

NOTES ON FISHES FROM THREE PANAMA LOCALITIES:

GATUN SPILLWAY, RIO TAPIA AND CALEDONIA BAY.

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(Figs. 33-38 incl.)

INTRODUCTION

The notes comprising this paper are based on three small collections of fishes which were made while attached to the Marsh-Darien Expedition in 1924 as the representative of the American Museum of Natural History. They were acquired quite incidentally to the main ichthyological work of the trip which was the surveying of the fish fauna of the Rio Chucunaque drainage and is to be reported elsewhere. As these collections have no especial bearing on that work, they are recorded here separately and with it complete the list of fishes taken on the trip, excepting those purchased in the markets simply as museum specimens. Each collection is treated as a unit, since they have no particular connection with each other, and should be considered as independent, being issued together for purposes of convenience.

As with all other papers based on this expedition I am of course primarily indebted to Mr. R. O. Marsh whose financial and other aid made the work possible. Regarding the section on the fishes of Caledonia Bay I am indebted to Mr. J. T. Nichols of the American Museum and to Mr. L. L. Mowbray of the New York Aquarium for assistance in diagnosing some of the smaller examples of the more difficult species. All measurements refer to the standard lengths of the specimens, without caudal. The material is deposited in the American Museum.

FISHES FROM GATUN SPILLWAY, CANAL ZONE

While equipping at Colon preparatory to our plunge into the jungles of Darien the opportunity was taken to make a collection at Gatun Spillway (Fig. 33.). The kindness and aid of Mr.

¹ Illustrations from drawings and photographs by the author.

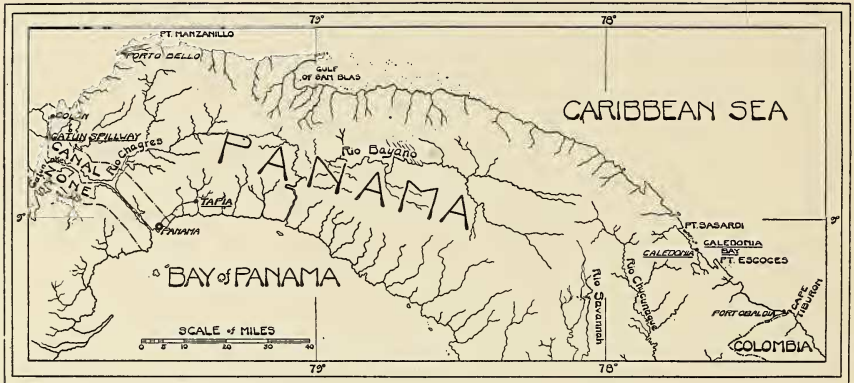


Fig. 33. Sketch map showing the location of the collecting sites at Gatun Spillway, Tapia, on the Rio Tapia, and Caledonia on Caledonia Bay.

William Markham, founder of the Panama Canal Tarpon Club, greatly facilitated the gathering of numerous small fishes at the foot of the spillway and the obtaining of information concerning many of the fishes that reach here only at a large size and of ones not collected during my short stay at the well appointed club house. Mr. Markham remarked, nevertheless, that the present collection was unusually varied and he is in a position to know as he habitually takes his bait fishes at this point. The collection was made on January 26 and 27. Most of the small fishes were taken in a small minnow seine although a dip net was also used. A few gobies were taken in the confluents of the lower Rio Chagres about two miles below the dam and in an overflow from the bait tanks located under the club house. Otherwise all others were taken at the foot of the spillway unless special mention is made to the contrary under the specific headings.

At this point there is a most interesting mixture of the fresh and salt water faunas. The sea fishes working up the stream are of course stopped here where they seem to stay in considerable numbers making the place one of particular favor with both local and visiting anglers. Apparently these marine fishes subsist largely on the many smaller fresh water fishes rushed over the spillway. Numerous larger ones come over also and it is odd that so many survive the swift and turbulent torrent presumably uninjured, but that they do, in part at least, is evidenced by the large number of strictly fresh water forms taken on the hook here. The Rio Chagres

below the spillway is practically at sea level and the slight Atlantic tide can be detected to the very foot of it. This is most prominent when all gates are closed and water is discharging only through the huge hydro-electric plant which operates at all times. The water is fresh, except for the minute and practically negligible amount of salt water that climbs through the locks and comes over by way of the dam, for the sea merely pushes back the river flow during tidal periods.

Usually one or two gates, at least, in the great Gatun dam are left open, supplying water to the lower Rio Chagres, in order to prevent Gatun Lake from rising too high. However, during the dry season these are sometimes left closed for during this period efforts are directed to maintain the necessary depth. Such action causes a rapid lowering of the stream below and leaves many small pools in pockets and depressions on either bank. Formerly these were always found to contain great numbers of small fishes. Sometimes even fishes of a larger size were so ensnared, it not being uncommon to find some running up to ten or fifteen pounds in weight. These were usually snook or jack. For some unknown reason, for the last eight years, according to Mr. Markham, who has carefully studied the fishes of this region from the anglers' point of view, no fishes have been so entrapped by the receding waters, although there has been no marked decrease in River's fauna. Mr. Markham further stated that at no time in his experience has a tarpon been so cut off from the stream. He explains it on the basis that, according to his observations, on the slightest slackening of flow all the tarpon at once rush into mid-stream, the point of maximum speed of current, for at least the tarpon observable from the apron of the spillway react in this manner to the slightest tampering with one of the gates. It would further seem probable that if one were at least partially entrapped it would leap as a reaction to the constraining influence of a small body of water and would soon find its way back to the main stream.

Even this short list of the more prominent species existing at the Gatun Spillway seems especially appropriate at this time for in less than a year after the collection was made the United States Bureau of Fisheries released a number of North American species in Gatun Lake and its confluent. That is, on December 3, 1924, the following species were released (Fisheries Service Bulletin No. 116).

<i>Micropterus salmoides</i> (Lacépède)	4 inch fish	2,250
<i>Pomoxis annularis</i> Rafinesque	2 inch fish	500
<i>Lepomis pallidus</i> (Mitchill)	Fingerlings	500

It will be exceedingly interesting to watch the progress of these fishes, if any, accustomed to a comparatively large seasonal fluctuation of temperature, under tropical conditions, especially as there already exist in the lake various cichlids which appear superficially, at least, to occupy rather similar ecological niches. However, Gatun Lake covers much territory and shows numerous different types of habitat.

At the foot of the dam one of the most striking absences was the complete lack of the smaller characins, for example, such as *Astyanax* which was found to swarm in practically all other places.

The common names given in the list which follows are those used by the local English speaking anglers.

ANNOTATED LIST OF SPECIES

Family I. SILURIDAE

- 1—*Rhamdia wagneri* (Günther). Catfish.
Fairly common. One example of 179 mm.

Family II. CHARACIDAE

- 2—*Brycon chagrensis* (Kner). Salmon.
Said to be common by the local anglers. Regarded as a fair game fish and sometimes eaten, but highly relished only by the natives. One example, a green male of 325 mm., stomach empty.

Family III. ANGUILLIDAE

- 3—*Anguilla rostrata* (Le Sueur). Eel.
Young ones from 54 to 68 mm. common in small pools under flat stones at the foot of the spillway where their further ascent, is prevented.

Family IV. ELOPIDAE

- 4—*Tarpon atlanticus* (Cuvier and Valenciennes). Tarpon.
Common. The principal object of the spillway fishermen. The largest example taken here had a total length of 188 cm. and a weight of 38.5 kilograms, whilst the smallest had a length of 254 mm. Although none were taken during my stay, they were seen constantly leaping near the foot of the dam. On June 22 I again visited this place but did no collecting. The rainy season was then under way and while a thunder storm confined us to the club house, hundreds of tarpon were seen disporting themselves. So numerous were they that they literally wallowed and rolled with their backs out of water. It is

interesting in this connection to note that some San Blas Indians that were with us, taken to view the Gatun locks, were much more impressed, judging from their gesticulations by these tarpon, their favorite food fish, than by the mechanical marvels of the white men. See the general discussion preceding this list for further data on the tarpon.

5—*Elops saurus* Linnaeus.

Bonyfish.

Common but not valued by the anglers. One example of 355 mm. Individuals larger than this are rare at the spillway.

Family V. ENGRAULIDAE

6—*Anchovia elongata* Meek and Hildebrand

Common. Five examples ranging from 68 to 74 mm. In two the pectorals reach the base of the ventrals but in the rest fall a trifle short of it.

Family VI. POECILIIDAE

7—*Poeciliopsis isthmensis* Regan.

One example, a young female is questionably referred to this species. Taken in company with small specimens of *Dormitator* in a very foul drainage ditch a short distance below the spillway.

Family VII. BELONIDAE

8—*Tylosurus timucu* (Walbaum).

Not common. One example of 272 mm.

Family VIII. ATHERINIDAE

9—*Thyrina chagresi* (Meek and Hildebrand).

Needle fish.

Common and much used for bait. Seven examples ranging from 45 to 62 mm.

Family IX. MUGILIDAE

10—*Agonostomus monticola* (Bancroft).

Needle fish.

Common and used for bait. Fifty-three examples, ranging from 27 to 54 mm., showed a mode of 47 mm. Apparently confused with *Thyrina* by the fishermen.

11—*Joturus pichardi* Poey.

Not especially common at the foot of the spillway, the local anglers having no name for it, not knowing it as a food fish. However, it is much valued by the natives. One example, a green male of 355 mm. The stomach was filled with an evil smelling black paste.

Family X. CARANGIDAE

12—*Caranx hippos* (Linnaeus).

Jack.

Apparently this species appears periodically at the spillway. Its identity could not be established with certainty from the descriptions as no examples were seen.

Family XI. CENTROPOMIDAE

13—*Centropomis pectinatus* Poey. Snook.

Two small examples of 31 and 34 mm. are somewhat reservedly referred to this species. The anglers rate snook as second only to the tarpon at this place but probably refer to another species, likely *C. parallelus* Poey, that attains greater proportions, specimens up to thirty pounds being spoken of.

Family XII. LUTIANIDAE

14—*Lutianus aya* (Bloch). Red snapper.

Apparently this species is occasionally taken here, judging from descriptions of the anglers although not taken in Panama by Meek and Hildebrand '25. Examples reaching up to ten pounds were mentioned but none were seen.

Family XIII. HAEMULIDAE

15—*Pomadasys crocro* (Cuvier and Valenciennes). Bass.

Small examples common. Thirteen ranged from 25 to 65 mm. with modes at 25 and 55 mm. Those in the smaller group have the soft anal rays slightly longer than the enlarged second anal spine, but as size increases this ratio becomes inverted, the transition coming between 28 and 35 mm. This difference is to be seen with the fin erect. Larger specimens are valued by the fishermen.

Family XIV. GERRIDAE

16—*Eucinostomus californiensis* (Gill). Snook.

Small examples common. Forty examples ranging from 14 to 49 mm. showed a mode at 25 mm. while the three larger 63, 70 and 84 mm. fell without the curve. These young fish are apparently confused with young *Centropomis* by the anglers.

Family XV. CICHLIDAE

17—*Cichlasoma maculicauda* Regan. Black perch.

Common. Sometimes used for food. Three examples, 74, 88 and 102 mm.

Family XVI. TETRAODONTIDAE

18—*Spheroides testudineus* (Linnaeus). Blow-fish.

Not very common. One example of 94 mm.

Family XVII. GOBIIDAE

19—*Dormitator maculatus* (Bloch). Doby.

Common, but not in the main stream. Two examples of 39 and 41 mm. from a puddle under a leaky spigot outside the club house, and many seen in the overflow from the bait tanks. Thirteen examples from a filthy, hot and stinking drainage ditch below the spillway. These ranged from 18 to 35 mm. and showed a mode of 22 mm.

20—*Eleotris pisonis* (Gmelin).

Three were found at the foot of the spillway and six in a tiny spring about

a mile below. This spring forms a small, but crystal clear, pool near the edge of a banana plantation about which a small stand of native plants clusters, oasis-like, on the baked and cracked flood plain of the lower Chagres. Many small birds and one spiny tailed rat came to drink in the short time I was there. The only species of fish in the pool appeared to be the present, but there were a few individuals of a slightly larger size that I was unable to capture. Those collected ranged from 34 to 80 mm.

21—*Sicydium salvini* Grant.

Common at the foot of the spillway. Nine examples ranged from 24 to 30 mm. and showed a mode at 25 mm.

FISHES FROM THE RIO TAPIA

While continuing our outfitting, at Panama City, the opportunity was taken to make a small collection of fishes from the Rio Tapia at a point where the new Tapia Road crosses the river (Fig. 33). Most of the collecting was done nearly under the bridge and all within sight of it. The collection was made on February 1 and 2, mostly with a twenty foot seine, although a few specimens were taken by dip net. It is believed to represent nearly the entire fish fauna at this point. It being the dry season, the water was crystal clear and shallow. This extremely interesting section is now easily reached by automobile over the excellent new road. The list is chiefly of interest because the locality is one that has not been collected in previously and therefore is an extension of local records. The Rio Tapia is one of the few short independent streams of the Pacific slope east of the Canal, not connected with any master drainage system.

ANNOTATED LIST OF SPECIES.

Family I. CHARACIDAE

1—*Curimatus magdalenae* Steindachner.

One example of 145 mm.

2—*Compsura gorgonae* (Evermann and Goldsborough).

Ten examples of from 20 to 25 mm. In company with the more numerous *Pseudocheirodon*.

3—*Pseudocheirodon affinis* Meek and Hildebrand.

Forty-three examples of from 20 to 28 mm. A specimen of either this or possibly *Compsura* was seen to be attacked by a large spider in the very swift water in which both species were disporting themselves. The attack was made while I was at extremely close range, the spider being well observed. It was

noted not to relinquish its hold on the bank with its hinder legs, simply dipping its forward parts enough to effect the capture. An inadvertent move caused it to drop its prey and allowed it to escape while the fish was rapidly swept away by the swift water, apparently quite dead, although it had only been in the spider's palps a very short time. See Gudger '25, page 263, for the full account.

4—*Gephyrocharax atricaudata* (Meek and Hildebrand).

Seven examples of from 23 to 31 mm.

5—*Astyanax ruberrimus* Eigenmann.

Eighty-nine examples of from 25 to 98 mm. Some of the larger individuals were ripe or nearly so. The dark shoulder spots so conspicuous in most of the examples subsequently taken in the Rio Chucunaque were practically absent in the present series, showing faintly in only a few. Possibly some of these should be referred to *A. fasciatus* (Cuvier) but all showed some evidences of a more or less distinct caudal spot.

6—*Roebooides occidentalis* Meek and Hildebrand.

Sixteen examples of from 62 to 139 mm. This species was seen in large schools which appeared to be made up exclusively of this form and which were not seen to mix with the equally common *Astyanax*. Numerous specimens were ripe.

7—*Ctenolucius beani* (Fowler).

One example of 175 mm. Small schools composed of individuals of about this size constantly cruised about near the surface but were exceedingly difficult to seine in the clear water on account of their leaping ability which compares not unfavorably with that of *Mugil*.

Family II. SYNBRANCHIDAE

8—*Synbranchus marmoratus* Bloch.

Three examples ranging from 88 immature to 248 mm., a spent female. Taken by seine amid the bottom debris.

Family III. POECILIIDAE

9—*Poeciliopsis elongatus* (Günther).

Two females of 21 mm. are probably referable to this species.

Family IV. CICHLIDAE

10—*Aequidens coeruleopunctatus* (Kner and Steindachner).

Three examples of from 88 to 118 mm.

Family V. GOBIIDAE

11—*Philypnus maculatus* (Günther).

Two examples of 67 and 180 mm.

FISHES FROM CALEDONIA BAY

The material and data upon which these notes are based was collected at Caledonia Bay, a small arm of the Caribbean Sea, that slightly indents the Atlantic coast of Panama near the Colombian border. See Fig. 33. As a collecting site it is of interest chiefly because of its comparative remoteness from other Atlantic coast collecting points. Porto Bello is the nearest place from which a collection has been reported (Meek and Hildebrand '23). In the other direction a much greater distance is spanned before another site of collection is found. My presence here was in a certain sense accidental, having just emerged from the Chucunaque drainage by force of necessity, after crossing the continental divide over an unspeakable trail. I was stationed at the Indian village of Caledonia for slightly more than two weeks, although all the actual collecting was done within a period of four days, May 4 to 8. Many obstacles made even this collecting of extreme difficulty, amongst which may be mentioned a dearth of preservatives and containers, most of my supplies being nearly exhausted, a lack of proper collecting gear, not being equipped for marine collecting and numerous other activities which occupied much of my time and finally the inroads of illness into my heretofore unbroken health which eventually made my withdrawal from the field imperative.

It is hoped that this fragmentary data will be of use to those who must eventually take up the much needed study of the life histories of the Caribbean fish fauna. In all cases where it was available the local appellation given the species by the Indians at Caledonia is indicated with syllabication, the spelling being purely phonetic. Other names, representing forms not taken but of which we had fair descriptions from the natives, follow.

Shark	Nali
Sawfish	Su-coo
Ray	Ne-der-di-be
Remora	Nali-ooru
Flounder	Oo-coo-ma-dera
Any small fry	Oo-new-su

Most of the collection was taken in a twenty foot seine operated over weedy patches, just off the beaches between coral snags. Calcium carbide, intended for use in acetylene lamps was found to be excellent as a poison for rock pools in the absence of any less

expensive substance. The efficiency of this gas generating substance was found to be high if strewn rather evenly over the bottom of such pools. The effect was rapid and not infrequently the doomed fishes would leap clear of the water landing several inches back from its edge. A small amount of angling was done whilst most of the larger fishes recorded, were collected for food by the natives of the village.

The methods these Indians used in capturing fishes, which I saw during my stay at their village, have been considerably influenced by their contact with small trading sloops and schooners that barter with these people for the splendid cocoanuts that grow here in profusion and the valuable shell of the hawksbill turtle. Of course the Indians receive a ridiculously small amount of merchandise in return, but to them the machine made artifacts of civilization are indeed of great value. In this way by degrees, many of them have accumulated a considerable store of very presentable fishing tackle, that is, at least, good hooks and stout lines. As a result, much of their fishing is simply angling after our own manner, but always by hand line. A primitive sort of surf casting is occasionally indulged in. That is, a piece of coral is tied below usually two hooks and thrown bodily from shore over sandy stretches where it will not snag and is then slowly retrieved. In doing this a coil of line is thrown seaward much as sailors use a heaving line. Live bait is generally employed, most usually *Hepsetia*, *Sardinella* or *Anchovia* although they sometimes troll from their dug-outs for jack and barracuda with a piece of white or colored rag as a lure.

What appear to be the more truly native methods may be tabulated as follows although these also show the effects of contact with civilization.

Spear—Spearing is a common practice and the natives are naturally expert. The spear of this region generally consists of a point made from a square iron rod, obtained from some trader, along the edges of which notches have been filed to serve as barbs, a head of black palm into which the point is affixed and a shaft of some light hollow reed. No doubt originally the black palm head was shaped into a point in lieu of the iron spear.

Bow and arrow—A certain amount of fishing is done by means of a small bow and a multi-pointed arrow, with black palm points and a reed shaft. This however is more of a fluvitile implement and not especially characteristic of the coast.

Harpoon—Harpoons are constructed somewhat similar to the

spears but with the characteristically removable point to which a stout line is affixed. This point is made of a three-cornered file from which the temper has been drawn so that it may be shaped by a second one. The three flat sides are deeply grooved in such a way that the cross section is a three pointed star. Then deep notches are filled into each of the three vanes to form barbs. I do not know if the finished point is retempered. Sharks, tarpon and other large fish are the quarry of these devices.

Trap—A device which seems to be the primitive forerunner of a fish trap was found in considerable numbers near the village of Sasardi Nuevo, just south of Point Sasardi. Such a trap (Fig. 34) consists of a vertical wall of slats lashed together with vines and running out at right angles to the shore line for 200 or 300 feet, here curving around abruptly for about half a circle with a radius of about five feet. Stationed at this point in a "Cayuka" or dug-out the fisherman stands with his spear poised ready to strike at the first edible fish deflected toward him by the wall. Some of these "traps" are improved by a platform on which to stand and I was informed that they are frequently used at night by lantern light. No true traps, however, were seen in the possession of these Indians, but one of the negro coconut traders had a typical West Indian basket trap or "fish pot" on board.

Seine—The closest approach to a seine which I saw was a small affair used for bait catching. A piece of coarse cloth about three by four feet strung on two long poles, much like a seine but without corks or leads was operated by two men standing in a cayuka holding the extending ends of either stick, with the net placed diagonally in the water. When a school of small fish came about it was suddenly raised bringing some of them up. Its success resides chiefly in the abundance of these small bait fishes which were mostly *Anchovia*. However, the Indians that helped me operate my seine took hold with real skill, giving me the impression that they had used such gear before. This was in decided contrast to the difficulty encountered with both our own negroes and the Indians of the Pacific drainage who were very unsatisfactory as seine men.

Caledonia Bay is shored for long stretches by gentle sloping beaches of coral sand (Fig. 35) here and there interspersed with old weathered aeolian rock formations or dense stands of mangrove (Fig. 36) about which fine flocculent silt accumulates. The beaches



Fig. 34. The seaward end of a Caledonia Bay native fish deflector or trap.



Fig. 35. A typical stretch of beach in Caledonia Bay. Along such shores small fishes find shelter in weeds growing just below the tide line.



Fig. 36. A typical lane through a mangrove swamp at Caledonia. Here small Tetraodonts swarm and *Anchoia* come for shelter.



Fig. 37. Brackish pools just back of the beaches at Caledonia, such as this one, generally are quite barren of fish life.

are narrow, dense shrubbery and coco palms growing almost to the water edge (Fig. 37), under which are brackish pools quite barren of fishes, for the tide here is so slight as to be practically negligible. Below the tide line in many places patches of *Zostera* grows in profusion. Here the young of many species seek shelter together with the adults of the more diminutive forms. Small tide pools, formed in the aeolian rock by the slight rise and fall, harbor a variety of invertebrates and small fishes, gobies and blennies being especially abundant in such places. Just off the edges of the mangrove swamps, schools of Engraulids and Clupeids surge back and forth retreating into its shelter when danger approaches, whilst Tetraodonts of small size teem in places under these upthrust tangled mats. Between May 4 and 16 about fifty feet from shore the water temperature ranged from 84° to 89° at the surface, whilst closer it reached 91° frequently and even higher in the rock pools. The accompanying air temperature ranged from 80° to 85°.

A short distance off shore the gradual beaches take a rather abrupt drop, meeting the fantastic coral beds of the typical Caribbean variety. Here the larger fishes commonly associated with such places distorted themselves. Still further off large numbers of small islands arranged in a single or multiple series parallel the coast. Some consist of a purely coral origin whilst others attaining greater heights clearly have had at least a nucleus of other genesis. These islands are much more numerous than any map shows, multitudes of tiny ones, some not over one hundred feet in diameter being scattered all about. They are variously fringed by shores similar to those found on the mainland. Fending off the force of the breakers still further seaward a typical fringing reef, just about awash, marks the shoreward approach of the open ocean. In the lanes, often of considerable depth, between the islands and between them and the reef the larger fishes roam, sharks, barracudas and so forth as well as schools of various Scombrid-like fishes.

The fish fauna, as would be expected, is typical of the Caribbean region and probably differs in no essential respect from that at Colon. As the collection is extremely small and fragmentary its variety indicates the richness of the region. In all only two rock pools were poisoned, two seining parties, one dip net party, four trolling and four angling parties, were undertaken and four native catches were examined. In addition to those species taken numerous others were seen but owing to circumstances were impossible of

capture, such as large sharks, probably *Carcharhinus*, Scombrids, probably *Scomberomorus*, Hemiramphids and numerous reef fishes more or less familiar.

A considerable paucity of small species was apparent although the shores abounded with little fishes but these were mostly the young of larger species, the only small fishes found in abundance being *Anchovia* and *Hepsetia*. The complete absence of Poeciliids was striking and in such places as they are usually found, in mangrove swamps and similar locations, young Tetraodonts swarmed. However, near the head of brackish water and above in the fresh water of the exceedingly short streams of this slope they were not uncommon although none were seen which could be considered marine.

ANNOTATED LIST OF SPECIES.

Family I. SYNBRANCHIDAE

1—*Synbranchus marmoratus* Bloch. Yar-be.

Contrary to the findings of Meek and Hildebrand '23 this species was noted to be fairly common in the fresh waters of Panama, being taken in numbers on several occasions. It is included in this list of marine fishes as a single example of 248 mm. was seined out of the sea at Caledonia. Gilbert and Starks '04 who found it common at Miraflores suggested that it burrows in the mud as they took none with their seine. Although three specimens were taken by seine in the Rio Tapia on the present expedition this secretive habit was found to be characteristic for it was only necessary to drop some effervescent substance in a sluggish creek or pond that superficially appeared to be barren of them to see them come wriggling out of their places of refuge which were usually hollows under rocks. The example taken in salt water at Caledonia showed a very evident emaciation and it is quite possible that it was washed down to the sea in a weakened condition after one of the cloud bursts of the early rainy season, since the species appears to be a typical inhabitant of the head waters, as all the other material was taken well inland, chiefly in small tributaries. Furthermore ripe examples were taken far from the sea, the species probably not being catadromous.

Family II. MURAENIDAE

2—*Gymnothorax funebris* Ranzani. Yar-be.

A single example of 234 mm. Its stomach contained the carapace of a crab 16 mm. across. The coloration was of as bright a green as I have ever seen this species show. The natives evidently confuse *Synbranchus* with this as probably they are not very familiar with the former.

3—*Echnida catenata* (Bloch). Ti Naipe.

Not uncommon, but greatly feared by the natives. Their name literally

translates to water snake. This they also apply to serpents which dwell along the water courses. One specimen of 370 mm. This example had its digestive tract crammed with the remains of small crabs, the carapaces of which averaged about 25 mm. across. These were intertwined with numerous parasitic worms. It was undeveloped sexually although Meek and Hildebrand '23 took a ripe female of not more than 120 mm. longer in April at Colon.

Family III. ELOPIDAE

4—*Tarpon atlanticus* (Cuvier and Valenciennes). Me-la.

Fairly common. Appears periodically in large schools. Valued by the Indians to the extent that it is apparently their most highly prized food fish. One large school which appeared on May 6 caused the bulk of the male population to give chase, which however was unsuccessful.

Family IV. CLUPEIDAE

5—*Sardinella macrophthalmus* (Ranzani). Sardina.

Common near the edges of mangrove swamps, in small schools of individuals up to about 230 mm., or as scattered individuals in company with the more numerous and smaller *Anchovia*. Two typical examples of 44 and 46 mm. In weedy places along sandy shores smaller examples were common in company with juvenile *Anchovia*. Four examples from 23 to 26 mm. just out of the larval stage. With these were five specimens ranging from 22 to 24 mm. which appear to be of this species but still show numerous larval characteristics. Most prominently they still have a somewhat rounded ventral outline and are more elongate. The name used by the Indians is obviously borrowed from the Spanish.

Family V. ENGRAULIDAE

6—*Anchovia brownii* (Gmelin). Oo-new-su.

Found in tremendous shoals of thousands of individuals skirting along the edges of mangrove swamps, into which they retreat on the slightest provocation only to reappear a few moments after quiet is restored. The precision and unanimity with which these schools wheel and turn is striking, reminding one of the actions of a wandering flock of European starlings. Twenty specimens of from 41 to 51 mm. with a mode of 43 mm. In grassy patches along sandy beaches, smaller sized individuals were found in more scattering schools. These were just passing out of the larval stage and ranged from 22 to 30 mm. showing a mode of 24 mm. (fifty two specimens).

Family VI. BELONIDAE

7—*Tylosurus timucu* (Walbaum). Tabu-garraty.

Small examples were common close to shore. Larger examples about 300 mm., likely of this species, were seen over greater depths. Three examples, 100 to 106 mm.

Family VII. SYNGNATHIDAE

8—*Syngnathus mackayi* (Swain and Meek). Time-mass-su.

Found amid patches of marine growth near shore. Previously not re-

corded south of Porto Bello. Two examples, 132 and 134 mm., both males.

Family VIII. ANTHERINIDAE

9—*Hepsetia stipes* (Müller and Troschel). Oo-new-su.

Abundant, fringing the shores all over. Previously Porto Bello marked the southernmost limit of its known range. The Indians apparently do not distinguish this from *Anchovia*. Twenty-three examples ranging from 29 to 46 mm. with a mode of 40 mm.

Family IX. SPHYRAENIDAE

10—*Sphyraena barracuda* (Walbaum). Da-bu.

Common along sandy beaches, especially the very young, which roamed around near the edges of weedy patches generally. Very large examples of this and possibly other species cruised about in the deeper water between the fringing reefs and keys more offshore. Whilst we were not equipped for collecting such material, trolling spoons were contrived by Mr. Marsh to the number of six or eight. Although supplied with heavy wire leaders they were all lost at the first strike of these fish, such was their force, some of which were much over 125-cm. The most numerous ranged between about 30 and 90 cm. Nine examples ranging from 47 to 71 mm. with a mode of 55 mm.

Family X. HOLOCENTRIDAE

11—*Holocentrus ascensionis* (Osbeck). Oo-ah-dar-see.

Common, the very small often in company with *Upeneus*, young Haemulids, et cetera. Five examples, one of 55 mm. and four of about 153 mm. each, the former from a weedy patch and the latter by hook and line about coral heads.

Family XI. MULLIDAE

12—*Upeneus maculatus* (Bloch). Se-no-oo-ah.

Very common about weedy patches. Nine examples ranging from 48 to 75 mm. with a mode of 55 mm.

Family XII. CARANGIDAE

13—*Caranx ruber* (Bloch). -----

One example of about 300 mm. was taken by Mr. Charles Charlton on a trolling spoon intended for barracuda. Many of this or closely similar species were seen, all well offshore, mostly in the lanes between the islands. This species appears not to have been recorded south of Cozumel.

14—*Caranx crysos* (Mitchill). Ca-lu.

Fourteen small carangins, taken near weed patches, which range from 38 to 65 mm. and show a mode of 42 mm. are somewhat questionably referred to this species, as they show numerous small differences from the adult descriptions of this well known form.

Family XIII. SERRANIDAE

15—*Cephalopholis fulvus* (Linnaeus)

Marga-too-go-willy.

One example of 103 mm.

- 16—*Epinephelus morio* (Cuvier and Valenciennes). _____
Not uncommon, but not nearly as abundant as *E. striatus*.
- 17—*Epinephelus adscensionis* (Osbeck). Marga-too-go-willy.
Not uncommon. Apparently not distinguished from *Cephalopholis* by the natives.
- 18—*Epinephelus striatus* (Bloch). _____
Thirteen examples ranging from 150 to 610 mm.
- 19—*Epinephelus guttatus* (Linnaeus). Too-goo.
Eight examples ranging from 125 to 254 mm. Generally in company with *E. striatus* near reef formations.

Family XIV. LUTIANIDAE

- 20—*Lutianus synagris* (Linnaeus). Oo-ah-nalu.
One example of 110 mm.
- 21—*Lutianus jocu* (Bloch and Schneider). Nalu-oo-sele.
Not uncommon. One example of 235 mm. was apparently immature and contained a single small crab in its stomach.
- 22—*Lutianus apodus* (Walbaum). Nalu-oo-sele.
Fairly common. Two examples of 150 and 343 mm. The latter, a nearly ripe female had a fish sound in its stomach whilst the former was immature. Naturally this is not distinguished from *L. jocu* by the natives.
- 23—*Lutianus ambiguus* (Poey). _____
One specimen of 100 mm. which considering its small size agrees well with the descriptions of this little known form.
- 24—*Ocyurus chrysurus* (Bloch). Yala-tail-a.
Not uncommon. The Indian name is obviously a corruption of the English West Indian name "Yellow tail." A favorite food fish of the natives.

Family XV. HAEMULIDAE

- 25—*Bathysoma rimator* (Jordan and Swain). Oo-ah-su.
One example of 103 mm.
- 26—*Haemulon flavolineatum* (Desmarest). _____
Seven examples of 101 to 152 mm. Twenty-three small Haemulids ranging from 22 to 35 mm. with a mode of 27 mm. are questionably referred to this species. The agreement is fair but the coloration and pattern is considerably different. These were taken in weedy places close to shore.
- 27—*Haemulon sciurus* (Shaw). Bu-too.
Not uncommon. Generally found in company with *H. flavolineatum*.
- 28—*Anisotremus surinamensis* (Bloch). Wati-car-see-che.
A single medium sized specimen was seen.

Family XVI. GERRIDAE

29—*Eucinostomus californiensis* (Gill).

Small examples were found chiefly in weedy places and occasionally off the coral island opposite Caledonia village. One group of eight specimens ranged from 25 to 39 mm. and showed a mode of 25 mm. and another of seventeen specimens ranged from 12 to 20 mm. and showed a mode of 14 mm.

Family XVII. POMACENTRIDAE

30—*Abudefduf saxatilis* (Linnaeus). Canis-ah-oo-wa. Young Qua-beb.

Fairly common about snags and coral heads. Young common in rock pools. Here they tend to school and keep more to the open places than the *Pomacentrus* there associated with them. The coloration of these was very pale in life, much less so than examples of similar size seen in Bermuda. They were somewhat reminiscent of *Cyprinodon variegatus* Lacépède in appearance and action. Twelve examples ranging from 12 to 29 mm. showed a mode of 17 mm.

31—*Pomacentrus fuscus* Cuvier and Valenciennes. Was-che-che.

Common in tide pools. Three examples of from 15 to 45 mm.

Family XVIII. LABRIDAE

32—*Doratonotus decoris* Evermann and Marsh. Ah-bu.

Two specimens (32 and 40 mm.) of this exquisite little bright green labrid were seined from a patch of weed on a sandy beach. The apparent irregular boundary of the dorsal, the completely transparent nature of the distal margins of the vertical fins, the entire transparence of the pectorals and the full coloration of the ventrals gave them in life, an extremely broken outline (Fig. 38),

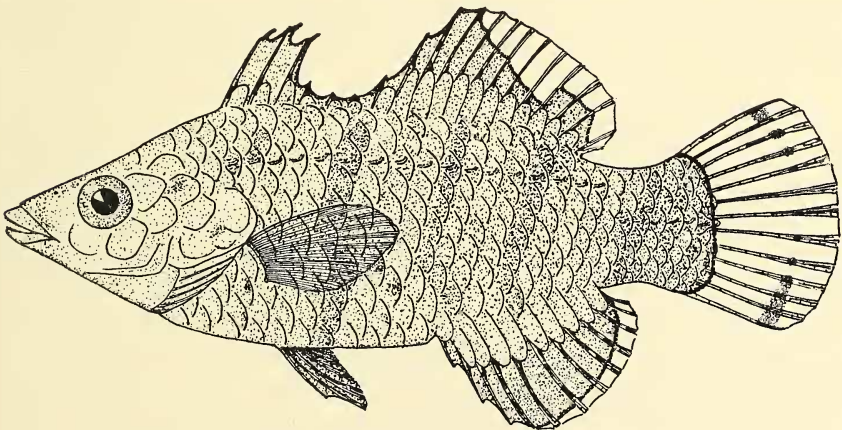


Fig. 38. *Doratonotus decoris*. A sketch of the larger example, showing the unusually broken and abrupt outline of the coloration extending on the vertical fins, beyond which they are nearly invisible in life.

so that they greatly resembled torn fragments of sea weed. As they swam in the collecting pail, after the manner of their family, slowly winging their way along by means of their pectorals alone, which were perfectly invisible, and steering by their nearly equally invisible caudal, the illusion was greatly enhanced. and were it not for their irregular and erratic gyrations I might not have recognized them as fish. Even when lifted in the hand the sense of touch was called in to supplement that of vision in definitely establishing the presence of the tail fin. Unfortunately much of this transparency has vanished in spirits. Examples from other localities do not always show this extremely irregular outline of color, there being apparently much variation in this character. Both of the present examples were ripe females. The ovarian eggs average 0.30 mm. in diameter. The abdomens were considerably distended. This is the southernmost record for the species.

Family XIX. SCARIDAE

33—*Sparisoma hoplomystax* (Cope). Ah-oo.

Two examples of 70 and 350 mm. The former may possibly be *S. niphobles* Jordan and Bollman which closely resembles this species and is almost impossible to differentiate at this size owing to the inconstancy of the differential characters.

34—*Scarus croicensis* (Bloch). Ah-oo.

Three examples ranging from 14 to 35 mm. They lack the characteristic light abdominal streak but otherwise the agreement is good considering their small size.

Family XX. CHAETODONTIDAE

35—*Pomacanthus arcuatus* (Linnaeus). Oo-ha-sigel-de.

Common about coral heads in company with what appeared to be *Angelichthys* as near as could be told without the aid of a water glass. One example of 80 mm.

Family XXI. TEUTHIDAE

36—*Teuthis bahianus* (Castelnau). Oo-ah-nali.

Seven examples ranging from 31 to 46 mm. with a mode of 33 mm. All near weed patches. Although showing numerous immature non-diagnostic characters they are referred to this species because of the shape of the tail even though it lacks the filament often found in the adults, the light margining of that fin which was blue in life and the body depth which increases from 1.7 in the smallest to nearly 2.0 in the largest.

Family XXII. BALISTIDAE

37—*Balistes vetula* Linnaeus. Old-wipe.

Three examples of from 101 to 203 mm. Common about coral heads. The Indian name is clearly a corruption of the English West Indian name "Old wife."

Family XXIII. MONACANTHIDAE

38—*Monacanthus ciliatus* (Mitchill).

Two examples of 31 and 42 mm. In weed patches near shore. In life numerous dermal flaps were prominently scattered over the sides which together with the general greenish coloration appears to attain nearly the same degree of deceptiveness that *Doratonotus* does by other means. Both these species living side by side and normally of slow movements greatly resemble fragments of sea weed to the human eye at least. This seems to be a case of parallel development induced by similar needs of protective resemblance for such it certainly appears to be, one meeting the requirements of the adults of a small species and the other those of the young of a larger one that loses it later.

39—*Alutera scripta* (Osbeck).

One example of 301 mm.

Family XXIV. OSTRACIIDAE

40—*Lactophrys bicaudalis* (Linnaeus).

Cala-pa-too.

One example of 381 mm.

Family XXV. TETRAODONTIDAE

41—*Spheroides testudineus* (Linnaeus).

No-sardele.

Common in mangrove swamps, particularly where fresh waters are emptying out, but all small. See Fig. 36. Here they "poke" about slowly, apparently feeding on small invertebrates attached to the roots and stalks of the mangrove trees. Occasionally about the shores of coral islands. Two examples 14 and 51 mm.

Family XXVI. GOBIIDAE

42—*Gobius soporator* Cuvier and Valenciennes.

Too-goo.

Common in tide pools. Twenty examples of from 16 to 71 mm. showed modes at 20, 45 and 65 mm.

Family XXVII. BLENNIIDAE

43—*Labrisomus nuchipinnis* (Quoy and Gaimard).

One example of 21 mm. from a rock pool. Only one opercule showed the characteristic spot.

44—*Blennius cristatus* Linnaeus.

Too-wala-lady.

One example of 36 mm. In company with *Gobius*.45—*Salariichthys textilis* (Quoy and Gaimard).

Too-wala-lady.

One example of 31 mm. In company with *Gobius* and *Blennius*. Naturally the Indians do not have separate names for these small fishes that are not of use to them.

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