of the wrasses that inhabit West Indian coral reefs, occasionally seen in the markets, but apparently only locally abundant. A related species is of frequent occurrence on the Pacific coast of tropical America. The West Indian

fauna is dominated by a somewhat different, usually larger, scaled group of wrasses.

Clepticus Cuvier

Clepticus parrae (Bloch and Schneider)

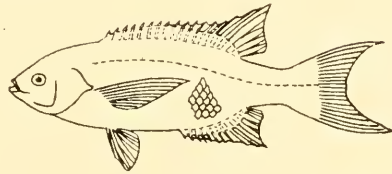
Purple-tailed Wrasse; genizara; janissary

Brama parrae Bloch and Schneider, 1801, Syst. Ichth., p. 100.

Clepticus parrae Jordan and Evermann, 1898, Bull. U. S. Nat. Mus., Vol. XLVII, Pt. 2, p. 1586.

Clepticus genizarra Cope, 1871, Trans. Amer. Phil. Soc., Vol. XIV, p. 463. St. Croix.

FIG. 187.—*Clepticus parrae*
From Zoologica, X



Type locality.—Havana.

Distribution.—West Indies, uncommon. Recorded from St. Croix by Cope.

Diagnosis.—Head 3.6 to 3.7; depth 2.8 to 2.9 (in specimens nearly a foot long). Dorsal XII, 10; anal III, 12; scales 35. Anterior teeth small, blunt, not canine-like; mouth small. Dorsal and anal sheathed in scales, except produced tips of the fins; caudal deeply forked. Attains a length of about a foot.

Halichoeres Rüppell

Halichoeres garnoti (Cuvier and Valenciennes)

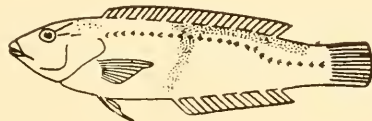
Coral Wrasse

Julis garnoti Cuvier and Valenciennes, 1839, Hist. Nat. Poiss., Vol. XIII, p. 390.

Iridio garnoti Jordan and Evermann, 1898, Bull. U. S. Nat. Mus., Vol. XLVII, Pt. 2, p. 1593.

PlatyGLOSSUS ruptus Cope, 1871, Trans. Amer. Phil. Soc., Vol. XIV, p. 464. St. Croix.

FIG. 188.—*Halichoeres garnoti*
From Zoologica, X



Type locality.—Martinique.

Distribution.—West Indies, usually not common. Recorded from St. Croix by Cope.

Diagnosis.—Head 3.5; depth 3.7 to 3.8; Dorsal IX, 11; anal III, 11; scales 26. Caudal fin rounded or subtruncate; scales before dorsal large, not crossing the median line of the back; ventral fins with the outer rays produced, more than twice the length of the inner; side without conspicuous dark lateral band, and with a distinct dark vertical bar downward from the spinous dorsal. Length 8 inches.

Habits.—Beebe and Tee Van report this wrasse as common at Port au Prince Bay, Haiti, to be seen at almost any time on the coral reefs. The color is very variable, but strikingly different in front and behind, which renders the species conspicuous. Its food is varied in nature, including small crustaceans, sea urchins, spines and all, and mollusks with their shells.

Halichoeres radiatus (Linnaeus)

Variegated wrasse; pudding wife

Labrus radiatus Linnaeus, 1758, Syst. Nat., ed. 10, p. 288; based on Catesby.

Iridio radiatus Jordan and Evermann, 1898, Bull. U. S. Nat. Mus., Vol. XLVII, Pt. 2, p. 1590.

PlatyGLOSSUS cyanostigma Cope, 1871, Trans. Amer. Phil. Soc., Vol. XIV, p. 464. St. Croix.

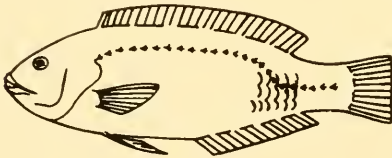


FIG. 189.—*Halichoeres radiatus*
From Zoologica, X

Type locality.—Bahamas.

Distribution.—West Indies, from Brazil north to the Florida Keys and Bermuda. Though generally common within its range, this wrasse seems not to have been recorded from Porto Rico. It is, however, known from St. Croix.

Diagnosis.—Head 3.6 to 4; depth 2.7 to 2.8; eye 6.5. Dorsal IX (rarely VIII), 11; anal III, 12; scales 28. Caudal fin slightly concave, truncate when spread open; scales before dorsal not crossing the middle line of the back. Side below spinous dorsal without a dark cross-bar; general color bluish or bronze, with blue spots and stripes. Length 18 inches.

Remarks.—This may be the adult form of *Halichoeres bivittatus*, from which it differs little except in color.

Habits.—Frequents coral reefs, gliding in and out among the projecting corals. Ranges from the surface to a depth of at least 50 feet. Larger individuals browse on sponge, coral, and other organic debris. Frequently captured in fish-traps.

Halichoeres bivittatus (Bloch)

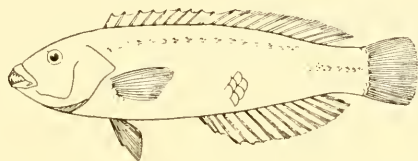
Slippery dick; doncella

Labrus bivittatus Bloch, 1792, *Icth.*, Pl. 284, Fig. 1; from a painting by Plumier.

Iridio bivittatus Evermann and Marsh, 1902, p. 232, Fig. 66. ♀

Halichoeres radiatus Meek and Hildebrand, 1928, *Fishes of Panama*, Pt. 3.

FIG. 190.—*Halichoeres bivittatus*



Type locality.—Martinique.

Distribution.—Throughout the West Indies, north to Pensacola, Fla., and Beaufort, N. C.; south to Brazil, usually abundant. Common in Porto Rican waters.

Diagnosis.—Head 3.2; depth 4; eye 6.3. Dorsal IX, 11; anal III, 12; scales 28. Caudal fin rounded or sub-truncate; ventral with its outer ray not produced, in length not more than twice the inner rays. Side with a dark lengthwise band; spinous dorsal pale colored, with a very small black spot or none. Length 6 inches.

Remarks.—This may be the young of *Halichoeres radiatus*.

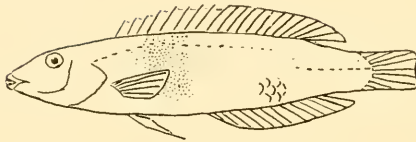
Habits.—Abundant, gliding in and out among the interstices of the reefs; also found in a variety of localities in shallow water. According to Gudger it rests on its side on the bottom; hides in weed; and swims rather slowly with a sinuous eel-like motion of the hinder part of the body. Like other wrasses it uses its pectoral fins a good deal in swimming.

Halichoeres kirschii (Jordan and Evermann)

Kirsch's wrasse

Iridio kirschii Jordan and Evermann, 1896, *Check-list of Fishes of North and Middle America*, p. 413; name only; 1898, *Bull. U. S. Nat. Mus.*, Vol. XLVII, Pt. 2, p. 1598.

Iridio kirschii Evermann and Marsh, 1902, p. 232.

FIG. 191.—*Halichoeres kirschii*

Type locality.—Bahia.

Distribution.—West Indies, south to Bahia, not common. A few small specimens have been taken in Porto Rico, and the fish is also known from St. Croix.

Specimens collected.—1: Santurce, San Juan.

Diagnosis.—Head 3.4; depth 4; eye 5.5. Dorsal IX, 12; anal III, 11; scales 28. Caudal fin very slightly concave, truncate when spread; ventral fins with their outer ray filamentous, more than twice as long as the inner ray. Side below spinous dorsal with a very broad blackish cross-bar. Attains a foot in length.

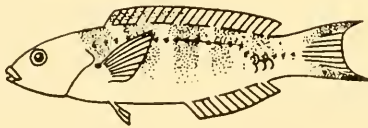
Thalassoma Swainson

Thalassoma nitidum (Günther)

Shining wrasse

Julis nitida Günther, 1862, Cat., Vol. IV, p. 190.

Thalassoma nitidum Nichols, 1915, Bull. Amer. Mus. Nat. Hist., Vol. XXXIV, p. 144. Porto Rico.

FIG. 192.—*Thalassoma nitidum*
From Zoologica, X

Type locality.—Jamaica.

Distribution.—West Indies. Abundant about San Juan, P. R.

Specimens collected.—Several: San Juan, where it is common in tide pools and close to shore among the rocks.

Diagnosis.—Head 3.7 to 3.8; depth 4. Dorsal VIII, 13; anal II (or III), 11; scales 26. Caudal fin truncate or slightly lunate. Olive or yellow in color, with a darker band backward from the eye, more or less broken posteriorly. Length 3 inches.

Remarks.—Questionably distinct from the young of *T. bifasciatum*.

Habits.—Loosely organized schools of this little wrasse weave their way about among the shallows and tide pools. Neither their habits nor their manner of swimming are quite the same as those of the blue-head,

which has a similar but not quite identical color phase. It has been claimed that they are the young of that species, but the proof advanced is not yet satisfactory to the present writer.

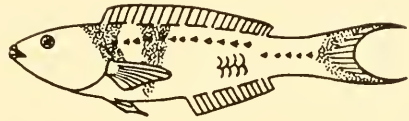
***Thalassoma bifasciatum* (Bloch)**

Blue-head; bicolored wrasse

Labrus bifasciatus Bloch, 1792, Ichth., Pl. 283.

Thalassoma bifasciatum Nichols, 1915, Bull. Amer. Mus. Nat. Hist., Vol. XXXIV, p. 144. Porto Rico.

FIG. 193.—*Thalassoma bifasciatum*
From Zoologica, X



Type locality.—West Indies.

Distribution.—West Indies. Generally common, but seemingly only a single specimen so far recorded from Porto Rican waters.

Specimens collected.—1: Santurce, San Juan.

Diagnosis.—Head 3.5; depth 3.6 to 3.7. Dorsal VIII, 13; anal II, 11; scales 27. Outer caudal rays produced. Head blue, one or two dark blue cross-bands behind it; posterior half of body contrastingly green. This striking pattern is not permanent, but may be replaced in a few minutes by more or less yellow colors suggesting those of *T. nitidum*. Length about 6 inches.

Habits.—Associates in schools, which keep about some point of coral reef. Ordinary swimming is mostly accomplished with the pectoral fins. Beebe and Tee Van found the food of those examined to consist of polychaete worms.

***Doratonotus* Günther**

***Doratonotus megalepis* Günther**

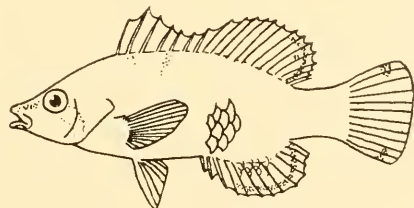
Tall-finned pigmy wrasse; baucket

Doratonotus megalepis Günther, 1862, Cat., Vol. IV, p. 125.

Doratonotus megalepis Evermann and Marsh, 1902, p. 233.

Doratonotus decoris Evermann and Marsh, 1902, p. 234, Pl. 29 (according to Meek and Hildebrand, 1928, Fishes of Panama, Pt. 3).

FIG. 194.—*Doratonotus megalepis*
From Zoologica, X



Type locality.—St. Kitts.

Distribution.—West Indies, north to Key West, Fla., rare. Two Porto Rican specimens recorded by Evermann and Marsh, from Hucares and Ponce.

Diagnosis.—Head 2.6 to 2.8; depth 2.6 to 3.4; eye 4 to 5. Dorsal IX, 10; anal III, 9; scales 20 to 26. Color green. Fins more or less white with reddish spots (*decoris*). Length from 1 to 3 inches.

Remarks.—There may be involved two or three species, or a single variable species.

Habits.—These little wrasses are occasionally found hiding in weed in shallow water.

SCARIDAE

Sparisoma Swainson

Sparisoma radians (Cuvier and Valenciennes)

Short-snouted parrotfish; grass parrotfish

Scarus radians Cuvier and Valenciennes, 1839, Hist. Nat. Poiss., Vol. XIV, p. 206.

Sparisoma radians Meek and Hildebrand, 1928, Fishes of Panama, Pt. 3.

Sparisoma xystrodon Evermann and Marsh, 1902, p. 236.

Sparisoma hoplomystar Evermann and Marsh, 1902, p. 237, Fig. 67.

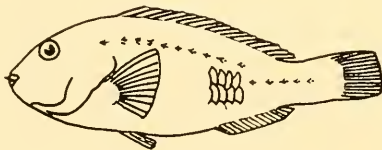


FIG. 195.—*Sparisoma radians*
From Zoologica, X

Type locality.—Brazil.

Distribution.—West Indies, north to Florida and south to Brazil. Very common about Porto Rico, especially abundant at Ponce and Mayagüez.

Specimens collected.—6; Santurce, San Juan; Ponce Market.

Diagnosis.—Head 3 to 3.2; depth 3.2; eye 3.5 to 5. Dorsal IX, 10; anal 11; scales 25. Canine teeth variable, 2 to 4 on each side; caudal truncate or slightly rounded, with or without black on the posterior margin; colors neutral,—frequently distinct whitish bars across chin, axillary region blue, fins mottled, body variegated or spotted with pale. Length from 6 to 8 inches.

Habits.—This small parrotfish is most plentiful in weed and celgrass.

Sparisoma niphobles Jordan and Bollman

White-spotted parrotfish

Sparisoma niphobles Jordan and Bollman, 1888, Proc. U. S. Nat. Mus. for 1888, p. 551.

Sparisoma niphobles Evermann and Marsh, 1902, p. 238.

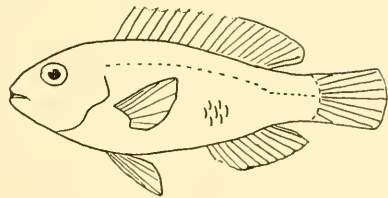


FIG. 196.—*Sparisoma niphobles*

Type locality.—Green Turtle Cay, Bahamas.

Distribution.—Bahamas and Florida Keys, and to an uncertain extent in the West Indies. Quite plentiful about Porto Rico.

Diagnosis.—Head 3; depth 2.6 to 2.7; eye 4.2 to 4.3. Dorsal IX, 10; anal II, 9; scales 25. A single posterior canine on each side; caudal slightly rounded.

Remarks.—This may be the same as *Sparisoma radians*, which it resembles, although more specked with white. Length from 5 to 6 inches or less.

Sparisoma aurofrenatum (Cuvier and Valenciennes)

Bridled parrotfish

Scarus aurofrenatus Cuvier and Valenciennes, 1839, Hist. Nat. Poiss., Vol. XIV, p. 191.

Sparisoma aurofrenatum Evermann and Marsh, 1902, p. 238.

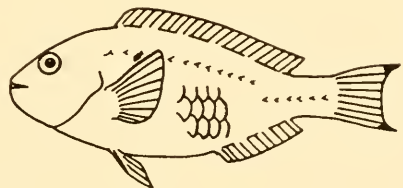


FIG. 197.—*Sparisoma aurofrenatum*
From Zoologica, X

Type locality.—Santo Domingo.

Distribution.—A West Indian species, known from St. Croix, and with one or two Porto Rican records.

Diagnosis.—Head 3.1; depth 3.1; eye 5. Dorsal IX, 10; anal II, 9; scales 25. Caudal lunate, its outer rays more or less exerted, but not

twice as long as inner rays; a single canine tooth on each side (rarely obsolete or duplicated). A scarlet stripe from below eye to angle of mouth; a round spot of yellow and black behind head; body chiefly purplish brown and fins chiefly red. Attains a length of from 8 to 10 inches.

***Sparisoma abildgaardi* (Bloch)**

Red parrotfish: loro colorado

Scarus abildgaardi Bloch, 1791, Ichth., Pl. 259.

Sparisoma abildgaardii Evermann and Marsh, 1902, p. 239, Pl. 30.

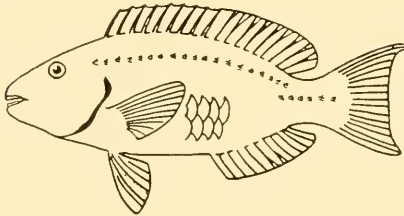


FIG. 198.—*Sparisoma abildgaardi*
From Zoologica, X

Type locality.—"America."

Distribution.—West Indies to Brazil. Appears in numbers at Arroyo, and probably common elsewhere about Porto Rico. Known from St. Croix.

Specimens collected.—2: Santurce, San Juan.

Diagnosis.—Head 3 to 3.5; depth 2.5 to 2.7; eye 5.3 to 6.4. Dorsal IX, 10; anal II, 9; scales 25. Caudal fin lunate, its outer rays more or less exerted, but not twice as long as the inner rays; a single canine tooth on each side (rarely obsolete or duplicated). Reddish brown or gray in color with whitish mottlings; belly and fins mostly cherry red. Attains a length of a foot or more.

Habits.—This is a striking and easily recognizable species among the numerous and varied parrot fishes which frequent coral reefs. It also extends its range out over sand or mud bottom and, perhaps correlated with this fact, is capable of considerable color changes, lighter or darker, brighter or duller. It is regularly found in West Indian fish markets, its capture, as in the case of other parrot fishes, being mainly in wicker traps placed on the bottom.

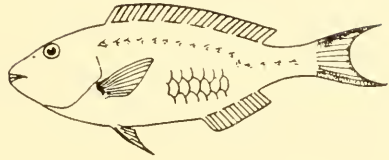
***Sparisoma chrysopterum* (Bloch and Schneider)**

Blue-green parrotfish: loro verde

Scarus chrysopterus Bloch and Schneider, 1801, Syst. Ichth., p. 286, Pl. 57.

Sparisoma chrysopterum Evermann and Marsh, 1902, p. 239.

FIG. 199.—*Sparisoma chrysopteryum*
From Zoologica, X



Type locality.—American Seas.

Distribution.—West Indies, south to Bahia, Brazil. Rather common about Porto Rico, and known from St. Croix.

Diagnosis.—Head 3.1; depth 3; eye 5.8. Dorsal IX, 10; anal II, 9; scales 25. Outer caudal rays, in adult, twice the length of inner rays or more; the caudal variegated in color. Usually from 4 to 6 canine teeth on each side. Greenish-blue; middle caudal rays red; axillary spot black, edged with red. Attains a length of a foot or more.

Remarks.—Of value as a food fish.

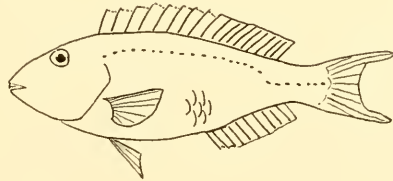
***Sparisoma lorito* Jordan and Swain**

Parrotfish; loro

Sparisoma lorito Jordan and Swain, 1884, Proc. U. S. Nat. Mus. for 1884, p. 95.

Sparisoma lorito Evermann and Marsh, 1902, p. 240.

FIG. 200.—*Sparisoma lorito*



Type locality.—Havana.

Distribution.—West Indies. Not uncommon about Porto Rico.

Diagnosis.—Head 3; depth 2.9; eye 5.3. Dorsal IX, 10; anal II, 9; scales 25. Outer caudal rays in adult twice the length of the inner rays or more. One or 2 canine teeth on each side. Opercle without black and yellow spot. Attains a length of about a foot.

Remarks.—Of some value as a food fish.

***Sparisoma viride* (Bonnaterre)**

Dark-green parrotfish; loro verde

Scarus viridis Bonnaterre, 1788, Enc. Méth., Vol. X, p. 96; after Catesby.
Sparisoma viride Evermann and Marsh, 1902, p. 240.

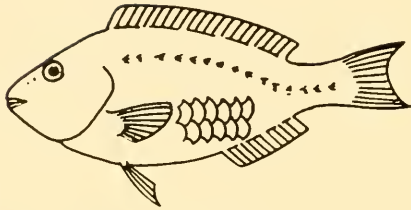


FIG. 201.—*Sparisoma viride*
From Zoologica, X

Type locality.—Bahamas.

Distribution.—West Indies. Known from Arroyo and Culebra, P. R., where it is probably common.

Diagnosis.—Head 3 to 3.3; depth 2.4 to 2.6; eye 6.2 to 7.5. Dorsal IX, 10; anal II, 9; scales 25. Upper lobe of caudal twice the length of its inner rays or more; one or 2 canine teeth on each side. Opercle with a black and yellow spot; general color green or greenish; caudal with bands or crescents of orange, and paler green or bluish. Attains a length of 2 feet or more.

Remarks.—Not of much value though used for food.

Habits.—Frequents coral reefs. Beebe and Tee Van report it commonly at a depth of from 20 to 40 feet.

***Sparisoma flavescens* (Bloch and Schneider)**

Mud parrotfish

Scarus flavescens Bloch and Schneider, 1801, Syst. Ichth., p. 290; after Parra.
Sparisoma flavescens Evermann and Marsh, 1902, p. 197.

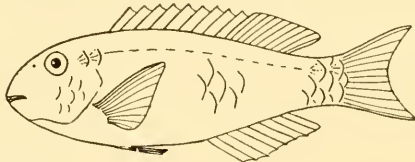


FIG. 202.—*Sparisoma flavescens*
From Zoologica, IX

Type locality.—Cuba.

Distribution.—Biscayne Bay and Key West, Fla., and straying further north; through the West Indies to Rio Janeiro, Brazil. Common and generally distributed in Porto Rican waters.

Diagnosis.—Head 3.1; depth 2.7; eye 5.5. Dorsal IX, 10; anal II, 9; scales 25. Upper jaw without posterior lateral canines; caudal lunate or truncate (rounded in the very young). Colors dull, mottled; caudal irregularly barred; lower fins mostly red; chin with a whitish crossband. Rarely exceeds a foot in length, usually small.

Habits.—This species, as its name implies, is not so typical a reef fish as most parrots. It hides about old dead reefs or ranges over open

ground, where it is quick to take refuge about snags or under stones, and frequents shallow water close to shore. Its relatively dull colors are doubtless correlated with such a habitat.

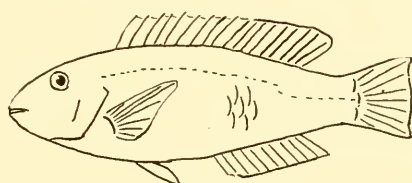
Sparisoma rubripinne (Cuvier and Valenciennes)

Red-finned parrotfish. Loro

Scarus rubripinnis Cuvier and Valenciennes, 1839, Hist. Nat. Poiss., Vol. XIV, p. 199.

Sparisoma rubripinne Evermann and Marsh, 1902, p. 241.

FIG. 203.—*Sparisoma rubripinne*



Type locality.—Santo Domingo.

Distribution.—West Indies. Common about Porto Rico, and known from St. Croix.

Diagnosis.—Head 3.3; depth 2.9; eye 5.5. Dorsal IX, 10; anal II, 9; scales 25. Caudal truncate, not lunate in the adult, angles very slightly produced,—rounded in the young. Colors in general like those of *Sparisoma flavescens* but paler. Length from 6 to 9 inches.

Remarks.—This species is close to and perhaps indistinguishable from *S. flavescens*.

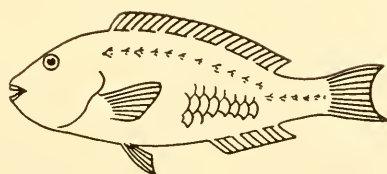
Sparisoma brachiale (Poey)

Red-tailed parrotfish

Scarus brachialis Poey, 1861, Memorias, Vol. II, p. 345.

Sparisoma brachiale Evermann and Marsh, 1902, p. 242.

FIG. 204.—*Sparisoma brachiale*
From Zoologica, X



Type locality.—Cuba.

Distribution.—Greater Antilles. Not uncommon in Porto Rico, where it was recorded by the U. S. Fish Commission from Aguadilla, Arroyo and Isabel Segunda.

Diagnosis.—Head 3.2; depth 3.1; eye 5.6. Dorsal rays IX, 10; anal II, 9; scales 25. Upper jaw without posterior lateral canines; caudal fin lunate or truncate with sharp angles (rounded in the very young), not marked by cross-bars, its center red. A very distinct black axillary spot. Color greenish, reddish below, a faint greenish streak running backward from the angle of the mouth. Length 9 inches to more than a foot.

Scarus Forskal

Differs from *Sparisoma* in that the gill-membranes form a fold across the isthmus, instead of being broadly joined thereto, the dorsal spines are flexible instead of stiff, and the teeth are more completely fused. Differs from *Pseudoscarus* in having white or rosy instead of blue or green teeth. Of the three genera, *Sparisoma* is the least specialized, but on the other hand it is the dominant genus in the West Indian fauna, and the one wherein speciation seems to be most active, and is there represented by many closely related species. There are not so many species of *Scarus* and but few of *Pseudoscarus*.

Scarus taeniopterus Desmarest

Painted-tailed parrotfish

Scarus taeniopterus Desmarest, 1831, Dict. Classique, Vol. XV, p. 244, Pl. 12.

Scarus taeniopterus Cope, 1871, Trans. Amer. Phil. Soc., Vol. XIV, p. 461. Santa Cruz.

Scarus taeniopterus Jordan and Evermann, 1898, Bull. U. S. Nat. Mus., Vol. XLVII, Pt. 2, p. 1646. Porto Rico and St. Thomas.

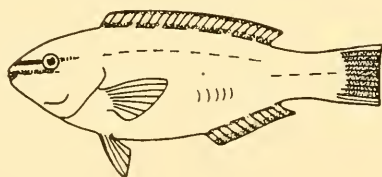


FIG. 205.—*Scarus taeniopterus*
From Zoologica, X

Type locality.—Cuba.

Distribution.—West Indies. Reported from St. Croix by Cope, from Porto Rico and St. Thomas by Jordan and Evermann.

Diagnosis.—Head 3; depth 2.6 to 2.7; eye 6. Dorsal IX, 10; anal II, 9; scales 24. A canine tooth, directed backward and outward, above the angle of the mouth; cheek with 2 or 3 rows of scales; caudal subtruncate. A yellow lengthwise stripe on the body; outer rays of caudal

orange, lighter than the median rays; head with bluish green stripes, the interspace reddish or yellow. Length from 8 to 9 inches.

Habits.—An uncommon, reef-dwelling species.

Scarus punctulatus Cuvier and Valenciennes

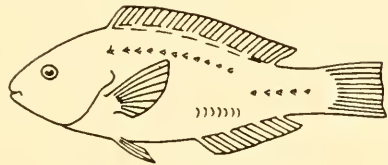
Punctulated parrotfish

Scarus punctulatus Cuvier and Valenciennes, 1839, Hist. Nat. Poiss., Vol. XIV, p. 195.

Scarus punctulatus Jordan and Evermann, 1898, Bull. U. S. Nat. Mus., Vol. XLVII, Pt. 2, p. 1645. Porto Rico.

Scarus diadema Cope, 1871, Trans. Amer. Phil. Soc., Vol. XIV, p. 461. St. Croix.

FIG. 206.—*Scarus punctulatus*
From Zoologica, X



Type locality.—Martinique.

Distribution.—West Indies. Recorded from Porto Rico by Jordan and Evermann and from St. Croix by Cope.

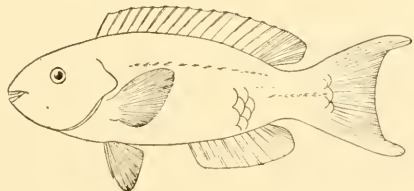
Diagnosis.—Head 3.1; depth 3.3 to 3.4; eye 5.2 to 5.3. Dorsal IX, 10; anal II, 9; scales 24. An outwardly directed canine tooth above angle of mouth on each side; cheek with 2 or 3 rows of scales; caudal subtruncate. A yellow stripe on the body; outer rays of caudal deep greenish blue, darker than the median rays; side of head with 2 bluish green stripes, the interspace reddish or yellow; dorsal and anal banded with green and orange, the anal with a roundish blue spot on the membrane between every 2 rays. Length from 6 to 8 inches.

Scarus vetula Bloch and Schneider

Old wife parrotfish; vieja

Scarus vetula Bloch and Schneider, 1801, Syst. Ichth., p. 289; after Parra.
Scarus vetula Evermann and Marsh, 1902, p. 243, Pl. 31.

FIG. 207.—*Scarus vetula*



Type locality.—Cuba.

Distribution.—Known from Cuba and Porto Rico. Not uncommon about Porto Rico.

Specimens collected.—1: Santurce, San Juan.

Diagnosis.—Head 2.7; depth 2.7; eye 7. Dorsal IX, 10; anal II, 9; scales 25. Upper jaw with 2 posterior lateral canines; cheek with 4 rows of scales; angles of caudal fin more or less salient. Color blue with rose edgings, bright yellow markings on the fins, and a variegated face. Length a foot or more.

Scarus croicensis Bloch

St. Croix parrotfish; bullon

Scarus croicensis Bloch, 1790, Ichth., Pl. 221.

Scarus croicensis Evermann and Marsh, 1902, p. 244.

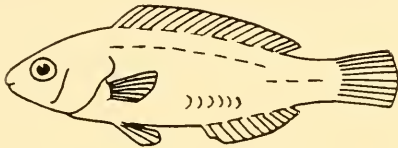


FIG. 208.—*Scarus croicensis*
From Zoologica, X

Type locality.—St. Croix.

Distribution.—Southern Florida and the West Indies, south to Brazil. Plentiful about Porto Rico and in neighboring waters.

Specimens collected.—4: San Juan.

Diagnosis.—Head 2.9; depth 3.3; eye 4.8. Dorsal IX, 10; anal II, 9; scales 25. Upper jaw without canines; $2\frac{1}{2}$ series of scales on the cheek, the third (partial) row consisting of 3 or 4 scales; caudal slightly rounded. Sides of body with 2 broad, dark, longitudinal shades; general color dark reddish brown. Length from 5 to 7 inches.

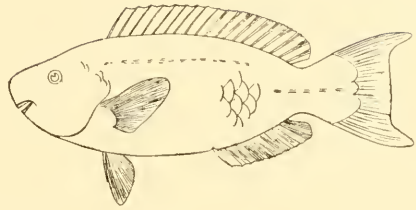
Habits.—This small parrotfish is usually abundant where found, particularly on shallow reefs or among weeds near shore. It also occurs on the deeper reefs. Beebe and Tee Van have found its food to consist of algae, small crustaceans, etc.

Scarus coeruleus (Bloch)

Blue parrotfish, loro

Coryphaena coerulea Bloch, 1786, Ausl. Fische, Pl. 176, in part; after Catesby, etc.

Scarus coeruleus Evermann and Marsh, 1902, p. 244.

FIG. 209.—*Scarus coarctatus*

Type locality.—Bahamas.

Distribution.—Florida and throughout the West Indies, north casually to Chesapeake Bay. Abundant about Porto Rico and in adjacent waters.

Diagnosis.—Head 3 to 3.4; depth 2.6 to 3; eye 6.8 to 8. Dorsal IX, 10; anal II, 9; scales 25. Upper jaw without canines; 2½ series of scales on the cheek, the third (partial) row of 1 or 2 scales only; caudal subtruncate, its outer rays more or less produced. Color bright blue, young more or less shaded with reddish brown. Attains a length of from 2 to 3 feet, and a weight of from 12 to 20 pounds.

Remarks.—Utilized but not highly regarded as a food fish.

Habits.—Frequents pools among the mangroves as well as the reefs.

Pseudoscarus Bleeker

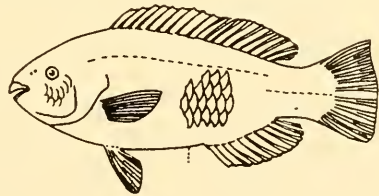
Pseudoscarus guacamaia (Cuvier)

Green parrotfish: guacamaia

Scarus guacamaia Cuvier, 1829, Règne Animal, ed. 2, Vol. II, p. 265; after Parra.

Pseudoscarus guacamaia Evermann and Marsh, 1902, p. 245, Fig. 68.

FIG. 210.—*Pseudoscarus guacamaia*
From Zoologica, X



Type locality.—Cuba.

Distribution.—West Indian fauna, from Florida to Rio Janeiro. Abundant in Porto Rican waters.

Specimens collected.—2: Santurce, San Juan.

Diagnosis.—Head 2.9; depth 2.7; eye 5. Dorsal IX, 10; anal II, 9; scales 25. Upper jaw without posterior canines; teeth deep blue-green

in color; caudal with its angles much produced in the adult, truncate or rounded in the young. Color dark green with lighter green markings, and more or less red, orange and blue. Attains a length of 2 feet or more.

Remarks.—Of some food value.

EPHIPPIDAE

Chaetodipterus Lacépède

Chaetodipterus faber (Broussonet)

Spadefish; paguala

Chaetodon faber Broussonet, 1782, Ichth., Decas 1, Pl. 6.

Chaetodipterus faber Evermann and Marsh, 1902, p. 246, Pl. 33.

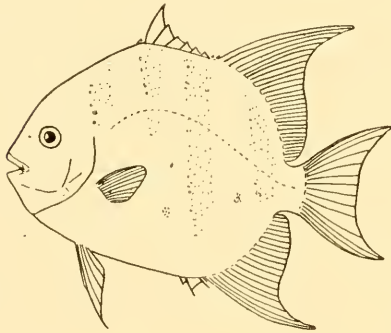


FIG. 211.—*Chaetodipterus faber*
From Zoologica, IX

Type locality.—Jamaica; Carolina; Society Islands.

Distribution.—Cape Cod to Rio Janeiro, common from Chesapeake Bay southward. Common in Porto Rican waters.

Diagnosis.—Head 3.5; depth 1.1 to 1.8; eye 4.2. Dorsal VIII-I, 20 to 22; anal III, 18; scales about 60. Third dorsal spine elongate; soft vertical fins falcate, with pointed lobes, turned backward. Dark cross-bands on the body, disappearing in large individuals. Attains a length of from 2 to 3 feet and a weight of 20 pounds.

Remarks.—A good food fish, of considerable market importance on the American coast from North Carolina to Florida.

Habits.—The spadefish frequents rocky patches, also wrecks and pilings. Its food consists of small crustaceans, worms, etc., also vegetable matter.

CHAETODONTIDAE

Chaetodon Linnaeus

The butterfly-fishes are small active flat deep-bodied fishes typical of the tropical coral reef, where several species are likely to be found associated, very similar in everything but the bold, diagnostic color pattern of each. Their colors are usually less gaudy than those of parrotfishes, wrasses, and other fishes which share this habitat with them, but their conspicuous liveries add much to the gay and attractive appearance of the reef.

Chaetodon ocellatus Bloch

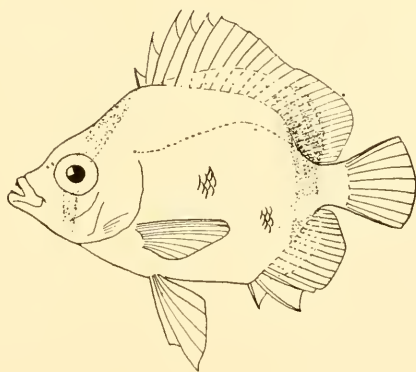
Common butterfly-fish; parché

Chaetodon ocellatus Bloch, 1787, Ichth., Pl. 211, Fig. 2.

Chaetodon ocellatus Jordan and Evermann, 1898, Bull. U. S. Nat. Mus., Vol. XLVII, Pt. 2, p. 1674.

Sarothrodus bimaculatus Cope, 1871, Trans. Amer. Phil. Soc., Vol. XIV, p. 474. St. Croix.

FIG. 212.—*Chaetodon ocellatus*
From Zoologica, IX



Type locality.—Uncertain.

Distribution.—West Indian fauna, the young straying northward to Rhode Island. Known from St. Croix and probably occurs also about Porto Rico, though it must be uncommon there as it is not recorded.

Diagnosis.—Head 2.9 to 3; depth 1.4 to 1.5; eye 3.4. Dorsal XII or XIII, 19 to 21; anal III, 16 to 17; scales 34. The series of scales below the axis of the body running obliquely upward and backward, the lowest becoming more or less horizontal. Ocular band extending from nape across cheek; base of soft dorsal with a large black spot, not ocellated. Attains a length of about 8 inches.

Habits.—A typical reef species, flitting about among the corals singly or by twos or threes. The young of this species may hide in weed more than do those of related species. In any event they are drifted great distances by ocean currents, and are relatively common northward, carried by the Gulf Stream drift. It is a fact which may have faunal significance that such "Gulf Stream" species are frequently less common in Porto Rican waters than one might suppose that they would be.

***Chaetodon striatus* Linnaeus**

Banded butterfly-fish; mariposa

Chaetodon striatus Linnaeus, 1758, Syst. Nat., ed. 10, p. 275.

Chaetodon striatus Evermann and Marsh, 1902, p. 249, Pl. 34.

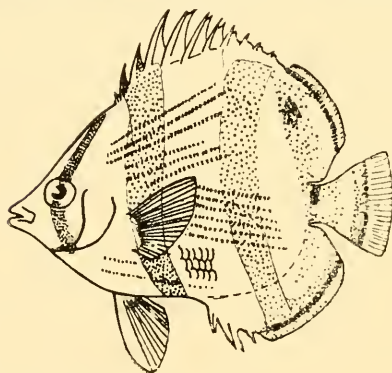


FIG. 213.—*Chaetodon striatus*
From Zoologica, X

Type locality.—Indies.

Distribution.—West Indian fauna, rare in southern Florida, ranging south to Brazil. Fairly abundant in Porto Rican waters; known from St. Croix.

Diagnosis.—Head 3; depth 1.6; eye 3.2. Dorsal XII, 20 or 21; anal III, 16 or 17; scales 38 to 40. The series of scales below axis of body running downward and backward, forming an angle with those above, each row marked by a continuous black streak. Body without ocelli, crossed by dark bands. Rarely more than 6 or 7 inches in length.

Habits.—The food of this species is doubtless similar to that of other butterfly-fishes. Beebe and Tee Van have found that the food includes minute crustaceans, algae and other organic matter.

***Chaetodon capistratus* Linnaeus**

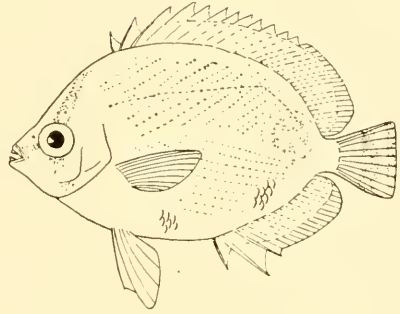
Eyed Butterfly-fish; four-eyed fish; mariposa

Chaetodon capistratus Linnaeus, 1758, Syst. Nat., ed. 10, p. 275.

Chaetodon capistratus Evermann and Marsh, 1902, p. 249, Pl. 35.

Chaetodon bricei H. M. Smith, 1897, Bull. U. S. Fish Comm. for 1897, p. 102. Woods Hole, Mass.; the young (according to Meek and Hildebrand, 1928, Fishes of Panama, Pt. 3).

FIG. 214.—*Chaetodon capistratus*
From Zoologica, IX



Type locality.—Indies.

Distribution.—West Indian fauna from southern Florida southward; the young casual north to Massachusetts. Abundant in Porto Rican waters and known from St. Croix.

Specimens collected.—2: Fort San Geronemo and Santurce, San Juan.

Diagnosis.—Head 2.5 to 2.9; depth 1.7; eye 2.8 to 2.9. Dorsal XII or XIII, 19 or 20; anal III, 17; scales about 40. The series of scales below axis of body running downward and backward, forming an angle with those above, each row marked by a continuous black streak. Body with a large black ocellus below soft dorsal; young with a second smaller ocellus on first 8 or 9 soft rays of dorsal. Attains a length of 6 inches.

Remarks.—This species, abundant in Porto Rico, is also plentiful about Bermuda—an incident of the similarity of the fauna at the two localities.

Pomacanthus Lacépède

The black angel-fishes are larger than the related butterfly-fishes and have a strong spine on the preopercle. They are deeper-bodied than the blue angel-fishes, or the gorgeous black and orange rock beauty, and less strictly reef-inhabiting than the latter.

Pomacanthus arcuatus (Linnaeus)

Black angel-fish; chirivita

Chaetodon arcuatus Linnaeus, 1758, Syst. Nat., ed. 10, p. 273.

Pomacanthus arcuatus Evermann and Marsh, 1902, p. 251, Fig. 69.

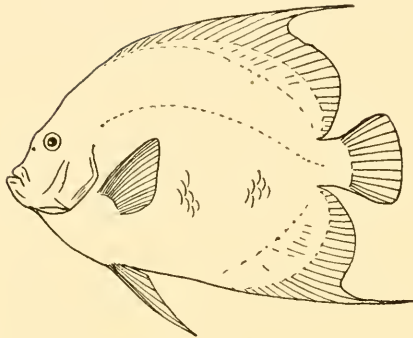


FIG. 215.—*Pomacanthus arcuatus*
From Zoologica, IX

Type locality.—India.

Distribution.—Generally common in the West Indies; south to Bahia, Brazil; casually north to New Jersey. Not uncommon about Porto Rico, and known from St. Croix.

Diagnosis.—Head 4; depth 1.2 to 1.5; eye 4. Dorsal VIII or IX, 30 to 32; anal III, 23 to 24; scales 50 to 56. Color dusky; the adult steel-gray or slightly yellowish with a white chin; the young with narrow pale cross-bands, which are more or less whitish. Attains a length of from 1 to 2 feet.

Habits.—An omnivorous feeder, algae constituting a considerable part of its diet (Gudger); algae, hydroids, etc. (Beebe and Tee Van).

Remarks.—Of some value as food and often seen in West Indian fish markets.

There are thus far no satisfactory records from our region of the closely related French angel-fish, *Pomacanthus paru*. The color of the adult is black, each scale edged with yellow, and the base of the pectoral fin yellow; the young have narrow pale cross-bands which are more or less yellow.

Holacanthus Lacépède

Holacanthus tricolor (Bloch)

Rock beauty; catalineta; palmoneta

Chaetodon tricolor Bloch, 1795, Ichth., Pl. 426.

Holacanthus tricolor Evermann and Marsh, p. 251, Pl. 36.

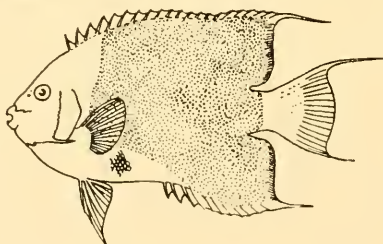


FIG. 216.—*Holacanthus tricolor*
From Zoologica, X

Type locality.—Cuba.

Distribution.—West Indies, south to Bahia, Brazil, and north to Bermuda. Probably not common about Porto Rico, where it has been recorded from Arroyo, Isabel Segunda and the Ponce Market. Known from St. Croix.

Specimens collected.—1: Ponce Market.

Diagnosis.—Head 3.4; depth 2.1; eye 4.4. Dorsal XIV, 18; anal III, 18; scales 48. Front of body, belly and caudal bright yellow or orange in color; posterior part of body and all but margins of vertical fins solid black. Attains a length of a foot or more.

Remarks.—Regarded as a good food fish.

Habits.—An inhabitant of coral reefs, usually solitary. Food consists of algae and scrapings (Beebe and Tee Van). Captured mainly in fish traps.

Angelichthys Jordan and Evermann

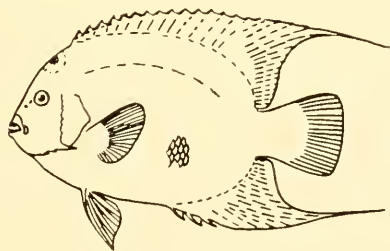
Angelichthys ciliaris (Linnaeus)

Blue angel-fish; queen angel-fish; isabelita

Chaetodon ciliaris Linnaeus, 1758, Syst. Nat., ed. 10, p. 276, in part.

Angelichthys ciliaris Evermann and Marsh, 1902, p. 252, Pl. 57.

FIG. 217.—*Angelichthys ciliaris*
From Zoologica, X



Type locality.—Indies.

Distribution.—From southern Florida and Bermuda through the West Indies to Brazil. Rather common in Porto Rican waters.

Specimens seen.—Ponce Market.

Diagnosis.—Head 3.8; depth 1.8 to 1.9; eye 4.7. Dorsal XIV, 21; anal III, 21; scales 47. Nape with a blue ocellus; soft dorsal and anal edged with dark blue; pectoral and caudal bright yellow. Attains a length of 2 feet.

Remarks.—A fair food fish.

Habits.—Primarily an inhabitant of the coral reef.

TEUTHIIDIDAE

Teuthis Linnaeus

The surgeon-fishes or tangs derive the former name from an erectile, forwardly directed, defensive knifelike spine on the peduncle. Other fishes in general recognize that "they carry a knife" and leave them alone.

Teuthis caeruleus (Bloch and Schneider)

Blue tang; barbero; medico

Acanthurus caeruleus Bloch and Schneider, 1801, Syst. Ichth., p. 214; based on Catesby, Parra and Browne.

Acanthurus cocculcus Meek and Hildebrand, 1928, Fishes of Panama, Pt. 3.

Teuthis cocculcus Evermann and Marsh, 1902, p. 253, Pl. 38.

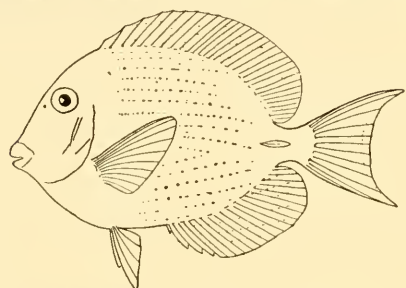


FIG. 218.—*Teuthis caeruleus*
From Zoologica, IX

Distribution.—Bermuda and southern Florida, through the West Indies to Brazil. Common and generally distributed in Porto Rican waters, and known from St. Croix.

Specimens seen.—San Juan.

Diagnosis.—Head 3.4; depth 1.5 to 1.75; eye 4.5. Dorsal IX, 26; anal III, 25; scales minute. An erectile spine on the peduncle. Color brown, washed with deep blue. Length from 8 to 12 inches.

Teuthis hepatus Linnaeus

Common tang; barbero; medico

Teuthis hepatus Linnaeus, 1766, Syst. Nat., ed. 12, p. 507.

Teuthis hepatus Evermann and Marsh, 1902, p. 254.

Acanthurus hepatus Meek and Hildebrand, 1928, Fishes of Panama, Pt. 3.

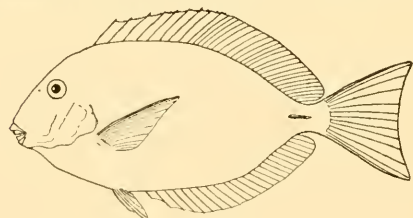


FIG. 219.—*Teuthis hepatus*
From Zoologica, IX

Type locality.—Carolina.

Distribution.—From the Carolinas and Florida south through the West Indies to Brazil. Abundant about Porto Rico, known from St. Croix.

Diagnosis.—Head 3.5; depth 2; eye 3.5. Dorsal IX, 24 to 26; anal III, 22 to 24; scales minute. An erectile spine on the peduncle. Color brownish, never blue, adult with narrow dark cross-marks; caudal slightly lunate. Sometimes grows to be a foot long, 6 or 7 inches being usual.

Remarks.—Of considerable importance as a food fish in Porto Rico.

Habits.—Of general distribution, but particularly about the reefs. Usually caught in fish traps. Feeds by browsing with its small mouth and incisor-like teeth on miscellaneous animal and vegetable matter, which is ground up in a powerful gizzard-like stomach.

***Teuthis bahianus* (Castelnau)**

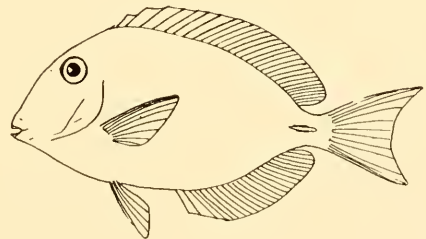
Ocean tang; crescent-tailed tang; barbero; medico

Acanthurus bahianus Castelnau, 1855, Anim. Nouv. ou Rares de l'Amer. Sud, p. 24, Pl. 11, Fig. 1.

Acanthurus bahianus Meek and Hildebrand, 1928, Fishes of Panama, Pt. 3.

Teuthis bahianus Evermann and Marsh, 1902, p. 254.

FIG. 220.—*Teuthis bahianus*
From Zoologica, IX



Type locality.—Bahia, Brazil.

Distribution.—From southern Florida through the West Indies to Brazil. Abundant in Porto Rican waters.

Specimens collected.—17: San Juan, Tallaboa near Ponce (all young).

Diagnosis.—Head 3.5; depth 2 to 2.4; eye 3 to 4.3. Dorsal IX, 24 to 25; anal III, 22 to 23; scales minute. An erectile spine on the peduncle. Color brownish, never blue, dorsal striped lengthwise, a pale band at base of caudal. Caudal lunate, deeply emarginate, upper lobe produced in a filament in adult. Attains a length of a foot or more.

Remarks.—An important food fish.

Habits.—Of general distribution, most plentiful about the deeper reefs. From stomach examinations Beebe and Tee Van record as its food finely disintegrated organic matter, with traces of algae and of worm tubes.

BALISTIDAE

Balistes Linnaeus**Balistes vetula** Linnaeus

Queen trigger-fish; old wife; cochino

Balistes vetula Linnaeus, 1758, Syst. Nat., ed. 10, p. 329; after Osbeck.

Balistes vetula Evermann and Marsh, 1902, p. 256, Pl. 39.

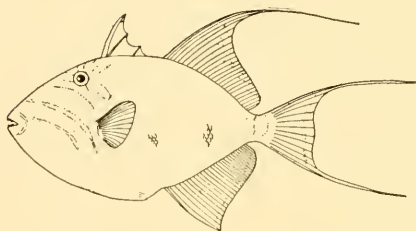


FIG. 221.—*Balistes vetula*
From Zoologica, IX

Type locality.—Ascension Island.

Distribution.—Bermuda, through the West Indies, and the warmer waters of the South Atlantic Ocean; also in the Indian Ocean; casually north to Woods Hole, Mass. Not uncommon about Porto Rico and known from St. Croix.

Specimens seen.—Ponce Market.

Diagnosis.—Head 3; depth 1.8; eye 4.5 in snout. Dorsal III, 29; anal 27; scales 63. Conspicuous curved blue stripes across face; anterior dorsal and outer caudal rays filamentous in the adult. Attains a length of about 15 inches without the caudal filaments.

Habits.—The trigger-fishes (*Balistes*) are sluggish, deep-bodied forms, with small mouth and strong incisor-like teeth. They feed on small crustaceans, shelly animals and to some extent on algae. They are protected from more active, predaceous fishes by a tough, leathery, defensive hide. The first spine of the trigger-fishes' back fin is also stout and strong, though not very long. The second, smaller dorsal spine locks the first in erection, hence the name trigger-fish. Trigger-fishes drift widely in ocean currents, especially at an early age. It is somewhat surprising that this is the only species common in Porto Rican waters, where the common trigger-fish, *B. carolinensis*, is so far

unrecorded. Presumably this fact is correlated with Porto Rico's lying somewhat outside the influence of the Gulf Stream current system.

Remarks.—As a species *Balistes vetula* has a very wide range in the North Atlantic, South Atlantic and Indian oceans. The fish from Trinidad Islet in the dominion of the Brazil current has been described as a distinct race (*B. v. trinitatis*) by Nichols and Murphy (see Copeia, 1917, No. 39), who find the Ascension form closer to West Indian examples than is the one from Trinidad. They suspect that if the West Indian fish is separable from the Ascension form, it will be found that the representative from the Indian Ocean is distinct also. The name *Balistes vetula bellus* (Walbaum) is available for the West Indian form, but until a more careful study has been made than the available material permits, there is little to be gained by attempting to divide the species into component races. The chief interest of the problem lies in correlations with ocean current distribution.

Melichthys Swainson

Melichthys piceus (Poey)

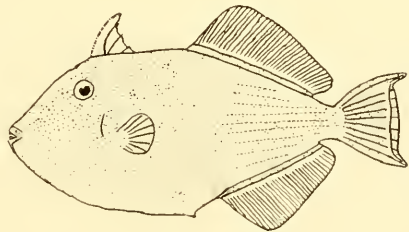
Black trigger-fish; galafate

Balistes piceus Poey, 1863, Proc. Ac. Nat. Sci. Phila. for 1863, p. 189.

Balistes piceus Cope, 1871, Trans. Amer. Phil. Soc., Vol. XIV, p. 478, St. Croix.

Melichthys piceus Jordan and Evermann, 1898, Bull. U. S. Nat. Mus., Vol. XLVII, Pt. 2, p. 1711.

FIG. 222.—*Melichthys piceus*



Type locality.—Cuba.

Distribution.—West Indies southward to Ascension Island, etc., not very common. Recorded from St. Croix by Cope. An East Indian form may be the same; a form about islands off the Pacific Coast of America is recognized as distinct.

Diagnosis.—Head 4 (to end of middle caudal rays); eye 4 in snout. Dorsal III, 34; anal, 32; scales about 53, skin leathery. Mouth small, with a series of even, white, incisor-like teeth. Caudal truncate, with its angles produced backward. Color blue-black, a sky-blue band along

bases of dorsal and anal fins, and usually a white band along the posterior edge of the caudal.

Habits.—Most frequently noted about outlying islands.

Xanthichthys Kaup

Xanthichthys ringens (Linnaeus)

Pelagic trigger-fish; cocuyo

Balistes ringens Linnaeus, 1758, Syst. Nat., ed. 10, p. 329.

Xanthichthys ringens Jordan and Evermann, 1898, Bull. U. S. Nat. Mus., Vol. XLVII, Pt. 2, p. 1709.

Xanthichthys cicatricosus Cope, 1871, Trans. Amer. Phil. Soc., Vol. XIV, p. 479. St. Croix.

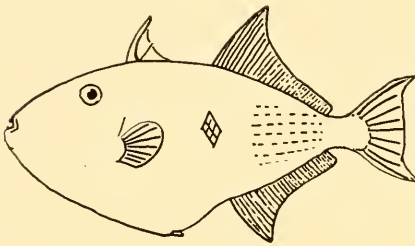


FIG. 223.—*Xanthichthys ringens*

Type locality.—Not given.

Distribution.—West Indies and southward, recorded from Mauritius, and probably widely distributed. Recorded from St. Croix by Cope.

Diagnosis.—Head 3; depth 2; eye 5. Dorsal II, 31; anal 28; scales 38, skin leathery. Cheek with 3 grooves; chin projecting; mouth small, with unequal oblique notched teeth. Sides with distinct lines of purplish spots. Length 10 inches.

Habits.—Apparently mostly pelagic at all ages, wandering and drifting at the surface of the high seas.

MONACANTHIDAE

The file-fishes are obviously a further specialization of the trigger-fish group,—more sluggish fishes with body more compressed, dorsal spines reduced to a single strong one and usually a rudiment, and leathery skin with only rudimentary spinigerous scales, that give it for the most part a rough velvety texture. The so-called plectognath fishes from the trigger-fishes through the file-fishes to the armored box-fishes, inflatable swell-fishes and monstrous, incomprehensible, specialized ocean sunfish, form an interesting series with obvious evolutionary interrelationships.

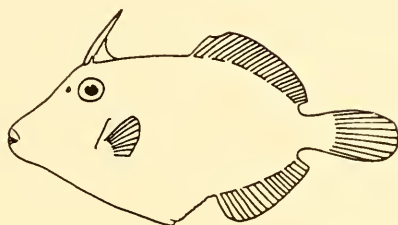
Cantherines Swainson**Cantherines pullus** (Ranzani)

Lija Colorado; peje puerco

Monacanthus pullus Ranzani, 1842, Nov. Comm. Act. Sci. Inst. Bonon., Vol. V, p. 4, Pl. 1.

Cantherines pullus Evermann and Marsh, 1902, p. 258.

FIG. 224.—*Cantherines pullus*
From Zoologica, X



Type locality.—Brazil.

Distribution.—West Indies to Brazil, occasionally north to southern Florida. Rather common in Porto Rico, and known from St. Croix.

Specimens seen.—San Juan.

Diagnosis.—Head 3.3; depth about 2. Dorsal II-35; anal 31; no scales, skin leathery. Dorsal spine without barbs. Coloration variable generally with a whitish spot behind last dorsal ray. Adults (12 inches long) with from 2 to 6 pairs of recurved spines on each side of the caudal peduncle. Attains a weight of 6 pounds.

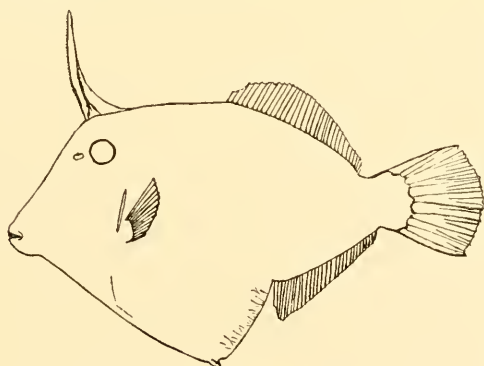
Cantherines amphioxys (Cope)

False file-fish

Monacanthus amphioxys Cope, 1871, Tran. Amer. Phil. Soc., Vol. XIV, p. 477.

Pseudomonacanthus amphioxys Silvester, 1916, Yearb. Carn. Inst. Wash. for 1915, Vol. XIV, p. 216. Off Ballenas Point, P. R.

FIG. 225.—*Cantherines amphioxys*



Type locality.—St. Martins.

Distribution.—West Indies, from Bermuda to Dominica, uncommon. Recorded from Porto Rico by Silvester.

Diagnosis.—Head 2.6 to 2.7 (at length of 2 or 3 inches) to 3.4 (at length of 5 or 6 inches); depth 2 to 1.6 (at 5 or 6 inches); eye 3 in snout (at 2 or 3 inches) to 4 in snout, 4.5 in head (at 5 or 6 inches). Dorsal I-34 to 35; anal 30; no scales, skin leathery. Dorsal spine with series (3 in front, 2 behind) of small spinules in the young, merely granular in the adult. Ventral spine fixed.

Remarks.—This species is probably not the same as *Cantherines pul-*
lus, as has been suggested, but a smaller fish with relatively smaller eye and greater depth. The genus *Pseudomonacanthus*, on the other hand, may be synonymous with *Cantherines*.

Monacanthus Cuvier

Monacanthus ciliatus (Mitchill)

File-fish; leather-fish; lija

Balistes ciliatus Mitchill, 1818, Amer. Monthly Mag. and Crit. Rev., March, 1818, p. 326.

Monacanthus ciliatus Evermann and Marsh, 1902, p. 258.

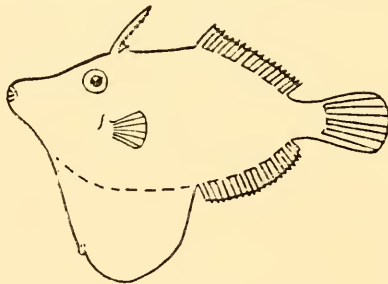


FIG. 226.—*Monacanthus ciliatus*
From Zoologica, X

Type locality.—Bahama Straits.

Distribution.—Southern Florida and the West Indies. Not uncommon about Porto Rico.

Diagnosis.—Head 2.9 to 3.5; depth 1.7 to 2.6; eye 3.3 to 3.8. Dorsal I-30 to 34; anal 30 to 33; scales minute, rudimentary, skin leathery. Ventral spine movable; ventral flap wide; profile concave; spines on peduncle in adult. Length from 3 to 8 inches.

Habits.—This species seems to be more solitary and nowhere as plentiful as is *M. hispidus* within its range of abundance; more strictly West Indian, and presumably with a somewhat different life history, as a

result of which the young drift less freely in weed carried by currents of the Gulf Stream system.

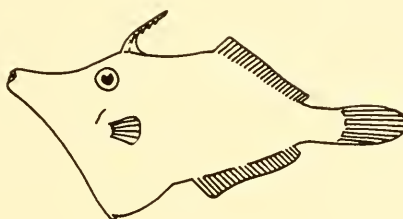
Monacanthus tuckeri Bean

Tucker's file-fish

Monacanthus tuckeri Bean, 1906, Proc. Biol. Soc. Wash., Vol. XIX, p. 33.

Monacanthus tuckeri Nichols, 1915, Bull. Amer. Mus. Nat. Hist., Vol. XXXIV, p. 145. Condado Bay, P. R.

FIG. 227.—*Monacanthus tuckeri*
From Zoologica, X



Type locality.—Bermuda.

Distribution.—Known from Bermuda, Porto Rico and Haiti, rare.

Specimens collected.—1: Condado Bay, San Juan.

Diagnosis.—Head 3; depth 3; eye 2.5 in snout. Dorsal I-35; anal 34 to 36; skin leathery, scaleless. Ventral spine movable; ventral flap wide, as in *M. ciliatus*. Size small (the Porto Rican specimen 1½ inches long).

Remarks.—This little file-fish, a well marked slender species related to *Monacanthus ciliatus*, was, like *Pomacentrus chrysus*, known for a long time only from Porto Rico and Bermuda.

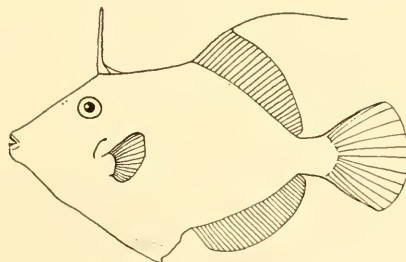
Monacanthus hispidus (Linnaeus)

Common file-fish; fool-fish; leather-fish; lija

Balistes hispidus Linnaeus, 1766, Syst. Nat., ed. 12, p. 405.

Monacanthus hispidus Evermann and Marsh, 1902, p. 259, Fig. 71 (mis-labeled *ciliatus*) and 72.

FIG. 228.—*Monacanthus hispidus*
From Zoologica, IX



Type locality.—Carolina.

Distribution.—Cape Cod to Cuba, Florida Keys, West Indies, Brazil. Apparently not common in Porto Rican waters.

Diagnosis.—Head 3.4; depth 1.7 to 1.8 (1.5 in young); eye 3.5 to 4. Dorsal I-32; anal 32; scales minute, rudimentary; skin leathery. Ventral spine movable; ventral flap narrow, little distensible; profile straight; peduncle without spines; first dorsal ray in adult (sometimes) produced as a filament. Attains a length of 10 inches.

Remarks.—Meek and Hildebrand (1928, Fishes of Panama, Pt. 3) differentiate *Monacanthus oppositus* from *M. hispidus* on the basis of a lower fin-count, as it is probable that the color differences given will not hold; and Beebe and Tee Van (1928, Zoologica, Vol. X, p. 258) refer all material from Port au Prince Bay, Haiti, to *oppositus*. There is some likelihood that *oppositus* will prove to be merely a southern race of *hispidus*. Should this be the case, it will be necessary to verify whether the Porto Rican form is typical *hispidus*, and the range of that form southward may have to be emended. For the present we follow Evermann and Marsh in referring the Porto Rican fish to *hispidus*.

Habits.—The common file-fish is somewhat intermediate in habits between the sluggish but free-swimming trigger-fishes (*Balistes*) and members of the genus *Alutera*, which have a tendency to drift about aimlessly in the currents, frequently not even maintaining an upright position in the water.

Young of this species less than an inch long are often very numerous in drifting eel-grass or gulf-weed, for instance among the Florida keys, and are carried in this manner far to the north along American shores. Porto Rican waters, somewhat removed from Gulf Stream influences, seem to be outside the range of abundance of *hispidus*.

Alutera Cuvier

Alutera scripta (Osbeck)

Unicorn file-fish; lija trompa

Balistes scriptus Osbeck, 1757. Iter. Chin., Vol. I, p. 144.

Alutera scripta Evermann and Marsh, 1902, p. 261, Fig. 73.

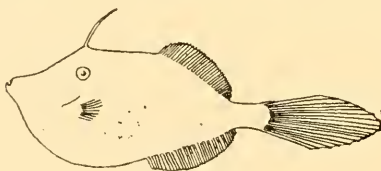


FIG. 229.—*Alutera scripta*
From Zoologica, X

Type locality.—China.

Distribution.—Cosmopolitan in warm seas. Rather common in the West Indies, and straying north to South Carolina. Recorded from Porto Rico by Poey.

Specimens seen.—Ponce Market.

Diagnosis.—Head 3.5; depth 3 to 3.3; eye 4.7. Dorsal I-44 to 48; anal 17 to 52; scales minute, rudimentary; skin leathery. No ventral spine (or external trace of ventrals); caudal graduated; profile concave. Irregular blue spots and lines and round dark spots on sides. Length from 2 to 3 feet.

Habits.—The file-fishes, particularly those of the genus *Alutera*, are sluggish drifters, which often do not bother to keep right side up in the water, and may frequently be caught in the hand. Their leanness and tough hide, inactivity and frequently concealing colors are sufficient protection against predaceous enemies.

OSTRACIIDAE

The trunk-fishes are encased in a bony shell or carapace, which greatly limits their facility of motion through the water, at the same time giving complete protection from other predaceous fishes of comparable size. They are sometimes used as food,—cooked in the shell.

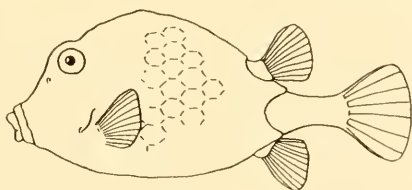
Lactophrys Swainson

Lactophrys triqueter (Linnaeus)

Trunk-fish: chapin

Ostracion triqueter Linnaeus, 1758, Syst. Nat., ed. 10, p. 330; after Mus. Ad. Fe.
Lactophrys triqueter Evermann and Marsh, 1902, p. 262, Fig. 74.

FIG. 230.—*Lactophrys triqueter*
From Zoologica, IX



Type locality.—India.

Distribution.—West Indies north to Bermuda, Key West and Pensacola, Florida, generally common in the tropics. Common in Porto Rican waters and known from St. Croix.

Diagnosis.—Head 3.5; height of side about 2; greatest ventral width 2.6; eye 3.4. Dorsal 10; anal 10. Encased in a three-cornered shell, or "carapace," without spines anywhere. Attains a foot in length.

Remarks.—Delicious eating when cooked in the shell, the entrails having been drawn (Gudger).

It is interesting that this species appears to be more abundant about Porto Rico, removed from Gulf Stream influences, than is *L. trigonus*, the generally common trunk-fish, which drifts northward most frequently along American shores.

Lactophrys trigonus (Linnaeus)

Common trunk-fish; chapin

Ostracion trigonus Linnaeus, 1758, Syst. Nat., ed. 10: after Artedi.

Lactophrys trigonus Evermann and Marsh, 1902, p. 263, Figs. 75, 76.

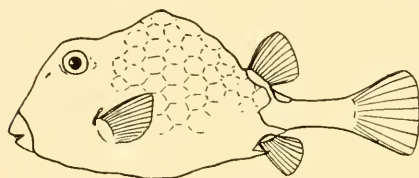


FIG. 231.—*Lactophrys trigonus*
From Zoologica, IX

Type locality.—India.

Distribution.—West Indies, north to Bermuda and Florida, occasionally to Woods Hole, Mass. Apparently not common in Porto Rican waters.

Diagnosis.—Head 2.9; height of side 1.7; greatest ventral width 1.7 to 1.8; eye 2.8. Dorsal 10; anal 10. Encased in a three-cornered shell or carapace, which is open behind the dorsal fin, and with distinct spines on the ventral ridges behind. Attains a length of about a foot.

Habits.—Young occur under gulf-weed or among eel-grass at Woods Hole, Mass. When $\frac{1}{2}$ inch or less in length, they are squarish or orbicular in outline (due to the slight development of the ridge in the center of the back, and the comparatively great development of the two ridges at the side) suggesting the allied genus *Ostracion*, which does not occur in America. One may reason from this that the *Ostracion* form of body is primitive for trunk-fishes, and the *Lactophrys* or triangular form secondary.

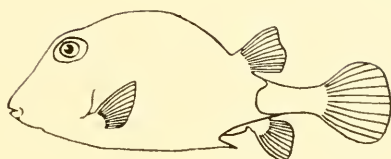
Lactophrys bicaudalis (Linnaeus)

Spotted trunk-fish; chapin

Ostracion bicaudalis Linnaeus, 1758, Syst. Nat., ed. 10, p. 330.

Lactophrys bicaudalis Evermann and Marsh, 1902, p. 264, Pl. 40.

FIG. 232.—*Lactophrys bicarinalis*
From Zoologica, X



Type locality.—India.

Distribution.—West Indies to Ascension Island; not known from Florida. Rather uncommon about Porto Rico.

Diagnosis.—Head 3.5; height of side 2.2 to 2.3; greatest ventral width 2.7; eye 3. Dorsal 10; anal 10. Body enclosed in a three-cornered shell or carapace, closed behind the dorsal fin, and with distinct spines on the ventral ridges behind. Attains a length of a foot or more.

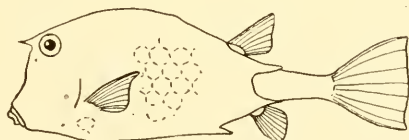
Habits.—The habits of all the trunk-fishes, must of necessity, due to the restrictions placed on them by their peculiar armament, be very similar. They swim lazily about, sucking small crustaceans and other creatures into their little mouths. They also do a certain amount of browsing, and Beebe and Tee Van record algae as a food of this species.

***Lactophrys tricornis* (Linnaeus)**

Horned trunk-fish: cowfish: toro

Ostracion tricornis Linnaeus, 1758, Syst. Nat., ed. 10, p. 331; after Artedi.
Lactophrys tricornis Evermann and Marsh. 1902, p. 264, Fig. 77.

FIG. 233.—*Lactophrys tricornis*
From Zoologica, IX



Type locality.—Not given.

Distribution.—West Indian fauna, from the Carolinas through the West Indies to Brazil, casually north to Massachusetts (young). Common in Porto Rican waters, and known from St. Croix.

Diagnosis.—Head 4.2 to 4.3; height of side 2.5; greatest ventral width 4.8; eye 2.7. Dorsal 10; anal 10. Body enclosed in a three-cornered shell or carapace, with distinct spines on the ventral ridges behind, and also on the frontal region directed forward, these last resembling a pair of horns. The body becomes relatively narrower (more compressed) in large specimens. Attains a length of a foot or more.

Habits.—This has perhaps the most general known distribution of any trunk-fish in West Indian waters, being one of the easiest fish to

recognize at sight. Beebe and Tee Van record algae, sponges and sea urchings as items of its diet. It is frequently seen in West Indian fish markets, and Gudger reported two half-digested specimens from the stomach of a six-foot shark (*Hypoprion brevirostris*) in Florida.

TETRAODONTIDAE

Lagocephalus Swainson**Lagocephalus laevigatus** (Linnaeus)

Smooth swell-fish; bottle-fish; tamboril; conejo

Tetraodon laevigatus Linnaeus, 1766, Syst. Nat., ed. 12, p. 411.

Lagocephalus laevigatus Evermann and Marsh, 1902, p. 266, Fig. 78.

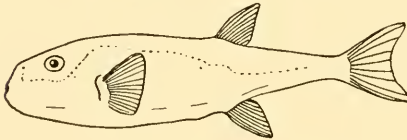


FIG. 234.—*Lagocephalus laevigatus*
From Zoologica, IX

Type locality.—Charleston, South Carolina.

Distribution.—West Indian fauna from Cape Cod to Brazil, generally common south of Cape Hatteras. Not uncommon in Porto Rican waters.

Diagnosis.—Head 3.2 to 3.3; depth 4.2 to 4.3; eye 4.8. Dorsal 13; anal 12; no scales, prickles most developed on abdomen. Abdomen capable of great inflation; dorsal and anal fins falcate, caudal somewhat lunate. Attains a length of 2 feet.

Remarks.—Of no value as food.

Habits.—As its better stream-lines would suggest, this the largest of our swell-fishes is more actively free-swimming than its relatives. Its colors are also those of an active surface fish, olive green above and lustrous silvery white on the sides and below. In the water it looks not unlike a glistening glass bottle, and is sometimes called "bottle-fish."

Tetraodon Linnaeus**Tetraodon spengleri** Bloch

Southern swell-fish; tambor; tamboril

Tetraodon spengleri Bloch, 1782, Ichth., Pl. 144.

Sphacroides spengleri Evermann and Marsh, 1902, p. 267, Fig. 79; Meek and Hildebrand, 1928, Fishes of Panama, Pt. 3.

FIG. 235.—*Tetraodon spengleri*
From Zoologica, IX



Type locality.—East Indies.

Distribution.—West Indies, north to Florida. Common about Porto Rico.

Specimens collected.—1: Santurce, San Juan.

Diagnosis.—Head 2.3 to 2.4; depth about 2.6; eye 5. Dorsal 7; anal 6 or 7. Body prickly, sometimes with dermal flaps, the head wholly or mostly without prickles. Abdomen capable of great inflation. Interorbital more or less concave, narrow. Lower part of sides with a series of about 12 regular rounded black spots. Rarely attains the length of about a foot; usually much smaller.

Habits.—Swell-fishes (sometimes called puffers) have the peculiar ability and habit in an emergency of inflating themselves with water or air so that they become much larger than normal and almost spherical. No doubt they frequently ward off the attack of some predacious enemy in this manner.

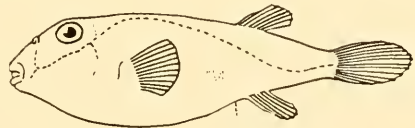
***Tetraodon marmoratus* Ranzani**

Spiny-back swell-fish

Tetraodon marmoratus Ranzani, 1840, Nov. Comm. Ac. Sci. Inst. Bonon., Vol. IV, p. 72, Pl. 10, Fig. 1.

Spheroides marmoratus Evermann and Marsh, 1902, p. 268; Meek and Hildebrand, 1928, Fishes of Panama, Pt. 3.

FIG. 236.—*Tetraodon marmoratus*
From Zoologica, X



Type locality.—Brazil.

Distribution.—West Indies to Brazil. Common in Porto Rico.

Specimens collected.—2: Paloseco Point and San Antonio Bridge, San Juan.

Diagnosis.—Head 2.75; depth 4; eye 4.5. Dorsal 7; anal 6. Sides of head and body, back, from upper lip to base of dorsal, and ventral surface prickly. Abdomen capable of great inflation. Color dark, olivaceous brown, black blotches on lower part of sides in the form of short, oblique cross-bars. Outline of head concave in front of the eye;

interorbital more or less concave, very narrow, its width about equal to the diameter of the pupil. Length 6 inches.

Tetraodon testudineus Linnaeus

Turtle-headed swell-fish; tambor; tamboril

Tetraodon testudineus Linnaeus, 1758, Syst. Nat., ed. 10, p. 332; based on Balk and Artedi.

Spheroides testudineus Evermann and Marsh, 1902, p. 269, Pl. 41; Meek and Hildebrand, 1928, Fishes of Panama, Pt. 3.

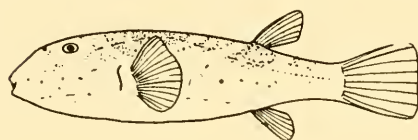


FIG. 237.—*Tetraodon testudineus*
From Zoologica, IX

Type locality.—Uncertain.

Distribution.—West Indian fauna, north to Florida (casually Massachusetts), south to Puerto Cabello and Brazil. Represented by the closely related *T. annulatus* on the Pacific coast. Common about Porto Rico.

Specimens collected.—17: San Juan (Santurce and Paloseco Point), Cataño.

Diagnosis.—Head 3; depth 3.5; eye 7.5. Dorsal 8; anal 6. Back and belly with prickles, those below rather large and closely set. Abdomen capable of great inflation. Interorbital broad and flattish, about one quarter the length of the head. Back with pale markings tending to form concentric ellipses. Attains a length of a foot or more.

Habits.—This species is abundant in open shallow water along the shore over sand or other bottom. It swims close to the bottom and is slow-moving even for a swell-fish.

CANTHIGASTERIDAE

Canthigaster Swainson

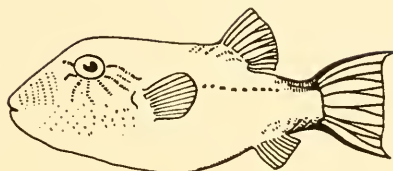
Canthigaster rostratus (Bloch)

Sharp-nosed swell-fish

Tetraodon rostratus Bloch, 1782, Ichth., Pl. 146.

Canthigaster rostratus Evermann and Marsh, 1902, p. 269.

FIG. 238.—*Canthigaster rostratus*
From Zoologica, X



Type locality.—India.

Distribution.—West Indies, Madeira, Bermuda, north in rather deep water to the banks off Pensacola, Fla. Not uncommon in Porto Rico.

Specimens collected.—4: Santurce and Condado Rocks, San Juan.

Diagnosis.—Head 2.6; eye 3.6; Dorsal 6; anal 8. Back and belly with weak prickles. Abdomen capable of inflation. Snout rather long and pointed; back elevated and somewhat compressed. Upper and lower caudal margins contrastingly dark-colored, each with a black basal blotch. Size small.

Habits.—Much like those of other small swell-fishes, but more active. Found about reefs and rocks.

DIODONTIDAE

Diodon Linnaeus

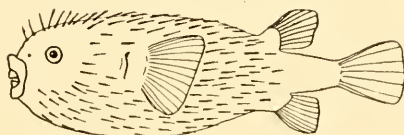
Diodon hystrix Linnaeus

Porcupine fish; erizo; puerco espino

Diodon hystrix Linnaeus, 1758, Syst. Nat., ed. 10, p. 335; after Artedi.

Diodon hystrix Evermann and Marsh, 1902, p. 271, Fig. 80.

FIG. 239.—*Diodon hystrix*
From Zoologica, IX



Type locality.—India.

Distribution.—Tropical seas everywhere, north to Florida, Lower California, and the Hawaiian Islands. Recorded from Porto Rico by Poey and Stahl.

Diagnosis.—Head 3; depth 3.5; eye 6. Dorsal 13 to 15; anal 13 to 15. Belly inflatable; body covered with terete erectile spines; frontal spines not particularly long. Body and fins with small round black spots. Occasionally attains a length of about 3 feet.

Habits.—The porcupine-fish has powers of inflation almost equal to those of the swell-fishes and, when inflated, its sharp spines, normally recumbent, project in every direction, making a truly formidable armor.

Nevertheless, various species of larger fish prey on small individuals. Porcupine-fishes are not very active swimmers but, when small, they drift great distances in ocean currents, and have a cosmopolitan range in warm seas.

Diodon holacanthus Linnaeus

Pied porcupine-fish; long-spined porcupine-fish

Diodon holacanthus Linnaeus, 1758, Syst. Nat., ed. 10, p. 335 (misprint for *holacanthus*): based on Artedi.

Diodon holacanthus Evermann and Marsh, 1902, p. 271.

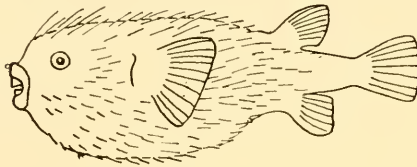


FIG. 240.—*Diodon holacanthus*
From Zoologica, X

Type locality.—India.

Distribution.—Tropical seas everywhere, north to Florida. Lower California and the Hawaiian Islands. Rare about Porto Rico, where there is a record of one about 5 inches long from Guanica Bay.

Diagnosis.—Dorsal 12; anal 12. Belly inflatable; body covered with terete erectile spines; frontal spines long. Body marked with larger black blotches than in *D. hystrix*, as well as small spots; fins with few spots or none. Length up to a foot, usually smaller.

Remarks.—There is considerable individual variation among porcupine-fishes, and it is questionable whether the two species recognized are valid. Small drifting individuals in the Atlantic generally have the color pattern that is supposed to be characteristic of *D. holacanthus*. Comparative isolation of Porto Rican waters from the Gulf Stream current system is doubtless correlated with the scarcity of these fishes about Porto Rico. They are common in most such tropical localities.

Chilomyeterus Bibron

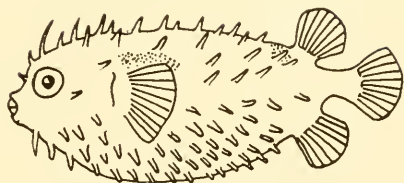
Chilomyeterus antennatus (Cuvier)

Cuvier's burr-fish

Diodon antennatus Cuvier, 1818, Mem. Mus. Hist. Nat. Paris, Vol. IV, p. 131, Pl. 7.

Chilomyeterus antennatus Evermann and Marsh, 1902, p. 272, Pl. 42.

FIG. 241.—*Chilomycterus antcanatus*
From Zoologica, X



Type locality.—Uncertain.

Distribution.—West Indies to the Cape of Good Hope. Several records from Porto Rico.

Diagnosis.—Spines over body strong, short, more or less immovable; body little inflatable. A longer spine in the middle of the forehead; superciliary edge not raised; a series of “antennae” along lower part of side. Upper parts with numerous black spots, some with bluish centers; a large spot or blotch above pectoral, another before and along base of dorsal; fins unspotted. Length 8 inches.

Remarks.—The young of the genus *Chilomycterus* are much more inflatable than is the adult. This genus may be derived from porcupine-fishes or swell-fishes, and the case be one where ontogeny parallels phylogeny. It is equally logical to suppose that inflatability was originally a larval character with *Chilomycterus*, becoming an adult character in *Diodon*, and that the swell-fishes are the most specialized of the series, their prickles being rudimentary spines. This view, which would derive *Chilomycterus* from *Ostracion*-like ancestors, is in line with the evolutionary trend in other groups of marine fishes, and is most acceptable to the writer.

SCORPAENIDAE

Scorpaena Linnaeus

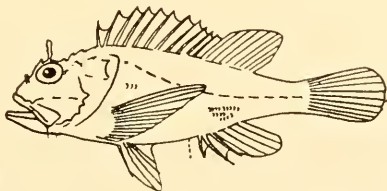
Scorpaena brasiliensis Cuvier and Valenciennes

Small-scaled scorpion-fish

Scorpaena brasiliensis Cuvier and Valenciennes, 1829, Hist. Nat. Poiss., Vol. IV, p. 305.

Scorpaena brasiliensis Evermann and Marsh, 1902, p. 274, Fig. 81.

FIG. 242.—*Scorpaena brasiliensis*
From Zoologica, X



Type locality.—Brazil.

Distribution.—West Indian fauna, from South Carolina and the Gulf Coast of the United States to Brazil (Rio Janeiro). Rare in Porto Rico.

Diagnosis.—Head 2.6; depth 2.6 to 3; eye 4. Dorsal XII, 10; anal III, 5 to 6; scales (oblique rows) 25 to 30, (vertical) 50 to 60. Anterior border of orbit with no distinct pit below it; suborbital stay with 3 distinct spines. Axil (of pectoral fin) pale-colored, with small dark spots; body with a few large, diffuse dark spots, or blotches. Length about 6 inches.

***Scorpaena albifimbria* Evermann and Marsh**

Porto Rican scorpion-fish

Scorpaena albifimbria Evermann and Marsh, 1902, Bull. U. S. Fish Comm. for 1900, Vol. XX, Pt. 1, p. 275, Fig. 82.

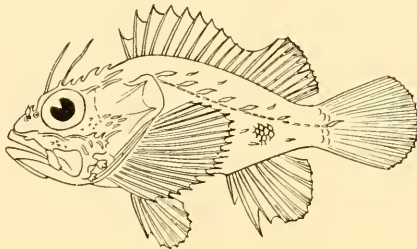


FIG. 243.—*Scorpaena albifimbria*

Type locality.—Off Culebra Island, Porto Rico, in 15 fathoms of water.

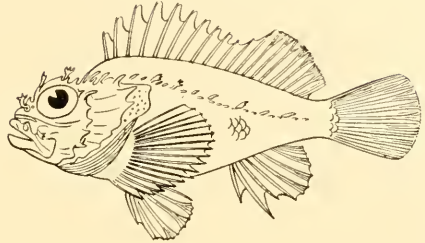
Distribution.—Only the type known.

Diagnosis.—Head 2.1; depth 2.4; eye 3.3. Dorsal XII, 10; anal III, 5; scales 45. Anterior border of orbit with no distinct pit below it; suborbital stay with 3 distinct spines. Axil (of pectoral fin) pale-colored, without spots; body and head with numerous small milky-white spots. Length $1\frac{3}{4}$ inches.

***Scorpaena bergii* Evermann and Marsh**

Berg's scorpion-fish

Scorpaena bergii Evermann and Marsh, 1902, Bull. U. S. Fish Comm. for 1900, Vol. XX, Pt. 1, p. 276, Fig. 83.

FIG. 244.—*Scorpaena bergii*

Type locality.—Mayagüez, Porto Rico.

Distribution.—Known only from Porto Rico, where it is not common.

Specimens collected.—1: Condado Bay, San Juan.

Diagnosis.—Head 2.4; depth 2.7; eye 3.5. Dorsal XI, 10; anal III, 5; scales 38. Anterior border of orbit with no distinct pit below it; suborbital stay without spines. Axil (of pectoral fin) pale-colored, with 5 or 6 large, round brown spots. Length from 2 to 3 inches.

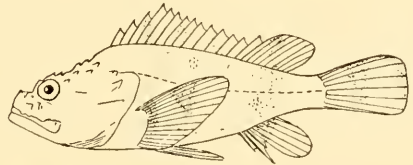
***Scorpaena plumieri* Bloch**

Plumier's scorpion-fish

Scorpaena plumieri Bloch, 1789, Nya. Handl. Stockh., Vol. X, p. 234.

Scorpaena plumieri Evermann and Marsh, 1902, p. 277.

FIG. 245.—*Scorpaena plumieri*
From Zoologica, IX



Type locality.—Martinique.

Distribution.—Florida (casually Massachusetts), through the West Indies to Brazil. Common about Porto Rico.

Specimens seen.—Ponce Market.

Diagnosis.—Head 2.2 to 2.5; depth 3; eye 5. Dorsal XII, 10; anal III, 5; scales 4. Anterior border of eye with a distinct pit between it and the suborbital stay; occipital pit deep. Axil (of the pectoral fin) black in color with large white spots. Attains a length of a foot or more.

***Scorpaena grandicornis* Cuvier and Valenciennes**

Long-horned scorpion-fish; lion-fish; rascacio

Scorpaena grandicornis Cuvier and Valenciennes, 1829, Hist. Nat. Poiss., Vol. IV, p. 309.

Scorpaena grandicornis Evermann and Marsh, 1902, p. 277, Fig. 84.

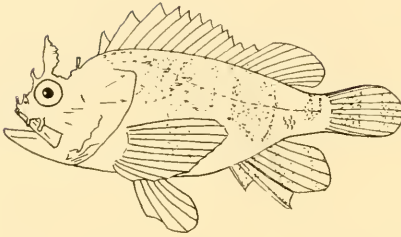


FIG. 246.—*Scorpaena grandicornis*
From Zoologica, IX

Type locality.—Martinique, Porto Rico, Havana, Santo Domingo.

Distribution.—Florida Keys, through the West Indies to Brazil. Abundant about Porto Rico, and also recorded from St. Croix.

Specimens collected.—1: San Juan.

Diagnosis.—Head 2.5; depth 2.6; eye 4. Dorsal XII, 10; anal III, 5; scales 40. A tentacle over the eye which is longer than twice the diameter of the eye. Axil (of pectoral fin) gray in color, with many small white spots. Attains a length of a foot or less.

Habits.—Scorpion-fishes are small, spiny, sluggish, concealingly colored, huge-mouthed, voracious bottom fishes. They occupy in tropical seas somewhat the same niche that sculpins do in colder northern waters. The present species is most numerous in shallows close to shore, frequently hiding in weed, which environment is perhaps correlated with its relatively conspicuous tentacles and a boldly variegated color pattern.

Pontinus Poey

Pontinus beanorum Evermann and Marsh

Porto Rican deep-water scorpion-fish

Pontinus beanorum Evermann and Marsh, 1902, Bull. U. S. Fish Comm. for 1900, Vol. XX, Pt. 1, p. 279, Fig. 85.

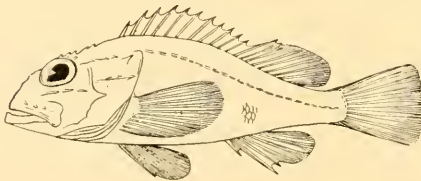


FIG. 247.—*Pontinus beanorum*

Type locality.—Near San Juan, Porto Rico, in 91 fathoms of water.

Distribution.—Known only from the type.

Diagnosis.—Head 2.5; depth 3.5; eye 4 to 4.1. Dorsal XII, 10; anal III, 5; scales 36. Pectoral rays all simple; base of pectoral broad, the

fin fan-shaped; snout above and interorbital without scales; eleventh dorsal spine nearly as long as the twelfth. Length $5\frac{1}{2}$ inches.

Remarks.—The genus *Pontinus* is closely related to *Scorpaena* but differs from it in having all the rays of the pectoral fin simple, instead of some of the median rays more or less branched. Its species are found in deeper water, and are more or less rosy in color.

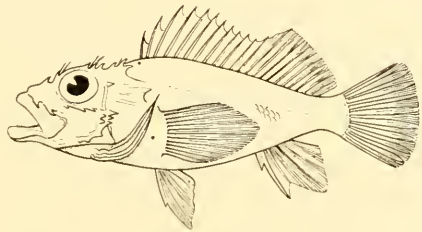
***Pontinus macrolepis* Goode and Bean**

Deep-water scorpion-fish

Pontinus macrolepis Goode and Bean, 1896, Ocean. Ichth., p. 257, Fig. 247.

Pontinus macrolepis Evermann and Marsh, 1902, p. 280, Pl. 43.

FIG. 248.—*Pontinus macrolepis*



Type locality.—Off Yucatan in 130 fathoms of water.

Distribution.—Gulf of Mexico to Porto Rico in deep water, rare. A specimen recorded from Mayagüez Harbor in about 230 fathoms of water.

Diagnosis.—Head 2.2; depth 3.2 to 3.3; eye 3.4. Dorsal XII, 10; anal III, 5; scales 35. Pectoral rays all simple; base of pectoral broad, fin fan-shaped; snout above and interorbital without scales; eleventh dorsal spine nearly as long as twelfth. Length from 4 to 6 inches.

TRIGLIDAE

To this family belong the gurnards (Mediterranean) and sea-robins (West Indian). The two are not very unlike, but the former are highly valued food-fishes, while the latter, which have somewhat larger, spiner heads and smaller bodies, are not as a rule eaten, though probably palatable.

***Prionotus* Lacépède**

***Prionotus punctatus* (Bloch)**

Spotted sea-robin

Trigla punctata Bloch, 1793, Ichth., Pl. 353; based on a drawing by Plumier.

Prionotus punctatus Evermann and Marsh, 1902, p. 238.

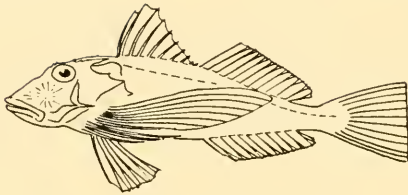


FIG. 249.—*Prionotus punctatus*
From Zoologica, X

Type locality.—Martinique.

Distribution.—West Indian fauna, south on the coast of South America to Uruguay. Uncommon in Porto Rican waters.

Diagnosis.—Head 2.8; depth 2.8; eye 6. Dorsal X-12; anal 12; scales 50. Mouth large, maxillary 2.5 in head; preopercular spine with a distinct smaller one at its base; cheek bone with a spine (small in adult, larger in young) at center of radiation of the striae; spines on bones of head moderate, not knife-like; first 3 dorsal spines little if at all serrate. Grows to a length of about a foot.

Habits.—Shrimps and other small crustaceans are probably the favorite food of this fish.

Sea-robins are usually found at the bottom, where they frequently glide slowly forward, appearing to crawl by moving the thick fleshy tentacles in front of the breast fin in a finger-like manner. They make grunting noises when caught, and perhaps communicate by similar sounds down in the water, as under natural conditions the writer has heard one make an audible croak when startled. At times they swim vigorously upward, it may be in pursuit of prey, then spread the broad pectoral fins and with their aid glide gracefully back to the bottom again. One may reason with a fair degree of probability that the expanded pectoral fins of the sea-robin are to help raise its big heavy bony head in the water; and that the increased size of these fins in the more specialized flying gurnard is correlated with leaping, a habit here homologous with the under-water gliding of its relatives.

PERISTEDIIDAE

Peristedion Lacépède

These peculiar armored large-eyed deep-water sea-robins are characteristic of considerable, though not abysmal, ocean depths. The one recorded from Porto Rico is merely tinged and marked with rose. Others—for instance, the one common off the North Atlantic States—are a striking bright red. There is a tendency to red colors in fishes found at more or less considerable depths of sea-water, but not beyond

the zone of penetration of sunlight, which is doubtless in some way correlated with the dim and exclusively blue-green light which reaches them. Perhaps in the absence of red light a potential red is for them the most inconspicuous livery; or it may be that it absorbs a maximum of the dim blue-green rays of some physiological benefit to the wearer; or there may be some purely mechanical (chemical) explanation.

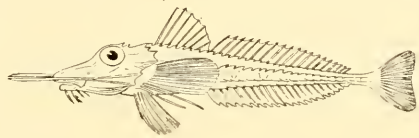
Peristedion gracile Goode and Bean

Slender deep-water gurnard

Peristedion gracile Goode and Bean, 1896, *Oceanic Ichthyol.*, p. 473, Pl. 114, Fig. 387.

Peristedion gracile Evermann and Marsh, 1902, p. 284, Pl. 44.

FIG. 250.—*Peristedion gracile*



Type locality.—Gulf of Mexico in 142 fathoms of water.

Distribution.—Gulf of Mexico to Porto Rico in deep water, rare. A specimen recorded from Mayagüez Harbor in about 225 fathoms of water.

Diagnosis.—Head (base of rostral prolongation to tip of opercular spine) 3; depth 6.5; eye 4. Dorsal VII-19; anal I, 19; body covered with bony plates. Color yellowish, or whitish washed with rose; a pearly lateral band. Preorbital process contained 2.25 times in the snout.

CEPHALACANTHIDAE

Cephalacanthus Lacépède

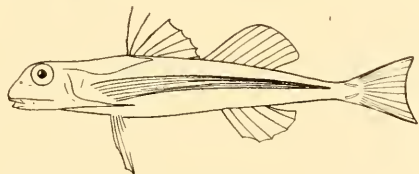
Cephalacanthus volitans (Linnaeus)

Flying gurnard; flying robin; murciélago

Trigla volitans Linnaeus, 1758, *Syst. Nat.*, ed. 10, Vol. I, p. 302; after Artdi.

Cephalacanthus volitans Evermann and Marsh, 1902, p. 285, Fig. 86.

FIG. 251.—*Cephalacanthus volitans*
From Zoologica, IX



Type locality.—Mediterranean and open tropical ocean.

Distribution.—Warmer waters of the Atlantic, on both coasts, rarely north to Massachusetts. Recorded from Porto Rico by Poey and Stahl.

Diagnosis.—Head 4.3; depth 5.5; eye 3.7. Dorsal II, IV-8; anal 6; scales small. Very long nuchal and preopercular spines; head blunt, bony; pectorals very large, reaching nearly to base of caudal in adult, shorter in young. Attains a total length of from 15 to 16 inches.

Habits.—Though widely distributed, the flying gurnard is generally uncommon on warm shores. It is rather a sluggish fish and may sometimes be seen resting quietly on the bottom, but it is capable of great activity as is evidenced when it lunges into the air, making long leaps supported by its broad pectoral fins. Its aerial powers in no wise compare with those of the true flying-fishes. Its young appear to be more or less pelagic, being sometimes found in mid-ocean.

Beebe writes of this species: "A secondary use for the great wing expanse is as a float. Several times in widely separated oceanic areas, I have seen gurnards, either singly or in a school, sunning themselves at the very surface, with the wings widely spread, floating buoyantly with only occasional flicks of the caudal fin." Again he says: "In large aquariums on my Haitian schooner, I watched these fish at leisure and was astonished at their peripatetic facility. Every movement brought to mind a strange, half-living aëroplane. A gurnard volplanes swiftly downward from the surface, wings tightly folded, and when close to the bottom turns slightly upward, partly spreads its pectorals and, stretching out the long, thin ventral fins, alights gently, and at once trots off, scampering here and there, now and then actually holding up one leg fin, as the fish pivots slightly and looks about. . . ."

"In front of the dorsal fin are two free rays, long, slender, and knobby at the tips, and for their entire length quite separate from the rest. When the fish begins walking, these separate laterally and act as balancers, one on each side, forming an angle of about 45 degrees. If the gurnard turns quickly or trips up, one of the two rays quickly dips down on the corrective side, exactly as a person's outstretched arms assist in regaining lost balance." (*Natural History*, 1928, pp. 85-87.)

CALLIONYMIDAE

Callionymus Linnaeus

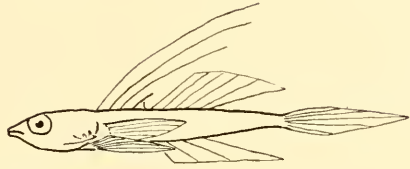
Callionymus calliurus Eigenmann and Eigenmann

West Indian dragonet

Callionymus calliurus Eigenmann and Eigenmann, 1888, Proc. Cal. Ac. Sci. for 1888, p. 76.

Callionymus calliurus Nichols, 1915, Bull. Amer. Mus. Nat. Hist., Vol. XXXIV, p. 145. Porto Rico.

FIG. 252.—*Callionymus calliurus*



Type locality.—Key West, Florida.

Distribution.—Florida Keys and West Indies, rare. One Porto Rican record.

Specimens collected.—1: Condado Bay, San Juan.

Diagnosis.—Head (to tip of opercular spine) 3 to 3.5; depth 1; eye 3.5. Dorsal IV, 6; anal, 4; scales absent. Ventral fins widely separated; preopercle strongly armed; lateral line present. Preopercular spine with 2 barbs, the anterior turned forward. Body with white spots. Size small.

Remarks.—The dragonets are among the few forms which have apparently reached American shores from the Mediterranean fauna, of which they are a characteristic element. One or two species are here described from rather deep water, as are certain other Mediterranean forms; but *Callionymus calliurus* is a true West Indian shore fish, though of insignificant size and, so far as known, everywhere rare.

Habits.—A small bottom fish, resembling the gobies or colder-water sculpins in form and habits.

Gobiidae

Gobiomorus Lacépède

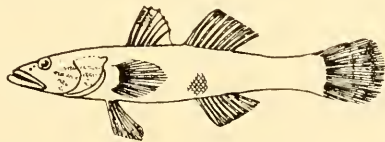
Gobiomorus dormitor Lacépède

Guavina

Gobiomorus dormitor Lacépède, 1798, Hist. Nat. Poiss., Vol. II, p. 599; from a drawing by Plumier.

Philypnus dormitor Evermann and Marsh, 1902, p. 288, Fig. 87.

FIG. 253.—*Gobiomorus dormitor*
From Zoologica, X



Type locality.—Martinique.

Distribution.—Fresh-water streams of the West Indies, and the At-

lantic shores of Middle America and Surinam. Abundant in all the larger streams of Porto Rico.

Specimens collected.—2: Mayagüez (Lutz).

Diagnosis.—Head 3; depth 5; eye 9.7 to 9.8. Dorsal VI-12; anal I, 10; scales about 61. Ventrals separate with rays I, 5; vomer with teeth; gill-openings extending forward to below posterior angle of mouth; caudal rounded, and lower jaw projecting. Attains a length of 2 feet.

Remarks.—One of the important fresh-water food fishes in the West Indies.

Habits.—All of the gobies, of which innumerable species occur in warm shore waters and relatively few in fresh waters of the tropics, are small, more or less concealingly colored bottom fishes of not dissimilar habits. The more primitive members with ventral fins separate, such as this one, are apt to be the more active, sometimes voracious, and to attain the largest size.

Dormitator Gill

Dormitator maculatus (Bloch)

Masaguan; mapiro

Sciacna maculata Bloch, 1790, Ichth., Pl. 299, Fig. 2.

Dormitator maculatus Evermann and Marsh, 1902, p. 289, Pl. 45.

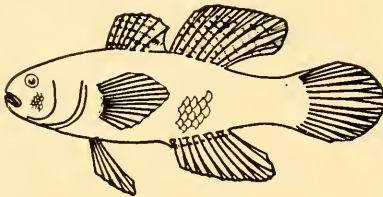


FIG. 254.—*Dormitator maculatus*
From Zoologica, X

Type locality.—West Indies.

Distribution.—Both coasts of tropical America, from South Carolina through the West Indies to Para; and from Cape San Lucas to Panama. Uncommon about Porto Rico.

Specimens collected.—1: San Juan (Lutz). Seen at Guanica.

Diagnosis.—Head 3.5; depth 3.5; eye 5.7 to 5.8. Dorsal VIII-9; anal I, 9; scales 33. Ventrals separate, their rays I, 5; vomer without teeth; gill openings scarcely reaching to below posterior angle of preopercle. Attains a length of from 1 to 2 feet.

Remarks.—Recorded from Porto Rico by Poey and Stahl as *Dormitator mugiloides*. Valued as a food fish.

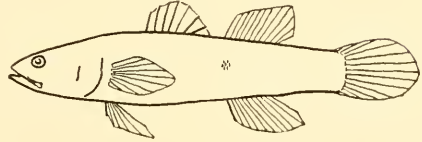
Habits.—Found in salt, brackish and fresh water.

Guavina Bleeker**Guavina guavina** (Cuvier and Valenciennes)

Moron

Eleotris guavina Cuvier and Valenciennes, 1837, Hist. Nat. Poiss., Vol. XII, p. 223.

Guavina guavina Evermann and Marsh, 1902, p. 289.

FIG. 255.—*Guavina guavina*

Type locality.—Martinique.

Distribution.—Fresh and brackish water from Cuba to Rio Janeiro; rare in Porto Rico, 2 examples in the San Juan Market believed to be from the mouth of the Bayamon River.

Diagnosis.—Head 3.5; depth 4.5; eye 6.5. Dorsal VII-12; anal I, 10; scales about 100. Ventral fins separate, their rays I, 5; gill openings scarcely extending forward to under posterior angle of preopercle. Attains a foot in length.

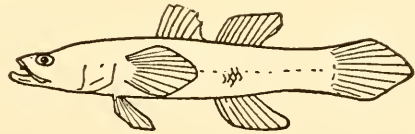
Remarks.—A good food fish.

Eleotris Bloch and Schneider**Eleotris pisonis** (Gmelin)

Moron

Gobius pisonis Gmelin, 1788, Syst. Nat., p. 1206; based on *Eleotris* of Gronow.
Eleotris pisonis Evermann and Marsh, 1902, p. 290, Fig. 88.

FIG. 256.—*Eleotris pisonis*
Breder's Field Book of Marine
Fishes (Putnam).



Type locality.—Uncertain.

Distribution.—Florida to Rio Janeiro. Common in fresh and brackish waters of Porto Rico, especially the lower portions of the rivers.

Specimens collected.—2: Guanica.

Diagnosis.—Head 2.9; depth 3.7 to 3.8; eye 7. Dorsal VI-9; anal I, 8; scales 57 to 66. Preopercle below with a small concealed spine, its tip hooked forward; ventrals separate, their rays I, 5; gill openings scarcely extending forward to under posterior angle of preopercle. Attains a length of more than 6 inches.

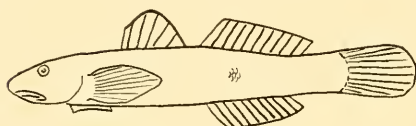
Remarks.—Not much used for food.

Sicydium Cuvier and Valenciennes**Sicydium antillarum** Ogilvie-Grant

Sirajo

Sicydium antillarum Ogilvie-Grant, 1884, Proc. Zool. Soc. Lond. for 1884, p. 157.

Sicydium antillarum Silvester, 1916, Yearb. Carn. Inst. Wash. for 1915, Vol. XIV, p. 216. Porto Rico.

FIG. 257.—*Sicydium antillarum*

Type locality.—Barbados.

Distribution.—Fresh waters of the West Indies. Several taken in mountain streams flowing into the Arecibo River near Utuado.

Diagnosis.—Head 4.6; depth 6; eye 6.5 (in a specimen 4 or 5 inches long). Dorsal VI-I, 10; anal I, 10; scales 68. Ventrals united into a short cup-shaped disk. Attains a length of about 5 inches.

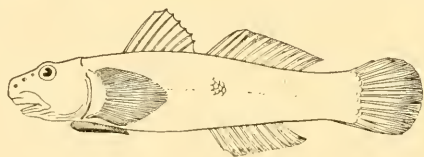
Habits.—Small gobies of the genus *Sicydium* inhabit fresh-water streams, holding to the rocky bottom with a cup-shaped disk formed by their united ventral fins, being thereby aided in stemming the current.

Sicydium caguitae Evermann and Marsh

Sirajo

Sicydium caguitae Evermann and Marsh, 1899, Rept. U. S. Fish Comm. for 1899, p. 355.

Sicydium caguitae Evermann and Marsh, 1902, p. 291, Fig. 89.

FIG. 258.—*Sicydium caguitae*

Type locality.—Rio de Caguitas, Caguas, Porto Rico.

Distribution.—Porto Rico.

Diagnosis.—Head 4.4; depth 4.8; eye 5.75. Dorsal VI-I, 10; anal I, 9; scales 83. Densely scaled. Ventrals united to form a short disk, adnate to the belly. No dark vertical bars on body. Length 3.63 inches.

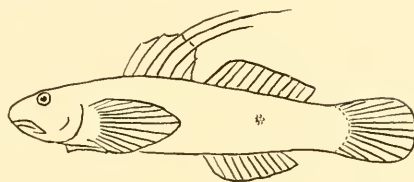
Remarks.—Known only from the type.

Sicydium plumieri (Bloch)

Sirajo

Gobius plumieri Bloch, 1786, Ichth., p. 125, Pl. 178, Fig. 3; based on a drawing by Plumier.

Sicydium plumieri Evermann and Marsh, 1902, p. 292.

FIG. 259.—*Sicydium plumieri*

Type locality.—Martinique.

Distribution.—Fresh waters of the West Indies. Recorded from Porto Rico by Poey.

Diagnosis.—Head 4 to 4.6; depth 4.5; eye 6 to 7. Dorsal VI-I, 10; anal I, 10; scales 84. Squamation sometimes more or less incomplete; ventrals united to form a short disk, adnate to the belly. About 7 more or less distinct vertical bars on the body. Size small.

Bathygobius Bleeker**Bathygobius soporator** (Cuvier and Valenciennes)

Silk-fin goby; sleeper; mapo

Gobius soporator Cuvier and Valenciennes, 1837, Hist. Nat. Poiss., Vol. XII, p. 56.

Gobius soporator Evermann and Marsh, 1902, p. 294.

FIG. 260.—*Bathygobius soporator*
From Zoologica, X

Type locality.—Martinique.

Distribution.—Generally distributed and abundant in the shallow shore waters of tropical seas, north to Carolina and the Gulf of California. Abundant and omnipresent about Porto Rico.

Specimens collected.—17: Condado Bay and Rocks, Martin Peña; Santurce, Paloseco Pt., San Juan.

Diagnosis.—Head 3 to 3.5; depth 4 to 4.8; eye 3.5 to 5. Dorsal VI-9 to 10; anal 9 to 10; scales 38. Upper rays of pectoral fin free for nearly their whole length, silklike, that is, very slender and flexible. Ventrals united, free from belly. Length from 3 to 5 inches.

Habits.—This is one of Nature's most successful species, an omnipresent small shallow-water bottom fish, with a practically universal range in warm seas. It has no great swimming powers, does not drift widely in the adult form, and superficially seems to resemble in habits other small species of which there are many with restricted ranges. The reason for its wide distribution is not at all obvious. It has a mottled coloration, which, combined with considerable ability to change its color tone to match the bottom, gives it a low visibility. As is usual in such cases, it takes advantage of its concealing coloration by resting quietly on the bottom or moving quickly from place to place.

Gobius Linnaeus

Gobius translucens Nichols

Translucent goby

Gobius translucens Nichols, 1915, Bull. Amer. Mus. Nat. Hist., Vol. XXXIV, p. 145, Fig. 2.

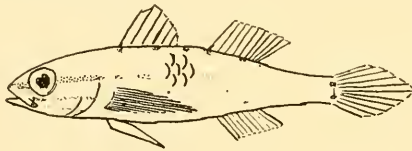


FIG. 261.—*Gobius translucens*

Type locality.—San Antonio Bridge, San Juan, Porto Rico.

Distribution.—Porto Rico and Bermuda.

Specimens collected.—1: San Antonio Bridge.

Diagnosis.—Head 3.3; depth 4.4; eye 3. Dorsal VI-10; anal 10; scales 23. Color pale; a dark streak from snout through eye to shoulder and other lengthwise streaks on head; two dark spots connected by a vertical bar on base of caudal; other small dark marks on body, particularly a row of spots along mid-line of back. Ventrals united. Lower jaw slightly projecting. Length about 1 inch.

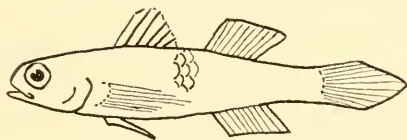
Remarks.—Few specimens known. Questionably distinct from *Gobius glaucofraenum*.

Gobius glaucofraenum (Gill)

Bridled goby

Coryphopterus glaucofraenum Gill, 1863, Proc. Ac. Nat. Sci. Phila. for 1863, p. 263.

Gobius glaucofraenum Fowler, 1928, Proc. Ac. Nat. Sci. Phila. for 1928, p. 466. Porto Rico.

FIG. 262.—*Gobius glaucofracnum*

Type locality.—Coast of Washington (evidently an error).

Distribution.—Florida Keys, not rare, occasionally recorded from the West Indies. Uncommon at Porto Rico.

Specimens collected.—1: Mayagüez (Lutz).

Diagnosis.—Head 3.3 to 3.6; depth 4.3; eye 3.3. Dorsal VI-10; anal 10; scales about 28. Color tawny; three rows of dark spots, on the ridge of the back along the bases of the dorsal fins, from the scapular region, and along the middle of the sides; blue marks on the head and dorsal fins. Ventrals united. Lower jaw slightly projecting. Length from 1 to 2 inches.

***Gobius bolcosoma* Jordan and Gilbert**

Darter-like goby

Gobius bolcosoma Jordan and Gilbert, 1882, Proc. U. S. Nat. Mus. for 1882, p. 295.

Gobius bolcosoma Nichols, 1915; Bull. Amer. Mus. Nat. Hist., Vol. XXXIV, p. 146. Porto Rico.

Gobionellus bolcosoma Meek and Hildebrand, 1928, Fishes of Panama, Pt. 3.

FIG. 263.—*Gobius bolcosoma*

Type locality.—Laguna Grande, Pensacola, Florida.

Distribution.—Gulf of Mexico and West Indies, Pensacola, Fla., to Porto Rico. Common in Condado Bay and vicinity.

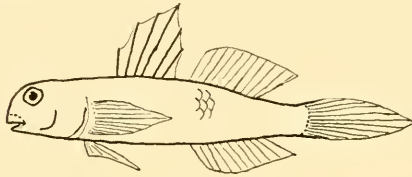
Specimens collected.—7: Martin Peña, mouth of the Loiza River, Hotel Nava, San Juan, Condado Bay.

Diagnosis.—Head 4; depth 4.5 to 5.5; eye about 4. Dorsal VI-12; anal I, 10 to 12; scales 25 to 30. Ventrals united, free from the belly. Lower jaw included; nape, breast and belly without scales. Dorsal spines low, the highest not or but little longer than head. Caudal with not more than a single spot at its base. Length about 2 inches.

Habits.—Common in shallow sandy bays, lurking in sea wrack.

Gobius lyricus Girard

Tall-finned goby

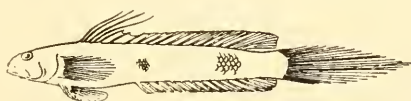
Gobius lyricus Girard, 1858, Proc. Ac. Nat. Sci. Phila. for 1858, p. 169.*Gobius lyricus* Evermann and Marsh, 1902, p. 295.*Gobionellus lyricus* Meek and Hildebrand, 1928, Fishes of Panama, Pt. 3.FIG. 264.—*Gobius lyricus**Type locality*.—Brazos Santiago, Texas.*Distribution*.—Coasts of the Gulf of Mexico and western Caribbean to Florida and the West Indies. Probably not common in Porto Rican waters.*Specimens collected*.—6: Martin Peña. 1: Guanica.*Diagnosis*.—Male: Head 4; depth 4.5 to 5; eye 4 to 5. Dorsal VI-11; anal I, 10; scales 29. Female: Head 3.8; depth 4.9; eye 3.6 to 4. Ventrals united, free from the belly. Dorsal spines high, highest reaching past middle of second dorsal. Caudal plain or with but a single spot at its base. Length from 2 to 3 inches.**Gobius bayamonensis** Evermann and Marsh

Porto Rican oceanic goby

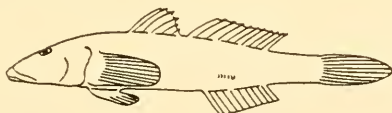
Gobius bayamonensis Evermann and Marsh, 1902, Bull. U. S. Fish Comm. for 1900, Vol. XX, Pt. 1, p. 296, Fig. 90.FIG. 265.—*Gobius bayamonensis**Type locality*.—San Juan Market, Porto Rico.*Distribution*.—Porto Rico.*Diagnosis*.—Head 5.8; depth 6.4; eye 5. Dorsal VI-14; anal 15; scales 74. Mouth large, the lower jaw slightly projecting; only a few scales on the opercle. Caudal long and pointed, much longer than head; ventrals united, free from the belly. Length 9 inches.*Remarks*.—Only the type known, from the San Juan Market, probably came from near the mouth of the Bayamon River at Palo Seco. This species is close to *Gobius oceanicus*.

Gobius oceanicus Pallas

Oceanic goby; esmeralda; seti

Gobius oceanicus Pallas, 1769, Spicilegia, Vol. VIII, p. 4; after Gronow.*Gobius oceanicus* Evermann and Marsh, 1902, p. 296, Fig. 91.*Gobionellus oceanicus* Meek and Hildebrand, 1928, Fishes of Panama, Pt. 3.FIG. 266.—*Gobius oceanicus*
From Zoologica, X*Type locality*.—Uncertain.*Distribution*.—South Atlantic and Gulf coasts of the United States from South Carolina south through the West Indies to the South American coast. Common in Porto Rican waters.*Specimens collected*.—1: Paloseco Point, San Juan.*Diagnosis*.—Head 5; depth 6 to 6.5; eye 5 to 5.5. Dorsal VI-14; anal 15; scales about 63. Mouth large, the lower jaw slightly projecting; upper part of opercle with a large patch of scales. Caudal long and pointed, much longer than the head; ventrals united, free from the belly. Attains a foot or more in length.*Remarks*.—Of considerable value as a food fish.*Habits*.—Abundant in deeper water than most of its congeners, from 4 or 5 to 15 fathoms.**Chonophorus** Poey**Chonophorus taiasica** (Lichtenstein)

Fringe-shouldered goby; guavina; saga

Gobius taiasica Lichtenstein, 1822, Berl. Abhandl. for 1822, p. 273; not *taiasica* of Maregrave.*Awaous taiasica* Evermann and Marsh, 1902, p. 297.FIG. 267.—*Chonophorus taiasica*
From Zoologica, X*Type locality*.—Brazil.*Distribution*.—Fresh waters of the West Indies and both coasts of Mexico, south to Brazil. Common in fresh and brackish waters of Porto Rico.*Specimens seen*.—Guanica.*Diagnosis*.—Head 3.5; depth 5.4 to 6; eye 5.5 to 6. Dorsal VI-11; anal I, 10; scales 66 to 71. Isthmus broad; inner edge of shoulder

girdle with 2 or 3 conspicuous dermal flaps; preorbital region very long. Ventrals united, free from the belly. Attains a length of a foot or more.

Remarks.—Of some value for food.

Bollmannia Jordan

Bollmannia boqueronensis Evermann and Marsh

West Indian Bollmania

Bollmannia boqueronensis Evermann and Marsh, 1899, Rept. U. S. Fish Comm. for 1899, p. 356.

Bollmannia boqueronensis Evermann and Marsh, 1902, p. 298, Fig. 92.

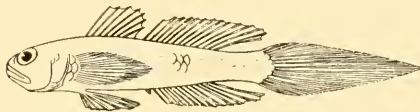


FIG. 268.—*Bollmannia boqueronensis*

Type locality.—Ensenada del Boqueron, Porto Rico.

Distribution.—Porto Rico.

Diagnosis.—Head 4; depth 5.5; eye 3.5. Dorsal VII-13; anal 12; scales 27. Sides of head scaled. Caudal long and pointed; ventrals united, free from the belly. Attains a length of from 2 to 3 inches.

Habits.—Unlike most gobies, members of this genus are found in water of moderate or considerable depth and do not inhabit the shallows.

Microgobius Poey

Microgobius meeki Evermann and Marsh

Meek's little goby

Microgobius meeki Evermann and Marsh, 1899, Rept. U. S. Fish Comm. for 1899, p. 356.

Microgobius meeki Evermann and Marsh, 1902, p. 300, Fig. 93.

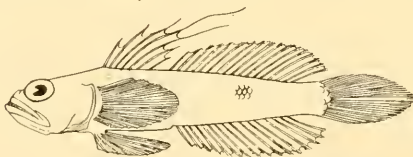


FIG. 269.—*Microgobius meeki*

Type locality.—Between Vieques and Culebra islands, east of Porto Rico, in $15\frac{1}{4}$ fathoms of water.

Distribution.—Known only from the type.

Diagnosis.—Head 3.75; depth 6; eye 3.5. Dorsal VII-17; anal 16; scales 55. Body greatly compressed; scales cycloid or nearly so; head

without scales; mouth large, the lower jaw prominent. Ventrals united, free from the belly. Length 1.5 inches.

Gobiosoma Girard

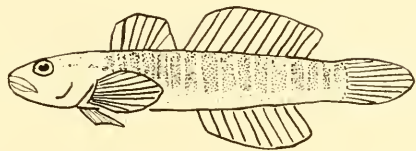
Gobiosoma multifasciatum Steindachner

Many-banded naked goby

Gobiosoma multifasciatum Steindachner, 1870, Ich. Beitr., No. V, p. 183.

Gobiosoma multifasciatum Silvester, 1916, Yearb. Carn. Inst. Wash. for 1915, Vol. XIV, p. 216. Porto Rico.

FIG. 270.—*Gobiosoma multifasciatum*



Type locality.—Lesser Antilles.

Distribution.—West Indies. Taken from coral rocks in shallow water east of Guanica Harbor, Porto Rico.

Diagnosis.—Head about 4; depth 5.6 to 5.7; eye 4. Dorsal VI or VII-11 or 12; no scales. Ventrals united, free behind. Head with a red band, ending behind over pectoral in a small blue spot; body with 16 or 17 light green cross-bars, separated by narrow whitish interspaces. Length from 1 to 2 inches.

Habits.—These little gobies are found in shallow water where they usually hide in weed, broken shells or crannies of a rocky bottom.

Gobioides Lacépède

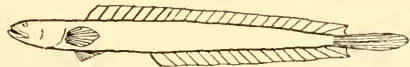
Gobioides broussonnetii Lacépède

Broussonnet's goby

Gobioides broussonnetii Lacépède, 1798, Hist. Nat. Poiss., Vol. II, p. 580.

Gobioides broussonnetii Evermann and Marsh, 1902, p. 300.

FIG. 271.—*Gobioides broussonnetii*



Type locality.—Probably Surinam.

Distribution.—West Indies to Brazil, common southward, ascending rivers; once taken near New Orleans. Recorded from Porto Rico by Poey.

Diagnosis.—Head 5.2 (young) to 7 (adult); body elongate; eye minute. Dorsal VII, 16; anal I, 16; scales moderate, those on anterior part

of body not imbricated, much smaller than those on posterior part, which are elongate oval. Dorsal fin continuous; soft vertical fins joined to base of caudal; ventrals united, free from the belly. Mouth oblique, lower jaw projecting. Attains a length of 20 inches or more.

ECHENEIDIDAE

Echeneis Linnaeus

Echeneis naucrates Linnaeus

Shark-sucker; pega; pegador

Echeneis neucrates (misprint for *naucrates*) Linnaeus, 1758, Syst. Nat., ed. 10, p. 261.

Echeneis naucrates Evermann and Marsh, 1902, p. 301, Fig. 94.



FIG. 272.—*Echeneis naucrates*
From Zoologica, IX

Type locality.—"In Pelago Indico."

Distribution.—Widely distributed in warm seas, common north to Cape Cod and occasionally to San Francisco. Recorded from Porto Rico by Poey and Stahl.

Diagnosis.—Head 5.2 to 5.3; depth 11 to 12; eye 5. Dorsal XXII to XXVIII (rarely XXI)-32 to 41; anal 31 to 38; scales minute. A conspicuous dark lengthwise stripe, which is more or less ephemeral. Usually less than a foot long, it may attain a length of 38 inches or more and a weight of 1¾ pounds.

Remarks.—This is the only sucking-fish or remora so far recorded from Porto Rican waters, but several others are to be expected there. Another slender striped form, *Phtheichthys*, is smaller with a shorter sucking disk. *Remora*, with more pelagic habitat, and *Rhombochirus*, which attaches to spearfishes and sailfishes and has the pectoral fin stiffened, are both shorter-bodied and plain-colored. *Remilegea*, which is rare and at times attaches itself to small *Cetacea*, has a very large sucking disk.

Habits.—The remoras or sucking-fishes have the head and front part of the body flattened dorso-ventrally, with a peculiar oval sucking disk on the head, its plates arranged like the slats of a blind, each one supposed to represent a spine of the dorsal fin. These fish attach themselves by means of this disk to sharks, other large fishes, etc., and thus obtain free transportation and protection against enemies. Their feeding habits are not well known, but doubtless they subsist to some extent

on scraps from the big fishes' table. This particular species is the most familiar, and the one usually found attached to coastwise sharks. It has a peculiar striped color pattern, which in life may be very bold and distinct or quickly fade out altogether. This color pattern is so similar to that of the Cobia (*Rachycentron*) as to suggest that it is to some more normal fish of this type that the sucking-fishes are most nearly akin; and it may be that such is the case though our present classification places them elsewhere. Their true relationship to other fishes is not known. Other such cases come to mind of animals removed from general evolutionary competition by some peculiar habit and structure,—of which the more primitive ancestral forms, that would give a clue to relationships, have been entirely swept away.

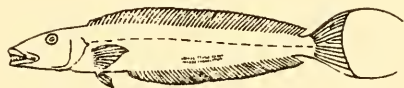
MALACANTHIDÆ

Malacanthus Cuvier**Malacanthus plumieri** (Bloch)

Slangdang; matajuelo blanco

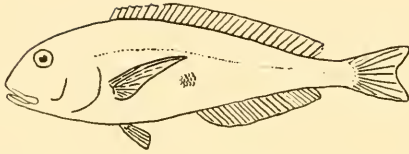
Coryphæna plumieri Bloch, 1787, Ichth., Vol. V, p. 119, Pl. 175.*Malacanthus plumieri* Jordan and Evermann, Bull. U. S. Nat. Mus., Vol. XLVII, Pt. 3, p. 2275.

FIG. 273.—*Malacanthus plumieri*
From Zoologica, X

*Type locality*.—Martinique.*Distribution*.—West Indies, not generally common. Recorded from St. Croix by Cope.*Diagnosis*.—Head 3.6 to 3.7; depth 6.5; eye 5.5. Dorsal VI, 49; anal 48; scales 130. Preopercle entire; caudal forked. Darker above and paler below without bold markings. Attains a length of 15 inches.*Remarks*.—Used as food.**Caulolatilus** Gill**Caulolatilus cyanops** Poey

Blanquillo; tremba

Caulolatilus cyanops Poey, 1867, Repertorio, Vol. I, p. 312.*Caulolatilus cyanops* Evermann and Marsh, 1902, p. 303.

FIG. 274.—*Cautolatilus cyanops*

Type locality.—Cuba.

Distribution.—Greater Antilles. Known from Cuba and recorded from Porto Rico by Poey and Stahl.

Diagnosis.—Head $\frac{1}{4}$ in total length. Dorsal VII, 24; anal I, 22; scales 108. Form robust; preopercle serrate; upper jaw with posterior canine teeth. Caudal slightly lunate. Region below the eye and belly rather clear bluish in color; spinous dorsal and edge of soft dorsal orange.

Remarks.—Valued as a food fish.

DACTYLOSCOPIDAE

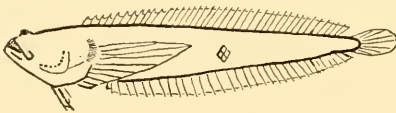
Dactyloscopus Gill

Dactyloscopus tridigitatus Gill

Sand star-gazer

Dactyloscopus tridigitatus Gill, 1859, Proc. Ac. Nat. Sci. Phila. for 1859, p. 132.

Dactyloscopus tridigitatus Evermann and Marsh, 1902, p. 304.

FIG. 275.—*Dactyloscopus tridigitatus*

Type locality.—Barbados.

Distribution.—West Indies north to southern Florida; one Porto Rican record (Ensenada del Boqueron).

Diagnosis.—Head 5 (in total length, with caudal); depth 7. Dorsal XII, 28; anal II, 32; scales 45. Head cuboid; eyes small, superior (directed upward); interorbital broad; mouth nearly vertical; opercular fringe of 15 filaments. Attains a length of only a few inches.

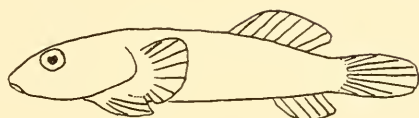
Habits.—Found in shallow water, burying itself in the coral sands near shore, with only the mouth and eyes exposed.

GOBIESOCIDAE

Gobiesox Lacépède**Gobiesox tudes** Richardson

Richardson's Cling-fish

Gobiesox tudes Richardson, 1845, Voy. Sulph., Fish., p. 103, Pl. 46, Figs. 1-3.
Gobiesox tudes Evermann and Marsh, 1902, p. 305.

FIG. 276.—*Gobiesox tudes*

Type locality.—Supposed to be China.

Distribution.—West Indies, rare. Recorded from Culebra Island.

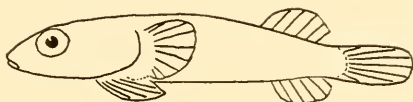
Diagnosis.—Head 2.5; depth 4.6 to 4.7; eye 3 to 4.8. Dorsal 8; anal 6; no scales. Incisors of lower jaw with entire edges; a large ventral sucking disk. Uniformly pale yellowish in color, with a slightly rosy tinge on middle of back. Length 1 or 2 inches.

Remarks.—If Evermann and Marsh have correctly identified the specimen they refer to *Gobiesox tudes*, this species proves to be West Indian, not Chinese as supposed.

Gobiesox cerasinus Cope

Cherry-colored Cling-fish

Gobiesox cerasinus Cope, 1871, Trans. Amer. Phil. Soc., Vol. XIV, p. 473.
Gobiesox cerasinus Silvester, 1916, Yearb. Carn. Inst. Wash. for 1915, Vol. XIV, p. 216. Near Guanica Harbor, Porto Rico.

FIG. 277.—*Gobiesox cerasinus*

Type locality.—St. Martins.

Distribution.—St. Martins and Porto Rico; common near Guanica Harbor.

Diagnosis.—Head 3 in total length (with caudal); eye $3\frac{1}{2}$. Dorsal 6; anal 6; no scales. Light red above, whitish below, without spots. Tadpole-shaped, flattened below; a large complex sucking disk between and behind the ventrals. Incisors of lower jaw with entire edges; lower jaw without distinct canines. Length from 2 to 3 inches.



Habits.—Frequents crevices in the rocks about coral reefs. The cling-fishes are small, little active, flattened fishes found clinging to rocky bottoms by a sucking disk on their lower surface, thus holding what sometimes seem like untenable positions against the wash of the sea.

BLENNIIDAE

Tropical members of the blenny family, very numerous in species as well as individuals in shallow water, are more or less elongate small bottom fishes which hide in the weed or among the intricacies of a broken bottom. They have in the main mottled concealing colors and are not as a rule very active but, when danger threatens, dart quickly into protecting holes and crannies.

Gillias Evermann and Marsh

Gillias jordani Evermann and Marsh

Rough-scaled blenny

Gillias jordani Evermann and Marsh, 1899, Rept. U. S. Fish Comm. for 1899, p. 357.

Gillias jordani Evermann and Marsh, 1902, p. 307, Fig. 95.

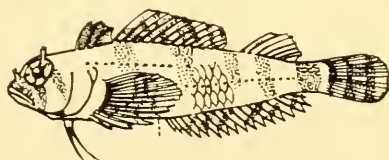


FIG. 278.—*Gillias jordani*
From Zoologica, X

Type locality.—Cordona Light-house Reef, Ponce, Porto Rico.

Distribution.—Porto Rico and Haiti, rare.

Diagnosis.—Head 3.5; depth 4.3; eye 2.5. Dorsal III-XII-7; anal II. 15; scales 33. Scales ctenoid; lateral line arched over pectoral, becoming median further back; ventrals jugular, their rays reduced in number. An inch or 2 in length.

Habits.—Found on coral reefs.

Brannerella Gilbert

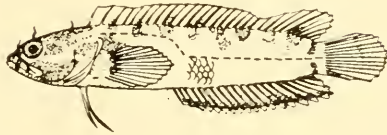
Brannerella culebrae (Evermann and Marsh)

Marbled blenny

Malucoctenus culebrae Evermann and Marsh, 1899, Rept. U. S. Fish Comm. for 1899, p. 357.

Malacoctenus culbrae Evermann and Marsh, 1902, p. 308, Fig. 96.
Brannerella culbrae Beebe and Tee Van, 1928, Zoologica, Vol. X, No. 1, p. 236.

FIG. 279.—*Brannerella culbrae*
 From Zoologica, X



Type locality.—Culebra Island.

Distribution.—Porto Rico, Curacao and Haiti.

Diagnosis.—Head 3.3 to 3.4; depth 5; eye 4.2. Dorsal XXI, 8; anal II, 18; scales 35. Nape with a single filament; a tentacle above eye; scales cycloid; lateral line arched over pectoral, becoming median further back; ventrals jugular-subthoracic, their rays in reduced number. Males with first anal spine detached and covered with rather thickened skin. Length from 1 to 2 inches.

Habits.—Found along shore and on reefs, especially among low seaweeds and in broken coral.

Acteis Jordan

Acteis moorei (Evermann and Marsh)

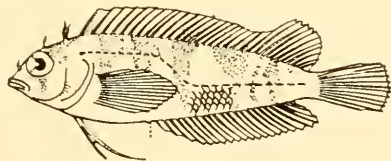
Moore's blenny

Malacoctenus moorei Evermann and Marsh, 1899, Rept. U. S. Fish Comm. for 1899, p. 358.

Malacoctenus moorei Evermann and Marsh, 1902, p. 309, Fig. 97.

Acteis moorei Beebe and Tee Van, 1928, Zoologica, Vol. X, No. 1, p. 235.

FIG. 280.—*Acteis moorei*
 From Zoologica, X



Type locality.—Culebra Island.

Distribution.—Tortugas, Florida, to Porto Rico and Haiti; rare.

Diagnosis.—Head 3.6; depth 3.7; eye 3.5. Dorsal XXI to XXII, 11; anal II, 20; scales 45 to 47. Nape with a single bifid filament; a tentacle above eye; scales cycloid; lateral line arched over pectoral, becoming median further back; ventrals jugular-subthoracic, their rays in reduced number. Length from 1 to 2 inches.

Remarks.—Evermann and Marsh give the teeth in jaws as one row only, probably having overlooked a group of inner villiform teeth, if

Beebe and Tee Van have correctly identified their material from Haiti.

Habits.—Frequents shallow water about reefs, broken coral and seaweed.

Malacoctenus Gill

Malacoctenus puertoricensis Evermann and Marsh

Porto Rican blenny

Malacoctenus puertoricensis Evermann and Marsh, 1899, Rept. U. S. Fish Comm. for 1899, p. 358.

Malacoctenus puertoricensis Evermann and Marsh, 1902, p. 309, Fig. 98.

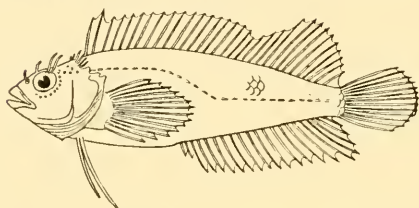


FIG. 281.—*Malacoctenus puertoricensis*

Type locality.—Hucares, Porto Rico.

Distribution.—Porto Rico (Hucares, Fajardo, Culebra), uncommon.

Diagnosis.—Head 3.4 to 3.5; depth 3.4 to 3.7; eye 3.8 to 4. Dorsal XX, 10; anal II, 19; scales 44 to 45. Nape with a comb of slender filaments: front of spinous dorsal notched; orbital filament present; dorsal without ocelli, its highest soft ray, 1.4 to 1.7 in head; scales cycloid; teeth in jaws in one row only; lateral line arched pectoral, becoming median further back; ventrals jugular-subthoracic, their rays in reduced number. Length about $2\frac{1}{2}$ inches.

Remarks.—Resembles *Malacoctenus bimaculatus* Steinachner, from which it differs in having a larger head, greater depth, smaller mouth, narrower interorbital, as well as in color.

Malacoctenus delalandi (Cuvier and Valenciennes)

Brazilian blenny

Clinius delalandi Cuvier and Valenciennes, 1836, Hist. Nat. Poiss., Vol. XI, p. 378.

Malacoctenus delalandi Evermann and Marsh, 1902, p. 310.

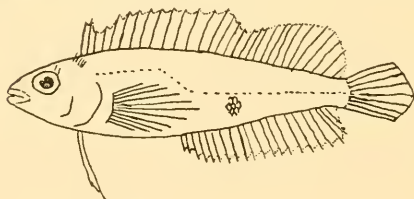


FIG. 282.—*Malacoctenus delalandi*

Type locality.—Brazil.

Distribution.—West Indies to Brazil, and probably both coasts of middle America. Not common about Porto Rico, being recorded from Ponce and Hucares.

Diagnosis.—Head 3.4; depth 4; eye 3.5. Dorsal XX, 10; anal II, 19; scales 53 to 55. Nape with a comb of slender filaments; front of spinous dorsal notched; orbital filament present; scales cycloid; teeth in jaws in one row only; lateral line arched over pectoral, becoming median further back; ventrals jugular-subthoracic, their rays in reduced number. Length about 2 inches.

Labrisomus Swainson

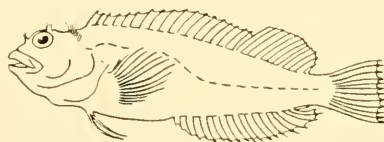
Labrisomus nuchipinnis (Quoy and Gaimard)

Fringe-naped blenny

Clinus nuchipinnis Quoy and Gaimard, 1824, Voy Uranie et Physicienne, Zool., p. 255.

Labrisomus nuchipinnis Evermann and Marsh, 1902, p. 311, Pl. 46.

FIG. 283.—*Labrisomus nuchipinnis*
From Zoologica, X



Type locality.—Brazil.

Distribution.—West Indies, north to southern Florida, south to Brazil, east to the Canary Islands. Common and generally distributed in Porto Rican waters.

Diagnosis.—Head 3.5; depth 3.5; eye 4.7. Dorsal XVIII, 12; anal II, 17; scales 70. Teeth in jaws in more than one row (some villiform); filaments present above eye and on nape; lateral line arched over pectoral, becoming median further back; ventrals thoracic, their rays in reduced number; scales cycloid; operculum with an ocellus. Attains a length of from 6 to 8 inches.

Habits.—Frequents coral reefs, and broken bottoms near shore.

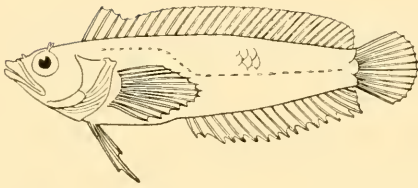
Auchenopterus Günther

Auchenopterus albicaudus Evermann and Marsh

White-tailed blenny

Auchenopterus albicaudus Evermann and Marsh, 1899, Rept. U. S. Fish Comm., for 1899, p. 360.

Auchenopterus albicaudus Evermann and Marsh, 1902, p. 313, Fig. 99.

FIG. 284.—*Auchenopterus albicaudus*

Type locality.—Arroyo, Porto Rico.

Distribution.—Porto Rico.

Diagnosis.—Head 3.2; depth 4; eye 4. Dorsal XXX, 1; anal II, 17; scales 34. Spinous dorsal notched in front; membrane of third dorsal spine joining fourth spine (shorter) near its tip; scales cycloid; lateral line arched over pectoral, becoming median further back; ventrals jugular-subthoracic, their rays in reduced number. Caudal white, with a broad black bar on its base; body dark, without cross-bars. Length about $1\frac{1}{2}$ inches.

Remarks.—Known only from the type specimen.

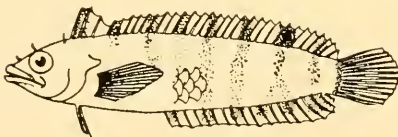
Auchenopterus fajardo Evermann and Marsh

Fajardo blenny

Auchenopterus fajardo Evermann and Marsh, 1899, Rept. U. S. Fish Comm. for 1899, p. 361.

Auchenopterus fajardo Evermann and Marsh, 1902, p. 313, Pl. 47.

Cremnobotas fajardo Beebe and Tee Van, 1928, Zoologica, Vol. X, No. 1, p. 239.

FIG. 285.—*Auchenopterus fajardo*
From Zoologica, X

Type locality.—Fajardo, Porto Rico.

Distribution.—Porto Rico, Haiti and the Bahamas, uncommon.

Diagnosis.—Head 3.2 to 3.3; depth 4.8; eye 4.2. Dorsal XXIX, 1; anal II, 17; scales 34. Spinous dorsal notched in front; membrane of third dorsal spine joining fourth spine near its tip; scales cycloid; lateral line arched over pectoral, becoming median further back; ventrals jugular-subthoracic, their rays in reduced number. Caudal fin mottled; body with about 7 dark cross-bars. Length from 1 to 2 inches.

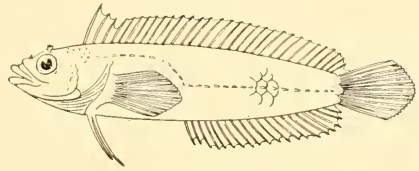
Habits.—Frequents shallow water among sea-weeds and small coral masses.

Auchenopterus rubescens Evermann and Marsh

Rosy blenny

Auchenopterus rubescens Evermann and Marsh, 1899, Rept. U. S. Fish Comm. for 1899, p. 360.

Auchenopterus rubescens Evermann and Marsh, 1902, p. 314, Fig. 100.

FIG. 286.—*Auchenopterus rubescens*

Type locality.—Puerto Real, Porto Rico.

Distribution.—Porto Rico.

Diagnosis.—Head 3.4; depth 5; eye 5. Dorsal XXX, 1; anal II, 18; scales 33. Spinous dorsal notched in front; membrane of third dorsal spine joining fourth spine (shortest) near its tip; scales cycloid; lateral line arched over pectoral, becoming median further back; ventrals jugular-subthoracic, their rays in reduced number. Caudal fin pale-colored, no dark bar at its base; body pale rosy with no cross-bars. Length 1.3 inches.

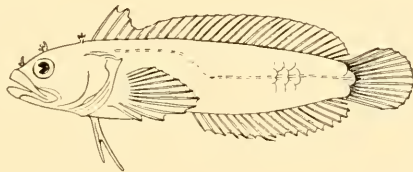
Remarks.—Only the type specimen known.

Tekla Nichols**Tekla cingulata** (Evermann and Marsh)

Belted blenny

Auchenopterus cingulatus Evermann and Marsh, 1899, Rept. U. S. Fish Comm. for 1899, p. 361.

Auchenopterus cingulatus Evermann and Marsh, 1902, p. 315, Fig. 101.

FIG. 287.—*Tekla cingulata*

Type locality.—Ponce, Porto Rico.

Distribution.—Ponce and Puerto Real, Porto Rico; uncommon.

Diagnosis.—Head 3; depth 4.4; eye 5. Dorsal XXVIII; anal II, 16; scales 30. Spinous dorsal notched in front, membrane of the third dorsal spine joining fourth spine (shortest) near its tip; scales cycloid; lateral line arched over pectoral, becoming median further back;

ventrals jugular-subthoracic, their rays in reduced number. Length about 1 inch.

Tekla fasciata (Steindachner)

Banded blenny

Cremnobates fasciatus Steindachner, 1877, Sitzb. Ak. Wiss. Wien, Vol. LXXIV, Pt. 1, p. 224.

? *Auchenopterus fasciatus* Evermann and Marsh, 1902, p. 315. Hucares, Porto Rico.

Tekla fasciata Nichols, 1922, Copeia, No. 110, pp. 69 and 95. Southern Florida.

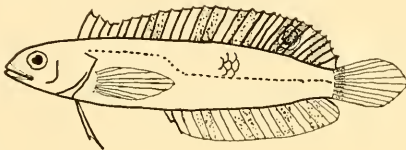


FIG. 288.—*Tekla fasciata*

Type locality.—Florida Straits.

Distribution.—Southern Florida and Porto Rico.

Diagnosis.—Head 3.5; depth 4.6; eye 4.5. Dorsal XXVIII to XXXI; anal II, 17 to 18; scales 31 to 38. Spinous dorsal notched in front, membrane of third dorsal spine joining fourth spine (shortest) near its tip; scales cycloid; lateral line arched over pectoral, becoming median further back; ventrals jugular-subthoracic, their rays in reduced number. Dorsal with a distinct ocellus; dorsal and anal boldly barred. Length from 1 to 2 inches.

Remarks.—The small scaled members of the blenny family of which we have been treating, although numerous in species, are poorly represented in collections, with the result that their number and exact relationship still remain uncertain. Further knowledge may synthesize some of the genera or species here recognized. In the present case it is somewhat doubtful if Evermann and Marsh are correct in identifying their Porto Rican specimen with *Tekla fasciata* from Florida.

Auchenistius Evermann and Marsh

Auchenistius stabli Evermann and Marsh

Green thalassia blenny

Auchenistius stabli Evermann and Marsh, 1899, Rept. U. S. Fish Comm. for 1899, p. 359.

Auchenistius stabli Evermann and Marsh, 1902, p. 316, Fig. 102.

FIG. 289.—*Auchenistius stahli*
From Zoologica, X



Type locality.—Ponce, Porto Rico.

Distribution.—Porto Rico, the Bahamas and Haiti.

Diagnosis.—Head 5; depth 6.5; eye 4.8. Dorsal XLI to XLII; anal I or II, 23 to 24; scales 58 to 60. Dorsal without a notch; dorsal and anal confluent with the base of the caudal; no lateral line; ventrals small, subjugular, their rays in reduced number. Attains a length of 1 inch or somewhat more.

Habits.—Hides about shallow reefs, broken coral or algae, such as *thalassia*.

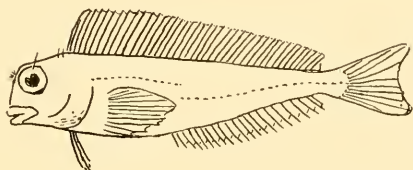
Rupiscartes Swainson

Rupiscartes macclurei Silvester

Silvester's rock-hopping blenny

Rupiscartes macclurei Silvester, 1916, Yearb. Carn. Inst. Wash. for 1915, Vol. XIV, p. 217. Porto Rico.

FIG. 290.—*Rupiscartes macclurei*



Type locality.—Dead coral reef, west of Guanica Harbor, Porto Rico.

Distribution.—Known only from the type locality.

Diagnosis.—Head 4.2; depth 4.3. Dorsal XI, 20 or XII, 19 = 31; anal 22; no scales. Dorsal continuous without a deep notch; posterior canines large, fanglike; teeth in a comblike row, movable, not firmly fixed. Length a trifle more than 2 inches.

Remarks.—This may be the young of the widely distributed *Rupiscartes atlanticus*.

Bleinius Linnaeus

Bleinius cristatus Linnaeus

Crested blenny

Bleinius cristatus Linnaeus, 1758, Syst. Nat., ed. 10, Vol. I, p. 256; after Gronow.

Bleinius cristatus Nichols, 1915, Bull. Amer. Mus. Nat. Hist., Vol. XXXIV, p. 146. Porto Rico.

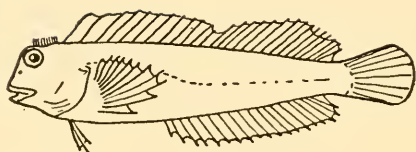


FIG. 291.—*Blennius cristatus*
Breder's Field Book of Marine
Fishes (Putnam).

Type locality.—Indies.

Distribution.—Warmer waters of both sides of the Atlantic; West Indies to Florida and Brazil. Found at Condado Rocks in July, and probably rather common about Porto Rico in suitable places.

Specimens collected.—4: Condado Rocks, San Juan.

Diagnosis.—Head 4; depth 4; eye 4.2 to 4.3. Dorsal XI, 16; anal 19; no scales. Nape with a comb of close-set cirri; a cirrus above the eye; short, stoutish canines present in lower jaw only; teeth comblike, firmly fixed; caudal rounded; gill membranes free from or forming a broad fold across isthmus. Length from $2\frac{1}{2}$ to 4 inches.

Salarichthys Guichenot

Salarichthys textilis (Cuvier and Valenciennes)

Silver-marked blenny

Salarichthys textilis Cuvier and Valenciennes, 1836, Hist. Nat. Poiss., Vol. XI, p. 307; from Quoy and Gaimard MS.

Salarichthys textilis Nichols, 1915, Bull. Amer. Mus. Nat. Hist., Vol. XXXIV, p. 146. Porto Rico.

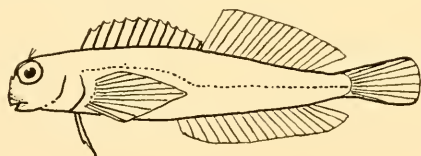


FIG. 292.—*Salarichthys textilis*

Type locality.—Ascension Island.

Distribution.—West Indies, from Bermuda to Brazil and Ascension Island. Found abundant at Condado Rocks in July, and probably common about Porto Rico in suitable places.

Specimens collected.—12: Condado Rocks, San Juan.

Diagnosis.—Head 4.6; depth 4.6; eye about 4. Dorsal XII, 16; anal 18; no scales. Teeth in a single comblike row, movable, implanted in the skin of the lips; small posterior canines present, and a few teeth on the vomer. Color olive, with silvery whitish markings. Length from 2 to 3 inches.

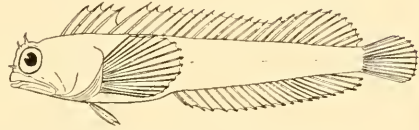
Habits.—Frequents shallow rocky sea-washed pools along shore.

Coralliozetus Evermann and Marsh**Coralliozetus cardonae** Evermann and Marsh

Coral blenny

Coralliozetus cardonae Evermann and Marsh, 1899, Rept. U. S. Fish Comm. for 1899, p. 362.

Coralliozetus cardonae Evermann and Marsh, 1902, p. 317, Fig. 103.

FIG. 293.—*Coralliozetus cardonae*

Type locality.—Reef at the Cardona lighthouse, Playa de Ponce, Porto Rico.

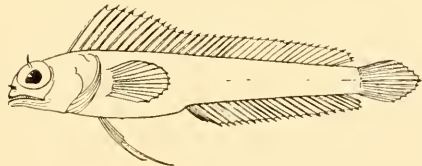
Distribution.—Porto Rico.—coral reefs about Ponce.

Diagnosis.—Head \pm ; depth 5.6; eye \pm . Dorsal XVII, 11; anal 21; no scales. Ventral subjugular; profile steep, subvertical; eye large, anterior, over the large mouth; dorsal notched behind the fourth spine; jaws each with 8 enlarged, curved, conical teeth; caudal rounded. Length up to 1 inch.

Emblemaria Jordan and Gilbert**Emblemaria pandionis** Evermann and Marsh

The "Fish-Hawk's" blenny

Emblemaria pandionis Evermann and Marsh, 1902, Bull. U. S. Fish Comm. for 1900, Vol. XX, Pt. 1, p. 318, Fig. 104.

FIG. 294.—*Emblemaria pandionis*

Type locality.—8 $\frac{1}{2}$ miles northeast from Isabel Segunda, Vieques Island, in 14 $\frac{3}{4}$ fathoms of water.

Distribution.—Off Vieques Island.

Diagnosis.—Head 3.7; depth 5.8; eye 3.6. Dorsal XVII, 18; anal II, 23; no scales. Eye with a cirrus above pupil; maxillary reaching to under posterior edge of orbit; jaws with numerous, more or less unequal teeth. Caudal short, bluntly pointed; dorsal continuous, unnotched,

highest in front; ventrals thoracic, their rays in reduced number. No dark cross-bars. Length 1.5 inches.

Remarks.—Only the type known.

FIERASFERIDAE

Fierasfer Cuvier

Fierasfer bermudensis (Jones)

Bermuda pearl-fish

Lefroyia bermudensis Jones, 1874, Zoologist, Vol. IX, p. 3838.

Fierasfer bermudensis Evermann and Marsh, 1902, p. 319.

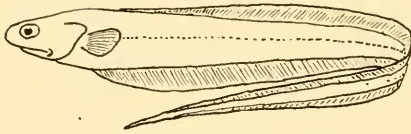


FIG. 295.—*Fierasfer bermudensis*

Type locality.—Bermuda.

Distribution.—Bermuda and Porto Rico, where recorded from Mayagüez and Puerto Real, uncommon.

Diagnosis.—Head 8.5; body elongate, compressed, tapering into a long and slender tail; eye 4. Vertical fins long, low, confluent; no scales. Vent at throat; ventrals absent. Pale brownish in color, pearly along the sides.

Remarks.—The genus *Fierasfer* in American waters is divided into several rather poorly defined species of small fishes, almost everywhere uncommon.

Habits.—The peculiar eel-like fishes of this genus are usually found seeking shelter within the shell of mollusks (the pearl oyster is a favorite), echinoderms or within the body cavity of large Holothurians (sea cucumbers). The fish has been observed to enter the anal aperture of these last named and, thus sheltered by the body of its host, to project its head through the opening in search of food outside. Thus the relationship between the two is not one of parasitism, nor is their any commensal benefit to the host so far as known. In thus entering a Holothurian the fish sometimes does so head first, sometimes tail first, taking advantage of the suction which alternates with the expulsion of water by the creature's orifice. There are one or two instances of dead specimens taken from the pearl oyster, enclosed in a pearly covering deposited on them by the shell-fish.

PLEURONECTIDAE

This family, the flounders, introduces us to a large, rather homogeneous group of flat fishes, peculiarly adapted to lying on one side on the bottom. They are bilaterally unsymmetrical in various ways, the most notable being that both eyes are on the same side of the head, the side which is uppermost when the fish is at rest. The lower, or blind, side is usually plain white, colorless, the upper side variously patterned to match the bottom and thus contribute to the fish's low visibility. When settling to rest, those species found on sand or mud frequently bury their margins loosely, sometimes so that only the mouth and eyes are exposed. It has been experimentally proved in the case of 2 or 3 species (and doubtless is true in many) that both color tone and pattern of a flounder's upper side is changed to match the particular bottom on which it is resting, the stimulus so to do being visual.—a fact which overthrows the fallacy that the fish eye has no color vision. Flounders take full advantage of their low visibility by spending much of the time at rest, shifting their position by gliding forward gently over the bottom or by swift rushes, when for a brief moment they become conspicuous, only to disappear immediately as they settle to rest again. Some flounders are more or less translucent, which further contributes to their concealment.

When the larval flounder hatches from the egg, it is bilaterally symmetrical, with an eye on either side of the head. Thus we have here a striking instance of ontogeny paralleling phylogeny, for these peculiar flattened forms are doubtless descended from more normal fishes.

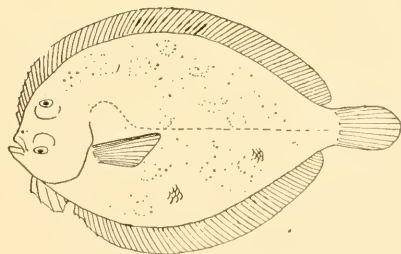
Platophrys Swainson**Platophrys ocellatus (Agassiz)**

Eyed flounder

Rhombus ocellatus Agassiz, 1829, in Spix, Pisc. Brazil., p. 85, Pl. 46.

Platophrys ocellatus Evermann and Marsh, 1902, p. 321, Fig. 105.

FIG. 296.—*Platophrys ocellatus*
From Zoologica, IX



Type locality.—Brazil.

Distribution.—Western Atlantic waters from Long Island, N. Y., to Rio Janeiro. Rather common about Porto Rico.

Specimens collected.—1: Condado Rocks, San Juan.

Diagnosis.—Head 3.7 to 4.1; depth 1.5 to 1.8; eye (lower) 3 to 3.4. Dorsal 80 to 85; anal 59 to 67; scales 75. Anal rays without spinules at their base; anterior profile of head convex before interorbital area, the very short snout scarcely forming a reentrant angle at its base. Eyes and color on the left side; lateral line with a distinct arch in front; scales adherent and ctenoid; interorbital more or less broad and concave, not a narrow ridge; caudal sub-sessile; mouth symmetrical; ventral fins dissimilar, that of the eyed side on the ridge of the abdomen. A small species, attaining a length of about 8 inches.

Habits.—Found on sandy shores in usually shallow water. A little one sometimes occurs on the small sand bottom of some tidal rock pool, where it is almost unbelievably hard to see.

Platophrys lunatus (Linnaeus)

Peacock flounder

Pleuronectes lunatus Linnaeus, 1758, Syst. Nat., ed. 10, p. 269; based on Catesby.

Platophrys lunatus Evermann and Marsh, 1902, p. 322.

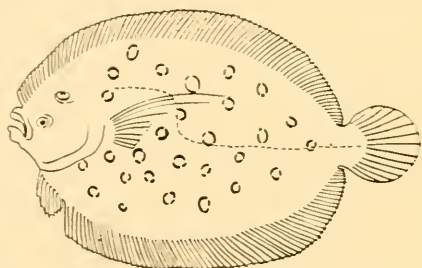


FIG. 297.—*Platophrys lunatus*
From Zoologica, X

Type locality.—Bahamas.

Distribution.—West Indies north to Florida. Not uncommon at Porto Rico; recorded from St. Croix.

Specimens collected.—1: San Juan.

Diagnosis.—Head 3.8; depth about 2; eye (lower) 6.2 to 6.3. Dorsal 92; anal 74; scales (pores) 92. Anal rays without spinules at their base; anterior profile of head strongly concave before interorbital area, the projecting snout leaving a marked reentrant angle above it; maxillary 3 in head. Eyes and color on the left side; lateral line with a dis-

tinct arch in front: scales adherent and ctenoid: interorbital more or less broad and concave, not a narrow ridge; caudal sub-sessile; mouth symmetrical; ventral fins dissimilar, that of the eyed side on the ridge of the abdomen. Attains a length of 18 inches.

Syacium Ranzani

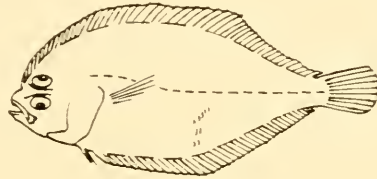
Syacium micrurum Ranzani

Transparent flounder

Syacium micrurum Ranzani, 1840, Nov. Spec. Pisc. Diss., Sec., p. 20, Pl. 5.

Syacium micrurum Evermann and Marsh, 1902, p. 324.

FIG. 298.—*Syacium micrurum*
From Zoologica, X



Type locality.—Brazil.

Distribution.—West Indian fauna. Key West to Rio Janeiro, Brazil. Rather common about Porto Rico.

Diagnosis.—Head 3.7 to 3.8; depth 2.4; eye 4 to 6. Dorsal 87 to 92; anal 54 to 70; scales (pores) 65 to 70. Interorbital space broad in the male, narrow in the female; lateral line without a distinct arch in front; teeth in the upper jaw biserial; gill-rakers short. Mouth symmetrical, ventral of the eyed side on the ridge of the abdomen. Length from 6 to 7 inches. "Young, quite transparent" (Beebe and Tee Van).

Habits.—Frequents sandy shores, the adults common in water several fathoms in depth.

Citharichthys Bleeker

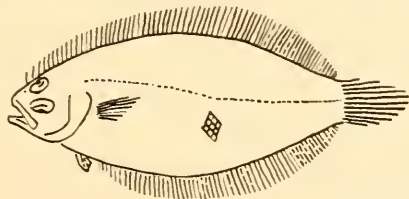
Citharichthys unicornis Goode

Deep-water whiff

Citharichthys unicornis Goode, 1880, Proc. U. S. Nat. Mus. for 1880, p. 342.

Citharichthys unicornis Evermann and Marsh, 1902, p. 325.

FIG. 299.—*Citharichthys unicornis*



Type locality.—Gulf Stream southeast of New England.

Distribution.—Deep waters of southeast coast of New England, Florida and Gulf of Mexico, seldom collected. A specimen about 2 inches long recorded from Mayagüez Harbor.

Diagnosis.—Head 4 to 4.5; depth 2.3 to 2.4; eye 2.3 to 3. Dorsal 77; anal 60; scales 42. Interorbital space with a wide ridge, about $\frac{1}{2}$ the diameter of eye; snout with a strong sharp spine on the eyed side, above upper lip; eyes and color on the left side; caudal fin sub-sessile; lateral line without an arch in front; teeth in each jaw uniserial; mouth not very small; gill-rakers slender, of moderate length; scales thin, deciduous, ciliated. Mouth symmetrical; ventral of the eyed side on the ridge of the abdomen. Size small.

***Citharichthys spilopterus* Günther**

Spot-finned whiff

Citharichthys spilopterus Günther, 1862, Cat., Vol. IV, p. 421.

Citharichthys spilopterus Evermann and Marsh, 1902, p. 326.

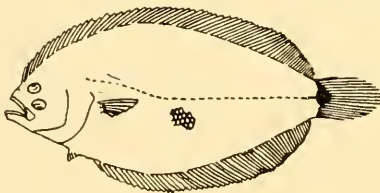


FIG. 300.—*Citharichthys spilopterus*
From Zoologica, X

Type locality.—New Orleans, Santo Domingo and Jamaica.

Distribution.—South Carolina (casually New Jersey) through the West Indies to Brazil. Abundant in Porto Rican waters.

Specimens collected.—2: Paloseco Point, San Juan.

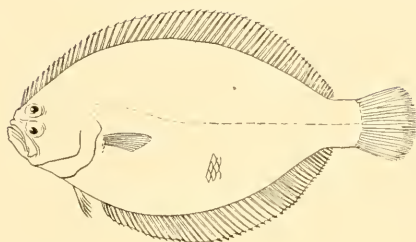
Diagnosis.—Head 3.7 to 3.8; depth 2.2 to 2.3; eye 7.8 to 8. Dorsal 82; anal 61; scales (pores) 48. Interorbital ridge low and narrow; head closely compressed. Eyes and color on the left side; caudal fin sub-sessile; lateral line without an arch in front; teeth in each jaw uniserial; mouth not very small; gill-rakers slender, of moderate length; scales thin, deciduous, ciliated. Mouth symmetrical; ventral of the eyed side on the ridge of the abdomen. Attains a length of 6 inches.

Habits.—Frequents sandy shores in shallow water.

***Citharichthys arenaceus* Evermann and Marsh**

Sand whiff

Citharichthys arenaceus Evermann and Marsh, 1902, Bull. U. S. Fish Comm. for 1900, Vol. XX, Pt. 1, p. 326, Fig. 106.

FIG. 301.—*Citharichthys arenaceus*

Type locality.—Mayagüez, Porto Rico.

Distribution.—Porto Rico (Mayagüez, Aguadilla and San Juan).

Diagnosis.—Head 3.8; depth nearly 2; eye 6. Dorsal 74; anal 54; scales (pores) 51 (from the type, 162 mm. long). Resembles *Citharichthys spilopterus* but with larger eye. Interorbital ridge low and narrow; head closely compressed. Eyes and color on the left side; caudal fin sub-sessile; lateral line without an arch in front; teeth in each jaw uniserial; mouth not very small; gill-rakers slender, of moderate length; scales thin, deciduous, ciliated. Mouth symmetrical; ventral of the eyed side on the ridge of the abdomen. Length up to a little more than 6 inches.

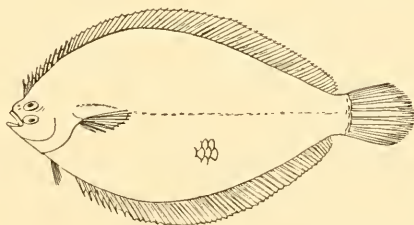
Etropus Jordan and Gilbert

Etropus crossotus Jordan and Gilbert

Small-mouthed flounder

Etropus crossotus Jordan and Gilbert, 1881, Proc. U. S. Nat. Mus. for 1881, p. 364.

Etropus crossotus Evermann and Marsh, 1902, p. 329, Fig. 107.

FIG. 302.—*Etropus crossotus*

Type locality.—Mazatlan.

Distribution.—Tropical America on both coasts, north to Cerros Island and North Carolina, south to Panama and Rio Janeiro. Not uncommon about Porto Rico.

Diagnosis.—Head 4.8; depth 1.7 to 2; eye 3.7 to 3.8. Dorsal 76 to 85; anal 56 to 67; scales 42 to 48. Caudal fin sub-sessile; lateral line

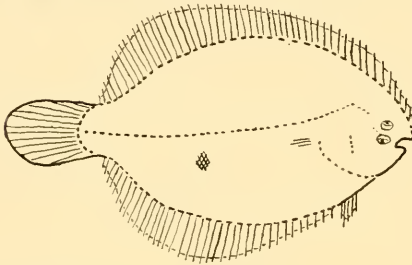
without a distinct arch in front; teeth in each jaw uniserial; inter-orbital space very narrow; mouth very small. Eyes and color on the left side; mouth symmetrical; ventral of the eyed side on the ridge of the abdomen. Size small.

SOLEIDAE

Achirus Lacépède**Achirus inscriptus** Gosse

Scrawled sole

Achirus inscriptus Gosse, 1851, Nat. Sojourn Jamaica, p. 52, Pl. 1, Fig. 4.
Achirus inscriptus Evermann and Marsh, 1902, p. 330.

FIG. 303.—*Achirus inscriptus*

Type locality.—Jamaica.

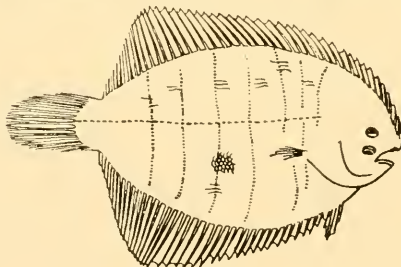
Distribution.—West Indies north to southern Florida. Generally distributed and not uncommon in Porto Rico.

Diagnosis.—Head 3.7 to 3.8; depth 1.7 to 1.8; eye small. Dorsal 53 to 57; anal 40; scales 75 to 80. Pectoral present on both sides, that of the eyed side of about 3 rays, that of the blind side of a single ray. Eyes and color on the right side; mouth small, twisted.

Achirus lineatus (Linnaeus)

Lineated sole

Pleuronectes lineatus Linnaeus, 1758, Syst. Nat., ed. 10, p. 268; based on Browne and Sloane.
Achirus lineatus Evermann and Marsh, 1902, p. 331, Fig. 108.

FIG. 304.—*Achirus lineatus*
From Zoologica, X

Type locality.—Jamaica.

Distribution.—Widely distributed, from the Florida Keys through the West Indies to Brazil, and south to Uruguay. Fairly common about Porto Rico.

Diagnosis.—Head 3.5; depth about 1.5; eye about 5. Dorsal 49 to 58; anal 38 to 44; scales 75 to 85. Only one pectoral present, that on the right side, with from 4 to 6 rays, considerably longer than eye. Eyes and color on the right side; mouth small, twisted. Length from 4 to 5 inches.

Remarks.—The soles represent a further specialization of the asymmetrical flounder form. Their mouths are small and crooked, eyes small, pectoral fins more or less imperfect or lacking. Two types are common in American waters, represented by this and the following genus, but we have no representative of the delicious edible sole of Europe. All our species are small and worthless as food.

Habits.—This widely distributed species is an adaptable bottom fish. In the work by Beebe and Tee Van the coming of the young to the surface at night is described as follows: "On several nights I caught young soles of this species, near the surface, at our submerged light. They swam slowly along and when at the surface elevated the encircling ring of vertical fins, and depressed the body, and in this cupped shape floated with no apparent movement of fins or body. The tips of all the rays could be seen breaking the surface film, but I could see no difference in the level of the enclosed water and that outside. These specimens measured from 17.5 to 25 mm. The color change in these young soles was more extreme than in any fish I have ever seen."

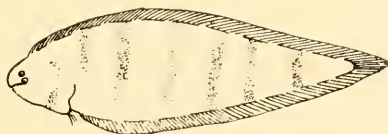
Symphurus Rafinesque

Symphurus plagusia (Bloch and Schneider)

Pleuronectes plagusia Bloch and Schneider, 1801, Syst. Ichth., p. 162; after Browne.

Symphurus plagusia Evermann and Marsh, 1902, p. 332.

FIG. 305.—*Symphurus plagusia*
From Zoologica, X



Type locality.—Jamaica.

Distribution.—West Indies to Brazil, common, probably occasionally north to Florida. Not uncommon in Porto Rico.

Specimens collected.—1: Paloseco Point.

Diagnosis.—Head 5.2 to 5.8; depth 3.1 to 3.7 (usually about 3.5). Dorsal 88 to 96; anal 74 to 83; scales 75 to 90. Caudal and a large part of dorsal and anal fins usually either uniformly black or with large black spots. Eyes and color on the left side; eyes small, very close together; mouth small, twisted; caudal pointed. Length up to 6 inches.

Remarks.—Several somewhat poorly differentiated species of *Symphurus* are recognized. They occur at the shore and also run into rather deep water. This seems to be a variable, plastic genus with recognizable geographic and bathymetric forms.

ANTENNARIIDAE

Histrio Fischer

Histrio gibbus (Mitchill)

Gibbous mouse-fish, gulf-weed fish, pescador

Lophius gibbus Mitchill, 1815, Trans. Lit. and Phil. Soc. N. Y., Vol. I, Pl. 4, Fig. 9.

Pterophryne gibba Evermann and Marsh, 1902, p. 334.

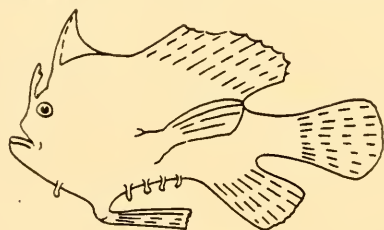


FIG. 306.—*Histrio gibbus*
From Zoologica, X

Type locality.—Off St. Croix (22° N. 64° W.).

Distribution.—West Indies, north to Key West and the Tortugas, more or less confounded with *Histrio histrio*. Recorded from Porto Rico by Poey and Stahl.

Diagnosis.—Dorsal II, 12; anal 7. “Bait” on first dorsal spine bulbous and covered with slender fleshy filaments instead of being bifurcate. Head compressed; a rostral spine or tentacle followed by 2 larger disconnected spines; skin naked and smooth; ventral fins elongate. Mouth large, opening upward; pectorals forming an elbow-like angle with their peduncles; numerous irregular dermal filaments. Length from 2 to 4 inches.

Remarks.—At present two species of gulf-weed fishes are recognized, this and *Histrio histrio*, which is more widely distributed in the open Atlantic, etc. It may be that *H. gibba* replaces this other form more or

less among the islands, but the literature is too confused to give any definite information on the point. The two are similar in habits and general appearance, and the extent of individual variation in them has not been worked out satisfactorily.

Habits.—The mouse-fish hides and has its being in drifting gulf-weed. Its peculiarly spotted color, the shape and irregularities of its form, and its usually deliberate movements all combine to give it almost complete concealment in this habitat. This is doubtless as serviceable to it in stalking the smaller Crustacea, etc., of the weed, as in escaping the attack of possible enemies, for the mouse-fish is eminently predacious, the dragon of its environment. It does not hesitate to swallow entire smaller individuals of its own kind. The eggs of *H. gibba* are embedded in a gelatinous egg-raft, similar to that laid by *H. histrio* (Gudger).

Antennarius Lacépède

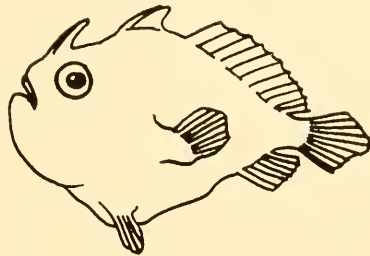
Antennarius inops Poey

White-spotted frog fish

Antennarius inops Poey, 1881, Anal. Soc. Esp. Hist. Nat., Vol. X, p. 340.

Antennarius inops Evermann and Marsh, 1902, p. 335.

FIG. 307.—*Antennarius inops*
From Zoologica, X



Type locality.—Porto Rico.

Distribution.—Porto Rico and Haiti, uncommon.

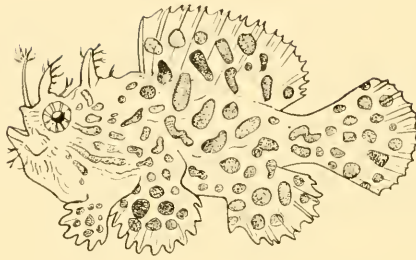
Diagnosis.—Depth 2.7 to 2.8 in total length (with caudal). Bulbous end or “bait” of first dorsal spine undivided at tip; skin inclined to be smooth except about eyes; first dorsal spine short, second rough; head compressed. Body brown with whitish spots or marks; no ocelli. A rostral spine or tentacle followed by 2 larger disconnected spines; mouth large, opening upward; pectorals forming an elbow-like angle with their peduncles. Attains a length of about 3 inches.

Antennarius scaber (Cuvier)

Rough frog-fish

Chironectes scaber Cuvier, 1817, Mem. Mus., Vol. III, p. 425, Pl. 16, Fig. 2.

Antennarius scaber Evermann and Marsh, 1902, p. 335, Pl. 48.

FIG. 308.—*Antennarius scaber*

Type locality.—Martinique.

Distribution.—Caribbean Sea and the West Indies; a specimen from Mayagüez, Porto Rico.

Diagnosis.—Head about 2; depth about 2.3; eye about 5. Dorsal III-12; anal 7; skin velvety or shagreen-like with prickles, and numerous dermal flaps. Bulbous end or "bait" on first dorsal spine bifid at tip; color reddish with brown spots, those about eye radiating. Head compressed; a rostral spine or tentacle followed by two larger disconnected spines; mouth large, opening upward; pectorals forming an elbow-like angle with their peduncles.

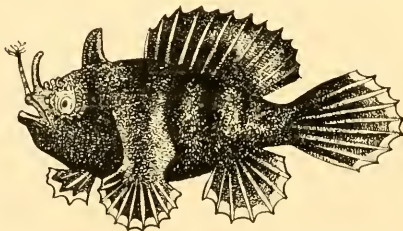
Habits.—The frog-fishes are more generalized in habits than the related mouse-fishes. They are frequently found with drifting sea-weed, but are not peculiar to gulf-weed as are the latter, and they are generally uncommon whereas mouse-fishes are plentiful. They are very variable, and some of the several recognized species may be nominal.

***Antennarius nuttingii* Garman**

Dusky frog fish; murcielago

Antennarius nuttingii Garman, 1896, Bull. Iowa Lab. Nat. Hist. for 1896, p. 83, Pl. 2.

Antennarius nuttingii Evermann and Marsh, 1902, p. 335, Pl. 49.

FIG. 309.—*Antennarius nuttingii*

Type locality.—Great Bahama Banks.

Distribution.—Bahamas and Porto Rico; rare.

Diagnosis.—Head about 1.8; depth about 2.3; eye about 5. Dorsal 11-12; anal 7. Skin velvety or shagreen-like with prickles. Color uniformly blackish, inside of mouth white. Head compressed; a rostral spine or tentacle followed by 2 larger disconnected spines; mouth large, opening upward; pectorals forming an elbow-like angle with their peduncles.

Antennarius multiocellatus (Cuvier and Valenciennes)

Many-eyed frog fish; martin pescador

Chironectes multiocellatus Cuvier and Valenciennes, 1837, Hist. Nat. Poiss., Vol. XI, p. 422.

Antennarius multiocellatus Cope, 1871, Trans. Amer. Phil. Soc., Vol. XIV, p. 480. St. Croix.

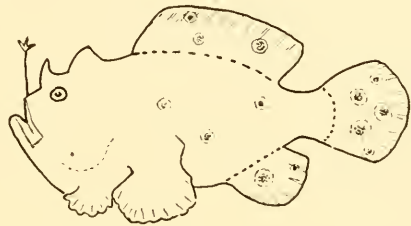


FIG. 310.—*Antennarius multiocellatus*

Type locality.—Martinique.

Distribution.—West Indies north to the Florida Keys, uncommon. Recorded from St. Croix.

Diagnosis.—Eye very small; skin with fine prickles, inclined to be smooth. Head compressed; a rostral spine or tentacle followed by 2 larger, disconnected spines; mouth large, opening upward; pectorals forming an elbow-like angle with their peduncles. Bulbous tip or "bait" or first dorsal spine trifold; first dorsal spine twice as long as the second. Sides with numerous black ocelli besides other streaks and dark spots.

Chaunax Lowe

Chaunax pictus Lowe

Deep-water rosy frogfish

Chaunax pictus Lowe, 1846, Trans. Zool. Soc. London for 1846, p. 339.

Chaunax pictus Evermann and Marsh, 1902, p. 336, Fig. 109.



FIG. 311.—*Chaunax pictus*

Type locality.—Madeira.

Distribution.—Waters of the warmer parts of the Atlantic at a depth of from 130 to 428 fathoms; Madeira and off Rhode Island to off Cape Verde and Barbados. One from 220 fathoms off Mayagüez.

Diagnosis.—Head 1.6; depth 2.5; eye 8 or 9. Dorsal 1-11; anal 5; thickly covered with prickles. Head depressed, cuboid; dorsal spines reduced to a small "bait" on snout; mouth rather large, opening upward; muciferous channels very conspicuous. Color more or less rose red. Length up to 6 or 8 inches or more.

OGCOEPHALIDAE

Ogcocephalus Fischer

Ogcocephalus vespertilio (Linnaeus)

Long-nosed bat-fish; diablo

Lophius vespertilio Linnaeus, 1758, Syst. Nat., ed. 10, Vol. I, p. 236; after Artedi.

Ogcocephalus vespertilio Evermann and Marsh, 1902, p. 338, Figs. 110 and 111.

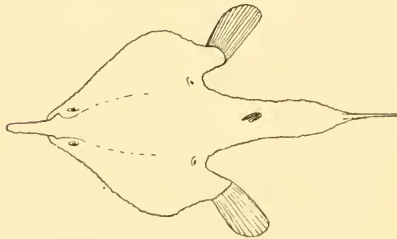


FIG. 312.—*Ogcocephalus vespertilio*
From Zoologica, IX

Type locality.—American Seas.

Distribution.—West Indian fauna, north regularly to the Florida Keys and accidentally to New York. Recorded from Porto Rico by Poey and Stabl.

Diagnosis.—Head (tip of upper jaw to gill opening) little more than 2; depth (in length from upper jaw) 5; eye about 6. Dorsal 4; anal 4; skin covered with numerous small rough bony tubercles. A depressed, broad, angular, fish, with a pointed rostral process projecting forward, which is contained 5 or 10 times in the length of the body; pectorals on backwardly projecting angles, between which the comparatively narrow tail portion of the body projects backward. Attains a length of 12 inches, usually smaller.

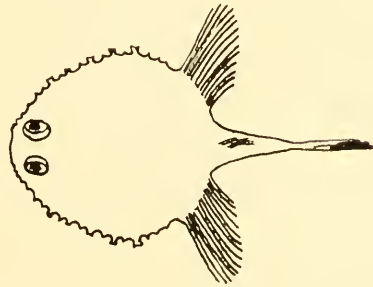
Habits.—A peculiar, sluggish, scarcely fishlike creature, found on the bottom in shallow tropical waters.

Halieutichthys Poey**Halieutichthys aculeatus** (Mitchill)

Reticulated deep-water batfish

Lophius aculeatus Mitchill, 1818, Amer. Month. Mag., Vol. 11, p. 325.*Halieutichthys aculeatus* Evermann and Marsh, 1902, p. 338.

FIG. 313.—*Halieutichthys aculeatus*
From Zoologica, X



Type locality.—Bahama Straits.

Distribution.—West Indies, Gulf of Mexico and Gulf Stream, in rather deep water. One specimen from off Mayagüez, Porto Rico, in 75 fathoms.

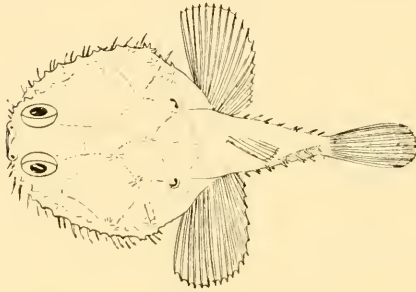
Diagnosis.—Head 1.8; depth 6; eye 5. Dorsal 5; anal 4; skin above sparsely armed with stellate tubercles, lower surface smooth. Flattened disk of the body with frontal region depressed; snout not produced; eyes partly superior; ground plan blunt and round in front (subcircular); pectorals spreading out fanwise where the broad disk joins the tapering caudal portion of the body; dorsal present; vomer and palatines with teeth. Surface of body covered with brownish reticulations. Size small.

Habits.—Specimens of this genus are dredged from the bottom in deep water, and it may be considered a sluggish bottom dweller like the not dissimilar, shallow-water batfishes. It is therefore interesting and surprising that Beebe and Tee Van record the young under an inch in length coming to a light at the surface at night, "swimming easily and sustaining themselves without effort. The pectorals were constantly expanded to the widest extent and the propelling power was derived from the caudal, with some help from the dorsal and anal fins. The full pectoral expansion is equal to four-fifths of the entire dorsal surface of the body, so its sustaining power, given any forward impetus at all, is very considerable. Twice I saw these young fish come to the surface and cup their pectorals and actually float motionless, with the tips of the pectoral rays and the snout and eyes just out of water."

Halicutichthys smithii Evermann and Marsh

Hugh Smith's deep-water batfish

Halicutichthys smithii Evermann and Marsh, 1902, Bull. U. S. Fish Comm. for 1900, Vol. XX, Pt. 1, p. 338, Fig. 112.

FIG. 311.—*Halicutichthys smithii*

Type locality.—Mayagüez Harbor, Porto Rico, in 75 fathoms of water.

Distribution.—Known only from the type locality, and the single type specimen.

Diagnosis.—Head 2; depth 6; eye 4. Dorsal 1, 5; anal 4; skin above sparsely armed with stellate tubercles, lower surface smooth. Flattened disk of the body with frontal region depressed, snout not produced, eyes partly superior, ground plan blunt and round in front (subcircular); pectorals spreading out fanwise to either side where the broad disk joins the tapering caudal portion of the body; dorsal present; vomer and palatines with teeth. Surface of body blackish, not reticulate; pectoral with a broad black bar. Length $3\frac{1}{4}$ inches.

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THE ASCIDIANS OF PORTO RICO AND THE VIRGIN ISLANDS

BY WILLARD G. VAN NAME

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INTRODUCTION

GENERAL CHARACTERISTICS OF THE ASCIDIANS AND THEIR RELATIONSHIP TO THE VERTEBRATES

The ascidians constitute a small class of marine animals of rather simple and low organization, which, it is thought, are descended from the same ancestors as the vertebrates, but which have gone backward in their evolution instead of advancing. Nevertheless, among all the great variety of forms of animal life to be found in favorable situations along the seashore, growing on the rocks or on other objects uncovered at low tide, there are few that at first sight show so little relationship to any of the higher animals.

They attach themselves permanently to rocks, corals, shells, the piles of wharves and other objects under water, and live upon the minute organisms that the waves and tides carry to them. The typical ascidians are saclike objects of oval or irregular form, usually from half an inch to a couple of inches in diameter, rarely much more, and are covered with a more or less tough though somewhat flexible outer tunic called the *test*, which protects the delicate internal parts after the manner of a mollusk's shell. By the other naturalists the ascidians were, in fact, classed as soft-shelled mollusks. The test not only serves to protect the body from injuries, but also to fix it in place, for it becomes firmly attached to solid objects or, if the animal lies buried in the sand or mud of the sea bottom, as many species do, it often develops hairlike or rootlike extensions to anchor the body. It entirely encloses the body except for two small openings, which are commonly situated at the tips of conical protuberances or short projecting tubes.

One of these is the mouth, also called the *branchial* (or *incurrent*) *siphon* or *aperture*. Through it passes a continuous current of sea water bearing the minute organisms on which the creature feeds as well as the oxygen utilized in respiration. The other, called the *atrial* (or *excurrent*) *siphon* or *aperture*, allows this water, as well as the waste products of the body, to pass out, and usually also serves for the exit of the eggs or young.

The ascidians have very poorly developed organs of sense but, when the animal is touched or otherwise alarmed by any sudden movement of the water, its muscles contract, and the water contained in the body is forced out through these apertures in small jets, hence the name "sea squirts."

If an ascidian is cut open, we find inside the tough thick test a much thinner saclike membrane (in this article termed the *mantle*) composed of connective tissue, muscles and blood vessels, which encloses all the internal parts, so that the body can be removed entire from the test. The mantle represents the real external body wall of the animals; the test is primarily a secretion of it, though cellular structures and blood vessels may grow out into it and multiply there so that it assumes the appearance of a true cellular tissue.

The body (enclosed by the mantle) is largely hollow, and during life is usually distended with sea water, the internal organs occupying but a small part of the space enclosed. In most species the two tubes or siphons arise from the body rather near together. The end at or near which the mouth or branchial siphon is situated, is of course the anterior end of the body; the excurrent or atrial siphon is on the dorsal aspect or back. If we carefully open the mantle, preferably by a longitudinal slit, it will be found that the interior is largely occupied by a third very delicate sac adherent to the interior of the mantle at certain points only (especially along the mid-ventral line and about the base of the incurrent siphon in such a way that the mouth opens into it), but otherwise hanging loosely in the general cavity of the body. Examined with a lens, this innermost sac, the *branchial* or *gill sac*, will be seen to be perforated with a great number of rows of minute clefts or slits called *stigmata*. These place its interior in communication with the *peribranchial space*, which surrounds it within the mantle and which is in communication with the excurrent siphon and through that with the exterior of the body.

The walls of the branchial or gill sac are pierced with such vast numbers of *stigmata* that it is, in fact, a net or sieve. It serves not only

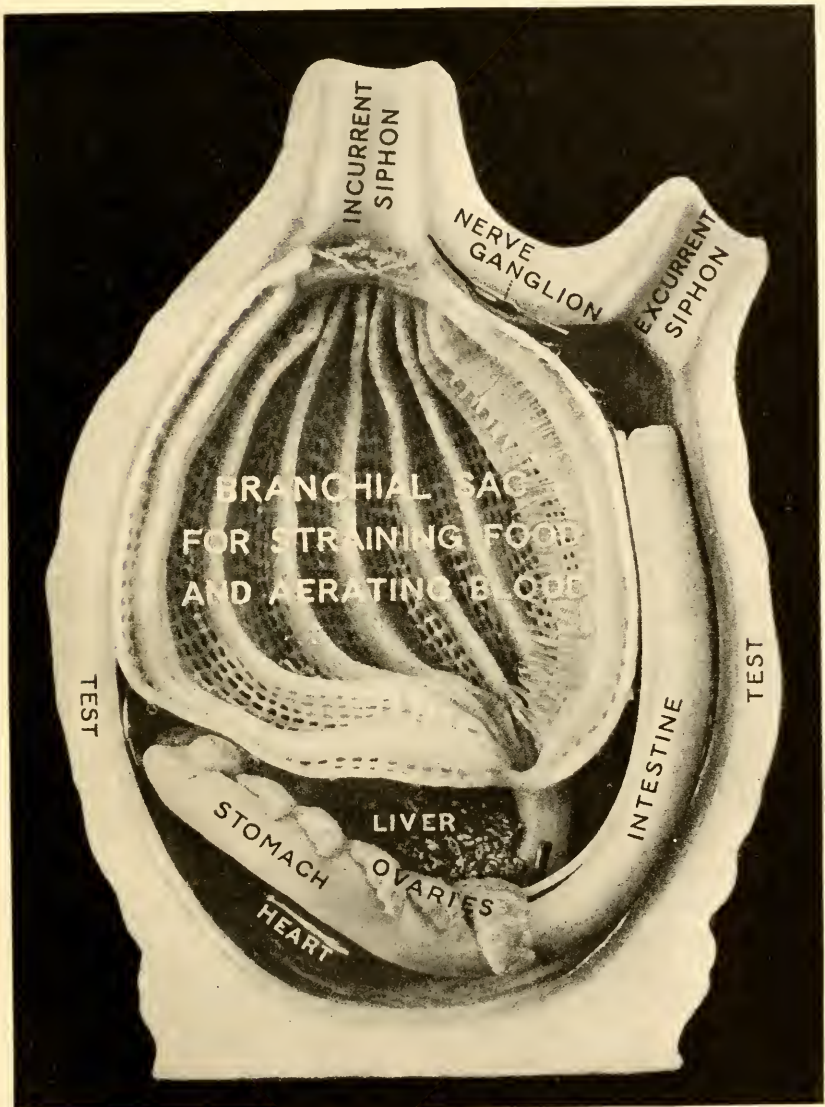


FIG. 1.—Internal Anatomy of Ascidian.—The incurrent siphon brings the stream of sea water into the large pharynx or branchial sac through the meshes of which the water is strained to pass out of the excurrent siphon, leaving behind it the minute organisms which form the ascidians' food. The latter are then passed into the stomach and intestine and digested. Blood vessels in the walls of the branchial sac absorb the oxygen from the water.

for respiration (its walls being full of blood vessels) but also for straining out the minute organisms which form the food supply of the ascidian. As the water taken in at the mouth passes through the stigmata, into the outer cavity and then out through the excurrent siphon, it leaves the food within the gill sac which opens at its rear end into the oesophagus and thus into the stomach and intestine. These latter organs form a loop lying either beside the branchial sac, or behind it.

In reality the branchial sac constitutes a greatly expanded and modified part of the alimentary canal, corresponding to the pharyngeal region of the vertebrates, that is, the part between the mouth and the oesophagus, and we may point out here the resemblance in the method of respiration to that which occurs in fishes.

The fish also takes in the water through its mouth; the water passes into the cavity of the throat, or pharynx (corresponding to the gill sac of the ascidian), and from there it passes through gill clefts in the sides of the pharynx (corresponding to the stigmata in the ascidian). In fishes the walls of these clefts bear the true gills or structures containing the blood vessels by which the oxygen in the water is absorbed, just as it is by the blood vessels in the walls of the gill sac of the ascidian. Even in their feeding many fishes, for example the herrings, which live on a minute swimming organisms, use a method similar to that of the ascidian, the gill apparatus straining the food from the water as it passes out through the gill clefts.

Here, in spite of the low simple organization of the ascidians, we have a distinct point of resemblance to the fishes, members of the vertebrate group, the highest primary division of the animal kingdom, of which man himself is a member. The possession of these characters by the ascidians might not be significant if we found them in other invertebrates, but among all the invertebrate animals of the land and sea, the above correspondence to the vertebrate type occurs only in the ascidians and a very few forms evidently closely related to them, so that its importance becomes obvious.

If we study only the adult ascidian, we shall note little else to suggest relationship to the vertebrates, and many things that seem to argue against it. One of these may be mentioned because of its strangeness. This is that the heart of the ascidians, which is situated in the posterior part of the body, after beating for a number of seconds in one direction, stops and reverses its action, so that the vessels which at one moment function as veins leading blood *to* the heart, the next moment function as arteries carrying blood *from* the heart. Yet this remarkable

process, which can be watched easily through the microscope in the case of some small and transparent species of ascidians, perhaps most easily in the genus *Perophora*, does not argue for relationship to the other invertebrates either, for it is almost unique.

As soon, however, as we study the life history of the ascidians, we come upon very strong evidence, first, that the ascidians are degenerate animals which have had ancestors more highly organized than themselves, and second, that these ancestors had the general type of structure that is possessed by the vertebrates and by the vertebrates only. Each additional point of similarity makes it less probable that we are dealing with mere coincidences and confirms more strongly the conclusion that a real relationship exists, due to descent from common ancestors.

As in nearly all the other attached marine animals, the early larval stages of ascidians are free-swimming, for in order to make possible the continued existence of the species, not only its reproduction but its dispersal must be provided for.

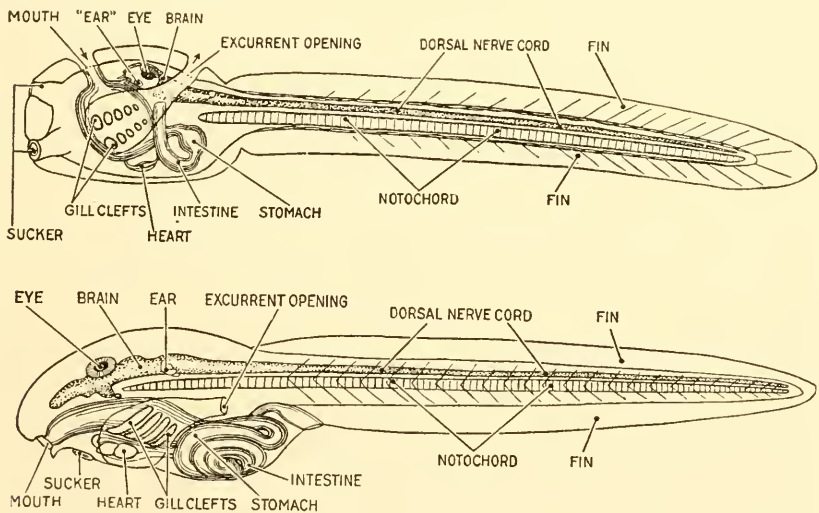


FIG. 2.—Comparative diagrams of the tadpoles or larval stages of an ascidian (upper figure), and of a frog (lower figure), to show their correspondence in many points of structure, especially in having gill clefts in the walls of the pharynx or throat, and a rodlike notochord corresponding to the backbone in the higher animals, above which is the main part of the nervous system, corresponding to the brain and the spinal cord.

In the ascidians the larvae have a form and appearance very similar to the larval stage or tadpole of the frog, though they are of comparatively minute size, the largest being only a few millimeters long. The

larva of the ascidian possesses, just as does the tadpole of the frog, a cylindrical rodlike stiffening or supporting structure extending nearly the length of the body. This structure, called the notochord, represents in position and in function the backbone of the vertebrates. It is found in the early stages of development of all vertebrates, including man, and in the higher vertebrates the bony segments or vertebrae forming the backbone or spinal column develop around it. In many of the lower vertebrates it persists throughout life, running through the center or body of each vertebra. Here again we have a character not found among invertebrates, but common to the vertebrates and ascidians. Moreover, if we study the process of its development in the early stages of the embryo, we are forced to the conclusion that it is the same in these two groups.

Another important character common to the vertebrates and the ascidian larva is the possession of a central nervous system of elongate tubular form lying dorsal to the notochord. In the vertebrates this is called the spinal cord, and both in the ascidians and in the vertebrates it develops in the embryo in the same way, by a pair of folds growing up on each side of the middle line of the back to form a troughlike area. The edges of this trough soon arch inward and join together, thus forming a tubular passage which becomes the central canal of the spinal cord. Here again we find that this character is not possessed by other invertebrates. In them the usual type of central nervous system is a pair of parallel nerve cords which are solid, not tubular, and which usually lie in the ventral part of the body, and not along the back or dorsal region as in the vertebrates.

The mode of respiration by means of gill clefts in the wall of the pharynx, the notochord that represents the first step toward the development of a backbone, the dorsally situated and tubular central nervous system or spinal cord—all separate the ascidian larva from invertebrates. There are several other structures regarded by many as confirming this relationship, but space will not permit of their discussion here.

All these resemblances are for the most part recognizable only in the larva of the ascidian, being lost or obscured in the adult by degenerative changes that begin to take place after the larva permanently attaches itself. This it does after swimming about for a very short time, at most a few hours or a day or two. It fixes itself to some solid object by means of adhesive organs developed for that purpose on the front end of the body, and the tail is soon drawn in and absorbed. The notochord and most of the nervous system degenerate, as do also the single

eye and an organ supposed to serve either for hearing or for balancing the body. The animal grows in size and relapses into the almost mechanical and vegetative existence characteristic of the adult ascidian.

One important character of many ascidians remains to be mentioned. This is that many of them, especially those in which the individuals are of small size, reproduce by budding (new individuals being formed from an outgrowth of the body of the parent) as well as by means of eggs and the tadpole-like larvae above described. The new individuals formed by budding do not as a rule become entirely detached and separated from the parent, but remain connected with it by blood vessels or at least by means of the test or outer tunic, in such a way that a more or less intimately joined group or mass (technically called a *colony*) is formed. This may in some cases contain many hundreds or occasionally even thousands of individuals. These individuals (known as *zooids*) may be completely imbedded in a common mass of test substance, the more usual condition, or be largely separate, each with its enclosing envelope of test substance and united only by narrow stems or stolons containing the connecting blood vessels, or intermediate conditions may exist. In many cases the connection may become severed, and it is then often difficult or impossible to tell whether any given zooid originated from a bud, or from a larva which attached itself to the group of other individuals.

The ascidians that have this power of reproduction by budding and which form colonies of connected individuals, are known as *compound ascidians*, those which lack it are called *simple ascidians*.

As already noted, only forms with small (usually very small) individuals of comparatively simple structure possess the power of budding and of colony formation. The largest and most highly organized forms are always simple.

The classification of ascidians into simple and compound, though a convenient one, is not a natural division, for of closely related forms some may develop buds while others never do so, and groups established on the basis of that character would be unnatural assemblages of unrelated and dissimilar forms, or would separate close allies.

ANATOMICAL STRUCTURE OF THE ASCIDIANS AND EXPLANATIONS OF THE TECHNICAL TERMS USED IN DESCRIBING THEM

While in the simple ascidians and in a few of the compound forms, the body is usually of oval saclike form, with the digestive and reproductive organs lying beside the branchial sac, in the majority of the compound species the zooids are more or less elongated, the body being

formed of either two or three distinctly marked segments. The anterior segment, called the *thorax*, bears the apertures and contains the branchial sac; the second, called the *abdomen*, contains the digestive and reproductive organs and the heart, or, in one large family (the Synoicidae), the digestive organs only, the reproductive organs and heart being in a third segment of the body known as the *post-abdomen*. In compound ascidians forming a compact, massive colony, each zooid has a separate branchial opening on the surface of the colony, but their atrial or excurrent openings are not usually on the surface, but discharge into canals in the common test substance of the colony, which eventually open by a few apertures on the surface called the *common cloacal apertures*. Those zooids collectively that discharge by the same common cloacal aperture constitute a *system*.

A few other structures and anatomical parts of ascidians should be mentioned, as they are of importance in the classification of the animals or in distinguishing the species or higher groups, and are therefore referred to in the descriptions or shown in the illustrations:

Tentacles, or oral tentacles.—Flexible processes in the interior of the branchial tube or siphon close to its base. They may be simple slender processes or they may be branched, sometimes in a very complex manner. (Some ascidians also have small, simple *atrial tentacles* in the excurrent siphon but, if not otherwise specified, the word tentacle refers to one of the oral tentacles).

Dorsal tubercle.—A small, usually rounded prominence on the mid-dorsal line at the anterior end of the branchial sac on its inner surface, close to but inside (posterior to) the circle of oral tentacles. It bears the aperture of a gland situated close to the cerebral ganglion. This aperture may be a simple pitlike opening, or an elongated but usually curved slit. One of the commonest forms of this slit is *C*-shaped, with one or both of the horns of the *C* strongly incurved or even spirally inrolled. The form of the slit is often regarded as a character of importance in distinguishing species, but its reliability has been overrated, as in many species great individual variation in the form of the aperture is common.

Branchial sac.—This organ (which is in reality the enormously enlarged pharyngeal part of the alimentary canal) and its functions in respiration and collecting food have already been briefly described. The details of its structure furnish some of the best characters for the classification and identification of ascidians. In most of them the sac is built up of transverse and longitudinal bars bearing (we might almost say

composed of) blood vessels of different sizes, crossing one another at right angles; the smallest longitudinal vessels separate the stigmata, which usually have the form of short longitudinal clefts. In a few groups a well developed spiral arrangement of the stigmata occurs.

In one order (Stolidobranchiata) the surface of the branchial sac is increased by a small number of pleatlike longitudinal folds of its wall. Such folds are usually definite and constant in number in a given species. Whether such folds are present or not, many simple and a few compound ascidians have in addition to the longitudinal blood vessels that take part in forming the wall of the branchial sac, a second system of longitudinal vessels, the *internal longitudinal vessels* lying upon, but usually slightly raised up from, the inner surface of the sac, with the transverse vessels of which they communicate by short connecting ducts. These vessels are much more numerous on the folds than on the flat parts of the sac between the folds (if the latter are present). The mid-ventral line of the branchial sac is occupied by a conspicuous structure termed the *endostyle*, consisting of two inwardly projecting parallel longitudinal ridges forming between them a broad and well marked channel or furrow, the ciliated and mucous-secreting cells of which have an important function in collecting and dealing with the food material which is strained out of the water by the branchial sac.

Opposite the endostyle on the mid-dorsal vessel of the branchial sac there is in many cases an inwardly projecting membrane, the *dorsal lamina*, which may have a serrate or toothed edge, or it may be replaced by a series of tongue-like processes (the *dorsal languets*), one arising at the origin of each pair of transverse vessels of the sac. (In many compound ascidians these languets, though present, are more or less displaced to the left of the median line.)

The alimentary tract proper begins at or near the posterior end of the branchial sac (though more strictly speaking the branchial sac should be included as the anterior segment of it) with a narrow oesophagus which opens into a stomach. This stomach may be short and rounded or elongate, and its walls may be smooth or plicated or pitted; in a few groups the external wall bears a glandular mass of tubules, the *hepatic gland* or *liver*, which discharges its secretion into the stomach. In many forms that have no liver a blindly ending curved pouch or *cæcum* communicates with the cavity of the stomach. The intestine usually loops around so as to pass near or beside the stomach and then continues as a comparatively straight and more or less elongate *rectum*, which ends inside the body, but near the base of the atrial or excurrent siphon;

through the latter undigested material is passed out of the body. There is also a peculiar glandular organ, consisting of some delicate tubules that embrace a section of the intestine some distance beyond the stomach. They join to form a common duct that runs to, and opens into, the alimentary canal at or near the pylorus or point where the intestine leaves the stomach. Its function is so little understood that no agreement has been reached even as to a satisfactory name for the organ. The heart is situated in the posterior part of the body (in most compound ascidians at the extreme posterior end). It is tubular, and is surrounded by a pericardium; the main blood vessels, which run to the branchial sac and other organs, and which, due to the peculiar alternating pulsations of the heart already mentioned, function alternately as arteries and veins, extend from each end of the heart.

The nervous system is poorly developed in adult ascidians, though in the larva an elongated dorsal nerve cord corresponding to the spinal cord in vertebrates is present. In the adult this degenerates into a small oval mass, the *cerebral ganglion*, which lies in the dorsal body wall between the bases of the siphons. The gland opening on the dorsal tubercle lies in close contact with it and may have an excretory function, but in one large family of simple ascidians (Molgulidae) there is on the right side of the body a large, closed, kidney-shaped sac in which waste matter is gradually deposited in the form of a hard concretion. This so-called kidney has no outlet and the solid matter deposited in it must remain during the lifetime of the animal. In some members of the family Ascidiidae, there is, instead of one such "kidney," a multitude of minute vesicles containing concretions, but in most ascidians this waste material must in some way be eliminated, for no such concretions are to be found.

The reproductive organs are varied in their structure and position and furnish some of the principal characters used in the classification of the ascidians. Their arrangement in the different species and higher groups is shown in the illustrations given and need not be described in detail here. Generally ascidians are hermaphroditic and, though sometimes the testes and ovaries are not both functional at the same time, in other cases fertilization of the eggs by spermatozoa from the same individual would seem to be the normal, if not the only possible, course of events.

In many ascidians the male and female glands, comprising several or many small testes and an ovary, are grouped together and often enclosed in a saccular membrane to form one or more hermaphroditic reproduc-

tive bodies called *gonads*, which are in such cases usually attached to the inner surface of the mantle on one or both sides of the body. The eggs are discharged into the peribranchial cavity, the space surrounding the branchial sac, and in some species they develop into tadpole larvae before they make their way out by the atrial siphon. In the genus *Distaplia* and a few others, a large *incubatory pouch* or *sac*, in which the larvae undergo development, may be produced by an outgrowth or dilation of the body wall of the parent.

THE ASCIDIANS OF THE WEST INDIAN REGION

The ascidian fauna of the tropical and sub-tropical parts of the eastern American coasts, including Bermuda, the Gulf of Mexico, the Caribbean and the coasts of the West Indies, is very uniform, although not all the species (fifty-six in number and including representatives of most of the principal families of the group) range throughout its whole extent. Porto Rico and the Virgin Islands, lying not far from the center of the region, are within the area where the greatest variety of species occurs and, although up to the present time Porto Rico is credited with only twenty-six species, a little more than half of those of the entire region, and Porto Rico and the Virgin Islands together with only thirty-five, yet it is probable that future collecting will eventually demonstrate that a large majority of the other West Indian ascidians occur also along their shores.

It is worthy of note that although a considerable amount of dredging at various depths has been done in this region, only one truly and exclusively deep-sea ascidian has been found in any part of it. All the species known from Porto Rico and the Virgin Islands are littoral forms, and may be found, if not actually up to low water mark, at least up to within a very few feet of it, and most of them have not been collected in depths of more than a few fathoms. It has not been necessary, therefore, to consider the distribution in depth of most of the species covered in this article unless they constitute exceptions to the above statements.

The relationships of the ascidians of the West Indies are, as might be expected, closer with those of other tropical regions than with those of the colder regions lying to the north or south. The relationship between the ascidian faunas of the West and East Indies is very close, at least eighteen species, or nearly one-third, of those of the West Indies being known also from the East Indian region, and several others have very near, if really separable, allies there. With the Mediterranean the West Indian fauna has but few species in common, and this would appear to be

true perhaps to a still greater extent of the west coast of tropical America although the ascidians of that region have not yet been much studied.

HISTORICAL REVIEW OF LITERATURE

The ascidians of Porto Rico and the Virgin Islands have not hitherto been the subject of any special papers or monographs; what has been published concerning them appears in works dealing with other regions, or with the West Indies in general.

So far as Porto Rico itself is concerned, literature or even notices of the ascidian fauna were practically non-existent until a few years ago. The Virgin Islands had, however, not been neglected, for in 1882 and 1883 Traustedt published two excellent articles on the simple ascidians of the West Indies based chiefly on collections made in the Virgin Islands. He did not, however, publish anything in regard to the compound ascidians. Most of the notices of ascidians from the Virgin Islands that have appeared in literature between the time of the publication of Traustedt's articles and 1921 are based on his records.

In that year (1921) the writer of the present paper published a general monograph of the ascidians, both simple and compound, of the West Indies and adjacent regions.* So far as Porto Rico is concerned, this monograph was based on the extensive series of specimens collected by Professor R. C. Osburn, of Ohio State University, and Dr. Roy W. Miner, of the American Museum of Natural History, in 1914 and 1915, on the expeditions made in coöperation with the New York Academy of Sciences and the Porto Rican Government, and these collections are also the basis of the present article. The extensive collection of the United States National Museum contains much ascidian material from the Virgin Islands, the greater part of it collected by Mr. C. R. Shoemaker of the staff of that museum in 1915, and this collection, which was kindly loaned for study, as well as material and records from numerous other sources were also made use of in the monograph of 1921.**

The reader is referred to the above monograph for more detailed descriptions and information concerning the species covered in this paper, as well as other West Indian species that may in future be found at Porto Rico or the Virgin Islands. A bibliography, which was intended to be as

*Ascidians of the West Indian Region and Southeastern United States, Bull. American Mus. Nat. Hist., XLIV, pp. 283-494, Figs. 1-159.

**A few additions and corrections to the list of West Indian ascidians were made by the present writer in a later article (1924, Ascidians from Curaçao, in *Bijdrage tot de Dierkunde*, XXIII, pp. 23-32, Figs. 1-7). They affect the families Botryllidae, Didemnidae, and Ascidiidae.

nearly complete as possible in respect to works dealing or mentioning West Indian ascidians, is also contained in this monograph. The bibliography at the end of the present paper aims only to include some of the more important earlier works here referred to and those published after the monograph of 1921 had gone to press.

Nearly all the species recorded from Porto Rico and the Virgin Islands are more or less widely distributed forms, and have been studied and described from material collected in other places, so that our knowledge of them is not limited to the results of the small amount of collecting and study devoted to them there. It is not at all probable that any ascidians are restricted to those islands, though two (*Ascidia styeloides* and *Microcosmus anchylodierus*) described by Traustedt, remain up to now unique records.

COLLECTION AND STUDY OF THE ASCIDIANS OF PORTO RICO AND THE VIRGIN ISLANDS

The collector will have little difficulty in finding ascidians in considerable numbers and variety along the coasts of these islands. They may often be noted growing in plain sight on corals, gorgonians, sponges and sea weeds along the shore or on reefs or rocks near low water mark, or on the piles of wharves among the numerous other attached organisms, animal and vegetable, that abound in tropical waters. Some of them frequently grow in groups or clusters of many individuals or colonies, the smaller and younger ones upon the older ones. Sometimes such a group contains five or six or even more different species, simple and compound.*

Tidal currents are favorable for ascidians, as these animals are dependent for food on what the waters bring them. Turning over stones lying on the shore at or near low water mark is one of the best ways to collect ascidians and other attached organisms, for provided the stone is not too closely bedded on the bottom, examples of the smaller compound ascidians may be seen adhering to its underside where fishes, crabs and other enemies cannot get at them.

Many of the ascidians are very handsomely colored during life, though there is often so much variation in color in different individuals of the

* In such groups of ascidians collected by the American Museum expeditions on wharf piles and mangrove roots in Guanica Harbor, Porto Rico, various associations of the following species occurred: *Styela partita*, *Styela plicata*, *Ascidia hygomiana*, *Ascidia nigra*, *Microcosmus claudicans exasperatus*, *Polyclinum constellatum*, *Distaplia bermudensis*, *Didemnum speciosum*, *Symplegma viride* and occasionally others (*Polycitor olivaceus*, *Polycarpa obtecta*, *Molgula occidentalis*, etc.).

same species that little reliance can as a rule be placed on color as a diagnostic character.

Owing to their great variation in shape, color and external appearance, it is generally necessary to examine the internal structure to make identification certain, although a few are so characteristic in appearance that they are recognizable from their external features. Identification of the compound ascidians is sometimes a matter of considerable difficulty, owing to the violently contracted state in which the zooids are very often found in material preserved in alcohol or formalin, or even when studied in a fresh condition. Microscopic examination of some of the zooids will usually be necessary, and this will be easier if their tissues are rendered more transparent by clearing in glycerin.

The internal structure of the larger simple ascidians is best examined in water or alcohol. For preservation of specimens of ascidians a weak solution of formalin (not over two per cent, or one part of the commercial forty per cent solution in twenty of water) will be found satisfactory and will in many cases preserve the colors. Specimens that are to be kept for more than a few years should be transferred to alcohol. Seventy per cent is strong enough to preserve them permanently, and considerably less strength will suffice to keep specimens that have once been thoroughly saturated with alcohol or formalin of the above-mentioned strengths.

Even in their internal structure the ascidians are subject to much individual variation, to which must often be added differences due to age, conditions of growth, etc., that may not be easy to distinguish from actual specific characters. A certain amount of experience in the study of these animals is required to recognize and to make the necessary allowance for these individual variations. They are likely to affect especially such characters as color, the shape of soft muscular structures liable to contraction or relaxation (as languets or the lobes about the apertures), the number of rows of stigmata, the number of internal longitudinal vessels, the size and number of subdivisions of the reproductive glands, etc. In compound ascidians zooids may often be found with only male or only female reproductive organs or with none at all, and the development of buds, brood pouches, etc., may cause conditions and appearances that will puzzle the student at first. Many compound ascidians pass through stages of degeneration which are followed by periods of renewal growth. During the former it is often impossible to make out many of the specific characters.

The tadpole larvae of ascidians are most easily studied in those forms in which they undergo development in the body cavities or brood pouches of the parent, or in cavities (probably usually parts of the common cloacal cavities) in the test of colonies of compound ascidians. By gently poking or perhaps opening up the cloacal cavities of living colonies in a dish of sea water, larvae fully developed and able to swim may often be obtained. The Botryllidae and some of the Synoicidae and Polycitoridae are among those from which larvae may be most easily obtained, provided, of course, that the colony contains them in the right stage of development. Larvae may often be secured by tearing up or sectioning preserved specimens of the above families and also of the Didemnidae; in the case of the simple ascidians we can expect to find them by such methods only in the comparatively few species in which they undergo development in the body of the parent.

ACKNOWLEDGMENTS

In preparing this paper I have taken both descriptive matter and illustrations largely from the West Indian monograph of 1921 and the article of 1924 on the Curaçao ascidians, referred to above, but a few are from an earlier article on the ascidians of Bermuda (Trans. Conn. Acad. Sci., XI, 1902, pp. 345-412, Pls. XLVI-LXIV). I would again express my thanks to Dr. Roy W. Miner, Dr. R. C. Osburn and Mr. C. R. Shoemaker, already mentioned as collectors of much of the Porto Rico and Virgin Island material that I have had at my disposal, also to the officers and to many members of the staffs of the American Museum of Natural History and of the United States National Museum for their cooperation and assistance.

ASCIDIANS FROM PORTO RICO AND THE VIRGIN ISLANDS

ASCIDIANS FROM PORTO RICO (26 SPECIES)—*Continued*

<i>Polyclinum constellatum</i> Savigny, 1816	<i>Didemnum (Polysyncrator) amethysteum</i> (Van Name), 1902
<i>Aplidium lobatum</i> Savigny, 1816	<i>Polycitor (Eudistoma) olivaceus</i> (Van Name), 1902
<i>Trididemnum savignii</i> (Herdman), 1886	<i>Clavelina oblonga</i> Herdman, 1880
<i>Trididemnum solidum</i> (Van Name), 1902	<i>Distaplia bermudensis</i> Van Name, 1902
<i>Diplosoma macdonaldi</i> Herdman, 1886	<i>Perophora viridis</i> Verrill, 1871
<i>Didemnum caudidum</i> Savigny, 1816	<i>Ascidia nigra</i> (Savigny), 1816
	<i>Ascidia hygomiana</i> (Traustedt), 1882

Ascidians from Porto Rico (26 Species)—Continued

<i>Ascidia sydnciensis</i> Stimpson, 1855	<i>Styela partita</i> (Stimpson), 1852
<i>Ascidia curvata</i> (Traustedt), 1882	<i>Styela plicata</i> (Lesueur), 1823
<i>Rhodosoma turcicum</i> (Savigny), 1816	<i>Microcosmus claudicans exasperatus</i> (Heller), 1878
<i>Botrylloides nigrum</i> Herdman, 1886	<i>Microcosmus helleri</i> Herdman, 1881
<i>Symplegma viride</i> Herdman, 1886	<i>Pyura vittata</i> (Stimpson), 1852
<i>Polycarpa obtecta</i> Traustedt, 1883	<i>Molgula occidentalis</i> Traustedt, 1883
<i>Polycarpa spongiabilis</i> Traustedt, 1883	

ASCIDIANS FROM THE VIRGIN ISLANDS (25 SPECIES)

<i>Aplidium lobatum</i> Savigny, 1816	<i>Ascidia nigra</i> (Savigny), 1816
<i>Aplidium</i> (<i>Amaroucium</i>) <i>bermudae</i> (Van Name), 1902	<i>Ascidia hygomiana</i> (Traustedt), 1882
<i>Trididemnum solidum</i> (Van Name) 1902	<i>Ascidia sydnciensis</i> Stimpson, 1855
<i>Didemnum candidum</i> Savigny, 1816	<i>Ascidia curvata</i> (Traustedt), 1882
<i>Diplosoma macdonaldi</i> Herdman, 1886	<i>Ascidicella stycloides</i> (Traustedt), 1882
<i>Lissoclinium fragile</i> (Van Name), 1902	<i>Rhodosoma turcicum</i> (Savigny), 1916
<i>Polycitor</i> (<i>Eudistoma</i>) <i>olivaceus</i> Van Name, 1902	<i>Corella minuta</i> Traustedt, 1882
<i>Polycitor</i> (<i>Eudistoma</i>) <i>hepaticus</i> Van Name, 1921	<i>Polycarpa obtecta</i> Traustedt, 1883
<i>Clavelina oblonga</i> Herdman, 1880	<i>Styela plicata</i> (Lesueur), 1823
<i>Distaplia bermudensis</i> Van Name, 1902	<i>Microcosmus claudicans exasperatus</i> (Heller), 1878
<i>Ecteinascidia turbinata</i> Herdman, 1880	[<i>Microcosmus anchylodiscus</i> Trau- stedt, 1883] Doubtful sp.
	<i>Pyura momus</i> form <i>pallida</i> (Heller), 1878
	<i>Pyura vittata</i> (Stimpson) 1852
	<i>Molgula occidentalis</i> Traustedt, 1883

Total number of species from Porto Rico and the Virgin Islands, 35.

Total number of species recorded from the West Indies, 49, not including ? reported only from the coasts of the mainland of North or South America or Bermuda. The species thus far known from Porto Rico are therefore only a little more than 53 per cent of those recorded from all the West Indies. No doubt this percentage will be greatly increased by future collecting.

No new species are described and no new genera are established in the present article.

OTHER SPECIES LIKELY TO BE FOUND IN PORTO RICO AND THE VIRGIN ISLANDS

A number of the other West Indian and Bermuda ascidians will probably be found at Porto Rico or the Virgin Islands when more thorough collecting is done. It has, therefore, seemed best to include at least a

brief notice and in some cases illustrations and more extended treatment of the following 13 species:

<i>Aplidium</i> (<i>Amaroucium</i>) <i>exile</i> (Van Name), 1902	<i>Polycitor clarus</i> (Van Name), 1902
<i>Trididemnum orbiculatum</i> (Van Name), 1902	<i>Distaplia bursata</i> (Van Name), 1921
<i>Didemnum vanderhorsti</i> Van Name, 1924	<i>Cystodytes dellechiaiæ</i> (Della Valle), 1877
<i>Echinoclinum verrilli</i> Van Name, 1902	<i>Rhopalaca abdominalis</i> (Sluiter), 1898
<i>Polycitor convexus</i> (Van Name), 1902	<i>Ascidia corelloides</i> (Van Name), 1924
	<i>Botryllus planus</i> (Van Name), 1902
	<i>Botryllus schlosseri</i> (Pallas), 1776
	<i>Polyandrocarpa tineta</i> (Van Name), 1902

There is only one deep-sea ascidian recorded from this region. This is *Pyura antillarum* Van Name, 1921, described in the monograph referred to above. It was dredged at Albatross Station No. 2750 (Lat. 18°30' N., Long. 63°31' W., 496 fathoms, fine gray sand).

DESCRIPTIONS OF SPECIES

EXPLANATION OF LETTERING ON ILLUSTRATIONS

<i>alg</i> atrial languet	<i>l</i> liver
<i>at</i> atrial orifice	<i>lg</i> languet
<i>br</i> branchial orifice	<i>lv</i> larva
<i>cc</i> common cloacal aperture	<i>mb</i> muscle band
<i>ccp</i> endocarp	<i>mp</i> muscular process
<i>em</i> embryo	<i>od</i> oviduct
<i>en</i> endostyle	<i>oe</i> oesophagus
<i>g</i> gonad	<i>r</i> rectum
<i>gc</i> gastric caecum	<i>rf</i> rudimentary fold
<i>ivr</i> internal longitudinal vessel	<i>sd</i> sperm duct
<i>in</i> intestine	<i>st</i> stomach
<i>ing</i> intestinal gland	<i>tu</i> tentacle
<i>ip</i> incubatory pouch	<i>trv</i> transverse vessel
<i>k</i> kidney	<i>vp</i> vascular process

Most of the figures show the animal (or one of the zooids if a compound ascidian) removed from the test, and often represent it as more transparent than is actually the case so as to reveal its internal parts.

Order APLOUSOBRANCHIATA Lahille

[= Krikobranchia Seeliger]

These are compound ascidians having the body divided into two or three distinct parts or segments (thorax, abdomen and sometimes post-

abdomen), the digestive tract and reproductive organs being situated in the posterior part or parts of the body. The tentacles are simple; the branchial sac is without folds or internal longitudinal vessels.

SYNOICIDAE Hartmeyer

[= *Polyclinidae auct. mult.*]

The body consists of three divisions or segments, the last (post-abdomen) containing the reproductive organs and heart. Budding occurs by segmentation of the post-abdomen.

Polyclinum Savigny

The post-abdomen is a small oval sac connected by a narrow elongated neck with the abdomen. The stomach wall is smooth; the intestine is twisted into a closed loop posterior to the stomach. The inner aspect of the transverse vessels of the branchial sac with small papillæ.

Polyclinum constellatum Savigny

Polyclinum constellatum Savigny, 1816, Mém. s. l. animaux sans vertèbres, Pt. 2, p. 189, Pl. 4, Fig. 2; Pl. 18, Fig. 1.

Polyclinum constellatum Van Name, 1921, Bull. Amer. Mus. Nat. Hist. Vol. XLIV, p. 299, Figs. 1 and 2.

Diagnosis.—This species forms colonies of a grayish-brown color which, when of small or medium size, tend to assume a capitate, oval or pyriform shape. The attachment is by the smaller end; the top may be rounded or more or less flattened. Larger colonies often become broader and sometimes even assume expanded and flattened or umbrella-like forms, but the area of attachment is usually small, so that much of the base of the colony, as well as the sides and top, are free, though the zooids are chiefly confined to the upper portions. In some cases the basal part of the colony tapers gradually to the size of the attached area, but a distinct pedicel is rarely developed, not even a very short one, the colony being sessile on the object on which it grows. Some colonies are cleft into two or more distinct lobes; these are perhaps often separate colonies that have grown together more or less at the base.

In all but the smallest colonies the zooids are arranged in several or many distinct systems. The small round or oval common cloacal orifices are scattered over the surface of the colony at distances of a

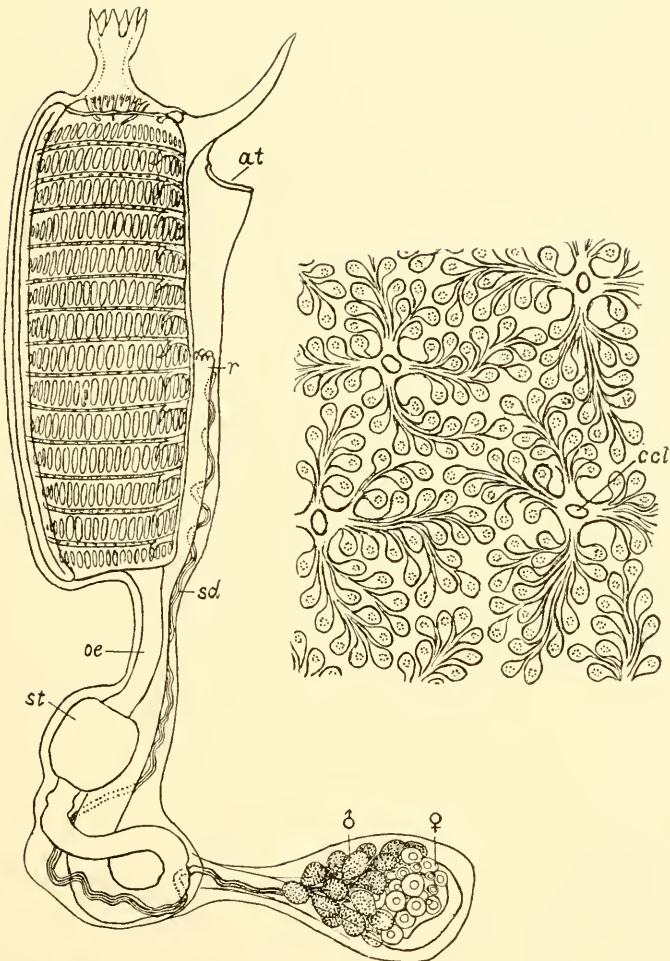


FIG. 3.—*Polyclinum constellatum* Savigny, 1816. Zooid, $\times 30$, and part of the surface of a colony, showing the arrangement of zooids and common cloacal canals, $\times 4.6$.

centimeter apart, or less. Each orifice opens from a small common cloacal cavity, into which several branching cloacal ducts or groups of individual ducts open. These lead from the atrial orifices of the individual zooids. These orifices and ducts are not always conspicuous in preserved specimens.

Ordinarily the colonies are 30 to 40 mm. high and 30 to 60 mm. in diameter near the top, or occasionally larger. One very low but wide colony is 160 mm. across the upper surface, though not more than

18 to 20 mm. high at any point, its attachment being by a small central area on the lower side. The surface of the colony is generally smooth but not shiny, and generally free from incrusting sand; if a coating of sand is present, it does not pervade the interior of the colony to any considerable extent. The test is usually dark grayish brown and of gelatinous consistency. In the alcoholic specimens, at least, it is much firmer toward the outside of the colonies than in the center, where it becomes very soft and there may be a large cavity. This, however, does not have any connection with the cloacal cavities. The dark color is due chiefly to pigment grains in the test cells and in some of the cells in the tissues of the zooids. A few colonies show, in the preserved state at least, very little pigmentation, and are yellowish or light grayish.

The zooids, when expanded and straightened out, are 5 to 6 mm. long or more; the thorax, with the long branchial sac, occupying nearly half the total length of the body. The abdomen and the thorax are separated by a narrow neck, and the pear-shaped post-abdomen is also connected to the abdomen by a neck of considerable length. The post-abdomen arises from one side of the abdomen and generally lies with its axis more or less at right angles to or at least very oblique that of the rest of the body.

Distribution.—Many specimens were collected on piles in Guanica Harbor, Porto Rico. The species is widely distributed in tropical seas.

Aplidium Savigny

[= *Aplidium* + *Amaroucium* Milne-Edwards, 1841]

The post-abdomen (when fully developed) is elongate and is not separated from the abdomen by an elongate neck, though there may be a slight constriction between these two parts of the body. The post-abdomen may be very short when the reproductive organs are not well developed. The stomach usually has distinct longitudinal plications; an atrial languet is present in all the West Indian forms.

Subgenus **Aplidium**

Members of this subgenus are distinguished by having the branchial sac short, with rather few (commonly five to ten) rows of stigmata, the post-abdomen short, the atrial aperture back from the anterior end of the thorax and often without a languet, and the testes in a more or less compact group instead of an elongated series.

Aplidium lobatum Savigny

Aplidium lobatum + *A. tremulum* Savigny, 1816. Mém. s. l. animaux sans vertèbres, Pt. 2, pp. 182, 184; Pl. 3, Fig. 4, Pl. 18, Figs. 1 and 2.

Aplidium lobatum Van Name, 1921. Bull. Amer. Mus. Nat. Hist., Vol. XLIV, p. 303, Fig. 3.

Diagnosis.—The colony in this species is apparently normally of a rather thick incrusting type with rounded edges. The borders and surfaces show a tendency to be raised into low rounded elevations at many points or produced into more or less distinct rounded lobes. The greatest diameter of the largest colony is about 75 mm.; the average thickness, where covering an even surface, probably not much over 3 mm. Zooids are arranged in elongate groups and rows; the limits of the systems are hard to determine, but in large colonies, at least, they appear to be quite extensive and more or less branched. The branchial orifices may or may not be slightly prominent on the surface: the common cloacal apertures are ordinarily inconspicuous in the preserved material. The test itself is rather transparent and nearly colorless or somewhat yellowish, but the colonies are rather opaque from the considerable quantities of sand which are present all through the test, and assume more or less the color of the sand. This included sand renders the test rather firm but easily broken in the alcoholic specimens.

The zooids are usually only 2 mm. to 3 mm. long in the preserved specimens. The stomach wall has five very deep furrows and the same number of very thick prominent longitudinal ridges. The intestinal loop is quite long in well-expanded zooids.

Ovaries were not found developed in the individuals studied. Testes few in number (about fifteen to twenty) and forming a compact rounded group as is characteristic of this subgenus.

Distribution.—The American Museum collection contains a small colony dredged off Guanica Harbor, Porto Rico, in five fathoms. The National Museum collection includes several larger specimens, all dredged at St. Thomas, W. I. Savigny described it from the Red Sea (Gulf of Suez).

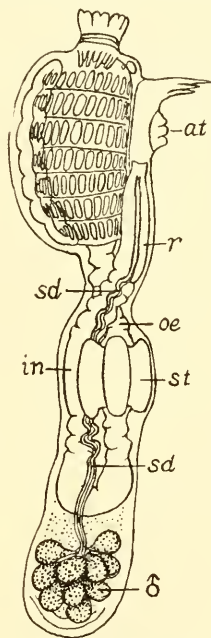


FIG. 4.—*Aplidium lobatum* Savigny, 1816. Zooid, $\times 32$.

Subgenus **Amaroucium** (Milne-Edwards)

This subgenus is distinguished from the subgenus *Aplidium* by having zooids with a more elongate branchial sac and post-abdomen, and the atrial aperture placed well forward near the anterior end of the thorax. The atrial languet is always present. The rows of stigmata are numerous; the testes arranged along the sperm duct in an elongate single or double series.

Aplidium (Amaroucium) bermudae (Van Name)

Amaroucium bermudae Van Name, 1902, Trans. Conn. Acad. Sci., XI, p. 352, Pl. 50, Fig. 20; Pl. 58, Figs. 96 and 97.

Aplidium (Amaroucium) bermudae Van Name, 1921, Bull. Amer. Mus. Nat. Hist., Vol. XLIV, p. 305, Fig. 4.

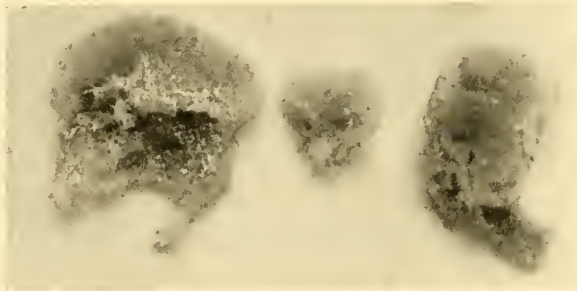


FIG. 5.—*Aplidium (Amaroucium) bermudae* (Van Name), Three colonies, slightly enlarged.

Diagnosis.—Colonies are usually capitate or inverted wedge-shaped, with rather abrupt sides and a rounded or flattened top, attached by a narrow base. They are generally small, 20 mm. or less in height and 20 to 30 mm. across the wide upper part, but much larger, more or less nearly hemispherical colonies also occur.

The test is rather firm, of somewhat cartilaginous character on the surface, but often softer in the interior. The surface is usually, though not always, free from sand. In color the preserved specimens are usually yellowish, or brownish yellow, the zooids showing indistinctly through the test, which varies from merely translucent to semi-transparent; during life the test is grayish, bluish or sometimes slightly pinkish. The zooids are usually brightly colored, orange or in part vermilion red when alive; in preservation they fade to a dingy yellowish or brownish-yellow. An arrangement of the zooids in systems cannot always be readily made out, but in some colonies it can be clearly seen that they

are placed in small circular or oval systems, each surrounding a small common cloacal cavity and aperture. The zooids are usually rather large and stout. In a fairly well preserved, though nevertheless somewhat contracted, individual the body measured 3.3 mm. long, exclusive of the post-abdomen; the latter often measures 5 to 10 mm. additional.

The stomach is unusually thin-walled as compared with its condition in the majority of species of this genus. Commonly it has a rather small number of longitudinal plications (generally from ten to eighteen): these may be fairly sharp and distinct, but more often they appear rather faint, and in some colonies the stomach appears practically smooth-walled—a condition rare, if not unique, in this genus. The stomach is, however, generally found folded and crushed in by the contraction of the body muscles.

Distribution.—Not yet recorded from Porto Rico, but the U. S. National Museum collection has some small specimens apparently of this species from Water Island, Virgin Islands. The type locality is Bermuda.

Aplidium (Amaroucium) exile (Van Name)

(Included as likely to be found)

Amaroucium exile Van Name, 1902, Trans. Com. Acad. Sci., Vol. XI, p. 354, Pl. 50, Fig. 21; Pl. 58, Fig. 98.

Aplidium (Amaroucium) exile, 1921, Van Name, Bull. Amer. Mus. Nat. Hist., Vol. XLIV, p. 311, Fig. 6.

Diagnosis.—In addition to *A. bermudae*, described above, there is also a similar form found at Bermuda, which appears to be a distinct species. This grows in small, rounded or button-shaped colonies, attached by the greater part of the lower surface. The edge or border of the colony is thick and rounded. It measures up to 15 or 20 mm. across and 5 to 6 mm. in height. The test is colorless and transparent, but often more or less

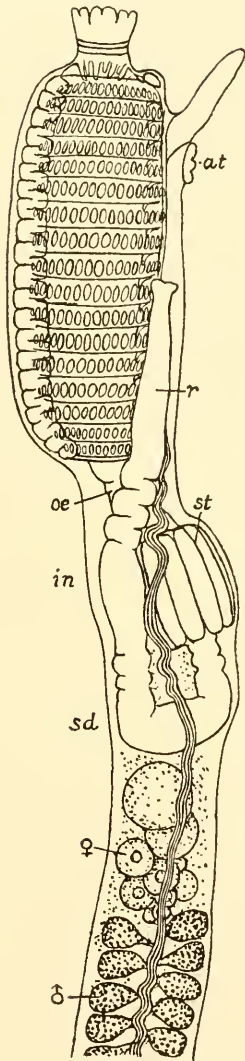


FIG. 6.—*Aplidium (Amaroucium) bermudae* (Van Name), 1902, Zooid, $\times 25$.

filled with sand grains and shell fragments, though some colonies are entirely free from such included matter. In the latter case the zooids, which vary from orange to bright scarlet, are very conspicuous. They are small; their stomach wall has 10 to 20 narrow longitudinal plications, sometimes more or less broken up into areolations.

DIDEMNIDAE Verrill

These are compound ascidians with minute zooids, having the body divided by a constriction into two parts (thorax and abdomen). The branchial sac has only three or four rows of stigmata. Didemnidae have a peculiar method of budding by which each new zooid grows from two buds (one for the thorax and one for the abdomen), arising from or near the constricted middle part of the body, so that characteristic double zooids with the two individuals joined together by the middle part of the body are temporarily formed.

Trididemnum Della Valle

This genus is distinguished by the fact that it has three rows of stigmata, a single testis about which the sperm duct is spirally coiled, and often a short tubular atrial siphon, but no atrial languet. Stellate calcareous spicules are present in the test.

Trididemnum savignii (Herdman)

Didemnum savignii Herdman, 1886, Rept. Voy. Challenger, Zool., Vol. XIV, p. 261, Pl. 34, Figs. 1-5.

Trididemnum savignii + *T. s.* form *porites* Van Name, 1921, Bull. Amer. Mus. Nat. Hist., Vol. XLIV, pp. 314, 317, Figs. 7 to 9.

Diagnosis.—This ascidian forms incrusting colonies, occasionally of considerable size (one specimen measures 90 mm. across) and of very variable thickness, usually only about 2 to 3 mm., but often considerably more when growing on an irregular surface. The external appearance of the colony is greatly dependent on two characters, both subject to a very great variability in different specimens: 1) the number and distribution of the large stellate spicules, and 2) the abundance and distribution of the brown or blackish pigment cells in the test. The spicules are of comparatively large size, generally at least .04 to .06 mm.; in some colonies some of them are .08 or .10 mm. in diameter, or even more. They are generally beautifully regular in form, being stellate, with moderately numerous conical points which taper to a rather sharp extremity, though in many colonies among such regularly formed spicules

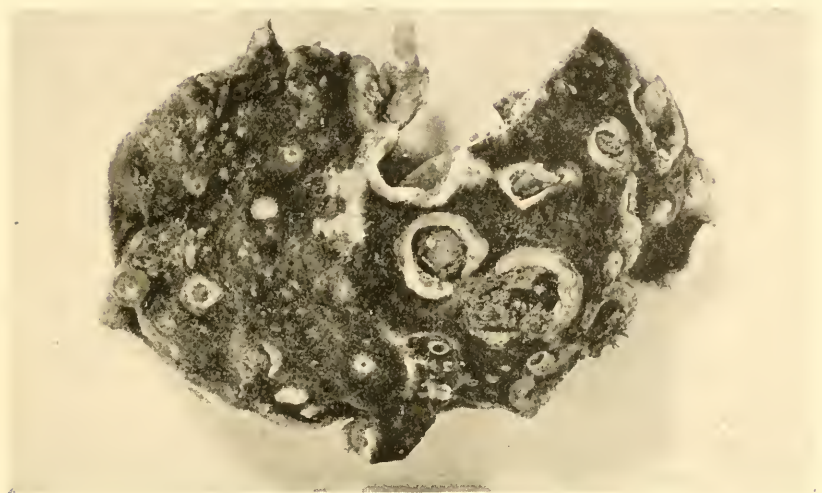


FIG. 7.—*Trididemnum savignii* (Herdman), 1886. A colony, natural size.

there will be found a number in which the points are irregular and broken or blunted at the tip. Occasional colonies occur in which the majority or all of the spicules exhibit such imperfections, the points being reduced to mere irregular protuberences on the spherical central portion of the spicule. In some specimens the spicules exhibit striking uniformity in size, in others large and small ones occur in varying proportions. Their distribution and relative abundance in the test are also subject to much variation. Generally the spicules are chiefly or entirely confined to a layer in the test a little beneath the upper surface, leaving the latter smooth and glossy. The spicules are often distributed in this layer in groups and patches, which may show white, in strong contrast to the dark areas where spicules are few or wanting, a quite regular light and dark color pattern sometimes resulting.

Some specimens have the spicules more abundant than usual and more evenly distributed throughout the test, including the surface layer. This often gives the surface a rough granular character, and the branchial apertures of the zooids are more or less prominent above the surface and surrounded by a more or less distinct ring of crowded spicules, within which six small groups of spicules mark the intervals between the six minute lobes surrounding the mouth. Such colonies also have a stiffer consistency, owing to the numerous spicules.

Specimens of this kind were originally described as a distinct species, *T. porites* (Van Name 1902), but more material has since shown that *porites* is only a form of the present species.

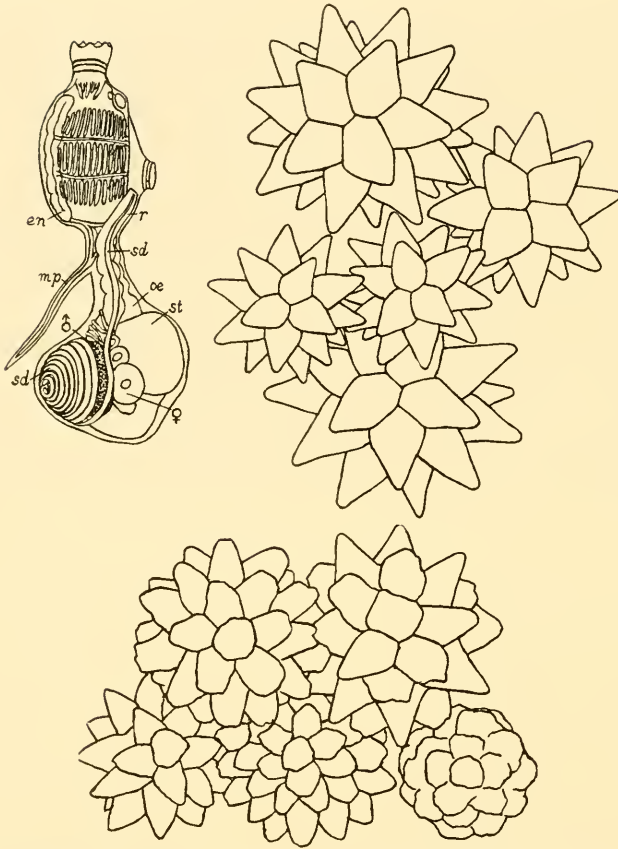


FIG. 8.—*Trididemnum sarignii* (Herdman), 1886. Zoid, $\times 40$, and groups of spicules, $\times 460$.

Where free from spicules, the test is of moderately firm gelatinous character; in some colonies, particularly young ones, it may be whitish or nearly colorless, but as a rule a dark smoky brown or blackish pigment is present both in the test and on some parts of the zooids, especially about the anterior end and on the thorax.

The pigment is chiefly contained in special cells, which are most abundant in the superficial part of the test and vary in form from the most irregular and elongate shapes to regular oval. Generally the pigment cells just described give the upper surface of the colony, or sometimes the whole test, a brownish or blackish color, according to their abundance; after preservation in alcohol for some time, this pigment attains a warmer brown tint.

The zooids are arranged in branching and anastomosing systems, apparently of considerable extent and complexity. In the preserved material they vary from 1.5 to 1.6 mm. to less than 1 mm. in length, this being largely dependent on the state of contraction they are in. They have a tapering muscular process extending out into the common test from the constricted middle part of the body; its length and thickness are very variable in different colonies.

The branchial aperture has six short lobes. The atrial aperture is round, situated on the dorsal side of the thorax at about the middle or somewhat farther toward the posterior end, the position varying in different colonies and often also in different individuals of the same colony. It is slightly produced, but usually not sufficiently to be called a tube.

Distribution.—The American Museum collection contains a typical specimen of this species from Salinas Cove, and others conforming more to the form *porites* from the vicinity of Cajo de Muertos, Guanica Harbor, and near Parguera, Porto Rico. The species appears to be widely distributed in warm regions.

***Trididemnum solidum* (Van Name)**

Didemnum solidum Van Name, 1902, Trans. Conn. Acad. Sci., Vol. XI, p. 358, Pl. 51, Figs. 31, 36; Pl. 59, Fig. 119.

Trididemnum solidum Van Name, 1921, Bull. Amer. Mus. Nat. Hist., Vol. XLIV, p. 318, Figs. 10-12.

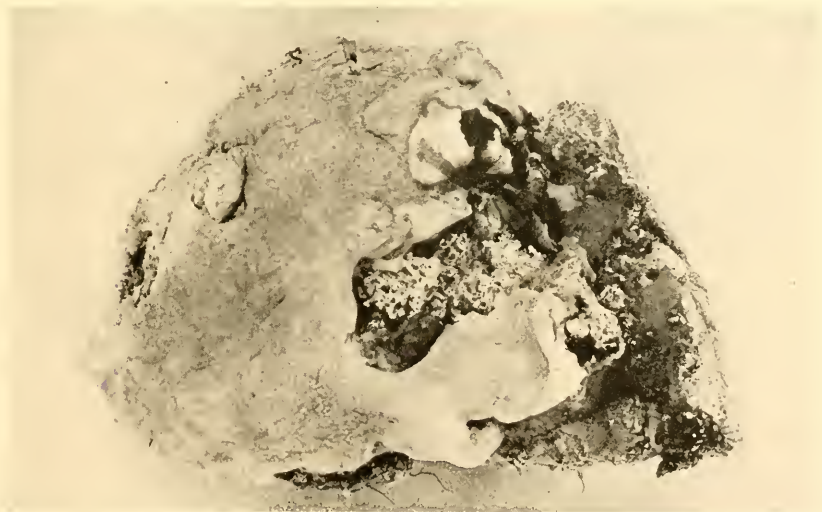


FIG. 9.—*Trididemnum solidum* (Van Name), 1902. A colony attached to dead coral, natural size.

Remarks.—This species was described from a single specimen, now in the Yale University collection, obtained at Coney Island, Bermuda, in shallow water. It is evidently closely allied to *T. savignii*, especially to the form *porites*, and its distinctness cannot be regarded as very well established.

When living, this colony was pale reddish gray, almost flesh colored, darker above, but it faded to yellow-white in preservation. It was without any of the dark pigment usual in *T. savignii*.

Among the Porto Rico material collected by the American Museum expeditions there are two good-sized colonies and one small one which agree well with the type of *T. solidum* from Bermuda in most characters. The larger colony incrusts a convex head of dead coral and would measure, if flattened out, about 130 mm. across and 4 to 5 mm. in thickness, or in some places even more. In its yellowish white color (in alcohol) and in the character of the surface and of the test it closely resembles the Bermuda specimen. The zooids likewise are elongate and slender and have only about eleven or twelve stigmata in a row on each side.

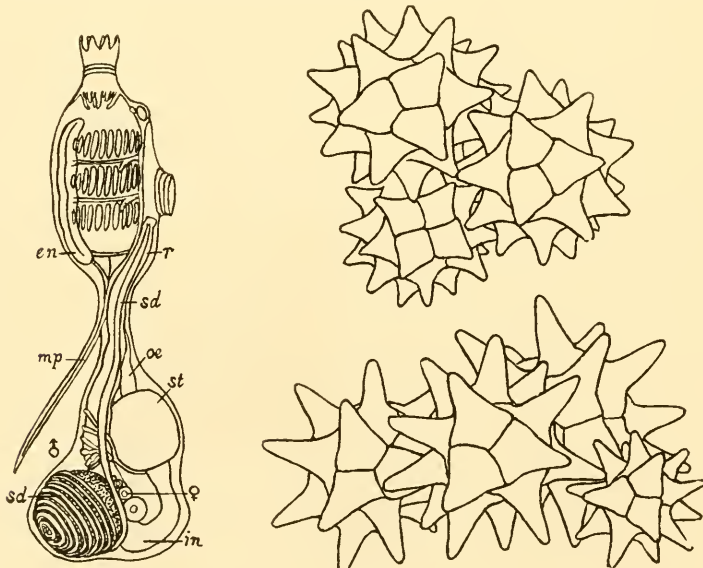


FIG. 10.—*Trididemnum solidum* (Van Name), 1902. Zooid, $\times 60$, and spicules from two colonies, $\times 460$.

Some of them have well-developed reproductive organs similar to those of *T. savignii*, described above. The spicules in all the colonies are numerous and closely crowded; they average greater in diameter than

those in the Bermuda type of *T. solidum*, sometimes reaching .07 mm. or even .08 mm. across the points. The points are much fewer and longer and slenderer than in the type colony, but quite regular, and the spicules have in consequence a very symmetrical stellate form.

Distribution.—The Porto Rican specimens just referred to were dredged south of Guanica on sandy bottom with coral rocks and algae, in depths of about twenty-three to thirty-five fathoms, and between Cajo Caribe and Cayo Parguera in five and one-half to eight fathoms. The National Museum contain similar specimens (also with rather long-pointed spicules) from the Bahamas, collected by B. A. Bean, 1903, and from Mosquito Bay, St. Thomas, collected by C. R. Shoemaker, also several very large ones from St. John (Virgin Islands), growing on millepore corals, collected by Mr. Shoemaker. One of these is 250 mm. in maximum length, covering a flattened branch of the coral on both sides and having a maximum width of over 80 mm., but it is not very thick at any point.

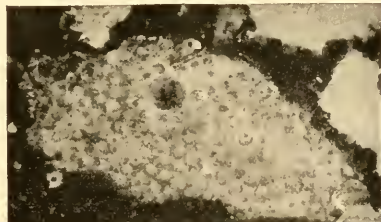
***Trididemnum orbiculatum* (Van Name)**

(Included as likely to be found)

Didemnum orbiculatum Van Name, 1902, Trans. Conn. Acad. Sci., Vol. XI, p. 361, Pl. 51, Figs. 32, 3S; Pl. 61, Figs. 127a and 12S.

Trididemnum orbiculatum Van Name, 1921, Bull. Amer. Mus. Nat. Hist., Vol. XLIV, p. 320, Figs. 13-15.

FIG. 11.—*Trididemnum orbiculatum* (Van Name), 1902. A living colony magnified nearly $\times 3$.



Diagnosis.—The colony (in contrast to that of *T. savignii*) is always very thin, flat and incrusting; translucent; and during life of a characteristic light slate-gray color, fading to almost white on preservation. The size of the largest specimens is 25 to 30 mm. across and 2 mm. or less in thickness. The surface is smooth in fresh specimens; in preserved material it is often uneven and raised over the positions of the zooids, which are usually quite thickly and evenly distributed, and are more or less concealed by a rather dense layer of spicules in the upper

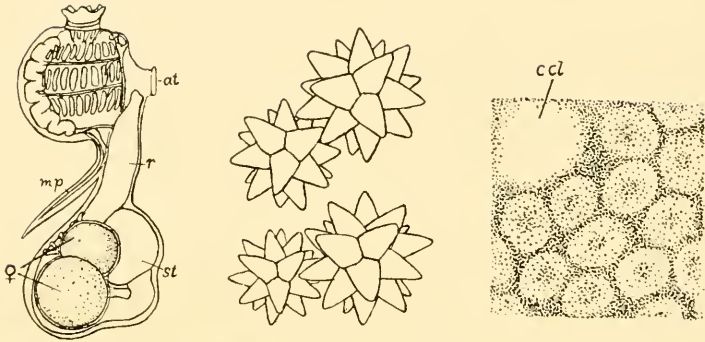


FIG 12.—*Trididemnum orbiculatum* (Van Name), 1902. Zooid, $\times 40$, spicules $\times 460$; part of the surface of a colony to show the distribution of spicules in the superficial layer of the test $\times 11$.

stratum of the colony. The spicules are so distributed that the surface of the colony usually shows over the position of each zooid a circular or oval area of about the diameter of the thorax, more transparent than the intervening spaces, which latter are whiter and more opaque, owing to the greater abundance of spicules there.

Distribution.—Known only from Bermuda and Curaçao.

Didemnum Savigny

[= *Leptoclinum auct. mult.*]

There are four rows of stigmata in the branchial sac. The proximal part of the sperm duct is wound spirally about the testis. Calcareous spicules are present in the test.

Subgenus Didemnum

The atrial orifice is not produced into a tube and there is usually no languet. The testis is single or is divided into not more than two lobes or separate glands.

The white or yellowish (sometimes reddish) colonies of animals of this group, which incrust stones, sponges, algae and other objects, and are often so densely crowded with minute spherical or stellate spicules as to become hard and brittle, are common in many parts of the world. Under the wrongly applied name *Leptoclinum* Milne-Edwards, they are familiar to nearly everyone who has collected marine invertebrates.

***Didemnum candidum* Savigny**

Didemnum candidum Savigny, 1816, Mém. s. l. animaux sans vertèbres, Pt. 2, pp. 14, 194, Pl. 4, Fig. 3; Pl. 20, Fig. 1.

Leptoclinum speciosum + *L. s.* var. *asperum* Herdman, 1886, Rept. Voy. Challenger, Zool., Vol. XIV, pp. 274, 277, Pl. 34, Figs. 8-13; Pl. 36, Figs. 1-9.

Didemnum candidum Van Name, 1921, Bull. Amer. Mus. Nat. Hist., Vol. XLIV, p. 323, Figs. 16-25.



FIG. 13.—*Didemnum candidum* Savigny, 1816. A colony, natural size.

Diagnosis.—Colony of the incrusting type, usually thin (not over 2 or 3 mm. thick), though sometimes measuring 60 to 70 mm. across or occasionally considerably more. When growing on uneven objects, its thickness in some places may become considerably greater than above stated. This is its usual form of development when growing on a continuous surface as a stone or a shell, but often it grows on an irregular branching object, as a gorgonian, hydroid or branching sponge. In such cases it surrounds the branches and often binds together or incloses two or more of them. As it grows larger, it may finally entirely envelop the object, covering all its branches and assuming more or less its form.

The color is usually white, sometimes very pure white, in other cases yellowish or less frequently reddish; in turbid waters it is more or less discolored with mud. Borders of the colony vary from thin to thick and rounded; the surface is very variable, sometimes quite even, in other cases much wrinkled. The surface, if comparatively free from spicules in the extreme superficial part, may be somewhat glossy and smooth to the touch, but an abundance of spicules there renders it a dead white and makes it feel slightly gritty. When the spicules are abundant, the zooids, which are yellow or in parts orange during life, may be entirely

concealed, unless their branchial apertures are expanded, but their positions are often indicated by a small, low, rounded elevation over the anterior end of each zooid. When less abundant, the spicules are often chiefly gathered in the upper layers of the colony, leaving the deeper portions of the test yellowish and translucent and the colony comparatively soft. In some colonies the branchial apertures are conspicuous in the preserved condition and each is surrounded by a minute circle of more densely crowded spicules within which the six-lobed character of the aperture is indicated by six minute groups of very small spicules between the lobes. Different colonies vary very greatly in respect to the clearness with which the systems and the courses of the common cloacal ducts show on the surface. These features may be very conspicuous, so that the zooids are seen to be arranged in branching and curving lines, or they may be impossible to follow out, the zooids appearing to be merely scattered irregularly in the superficial part of the colony.

In some colonies the spicules exhibit very striking uniformity in size, in others they are of various sizes, which may be present in varying proportions; occasional abnormally large spicules ("giant spicules") may be found in a few specimens. The usual diameter of the spicules varies in different colonies from .025 mm. (sometimes even less) to about .04 or .05 mm.; rarely more. Commonly there is within a single colony great uniformity in the shape of the spicules, as well as in their size; different colonies, even those growing side by side on the same stone, may differ conspicuously in the type and average size of their spicules. The illustrations here given show typical groups of spicules from different colonies and illustrate the principal modifications that occur.

In completing this description of the general character of the colony, it should be mentioned that there are occasional specimens, apparently of this species, which for some unexplained reason develop very few spicules in the test, so that the colony remains soft, flexible, semitransparent, and (in the preserved material) of a yellow or grayish color. The few spicules present are generally in the upper parts of the colonies (sometimes chiefly about the branchial apertures of the zooids) and are of small size. Such colonies may attain a large size and appear normal in all other respects except in the scarcity and poor development of the spicules, though this deficiency gives them a very different superficial appearance. I have seen such specimens from widely separated localities (Florida, Porto Rico, and South Carolina).

There are also colonies containing large accumulations of dark-colored faecal pellets in the cloacal canals and cavities and imbedded

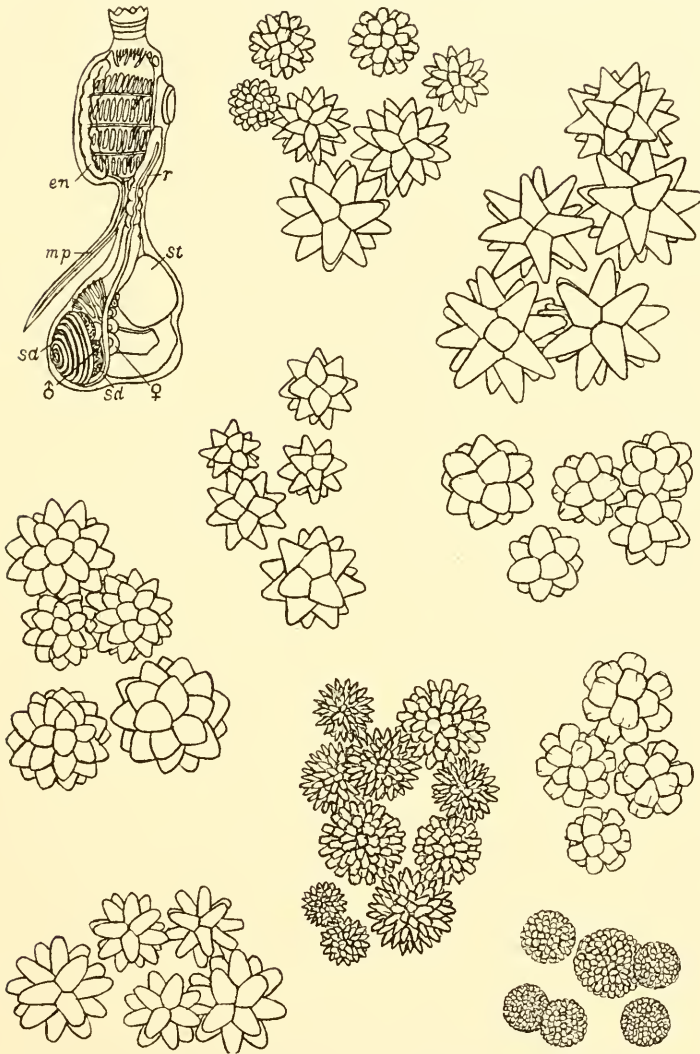


FIG. 14.—*Didemnum candidum* Savigny, 1816. Zooid, $\times 40$, and groups of spicules showing their variation in different colonies, $\times 460$.

in the solid test substance. This is merely the result of some abnormal or pathological condition, the water currents being insufficiently strong to carry off this waste material. Its presence in large quantities may greatly alter the appearance of the colonies and make it difficult to realize that they belong to the same species as normal examples.

When considerably expanded, the zooids may measure 1.6 mm. in total length, even in preserved material, but in most alcoholic specimens they will be found strongly contracted and often not more than 1 or 1.1 mm. long. They have six lobes to the branchial tube; these lobes vary greatly in length and form in different colonies. A tapering muscular process, often of considerable length, extends out into the test from the constricted middle part of the zooid; its development is very variable in different colonies, though often quite constant within the same colony. Atrial orifice round, without a languet. Its border is usually almost flush with the dorsal surface of the thorax; even if slightly raised, it is not produced sufficiently to form a tube.

The testis is sometimes cleft into two more or less completely or entirely separate lobes or distinct glands, but more frequently it is undivided. I have never observed it cleft into three lobes or glands. The sperm duct usually makes six or eight spiral turns about the testis. The ovary consists of a few eggs situated in the region between the stomach and the testis.

Distribution.—This species, which is widely distributed, was found abundant at many points on the south coast of Porto Rico attached to the under side of stones along the shore and to algæ, sponges, and other ascidians, etc. Though mainly a shallow water form, it is occasionally found in fairly deep water. It is also recorded from St. Thomas, Virgin Islands.

***Didemnum vanderhorsti* Van Name**

(Included as likely to be found)

Didemnum vanderhorsti Van Name, 1924, Bijdr. t. d. Dierkunde, Vol. XXIII, p. 25, Fig. 1.

Diagnosis.—This species forms incrusting colonies of a size similar to that of *D. candidum*, and the zooids are much alike in the two species. In this form, however, the colony has very few and minute spicules, which are of spherical or burrlike shape. In some colonies the spicules may be practically wanting. The test is semitransparent and contains abundant pigment cells, giving the colony a more or less deep brown or purple color.

Distribution.—Known thus far from Curaçao; Jamaica, and Tortugas, Fla.

Subgenus **Polysyncraton** Nott

This differs from the typical subgenus of *Didemnum* in having the testis divided into several entirely separate glands, disposed in a circular group, about which the sperm duct coils. The typical species (including the West Indian form) have an atrial languet.

Didemnum (Polysyncraton) amethysteum (Van Name)

Polysyncraton amethysteum Van Name, 1902, Trans. Conn. Acad. Sci., Vol. XI, p. 366, Pl. 54, Figs. 62, 64-67; Pl. 58, Fig. 102.

Didemnum (Polysyncraton) amethysteum Van Name, 1921, Bull. Mus. Nat. Hist., Vol. XLIV, p. 333, Figs. 27-29.

FIG. 15.—*Didemnum (Polysyncraton) amethysteum* (Van Name), 1902. A colony attached to a sponge, natural size.



Diagnosis.—The colonies in this species are of a flat, incrusting type; the upper surface is nearly smooth and even; the thickness of the colony is about 3 mm., and the greatest diameter rarely over 25 or 30 mm. In spite of their small size, the colonies are during life of striking appearance. The test is transparent and of a handsome purple or rose-purple tint, which fades to yellow on preservation. The color is due to pigment in the test cells. The zooids during life are bright red. The upper surface-layer of the colony contains a layer of small white burrlike or almost spherical spicules, but small oval areas about the branchial apertures of the zooids and a large central area on the upper surface of the colony surrounding the common cloacal aperture (there appears to be usually but one) are without spicules, except that in the small areas about the branchial orifices there are six small V-shaped groups of them corresponding to the intervals between the six lobes of the branchial tubes. The deep purple of the exposed areas of the test, with the contained brightly colored zooids, often appears in strong contrast to the pure white of the spicule-covered portion. The layer of test containing the spicules may readily be stripped off. The spicules are always small, .015

or .02 mm. in diameter or even less, with short and often more or less blunted rays, so numerous that the spicule appears nearly spherical except under high magnification.

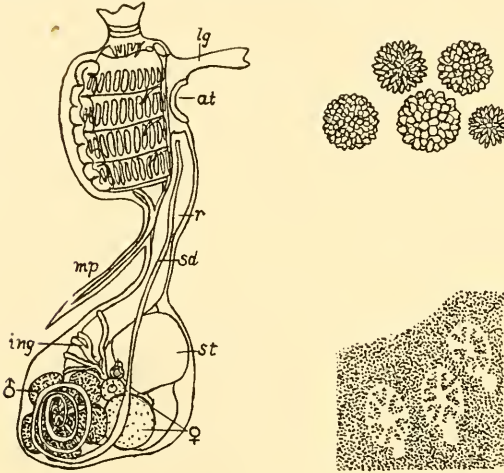


FIG. 16.—*Didemnum (Polysyncraton) amethysteum* (Van Name), 1902. Zooid, $\times 40$. Spicules (all from same colony), $\times 460$, and part of a colony showing distribution of spicules in superficial layer of test. $\times 11$.

The zooids are about 1.5 mm. long when well expanded. The body is strongly constricted between the thorax and abdomen; a tapering muscular process extends ventrally and posteriorly out into the test from the constricted part of the body. The branchial aperture is six-lobed, the atrial plain, with a languet at its anterior border. This languet is, in well-expanded zooids, fairly long and wider toward the end, where it is slightly forked. In strongly contracted individuals it is merely a small tongue-like projection.

Distribution.—Specimens of this species, previously known from Bermuda and Florida, were dredged off Point Brea and off Guanica Harbor, Porto Rico, in water 35 to 100 feet deep.

Diplosoma MacDonald (Nomen Conservandum) = *Leptoclinium* Milne Edwards

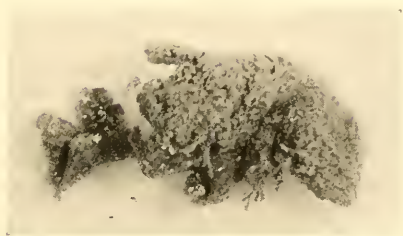
In this genus there are four rows of stigmata; the testis is divided into two separate glands, and the sperm duct is not spirally coiled. No atrial languet or atrial tube is developed and the test is without spicules. Usually the common cloacal cavities are greatly developed.

Diplosoma macdonaldi Herdman

Diplosoma macdonaldi Herdman, 1886, Rept. Voy. Challenger, Zool., Vol. XIV, p. 315, Pl. 42, Figs. 1-4.

Leptoclinium macdonaldi Van Name, 1921, Bull. Amer. Mus. Nat. Hist., Vol. XLIV, p. 335, Fig. 30.

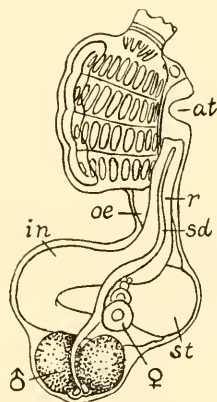
FIG. 17.—*Diplosoma macdonaldi* Herdman, 1886. A colony, natural size.



Diagnosis.—The colony is thin and incrusting, rarely much over 2 mm. thick, but sometimes 50 mm. or more across. (One specimen surrounds a blade of turtle grass for a length of 138 mm.) Test in life transparent and colorless or sometimes suffused with milky white, which commonly disappears on preservation. The zooids are clearly visible through the test and often quite conspicuous as small, irregular distributed, blackish objects, since they usually have more or less black pigment in the mantle cells about the branchial tube and on the surface of the abdomen. Their tissues are otherwise light colored, except that the stomach and part of the intestinal loop are yellow or orange during life, fading out in preservation.

The common cloacal cavities are very extensive, though developed to a varying degree in different colonies: in extreme cases the entire interior of the colony may be hollow, except for columns or trabeculae of test substance in which the zooids are imbedded. Large and conspicuous pale yellowish, oval cells are often present in the test substance.

FIG. 18.—*Diplosoma macdonaldi* Herdman, 1886. Zooid, $\times 48$.



The zooids are very small; their apparent length is further diminished by the fact that the axis of the abdomen is usually bent at right angles to that of the thorax, so that they often average only .8 or .9 mm. long in

the preserved colonies but, when moderately expanded and straightened out, they may measure 1.5 or 1.6 mm. in total length. As seen from the surface of the colony, the branchial apertures appear round or oval, without lobes, but the usual six lobes are slightly developed on the branchial tube and are often visible within the circular exterior orifice. There is no atrial tube or atrial languet; the atrial opening is large and plain-edged.

Distribution.—Widely distributed in both the East and West Indian regions. At Porto Rico it was collected in Guanica Harbor and dredged at other points off the south coast with a depth of 6 to 8 fathoms. The U. S. National Museum collection contains specimens from St. Thomas, Virgin Islands.

Habits.—It appears to grow more commonly on corals, gorgonians, sponges and other ascidians in water at least a few feet deep than near low-water mark, perhaps because its delicate structure is not adapted to withstanding either exposure to the air or to strong waves.

Lissoclinum Verrill

[= *Diplosomoides* Herdman]

This genus is similar to *Diplosoma* in general characters, but has stellate calcareous spicules in the test. There are four rows of stigmata; the testis is partially or completely divided into two or more glands or lobes; the sperm duct is not coiled, and the atrial orifice has a languet.

Lissoclinum fragile (Van Name)

Diplosomoides fragile Van Name, 1902, Trans. Conn. Acad. Sci., Vol. XI, p. 370, Pl. 53, Figs. 57 and 58; Pl. 61, Fig. 126.

Lissoclinum fragile Van Name, 1921, Bull. Amer. Mus. Nat. Hist., Vol. XLIV, p. 338, Figs. 31 and 32.

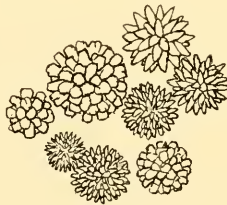
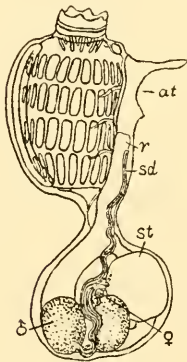


FIG. 19.—*Lissoclinum fragile* (Van Name), 1902. Zooid, the branchial sac well extended, $\times 36$, and spicules (all from the same colony), $\times 460$.

Diagnosis.—This animal forms very thin, flat, incrusting colonies, often of considerable extent (60 mm. to 80 mm. across), but only 2 to 3 mm. thick. Living specimens collected at Bermuda were easily recognizable by two characters: 1) their snowy whiteness without the least tinge of yellowish (though preserved specimens become somewhat yellowish) and 2) their very fragile character. The test breaks or tears at the slightest touch, and the colony cannot readily be removed entire from the surface on which it grows. The white color is due to the spicules that densely crowd the test and conceal the zooids, which are yellow or orange during life. The spicules are minute (usually not more than .02 to .023 mm. in diameter) and stellate or burrlike in form, built up of very numerous rays, which may end in sharp points but are more often truncated or broken at the tips. The rays or points are so short and numerous that under low magnification the spicules appear nearly spherical. The fragile character of the colony is in part due to the brittleness of the test, caused by the great abundance of spicules, but still more to the very extensive development of the common cloacal cavities, as in the genus *Diplosoma*. The apertures of the zooids are usually quite conspicuous on the surface of the colony, which is fairly smooth, though not glossy, during life, but becomes much wrinkled through the collapse of the common cloacal cavities in preserved specimens.

The zooids are about 1.5 long when fairly well expanded. They have the branchial aperture six-lobed; the atrial is provided with a languet. No muscular process extending out into the test is developed.

Distribution.—This ascidian, which is common at Bermuda, has not yet been recorded at Porto Rico. It was collected by Mr. C. R. Shoemaker of the U. S. National Museum in 1915 at St. Thomas, Virgin Islands, where it was growing on piles and other ascidians in shallow water.

Echinoclinum Van Name

This genus is closely related to *Lissoclinum* and *Diplosoma* though at once distinguishable by the peculiar form and arrangement of the spicules described below. The following is the only known species.

Echinoclinum verrilli Van Name

(Included as likely to be found)

Echinoclinum verrilli Van Name, 1902. Trans. Conn. Acad. Sci., Vol. XI, p. 372, Pl. 50, Figs. 23-25.

Echinoclinum verrilli Van Name, 1921. Bull. Amer. Mus. Nat. Hist. Vol. XLIV, p. 340, Figs. 33-35.

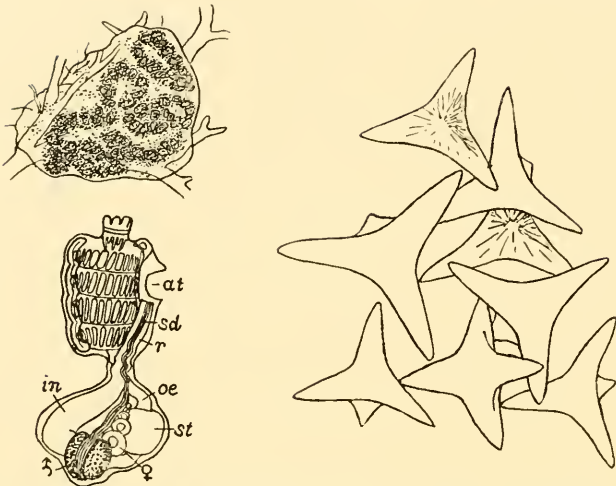


FIG. 20.—*Echinoclinum verrilli* Van Name, 1902. A colony, $\times 2$; zooid, $\times 36$; group of spicules, $\times 230$.

Diagnosis.—The colony is of the flat, incrusting type but usually rather thick, with the upper surface generally smooth but uneven. It attains a considerable size, one specimen from near Key West, Florida, measuring 125 mm. by 95 mm. across and averaging at least 5 or 6 mm. in thickness (at some points considerably more). The zooids are arranged in systems often of considerable extent and complexity. The test is more or less transparent, colorless or yellowish in preservation; there are no notes on its color in life. The spicules have the form of tetrahedrons whose four apices are produced into points; they are mostly so placed as to form a spiny capsule about each zooid.

Distribution.—Known from Bermuda and Florida.

POLYCITORIDAE Hartmeyer

[= Polycitoridae + Clavelinidae *auct. plur.*]

Members of this family are compound ascidians, having the body consisting of two parts (thorax and abdomen) joined by a constricted part or neck, usually rather long. The buds form on vascular processes or stolons (often of considerable length) arising from the posterior end of the abdomen of the parent. The dorsal lamina is represented by a series of languets. The reproductive organs are in the abdomen (or in a diverticulum of it), usually in or near the loop formed by the intestine.

Polycitor Renier

This genus includes forms with many rows of stigmata, and a plicated stomach wall (constituting the subgenus *Polycitor*) and those with but three or four rows of stigmata and a globular stomach, always smooth-walled, which constitute the subgenus *Eudistoma*. To this latter group the species here described belong.

Subgenus **Eudistoma** Caullery

See above, under *Polycitor*.

Polycitor (Eudistoma) olivaceus (Van Name)

Distoma olivaceum Van Name, 1902. Trans. Conn. Acad. Sci., Vol. XI, p. 344, Pl. 48, Fig. 9; Pl. 59, Fig. 113.

Polycitor (Eudistoma) olivaceus Van Name, 1921, Bull. Amer. Mus. Nat. Hist., Vol. XLIV, p. 343, Fig. 36.



FIG. 21.—*Polycitor (Eudistoma) olivaceus* (Van Name), 1902. Two colonies, natural size.

Diagnosis.—The usual form of the colony in this species is a group of numerous, small, somewhat flat-topped heads of circular outline, with fairly abrupt sides, which contract toward the base in to a rather thick peduncle. The several peduncles expand and unite into a basal mass by which the colony is attached. These heads are usually only

5 to 8 mm. across and 8 to 10 mm. high, or often much smaller, but many may be united into one colony. The color in life varies from olive-green or yellowish olive to olive-brown, often more or less blackish on the upper surface. The color holds fairly well in alcoholic material.

The upper portion of the colony is smooth and shiny, free from incrusting or imbedded sand; the basal parts and peduncles contain sand grains and are often covered with an outside layer or pellicle densely crowded with fine sand. This pellicle, however, usually ends abruptly at the top of the peduncle. The test is gelatinous and semitransparent, in spite of its dark coloration, which is in part due to pigment contained in the test cells.

The zooids are rather slender and elongate when expanded, the thorax and abdomen being connected by a long slender neck but, owing to the very strong longitudinal muscle bands in the mantle, especially in the thoracic region, they are apt in the case of preserved material to be found contracted and distorted out of all semblance to their natural form and size, and in such condition measure only 3 to 4 mm. long or even less. They are light-colored, with the stomach and parts of the intestinal loop orange during life. The mantle, especially on the anterior part of the thorax, is dotted with blackish pigment, sometimes to a very conspicuous extent: in other cases there is very little such pigment. In many colonies the regions over the ganglion and anterior end of the endostyle are much more deeply pigmented than any other part, so that these areas show from the outside of the colony as black dots on the otherwise light-colored zooids. Both apertures on tubes, the atrial usually the longer. The branchial aperture has six or seven, the atrial six lobes.

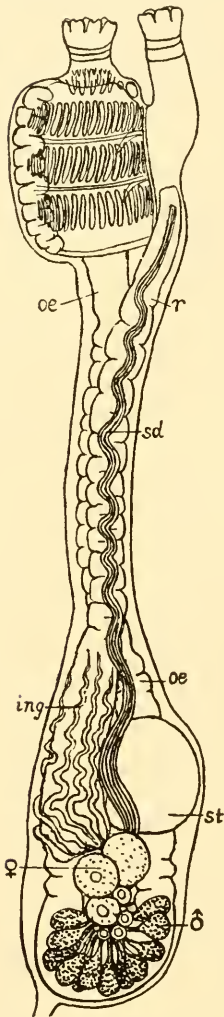


FIG. 22.—*Polycitor* (*Eudistoma*) *olivaceus* (Van Name), 1902. Zooid, $\times 32$.

The mantle musculature is strong on the thorax, where it consists of many stout longitudinal bands, and underlying transverse fibers. On the abdomen the long bands spread out and gradually become weak, disappearing near the posterior end of the body.

Distribution.—This is one of the commonest compound ascidians at Bermuda, in Florida and many parts of the West Indies in very shallow water, growing on rocks, piles, mangrove roots, etc. Collected in Guanica Harbor, Porto Rico, and at St. Thomas, Virgin Islands.

Remarks.—*Polycitor (Eudistoma) obscuratus* (Van Name), 1902, is probably only a form of this species based on specimens in which the blackish pigment is very abundant and the colony unusually broad and sessile, without distinct division into separate heads. It has been recorded from Water Island, Virgin Islands. (See Van Name, 1921, p. 345.)

Polycitor (Eudistoma) convexus (Van Name)

(Included as likely to be found)

Distoma concrum Van Name, 1902, Trans. Conn. Acad. Sci., Vol. XI, p. 342, Pl. 49, Fig. 16; Pl. 58, Fig. 104; Plate 59, Fig. 118.

Polycitor (Eudistoma) concrus Van Name, 1921, Bull. Amer. Mus. Nat. Hist., Vol. XLIV, p. 346.

Diagnosis.—The colonies are larger and more massive than in *P. olivaceus*, consisting usually of a single irregularly rounded mass, which is often attached by a broad base and seldom divided into more than a very few separate heads or lobes if divided at all. The color of the test is yellowish, pale brownish or horn color, sometimes with a reddish or a violet shade. The zooids are somewhat larger and stouter than in *P. olivaceus*, but of similar structure.

Distribution.—Known from Bermuda, coasts of the southeastern United States, Bahamas and Cuba.

Polycitor (Eudistoma) hepaticus Van Name

Plate VII, lower fig.

Polycitor (Eudistoma) hepaticus Van Name, 1921, Bull. Amer. Mus. Nat. Hist., Vol. XLIV, p. 349.

Diagnosis.—This species (if it is correct to regard it as a species) forms very large massive colonies, a specimen from St. Thomas, Virgin Islands, in the U. S. National Museum measuring 270 by 240 mm. in its longer and shorter diameters respectively and being about 100 mm. in height. Such dimensions are, however, unusual.

The colonies as a rule form large ovoid or ellipsoidal masses, commonly more or less flattened in one direction and generally attached by

a rather small area on or near one of the narrower sides or by one end; the surface of the test is more or less uneven, and large colonies are often partly divided by narrow clefts into two or more large lobes, which may have one or more of their sides flattened and the borders sharp and angular as a result of pressure against one another. In such cases the form of the colony, the dark color, and the consistency of the rather soft test give it an appearance suggesting the liver of a vertebrate animal, except that the color (in preservation) instead of red is a pure, intense purple, caused by grains of purple pigment in the test cells. There are no notes regarding the color in life.

In some specimens the purple pigment is much less in amount, the colonies having sometimes only a pale purple or violet shade—in extreme cases only a purplish buff color; this may be in part due to fading, but such specimens approach *P. convexus* in character, and in spite of the difference in typical examples, raise the question whether *hepaticus* should not be regarded as a form of *convexus* instead of as a distinct species. The collection and study of more material and possibly the study of the two forms in a living state will be necessary to determine the question.

Distribution.—Except that it is not known from Bermuda, the distribution of this form is similar to that of *P. convexus* though somewhat wider, extending from North Carolina to Yucatan, Jamaica and the Virgin Islands, where it appears to be abundant. Such a distribution would seem to increase the possibility that this is a form of *P. convexus*.

Habits.—Three small purple specimens obtained by the "Albatross" at St. Thomas in 1884 appear to have grown on crabs, as many other compound ascidians sometimes do.

Polycitor (Eudistoma) clarus (Van Name)

(Included as likely to be found)

Distoma clarum Van Name, 1902, Trans. Conn. Acad. Sci., Vol. XI, p. 345, Pl. 48, Fig. 10; Pl. 59, Fig. 117.

Polycitor (Eudistoma) clarus Van Name, 1921, Bull. Amer. Mus. Nat. Hist., Vol. XLIV, p. 350, Fig. 37.

Diagnosis.—The colony is a small, rounded or oval mass without a peduncle, attached by most of the under surface. The test is transparent and colorless in preserved specimens, but slightly opalescent in life, with a grayish, pinkish, or sometimes a blue or green cast. The size of the

largest colonies is about 12 mm. across and 6 mm. or less in height. The zooids are irregularly distributed, lying in preserved colonies at all angles to the surface, no systems discernible. The zooids are visible with perfect clearness through the test; they are small, and are provided with very strong longitudinal muscle bands on the thorax and anterior part of the abdomen: these usually produce such violent contractions in preserved specimens that the natural size and form of the zooid is entirely changed and distorted. Both apertures are on muscular tubes; the branchial tube is very stout, six or seven-lobed; the atrial is longer and six-lobed. In immature zooids both tubes may be mere conical projections. The posterior end of the body is produced into a vascular process, which is often very large and thick. The length of the zooids when moderately extended is 3 to 4 mm. or more, but in the strongly contracted and distorted condition in which they are found in preserved specimens, the length is usually much less (2 mm. or under). During life the thorax of the zooids is white, the stomach and more or less of the intestinal loop is yellow or orange. In preservation the zooids fade to yellow or flesh-color, and usually eventually turn dark (dark yellow or brown).

Distribution.—Known only from Bermuda, where it is abundant.

Clavelina Savigny

This genus is very insufficiently distinguished from the typical subgenus of *Polycitor*, the chief difference being that the zooids are usually more separated from one another, each having its own separate covering of test, at least so far as the anterior part of the zooid is concerned, instead of being wholly buried in the common mass of test of the colony. Yet every degree between complete burying in the common test to complete separation of the zooids except for connection at their rear end, can apparently be exhibited within the same species, and even within the same colony at different periods of its development. The zooids in this genus are usually of rather large size.

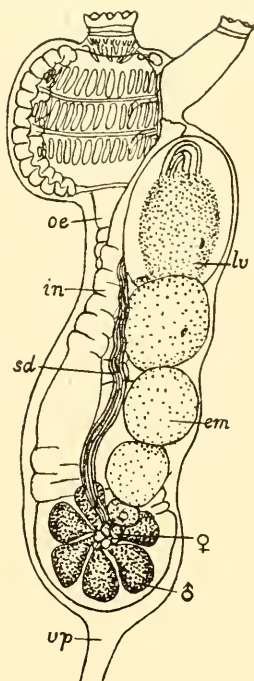


FIG. 23.—*Polycitor* (*Eudistoma*) *clarus* (Van Name), 1902. Zooid containing four developing embryos or larvae, $\times 35$.

Clavelina oblonga Herdman

Plate V

Clavelina oblonga Herdman, 1880, Proc. Roy. Soc. Edinburgh, Vol. X, p. 724, Figs. 93-95.

Clavelina oblonga Herdman, 1882, Rept. Voy. Challenger, Zool., Vol. VI, p. 246, Pl. 35 Figs. 6-10.

Clavelina oblonga + *Clavelina gigantea* Van Name, 1921,¹ Bull. Amer. Nat. Hist., Vol. XLIV, pp. 354, 358, Figs. 38-40 and 53.

Diagnosis.—This species exhibits the full range of variability in the degree of separation or union of the zooids alluded to above. In many colonies the individuals are club-shaped, usually 20 to 30 mm. long (high) inclusive of the test; each is inclosed in a thick covering of test, which is wide and rounded at the summit or anterior end, where the two apertures are situated, and tapers into a narrow base by which it is attached to the other members of the colony through a basal mass of test containing branching vessels that may bear a few bulbs or enlargements.

Colonies of this type are frequent, but along with them are often found others in which the posterior half of each zooid (or a greater or less part of its length) is buried in the common basal mass of the colony; only their anterior parts have a separate and independent test covering; in immature or imperfectly developed colonies the entire length of the zooid may be thus buried, as it is in most compound ascidians, the colony consisting of one or more capitate lobes; in some specimens this entirely buried condition persists even though the zooids have attained large size and fully adult condition.

The usual condition is, however, that of at least partial separation of the zooids.

The test is gelatinous, more or less perfectly transparent, sometimes entirely colorless, in other cases with a pink, violet or brown tinge, which may or may not be retained in preserved material. In some living specimens the zooids show through the test as light yellowish, with the stomach and intestine deep yellowish brown. Some opaque white pigment was present about the apertures and elsewhere on the thorax. There was no pink or carmine color on any part of these specimens, but in some colonies there is a carmine ring about the oral aperture and often a stripe of the same color down the ventral side of the thorax of each zooid.

¹ *Clavelina gigantea* Van Name, 1921, is not *Polycitor giganteus* Sluiter, 1919. The latter is a *Diazona*. See Årnåbäck Christie-Linde, Arkiv f. Zool., Vol. XVIII, No. 1, p. 15.



FIG. 24.—*Clavelina oblonga* Herdman, 1880. Two colonies, showing zooids almost completely separated (left figure) and one section of a completely consolidated colony (right figure), both natural size.

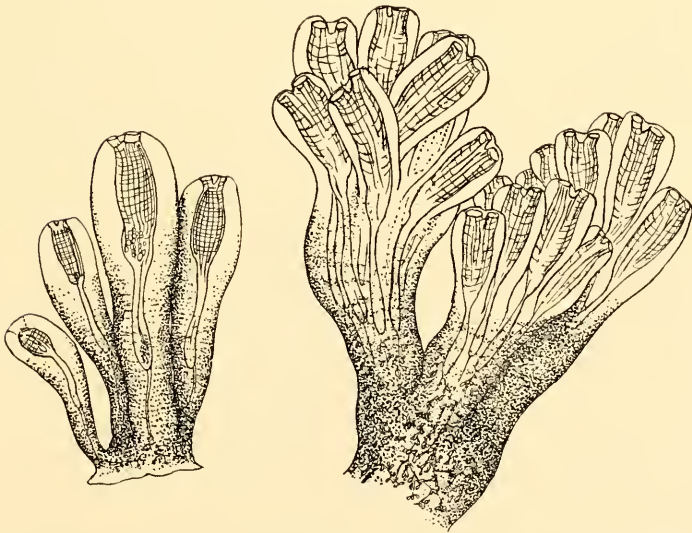


FIG. 25.—*Clavelina oblonga* Herdman, 1880. A small colony with separate zooids, $\times 1.8$, and three lobes of a large colony with partially united zooids, $\times 1.8$.

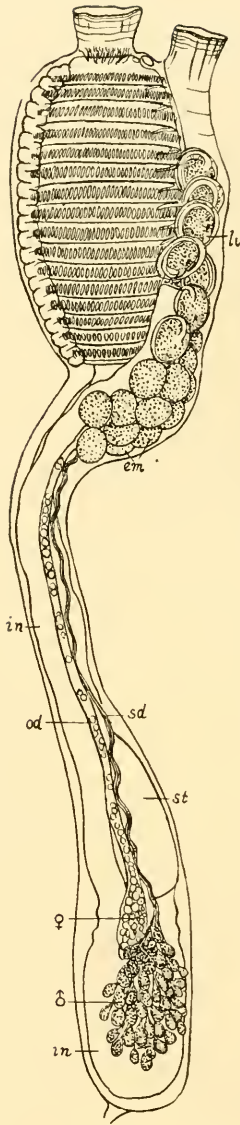


FIG. 26.—*Clavelina oblonga* Herdman, 1880. Zooid (branchial sac contracted: embryos and larvae in peribranchial cavity), $\times 10.5$.

The zooids are very variable in size in different colonies: in some their length is quite uniform, in others it is not at all constant. Large zooids, well expanded, may reach 25 mm. to 35 mm. in length. In the ordinary, contracted, preserved condition they do not usually exceed half or two-thirds this length. A vascular process from the posterior end of each zooid joins it to the branching stolons in the base of the colony. Spinctor muscles of apertures not very strong. Both apertures frequently have six distinct lobes; in other specimens the border may be merely sinuous or even perfectly plain.

The stigmata are small and arranged in numerous rows (twenty or more in large zooids). The atrial cavity often contains numerous small tadpole larvae.

Distribution.—A common and widely distributed shallow-water species ranging from Bermuda and South Carolina to Brazil. Small colonies of it were found at several points off the south coast of Porto Rico, and it has been recorded from St. Thomas (Hartmeyer, 1912).

Remarks.—Some of the colonies of this species are, from their large size, delicate structure, transparency and bright coloration, among the most beautiful members of the varied marine fauna of the West Indian region.

Cystodytes von Drasche

Cystodytes is distinguished from *Polycitor* chiefly by possessing disk-shaped calcareous spicules in the test.

Cystodytes dellechiaiæ (Della Valle)

(Included as likely to be found)

Distoma dellechiaiæ Della Valle, 1877. Contribuzioni alla storia naturale delle Ascidie composte del Golfo di Napoli, p. 40 (*vide* Herdman).

Cystodytes draschii Herdman, 1886. Rept. Voy. Challenger, Zool., Vol. XIV, p. 137. Pl. 19, Figs. 1-15.

Cystodytes dellechiaiaie Van Name. 1921. Bull. Amer. Mus. Nat. Hist., Vol. XLIV, p. 360, Figs. 41-42.



FIG. 27.—*Cystodytes dellechiaiaie* (Della Valle), 1877. Two entire colonies and a section of another colony, natural size.

Diagnosis.—Forms flat incrusting colonies which may measure as much as 60 to 80 mm. across and 5 mm. in thickness. The color is very variable; often dark brown, blackish or purple, but sometimes pale buff or almost white. Purple colonies turn brown on preservation in alcohol. Though there is little that is distinctive in an exterior view of the colony, the white calcareous capsules built up of overlapping disk-shaped spicules that surround the body of each zooid are quite conspicuous when the colony is sectioned.

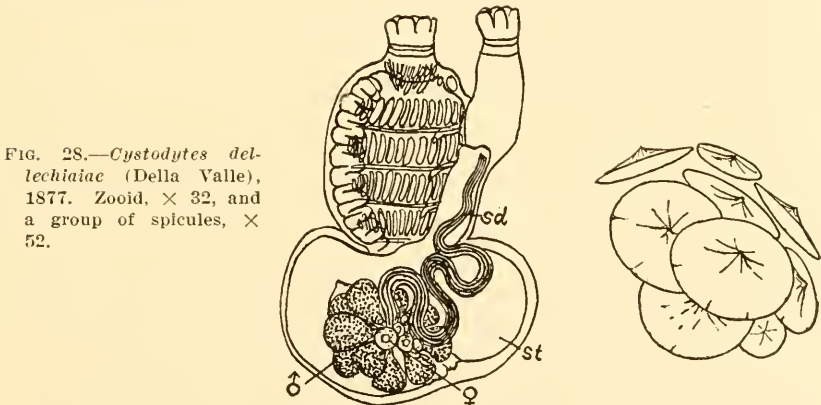


FIG. 28.—*Cystodytes dellechiaiaie* (Della Valle), 1877. Zooid, $\times 32$, and a group of spicules, $\times 52$.

Distribution.—This is a widely distributed and in many places a common species, occurring along the shore as well as in water of considerable

depth. The size of the spicules and some of the other characters are variable in different specimens as well as the color, as I have already mentioned, but I have been unable to find grounds for distinguishing more than one species in the West Indian region.

Distaplia Della Valle (Nomen Conservandum) = *Holozoa* Lesson

The branchial sac has four rows of stigmata, each row crossed at its middle by a slender transverse (dorso-ventral) vessel. Development of the embryos (in the typical species, at least) takes place in a large pouch or external diverticulum of the peribranchial cavity into which the oviduct passes.

Distaplia bermudensis Van Name

Cellulophana collectrix ? O. Schmidt, 1870, Grundz. Spongienf. Atlant. Geb., p. 25.

Distaplia bermudensis Van Name, 1902, Trans. Conn. Acad. Sci., Vol. XI, p. 349, Pl. 49, Figs. 15, 18 and 19; Pl. 59, Figs. 108 and 111; Pl. 62, Fig. 130b.

Holozoa bermudensis Van Name, 1921, Bull. Amer. Mus. Nat. Hist., Vol. XLIV, p. 363, Fig. 43.

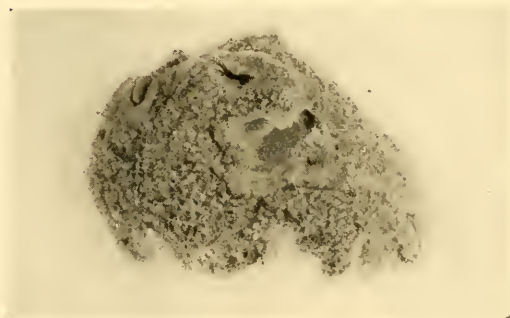


FIG. 29.—*Distaplia bermudensis* Van Name, 1902. A colony, natural size.

Diagnosis.—The form of the colony is very variable: sometimes capitate, consisting of one or more heads, usually somewhat flattened on top with rather abrupt sides tapering into a short peduncle, in other cases it forms a flat incrusting sheet, commonly 4 or 5 mm. thick and often several centimeters across. The colony may, however, have any of an infinite variety of intermediate forms. The heads in the capitate colonies may reach a diameter of 20 mm. or more. They are rarely of very symmetrical form. The colors of the colonies are as variable as their shape, often very brilliant during life, but usually fading to a green, blue-green, yellowish or olive tint in preserved material, though

some alcoholic specimens are reddish or pink, or are mottled or marbled with areas of greenish or blue-green and red or pink. As a rule, the basal parts of the colony are pale, the upper portions darker, sometimes shading into blackish. The colors of living specimens are much more varied and beautiful, often chocolate-brown, shading into or marbled with olive, violet, purple, black, rose color, or even an intense orange-red; any one of these colors may predominate. White pigment is often present about the orifices. These colors are chiefly due to oval pigment cells in the test.

The test is translucent or semitransparent; the surface of the colony is not shiny. The zooids are arranged in systems, sometimes composed of but few zooids, in other cases extensive and complex. Vascular processes, straight and unbranched, extending down from the posterior ends of the zooids, are often conspicuous in the basal parts of the colonies.

Expanded zooids may measure over 3 mm. in length and 1.3 mm. across the thorax, even in preserved material, but are much subject to shrinkage owing to the delicacy of their tissues, which are often beautifully transparent. The mantle musculature is slight, consisting chiefly of very delicate bands in the thorax, which run largely in oblique directions. This is in strong contrast to the condition prevailing in the genus *Polycitor*, where there are very powerful longitudinal bands on the thorax. Even the sphincter of the branchial orifice is comparatively weak in the present genus. The margin of branchial orifice has irregular rounded teeth or crenations; when contracted often appearing plain. Atrial orifice large, smooth-margined, its anterior lip produced into a large languet.

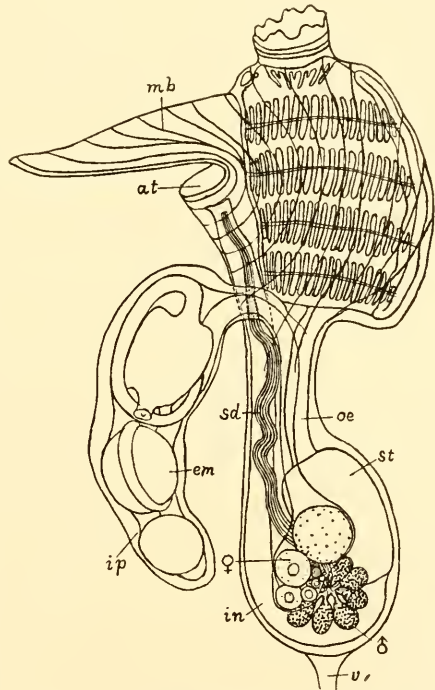


FIG. 30.—*Distaplia bermudensis* Van Name 1902. Zooid with incubatory pouch containing three embryos or larvae, $\times 30$.

The stomach is elongate-oval, tapering toward the pyloric end. In all of the many zooids examined from different colonies and localities, its walls were found smooth within and without. The stomach and proximal part of the intestine are orange or yellow in life.

The zooids are hermaphroditic; the reproductive glands are on the right side of the intestinal loop. The small, oval testes (about ten to twelve in number) and the ovary lie close together. The thick-walled sperm duct accompanies the ascending branch of the intestine. The delicate, thin-walled oviduct does likewise for a distance, then enters the incubatory pouch. The latter structure is not present on all zooids, and in many colonies none will be found on any of them. Apparently it develops only when needed to receive the embryos. It is a large, elongate, curved, tapering evagination of the wall of the right posterior dorsal part of the peribranchial cavity, connected with the body of the zooid by a neck too narrow to allow the embryos to pass out again when they have attained their growth; these escape by bursting the walls of the pouch and the surrounding test substance. The embryos are arranged in the pouch in one row, the oldest in the proximal part. Often pouches with their contents of developing young are found lying in the test unattached to any zooid, having broken away, or the zooids originating them having died and been absorbed.

Habits.—This is a shallow-water species which grows on stones, piles, corals and a great variety of other objects, including other species of ascidians.

Distribution.—This is one of the commonest species at Bermuda and at St. Thomas, W. I. At Porto Rico it was found common along the shores of Guanica Harbor, and was also dredged off the mouth of that harbor in 5 fathoms and near the mouth of Guayanilla Harbor in 15 feet. One colony was also obtained in San Juan Harbor below San Antonio bridge.

***Distaplia bursata* (Van Name)**

(Included as likely to be found.)

Holozea bursata Van Name, 1921, Bull. Amer. Mus. Nat. Hist., Vol. XLIV, p. 366, Figs. 44-47.

Diagnosis.—The peculiar mushroom-like shape of mature colonies and the situation of the ovaries and testes of the zooids in a pouch-like diverticulum of the abdomen are clearly shown in the illustrations. Only in the case of immature colonies that have not attained their characteristic shape would there be any danger of confusing it with *D. ber-*

mudensis. The color of preserved specimens is yellowish to grayish brown.

Distribution.—Known from Marco and Key West, Florida, washed up on the beach and from southeast of Jamaica (52 fathoms).

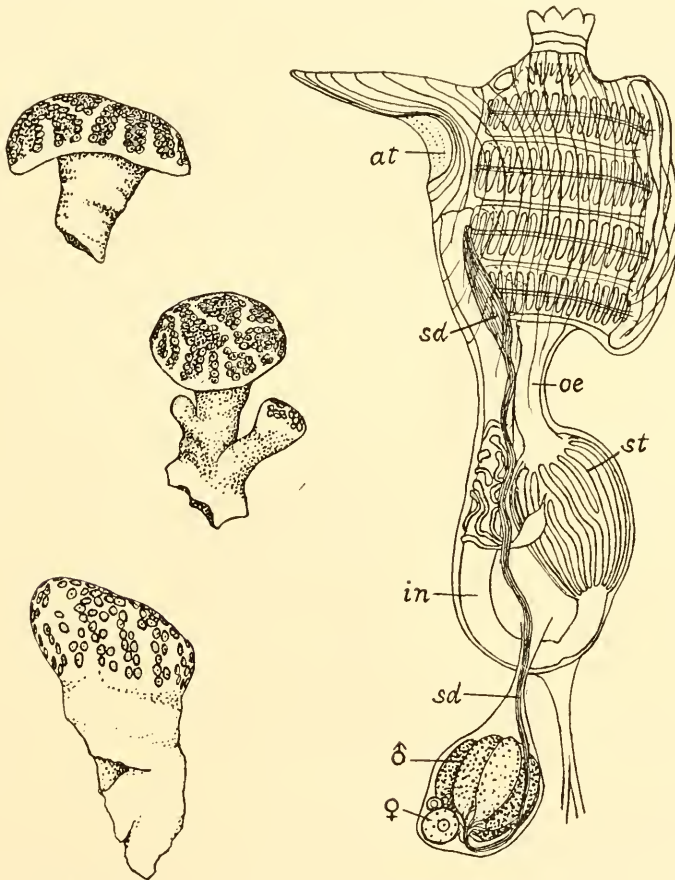


FIG. 31.—*Distaplia bursata* (Van Name), 1921. Three colonies, $\times 1.3$, and zooid $\times 55$.

Order PHLEBOBRANCHIATA Lahille

[= Diktyobranchia Seeliger]

This is a rather well-defined, though varied group of simple and compound ascidians having a system of internal longitudinal vessels (though in a few cases these are rudimentary or lost), but no large folds in the branchial sac. The tentacles are always simple, the gonads are on one side only, in the immediate vicinity of the digestive tract.

DIAZONIDAE Garstang

This is a small family that has the body divided, as is usual in compound ascidians, into thorax and abdomen, and the dorsal lamina replaced by a series of languets, but it is distinguished by possessing internal longitudinal vessels (usually well developed) and many rows of stigmata in the branchial sac.

Rhopalaea Philippi**Rhopalaea abdominalis** (Sluiter)

(Included as likely to be found)

Ciona abdominalis Sluiter, 1898, Mém. Soc. Zool. France, Vol. XI, p. 8, Pl. 1, Figs. 3-8.

Rhopalaea abdominalis Van Name, 1921, p. 372, Figs. 48-51.

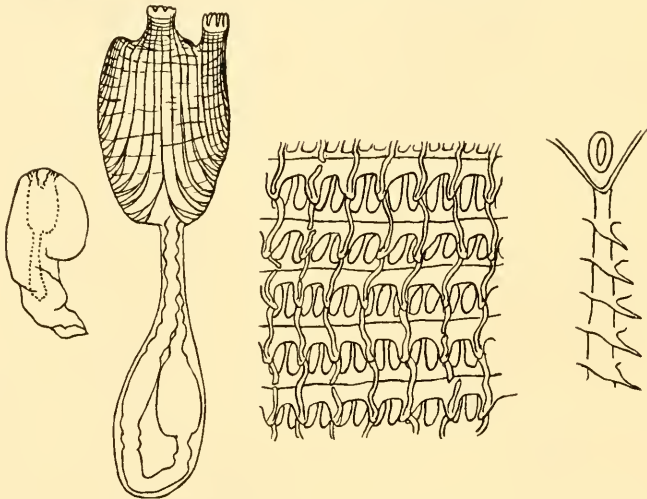


FIG. 32.—*Rhopalaea abdominalis* (Sluiter), 1898. On the left, the outline of the entire individual, including the test, slightly enlarged. In the center, the individual removed from test, showing muscle bands on mantle, $\times 5.6$; also a piece of the branchial sac, $\times 5.6$. In the right, the upper part of the median dorsal vessel, showing the dorsal tubercle and five of the dorsal languets, $\times 56$.

Diagnosis.—Of the few specimens of this species that were collected, only one shows any evidence of budding, consisting of several small individuals united by their basal portions into an irregular group; the other specimens each consist of a single individual only.

The external form is exceedingly variable and usually quite irregular, owing to the great and uneven thickness of the test. The normal form

is evidently club-shaped, with the anterior end large and rounded; the posterior part of the body is usually narrower, though irregularities in the thickness and outline of the test may alter these relations. The attachment is in most cases by the greater part of one side, leaving, however, the anterior part of the body more or less free. The external length of the largest individual is 24 mm., the greatest width about 10.5 mm.; when removed from the test, the body in its somewhat contracted state may be only from one-half to two-thirds of the external length.

Test free from incrusting foreign matter and smooth externally, except for a few slight wrinkles, which are probably due to shrinkage in preservation. It is semitransparent, slightly cartilaginous in character, and not very tough, though a thin inner layer of a much tougher consistency immediately incloses the abdominal part of the body of the animal. The color of the alcoholic specimens is carmine pink or somewhat violet-pink, shading toward a deep carmine on the anterior part of the body, especially about the apertures.

The branchial sac of zooids has about forty rows of very small and numerous stigmata. The rows are separated by transverse vessels bearing small triangular papillae which support a well-developed system of internal longitudinal vessels. These vessels connect with the supporting papillae a little below the tips of the papillae, so that the tips project into the branchial cavity a very little beyond the level of the internal longitudinal vessels. Reproductive organs placed in the abdomen beside the intestinal loop. They consist of a saccular ovary and of very numerous small pear-shaped testes whose common sperm duct accompanies the ascending branch of the intestine.

Distribution.—Described by Sluiter from a specimen obtained at La Tortuga Island, Venezuela, in 45 fathoms. The steamer "Albatross" dredged what is apparently the same species at several stations off the Florida coasts in 23 to 45 fathoms. The above description is based on the "Albatross" specimens.

ASCIDIIDAE (Nomen Conservandum)

[= Ascidiidae, s. Phallusiidae *auct. omn.* + *Perophoridae* Giard]

The body is not divided into a thorax and abdomen. The digestive and reproductive organs lie beside the branchial sac on the left side of the body. The branchial aperture most frequently has eight or seven lobes, the atrial aperture six. The tentacles are simple and filiform. The dorsal lamina is a continuous (often toothed) membrane, or is re-

placed by a series of languets. The branchial sac has internal longitudinal vessels (which often bear papillae), but no large folds. The reproductive organs are in, or spread over the surface of, the intestinal loop.

In the classification here adopted *Perophora* and allied genera are included in the Ascidiidae on account of their close conformity in structure to that family, although they reproduce by budding and have zooids of small size. It seems likely that the typical Ascidiidae, which are large forms, originally possessed but have now lost the power of budding. Similar examples of closely allied simple and compound forms occur in the family Styelidae (see below).

Perophora Wiegmann

These are compound ascidians with small zooids having only a few rows of stigmata. In our species the zooids are entirely separate, connected only by vine-like

branching vessels. The dorsal lamina is represented by languets.

Perophora viridis Verrill

Perophora viridis Verrill, 1871, Amer. Jour. Sci., (3), Vol. II, p. 359.

Perophora viridis, Van Name, 1921, Bull. Amer. Mus. Nat. Hist., Vol. XLIV, p. 373, Fig. 52.

This species is considered identical with *P. listeri* Forbes and Hanley, 1848, of European waters, by Harant (1927, Ann. Inst. Océan., Vol. IV, p. 236). If that is correct, the name *listeri* has priority.

Diagnosis. — The small ovoid bodies of the zooids of this species, which measure from 2.5 to 3.5 mm. in

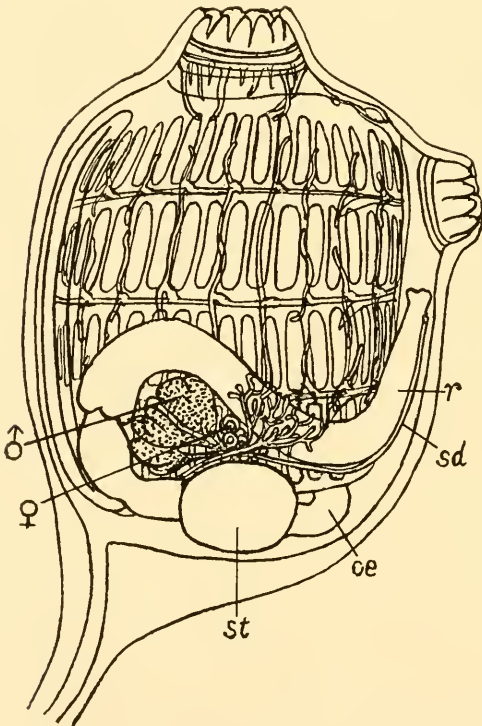


FIG. 33.—*Perophora viridis* Verrill, 1871.
Zooid, $\times 27$.

greatest diameter (length), are borne on the tips of the branches of a slender stolon which grows like a vine over shell, algæ, other ascidians, or other submerged objects in shallow water. The zooids have a thin, transparent covering of test; their tissues are usually transparent and colorless, except for some yellowish or greenish pigment contained in branching vessels in the mantle, which, aside from the sphincters of the apertures, has only a few slender longitudinal and oblique muscle bands. The apertures have a variable number of lobes.

The reproductive glands lie in the intestinal loop. The male glands are pear-shaped or cuneate: arranged in a fanlike manner about the origin of the common sperm duct with which they communicate by small individual ducts. Their number varies in different individuals: in some zooids some or most of the individual glands are fused together into a large mass, though this may be incompletely divided by clefts into lobes representing the individual glands. The common sperm duct accompanies the rectum. The ovary is situated besides the origin of the common sperm duct.

Distribution.—Collected at Ponce, Porto Rico, along the shore and off Point Brea, in $9\frac{1}{2}$ fathoms. This is the most southern record for the species, which ranges from New England to Bermuda and Florida.

Ecteinascidia Herdman

This genus differs from *Perophora* chiefly in the elongated branchial sac with many rows of stigmata, and in the larger size of the zooids.

Ecteinascidia turbinata Herdman

Plate VI

Ascidia claviformis ? Lesueur, 1823, Journ. Acad. Nat. Sci. Philadelphia, Vol. III, p. 5, Pl. 1, Fig. 3.

Ecteinascidia turbinata Herdman, 1880, Proc. Royal Soc. Edinburgh, Vol. X, p. 724.

Ecteinascidia turbinata (? part) Herdman, 1882, Rept. Voy. Challenger, Zool., Vol. VI, p. 243, Pl. 36, Figs. 1-6.

Ecteinascidia turbinata Van Name, 1921, Bull. Amer. Mus. Nat. Hist., Vol. XLIV, p. 375, Fig. 54.

Diagnosis.—The colony in this species consists of a dense group or cluster of elongate, somewhat club-shaped zooids, each with its own separate covering of test, which are connected by their tapering bases

with a network of stolons that adheres to the surface of the object on which the colony grows. Mangrove roots and turtle grass are among the most frequent bearers of such colonies; in such cases the colony generally

entirely surrounds the root or the grass, not infrequently for a length of 12 or 15 cm.

The zooids ordinarily are about 20 mm. long or less, but are occasionally larger. They are of oblong form, truncate at the anterior end, where the two apertures are situated, and rather abruptly tapered at the other end to a narrow pedicel containing the vessel that connects the individual with the rest of the colony.

The test is transparent and colorless, thicker on the ends of the body. The mantle and internal organs are also very transparent, but in the living zooids and in specimens not too long preserved, this shades into yellow, orange or pinkish orange on the anterior part of the body, the color being largely due to pigment in cells in branching vessels in the mantle. The intestinal loop is colored yellow or orange.

The reproductive organs are in the bend of the intestinal loop. The male portion consists of a C-shaped or horseshoe-shaped group of small oval or lobed glands which lie more or less concentrically with the curvature of the intestine. The common sperm duct accompanies the rectum almost to the anus. The ovary consists of a cluster of eggs in the bend of the C-shaped group of testes. No oviduct was demonstrated.

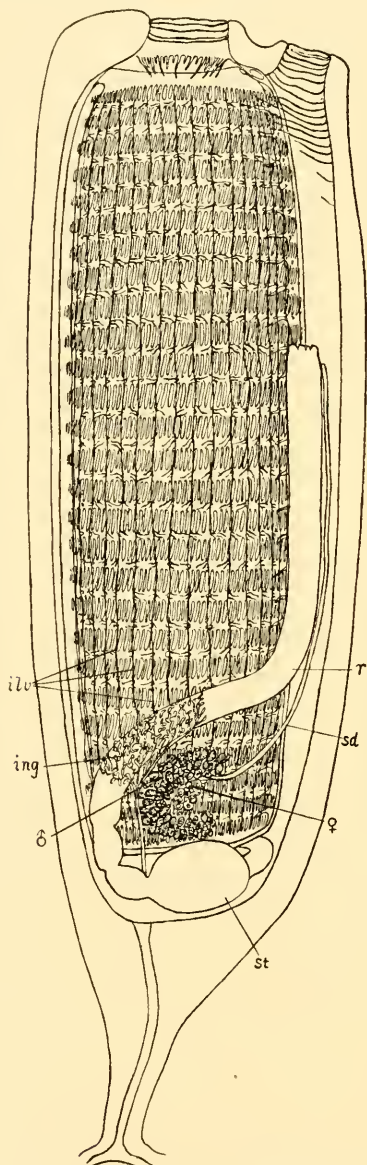


FIG. 34.—*Ecteinascidia turbinata* Herdman, 1880. Zooid, $\times 7.2$.

Young zooids have the body shorter and more oval, the apertures more prominent and relatively farther apart, and the rows of stigmata less numerous than in the adult. They much resemble individuals of the genus *Perophora* in their appearance.

Distribution.—Widely distributed in the West Indian region. No record as yet from Porto Rico, but it was collected along the shore at St. Thomas, Virgin Islands, by the steamer "Albatross."

Ascidia Linnaeus (Nomen Conservandum) = *Phallusia* Savigny

These are simple ascidians, often of large size, with characters as given above for the family. Papillae are present on the internal longitudinal vessels. Dorsal lamina consists of a continuous (often more or less toothed) membrane.

Ascidia nigra (Savigny)

Plate III, lower fig.

Phallusia nigra Savigny, 1816. Mém. s. l. animaux sans vertèbres. Vol. II, Pt. 1, p. 163. Pl. 2, Fig. 2; Pl. 9, Fig. 1.

Ascidia atra Lesueur, 1823. Journ. Acad. Nat. Sci. Philadelphia, Vol. III, Pt. 1, p. 2. Pl. 1, Fig. 2.

Phallusia nigra Van Name, 1921. Bull. Amer. Mus. Nat. Hist., Vol. XLIV, p. 379. Figs. 55-58.

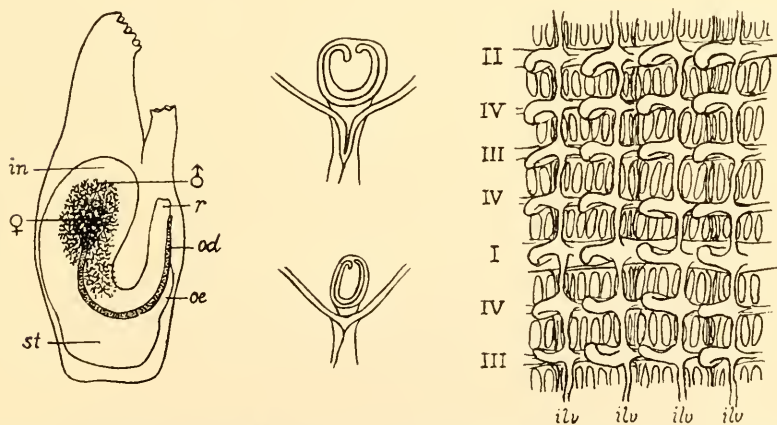


FIG. 35.—*Ascidia nigra* (Savigny), 1816. The left side of the body slightly reduced; the dorsal tubercles of two individuals and part of the branchial sac. $\times 32$.

Diagnosis.—The body is oval or elongate, more or less flattened from side to side. The atrial aperture is usually on a short anteriorly directed tube or prominence, a little way back from the anterior end. The whole

anterior part of the body is very commonly curved dorsally so as to bring the two apertures quite close together. This seems to be more or less characteristic of this species. Attachment by an area on the posterior or left posterior part of the body, sometimes by much of the left side.

The test is thick and firm but not very tough. The color is blue-black; the surface is smooth and shiny, with the exception of a few shallow furrows. The color, which pervades many of the internal structures as well as the test, is retained in preserved specimens. Very young specimens are colorless, but the dark pigment usually begins to appear when they are still very small.

The largest specimen in the Porto Rico collection measures even in a strongly curved condition 95 mm., and 45 mm. in transverse (dorso-ventral) diameter, but usually a length of 60 mm. is not exceeded. The mantle is dark colored and is provided with many narrow longitudinal muscle bands that are crossed by slenderer and more closely placed transverse and oblique bands forming a fine network. On the right side the musculature extends the whole length of the body; on the left side the muscles disappear on the region covering the stomach and intestine.

Distribution.—One of the largest, commonest and most conspicuous of the West Indian ascidians, also known from the Red Sea (type locality). Reported from the Virgin Islands. In Guanica Harbor, Porto Rico, it was very common on piles and mangrove roots, often growing with other ascidians.

***Ascidia hygomiana* (Traustedt)**

Ascidia interrupta ? Heller, 1878, Sitzungsber. Akad. Wiss. Wien, math.-nat. Kl., Vol. LXXVII, p. 89, Pl. 2, Fig. 9.

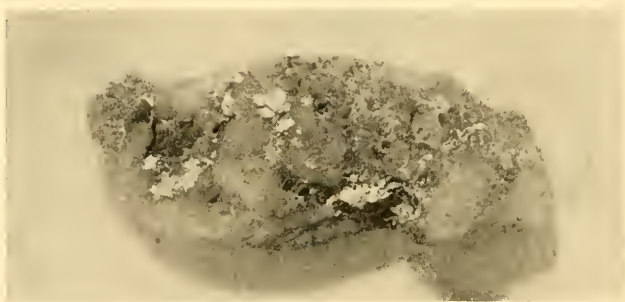


FIG. 36.—*Ascidia hygomiana* (Traustedt), 1882. Natural size.

Phallusia hygomiana Traustedt, 1882, Vidensk. Meddel. natur. For. Kjöbenhavn, ann. 1881, pp. 280, 286, Pl. 4, Fig. 7; Pl. 5, Fig. 18.

Phallusia hygomiana Van Name, 1921, Bull. Amer. Mus. Nat. Hist., Vol. XLIV, p. 383, Figs. 59-61.

Diagnosis.—Closely related to *A. nigra* but lacking the blue-black pigment, the test being yellowish gray or yellowish brown, or in some specimens tinged with smoky bluish or pinkish gray, but without any decided pigmentation. Its surface is usually fairly even but generally not shiny, and is often discolored with mud, and commonly not transparent. In size it is usually inferior to *A. nigra*, at least in bulk if not also in length.

Its external shape and appearance are very variable; the form is usually rather elongate, the branchial aperture terminal on the somewhat narrowed anterior part of the body, the atrial aperture rather far back (often near the middle of the dorsal border) on a short tube which usually extends out at a considerable angle from the long axis of the body. The body is usually considerably compressed laterally; in the more regularly shaped specimens the dorsal, ventral and posterior borders are thick and rounded, but the body is very liable to distortion, or

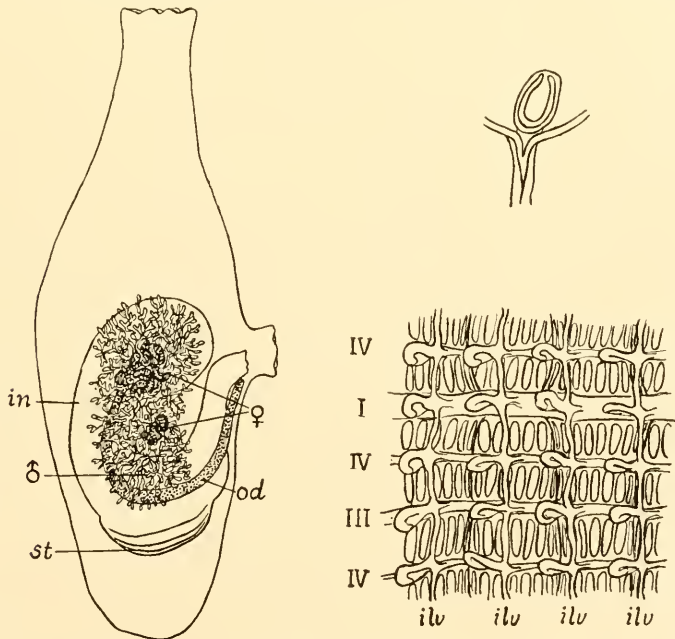


FIG. 37.—*Ascidia hygomiana* (Traustedt), 1882. The left side of the body, $\times 3$, dorsal tubercle, $\times 10$, and part of branchial sac, $\times 36$.

to irregular depressions, folds or furrows, which often greatly disturb its symmetry and baffle all attempts to give a description which would cover all the variations. Attachment is usually by the left ventral region, but individuals vary greatly in this respect.

The branchial sac is usually narrow and tapering in the anterior part. The posterior part extends back a considerable distance beyond the stomach, and is also usually somewhat narrowed, its extreme posterior end being usually rounded off or extended into a rather narrow rounded apex, but there is great variation in its shape in different individuals.

The mantle musculature in most respects is rather similar to that of *A. nigra* but the greater part of the left side is almost entirely free from muscles. Another difference distinguishing it from *A. nigra* is that the alimentary tract is smaller, covering in most individuals a smaller proportion of the left side, though the intestinal loop is bent a little more than in that species and its anteriorly extending loop is opened out somewhat more. Near the end the rectum often makes an abrupt dorsal bend, conforming to the dorsal direction of the atrial tube. Many of the specimens have the part of the intestine between the apex of the anterior loop and the commencement of the rectum greatly distended with mud into a saccular enlargement. The stomach is small, its wall with a few obscure plications.

Distribution.—It was obtained in great abundance on the piles and stringpieces of the wharves in Guanica Harbor, Porto Rico, by the American Museum expeditions. Most of the specimens were growing in densely crowded clumps and clusters containing several other kinds of ascidians, mussels, worm tubes, etc., besides numbers of this species, and the individuals were much compressed and distorted, owing to this crowding and pressure. It is also recorded from St. Thomas, Virgin Islands, where it was observed growing on piles. Known also from the North Carolina coast, Bahamas, Cuba, etc.

***Ascidia curvata* (Traustedt)**

Phallusia curvata Traustedt, 1882, Vidensk. Meddel. natur. For. Kjöbenhavn, ann. 1881, pp. 281, 286, Pl. 4, Figs. 8-10; Pl. 5, Fig. 19.

Phallusia curvata Van Name, 1921, Bull. Amer. Mus. Nat. Hist., Vol. XLIV, p. 389, Figs. 66-68.

Diagnosis.—The body is long and narrow, tapering to the branchial aperture at the anterior end and more or less truncate at the posterior end; usually attached by a large part of the left side, the tubes being turned more or less to the right or exposed side. The atrial tube far

back, often beyond the middle of the body, usually rather short. The test very thin on the attached side, thicker on the other, pale gray or colorless, and sometimes very transparent: markings of light orange-brown about the apertures are present in many living specimens. Some

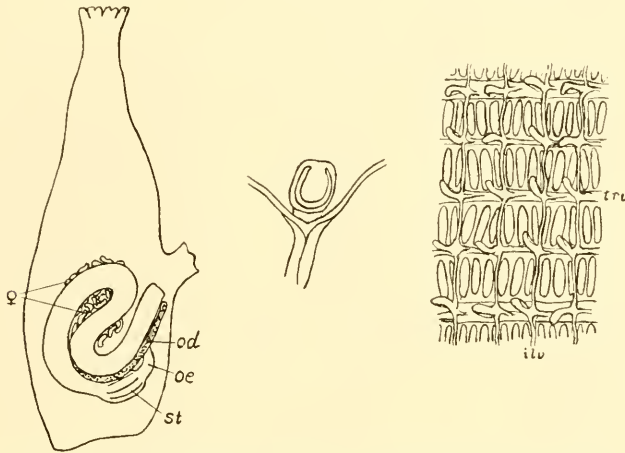


FIG. 38.—*Ascidia curvata* (Traustedt), 1882. The left side of the body, $\times 2.2$, dorsal tubercle, $\times 16$, Fig. 68, and part of the branchial sac, $\times 42$.

individuals have the external surface smooth and clean: others are wrinkled, or more or less completely covered with small shell fragments rather loosely adherent or slightly imbedded.

The mantle is delicate and transparent. The body musculature is weak and mainly confined to the right side, where it consists of a delicate and rather open network of transverse and oblique fibers or very narrow bands crossing each other at various acute angles.

The branchial sac extends a varying distance posterior to the stomach in different specimens.

The alimentary loop is proportionately smaller than in *A. hygomiana* and considerably more bent, forming a fairly compact mass chiefly or entirely in the posterior half of the body. The stomach is small, with a few longitudinal plications.

This is a smaller and more delicate species than *A. hygomiana* with a more transparent test. The largest specimen seen was about 50 mm. long; the usual size is not over one half or two thirds that length.

Distribution.—This species was described by Traustedt from St. Thomas, Virgin Islands. The American Museum collection contains a specimen from San Juan Harbor, Porto Rico. It is common at Bermuda.

Ascidia sydneyensis Stimpson

Ascidia sydneyensis Stimpson, 1855, Proc. Acad. Sci. Philadelphia, Vol. VII, p. 387.

Phallusia sydneyensis Van Name, 1921, Bull. Amer. Mus. Nat. Hist., Vol. XLIV, p. 386, Figs. 62-65.

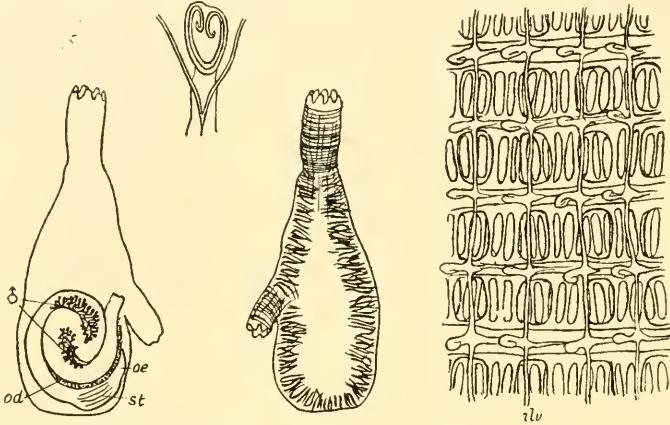


FIG. 39.—*Ascidia sydneyensis* Stimpson, 1855. The dorsal tubercle, $\times 12$; the left side of the body, $\times 1.6$; the right side of the body showing the arrangement of the muscles in the mantle, $\times 1.6$; and part of the branchial sac, $\times 42$.

Diagnosis.—At once distinguishable from *A. hygomiana*, when removed from the test, by the peculiar arrangement of the mantle muscles. The whole left side is nearly free from muscles, the mantle being thin, colorless and transparent. The greater part of the right side is in the same condition, but all round the dorsal, ventral, and posterior margins of the right side there is a wide border of short stout muscle bands extending inward from the margin for a varying distance. They lie for the most part parallel to each other and at right angles to the margin (Fig. 21).

The alimentary tract is very compactly disposed and the branchial sac does not extend much, if at all, posterior to it. The test is usually transparent and colorless. The size of the largest specimen examined was 53 mm. by 27 mm.

Distribution.—Though widely distributed in the Pacific and Indian oceans, this is a rare species in the West Indies. At Porto Rico two small specimens were dredged by the American Museum Expedition; in Guanica Harbor, at a depth of from 10 to 20 feet, in mud, and in Condado Bay, San Juan, at a depth of from 16 to 22 feet, in sand and mud.

Traustedt reported it from St. Thomas, Virgin Islands (there is also a specimen from there in the U. S. National Museum, and Crab (Vieques) Island of the same group.

***Ascidia corelloides* (Van Name)**

(Included as likely to be found)

Phallusia corelloides Van Name, 1924, Bijdr. t. d. Dierkunde, part XXIII, p. 27, Figs. 2-4.

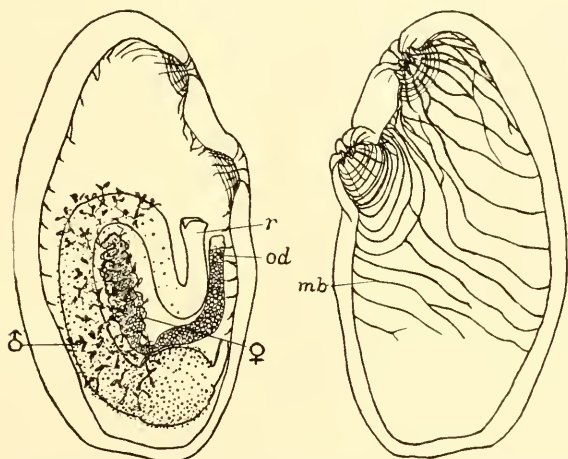


FIG. 40.—*Ascidia corelloides* (Van Name), 1924. The left and right sides of the body, $\times 3.5$.

Diagnosis.—The body is ovate, more or less flattened; the test is transparent, nearly colorless or slightly brownish, its substance tough and permeated by branching blood vessels, thick (especially toward the anterior end) and with the surface smooth and free from foreign matter, without many folds or wrinkles.

The mantle musculature is mainly confined to the right side and consists of oblique bands; the alimentary tract occupies more than half of the left side.

The tentacles are few; the dorsal tubercle is very small, with a simple orifice, which appears U-shaped in one specimen. The dorsal lamina are plain-edged, but with well developed transverse buttress membranes arising from each transverse vessel; these are higher than the dorsal lamina itself, and those of opposite sides unite to form a tooth or languet where they meet over the dorsal lamina.

The branchial sac with papillae on the internal longitudinal vessels at the points of crossing the transverse vessels, and *additional somewhat smaller papillae at the points midway between the transverse vessels*. This is the only known West Indian *Ascidia* having these intermediate papillae.

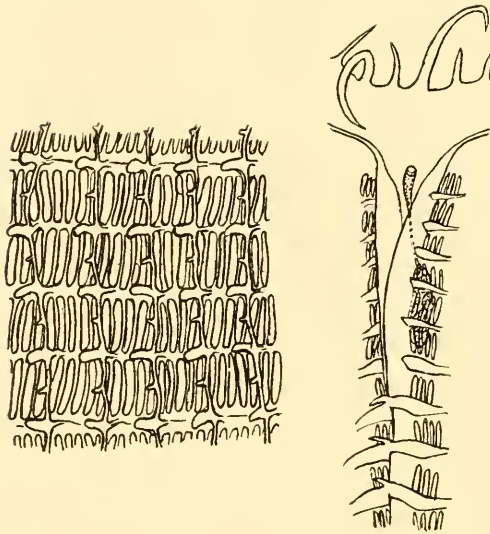


FIG. 41.—*Ascidia corelloides* (Van Name), 1924. Part of the branchial sac, $\times 25$, and part of the circle of tentacles with dorsal tubercle and anterior end of the branchial sac, $\times 18$.

Distribution.—The type locality of this species is Caracas Bay, Curaçao (see Van Name, 1924). A small specimen (12 mm. long) was collected by Mr. William Beebe in Port-au-Prince Bay, Haiti, in 1927.

Asciella Roule

Differs from *Ascidia* chiefly in having no papillae on the internal longitudinal vessels of the branchial sac.

Asciella styeloides (Traustedt)

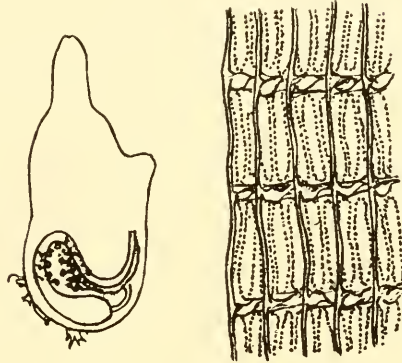
Phallusia styeloides Traustedt, 1882, Vidensk. Meddel. nat. For. Kjöbenhavn, ann. 1881, p. 277, Pl. 4, Fig. 5. Pl. 5, Fig. 16.

Asciella styeloides Van Name, 1921, Bull. Amer. Mus. Nat. Hist., Vol. XLIV, pp. 391, 483. (No description.)

Diagnosis.—This species, which I have not seen, is described by Traustedt as having the test thin, membranous, transparent and almost smooth. It may be readily distinguished from the species of *Ascidia* described above by the different curvature of the alimentary tract, which

is shown in the figure, as well as by the absence of papillae on the internal longitudinal vessels of the branchial sac. Traustedt gives 12 by 5 mm. as the dimensions.

FIG. 42.—*Ascidella styeloides* (Traustedt), 1882. The left side of the body, $\times 4$, and part of the branchial sac, enlarged (outlines of Traustedt's figure).



Distribution.—Traustedt reports it from St. Croix and St. Thomas, Virgin Islands. There are no other records.

RHODOSOMATIDAE Hartmeyer

This is a small but widely distributed and varied family of simple ascidians, characterized (in many cases at least) by the course of the intestine, which bends ventrally after leaving the stomach, instead of dorsally as in most ascidians, thus coming to lie more or less on the right side of the body beside the branchial sac. Internal longitudinal vessels are commonly present, though sometimes rudimentary or lost; there are no large folds in the branchial sac.

Rhodosoma Ehrenberg

Anterior end of the body is modified into a valve or cover which can close upon and protect the apertures. The stigmata are straight.

Rhodosoma turcicum (Savigny)

Phallusia turcica Savigny, 1816. Mem. Anim. sans Vert., Vol. I, pp. 102, 105, Pl. 10, Fig. 1.

Rhodosoma pellucidum Van Name, 1921. Bull. Amer. Mus. Nat. Hist., Vol. XLIV, p. 392, Figs. 69 and 70.

Rhodosoma pellucidum Van Name, 1924. Bijdr. t. d. Dierkunde, part XXIII, p. 29.

Diagnosis.—Body more or less irregularly oblong, not much compressed laterally, tapering toward the posterior end and commonly attached by an area on the posterior part of the right side. The anterior end of the body is obliquely truncated. Just behind the anterior margin

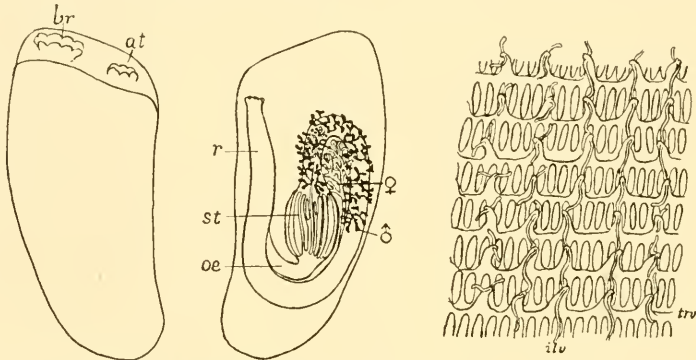


FIG. 43.—*Rhodosoma turcicum* (Savigny), 1816. The left and right sides of the body, $\times 2$, and part of the branchial sac, $\times 38$.

a deep, obliquely transverse cleft partially separates the anterior wall of the body, which thus forms a hinged lid or cover, so that the two edges of the cleft may be brought together or separated. In the soft flexible test with which this cleft is lined the two apertures are situated, near together, but the branchial a little nearer the anterior end than the atrial. The former has about eight obscurely defined lobes, and is somewhat more prominent than the atrial, which has but six lobes. The test is rather transparent, usually nearly colorless in preserved specimens; free from foreign matter and smooth externally, except for numerous minute conical points or projections arising from the surface on the anterior end of the body and in the vicinity of the above-mentioned cleft. (Occasionally the surface is incrustated with foreign matter, or overgrown with other organisms.) The test not very thick, but firm and rigid, particularly the portion constituting the lid and the margins of the cleft (which are somewhat thickened); the part lining the cleft is softer and quite flexible, permitting the lid to close tightly and entirely conceal the apertures. The species attains a length of 50 mm. or more but specimens are usually much smaller. When tightly closed, the cleft may be easily overlooked.

Remarks.—This is apparently the only valid species of the genus. It is widely distributed in warm seas and has been described under many different names.

Distribution.—In most parts of the West Indies it seems to be rather uncommon, but many specimens were obtained by Dr. Van der Horst at Curaçao. Only one specimen was obtained by the American Museum expedition at Porto Rico (Condado Bay, San Juan Harbor, at a depth of from 16 to 22 feet, in sand and mud). Traustedt, 1881, reported it from both St. Croix and St. Thomas, Virgin Islands.

Corella Alder and Hancock

There is no valve or cover for the apertures. The stigmata are arranged in small spirals.

Corella minuta Traustedt

Corella minuta Traustedt, 1882, Vidensk. Meddel. natur. For. Kjöbenhavn, ann. 1881, p. 271, 285, Pl. 4, Fig. 1.

Corella minuta Van Name, 1921, Bull. Amer. Mus. Nat. Hist., Vol. XLIV, p. 395, Figs. 71 and 72.

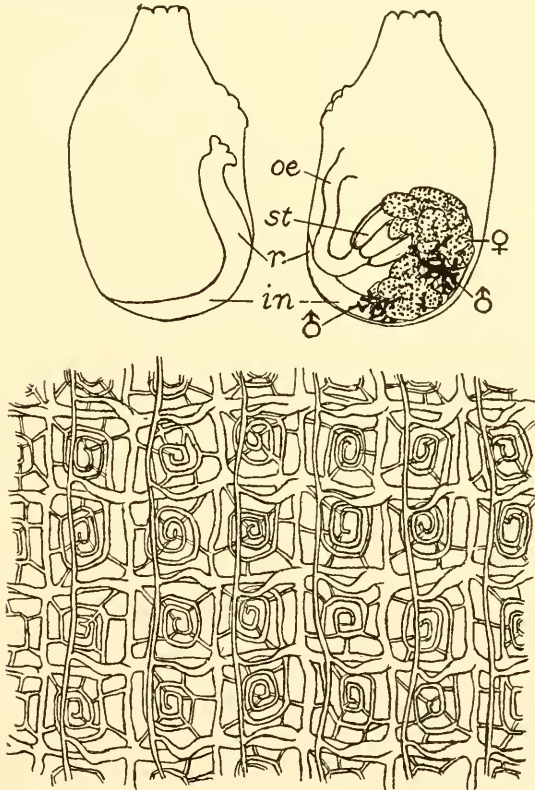


FIG. 44.—*Corella minuta* Traustedt, 1882. The left and right side of the body, $\times 2.5$, and part of the branchial sac, $\times 25$.

Diagnosis.—The body ovate; the test thin, flexible and often quite transparent, its surface smooth and clean except for wrinkles and folds, many of which, however, are probably caused by shrinking and are not present during life. The size of the largest specimen is 28 mm. long by 18 mm. in greatest dorso-ventral diameter.

The mantle is very thin and transparent, practically free from muscles.

The branchial sac is divided into small square meshes by transverse and longitudinal vessels. In each mesh there is normally a slender spiral vessel making usually from two to four complete turns. In addition to the above vessels there is a system of slender internal longitudinal vessels, raised on high, tapering supporting papillae which arise from the transverse vessels.

Distribution.—This is a rare species confined to the West Indies and Florida. Traustedt reported it from St. Thomas, Virgin Islands, but there are as yet no records from Porto Rico. Van der Horst obtained a small specimen at Curaçao (see Van Name, 1924) and lately (1927) one was collected by Beebe at Haiti (Port-au-Prince Bay).

Order STOLIDOBRANCHIATA Lahille

[= Ptychobranchia Seeliger]

The most highly specialized order of ascidians. It contains both compound and simple forms. The body is never divided into a thorax and abdomen: the digestive tract and reproductive organs always lie beside, or project only slightly behind, the branchial sac, which has internal longitudinal vessels and a few large longitudinal folds or plications (rudimentary or lost in a few forms). The tentacles are sometimes branched.

BOTRYLLIDAE Verrill

A small but widely distributed group of compound ascidians evidently belonging to the same stock as the Styelidae, and very closely related to some of the compound members of that family, in which Michaelsen, following the suggestion made by Ärnäck, 1923, has recently, 1928, included them as a subfamily. They differ from the compound Styelidae in having the zooids arranged in well developed systems with common cloacal canals discharging by common cloacal apertures, instead of having the atrial aperture of the zooids opening separately and directly on the surface of the colony.

The branchial sac is without folds, and with only three internal longitudinal vessels on each side. The tentacles are simple. The dorsal lamina is a plain membrane. The colonies are soft, smooth and fleshy, usually thin and incrusting, but sometimes thick, and produced into lobes, or irregular, especially when growing on irregularly shaped objects. The systems in which the zooids are arranged may be small circular or oval groups with a common cloacal aperture in the center of each group, or may be elongate and irregular (often branched) and composed of many zooids.

Living colonies are often very strikingly and beautifully colored objects. In many of the species numerous color variations exist, but seem to be without significance as specific or even subspecific characters. The bright colors and conspicuous markings fade out after death. In preserved specimens the test is usually more or less transparent (pale grayish or purplish, or yellowish) and the zooids some shade of purple, purplish brown or brown, sometimes pale, sometimes dark, in a few species occasionally almost black. The test (as also in *Symplegma* among the Styelidae) contains branching blood vessels ending in enlarged bulbs. These are commonly most numerous and conspicuous near the margins of the colony.

Until recently the classification of this family was not well understood. Genera were based upon very superficial characters and a multitude of species were distinguished only by color, which is not to be relied on at all. The difficulty of determining specimens of this group is much increased by the fact that as a rule only a few colonies out of a large number of specimens contain zooids with both male and female reproductive organ well developed, while most of the other characters show a great deal of similarity throughout the family. The recent studies of Ärnäck Christie-Linde and Michaelsen have cleared up much of the uncertainty regarding the group and placed its classification on a sound basis. They recognize two genera, *Botryllus* and *Botrylloides* (syn. *Metrocarpa* Ärnäck), in European waters, and the American forms, several of which are identical with those of Europe, confirm the correctness of this classification.

In my monograph, 1921, of the West Indian ascidians two distinct forms (*Botrylloides nigrum* and *Botryllus planus*) were confused under the name *B. nigrum*. To prevent any misunderstanding that may arise from that cause it seems best to treat briefly all three of the species thus far reported from the West Indies and southeastern United States in the present article, although the error has already been corrected in my

article of 1924 on the ascidians of Curaçao, and although but one species has as yet been reported from Porto Rico.

Botryllus Gaertner and Pallas

In the restricted sense in which it is employed here, *Botryllus* is confined to forms having the ovaries anterior or dorsal to the testis and no incubatory pouch, the embryos developing in the peribranchial cavity. The anterior margin of the atrial orifice, which often forms a short, wide siphon, is usually produced into a large languet.

Botryllus planus (Van Name)

(Included as likely to be found)

Plate VIII

- Botrylloides nigrum* var. *planum* + *B. n.* var. *concolor* Van Name, 1902, Trans. Conn. Acad. Sci., Vol. XI, pp. 377, 378, Pl. 53, Figs. 53, 55; Pl. 59, Fig. 110.
Botryllus (Botrylloides) niger (part) Van Name, 1921, Bull. Amer. Mus. Nat. Hist., Vol. XLIV, p. 399, Fig. 74.
Botryllus niger (part) Michaelsen, 1921, Wiss. Meeresunters. (new series), Vol. XIV (Abt. Helgoland), p. 107.
Botryllus planus Van Name, 1924, Bijdr. t. d. Dierkunde, part XXIII, p. 30, Figs. 5 and 6.
Botryllus namci (in part, as far as applies to *B. nigrum* var. *planum* Van Name, 1902) Michaelsen, 1928, Fauna Südwest-Australiens, Vol. V, pp. 334, 335.

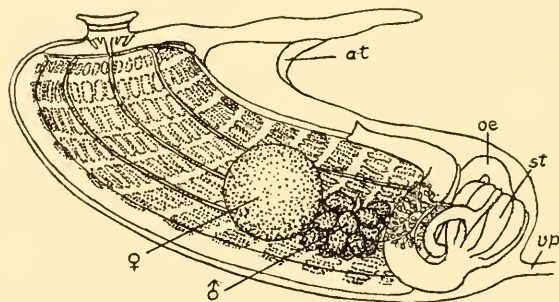


FIG. 45.—*Botryllus planus* (Van Name). 1902. Zooid seen from left side, $\times 36$.

Diagnosis.—Colonies incrusting, often several centimeters in greatest diameter, but rather thin, often so thin that the zooids, which do not average over 1.5 to 1.75 in length in the more or less contracted, preserved condition, are forced to assume either an inclined position or one somewhat parallel to the surface (the anterior end being upturned);

but in other cases the colony is thick enough to allow the zooids to assume a nearly upright position.

The systems are of irregular outline, often rather extensive.

The color very variable during life; in most cases the colony is dark colored, the zooids being some shade of purple, purplish-brown or blackish with a white, pale green or golden yellow area surrounding the branchial orifice of each zooid. These light colored markings fade out after death, the zooids generally becoming some shade of purple or brownish-purple. Some specimens collected at Bermuda were bright orange when alive, this color suffusing the test as well as the zooids. In alcohol the test lost its color and the zooids became reddish brown.

Not more than eight tentacles were demonstrated in the individuals studied. The number of rows of stigmata is somewhat variable, from eleven to thirteen being usual.

The reproductive and digestive organs furnish the easiest means of distinguishing this species. The male organs consist of a single testis on each side of the body, situated posterior to the middle and so deeply cleft into numerous (ten to twenty) rounded lobes that it appears like a rosette-shaped mass of small separate glands. The female organs consist of a single ovary on each side, each containing a large egg situated close to and directly anterior to the testis.

The stomach is oblong or barrel-shaped (though tapering somewhat more toward the pyloric end) with about 9 complete glandular folds and one incomplete one, that increase gradually in prominence toward the esophageal end, and a very long tubular curved pyloric cæcum that is slightly enlarged at the extreme end. (See Fig. 49a.)

Distribution.—This species will undoubtedly be found at Porto Rico, as it is known from Bermuda (the type locality), Florida and Curacao. It is very close to the Old World *B. magnicoecus* Hartmeyer, 1912, but even if not distinct, the name *planus* will have priority. The name *B. chazaliei* Sluiter, 1898, will, however, have priority if it belongs to this species, but the scanty information now available indicates that *chazaliei* is more probably a synonym of *Botrylloides nigrum* (see *Remarks* in connection with that species).

***Botryllus schlosseri* (Pallas)**

(Included chiefly for comparison, though its occurrence at Porto Rico or the Virgin Islands is possible)

Alcyonium schlosseri Pallas, 1766, Elench. Zoophyt., No. 208.

Botryllus schlosseri Van Name, 1921, Bull. Amer. Mus. Nat. Hist., Vol. XLIV, p. 398, Fig. 73.

Botryllus schlosseri + *B. namci* (part) Michaelsen, 1928, Fauna Südwest-Australiens, Vol. V, pp. 330, 334, 335.



FIG. 46.—*Botryllus schlosseri* (Pallas), 1766. A colony, natural size.

Diagnosis.—In this species the colony varies from thin and incrusting to rather thick and fleshy, and the zooids are arranged in small circular or elliptical, well separated systems of usually from about eight to twenty zooids. The colors are very variable during life but in preservation the zooids are generally rather light brownish or violet, and the test is pale grayish or nearly colorless.

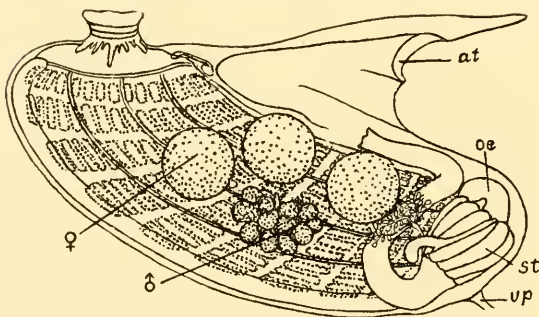


FIG. 47.—*Botryllus schlosseri* (Pallas), 1766. Zooid, $\times 36$.

The zooids average from 1.75 to 2 mm. in length and are of shorter, broader form than in *B. planus*, with fewer rows of stigmata (usually eight or nine). They often, if not usually, have sixteen tentacles. The

stomach resembles that of *B. planus* in many respects; it is elliptical, but contracts more toward the pyloric end than in that species and has about nine or ten longitudinal, somewhat spirally directed, glandular folds. One of these is produced near the pyloric end into a tubular caecum which is much curved and enlarged at the distal end. The caecum is not much more than half the length of that of *B. planus*; it has been well described as retort-shaped.

The male reproductive organs resemble those of *B. planus*, the testes being cleft into a large number of small lobes (often about twenty). The short sperm duct arises at or near its dorsal border. The female organs consist of from one to three ovaries containing one large egg each, on each side of the body. They form a more or less curved row dorsal to the testis (extending both anterior and posterior to the latter). There may be four or it is said, even five or six ovaries on one side, but in such cases the other side has a smaller number.

Distribution and Remarks.—Special attention should be called to the fact that often but one egg on each side will be found, and that in such cases this may be situated more or less anterior or antero-dorsal to the testis, much as in *B. planus*. In some colonies no more than one egg on each side is present in any of the zooids. Michaelsen's conclusion that such specimens described and figured in my report on the West Indian ascidians (1921, p. 398, Fig. 73) represent a different species which he proposes (1928, p. 330) to call *B. namei*, cannot be accepted. No member of the family except *B. schlosseri* is known from the coasts of the middle Atlantic and New England States save that in northern New England *Botrylloides aureum* Sars, 1851, occurs.* The *B. namei* of Michaelsen is in part a synonym of *schlosseri* and in part of *planus*. *B. schlosseri* is a species of much more northern distribution than either *Botryllus planus* or *Botrylloides nigrum*. It is common on the European coasts and on those of southern New England and the Middle States. It lives in the shallowest water, often growing on eel grass (*Zostera*) in great abundance. The U. S. National and American Museums have specimens from the west coast of Florida and the discovery of the species at Porto Rico or other West Indian points is, therefore, a possibility.

* Regarding *B. aureum* I may add that the contention of Årnåbäck Christie-Linde (Nyt. Mag. f. Naturv., LXI, p. 285) that it is a distinct and valid species, not merely a form of *Botryllus schlosseri*, as Hartmeyer (1923) and Michaelsen (1928) have treated it, seems to be perfectly correct. It is in fact a *Botrylloides*, not a *Botryllus* in the restricted sense of that genus.

Botrylloides Milne-Edwards(Syn. *Metrocarapa* Årnäck)

This genus is here employed in the emended sense proposed by Michaelsen for species having a single ovary with one large egg on each side of the body situated posterior to the testis. The egg passes by means of a short oviduct into a saclike incubatory pouch that develops as an outgrowth of the body wall for its reception. In these pouches, which extend from the posterior lateral part of the body on each side, the development of the embryo takes place. As thus used, *Botrylloides* is equivalent to *Metrocarpa* Årnäck Christie-Linde, 1923, but as the types of both genera seem to be the same, the earlier name is employed.

Botrylloides nigrum Herdman

Botrylloides nigrum Herdman, 1886, Rep. Voy. Challenger, Vol. XIV, p. 50, Pl. 1, Fig. 8; Pl. 3, Figs. 19-21.

Botrylloides chazaliei ? Sluiter, 1898, Mem. Soc. Zool. France, Vol. XI, p. 10.

Botrylloides nigrum (part) + *B. n.* var. *sarcinum* Van Name, 1902, Trans. Conn. Acad. Sci., Vol. XI, pp. 374, 378, Pl. 52, Fig. 54.

Botryllus (*Botrylloides*) *niger* Van Name, 1921, Bull. Amer. Mus., Nat. Hist., Vol. XLIV, p. 399 (part, not Fig. 74).

Botryllus niger Michaelsen, 1921, Wiss. Meeresunters. (new series), Vol. XIV, Abt. Helgoland, p. 107, Fig. 2.

Botryllus niger Van Name, 1924, Bijdr. t. d. Dierkunde, part XXIII, p. 30, Fig. 7.

Botrylloides nigrum Michaelsen, 1928, Fauna Südwest-Australiens, p. 345.

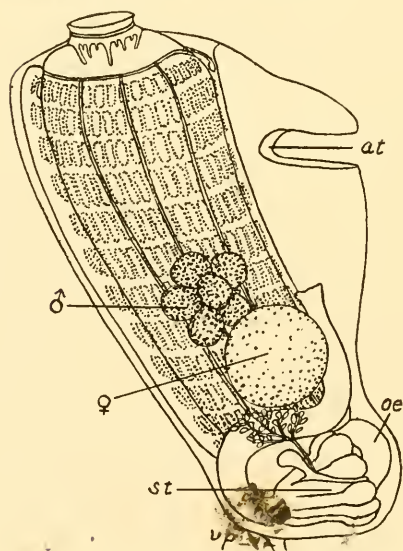


FIG. 48.—*Botrylloides nigrum* Herdman, 1886. Zooid, $\times 40$.

Diagnosis.—This species forms incrusting colonies with the zooids arranged in extensive, often branching systems much as in *Botryllus planus*, although in many cases the colony becomes considerably thicker than in that species. I have no color notes that certainly refer to this species when alive; after death the test is more or less transparent so that the zooids, which are purple or brownish purple, sometimes so dark as to be almost black, show conspicuously through it. Often, however, they are so crowded, at least in parts of the colony, that the outlines and limits of the systems are not easily traceable.

Of course, if the reproductive organs of the zooids are well developed, this species can be easily distinguished from *B. planus* but, even if that is not the case, the stomach furnishes an easy means of identification. It usually has nine or ten glandular folds, exclusive of the narrow somewhat oblique ridge from which the caecum arises. The caecum is short, enlarged toward the blind distal end and often but little curved. The stomach is, moreover, of conspicuously conical form, its cardiac end wide and truncated, the ends of the folds forming conspicuous and prominent rounded projections at that end; it tapers rapidly toward the pyloric end. Only on the cardiac part are the folds very prominent, for at a point a little way back from the end they decrease in height quite abruptly though they continue to the pyloric end with diminishing distinctness.

FIG. 49.—Outlines of the stomach of (a) *Botryllus planus* (Van Name), 1902, and (b) *Botrylloides nigrum* Herdman, 1886.



Another but less constant distinguishing character is in the testis, which has a smaller number of lobes, often not more than six. Sixteen tentacles are often, perhaps usually, present in adult zooids, and the range of variation in the number of rows of stigmata seems to be even greater than in *Botryllus planus*; in a number of Florida and West Indian specimens it ranged between eleven and fourteen or possibly fifteen. The atrial aperture is, often, at least merely a cleftlike opening without a well developed languet, and not produced into anything approaching a tube or siphon. Its zooids are of about the same size as those of *B. planus*, or often a little smaller.

Distribution.—This is a species very widely distributed in the warm regions of both hemispheres. The American Museum expeditions collected it at Porto Rico in Guanica Harbor and east of Caribe Cayo at

a depth of from $5\frac{1}{2}$ to $8\frac{3}{4}$ fathoms; also in Condado Bay, San Juan Harbor, at a depth of from 16 to 22 feet.

Remarks.—*Botrylloides chazaliei* Sluiter, 1898, from Margarita Island, Venezuela, listed above as a doubtful synonym, requires reexamination, but seems more likely to be the present species than *Botryllus planus*, in view of information kindly supplied by Dr. Ärnäck-Christie-Linde, who examined a small, poorly preserved fragment of Sluiter's material. Nothing regarding the reproductive organs could be made out; the stomach had at least eight folds (perhaps more) and the "cardiac caeca bent outwards." The pyloric caecum was "large and well developed"; the zooids were small and resembled externally those of *Botrylloides leachi*, a common European species.

STYELIDAE Sluiter

[= Tethyidae Hartmeyer, 1909-1911, not Huntsman, 1912]

This is a large family found in all parts of the world and including both compound and simple forms. Its members have both apertures square or four-lobed, simple filiform tentacles, a continuous dorsal lamina and four (or less) large curved longitudinal folds on each side of the branchial sac, which always has straight longitudinal stigmata. The compound forms do not have the zooids arranged in systems with common cloacal cavities.

Symplegma Herdman

[= *Diandrocarpa* Van Name]

These compound ascidians superficially like Botryllidae except for the absence of common cloacal canals and apertures. The branchial sac has no folds, and only four internal longitudinal vessels on each side. There is only one gonad on each side of the body.

Symplegma viride Herdman

Symplegma viride Herdman, 1886, Rept. Voy. Challenger, Zool., Vol. XIV, p. 144, Pl. 18, Figs. 7-14.

Symplegma viride + *S. v. brakenhielmi* Van Name, 1921, Bull. Amer. Mus. Nat. Hist., Vol. XLIV, pp. 404, 407, Figs. 75 and 76.

Diagnosis.—The colony is normally thin and incrusting, usually not averaging over 2 mm. in thickness but sometimes from 60 mm. to 90 mm. across. It is occasionally of very irregular form, owing to the irregular objects (often branching algae, corals, etc.) on which it grows. The test

usually is transparent and gelatinous in preserved specimens, darker and more opaque in living colonies. The surface of the colony is somewhat raised over the position of each zooid, the small, dome-like eleva-



FIG. 50.—*Symplogma viride* Herdman, 1886.
A colony attached to rock.
Natural size.

tions thus formed sometimes being distinctly bordered and separated from adjacent ones by a furrow; in other cases this is not noticeable.

The zooids are not arranged in systems; each has two independent apertures on the surface of the colony. They lie on their ventral side; the branchial aperture is close to the somewhat upturned anterior end of the body; the atrial is near the middle of the body. Both have slightly prominent margins, not lobed but sometimes minutely denticulate. Both are elliptical in outline (elongated longitudinally), and the atrial, when expanded, is much the larger of the two. The largest zooids are from 2.5 to 4 mm. long and from about 1.3 to 1.8 mm. wide.

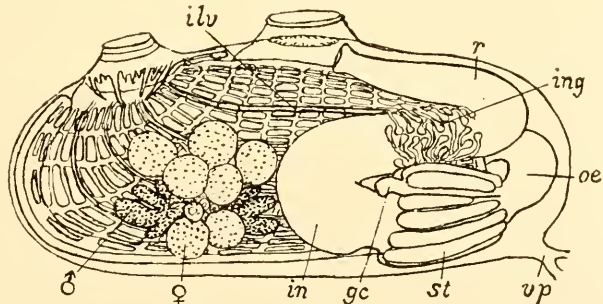


FIG. 51.—*Symplogma viride* Herdman, 1886. Zooid (individual with developing eggs), $\times 35$.

The zooids are oval when seen from above, broad and rounded at the posterior end, narrower in front; blackish, brownish, or purplish, or

occasionally olive or greenish in color, due chiefly to pigment cells contained in the mantle and vessels of the branchial sac. During life an area of light-colored pigment, greenish white, pale yellow, or pale salmon, surrounds the branchial aperture. The whole appearance and pigmentation is strongly suggestive of the family Botryllidae. Branching vessels arising from the posterior ends of the zooids extend through the common test connecting the zooids and ending in the marginal regions of the colonies in bulbs containing pigmented corpuscles similar to those occurring in that family.

The branchial sac is without folds. There are four internal longitudinal vessels on each side. The œsophagus is short and curved; in the wall of the stomach there are rather few (ten to fourteen) well-marked longitudinal folds, and a large curved caecum near the pyloric end.

There is one gonad on each side of the body, each consisting of a pair of oval or pyriform testes, usually irregularly cleft at their larger ends into several lobes, and of a group of eggs representing the ovary.

Distribution.—A handsomely colored incrusting species common in shallow water on stones, algae, other ascidians, etc., throughout much of the West Indian region and represented by closely allied if distinguishable varieties in the Indian Ocean. At Porto Rico it was found in Guanica Harbor in shallow water.

Remarks.—After examining additional material I am no longer able to maintain that the West Indian specimens are a variety or subspecies (*brakenhielmi*, Michaelsen) distinct from the typical form described from Bermuda.

Polyandrocarpa Michaelsen

The characters are practically those of *Polycarpa* (see p. 486), except that it produces buds and forms colonies. The gonads, though small, are similar to those of that genus. *Eusynstyela* Michaelsen, 1904, to which the following species belongs, differs from *Polyandrocarpa* only in the smaller zooids and in the reduction of the testes to two in each gonad, and is better considered a subgenus of *Polyandrocarpa*.

Polyandrocarpa (*Eusynstyela*) tineta (Van Name)

(Included as likely to be found)

Michaelsenia tineta Van Name, 1902, Trans. Conn. Acad. Sci., Vol. XI, p. 381, Pl. 54, Figs. 61 and 63; Pl. 59, Fig. 109.

*Polyandrocarpa (*Eusynstyela*) tineta* Van Name, 1921, Bull. Amer. Mus. Nat. Hist., Vol. XLIV, p. 414, Figs. 84-86.

Diagnosis.—The colony ordinarily is of the flattened incrusting type and commonly of small size, often consisting only of from half a dozen to a dozen zooids. Such colonies measure from 25 to 35 mm. in greatest thickness and from 15 to 20 mm. in greatest diameter; they commonly

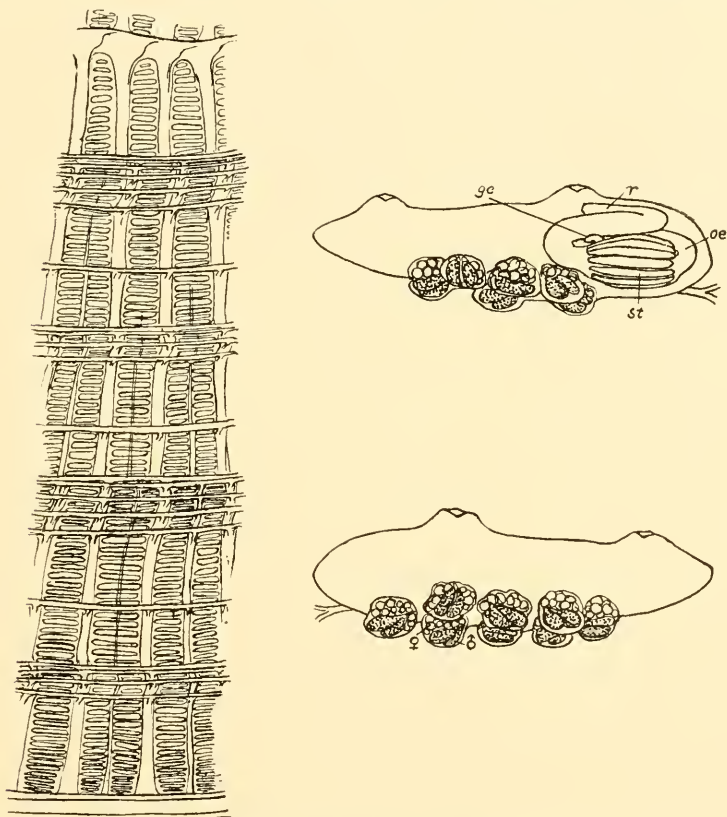


FIG. 52.—*Polyandrocarpa (Eusynstyela) tinctoria* (Van Name), 1902. Part of the branchial sac, $\times 45$, and left (upper figure) and right (lower figure) sides of zooid, $\times 9$.

have a rather thick rounded border and uneven upper surface. The specimens usually found on stones, etc., along the shore are of this character. *P. tinctoria* forms, however, under favorable conditions (especially when growing in water a few feet in depth), much more extensive colonies, containing one hundred individuals or more. When these grow on some branching object, as a gorgonian, they may entirely surround the branch or two or more adjacent branches and form a much thicker mass or irregular shape, having all or nearly all its surface exposed and bearing

zooids on all its aspects, as well as in such clefts or depressions as may exist in its contour. The surface of the colony is very slightly rough and finely wrinkled; generally the number and position of the zooids is indicated chiefly by the pairs of small rough papillæ on which their apertures are situated.

The test is very tough and leathery and very opaque, so that neither the zooids nor the branching vessels which ramify in the test and end in elongate club-shaped bulbs are visible through it. The color of the test during life varies from rose pink to carmine red, being deepest about the apertures of the zooids, but fading in many cases to pink or yellowish in the marginal and basal parts of the colony. The test substance is yellowish in the interior of the colony. The red color soon fades out in preserved material.

The zooids are few in most of the colonies and not at all equal in size. In most colonies none of them exceed about 6 mm. in length and 2.4 mm. in width. They are somewhat flattened dorso-ventrally and lie parallel to the surface of the colony; both their apertures are on the dorsal surface widely separated, and prominent as minute papillæ on the surface of the colony, the apertures themselves being square as is usual in this family.

Distribution.—This species is common at Bermuda, and on the Florida coasts, both on stones, etc., along the shore, and in water a few fathoms deep.

Polycarpa Heller

[= *Pandocia auct. mult.*]

These are simple ascidians with the characters as given above for the family, having a number of compact sac-like or short tubular hermaphroditic gonads on each side of the body. In the typical species the gonads are small oval or oblong sacs, and are very numerous.

Polycarpa obtecta Traustedt

Polycarpa tumida ? Heller, 1878, Sitzungsber. Akad. Wiss. Wien., math.-nat. Kl., Vol. LXXVII, p. 103, Pl. 2, Fig. 15.

Polycarpa obtecta Traustedt, 1883, Vidensk. Meddel. natur. For. Kjöbenhavn, ann. 1882, pp. 126, 134, Pl. 5, Figs. 7, 8; Pl. 6, Fig. 15.

Polycarpa obtecta Van Name, 1921, Bull. Amer. Mus. Nat. Hist., Vol. XLIV, p. 420, Fig. 90.

Diagnosis.—The body is rounded-oblong, often with the dorso-ventral diameter exceeding the length; when not distended with water, the flexibility of the test permits the sides to collapse so that it is quite narrow

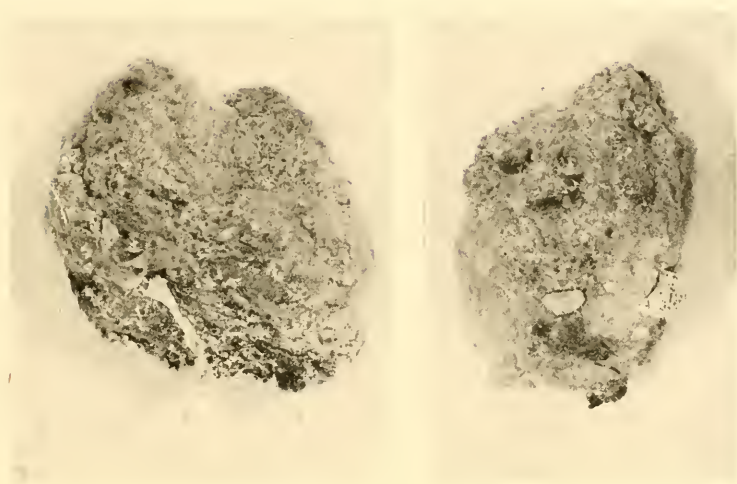
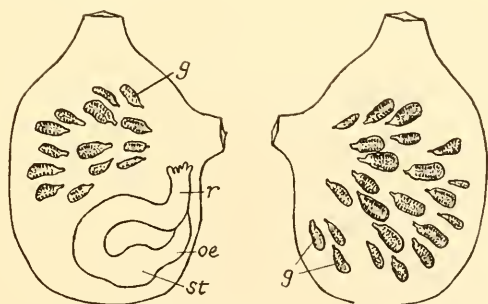


FIG. 53.—*Polycarpa obtecta* Traustedt, 1883. Two specimens, natural size.

from side to side. The apertures, which may be raised on conical elevations, or in contracted specimens, may be nearly flush with the external surface, are both conspicuously four-sided; the branchial aperture is situated at or close to the anterior end; the atrial is forward of the middle of the dorsal region. The body is usually attached by a small area on the posterior or ventral part of the body, where the test may be produced into a sort of rudimentary peduncle, or may develop some root-like processes or irregular projections to assist in the attachment. The largest specimens studied were about 50 mm. long by 45 mm. in dorso-ventral diameter, exclusive of the short tubes.

FIG. 54.—*Polycarpa obtecta* Traustedt, 1883. The left and right sides of the body, natural size.



The test is rather thin except in the dorsal region where it becomes very thick. The color of the outer surface is dirty yellowish or brownish gray, usually more or less stained with mud, darkening to red, brown or

purplish brown about the apertures in fresh specimens. Some individuals have the entire surface or parts of it incrustated with sand and shell fragments, but in a majority of the specimens it is practically bare, fairly smooth in some parts, but with more or less extensive areas which are rough, wrinkled and warty, or it may even develop patches of short irregular moss-like processes. Other specimens may have the entire surface wrinkled. Internally the test is grayish with a slight pearly cast. The test substance is strong, yet soft and flexible when fresh, and even in material long preserved in alcohol it has less tendency to become hard and rigid than in many other allied ascidians.

The mantle is smooth and often of a somewhat gelatinous appearance, conspicuously brown in color in most individuals and provided with a rather weak musculature, semi-transparent, allowing the stomach and intestine (which forms a small rounded loop), and the numerous small saclike hermaphroditic gonads, which are attached to its inner surface, to be distinctly seen. Somach small and rounded, nearly smooth-walled.

Distribution.—*P. obtecta* is one of the commonest and most widely distributed simple ascidians of the West Indies, having also near allies in the Old World. It is perhaps commoner in water a few feet or fathoms deep than right along the shore. At Porto Rico it was collected in Guanica Harbor on piles and dredged in 18 feet. St. Thomas, Virgin Islands, is Traustedt's type locality.

Polycarpa spongiabilis Traustedt

Polycarpa spongiabilis Traustedt, 1883, Vidensk. Meddel. natur. For. Kjöbenhavn, 1882, pp. 125, 134, Pl. 5, Fig. 9.

Polycarpa spongiabilis Van Name, 1921, Bull. Amer. Mus. Nat. Hist., Vol. XLIV, p. 424, Figs. 91-93.



FIG. 55.—*Polycarpa spongiabilis* Traustedt, 1883. Natural size.

Diagnosis.—In internal structure this species corresponds closely with *P. oblecta*, with which it may eventually have to be united, although its external characters and appearance seem sufficiently to separate it.

The spongelike appearance of the test readily explains its specific name. It is due to the rough fibrous surface of those parts of the body free from foreign matter, the rigid yet easily broken test and the non-contractile character of the tubes and apertures, which gives them, in the alcoholic specimens at least, a resemblance to the oscula of sponges.

The shape of the body is very variable in the specimens available for study, which were collected at Porto Rico; strongly compressed from side to side in the small ones, but tumid in the larger ones. The tubes are of varying length, mere conical eminences in two of the individuals, large, cylindrical and very long in other cases. The orifices are somewhat square, not contracted in any of the specimens. The tubes arise near together on the dorsal part of the body, but curve apart so as to form a widely diverging angle (in once case nearly 180 degrees). The largest specimen is 40 mm. long, 35 mm. in dorso-ventral diameter and about 28 mm. wide, exclusive of the tubes. The color of the test is yellowish or brownish, becoming reddish or purplish on the tubes; opaque in the alcoholic specimens; its surface rough, uneven and fibrous, but not greatly incrustated with foreign matter on the upper half of the body or on the tubes, though in the two larger specimens some minute bivalve mollusks are imbedded in its substance. Upon the ventral half of the body there may, however, be a tangled growth of hair-like processes to which sand, shell fragments, mud, etc., adhere, and which evidently serve to anchor the animal.

Distribution.—Traustedt, 1883, gives the localities of his specimens as West Indies and Brazil. A total of six specimens were dredged by the American Museum expeditions at Porto Rico, as follows: entrance to Guanica Harbor, 10-25 feet, mud, 1 specimen; Condado Bay, San Juan Harbor, 16-22 feet, sand and mud, 3 specimens (large); Salinas Cove (east of Parguera) off Don Luis Cayo, 4½-5 fathoms, coral, mud, 2 specimens.

Styela Fleming

Simple ascidians with characters as given above for the family, having but few elongate gonads (often only one or two on each side) composed of a tubular ovary with the male glands arranged along each side of it.

Styela partita (Stimpson)

Cynthia partita Stimpson, 1852. Proc. Boston Soc. Nat. Hist., Vol. IV, p. 231.

Styela partita Van Name, 1921. Bull. Amer. Mus. Nat. Hist., p. 431, Figs. 98-101.



FIG. 56.—*Styela partita* (Stimpson), 1852. Specimens natural size.

Diagnosis.—The form of the body is largely dependent on whether the animal is attached singly or in a crowded group of several or many individuals. In the former case, the body may be attached by much of the ventral surface and the branchial aperture situated on the dorsal surface slightly back from the anterior end; in the latter case, the body is often attached by only a small area near the posterior end and the branchial aperture is situated at the anterior end. The atrial aperture is on the dorsal surface, rather near the branchial aperture in either case. When so situated as to grow symmetrically, the body is ovoid, smaller at the anterior end and not much compressed laterally: the apertures are on conical papillae. The body surface is more or less rough and wrinkled, and raised into minute irregular elevations toward the anterior end of the body, and especially on and immediately about the papillae bearing the apertures, the surface becomes rougher and the small elevations larger and more conspicuous, giving the surface a characteristic nodular appearance by which the species can often be recognized.

The color is dirty yellowish or grayish brown, more or less tinged during life with red, red-brown or purplish, especially toward the anterior end and about the apertures, which may exhibit radial white markings; some specimens are red or reddish all over. The test is coriaceous,

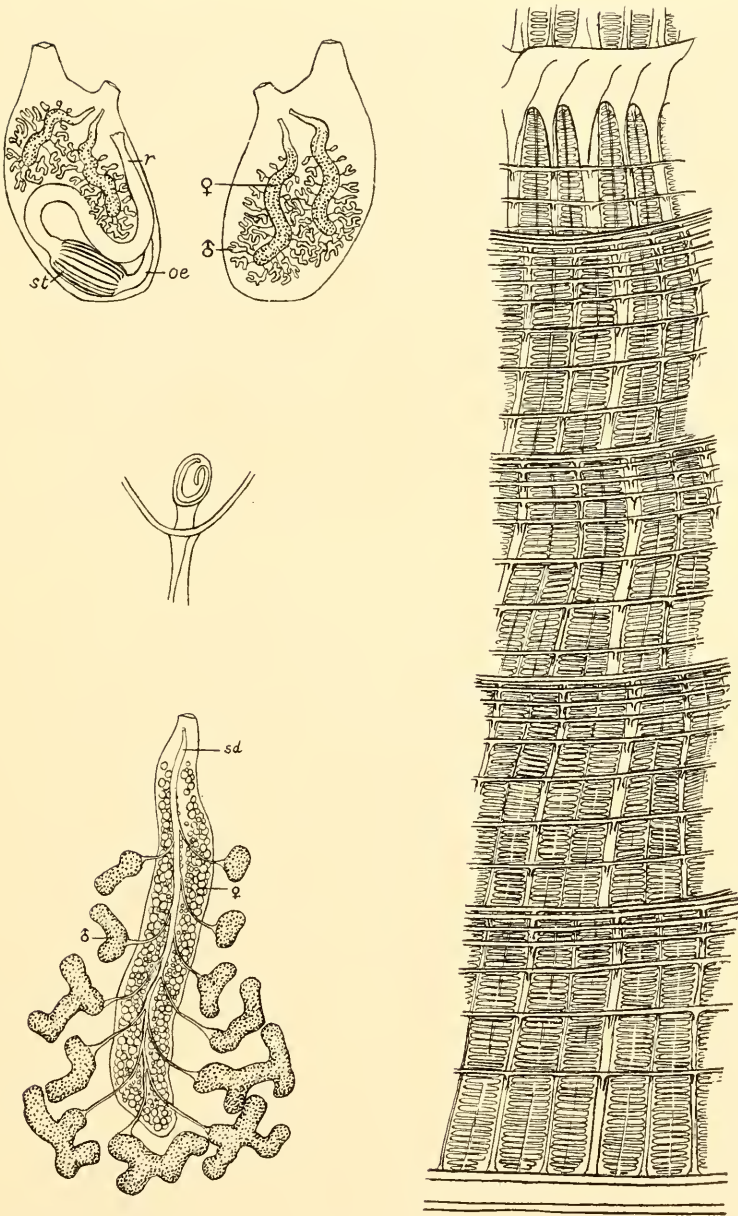


FIG. 57.—*Styela partita* (Stimpson), 1852. The left and right sides of the body, $\times 2$. The dorsal tubercle, $\times 12$. A gonad of a small individual, $\times 20$, and part of the branchial sac, $\times 14$.

usually of a somewhat fibrous texture, rather thin on the posterior part of the body, thicker on the anterior part.

On the New England coast it reaches a length of 30 mm., but the specimens from southern localities (Florida and Porto Rico) appear to average smaller, rarely exceeding 20 mm. in length.

The best distinguishing character of the species is furnished by the gonads, which, owing to the thinness of the mantle, are usually distinctly visible when the animal is removed from its test. There are two on each side, each consisting of a tubular, more or less sinuous ovary, narrowed to a neck at its dorsal end, where the opening for the discharge of the eggs is situated. Each ovary is surrounded by a varying number of small male glands, which are distributed around the ventral end of the ovary and along its sides, except toward the dorsal end. The male glands lie attached to the mantle a little way removed from the ovary.

Distribution.—This is a well-known and widely distributed form which has been described under several different names. On the American coast it ranges from Massachusetts Bay to Florida and the West Indies (Cuba and Porto Rico): its distribution in the Old World is also extensive.

It was collected by the American Museum expeditions to Porto Rico from the piles of wharves and mangrove roots in Guanica Harbor, where it was growing in large clumps with mussels, barnacles, bryozoans, ascidians of other species, etc. It was also obtained at Santurce near San Juan and off Tallaboa Bay, where it was dredged at a depth of from 6 to 11 fathoms (one small specimen).

Styela plicata (Lesueur)

Ascidia plicata Lesueur, 1823, Journ. Acad. Nat. Sci. Philadelphia, Vol. III, p. 5, Pl. 3, Fig. b.

Styela plicata Van Name, 1921, Bull. Amer. Mus. Nat. Hist., Vol. XLIV, p. 435, Figs. 102-105.

Diagnosis.—This is a much larger species than *S. partita* and is very variable in external appearance. Sometimes the body is broader in the anterior part or near the middle and narrowed toward the posterior and by which it is attached; the test at this end of the body may be so produced as to form a short stout pedicel. Some specimens are strongly compressed laterally, others scarcely at all. In other examples the general outline of the body is merely oval or rounded and attached by one side or near the posterior end.



FIG. 58.—*Styela plicata* (Lesueur), 1823. Four specimens, natural size.

The branchial orifice is terminal or nearly so, the atrial a little way back on the dorsal side; both are usually surrounded by four rounded eminences corresponding to the four sides of the square aperture, which lies in the depression between them. In many individuals there is a conspicuous curvature of the long axis of the body by which the apertures are brought towards each other and the ventral side of the body becomes more convex.

The most conspicuous external characters of the species are furnished by the test and the body surface. The test when not discolored is of a dull white color, quite opaque in alcoholic material, but more or less translucent in formaldehyde. It is said to be whitish also in living

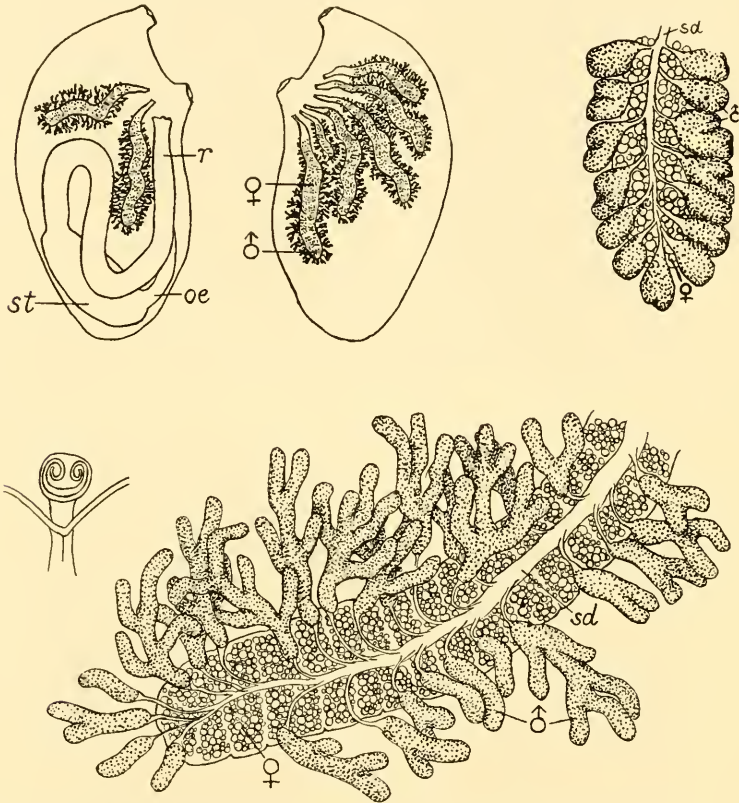


FIG. 59.—*Styela plicata* (Lesueur), 1823. Upper figures: left and right sides of body, slightly enlarged, and terminal part of a gonad of an individual having the gonads compact and the testes of simple form, $\times 16$. Lower figures: dorsal tubercle, $\times 6$, and terminal part of the gonad of an individual with highly developed branching testes, $\times 12$.

specimens. Except for a trifling amount of mud, frequently no more than sufficient to discolor the surface, the latter is usually free from foreign matter, though ascidians of the same or other species and other organisms sometimes grow upon it. In some individuals the surface is merely irregularly furrowed: or there are a few conspicuous, rather widely separated furrows whose direction is longitudinal and which are separated by broad, rounded ridges running toward the apertures and ending

in the eminences surrounding the latter, which have already been mentioned. In many individuals the ridges are broken, especially in the anterior part of the body, into low but rather large dome-shaped elevations, giving the body surface, or parts of it, an appearance suggesting a coarse unevenly laid cobblestone pavement. Such specimens are very characteristic and easily recognized.

A number of the largest specimens measured ranged from 45 to 72 mm. in length and from 25 to 38 mm. in greatest dorso-ventral diameter.

There are also several conspicuous differences in the internal structure separating it from *S. partita*. Though there are usually but two gonads on the left side, as in that species, on the right side there are as a rule from four to seven: the internal longitudinal vessels are more numerous and the stomach more elongate and less conspicuously plicated. The testes lie closer to the ovaries, often overlapped or, when small and short, almost covered by the latter instead of a little removed from the ovary as in *S. partita*.

Distribution.—This is an even more widely distributed form than *S. partita* in the warm parts of the world. It is known from the Virgin Islands (St. Croix and St. Thomas) and at Porto Rico was found abundant at Guanica Harbor on wharf piles in clusters with other ascidians.

PYURIDAE Hartmeyer

[=CYNTHIIDAE, HALOCYNTHIIDAE *auct. plur.* and TETHYIDAE Huntsman]

These are simple ascidians having the branchial sac with longitudinal folds (usually five to eight or more on each side) and generally with branching tentacles and straight stigmata. Dorsal lamina variable, usually replaced by a row of languets. A liver consisting of masses of tubules opening into the stomach is present, but there is no kidney.

Pyura Molina

[= *Cynthia* s. *Halocynthia* (part) *auct. plur.*]

This is the largest genus of the family, having elongate, longitudinally placed gonads, usually one (less often two) on each side of the body. Dorsal lamina replaced by a row of languets. The stomach is elongate. The external body surface is rough but usually not spiny.

***Pyura vittata* (Stimpson)**

Cynthia vittata Stimpson, 1852, Proc. Boston Soc. Nat. Hist., Vol. IV, p. 230.

Cynthia laevigata Heller, 1878, Sitzungsber. Akad. Wiss. Wien. math.-nat. Kl., Vol. LXXVII, p. 93, Pl. 2, Fig. 11.

Pyura vittata Van Name, 1921, Bull. Amer. Mus. Nat. Hist., Vol. XLIV, p. 446, Figs. 112-122.



FIG. 60.—*Pyura vittata* (Stimpson), 1852. The body removed from the test, $\times 1.5$.

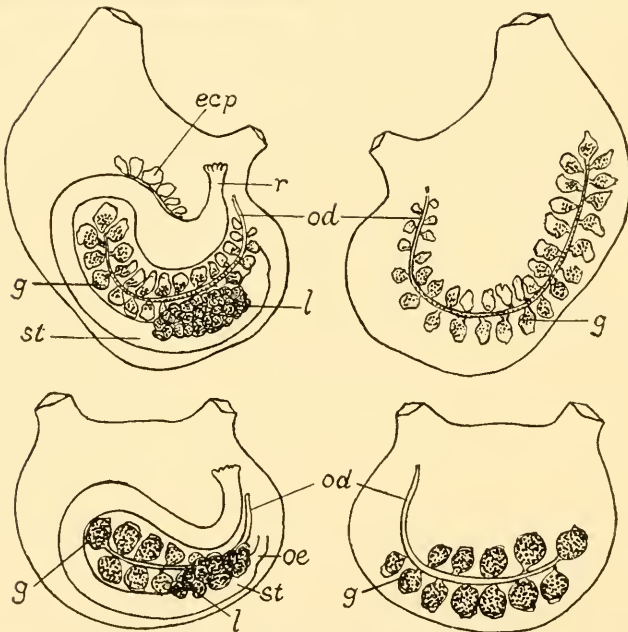


FIG. 61.—*Pyura vittata* (Stimpson), 1852. The left and right sides of two individuals. The large one is only slightly enlarged; the small one is 1.6 times the natural size.

Diagnosis.—The external form and characters are so varied that it is practically impossible to give any description covering them; often the species can be recognized only on dissection. The body is more or less oval, but often very irregularly so, sometimes laterally compressed, sometimes not. The attachment is variable, occasionally by the whole of the ventral surface, in other examples by a larger or smaller area at or near the posterior end (which may be produced into a very short extension or

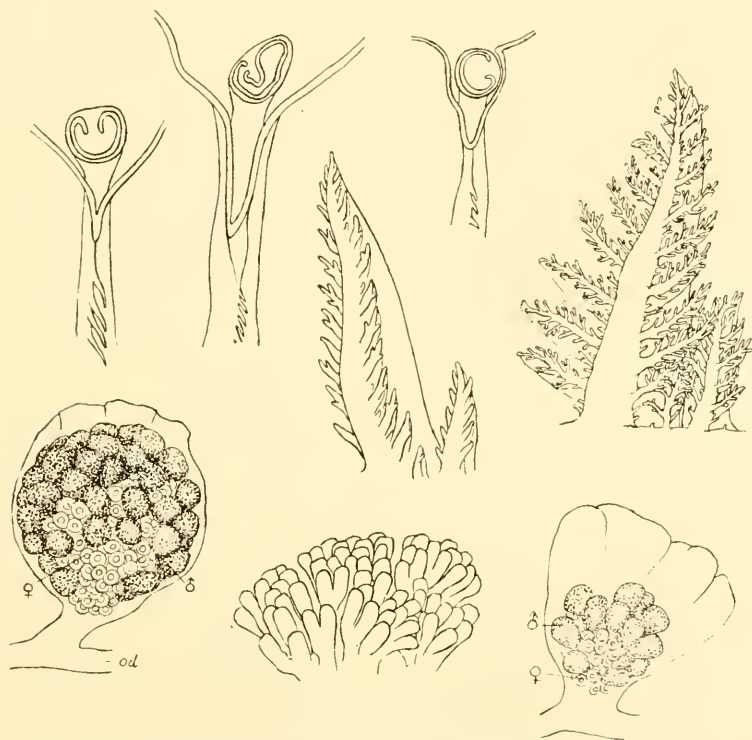


FIG. 62.—*Pyura vittata* (Stimpson), 1852. Upper figures: dorsal tubercles and tentacles of different individuals to show variation, $\times 12$ to 20 times. Lower figures: genital sacs from gonads of two individuals, one sac fully, the other partly, filled by the reproductive glands, $\times 14$; also (in center) part of the liver, $\times 18$.

peduncle), or by an area one one side. The apertures are square, generally rather far apart, and raised on papillæ, which in some specimens are produced into more or less elongate tubes.

The test, especially in old specimens, is tough and opaque, sometimes remarkably so, and often much wrinkled. The wrinkles and folds, though separated by narrow, sharply defined furrows, generally have the upper

edge rounded. The outer body surface may be incrustated with sand or shell fragments, or overgrown by other organisms, or be nearly clean; around the apertures the surface is usually more or less nodulose. The fresh specimens I have seen are generally reddish or reddish brown, the color becoming more intense (often bright red) near the apertures; the color is often obscured or concealed by the incrusting material. When the specimen is preserved in alcohol, the colors fade to a dirty yellowish or yellowish brown. This species reaches a large size; a specimen from Porto Rico measures 49 mm. in length and 35 mm. dorso-ventrally.

The branchial sac usually has six folds on each side. The gonads consist of small sacs, each containing both eggs and testes, arranged at intervals along a slender curved duct that ends near the base of the atrial siphon.

Distribution.—This species is known only from the West Indian and neighboring regions. At Porto Rico only four specimens were obtained by the American Museum expeditions. These were found in shallow water along the shore of Guanica Harbor and at Parguera, and at a depth of 5 fathoms off Guanica Harbor. Traustedt records the species from St. Thomas, Virgin Islands.

***Pyura momus form pallida* Heller**

Cynthia pallida Heller, 1878, Sitzungsber. Akad. Wiss. Wien, math.-nat. Kl. Vol. LXXVII, p. 96, Pl. 3, Figs. 17, 18.

Pyura (Rhabdocynthia) momus, form pallida Van Name, 1921, Bull. Amer. Mus. Nat. Hist., Vol. XLIV, p. 454, Figs. 129-136.

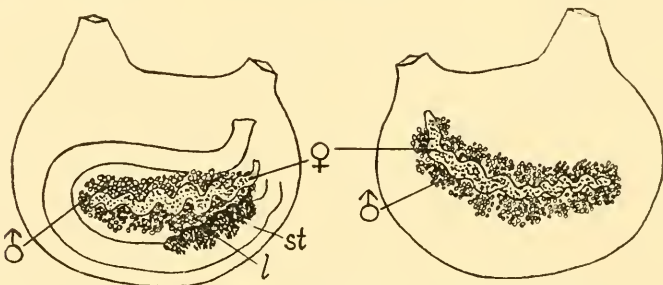


FIG. 63.—*Pyura momus form pallida* (Heller), 1878. The left and right sides of the body, natural size.

Diagnosis.—The usual form of the body is rounded or oblong, somewhat compressed laterally, and attached by a small ventrally or more or less laterally situated area. The apertures are on the dorsal side, rather widely separated, often raised on papillae.

The test is moderately thick, opaque, rather soft though tough in fresh material, and remaining soft in formalin, but becoming harder in alcoholic specimens. The surface varies from uneven and wrinkled to rather smooth, being occasionally overgrown with other organisms. The external surface and interior of the test is usually a dull white (sometimes tinged with pink about the apertures) when not stained or incrustated with mud or other substances. The size is sometimes very large: 55 by 45 mm. in longitudinal and dorso-ventral diameter respectively is, however, not usually exceeded in the West Indies.

The species is most readily recognized by the characteristic spicules, present chiefly in the mantle and large blood vessels of the branchial sac. These are rod-like or needle-like, very variable in size and proportions,

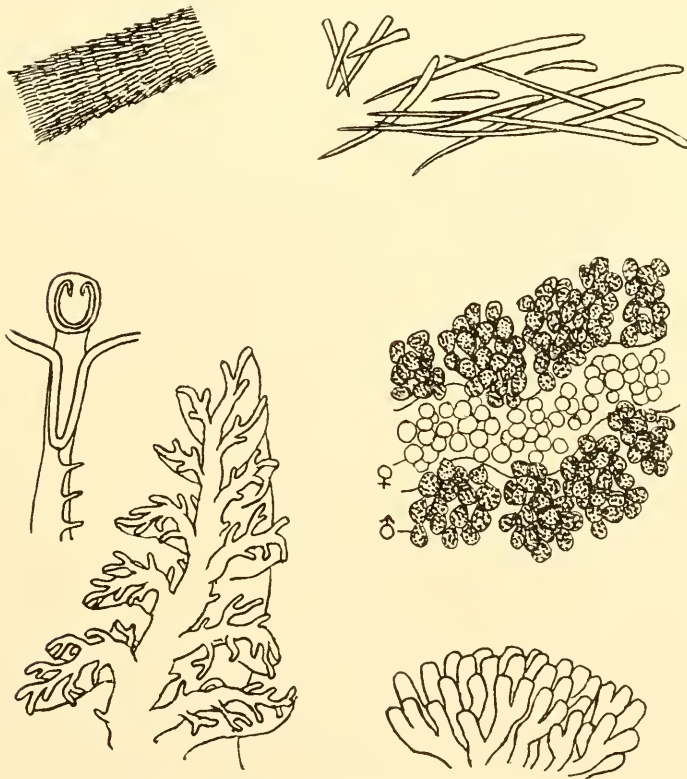


FIG. 64.—*Pynna momus* form *pallida* (Heller), 1878. Upper figures: spicules. On the left, part of a spicule, $\times 420$; on the right, spicules from the test (small group) and from the vessels of the branchial sac (large group), $\times 35$. Lower figures: anatomy. On the left, dorsal tubercle, $\times 8$, and tentacle, $\times 25$; on the right, part of a gonad, $\times 8$, and part of liver, $\times 20$.

but in large individuals sometimes 2 mm. or more in length. They taper toward one or both ends and are usually slightly curved. Under magnification, their surface is seen to be covered with minute appressed points or spines arranged in transverse rings. Spicules are also found, though less abundantly, in the test, where they are usually very short, stout and straight, and often have one end enlarged into a head, the other being either blunt or pointed. The presence of these spicules has led some writers to make this species the type of a genus or subgenus *Rhabdocynthia*.

The mantle is thin, with rather weak musculature except for some stout bands extending from the bases of the tubes down on the sides.

The branchial sac has high, sharply defined folds separated by narrow flat intervals. The number of folds is variable; in West Indian specimens there are usually eight or nine on a side.

The digestive tract is curved in a simple, broad loop. The stomach is elongated, bearing a large and dense mass of short hepatic tubes, which are crooked and often slightly branched.

There is one long, horizontally or obliquely placed gonad on each side, each consisting of a central, sinuously curved ovary bordered by numerous small testes. On the left side the gonad lies in the intestinal loop.

Distribution.—This is now considered merely a form or subspecies of *P. momus* Savigny, described from the Red Sea. It has been recorded from St. Croix and St. Thomas, Virgin Islands (Traustedt, 1883), though not yet from Porto Rico.

Microcosmus Heller

Microcosmus is distinguished from *Pyura* chiefly by the possession of a continuous dorsal lamina instead of a row of languets. A further distinction is the narrower intestinal loop, the branches of which lie partly in contact with each other.

Microcosmus claudicans exasperatus Heller

Microcosmus crasperatus + *M. variegatus* + *M. distans* (part) Heller, 1878, Sitzungsber. Akad. Wiss. Wien, math.-nat. Kl., Vol. LXXVII, pp. 99, 100, Pl. 3, Figs. 19, 20; Pl. 5, Fig. 27.

Microcosmus crasperatus Van Name, 1921, Bull. Amer. Mus. Nat. Hist., Vol. XLIV, p. 459, Figs. 137-144.

Diagnosis.—The body is irregularly elongate ovate, generally attached by considerable area on the ventral or posterior ventral side. The apertures are on the dorsal side, widely separated, generally on rather low

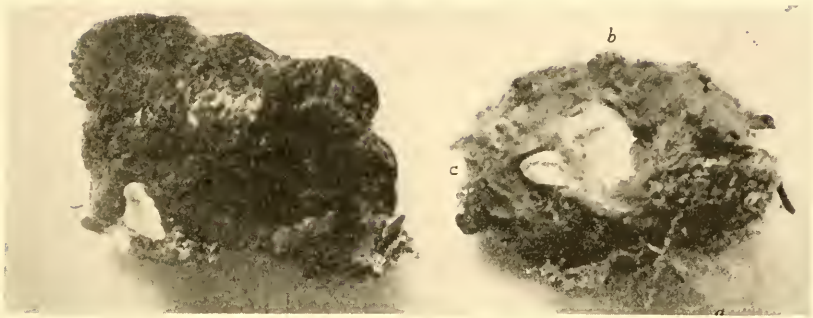


FIG. 65.—*Microcosmus claudicans exasperatus* (Heller), 1878. Two specimens, natural size. The right-hand one has three species of compound ascidians growing on it. At *a*, *Clavelina oblonga*; below *b*, *Distaplia bermudensis*; opposite *c*, *Didemnum candidum*.

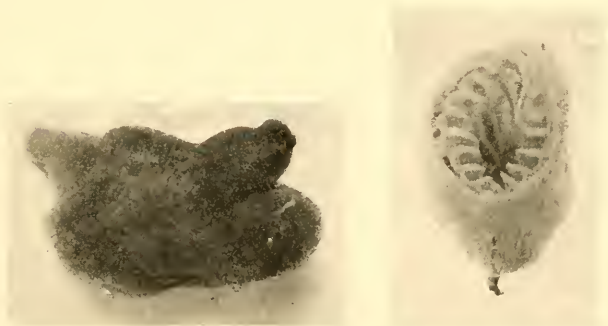


FIG. 66.—*Microcosmus claudicans exasperatus* (Heller), 1878. The body removed from the test and slightly enlarged: the right-hand specimen is transversely sectioned to show the folds of the branchial sac.

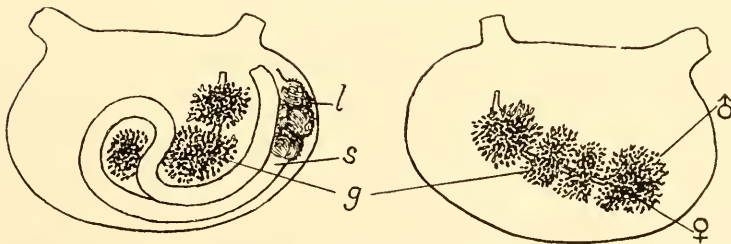


FIG. 67.—*Microcosmus claudicans exasperatus* (Heller), 1878. The left and right sides of the body, $\times 1.2$.

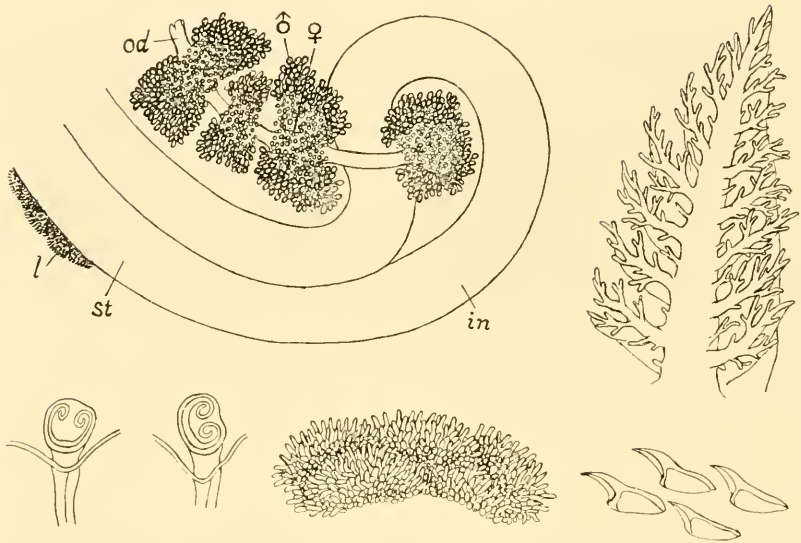


FIG. 68.—*Microcosmus claudicans crasperatus* (Heller), 1878. Upper figures: intestinal loop and gonad of left side, seen from side next to the branchial sac. $\times 6$, and tentacle. $\times 15$. Lower figures: dorsal tubercles of two individuals, $\times 7$, and part of liver, $\times 10$, and minute spines from the lining of the distal part of the branchial tube, $\times 280$.

papillae, which, however, are sometimes produced into tubes of conspicuous length. The size of the largest specimen is about 55 mm. by 35 mm. by 27 mm. The body surface is very rough and uneven with irregular folds, furrows and ridges, the latter often with rough angular edges, which are sharper and more prominent than usual in other West Indian forms. Though often overgrown to some extent with algae, compound ascidians or other organisms, it is generally not much incrustated by sand or shell fragments. The color of the test in life is some shade of red or pink externally and pearly gray or whitish internally. The test is fairly thick and tough, often becoming hard and rigid in alcoholic specimens.

Branchial sac with about nine (sometimes eight or ten) folds on each side; the folds diminish in height, and in the number of internal longitudinal vessels they bear, fairly regularly from the dorsal to the ventral region, the ninth fold being often much reduced and fading out before the posterior end of the body is reached, or it may be wanting entirely.

When removed from the test, the characteristic arrangement of the intestinal loop and the gonads is usually visible (the mantle being thin,

except for stout muscle bands radiating from the bases of the siphons), and at once serves to identify the species.

Distribution.—It is one of the largest and commonest of the West Indian ascidians and is found also in parts of the Old World. Traustedt (1883) records it under the name *variegatus* from St. Thomas, Virgin Islands. Many specimens were collected by the American Museum expeditions in the vicinity of Guanica Harbor and Parguera, Porto Rico, mostly in very shallow water, attached to piles, mangrove roots or stones along the shore, but several were dredged in water of from 3 to 7 fathoms in depth.

Remarks.—In the present paper I am following Michaelsen (1928, pp. 401-404) in regarding this as a subspecies of the European *M. claudicans* Savigny, which seems to be distinguished mainly by not having the gonads broken up into several segments as is usual in the American specimens. However the segments may be more or less confluent in the American form also.

[***Microcosmus anchylodeirus* Traustedt**]

(Doubtful Species)

Microcosmus anchylodeirus Traustedt, 1883, Vidensk. Meddel. naturf. For. Kjöbenhavn, 1882, p. 121, Pl. 6, Fig. 18.

Microcosmus anchylodeirus Van Name, 1921, Bull. Amer. Mus. Nat. Hist., Vol. XLIV, pp. 466, 485 (no description).

Microcosmus anchylodeirus Michaelsen, 1919, Denk. Acad. Wiss. Wien. math.-nat. Kl., Vol. XCV, pp. 58, 62.

Diagnosis.—Traustedt in 1883 briefly described this species from a single specimen from St. Thomas, Virgin Islands. The only figure he gave shows a small piece of the branchial sac. The species is distinguished by having a branchial sac with seven folds on each side. Aside from this there does not appear to be anything in the description or figure to prevent us from considering it an example of *M. c. exasperatus*, and in spite of the above discrepancy I would be more inclined to adopt that hypothesis than the suggestion of Michaelsen (1919) that it is identical with *M. pupa* Savigny, 1816, a species described from the Red Sea but never reported from American waters.

***Microcosmus helleri* Herdman**

Text Figs. 69 and 70

Microcosmus helleri Herdman, 1881, Proc. Royal Soc. Edinburg, Vol. XI, p. 54.

Microcosmus helleri Van Name, 1921, Bull. Amer. Mus. Nat. Hist., Vol. XLIV, p. 463, Figs. 145 and 146.

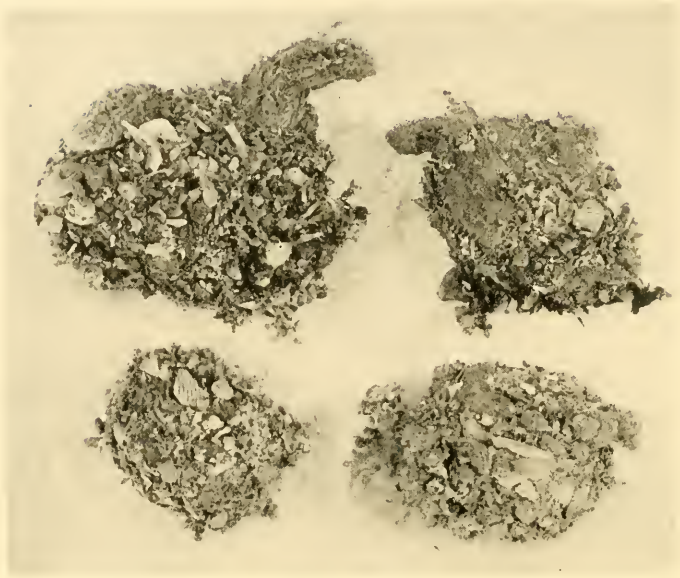


FIG. 69.—*Microcosmus helleri* Herdman, 1881. Four specimens, natural size.

Diagnosis.—The body is irregularly spheroidal, longer than broad, and usually not laterally compressed, though sometimes slightly compressed in a dorso-ventral direction. The tubes arise from the dorsal surface at a varying distance apart: they are long, narrow and diverging in most specimens, and often very crooked. In some specimens, however, they are quite short, perhaps because of contraction. The size of the largest specimen is 45 mm. in length, 32 mm. in dorso-ventral and 29 mm. in lateral diameter, exclusive of the tubes. These arise more than 10 mm. apart; the branchial tube is about 16 mm. long, the atrial about 11 mm. long.

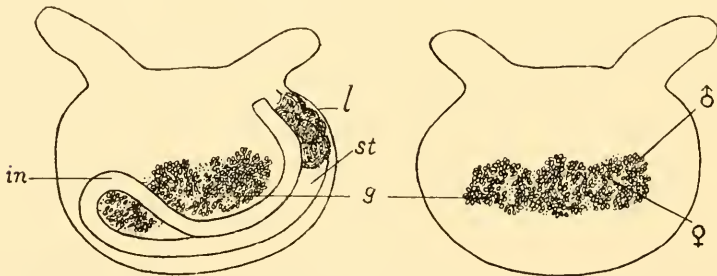


FIG. 70.—*Microcosmus helleri* Herdman, 1881. The left and right sides of the body, $\times 1.5$.

The surface is rough and raised into small, sharp, irregular ridges and small irregular processes. It is so completely incrustated with sand grains, shell and coral fragments, etc. (which are imbedded in the test, and in the substance of the processes, as well as firmly attached to their surfaces) and so plastered with loosely adherent mud that the surface is generally entirely concealed and the animal often looks like a ball of mud and débris.

In its internal structure it differs conspicuously from *M. c. exasperatus* in having but six branchial folds, and in having the intestinal loop much less bent, while the gonads are not distinctly broken up into separate lobes or masses.

Distribution.—The specimens of this species were all dredged off the coast of Porto Rico in the vicinity of Guanica and Tallaboa by the American Museum expeditions. Their localities are as follows:

East of Caribe Islands, $5\frac{1}{2}$ to $8\frac{3}{4}$ fathoms, 27 specimens; off Guanica Playa, 18 feet, sand and algæ, 1 specimen; between Ratones and Caribe islands, 6 to 11 fathoms, 1 specimen.

This species is widely distributed in the warm parts of the Old World.

MOLGULIDÆ Lacaze-Duthiers

[=Caesiridæ *auct. mult.*]

These are simple ascidians, usually having the tentacles compound and the branchial sac with longitudinal folds, more or less curved and sometimes spirally arranged stigmata, and a kidney (in the form of a single completely closed sac in which concretions form) situated on the right side of the body. The dorsal lamina is continuous but often toothed.

Molgula Forbes and Hanley

[= *Caesira* *auct. mult.*]

This is the largest genus of the family Molgulidæ. The branchial sac is provided with folds (usually six or seven on each side), each bearing a number of internal longitudinal vessels and usually a row of infundibula with spiral stigmata along its summit; the spirals are more or less imperfect and interrupted. A gonad is usually present on each side of the body.

Molgula occidentalis Traustedt

Molgula occidentalis Traustedt, 1883, Vidensk. Meddel. natur. For. Kjöbenhavn, 1882, pp. 113, 128, Pl. 5, Figs. 4 and 5; Pl. 6, Fig. 14.

Molgula occidentalis Van Name, 1921, Bull. Amer. Mus. Nat. Hist., Vol. XLIV, p. 467, Figs. 147-152.



FIG. 71.—*Molgula occidentalis* Traustedt, 1883. Natural size.

Diagnosis.—The body is of rounded or oval outline: the depth may or may not exceed the length. It is not much compressed laterally. The apertures are on the dorsal side, usually situated not far apart, sometimes sunk in the depressions between rounded prominences of the test that are present on that part of the body, in other cases raised on low papillæ. The size of the largest specimen examined was 44 mm. in length, 45 mm. in dorso-ventral diameter and nearly 25 mm. in width from side to side when distended.

The test is rather thin, though tough, on most parts of the body; on the dorsal region it becomes quite abruptly very thick and hard. The surface is sometimes roughened by rather fine wrinkles and much incrustated with mud, sand, shell fragments, etc., these materials being in

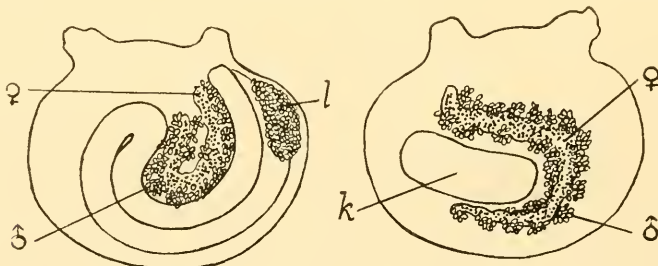


FIG. 72.—*Molgula occidentalis* Traustedt, 1883. The left and right sides of the body. $\times 1.5$.

part imbedded in the test and in part adherent to short fibrous processes with which parts of the surface are provided, but some specimens have much of the body bare of foreign matter and are fairly smooth. The color is usually that of the incrusting sand or mud; where the surface is

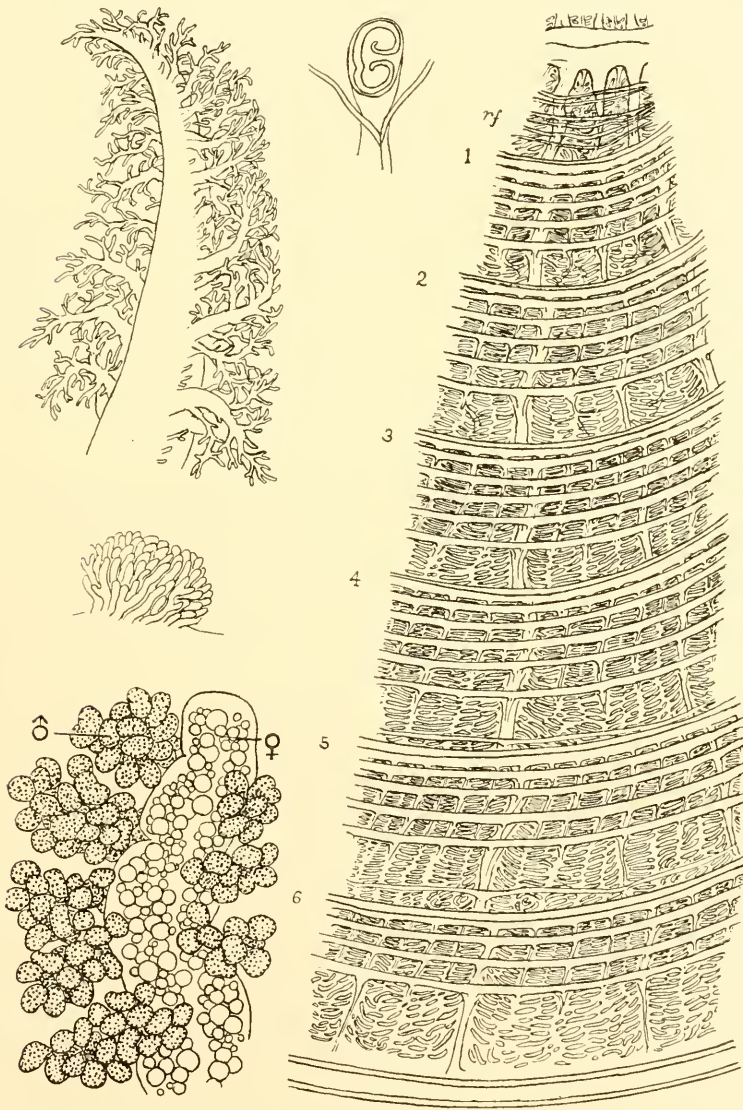


FIG. 73.—*Molgula occidentalis* Traustedt, 1883. On the left, large tentacle, $\times 9$, the dorsal tubercle, $\times 12$, part of the liver, $\times 6$, and the closed end of the left gonad, $\times 15$. On the right, part of the branchial sac, $\times 12$.

exposed, it is of a dingy yellowish or gray color. The mantle is thin and semi-transparent, sometimes dark colored.

The branchial sac has six well-developed folds on each side. The stigmata are short and small and for the most part very little curved.

The intestinal loop is very narrow (its branches in contact for practically the whole length). It is bent into about three quarters of a circle. The stomach has a large greenish hepatic gland consisting of an immense number of very minute, short, sparingly branched tubules.

The kidney is a large elongate-oblong sac on the right side of the body, visible through the mantle.

A large gonad is present on each side of the body. Each gonad consists of an elongate curved tubular ovary bordered along its sides with clusters of small oval or pear-shaped male glands. The right gonad is very long and narrow, and bent around the kidney so as to surround all except the posterior part of it. The left gonad is situated dorsal to the intestinal loop and is bent into a U-shaped curve conforming to that of the intestine. The gonads are visible through the mantle when the animal is removed from the test, and furnish the easiest means for recognizing the species.

Distribution.—Collected at Porto Rico in Guanica and San Juan harbors, and off Guanica Playa at a depth of 18 fathoms. Traustedt's type was from the West Indies, probably from the Virgin Islands. The species is common on the coast of the mainland from North Carolina to Florida inclusive. Not known to occur in the Old World.

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THE ARID SECTION OF PORTO RICO
View east of Ponce. (H. E. Crampton, photo.)



THE ARID EXTREME IN PORTO RICO
View near Guanica. (H. E. Crampton, photo.)



OPEN PLACE IN SIERRA PALM FOREST, EL YUNQUE

A colony of *Begonia decandra* occupies the center; the trunks of the palms are covered with mosses, juvenile plants of *Marcgravia*, and a few large Bromeliaceae. (From Plant Ecology of Porto Rico, by H. A. Gleason and Mel T. Cook.)



FORESTS OF THE UPPER SLOPES OF EL YUNQUE

Altitude about 1050 m. The distribution of sierra palms in strips and patches follows the contour of the land. (From Plant Ecology of Porto Rico, by H. A. Gleason and Mel T. Cook.)



THE PORTO RICAN BOA, *Epicrates inornatus* Reinhardt
Luquillo Forest. Photographed by F. H. Winslow; photograph supplied through the courtesy of
B. A. Wall.



PLATE V

CLAVELINA OBLONGA HERDMAN, 1880

A colony attached to a gorgonian, \times about 1.3 (From Trans. Conn. Acad. Sci., Vol. XI, Pl. LX).



PLATE VI

ECTEINASCIDIA TURBINATA HERDMAN, 1880

A colony attached to a mangrove root. Nearly natural size



PLATE VII

ASCIDIA NIGRA (SAVIGNY), 1816, and POLYCITOR HEPATICUS (Van Name), 1921

Ascidia nigra (Savigny), three individuals, natural size (upper figure). *Polycitor hepaticus* Van Name, natural size (lower figure).

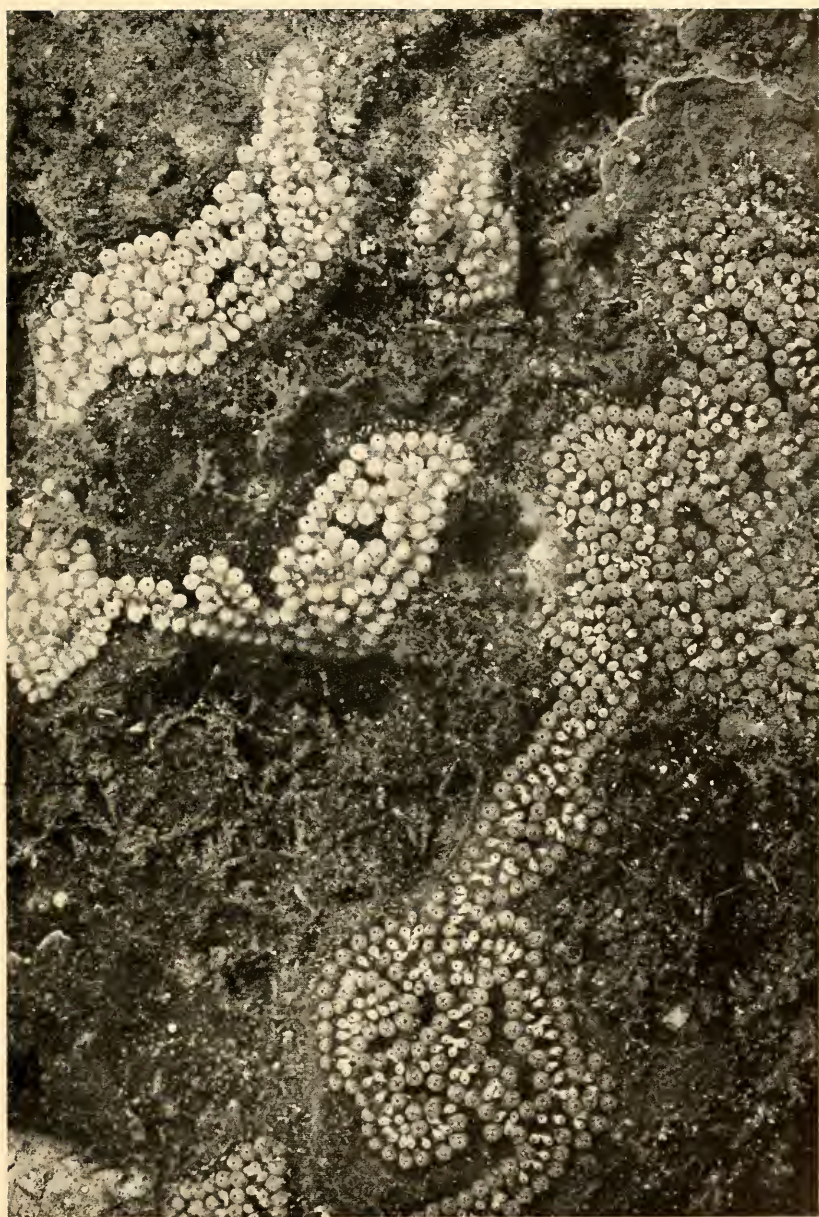


PLATE VIII

BOTRYLLUS PLANUS (VAN NAME), 1902

Two differently colored living colonies growing on the same rock; \times more than 2.5.
(From Trans. Conn. Acad. Sci., Vol. XI, Pl. LXI.)

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VOLUME X—Part 3

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Pomacentridae to Ogcocephalidae—*J. T. Nichols*



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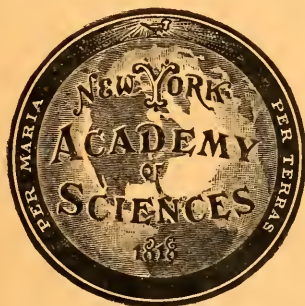
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Willard G. Van Name



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