Notes on the Blennioid Fishes of Hawaii with Descriptions of Two New Species

DONALD W. STRASBURG[1]

ALTHOUGH NEARLY EVERY REPORT on the Hawaiian inshore fishes alludes to the blennies, the Hawaiian members of this group have never been reviewed in their entirety. Jordan and Evermann (1905) discuss and figure most of the common forms, while Jordan and Seale (1906) and Fowler and coauthors (1901, 1922, 1925, 1928, 1949) present supplemental data. Unfortunately the taxonomy employed in the above reports is sometimes inaccurate because of the close resemblance between Hawaiian blennies and those of other areas, and in a few instances it errs because of a species being based on a larval or sexual form. There are overall problems of a lack of adequate keys and of generic names not being up to date.

This paper was prepared with a three-fold purpose. It attempts to clarify certain nomenclatorial problems, it provides a key and a description for the identification of each Hawaiian species, and it reports two hitherto undescribed forms as new, along with a new record of a previously known species. The geographical scope of this study includes the high or windward Hawaiian Islands, the leeward islets and shoals extending from Niihau northwest to Midway Island, Midway Island itself, and Johnston Island. Specimens have been taken from numerous islands in this assemblage, with the major collecting emphasis being on Oahu, in the windward Hawaiian chain. Where synonymies are given they refer only to Hawaiian records unless otherwise noted.

[1] United States Fish and Wildlife Service, Honolulu. Work done at Duke University, Durham, N. C. Manuscript received May 23, 1955.

ACKNOWLEDGEMENTS

I am greatly indebted for assistance received from numerous individuals and institutions. Dr. William A. Gosline and other staff members of the University of Hawaii aided me in collecting many of the specimens examined. The Museum of Comparative Zoology at Harvard College sent certain early collections of Hawaiian blennies; Dr. J. L. B. Smith loaned a South African specimen of *Entomacrodus;* and Dr. Itiro Tomiyama supplied specimens of several Japanese blennies. Drs. N. B. Marshall and Gilbert P. Whitley, of the British and Australian Museums respectively, examined type material unavailable to me. I am grateful for permission to examine specimens and use various facilities at the United States National Museum, the American Museum of Natural History, the Bernice P. Bishop Museum, the University of Hawaii, the Pacific Oceanic Fishery Investigations (U. S. Fish and Wildlife Service, Honolulu), and the Territorial Division of Fish and Game (Honolulu). In this report these institutions are referred to as follows: USNM, AMNH, BPBM, UH, POFI, and DFG. The

Museum of Comparative Zoology at Harvard College is abbreviated as MCZ. Mr. James K. Park of Honolulu prepared Figure 2.

METHODS

The Hawaiian blennioid fishes include representatives of the families Blenniidae and Tripterygiidae. As pointed out by Clark Hubbs (1952: 50), these families are readily distinguishable by the presence of scales in the Tripterygiidae and by their universal absence in the Blenniidae (except in *Neoclinus*, which does not occur in Hawaii). In addition to the presence of scales, the three dorsal fins and bright red coloration render the single Hawaiian tripterygiid a readily identifiable form.

Norman's analysis of the genera (1943), supplemented by Schultz's definition of *Runula* (1950) and Strasburg and Schultz's of *Cirripectus* and *Exallias* (1953), constitutes the basis for generic subdivision of the Hawaiian Blenniidae. The need for dividing certain heterogeneous genera such as *Istiblennius* has been implied by Norman (*op. cit.*), but it is felt that such separation should be made in monographic treatments and not in a faunal report. The Hawaiian blennies can be subdivided into the subfamilies Blenniinae and Salariinae as shown by Norman (*op. cit.*), but it appears that his Ophioblenniinae may represent only larval forms.

In the following key considerable use has been made of meristic characters, and the methods used in counting certain structures need explanation. Each fin ray with a separate and distinct base was counted as one, and those rays split to a single base were also counted as one ray. Spines and soft rays are sometimes difficult to distinguish in the Hawaiian blennies, but can often be differentiated when the fin is held before a strong light, or by removing the membrane from one side of the fin. In general, the spines are soft and flexible but rather more slender than articulated rays. In certain genera the dorsal fin membrane is notched between the spinous and soft-rayed portions, and the minute last dorsal spine occurs at the base of this notch. In those genera having the dorsal fin entire the last dorsal spine is about the same size as the penultimate one.

The anal fin of Hawaiian blennies is composed of two short, weak spines (only one spine in the tripterygiids) followed by a series of longer soft rays. Aside from their length it is practically impossible to distinguish anal spines from rays without dissection and staining, and the problem is further complicated in female blenniids where the first spine becomes embedded in genital tissue with growth. In adult male *Cirripectus* and *Exallias* each anal spine is enclosed in a mass of spongy tissue, the presence of which facilitates sex determination.

The methods employed by Strasburg and Schultz (1953: 129) have been used for counting head cirri. A nuchal cirrus was counted as one if it had a single base, cirri with distal or basal branches thus being enumerated as one. The degree and type of branching of supraorbital cirri was found to be useful in distinguishing species of *Cirripectus*, and the morphology of these structures is discussed in the key and species diagnoses.

An important characteristic of some blenniids is their possession of canine teeth in addition to numerous small incisors. Canines range in size from short stubs in *Entomacrodus* to large fangs in *Runula*, but are lacking in *Istiblennius zebra* and *Exallias*. When present, canines occur posteriorly in the jaws and mesial to the incisors.

Many Hawaiian blennies have relatively large larvae which are considerably different from the adults. In a few cases such larvae have been the basis for the erection of genera and species, and only recently (Chapman, in de Beaufort and Chapman, 1951: 249–254) have they been recognized as larval forms. Larvae are readily distinguished from juveniles by their glassy transparency when alive and their nearly uniform straw or white coloration

in preservative. Identification of larvae usually cannot be made with the following key.

DUBIOUS RECORDS

Jordan and Evermann (1905: 5, 7, 10, 23, 497), Fowler (1928: 432), (1938: 300), and others have listed *Hypsoblennius sordidus* (Bennett) as a valid Hawaiian species. Fowler (1901: 517; 1922: 84; 1928: 428; 1938: 300) also records *Aspidontus filamentosus* (Valenciennes) from Hawaii but later (1949: 146) changes the name of his specimen to *Aspidontus taeniatus* Quoy and Gaimard. Fowler (1928: 442; 1938: 301) lists Hawaiian specimens of *Istiblennius lineatus* (Valenciennes) as being in the United States National Museum, but a thorough search by the writer did not reveal the specimens there. Günther's Hawaiian record of *Hypsoblennius brevipinnis* (1861: 226; 1877: 194) is probably a geographical error as was pointed out by Jordan and Evermann (1905: 504), although the species is not a synonym of *Exallias brevis* as indicated by the latter authors (*ibid.*). Jordan and Evermann's listing of *Scartichthys sauritus* (1905: 17), which would be a blenny, is a misspelling based upon Fowler's earlier record (1901: 511) of *Scarichthys auritus*, a parrot fish.

Since none of the above species has been taken in the writer's five years of collecting in Hawaii, it is possible that records of their Hawaiian occurrence are invalid. They are not considered further in this report, but erroneous records of other species are listed under the appropriate synonymy.

KEY TO THE HAWAIIAN BLENNIOID FISHES

1a. Body covered with scales; three separate dorsal fins, the anterior two composed of spines; living specimens red or brownish red, males with black heads (family Tripterygiidae) . . . . . **Tripterygion atriceps**

1b. Body without scales; dorsal fin composed of flexible spines anteriorly and soft rays posteriorly, the two regions often separated by a notch in the connecting membrane, and appearing as separate fins (family Blenniidae) 2

2a. A transverse fringe of from 25 to 45 cirri across the nape 3

2b. No fringe of cirri across nape; if cirri occur on nape they total four or less . . 6

3a. Dorsal rays XII, 13 (rarely XII, 12); no canines on dentary; teeth in lower jaw more or less rigidly implanted, those in upper jaw freely movable; lower teeth about twice as broad and half as numerous as those in upper jaw; a pair of stubby tentacles on each side of chin; with numerous small dark spots on pale background, spots sometimes arranged in clusters which may align to form vertical bars . . . . . **Exallias brevis**

3b. Dorsal rays XII, 14 to 16 (very rarely 13); a short stout canine posteriorly on dentary; teeth in both jaws freely movable, of approximately equal width and number; no tentacles on chin; ground color dark, unmarked, or with light or dark spots 4

4a. An elongate dark spot, about size of pupil, behind eye; dorsal rays XII, 16 (rarely 15); anal rays usually II, 17; upper part of membrane between anterior dorsal spines dusky, not abruptly pale or transparent; bases of upper pectoral rays notably darker than bases of lower rays; head and trunk rosy or reddish brown, tail dark brown, frequently with irregular olive or tan blotches; head and body usually covered with scattered white dots . . . . . **Cirripectus obscurus**

4b. No dark spot behind eye; dorsal rays XII, 14 or 15 (very rarely 16); anal rays II, 15 or 16 (rarely 17); anterior dorsal fin membrane dusky basally, abruptly pale or transparent (red in life) distally; base of upper and lower pectoral rays about same shade 5

5a. Body dark brown, marked with small

white or yellowish dots arranged in three to five lengthwise rows, sometimes also marked with tiny black dots; supraorbital cirrus slender, normally unbranched, if branched, filaments (not more than 5) arise from a central axis; dorsal rays usually XII, 15; anal rays usually II, 16; nuchal cirri totaling 25 to 32, usually 26 to 30; membranous attachment of last dorsal ray to caudal peduncle ending directly above flexure marking caudal base; line separating dusky and pale portions of dorsal fin running from base of first spine to tip of about sixth spine. . . . . **Cirripectus lineopunctatus,** n. sp.

5b. Body uniform tan to brownish black, unmarked; supraorbital cirrus multifid, 4–11 (usually 5–8) branches arising from a broad base; dorsal rays XII, 14; anal rays II, 15; nuchal cirri totaling 31 to 43, usually 32 to 40; membranous attachment of last dorsal ray to caudal peduncle ending about one pupil diameter, or more, posterior to flexure marking caudal fin base; line separating dusky and pale portions of dorsal fin running from base of first spine to tips of anterior soft rays. . . . . **Cirripectus variolosus**

6a. Teeth, excluding canines, loosely set in gums and freely movable (only in upper jaw of *Ecsenius*); gill opening large, elongate, extending beyond base of pectoral fin both dorsally and ventrally. 7

6b. Teeth in both jaws firmly attached, practically immovable; gill opening restricted to a narrow slit commencing above pectoral base and running ventrally to level of middle pectoral rays. **10**

7a. A cirrus present over each eye; dorsal fin with deep notch between spinous and soft-rayed portions; more than 100 incisiform teeth in lower jaw, freely movable; dorsal spines XIII (very rarely XII); a single multifid cirrus on each anterior nostril. **8**

7b. No supraorbital cirrus; dorsal fin entire; not more than 50 incisiform teeth in lower jaw, firmly attached, only slightly movable; dorsal rays XII, 16–18; anal rays II, 17–20; two cirri on each anterior nostril, the upper one longer and simple, the lower one sometimes bifid. . . . . **Ecsenius hawaiiensis**

8a. A pair of cirri present on each side of nape, the mesial one larger and usually multifid, the lateral one slender and simple or occasionally bifid (lateral cirrus sometimes lacking in juveniles); supraorbital cirrus multifid; upper lip crenulate; soft dorsal rays 14–16; anal rays II, 15–17. . . . . **Entomacrodus marmoratus**

8b. No cirri on nape; supraorbital cirrus simple; upper lip smooth; soft dorsal rays 18–23; anal rays II, 19–24. . . . . **9**

9a. Adults and juveniles over 50 mm. in length with a median membranous crest on head, and with last soft dorsal ray attached to uppermost caudal rays by a membrane; no canines on dentary; dorsal rays usually XIII, 21–23, most commonly XIII, 22; anal rays II, 22 or 23; body tan to bluish black, frequently marked with light vertical bars; fins nearly uniformly dusky. . . . . **Istiblennius zebra**

9b. No crest on head; last soft dorsal ray free from caudal fin; a short canine posteriorly on dentary; dorsal rays XIII, 19–21, usually XIII, 19 or 20; anal rays II, 19–21; body tan, variously covered with light and dark spots; vertical fins spotted. . . . . **Istiblennius gibbifrons**

10a. Trunk and tail uniform deep brownish black or jet black; head and dorsal fin of males dark gray and marked with black lines or spots; dorsal and anal fins united to caudal by membranes (except in small juveniles); length rarely greater than 1 inch. . . . . **Enchelyurus brunneolus**

10b. Trunk and tail not uniformly colored but marked with dark stripes, lines, or bars on a lighter background; dorsal and anal fins not united to caudal; adult length 2–4 inches **11**

11a. Isthmus and throat pale, crossed by 5 or 6 dark V-shaped lines which are continued on cheeks; a dark spot, about size of eye, behind eye; body tan or yellowish, marked with about 11 oblique and vertical dark bars; a stout canine on each side of upper and lower jaws; pectoral rays 13 . . . . . **Omobranchus elongatus**

11b. Isthmus and throat pale, not crossed by dark lines; no dark spot behind eye; color pattern consisting of a dark lengthwise stripe, or stripes, against a lighter background; canines limited to lower jaw; pectoral rays 12 . . . . . **12**

12a. A pair of black-edged blue stripes running length of body but not extending onto caudal fin; upper stripe narrow, passing dorsal to eye; lower stripe broad, passing ventral to eye; rest of body gray (brick-red in life); anal rays II, 32 or 33 . . . . . **Runula ewaensis**

12b. No black-edged blue stripes present; upper half of head and body brown, lower half abruptly white; brown area divided into two lengthwise stripes by a narrow white line running from snout across upper edge of eye to caudal peduncle; lower brown stripe frequently bearing dark blotches along its length; anal rays II, 29 or 30 . . . . . **Runula goslinei,** n. sp.

Family TRIPTERYGIIDAE

Genus TRIPTERYGION Risso

Tripterygion Risso (1826: 241). Type of genus, *Tripterygion nasus* Risso.

Tripterygion atriceps Jenkins

Tripterygion atriceps Jenkins (1903: 505, type locality Honolulu).

Enneapterygius atriceps. Jordan and Evermann (1905: 19, 27, 496); Jordan and Seale (1906: 416); Fowler (1922: 84); Fowler and Ball (1925: 28); Pietschmann (1930: 20).

Enneapterygius atripes Jordan and Jordan (1922: 82).

Enneapterygius hemimelas. Fowler and Ball (1925: 28); Fowler (1927*a:* 29; 1928: 427; 1934: 445; 1938: 300; 1949: 145, in part); Pietschmann (1938: 44); Tinker (1944: 341); Edmondson (1946: 352).

This diminutive blenny has frequently been considered synonymous with the Samoan *T. hemimelas* Kner and Steindachner (1866: 371) to which it is closely related. Although the type of *hemimelas* was not seen, 20 specimens from Samoa and the neighboring islands of Tau and Rose were examined, and meristic data from these specimens and Hawaiian *atriceps* are presented in Table 1. These data may be summarized by saying that *atriceps* averages about one ray more than *hemimelas* for the anal and second and third dorsal fins, and that it also has more notched scales in the posterior lateral line. Males of both species differ from females in that their heads are black whereas those of females are relatively pale. Male *atriceps* have dark lips and their bodies are marked with a series of 9–14 dusky vertical bars which are frequently interrupted on the mid-sides and are sometimes fused to form about 6 bars dorsally. In male *hemimelas* the upper lip is dusky anteriorly and pale posteriorly, and the dusky body pigmentation is localized as a very broad vertical bar beneath the soft dorsal and another across the caudal peduncle. Female *atriceps* have the barred pattern of males but lack the black head pigmentation; female *hemimelas* are marked with only a few scattered dark pigment spots. In light of these differences *T. atriceps* is regarded as distinct from *T. hemimelas*.

Chapman and Schultz (1952: 528), believing *atriceps* and *hemimelas* synonymous, reported a specimen of *hemimelas* from a barge

hauled from Guam to Pearl Harbor and there placed in drydock. This specimen (USNM No. 112290) was examined and found to be neither *atriceps* nor the Guamanian form (undescribed, and here based on USNM No. 123931). The barge specimen appeared to be most similar to typical Rose Island and Samoan *hemimelas*, and it is possible that this species is now established in Hawaii. In view of our limited knowledge of this barge's itinerary it is perhaps unwise to ascribe specific locales to specimens taken from it (cf. *Ecsenius hawaiiensis*).

T. atriceps is apparently an endemic Hawaiian blenny. It is abundant but seldom seen alive because of its habit of secreting itself in crevices in shallow reefs. Specimens may be obtained by splitting masses of coral rock or by the use of rotenone.

MATERIAL EXAMINED: *T. atriceps*—holotype and 6 paratypes at USNM; 15 Oahu at UH; 5 Oahu and 21 Hawaii in writer's collection. *T. hemimelas*—1 Apia, 8 Tutuila, 5 Rose Is., 6 Tau Is. at USNM.

TABLE 1
COUNTS MADE ON SPECIES OF *Tripterygion*

		T. atriceps (HAWAII)	*T. hemimelas* (SAMOAN AREA)
Dorsal fin	III	48	16
	XII		2
	XIII	4	14
	XIV	41	
	XV	3	
	8	4	
	9	23	14
	10	21	2
Anal fin	I	48	18
	16		2
	17		9
	18	5	7
	19	35	
	20	8	
Pectoral fin (both sides counted)	14	1	3
	15	27	20
	16	24	13
Pore-bearing scales in anterior lateral line	16	3	1
	17		6
	18	11	1
	19	9	4
	20	4	
Notched scales in posterior lateral line	16	3	3
	17	3	4
	18	9	
	19	7	1
	20	2	

Family BLENNIIDAE

Genus EXALLIAS Jordan and Evermann

Exallias Jordan and Evermann (1905: 503). Type of genus, *Salarias brevis* Kner.
Gloriella Schultz (1941: 17), based on Ternate material.
Leoblennius Reid (1943: 382).

Exallias brevis (Kner)

Salarias brevis Kner (1868*a:* 29; 1868*b:* 334, pl. 6, fig. 18, type locality Savay, Samoa); Fowler (1901: 518); Jenkins (1903: 506).
Salarias leopardus Day (1869: 518), Ceylon material.
Blennius leopardus Day (1876: 325), Hawaii and Ceylon material.
Alticus brevis. Jordan and Evermann (1905: 17).
Exallias brevis. Jordan and Evermann (1905: 503); Jordan and Seale (1906: 431); Jordan and Jordan (1922: 83); Strasburg and Schultz (1953: 128).
Cirripectes brevis. Fowler (1922: 84; 1928: 432; 1938: 300; 1949: 149); Tinker (1944: 342).
Cirripectes leopardus. Schultz (1941: 18; 1943: 272); Fowler (1949: 149).
Cirripectus leopardus. Norman (1943: 810); Chapman, in de Beaufort and Chapman (1951: 247).
Cirripectus brevis. Norman (1943: 810).
Leoblennius schultzi Reid (1943: 382); Fowler (1949: 148).

The confusion regarding the names *brevis* and *leopardus* has been corrected by Strasburg and Schultz (1953), and to their synonymy

must also be added *Leoblennius schultzi* Reid (1943: 382). The holotype of *L. schultzi* was examined and found to be a late larval stage of *E. brevis*. A similar larva formed the basis for Schultz's earlier genus *Gloriella*.

E. brevis is a handsomely marked but rather uncommon blenny in Hawaii. As noted in the key, its color pattern consists of clusters of dark spots on a light background. In most fresh specimens the ground color is white or creamy, and the spots range from brown to almost black. In mature males the spongy pads covering the anal spines are deep indigo. Most specimens have been obtained from depths of 4–10 feet, but a series of three large males was taken at 20–35 feet off Waikiki on December 31, 1952. These males differed from others in that they were bright reddish orange marked with brown spots. It is possible that this vivid coloration is associated with habitat or perhaps breeding, since masses of blenny (?) eggs were found nearby.

Little is known of the habits of this fish. All but one of the mature specimens examined were taken by the use of rotenone; the exception was speared in shallow water. The species is widespread throughout the Indo-Pacific but is apparently nowhere common.

MATERIAL EXAMINED: Holotype of *Leoblennius schultzi*, 1 other Oahu, 5 "Hawaii," and 3 Johnston Is. at USNM; 1 Oahu at BPBM; 5 Oahu, 2 Kauai, 1 Hawaii, and 1 Johnston Is. at UH; 1 Lanai at POFI; 2 Hawaii at DFG.

Genus CIRRIPECTUS Swainson

Cirripectus Swainson (1839: 79–80, *Cirripectes* on pp. 182, 275). Type of genus, *Salarias variolosus* Valenciennes.

Cirripectus obscurus (Borodin)

Cirripectes alboapicalis. Fowler (1923: 389; 1927*b*: 91; 1928: 433; 1938: 300); Tinker (1944: 342).

Exallas obscurus Borodin (1927: 1, type locality Oahu).

Exalias obscurus Borodin (1928: 53).

Cirripectes obscurus Borodin (1928: 54).

Cirripectes variolosus. Schultz (1941: 20, in part); Fowler (1949: 148, in part).

Cirripectus variolosus. Chapman, in de Beaufort and Chapman (1951: 250, in part).

In a report on the fishes of Lord Howe Island, Ogilby (1899: 742) described *Salarias alboapicalis* as new, the species being characterized and named because of a conspicuous white patch located anteriorly and distally on the spinous dorsal fin. McCulloch and McNeill (1918: 23), although disagreeing with Ogilby on other characters of the species, present a figure of a Lord Howe specimen which clearly shows the fin-marking noted by Ogilby. While these records are extralimital to the present study they are worthy of note in that the descriptions and figures come very close to fitting a common Hawaiian blenny. This fish was initially identified as *C. alboapicalis* by Fowler (1923: 389) but later described as a new species, *Exallias obscurus*, by Borodin (1927: 1), both names ultimately being relegated to the synonymy of *C. variolosus*.

Dr. Gilbert P. Whitley of the Australian Museum has kindly examined all specimens referable to *Cirripectus* in that institution. His counts on the Lord Howe cotypes of *alboapicalis* (the holotype is lost) are in close agreement with those obtained from Hawaiian material, but the fading of his specimens precludes adequate color notes. In any case both the Lord Howe *alboapicalis* and the Hawaiian form are quite distinct from *variolosus*, and further, appear to be separable themselves. The holotype of *C. obscurus* (Borodin) and numerous other Hawaiian specimens referable to that species have been examined, and in none of them is the dorsal fin characterized by the white membrane shown by McCulloch and McNeill (1918: pl. 4). Furthermore, no specimens of *obscurus* show any

indication of white spotting on the anal fin as depicted for *alboapicalis* by these authors. It is felt that these differences in coloration warrant the separation of *obscurus* from *alboapicalis* until such time as fresh Lord Howe material is available.

The color pattern of *C. obscurus* is somewhat variable, a 113 mm. freshly-killed male being marked as follows: head and anterior trunk rose, shading to rosy brown, covered with small white dots; posterior trunk and tail dark brown, covered with scattered white dots, and with a series of eight broken olive bars on sides; first dorsal rosy; second dorsal dusky rose shading to purple; anal indigo; pectorals purple; caudal rose; nuchal cirri dark blue; nasal and supraorbital cirri red; iris golden. A 94 mm. female had the body golden brown with darker mottlings and covered with small white dots; the fins and other structures were as in the male except that the anal fin bore two lengthwise red stripes.

C. obscurus is probably the largest and among the most colorful of the Hawaiian blennies. Specimens of standard lengths up to 135 mm. are common over rocky bottoms at depths of from 4 to 20 feet. The species must be regarded as an Hawaiian endemic for the present. Its affinities appear to lie with *alboapicalis* and also with an as yet undescribed blenny (USNM Nos. 65412 and 65413) from Easter Island.

MATERIAL EXAMINED: Holotype of *C. obscurus* (Borodin) at AMNH; 30 Oahu, 7 Hawaii at UH; 39 Oahu in writer's collection.

Cirripectus lineopunctatus, new species
Fig. 1

HOLOTYPE: USNM No. 164198, a male, 59 mm. in standard length, taken in a shallow-water rotenone station at Kaena Point, Oahu, T.H., on March 19, 1950, by Gosline, Strasburg, Banner, and Sherman.

PARATYPES: USNM No. 164199, 8 specimens, 28–69 mm. in standard length, taken with holotype; USNM No. 164201, 5 specimens, 28–44 mm. in standard length, taken in a shallow-water rotenone station just north of Makapuu Point, Oahu, T.H., on Sept. 28, 1950, by Gosline and party; USNM No. 164200, 6 specimens, 36–62 mm. in standard length, taken in a rotenone station at depths of 5–30 feet, Hanauma Bay, Oahu, T.H., on Sept. 16, 1951, by Gosline and Holland.

It is probable that, if previously taken, this

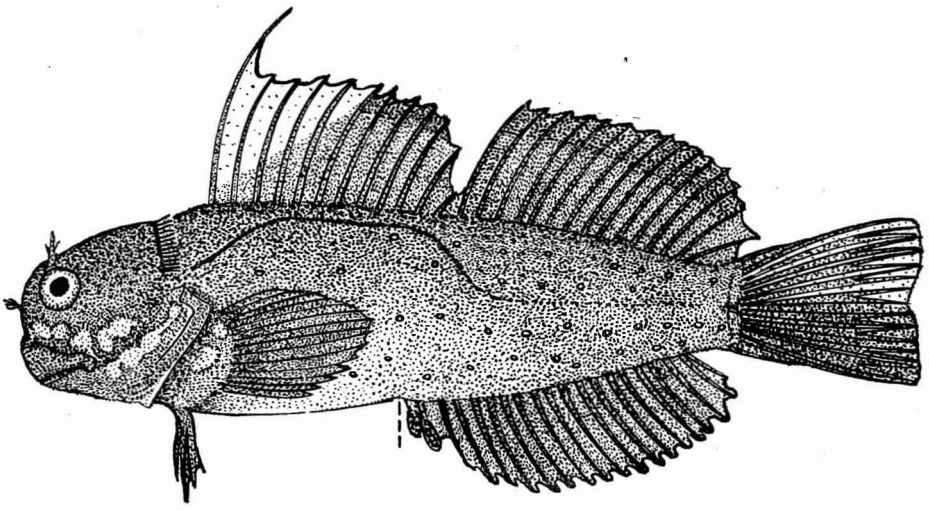

FIG. 1. Holotype of *Cirripectus lineopunctatus*, new species (USNM No. 164198) from Kaena Point, Oahu. Scale represents 20 mm.

species has been confused with either *C. obscurus* or *variolosus*. Fowler (1941: 276) reports a specimen of *variolosus* from Waianae, Oahu, which is marked somewhat as *lineopunctatus*. His description is inadequate for definite identification, and the specimen has not been seen.

DESCRIPTION: Counts made on *lineopunctatus* are recorded in Table 2, and detailed measurements, expressed in thousandths of the standard length, appear in Table 4.

Dorsal rays XII, 15 (very rarely 16); anal II, 15–17 (rarely 15 or 17), first anal spine embedded in females; pectoral 15; pelvics I, 4; branched caudal rays 5+4; fringe of cirri on nape 25–32; nasal cirri 3–6, usually 5; supraorbital cirri usually slender and unbranched, or if branched, branches arise from a central axis and never number more than 5.

Head 3.5 or 3.6; greatest depth 3.2–4.1; longest dorsal spine 3.3–5.4 (spine elongate in mature males); longest pectoral ray 4.6–5.1; all in the standard length. Eye 4.1–4.7; snout 2.9–3.3; interorbital space 8.3–9.3; postorbital length of head 1.5; least depth of body 2.4–2.7; greatest depth of body 0.9–1.1; all in length of the head; snout 1.2–1.4 in least distance between eye and nuchal fringe.

Supraorbital cirrus commonly a simple tapered flap; in some specimens a few branches arise from near its base, but cirrus base is never notably enlarged (as in *C. obscurus* and *variolosus* where it resembles a candelabrum); nuchal band of cirri interrupted on middorsal line, extending ventrally to level of pupil, cirri usually simple; snout profile nearly vertical; edge of upper lip with about 35–40 short fleshy papillae; lower lip plicate laterally, weakly papillate mesially, and with a short flap lateral to plicate portion; lateral line arched over pectoral fin, then running along midsides to base of caudal; tip of depressed pectoral just reaches anus; anal spines two, first embedded in mature females, both enclosed in convoluted pads of fleshy tissue in mature males; membrane between eleventh dorsal spine and first soft ray deeply notched, minute twelfth dorsal spine at base of notch; membranous attachment of last dorsal ray to caudal peduncle ending directly above flexure marking caudal fin base; fifth pectoral ray from lowermost edge of fin longest; caudal fin subtruncate, occasionally slightly concave; a curved canine present posteriorly on dentary; incisiform teeth in both jaws very numerous, of equal size, and freely movable.

Color in alcohol. Ground color light to dark brown; trunk and tail with 3–5 irregular lengthwise rows of light dots, many of which are rimmed with black; a few black dots posteriorly on tail; cheeks, snout, upper lip, and pectoral bases brown, irregularly marbled with white; throat and belly brown; dorsal fin blackish, sometimes a few white dots on posterior part; membrane between first few dorsal spines unpigmented and transparent distally, line of demarcation between pigmented and pale portions running from base of first spine to tip of about sixth spine; anal fin plain blackish or with a few white dots in males, abundantly spotted with white in females; tissue covering anal spines of males grayish; lower lobe of caudal blackish in males, spotted with white in females; upper lobe of caudal white or gray in both sexes; pectorals brownish with weak indications of white spotting in both sexes; pelvics brown; nuchal, supraorbital, and nasal cirri dusky.

Color in life. Head, body, and fins dark brown; cheeks, upper lip, and pectoral bases mottled with light olive; body covered with small black-rimmed white or yellow dots arranged in lengthwise rows and frequently aligned vertically; small black dots, also arranged in rows, sometimes present; dorsoanterior part of spinous dorsal red; nuchal cirri blackish; supraorbital cirri red or black; nasal cirri red.

RELATIONSHIPS: *C. lineopunctatus* is most closely related to *C. quagga*. The latter was described from Wake Island (Fowler and Ball, 1924: 273) but has also been taken throughout the Indo-Pacific region (Chapman, in de Beaufort and Chapman, 1951:

255). By comparing the description of *lineopunctatus* with that of *quagga* given by Strasburg and Schultz (1953) it is apparent that the two have the following characters in common: about the same number of nuchal cirri and dorsal, anal, and pectoral rays; a simple or occasionally multifid supraorbital cirrus; a high ratio for the least distance between the eye and nuchal fringe compared to the snout length; and a color pattern in part composed of light and dark dots on a brown background. Examination of fresh specimens of *quagga* obtained by Gosline and Randall at Wake in 1953 shows that the two forms are separable as follows. In *quagga* two dark lines extend transversely across the throat and are continued on the cheeks and suborbital regions; in *lineopunctatus* the throat is uniform brown. In *quagga* the sides are marked with 10–16 dark vertical bars, these being very distinct in light-colored specimens but obsolescent in dark or large individuals, with some indications persisting in all but the most melanistic specimens. In *lineopunctatus* there is never any indication of dark bars on the sides from standard lengths of 29 to 69 mm. In *quagga* the white dots on the sides are not rimmed in black (based on preserved material and Fowler's figure [1928: 437]), while in *lineopunctatus* they are. There are also minor tendencies for the mean dorsal and anal ray counts to be greater in *lineopunctatus*, while the mean number of its nuchal cirri is slightly less than in *quagga*.

So far as known, *C. lineopunctatus* is limited to Hawaii and Johnston Island. The species is moderately common at depths of 4–10 feet, and occurs in rocky areas subject to a fairly strong surf. It has been named *lineopunctatus* in reference to the lengthwise rows of dots on the body.

MATERIAL EXAMINED: Holotype, paratypes, and 7 Johnston Is. at USNM; 5 Oahu and 3 Johnston at UH.

Cirripectus variolosus (Valenciennes)

Salarias variolosus Valenciennes, in Cuvier and Valenciennes (1836: 317, type locality Guam); Fowler (1901: 518); Jenkins (1903: 507).

Alticus variolosus. Jordan and Evermann (1905: 17, 497); Jordan and Seale (1906: 424).

Cirripectes variolosus. Fowler (1922: 84; 1928: 433; 1938: 243, 300; 1949: 148); Tinker (1944: 342); Edmondson (1946: 352).

Rupiscartes variolosus. Jordan and Jordan (1922: 83); Fowler and Ball (1925: 29).

Cirripectes alboapicalis. Pietschmann (1938: 44).

Ophioblennius vanderbilti Fowler (1938: 242, 300; 1949: 148); Reid (1943: 380).

Ophioblennius capillus Reid (1943: 381); Fowler (1949: 148).

Cirripectus variolosus. Fowler (1941: 276); Chapman, in de Beaufort and Chapman (1951: 249).

Its wide distribution and number of close relatives has caused *C. variolosus* to present a confusing taxonomic picture, part of which was corrected by Strasburg and Schultz (1953). Like *Exallias brevis* this blenny has distinctive larval stages which have been the basis for the erection of *Ophioblennius vanderbilti* and *O. capillus*. Chapman (in de Beaufort and Chapman, 1951: 251), correctly synonymized *O. vanderbilti* with *variolosus* but apparently overlooked Reid's *O. capillus*. The holotype of this species was examined and found to be another large larva of *C. variolosus*. The dentition differences between it and *O. vanderbilti* noted by Reid (*op. cit.*: 382) are probably ascribable to damage or to its greater ontogenetic age. Pietschmann's record of *C. alboapicalis* (1938: 44) from Pearl and Hermes Reef is obviously based on specimens of *C. variolosus*.

Color in life: head brown, with or without bright red markings; body olive-brown to deep brownish black, often with a blue or purple sheen; upper portions of dorsal and caudal fins red, rest of these fins blackish; anal fin deep blue-black; nasal and supraorbital cirri either red or brown; nuchal cirri brown. In preservative, red markings dis-

appear from head, and red fin membranes become colorless or white, leaving specimens uniform leather-brown or blackish.

C. variolosus is one of the most numerous Hawaiian blennies, being taken in nearly every rotenone station at depths of from 2 to 30 feet. It abounds particularly on the shallow "dead" reefs such as characterize Waikiki, and a swimmer may see numerous specimens flitting in and out of crevices. The species is widespread throughout the Indo-Pacific area.

MATERIAL EXAMINED: Holotype of *O. capillus* at USNM; 28 Oahu, 3 Kauai, 51 Johnston, 2 French Frigate Shoals, and 4 Midway at UH; 1 Maui and 1 Hawaii at POFI; 23 Oahu in writer's collection.

TABLE 2
COUNTS MADE ON HAWAIIAN SPECIES OF *Cirripectus*

		C. obscurus	*C. lineopunctatus*	*C. variolosus*
Dorsal fin	XI	1		
	XII	76	35	114
	13			1
	14			108
	15	4	34	5
	16	73	1	
Anal fin	II	77	35	114
	14			4
	15	1	1	107
	16	11	30	3
	17	65	4	
Pectoral fin (both sides counted)	13			1
	14	1	1	
	15	85	53	51
	16	2		1
Total nuchal cirri	25–26		5	
	27–28		15	
	29–30		12	
	31–32		3	6
	33–34			17
	35–36			25
	37–38	9		42
	39–40	20		15
	41–42	26		6
	43–44	16		1
	45–46	2		
Supraorbital cirri (both sides counted)	1		62	
	2		3	1
	3		2	4
	4	4	2	12
	5	43	1	41
	6	67		54
	7	23		61
	8	5		35
	9			9
	10			3
	11			1

Genus ENTOMACRODUS Gill

Entomacrodus Gill (1859: 168). Type of genus, *Entomacrodus nigricans* Gill.

Entomacrodus marmoratus (Bennett)
Fig. 2

Blennius marmoratus Bennett (1828: 35, type locality Sandwich Islands).

Salarias marmoratus. Günther (1861: 248, 562; 1877: 204, but not pl. 116, fig. B); Jenkins (1903: 507); Snyder (1904: 536); Fowler (1927*a*: 29, in part; 1928: 435, in part; 1934: 445, in part; 1938: 243, 300, in part; 1940: 794; 1941: 276; 1949: 149, in part); Galtsoff (1933: 20); Tinker (1944: 342, but not his figure).

Alticus marmoratus. Jordan and Evermann (1905: 5, 7, 10, 23, 498, but not fig. 220); Jordan and Seale (1906: 424); Fowler (1922: 84).

Rupiscartes marmoratus. Jordan and Jordan (1922: 83); Fowler and Ball (1925: 29, in part).

Salarias meleagris. Fowler (1923: 389; 1928: 440; 1938: 301; 1949: 150); Tinker (1944: 344); Edmondson (1946: 352).

Rupiscartes striatus. Fowler and Ball (1925: 28).

Istiblennius marmoratus. Norman (1943: 812).

Entomacrodus marmoratus. Chapman, in de Beaufort and Chapman (1951: 272, 283, 285).

Although Norman (1943: 807) was the first to properly define the genus *Entomacrodus* he failed to place *marmoratus* and other

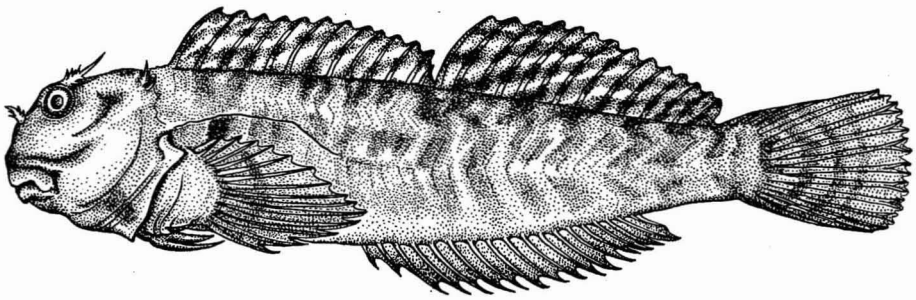

FIG. 2. *Entomacrodus marmoratus* (Bennett), based on a specimen 95 mm. in standard length from Hanauma Bay, Oahu.

congeners in it, probably because of difficulty in determining the presence of vomerine teeth, the salient generic character. Chapman (de Beaufort and Chapman, 1951: 272), discusses six Indo-Australian species of *Entomacrodus*, and also mentions seven others, including *marmoratus*, from other parts of the Pacific and the tropical Atlantic. The recorded distribution of *marmoratus* covers much of the Indo-Pacific, but both Chapman's work and the manuscripts for the Bikini studies demonstrate that the non-Hawaiian records are based on other species. It has not been possible to investigate many records extra-limital to this study, but both Fowler and Ball's record from Wake Island (1925: 29) and Smith's from South Africa (1950: 508, pl. 75) were seen and found to be other species. Fowler's records of *S. meleagris* from Hawaii (see synonymy) were also checked and found to be based on specimens of *marmoratus*. It should be noted that neither Günther's figure (1877: pl. 116, fig. B), Jordan and Evermann's (1905: fig. 220), nor Tinker's (1944: 343) actually represent *marmoratus*. Figure 2 is here supplied as an illustration of this blenny.

As noted in the key, the quickest method of identifying *E. marmoratus* is by the presence of two (sometimes only one in juveniles) cirri on each side of the nape. The lateral member of each pair is a short simple filament while the mesial one is commonly multifid. Unfortunately, only the mesial cirrus is clearly visible in Figure 2. The presence of vomerine teeth, while of considerable taxonomic importance, is hardly useful in routine species determination. Dissection and staining are almost necessities to see the series of about a dozen minute conical teeth on the vomer. Other distinguishing characters are presented in the key.

The mottled color pattern of *marmoratus* is well shown in Figure 2 but the actual colors involved are rather variable. The dark blotches are a rich brownish black in life and the belly is pure white. The ground color of the rest of the fish consists of various shades of olive-brown, brownish pink, or olive-green, with olive-brown the most common.

E. marmoratus abounds in areas of heavy surf such as occur along the rocky shores of the Hawaiian Islands. It is commonly seen leaping into the surf or skittering across the surface of rough water. Specimens are easily obtained by the use of rotenone, by pole-fishing using tiny hooks, or by scoop net. The species is endemic to Hawaii and appears to be most closely related to *E. epalzeocheilos* (Bleeker) of the East Indies, Indian Ocean, and Samoa. Distinguishing features of *epalzeocheilos* are given by Chapman (de Beaufort and Chapman, 1951: 274, 281).

MATERIAL EXAMINED: 16 Hawaiian Is., 5 Oahu, 9 Molokai at USNM; 35 Midway at UH; 1 Laysan, 2 Oahu at BPBM; 7 Lanai, 5 Oahu, 3 Hawaii, 31 Maui at POFI; 1 Hawaii at DFG; 108 Oahu in writer's collection.

Genus ISTIBLENNIUS Whitley

Istiblennius Whitley (1943: 185). Type of genus, *Salarias mulleri* Klunzinger.

This genus, as here understood, includes those blennies which possess the following characters: teeth (excluding canines) freely movable in both jaws; trunk lateral line well developed; ventral rays I, 2 or 3; branched caudal rays 5 above plus 4 below except in very young; a tentacle over each eye; spinous and soft dorsal separated by a distinct notch in their connecting membrane. Its species lack the following characters possessed by related genera: transverse fringe of nuchal cirri, sucking appendage on lower lip, elongate anterior anal rays, vomerine teeth, and membranous connection of last anal ray to caudal peduncle. Even with the above restrictions the genus is probably heterogeneous, and has been described by Norman (1943: 811) as a ". . . large and varied assemblage of species."

Members of *Istiblennius* have been observed by the writer in the Hawaiian, Marshall, and Gilbert Islands, and were found to fall into two natural groupings on morphological and ecological grounds. In one group a stout canine tooth is present posteriorly on the dentary and there is a prominent bulging of the forehead so that the snout slopes backward from the eye to the mouth. Species included here are *I. gibbifrons* in Hawaii and *I. paulus* and *coronatus* in the Central Pacific. All three characteristically occur on submerged reefs at depths of from 1 to 4 feet, and they rarely frequent supratidal habitats.

The second group of species lacks the canine teeth and bulging forehead of the first, and includes *I. zebra* in Hawaii and *I. edentulus* and *lineatus* of the Central Pacific. All of these are found in either supra- or intertidal pools and only rarely on submerged reefs. A study of *zebra* and the descriptions of eight other members of the second group listed by Chapman (de Beaufort and Chapman, 1951), indicates other phyletic tendencies which are probably sufficiently strong to warrant the separation of the two groups as distinct subgenera or genera. As noted in the introduction, however, it is felt that such separation should not be attempted outside of monographic treatment, and thus is not included here.

Istiblennius zebra (Vaillant and Sauvage)

Salarias zebra Vaillant and Sauvage (1875: 281, type locality Sandwich Islands); Snyder (1904: 536); Jordan and Evermann (1905: 501); Jordan and Seale (1906: 426); Jordan and Jordan (1922: 83); Fowler and Ball (1925: 29); Fowler (1927*a:* 30; 1928: 439; 1934: 446; 1938: 244, 301; 1940: 796; 1941: 276; 1949: 150, in part); Pietschmann (1938: 45); Tinker (1944: 344); Edmondson (1946: 352).

Salarias edentulus. Fowler (1901: 517; 1922: 84; 1928: 438, in part; 1938: 301; 1949: 150); Steindachner (1901: 499, 520); Jordan and Evermann (1905: 15, 17, 503); Jordan and Jordan (1922: 83); Tinker (1944: 343); Chapman, in de Beaufort and Chapman (1951: 331).

Salarias cypho Jenkins (1903: 506).

Scartichthys zebra. Jordan and Evermann (1905: 11, 19).

Alticus zebra. Jordan and Evermann (1905: 24, 27).

Istiblennius zebra. Norman (1943: 812); Strasburg (1955: 299).

As pointed out by Strasburg (1955: 299) there has been some confusion in the literature with respect to *I. zebra* and *I. edentulus* (Bloch, in Bloch and Schneider, 1801: 172), and the two are undoubtedly closely related. The fin ray counts of Hawaiian "*edentulus*" given by Steindachner (1901: 499) are sufficiently complete to show that he dealt with *zebra*, and some Hawaiian *edentulus* listed by Fowler (1928: 438) have been examined and also found to be *zebra*. Other specimens of *edentulus* from Hawaii (Fowler, 1901: 517; 1922: 84; 1938: 301; and Tinker, 1944: 343–

344) have not been seen, and their taxonomic status is subject to some doubt. Records of *zebra* from Tahiti (Fowler, 1949: 150) and the Tuamotus (Harry, 1953: 134) are possibly based on a species still undescribed but perhaps identical to one noted by Chapman (de Beaufort and Chapman, 1951: 331), from the Marquesas.

Among Hawaiian blennies, *I. zebra* is unique in its possession of a high fleshy crest along the midline of the head. This crest is present in both sexes at lengths greater than 50 mm., but appears earlier and attains a greater size in males. Specimens too small to have the crest could be confused only with *I. gibbifrons*, *E. marmoratus*, or perhaps *Omobranchus elongatus*. Separation from these can be accomplished by the fact that *zebra* has no canine teeth, lacks nuchal cirri, and has a notched dorsal fin.

Life coloration of adult *zebra* varies from bluish black through gray to yellowish brown, the sides commonly being marked with a series of gray or tan vertical bars. In large specimens the fins may be irregularly blotched with red, and in males the cheeks may be dull orange.

This blenny abounds in pools on rocky coasts, being particularly common on Oahu along the Koko Head coast, on Rabbit Island, and on the rocky shores between Waimea and Kaena Point. It is generally restricted to supra- or inter-tidal pools, and was taken only twice by the writer from submerged reefs. The species is not known from Midway or Johnston islands, probably because of a lack of suitable habitats, but may otherwise be regarded as endemic to the Hawaiian area.

MATERIAL EXAMINED: 34 Oahu, including holotype of *Salarias cypho*, 31 Necker, 31 Laysan, 24 Hawaii, 30 Maui, and 3 "Hawaiian Islands" at USNM; 1 Maui, 4 Hawaiian Islands at MCZ; 87 Oahu in writer's collection.

Istiblennius gibbifrons
(Quoy and Gaimard)

Salarias gibbifrons Quoy and Gaimard (1824: 253, type locality Hawaiian Islands); Valenciennes, in Cuvier and Valenciennes (1836: 312); Günther (1861: 251; 1877: 205); Fowler (1901: 517; 1928: 437; 1934: 446; 1938: 243, 301; 1949: 150); Snyder (1904: 536); Pietschmann (1938: 45); Tinker (1944: 343); Chapman, in de Beaufort and Chapman (1951: 342, in part).

Salarias saltans Jenkins (1903: 508).

Salarias rutilus Jenkins (1903: 509).

Alticus gibbifrons. Jordan and Evermann (1905: 4, 10, 17, 19, 27, 499); Jordan and Seale (1906: 423); Fowler (1922: 84).

Entomacrodus gibbifrons. Jordan and Evermann (1905: 23).

Rupiscartes gibbifrons. Jordan and Jordan (1922: 83); Fowler (1925: 30); Fowler and Ball (1925: 29).

Salarias periophthalmus. Fowler (1928: 439, in part).

Istiblennius gibbifrons. Norman (1943: 812).

Blenniella rhessodon Reid (1943: 383); Fowler (1949: 148).

Dissimilarities between various growth and sexual forms of *gibbifrons* have resulted in males and females being described as separate species (Jenkins, 1903) and a larval stage as a new genus and species (Reid, 1943). Sexual dimorphism was clarified by Snyder (1904), and the writer's examination of the holotype of *Blenniella rhessodon* revealed it to be a late larval stage of *I. gibbifrons*. Fowler (1928: 439) lists MCZ as having Hawaiian specimens of *Salarias periophthalmus*, but upon examination these proved to be *I. gibbifrons*.

I. gibbifrons has been widely recorded from the Pacific Ocean, but Chapman (de Beaufort and Chapman, 1951: 344), limits its certain distribution to Hawaii and adjacent regions. Unpublished work on the blennies of the northern Marshall Islands by Schultz and Chapman indicates that a closely related Marshallese form is specifically distinct, but the writer's examination of specimens from Wake Island (only 500 miles north of Bikini) showed them to be indistinguishable from

the Hawaiian form. The Hawaiian form is also abundant at Johnston Island, but no specimens were found in a collection from Palmyra. In view of these circumstances, *gibbifrons* may probably be regarded as limited to the area immediately around the Hawaiian Islands.

Jenkins' figures (1903: 508–509) are duplicated by Jordan and Evermann (1905: 499–500) and give an excellent representation of the color pattern of the two sexes of *gibbifrons* ("*saltans*" is a male, and "*rutilus*" a female). Unfortunately, neither figure depicts the bulbous forehead characteristic of this group of blennies (see generic diagnosis). Life coloration consists of a pale olive or tan ground color overlaid with a network of fine golden-brown lines. Females bear a series of eight dusky bars on the trunk and tail but these are much less obvious in males. In males the sides are marked with rows of small bluish white ocelli, and the spinous dorsal is dusky distally. In females this duskiness is usually reduced to a single black spot in the membrane between the first two spines.

I. gibbifrons occurs on permanently submerged reefs at depths less than about 4 feet. It is common at Waikiki and also on limestone benches along the Waianae coast. The species is very alert and agile and can be taken easily only with rotenone. Large larvae are phototaxic and numerous specimens have been taken at night using an electric surface light.

MATERIAL EXAMINED: Holotype of *Blenniella rhessodon* at USNM; 7 Sandwich Islands at MCZ; 22 Midway, 22 Johnston, and 31 Oahu at UH; 1 French Frigate Shoals, 1 Nehoa, 1 Oahu, 3 Maui, 2 Hawaii at POFI; 35 Hawaii in writer's collection.

Genus ECSENIUS McCulloch

Ecsenius McCulloch (1923: 121). Type of genus, *E. mandibularis* McCulloch.

Ecsenius hawaiiensis Chapman and Schultz

Ecsenius hawaiiensis Chapman and Schultz (1952: 526, type locality Pearl Harbor, Oahu).

The peculiar circumstances leading to the capture of the only known specimens of this blenny have been mentioned in the discussion of *Tripterygion atriceps*. Suffice it to say that fish living in the fouling on the bottom of a barge brought to Hawaii from Guam may not necessarily be Hawaiian species. Chapman and Schultz's statements (1952: 528) concerning the Hawaiian nature of the barge's fauna have been shown to be in error for *Tripterygion*, and may also be so for *Ecsenius*. Regardless of its geographic origin, however, *E. hawaiiensis* may now have established itself on Oahu, and is therefore included in this report.

E. hawaiiensis may be quickly distinguished from other Hawaiian blennies by its lack of supraorbital cirri and by the fact that the teeth in the upper jaw are freely movable, whereas those in the lower jaw are fixed. Mr. Kenneth Wong, formerly of the Honolulu Aquarium, noted that living specimens of the type series of *E. hawaiiensis* were purple anteriorly and yellow posteriorly. Preserved specimens are plain olive or brownish, with no indication of this regional color differentiation. The vertical white bars noted on the sides by Chapman and Schultz (1952: 527) are not present on all specimens, and these authors' figure does not clearly depict the basal black spot between the first three dorsal spines. Other distinguishing characters are given in the key.

Little is known concerning the biology of the genus *Ecsenius* aside from Chapman and Schultz's general statements of its occurrence at moderate depths as opposed to shallow reefs. If it is normally a deep water form it is possible that specimens of *E. hawaiiensis* will not be taken for some time, even if well established in the Hawaiian area. So far as known, the species has been taken only from the Hawaiian Islands.

MATERIAL EXAMINED: Holotype and 12 paratypes at USNM; 1 Oahu taken with the type series and retained at UH.

Genus ENCHELYURUS Peters

Enchelyurus Peters (1868: 268). Type of genus, *Enchelyurus flavipes* Peters.

In setting up *Enchelyurus*, Peters presents the following diagnostic characters: dentition and lack of scales as in *Petroscirtes*, gill opening as wide as pectoral base, and dorsal and anal fins united with the caudal. Norman (1943: 798) uses the united vertical fins as a major character, but further limits the genus to species with gill openings extending about halfway down the pectoral bases, even though his list of pertinent species (*op. cit.*: 804) includes *flavipes* which has much larger gill openings. The writer's examination of *flavipes*, *kraussi*, *ater*, *hepburni*, and *brunneolus* showed that *Enchelyurus*, as used by Norman, is not only poorly defined but probably also polyphyletic. A review of this and related genera is not possible at present, and the genus *Enchelyurus* is temporarily used for those blennies with no scales, fixed teeth, and united vertical fins.

Enchelyurus brunneolus (Jenkins)

Aspidontus brunneolus Jenkins (1903: 510, type locality Honolulu); Snyder (1904: 536).

Enchelyurus ater. Jordan and Evermann (1905: 19, 27, 500); Jordan and Seale (1906: 434); Jordan and Jordan (1922: 83); Fowler (1925: 30; 1928: 443; 1934: 447; 1938: 301; 1949: 151); Fowler and Ball (1925: 29); Pietschmann (1930: 22; 1938: 50); Tinker (1944: 345).

Enchelyurus edmondsoni Fowler (1923: 389; 1928: 443–444; 1938: 301; 1949: 151); Norman (1943: 804); Tinker (1944: 345).

Jordan and Evermann synonymized *brunneolus* with the closely related *E. ater* (Günther, 1877: 199) in 1905. The latter species occurs in the southeastern Pacific, and on the average differs from *brunneolus* of Hawaii as follows: *brunneolus* has 14 pectoral rays, *ater* has 15; in *brunneolus* the gill opening extends ventrally to the level of the fifth or sixth pectoral ray, in *ater* it extends to the eighth to tenth; *brunneolus* has 10 dorsal spines while *ater* has 9; and in *brunneolus* there are 19 or 20 soft anal rays whereas *ater* has 17–19. Dr. N. B. Marshall, of the British Museum, has kindly confirmed these findings for the holotype of *Petroscirtes ater* Günther.

Some sexual dimorphism occurs in *brunneolus*, the general picture being that females are uniform blackish brown or black, whereas in mature males the trunk and tail are black and the throat, gill membranes, and cheeks are gray with black spots and bars. In males the dorsal fin is traversed by a series of narrow black lines running posteriorly and dorsally; in females this fin is nearly uniform black with an intensely black spot between the first two spines. Finally, in mature males the anal fin is marked with two or three dark lengthwise stripes and the tips of the rays are somewhat enlarged and arrow-shaped. In females the anal fin is uniform black and the rays have a normal taper.

The holotype of Fowler's *E. edmondsoni* was examined and found to be a mature male *brunneolus*. The specimen is now a light brown and probably too discolored to permit an adequate color description to be made. Fowler's figure of the holotype of *edmondsoni* (1928: 444) is very misleading in that he shows the species to have dark markings on a white or very light background, whereas actually the ground color is quite dark and the markings even darker. The lengthwise bands on the trunk and tail shown by Fowler are neither mentioned in the type description (1923: 390) nor visible on the holotype.

The fact that this blenny is nearly jet black in color and rarely exceeds an inch in length makes it quite easy to recognize. It could be confused only with juvenile *Cirripectus*, but can be readily told from these by its lack of

nuchal and supraorbital cirri. Its united dorsal, caudal, and anal fins (except in the very young) also make it distinctive.

E. brunneolus is fairly common within the interstices of a dead coral reef, such as at Waikiki, and specimens may also be found clinging to the undersides of reef rocks. It is frequently overlooked in rotenone collecting because of its small size, but living specimens can be captured by splitting masses of coralline rock. The species is endemic to the Hawaiian area.

MATERIAL EXAMINED: *E. brunneolus*, holotype of *Aspidontus brunneolus* at USNM; holotype of *Enchelyurus edmondsoni* at BPBM; 21 Oahu, 1 Kauai, 2 French Frigate Shoals, 1 Laysan at UH; 10 Maui at POFI; 6 Oahu in writer's collection.

Enchelyurus ater, 21 Samoa at USNM; holotype of *Petroscirtes ater* (from Tahiti) at British Museum (examined by Dr. N. B. Marshall).

Genus OMOBRANCHUS (Ehrenberg) Valenciennes

Omobranchus (Ehrenberg) Valenciennes, in Cuvier and Valenciennes (1836: 287). Type of genus, *Blennechis fasciolatus* Valenciennes (ex *Omobranchus fasciolatus* Ehrenberg MS).

Omobranchus elongatus (Peters)
Fig. 3

Petroscirtes elongatus Peters (1855: 249, type locality Mossambique).

Omobranchus elongatus. Norman (1943: 804, undoubtedly based on non-Hawaiian material).

Although Hawaiian specimens of *Omobranchus* appear to fit Peters' description of *elongatus* there is some doubt as to whether they are actually that species. Color pattern differences, perhaps ascribable to sexual dimorphism, have resulted in considerable confusion between *elongatus* and *kallosoma* of Bleeker (1858: 227). The two species have been synonymized by Günther (1877: 196) and Fowler (1928: 429) but regarded as distinct by Fowler (1949: 146) and de Beaufort (de Beaufort and Chapman, 1951: 374). A lack of comparative material has prevented a study of differences between these species, and the name *elongatus* is tentatively used because it fits fairly well and is the oldest available name.

The four known Hawaiian specimens of *O. elongatus* may or may not deserve a place in the fauna of the Hawaiian Islands. All were obtained from a concrete tank located on Coconut Island, Kaneohe Bay, Oahu, which has been figured by Tester (1952: 3). From Tester's photograph and description the following facts about this tank are of note. It is located on land but near water, its dimensions are about 11 by 35 feet with a depth of 4 feet, and it is supplied with running water from Kaneohe Bay by a submerged inlet and an overflow-type outlet. The biota of the tank normally consists of tuna, tunny, surgeon fish, and other moderately large experimental animals, a few small fish and crabs (which presumably enter with incoming water), and a variable growth of algae. During the spring of 1951 a number of pieces of coralline rock bearing *Tridacna* clams and undoubtedly other organisms were obtained from near the Samoan Islands and placed in the tank by the staff of the Pacific Oceanic Fishery Investigations, United States Fish and Wildlife Service, Honolulu. Sometime after the removal of these exotic elements the tank was pumped dry, painted, and restocked with Hawaiian experimental fish. On July 29, 1953, Messrs. Eugene Nakamura and John Randall, of the University of Hawaii, captured a living *Omobranchus* from the tank, and on September 26 of that year Randall took three more by draining the tank.

It was originally presumed that the four *Omobranchus* represented an indigenous Hawaiian form not previously taken because of some habitat peculiarity. Subsequent examination of collections from Palmyra Island

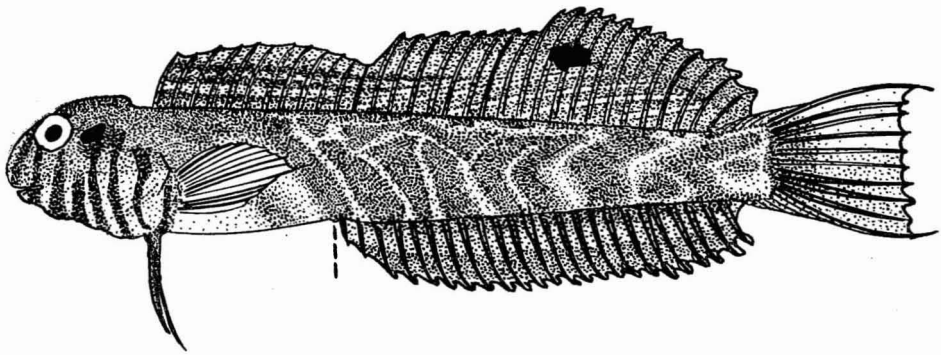

FIG. 3. *Omobranchus elongatus* (Peters), based on a mature male specimen from Coconut Island, Oahu. Scale represents 20 mm.

(a member of the Line group) showed a morphologically identical species to be present there, and it then appeared that perhaps the species was introduced into Hawaii when the *Tridacna* clams were brought to Coconut Island. If this is so, then it is difficult to explain how the fish withstood tank draining and painting. It is possible that they retreated a considerable distance into the inlet pipe, or that some had previously escaped, established a population in Kaneohe Bay, and then members of this population subsequently reentered the tank. That breeding populations have existed in Hawaii is evident from the size range of the four known specimens. The smallest of these is a gravid female measuring only 36 mm. in standard length; certainly this fish was hatched in Hawaii.

Regardless of the history and unorthodox locality record of *O. elongatus*, a strong possibility exists that it is now locally established in Hawaiian waters. The area where it is most likely to occur, Coconut Island and environs, has not been recently sampled because of the inadvisability of using rotenone near experimental ponds.

Counts and other distinguishing characters are given in Table 3 and the key, and the following color notes supplement Figure 3 as an aid in distinguishing this blenny.

Color in life. Body more or less translucent, vertebral column clearly visible in tail; ground color olive-brown becoming dull red below midsides, belly grayish white; dorsal half of body covered with a reticulum of narrow white lines; on sides reticulum breaks up into a series of narrow parallel lines which slant posteriorly and ventrally. Ground color of head olive-green; opercle dull red-brown anteriorly and with an oval red-brown area posterodorsally; preopercle olive-green dorsally, breaking up into two or three green streaks separated by yellowish interspaces ventrally; head with dark vertical bars bordered by irridescent blue-green lines as follows: red-brown bar from front edge of eye to snout, olive-green bar across cheek and throat below center of eye, red-brown bar across cheek and throat at rear edge of eye, two red-brown bars across preopercle and throat, the second not meeting its opposite member, a short red-brown bar across branchiostegals from tip of preopercle to lower pectoral base. Membrane of spinous dorsal pinkish, broken into numerous lengthwise stripes with clear interspaces, spines yellowish with white tips; membrane of soft dorsal yellowish-hyaline with a few diagonal pinkish lines basally, rays yellowish, their tips irridescent blue-white, and a brilliant blue-green spot between rays 10 to 12; caudal fin membrane hyaline, caudal rays yellow; anal fin yellowish-hyaline basally, gray distally, each ray with a conspicuous blue-white tip; pectorals yellow-hyaline; ventrals orange-yellow; iris bronze, pupil black (based on a male

specimen 52 mm. in standard length).

The specimen from which the above notes were made was placed alive into 5 per cent formalin upon which it developed a color pattern suprisingly different from that of life. All white and blue-green lines disappeared from the head and body, the interspaces between them turning dark brown and forming the oblique and vertical bars noted in the key. An oval black spot also appeared on the head behind the eye. The reported variability in the presence or appearance of the body bars or the head spot is probably partially dependent on how soon after death specimens are preserved.

Three of the Hawaiian specimens are males and have a standard length range of from 52 to 56 mm. All have the spot on the soft dorsal noted above and by Peters (1855: 249), and in the most mature specimen there is also a low fleshy ridge down the midline of the head, and a decided tendency for the tips of the last eight anal rays to be compressed and broad when viewed from the side. The single 36 mm. female lacks the soft dorsal spot, the head ridge, and compressed tips of the anal rays. Five specimens of what appears to be the same species from Palmyra Island have a length range of only 33–46 mm., yet all are sexually mature. Here, too, females lack the soft dorsal spot of the males.

The ecology of *O. elongatus* is not well known except as noted above for the collection locale. The Palmyra specimens came from a shallow inshore reef. Distribution of the species includes East Africa, the East Indies, and the Central Pacific.

MATERIAL EXAMINED: 4 Oahu in writer's collection; 5 Palmyra at UH.

Genus RUNULA Jordan and Bollman

Runula Jordan and Bollman (1890: 171). Type of genus, *Runula azalea* Jordan and Bollman.

Schultz's separation of *Runula* from *Aspidontus* (1950: 266) has been followed in this report.

Runula ewaensis (Brock)

Petroscirtes ewaensis Brock (1948: 125, type locality, off Ewa Beach, Oahu).

R. ewaensis is apparently a moderately deep-water inhabitant, and has been taken only rarely to date. Of the five known specimens, two came from depths of about 120 feet and one, the holotype, from 30 feet. It is of interest that the holotype and one of the specimens from 120 feet were taken from pipes hauled to the surface. It is suggested that examination of the pipe frameworks of Hawaiian fish traps might yield additional specimens and perhaps throw some light on the biology of this blenny.

An attempt has been made to determine the systematic position of *ewaensis*, and the species appears to be most closely related to *R. rhinorhynchos* (Bleeker, 1852: 273) of the East Indies, Palau, etc. Meristic differences between the two may be summarized briefly as follows: *ewaensis* has 34 or 35 soft dorsal rays while *rhinorhynchos* has 32 or 33; *ewaensis* has 32 or 33 soft anal rays, and *rhinorhynchos* has 29 or 30. From the standpoint of color pattern, *rhinorhynchos* has two plain, lengthwise blue stripes against a brownish background (cf. Smith, 1950: pl. 21, fig. 962), while in *ewaensis* these stripes are edged in black and the ground color is pale (brick red in life). Three Philippine specimens of *rhinorhynchos* at USNM differ from Smith's figure in having a black blotch on each side of the caudal peduncle which extends about one-third to one-half the length of the caudal fin. This spot is usually lacking in *ewaensis*, but when present it ends at the flexure denoting the caudal fin base. The brick red ground color and two lengthwise blue stripes are sufficiently distinctive to make identification of specimens an easy matter.

R. ewaensis has been reported only from Oahu and is regarded as endemic to the Hawaiian Islands for the present. Its habitats cannot be considered well sampled, however,

and it is possible that the species will be taken elsewhere.

MATERIAL EXAMINED: *R. ewaensis*, holotype and 1 other Oahu at USNM; 1 Oahu in collections of Honolulu Aquarium; 2 Oahu in writer's collection.
R. rhinorhynchos, 3 Philippines at USNM.

Runula goslinei, new species
Fig. 4

HOLOTYPE: USNM No. 164202, a female, 43 mm. in standard length, taken in a shallow-water rotenone station at Pupukea, Waimea coast, Oahu, T. H., on December 23, 1949, by Gosline, Strasburg, and party.

PARATYPES: USNM No. 164203, 1 specimen 38 mm. in standard length, taken with the holotype; USNM No. 164204, 1 specimen 37 mm. in standard length, taken in a shallow-water rotenone station at Makapuu Beach, Oahu, T. H., on October 2, 1952, by Gosline and party; USNM No. 108503, 1 specimen 38 mm. in standard length, caught on reef off Mokuleia, Waialua, Oahu, in 1937 by Otto Degener.

DESCRIPTION: Counts made on *R. goslinei* are recorded in Table 3, and detailed measurements, expressed in thousandths of the standard length, made on the holotype and two paratypes appear in Table 4.

Dorsal rays VIII, 34–37 (usually 35); anal II, 29 or 30, first anal spine minute and partially embedded in females; pectoral 12; pelvics I, 3, spine and mesial ray visible only

TABLE 3
COUNTS MADE ON SPECIES OF *Runula* AND *Omobranchus*

		R. goslinei	*R. tapeinosoma*	*R. ringens*	*O. elongatus* (OAHU)	*O. elongatus* (PALMYRA)
Dorsal fin	VII	1				
	VIII	10	11	12		
	IX		1	1		
	X		1			
	XI					
	XII				4	5
	19				3	4
	20				1	1
	32			1		
	33			6		
	34	1	1	6		
	35	6	4			
	36	1	8			
	37	1				
Anal fin	II	9	13	13	4	5
	20				1	
	21				1	4
	22				2	1
	27			3		
	28			4		
	29	6	3	5		
	30	2	9	1		
	31		1			
Pectoral fin (both sides counted)	10		1			
	11					
	12	16	15	23		
	13			3	8	10
Number of upper pectoral rays encompassed by gill openings (both sides counted)	4					6
	5	9	6	10	4	4
	6	5		16	4	

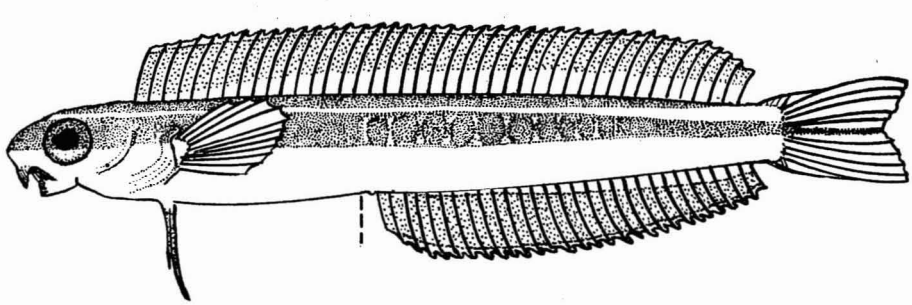

FIG. 4. Holotype of *Runula goslinei*, new species (USNM No. 164202) from Pupukea, Waimea Coast, Oahu. Scale represents 10 mm.

with staining and dissection; principal caudal rays 11, none branched; no nuchal, nasal, or supraorbital cirri; teeth incisiform, firmly attached, immovable, an enormous fang-like canine on dentary; incisiform teeth totaling 32–56 in lower jaw and 21–28 in upper, the number increasing with growth; gill opening a small slit running from above pectoral base to level of fifth or sixth ray from top of pectoral fin.

Head 4.0–4.5; greatest depth 6.9–7.9; longest dorsal spine 9.2–11.0; longest pectoral ray 7.3–8.2; all in the standard length; eye 3.2–3.8; snout 3.8–4.8; interorbital space 3.2–3.5; postorbital length of head 2.1; least depth of body 2.8–3.2; greatest depth of body 1.5–2.0; all in length of the head.

Dorsal fin entire, spinous part slightly lower than soft-rayed portion; last dorsal and anal rays membranously attached to caudal peduncle, attachment occurring anterior to small caudal rays; snout pointed; mouth subterminal, inferior; lips smooth; four tiny tentacles just posterior to lower lip in some specimens; lateral line absent (?); fifth or sixth pectoral ray from upper edge of fin longest, reaching posteriorly to level of second soft dorsal ray; caudal fin slightly forked.

Color in alcohol. Lower half of head and body silvery white, upper half brown, the two colors sharply separated at level of lower edge of pupil; a narrow white line down dorsal midline of head from near tip of snout to base of first dorsal spine; a second narrow white line from side of snout to dorsolateral portion of caudal peduncle, touching upper edge of eye and broadening beneath soft dorsal; second line divides brown portion of body into a narrow upper band and a broader lower one; upper band uniformly brown, lower band either uniform or with 10–18 pigment intensifications along its length so that band appears spotted; lower band narrow and without spots on caudal peduncle, and extends to rear edge of caudal fin as a streak covering middle caudal ray; upper band becomes narrow posteriorly and disappears below last soft dorsal ray; upper surface of caudal peduncle whitish; entire ventral half of head and body silvery white, unmarked; dorsal fin hyaline for basal two-fifths, then a broad submarginal brown band, with distal edge of fin white; caudal fin white except for median brown streak and scattered brown pigment spots at tips of outermost rays; pectorals hyaline; pelvics white; basal fourth of anal fin hyaline, then a broad submarginal brown band, with distal edge of fin white; upper two-thirds of iris blackish, lower third silvery white. Some variability has been noted with respect to spotting along the lower lateral band. The dark pigment ranges from golden brown to brownish black, and pigment intensifications may be either lacking, poorly defined and not countable, or fairly distinct and numbering from 10 to 18.

Color after twenty hours preservation in formalin. (Based on holotype and one paratype.) Upper half of head and body brownish black, lower half white; line down midline of head and line separating dark area into lengthwise bands bluish green; area around mouth yellowish green (holotype), faintly yellow (paratype); dorsal and anal transparent, yellowish, with a broad submarginal brown band; caudal transparent, tinged with yellow, outer rays somewhat dusky, median ray brown and bordered with yellowish white; pectoral transparent, colorless; pelvics white.

ECOLOGY: Of the 11 known specimens of *R. goslinei* specific habitat data can be given for only 4. These were taken with rotenone at depths of 3–5 feet along rocky seashores where there was some sand bottom and where water circulation was good. Another specimen was taken from a reef near Mokuleia, Oahu, presumably at a similar depth. The six remaining specimens were recovered from the stomachs of large fish, five being from dolphins (*Coryphaena hippurus*) and one from a yellowfin tuna (*Neothunnus macropterus*). These large fish were caught by trolling near Moku Manu (Bird Island), Kaneohe Bay, Oahu, and their stomachs also contained deep-water

scorpaenids and Anthiinae (family Serranidae), the former being demersal. It is presumed that the ingested *Runula* came from near the bottom and probably from depths considerably greater than those sampled with rotenone. The writer has not seen *R. goslinei* alive, and can make no statements on its behavior.

RELATIONSHIP: *R. goslinei* was originally thought to represent a juvenile stage of *R. tapeinosoma* (Bleeker, 1857: 64) of the East Indies, Micronesia, and the southeast Pacific. It was also found to have striking similarities to *R. ringens* (Vaillant, 1894: 74) of the Pacific coasts of the Americas. A critical examination of all three indicated that *goslinei* was an intermediate between two extremes. On one hand was *tapeinosoma*, occurring up to about 1,800 miles from Hawaii, and on the other, *ringens*, separated from Hawaii by more than 2,500 miles of "East Pacific Barrier," with *goslinei* being a geographical and morphological intermediate. It seems very unlikely that there is gene interchange between these widely separated populations, and their morphological similarities are probably better ascribed to a common ancestry rather than interbreeding.

Table 3 presents meristic data for these three blennies, the discrepancies between numbers of specimens in various categories reflecting the damaged condition of those obtained from fish stomachs. The general tendency indicated in Table 3 is that *tapeinosoma* has the most soft fin rays, *ringens* the fewest, and *goslinei* is intermediate. With regard to size, *goslinei* is a small form, becoming sexually mature at standard lengths of 35–40 mm. and probably not growing much beyond that, while *tapeinosoma* and *ringens* appear to be larger, most specimens ranging from 35–65 mm. in standard length. Color pattern and other differences are summarized in the following key which can be used to separate the three species.

1a. Anal fin transparent, colorless; dorsal soft rays 32–34 . . . . . **ringens**

1b. Anal fin with a submarginal brown band; dorsal soft rays 35–37 (rarely 34).

2a. Submarginal brown band on dorsal and anal fins narrow, about one-half to two-thirds as broad as basal clear part of fins; brown band on sides broken into 15–20 vertically elongate spots, band absent or faint between some spots; anal soft rays usually 30 . . . . . **tapeinosoma**

2b. Submarginal brown band on dorsal and anal fins broad, equal to or up to twice as broad as basal clear part of fins, sometimes clear area completely lacking; brown band on sides of nearly uniform intensity, if spots present they are poorly defined and connected by band; anal soft rays usually 29 . . . . . **goslinei**

Notes on the life coloration of *ringens* (as R. *albolinea*) are given by Herre (1936: 403).

DISTRIBUTION: Thus far, limited to the Hawaiian Islands.

REMARKS: Named *goslinei* in honor of Dr. William A. Gosline of the University of Hawaii.

MATERIAL EXAMINED: *R. goslinei*, holotype and paratypes at USNM; 6 Oahu from fish stomachs at UH; 1 Kauai at POFI.

R. tapeinosoma, 5 Marshall Is. at USNM; 3 Marshall Is. and 5 Gilbert Is. at UH.

R. ringens, 9 Mexico, 1 Costa Rica, 1 Colombia, 1 Ecuador, and 1 Galapagos at USNM.

FAUNAL AFFINITIES

The Hawaiian blennies belong to or are derived from the East Indian faunal group, and of the nine genera here considered, all but *Tripterygion*, *Entomacrodus*, and *Runula* are confined to the Indo-Pacific area. Both *Tripterygion* and *Entomacrodus* occur in the warmer parts of the Atlantic and Indo-Pacific while *Runula* appears to be basically Indo-Pacific but occurs also on the tropical Pacific Coasts of the New World. No genus found in Hawaii is restricted to the Hawaiian area.

On the specific level, about 60 per cent of the blennioid fishes reflect the well-known

endemic nature of the Hawaiian fauna. The distribution of 8 of the 13 species (*Tripterygion atriceps*, *Istiblennius zebra*, *Entomacrodus marmoratus*, *Cirripectus obscurus*, *C. lineopunctatus*, *Enchelyurus brunneolus*, *Runula ewaensis*, and *R. goslinei*) is limited to the Hawaiian chain, Johnston, and Midway islands. One blenny, *Istiblennius gibbifrons*, also occurs at Wake Island, the fish fauna of which is predominantly Marshallese, while two others, *Exallias brevis* and *Cirripectus variolosus*, are widespread throughout the Indo-Pacific. Of the remaining two, *Omobranchus elongatus* is wide-ranging in the Indo-Pacific but probably artificially introduced into Hawaii, while *Ecsenius hawaiiensis* is known only from the Hawaiian Islands but under rather peculiar circumstances.

A summary of the distribution of the closest relatives of the endemic Hawaiian blennioids is presented in Table 5. Although distributional pathways are not evident from this table the data tend to fall into several geographical categories, the location of which relates species affinities to the direction of flow of ocean currents. In the first group are wide-ranging species such as *I. edentulus*, *E. epalzeocheilos*, and *R. tapeinosoma;* the second is composed of western Pacific and Indian Ocean forms (*E. bicolor* and *R. rhinorhynchos*); the third of central Pacific species (*T. hemimelas*, *Istiblennius* sp., and *C. quagga*); the fourth of species from the southeastern Pacific (*Cirripectus* sp. from Easter Island, *E. ater*); the fifth of a form from the extreme eastern Pacific (*R. ringens*), and the last of a species from Lord Howe Island (*C. alboapicalis*).

It seems likely that the clockwise current systems north of the Equator have carried some East Indian blennies to southern Japan, Hawaii, and tropical Pacific America, and that the North and South Equatorial Currents have distributed these forms, or their derivatives, to the Marshall and Caroline Islands and to Easter Island, Tahiti, and Samoa. Further distribution in the central Pacific could be effected by local currents or by "island hopping" in areas where atolls are closely spaced. Isolation and other factors acting on variously dispersed stocks has led to their divergence on the specific or infra-specific level.

TABLE 4
MEASUREMENTS, EXPRESSED IN THOUSANDTHS OF THE STANDARD LENGTH, MADE ON CERTAIN HAWAIIAN BLENNIIDAE

	Cirripectus lineopunctatus			*Runula goslinei*		
	HOLOTYPE	PARATYPE	PARATYPE	HOLOTYPE	PARATYPE	PARATYPE
Standard length (mm.)	59.0	69.0	62.6	42.7	37.7	37.2
Head length	280	284	277	223	236	248
Greatest depth of body	280	316	247	145	130	126
Least depth of body	119	106	112	80	74	78
Postorbital length of head	186	194	190	105	111	118
Eye diameter	63	61	67	70	72	65
Snout length	92	97	85	47	53	65
Fleshy interorbital	34	30	32	68	74	70
Least distance between eye and nuchal fringe	115	115	115	...	...	...
Longest dorsal spine	278	184	307	91	109	100
Longest dorsal soft ray	186	197	200	96	122	108
Longest soft anal ray	142	130	136	91	111	108
Longest pectoral ray	203	219	195	127	122	137
Longest pelvic ray	149	145	133	122	159	156
Longest caudal ray	237	235	228	180	175	186
Snout tip to anus	508	528	493	429	419	437
Snout to dorsal origin	272	295	303	169	204	210
Length anal base	449	385	449	491	488	525
Sex	♂	♀	♂	♀	?	?

TABLE 5
DISTRIBUTION OF CLOSEST RELATIVES OF ENDEMIC HAWAIIAN BLENNIES

HAWAIIAN SPECIES	CLOSEST RELATIVE	DISTRIBUTION OF CLOSEST RELATIVE
Tripterygion atriceps	*T. hemimelas*	Phoenix and Samoan Islands
Istiblennius zebra	*I. edentulus*	Entire Indo-Pacific
Istiblennius gibbifrons	*Istiblennius* sp.*	Marshall, Gilbert, and Phoenix Islands
Entomacrodus marmoratus	*E. epalzeocheilos*	East Indies, India, Ceylon, Samoa
Ecsenius hawaiiensis	*E. bicolor*	East Indies, India, Burma, Red Sea, Formosa, New Hebrides, Caroline Islands
Cirripectus obscurus	*C. alboapicalis*	Lord Howe Island
	Cirripectus sp.	Easter Island
Cirripectus lineopunctatus	*C. quagga*	Marshall, Gilbert, Phoenix, and Wake Islands, Samoa
Enchelyurus brunneolus	*E. ater*	Tahiti, Samoa
Runula ewaensis	*R. rhinorhynchos*	East Indies, Philippines, East Africa, Caroline Islands
Runula goslinei	*R. tapeinosoma*	East Indies, East Africa, Caroline, Marshall, Society, and Samoan Islands
	R. ringens	Pacific coasts of Americas

*To be described in the second volume of the "Bikini Reports" of Schultz *et al.*

The close similarity between species with great geographical separation, such as *E. brunneolus* and *E. ater*, or *R. goslinei*, *R. ringens*, and *R. tapeinosoma*, is explicable on these grounds, the major supposition being the ability of migrants to withstand a pelagic journey. Confirmative evidence for this ability is available from data derived from high-seas plankton collections made by POFI. Large blenny larvae are considerable components of some collections, and it is significant that the genus *Tripterygion* has been taken 285 miles from land in the vicinity of the Line Islands, and that *Aspidontus* (closely related to *Runula*) occurred about 110 miles from land in the same area. Specimens of *Istiblennius* and *Cirripectus* were found as much as 15 miles offshore, with other genera appearing closer inshore. The fact that these larvae were large (of sizes equal to or only slightly smaller than juveniles) suggests that their pelagic welfare had been good, and that an open sea life was normal.

It is difficult to explain the maintenance of Hawaiian endemism if the influx and egress of larvae occurs at the appreciable rate suggested by the number of specimens in plankton collections. The occurrence of *I. gibbifrons* at Wake Island may represent the beginnings of a breakdown in Hawaiian endemism, and the single-specimen records of other species mentioned in the introduction may similarly represent stragglers from remote areas.

REFERENCES

BENNETT, E. T. 1828. On some fishes from the Sandwich Islands. *Zool. Jour.* 4: 31–43.

BLEEKER, P. 1852. Bijdrage tot de kennis der ichthyologische fauna van de Moluksche eilanden. Visschen van Amboina en Ceram. *Natuurk. Tijdschr. v. Nederland. Indie* 3: 229–309.

——— 1857. Achtste bijdrage tot de kennis der vischfauna van Amboina. *Soc. Sci. Indo-Neerl., Acta* 2: 1–102.

——— 1858. Vierde bijdrage tot de kennis der vischfauna van Biliton. *Natuurk. Tijdschr. v. Nederland. Indie* 15: 219–240.

BLOCH, M. E., and J. G. SCHNEIDER. 1801. *Systema ichthyologiae iconibus ex illustratum.* lx + 584 pp., 110 pls. Bibliopolio Sanderiano Commissum, Berolini.

BORODIN, N. A. 1927. A new blenny from the Hawaiian Islands. *Amer. Mus. Novitates* 281: 1–2, 1 fig.

——— 1928. *Exalias obscurus* Borodin, vs. *Cirripectes alboapicalis* (Ogilby). *Copeia* 167: 53–54.

BROCK, V. E. 1948. A new blennoid fish from Hawaii. *Pacific Sci.* 2(2): 125–127, 1 fig.

CHAPMAN, W. M., and L. P. SCHULTZ. 1952. Review of the fishes of the blennioid genus *Ecsenius*, with descriptions of five new species. *U. S. Natl. Mus., Proc.* 102: 507–528, 7 figs.

CUVIER, G., and A. VALENCIENNES. 1836. *Histoire naturelle des poissons.* Vol. 11. xx + 506 pp., pls. 307–343. F. G. Levrault, Paris.

DAY, F. 1869. Remarks on some of the fishes in the Calcutta Museum. *Zool. Soc. London, Proc.* 1869: 511–527.

——— 1876. *The fishes of India.* Vol. 1, text and supplement, xx + 816 pp.; Vol. 2, Atlas, 198 pls. Bernard Quaritch, London.

DE BEAUFORT, L. F., and W. M. CHAPMAN. 1951. *The fishes of the Indo-Australian Archipelago.* Vol. 9. xi + 484 pp., 89 figs. E. J. Brill, Leiden.

EDMONDSON, C. H. 1946. *Reef and shore fauna of Hawaii.* [Bernice P. Bishop Mus., Spec. Pub. 22.] iii + 381 pp., 223 figs. (Rev.) Bishop Museum, Honolulu.

FOWLER, H. W. 1901. Contributions to the ichthyology of the tropical Pacific. *Acad. Nat. Sci. Phila., Proc.* 52: 493–528, pls. 18–20.

——— 1922. A list of Hawaiian fishes. *Copeia* 112: 82–84.

——— 1923. New or little-known Hawaiian fishes. *Bernice P. Bishop Mus., Occas. Papers* 8(7): 373–392.

——— 1925. Fishes of Guam, Hawaii, Samoa, and Tahiti. *Bernice P. Bishop Mus., Bul.* 22: 1–38.

——— 1927*a*. Fishes of the tropical central Pacific. *Bernice P. Bishop Mus., Bul.* 38: 1–32, 1 pl., 6 figs.

——— 1927*b*. Notes on *Exallias obscurus* Borodin. *Copeia* 165: 91–92.

——— 1928. The fishes of Oceania. *Bernice P. Bishop Mus., Mem.* 10: i–iii + 1–540, 49 pls., 82 figs.

——— 1934. The fishes of Oceania. Supplement 2. *Bernice P. Bishop Mus., Mem.* 11(6): 383–466, 4 figs.

——— 1938. The fishes of the George Vanderbilt South Pacific Expedition. *Acad. Nat. Sci. Phila., Monog.* 2: i–v + 1–349, 12 pls.

——— 1940. The fishes obtained by the Wilkes Expedition, 1838–1842. *Amer. Phil. Soc., Proc.* 82(5): 733–800, 76 figs.

——— 1941. The George Vanderbilt Oahu Survey—the fishes. *Acad. Nat. Sci. Phila., Proc.* 93: 247–280, 32 figs.

——— 1949. The fishes of Oceania. Supplement 3. *Bernice P. Bishop Mus., Mem.* 12(2): 37–186.

FOWLER, H. W., and S. C. BALL. 1924. Descriptions of new fishes obtained by the Tanager Expedition of 1923 in the Pacific Islands west of Hawaii. *Acad. Nat. Sci. Phila., Proc.* 76: 269–274.

——— and ——— 1925. Fishes of Hawaii, Johnston Island, and Wake Island. *Bernice P. Bishop Mus., Bul.* 26: 1–31.

GALTSOFF, P. F. 1933. Pearl and Hermes Reef, Hawaii, hydrographical and biological observations. *Bernice P. Bishop Mus., Bul.* 107: 1–49, 5 pls., 9 figs.

GILL, T. N. 1859. Description of a new genus of Salarianae, from the West Indies. *Acad. Nat. Sci. Phila., Proc.* 11: 168–169.

GUNTHER, A. C. 1861. *Catalogue of the acanthopterygian fishes in the collection of the British Museum.* Vol. 3, xxv + 586 pp. + x. Taylor and Francis, London.

——— 1877. Andrew Garrett's *Fische der Südsee. Mus. Godeffroy, Jour.* 13: 169–216, pls. 101–120.

HARRY, R. R. 1953. *Ichthyological field data of Raroia Atoll, Tuamotu Archipelago.* [Atoll Res. Bul. 18] 190 pp., 7 figs. Pacific Science Board, National Academy of Sciences, Washington (mimeographed).

HERRE, A. W. 1936. Fishes of the Crane Pacific Expedition. *Field Mus. Nat. Hist., Chicago, Zool. Ser.* 21: 472 pp., 50 figs.

HUBBS, CLARK. 1952. A contribution to the classification of the blennioid fishes of the family Clinidae, with a partial revision of the eastern Pacific forms. *Stanford Ichthy.*

Bul. 4(2): 41–165, 64 figs., 79 graphs, 2 maps.

JENKINS, O. P. 1903. Report on collections of fishes made in the Hawaiian Islands, with descriptions of new species. *U. S. Bur. Fisheries, Bul. 1902–22:* 417–511, 4 pls., 50 figs.

JORDAN, D. S., and C. H. BOLLMAN. 1890. Description of new species of fishes collected at the Galapagos Islands and along the coast of the United States of Colombia, 1877–'88. *U. S. Natl. Mus., Proc. 1890* [1889], 12: 149–183.

JORDAN, D. S., and B. W. EVERMANN. 1905. The aquatic resources of the Hawaiian Islands. Part I. The Shore Fishes. *U. S. Bur. Fisheries, Bul. 1903*, 23(1): i–xxviii + 1–574, 1 map, 73 col. pls., 65 black and white pls., 229 figs.

JORDAN, D. S., and E. K. JORDAN. 1922. A list of the fishes of Hawaii, with notes and descriptions of new species. *Carnegie Mus., Mem.* 10(1): 1–92, 4 pls., 7 figs.

JORDAN, D. S., and A. SEALE. 1906. The fishes of Samoa. *U. S. Bur. Fisheries, Bul. 1905*, 25: 173–455, 16 col. pls., 5 black and white pls., 111 figs.

KNER, R. 1868*a*. Über neue Fische aus dem Museum der Herren Johann Cäsar Godeffroy & Sohn in Hamburg. *Akad. der Wiss. Wien, Math.-Nat. Kl., Sitzber.* 58(1): 26–31.

——— 1868*b*. IV. Folge neuer Fische aus dem Museum der Herren Joh. Cäs. Godeffroy und Sohn in Hamburg. *Akad. der Wiss. Wien, Math.-Nat. Kl., Sitzber.* 58(1): 293–356, 9 pls.

KNER, R., and F. STEINDACHNER. 1866. Neue Fische aus dem Museum der Herren Joh. C. Godeffroy & Sohn in Hamburg. *Akad. der Wiss. Wien, Math.-Nat. Kl., Stizber.* 54 (1): 356–395, 5 pls.

MCCULLOCH, A. R. 1923. Fishes from Australia and Lord Howe Island. *Austral. Mus. Rec.* 14(2): 113–125, pls. 14–16.

MCCULLOCH, A. R., and F. A. MCNEILL. 1918. Some Australian blennioid fishes. *Austral. Mus. Rec.* 12(2): 1–25, 4 pls., 1 fig.

NORMAN, J. R. 1943. Notes on the blennioid fishes.–I. A provisional synopsis of the genera of the family Blenniidae. *Ann. and Mag. Nat. Hist.* XI, 10: 793–812.

OGILBY, J. D. 1899. Additions to the fauna of Lord Howe Island. *Linn. Soc. N. S. Wales, Proc.* (1898) 23(92): 730–745.

PETERS, W. C. H. 1855. Uebersicht der in Mossambique beobachteten Fische. *Arch. f. Naturgesch.*, Jahrg. 21, 1: 234–282.

——— 1868. Über die von Hrn. Dr. F. Jagor in dem ostindischen Archipel gesammelten Fische. *Akad. der Wiss. Berlin, Monatsber.* 1868: 254–281, 460–461.

PIETSCHMANN, V. 1930. Remarks on Pacific fishes. *Bernice P. Bishop Mus., Bul.* 73: 1–24, 4 pls., 4 figs.

——— 1938. Hawaiian shore fishes. *Bernice P. Bishop Mus., Bul.* 156: 1–55, 18 pls., 13 figs.

QUOY, J. R. C., and P. GAIMARD. 1824. *Voyage autour du monde . . . exécuté sur les corvettes de S. M. "L'Uranie" et "La Physicienne" pendant les années 1817–20.* 712 pp., atlas. Pillet Aîne, Paris.

REID, E. D. 1943. Review of the genera of blennioid fishes related to *Ophioblennius. Wash. Acad. Sci., Jour.* 33(12): 373–384, 4 figs.

RISSO, A. 1826. *Histoire naturelle des principales productions de l'Europe meridionale et particulierement de celles des environs de Nice et des Alpes maritimes.* Vol. 3. xvi + 480 pp., 16 col. pls. F. G. Levrault, Paris and Strasbourg.

SCHULTZ, L. P. 1941. The species of *Cirripectes* Swainson and a new genus of blennioid fishes from the tropical Pacific. *Copeia* 1941: 17–20, 1 fig.

——— 1943. Fishes of the Phoenix and Samoan Islands. *U. S. Natl. Mus., Bul.* 180: i–x + 1–316, 32 tab., 9 pls., 27 figs.

——— 1950. Notes on the blennioid fish genera *Runula* (subfamily Petroscirtinae) and *Tripterygion* and *Helcogramma* (family Clinidae), of the American tropical Pacific. *Wash. Acad. Sci., Jour.* 40(8): 266–268.

SMITH, J. L. B. 1950. *The sea fishes of southern Africa.* xvi + 550 pp., 103 col. pls., text figs. Central News Agency, Cape Town.

SNYDER, J. O. 1904. A catalogue of the shore fishes collected by the steamer "Albatross" about the Hawaiian Islands in 1902. *U. S. Bur. Fisheries, Bul. 1902,* 22: 513–538, 13 pls.

STEINDACHNER, F. 1901. Fische aus dem Stillen Ocean. Ergebnisse einer Reise nach dem Pacific (Schauinsland 1896–97). *Akad. der Wiss. Wien, Math.-Nat. Kl., Denkschr.* 70: 483–521, 6 pls.

STRASBURG, D. W. 1955. North-south differentiation of blenniid fishes in the central Pacific. *Pacific Sci.* 9(3): 297–303.

STRASBURG, D. W., and L. P. SCHULTZ. 1953. The blenniid fish genera *Cirripectus* and *Exallias* with descriptions of two new species from the tropical Pacific. *Wash. Acad. Sci., Jour.* 43(4): 128–136, 2 figs.

SWAINSON, W. 1839. *The natural history and classification of fishes, amphibians, and reptiles, or monocardian animals.* Vol. 2. vi + 452 pp., 134 figs. Longman, Orme, Brown, Green & Longmans, London.

TESTER, A. L. 1952. Reaction of tunas and other fishes to stimuli. Part I: Background and summary of results. *U. S. Dept. Int., Fish and Wildl. Serv., Spec. Sci. Rpt.–Fish.* 91: 1–7, 1 fig.

TINKER, S. W. 1944. *Hawaiian fishes.* 404 pp., illus. Tongg, Honolulu.

VAILLANT, L. L. 1894. Sur une collection de poissons recueillie en Basse-Californie et dans le Golfe par M. Léon Diguet. *Soc. Philom. de Paris, Bul.* III, 6: 69–75.

VAILLANT, L. L., and H. E. SAUVAGE. 1875. Note sur quelques especes nouvelles de poissons des Iles Sandwich. *Rev. et Mag. de Zool.* III, 3: 278–287.

WHITLEY, G. P. 1943. Ichthyological notes and illustrations. *Austral. Zool.* 10(2): 167–186, 10 figs.