

***Balistes polylepis* and *Xanthichthys caeruleolineatus*, Two Large Triggerfishes (Tetraodontiformes: Balistidae) from the Hawaiian Islands, with a Key to Hawaiian Species¹**

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ABSTRACT: The large triggerfish *Balistes polylepis* Steindachner, the most common species of the family in the eastern Pacific, was previously reported from Hawai'i as *Pseudobalistes fuscus* (Bloch & Schneider) or questionably as *B. polylepis*; the identification as *B. polylepis* is here confirmed. Because of its rare occurrence in Hawai'i, it was believed to be a waif; however, an underwater photograph of one guarding a nest indicates that spawning has occurred in Hawai'i. A second large balistid, *Xanthichthys caeruleolineatus* Randall, Matsuura & Zama, wide ranging from the western Indian Ocean to Cocos Island, Costa Rica, is recorded from the Hawaiian Islands, where it is known from 46 to 165 m. A key is presented to the 11 Hawaiian species of the Balistidae. An enigmatic specimen of *Canthidermis* reportedly collected in Hawaiian waters is also discussed.

JORDAN AND EVERMANN (1905) recorded 11 species of the triggerfish family Balistidae from the Hawaiian Islands. None of the species they listed is recorded by the same binomial name today, although four of the specific names are correct.

Jordan and Jordan (1922) listed the same 11 balistid species from the Hawaiian Islands, but they shifted five of them from the genus *Balistes* to the genus *Sufflamen*. They illustrated one of two species of *Canthidermis*, *C. angulosus* (Quoy & Gaimard), as plate 4, fig. 3, clearly an adult of *C. maculatus* (Bloch).

Fowler (1928) reported Hawaiian localities for 11 balistid fishes. He identified specimens of two species of *Canthidermis* as *C. maculatus* (Bloch) and *C. rotundatus* (Procé). He regarded earlier Hawaiian records of *Balistes aureolus* (non Richardson) as *Canthidermis rotundatus*, but listed *B. aureolus* Richardson as a junior synonym of *B. ringens* Linnaeus,

later identified as a species of *Xanthichthys* by Berry and Baldwin (1966). He referred *B. fuscolineatus* Seale to the synonymy of *Melichthys buniva* (Lacepède), itself a synonym of *M. niger* (Bloch) (Randall and Klauswitz 1973). Fowler included *B. fuscus* Bloch & Schneider in the Hawaiian fauna. However, as discussed below, his Hawaiian specimens are *B. polylepis* Steindachner. The true *B. fuscus* is a wide-ranging Indo-Pacific species now placed in the genus *Pseudobalistes*; it remains unknown from the Hawaiian Islands.

Clark (1949) included 11 species of balistids in her key to the species of Hawaiian plectognaths based on names mentioned in earlier publications. Among these, *Balistapus undulatus* has never been collected in Hawai'i. She mentioned *Melichthys radula* in her text but referred to this species as *M. buniva* in her key and figure caption. Clark concluded that the five nominal species of *Canthidermis* reported from the archipelago are synonyms of *C. maculatus*.

Gosline and Brock (1960) recorded the same balistids from the Hawaiian Islands as Fowler except no mention was made of *Canthidermis rotundatus*. They correctly classified

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the species *aculeatus* and *rectangulus* in the genus *Rhinecanthus*.

Berry and Baldwin (1966) reviewed the eastern Pacific species of Balistidae. They included *Canthidermis rotundatus* among the long list of synonyms of *C. maculatus* (Bloch) and classified the Indo-Pacific *Balistes fraenatus* (Latreille) in the genus *Sufflamen* Jordan, noting that it is a senior synonym of *S. capistratus* (Shaw). Jordan and Evermann (1905), Fowler (1928), and Gosline and Brock (1960) all used the name *capistratus* for this species in Hawai'i. The description of *S. fraenatus* (Latreille) was published in March 1804, and that of *S. capistratus* (Shaw) in November 1804 (F. H. Berry, pers. comm., 1966). Berry and Baldwin examined three Hawaiian specimens that had been identified as *Balistes fuscus* and concluded that they are *B. polylepis*. They added, "This species in Hawaiian waters is generally inadequately known or unrecognized. It may also occur in other Indo-Pacific areas, and these uncertainties restrict our analysis of the zoogeography and relationships of the species of *Balistes*." In their synopsis, however, they wrote, "*Balistes polylepis*, obviously related to the Atlantic *B. caprisus*, is more closely related to specimens we have seen from Hawai'i."

Randall (1971) showed that *Balistes nycteris* (Jordan & Evermann), a nominal Hawaiian species regarded as valid by Fowler (1928) and Gosline and Brock (1960), is the pelagic juvenile stage of *Melichthys vidua* (Solander).

In a paper on food habits of Hawaiian reef fishes, Hobson (1974) included data on four species of triggerfishes, one of which he identified as *Xanthichthys ringens*. His illustration of this species, however, is the female of *X. auromarginatus* (Bennett), previously unrecorded from the Hawaiian Islands. His misidentification was corrected by Randall et al. (1978), who noted that *X. ringens* is confined to the western Atlantic. Randall et al. (1978) illustrated the female and male of *X. auromarginatus* in color.

Tinker (1978) recorded and illustrated nine triggerfishes from the Hawaiian Islands. He correctly placed *Balistes bursa* (Bloch &

Schneider) in the genus *Sufflamen*, but he continued to use the invalid name *S. capistratus* (Shaw). He also included *Balistes fuscus* Bloch & Schneider as a valid Hawaiian species, although he added that it is "very closely related to *Balistes polylepis* Steindachner, 1876, a large triggerfish from the eastern Pacific."

Springer (1982) stated that *Balistes* is known in the Indo-Pacific only from Hawaiian records of "the common eastern Pacific species *Balistes polylepis*, which has usually been misidentified as *B. fuscus* in Hawaiian references." He cited a personal communication from J.E.R. as the source of this information.

In a book on shore fishes of the Hawaiian Islands, Randall (1996) provided color photographs and brief species accounts of nine triggerfishes, including *Balistes polylepis*. He mentioned the pelagic *Canthidermis maculatus* as also occurring in the Islands and added, "the Hawaiian record of *Xanthichthys caeruleolineatus* will be reported by the author and Bruce C. Mundy."

In this paper, we show that *Balistes polylepis* is the correct identification for the large triggerfish in Hawai'i that was first identified as *B. fuscus*. Its distribution is not known to extend to other Indo-Pacific localities. We also formally record the large triggerfish *Xanthichthys caeruleolineatus* Randall, Mat-suura & Zama from the Hawaiian Islands. Diagnoses are presented for these two species, based on Hawaiian material, and discussion is provided of the one extant specimen identified as *Canthidermis rotundatus* (Procé) by Fowler (1928). A key to the Hawaiian species of Balistidae is presented.

MATERIALS AND METHODS

Hawaiian specimens of *Balistes polylepis* and *Xanthichthys caeruleolineatus* are deposited at the Bernice P. Bishop Museum, Honolulu (BPBM). Eastern Pacific specimens of *B. polylepis* were examined at the California Academy of Sciences, San Francisco (CAS), and obtained on loan from the Scripps Institution of Oceanography, La Jolla (SIO).

A loan was received of the Hawaiian specimen identified as *Canthidermis rotundatus* by Fowler (1928) from the Academy of Natural Sciences of Philadelphia (ANSP).

Specimen lengths are recorded as standard length (SL), the straight-line distance from the front of the upper lip or median upper teeth (whichever is most anterior) to the base of the caudal fin; body depth is measured vertically from the origin of the anal fin to the base of the dorsal fin (excluding the scaly sheath at the dorsal-fin base). This measurement is preferred with balistid fishes because maximum depth may vary greatly depending on the degree which the pelvic flap is extended. Head length is taken from the front of the upper lip to the upper end of the gill opening, and snout length from the same anterior point to the fleshy edge of the orbit. Caudal-peduncle depth is the least depth. Orbit diameter is the greatest diameter between the fleshy edges of the orbit. Measurements of the longest dorsal and anal soft rays exclude the basal scaly sheath. Caudal concavity is the horizontal distance between verticals at the tips of the longest and shortest caudal rays. Pectoral-ray counts include the rudimentary uppermost ray. Longitudinal scale series is the number of oblique to near-vertical scale rows from the upper end of the gill opening to the mid-base of the caudal fin. Head scales are the number of near-vertical to oblique scale rows from behind the corner of the mouth (disregarding very small isolated scales just behind the mouth on some species) to the upper end of the gill opening. Scale counts may be difficult to make because of irregularities or incomplete scale rows, but even approximate counts can be useful to distinguish some species. Randall et al. (1978) wrote that gill-raker counts gave little promise of being a useful character for species of *Xanthichthys*; they also pointed out that such counts result in damage to specimens because of the need to enlarge the gill opening to expose the first gill arch. No gill-raker counts were made on the Hawaiian specimens of *X. caeruleolineatus*, and only one count was made of a Hawaiian specimen of *Balistes polylepis*.

Balistes polylepis Steindachner

Figures 1–3

Balistes polylepis Steindachner, 1877:69 (type locality: Magdalena Bay, Baja California, Mexico).

Balistes fuscus (non Bloch & Schneider) Fowler, 1928:451, pl. 45, fig. C (Honolulu); Gosline and Brock, 1960:295; Tinker, 1978:472, fig. on p. 436.

Balistes polylepis: Berry and Baldwin, 1966:436, figs. 1, 2 A, and 4 of Mexican specimens.

DIAGNOSIS: Dorsal rays III + 26–28; anal rays 25–26; pectoral rays 15; gill rakers 31 (311-mm specimen only); longitudinal scale series 70–75; head scales 33–40.

Body very deep, depth at origin of anal fin 2.0–2.05 in SL; head length 2.75–2.9 in SL; dorsal profile of head nearly straight; snout length 1.25–1.3 in head; a deep oblique groove on snout extending anteriorly from eye and passing below nostrils; no prominent longitudinal oblique grooves on lower side of head; orbit diameter 5.8–6.6 in head; gill opening 2.95–3.1 in head; caudal-peduncle depth 3.9–4.0 in head; pelvic flap not well developed; no longitudinal ridges posteriorly on side of body; first dorsal spine 1.65–1.9 in head; second and third dorsal spines extending well above dorsal profile of back when erect; anterior part of second dorsal and anal fins strongly elevated in adults; fourth dorsal soft ray longest, 1.25–1.4 in head; fourth anal soft ray longest, 1.45–1.55 in head; caudal fin lunate in adults, the central part of fin margin slightly rounded, the fin length 1.1–1.15 in head; caudal concavity 1.85–2.45 in head; pectoral fins short, 2.6–2.8 in head.

Light olive brown to bluish gray with no distinctive markings; edges of scales narrowly dark (Figure 1). A 311-mm specimen (Figure 2) has a fine reticular pattern on the body not noted in other specimens. In other respects it is the same as other specimens. A gill-raker count of 31 was made on this fish. This count is within the range of 30–37 made on four eastern Pacific specimens.

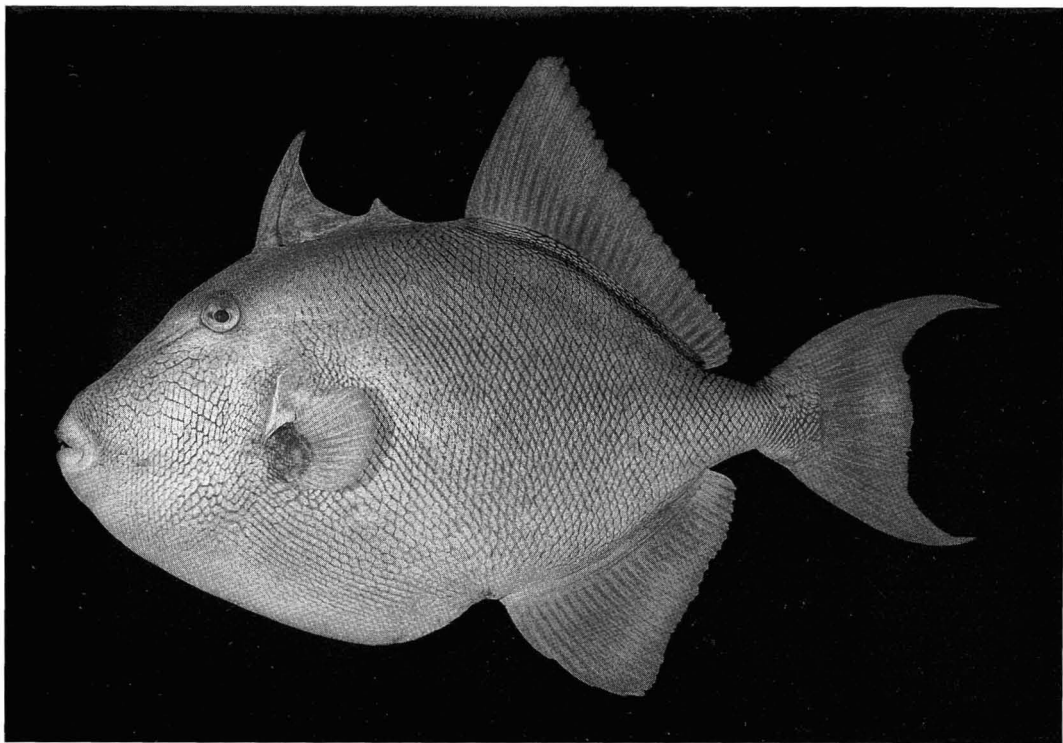


FIGURE 1. *Balistes polylepis*, BPBM 19673, 366 mm SL, O'ahu, Hawaiian Islands.

REMARKS: Berry and Baldwin (1966) reported the Finescale Triggerfish, *Balistes polylepis*, as the most abundant and wide-ranging triggerfish in the eastern Pacific. They gave the distribution as northern California to Peru, including the Gulf of California and offshore islands such as the Galápagos and Revillagigedo Islands. This triggerfish was collected off the coasts of Oregon and Washington during the strong El Niño of 1983 (Percy and Schoener 1987).

Randall (1996:183) illustrated a small adult in color from a photograph taken at the Waikīkī Aquarium. Underwater color photographs of the species in the eastern Pacific were published in Humann (1993), Allen and Robertson (1994), and Allen (1995). The species is often described as being olive brown, blue gray, or gray without distinguishing marks, but Allen's (1995) photograph from Clipperton Island portrays a fish

with reticular blue-gray markings on the head and nape, hence similar to the pattern found over most of the head and body of the Hawaiian specimen of Figure 2.

The Hawaiian specimens here identified as *B. polylepis* show no differences from ones collected in the eastern Pacific. The species is rare in Hawai'i. J.E.R. has never seen it while diving in the Islands. B.C.M. has observed it twice, the first time just north of Hōnaunau Boat Harbor on the Kona coast of the island of Hawai'i in about 12 m over finger coral and rock, and the second at the bow of the wreck of the *Mahi*, a popular diving site off the southwest coast of O'ahu, in 29.6 m over sand. The fish were wary, moving away 1 to 2 m above the substrate; they could not be approached closer than 5 m. The species has also been observed from submersibles at 47–60 m at Penguin Bank (Chave and Mundy 1994). Initially we believed that *B. polylepis*



FIGURE 2. *Balistes polylepis*, BPBM 36778, 311 mm SL, Kona coast of Hawai'i.

was a waif to the Hawaiian Islands from the eastern Pacific. The species is known to associate with floating objects long after transformation from the larval stage (Hunter and Mitchell 1967). Those authors reported *B. polylepis* under a floating object 370 km from shore. However, an underwater photograph taken by Kendra Choquette (Figure 3) in October 1996 of an adult (presumed to be the female) guarding a nest on the Kona coast of Hawai'i indicates that spawning by the species has taken place in the Islands.

Fitch and Lavenberg (1971) gave the maximum size of *Balistes polylepis* as 30 inches (762 mm). The largest from Hawai'i we have examined is an uncataloged stuffed specimen at the Bishop Museum that Fowler (1928:pl. 45 C), illustrated as *Balistes fuscus*. It measures 483 mm SL and 660 mm in total length.

Fitch and Lavenberg (1971:32) wrote, "As common as this fish is in the Gulf

of California, its life history has not been studied." They added, "We have found remains of barnacles, clams, and snails in the stomachs..."

MATERIAL EXAMINED: California, San Diego County, Pacific Beach, SIO 81-135, 338 mm. Mexico, Baja California, Los Frailes, CAS 36626, 170 mm; Magdalena Bay, SIO 64-63-34A, 310 mm. Panama, CAS-SU 6878, 210 mm. Hawaiian Islands, Hawai'i, Kona coast, BPBM 36798, 311 mm; O'ahu, Honolulu market, BPBM 5011, 395 mm; BPBM 5013, 356 mm; O'ahu, between Barbers Point and Kahe Point, BPBM 19674, 366 mm (maintained in Waikiki Aquarium from 10 December 1974 to 7 May 1975).

In addition, a photograph of a specimen caught off Nānākuli, O'ahu, in 24 m by Trent A. Cypriano, measuring 500 mm total length and weighing 3.3 kg, was identified by us as *Balistes polylepis*.

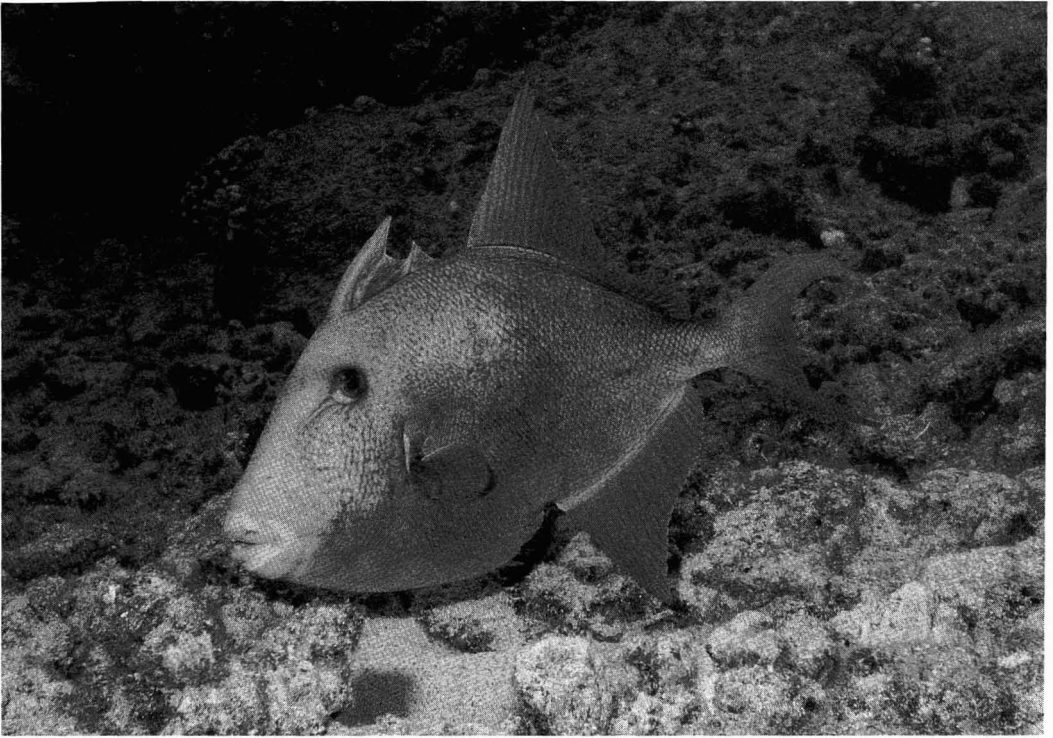


FIGURE 3. *Balistes polylepis*, presumed female guarding nest, Kona coast of Hawai'i (Kendra Choquette).

Xanthichthys caeruleolineatus Randall, Matsuura & Zama

Figures 4 and 5

Xanthichthys caeruleolineatus Randall, Matsuura & Zama, 1978:701, figs. 2 D and 7 (type locality: Manihi Atoll, Tuamotu Archipelago).

DIAGNOSIS: Dorsal rays III + 26 (one specimen with 24, but abnormal); anal rays 24; pectoral rays 14; longitudinal scale series 43–47; head scales 22–23.

Body not very deep, depth at origin of anal fin 2.7–2.95 in SL; head length 2.9–3.3 in SL; dorsal profile of head convex; snout length 1.4–1.45 in head; a deep oblique groove on snout extending anteriorly from eye and passing below nostrils; five or six prominent oblique grooves on lower side of head separating scale rows; orbit diameter 5.1–5.65 in head; gill opening 4.4–4.6 in

head; caudal-peduncle depth 3.75–3.9 in head; pelvic flap not well developed; median tubercles of scales slightly enlarged posteriorly on side of body, forming weak longitudinal ridges; first dorsal spine 2.0–2.05 in head; second dorsal spine slender and short; third dorsal spine minute, not extending above dorsal profile of back when fin erect; anterior part of second dorsal and anal fins elevated in adults; third or fourth dorsal soft rays longest, 1.6–1.7 in head; fourth anal soft ray longest, 1.75–1.8 in head; caudal fin lunate, 1.1–1.2 in head; caudal concavity 2.3 in head; pectoral fins short, 2.6–2.65 in head.

Color when fresh: light greenish brown dorsally, the edges of the scales darker brown, with a vertical pale blue line on each scale; lower part of body paler and more yellowish; an irregular blue line passing from pectoral axil to upper side of caudal peduncle; oblique grooves on head blue, the intervening scale rows yellowish brown; an orangish

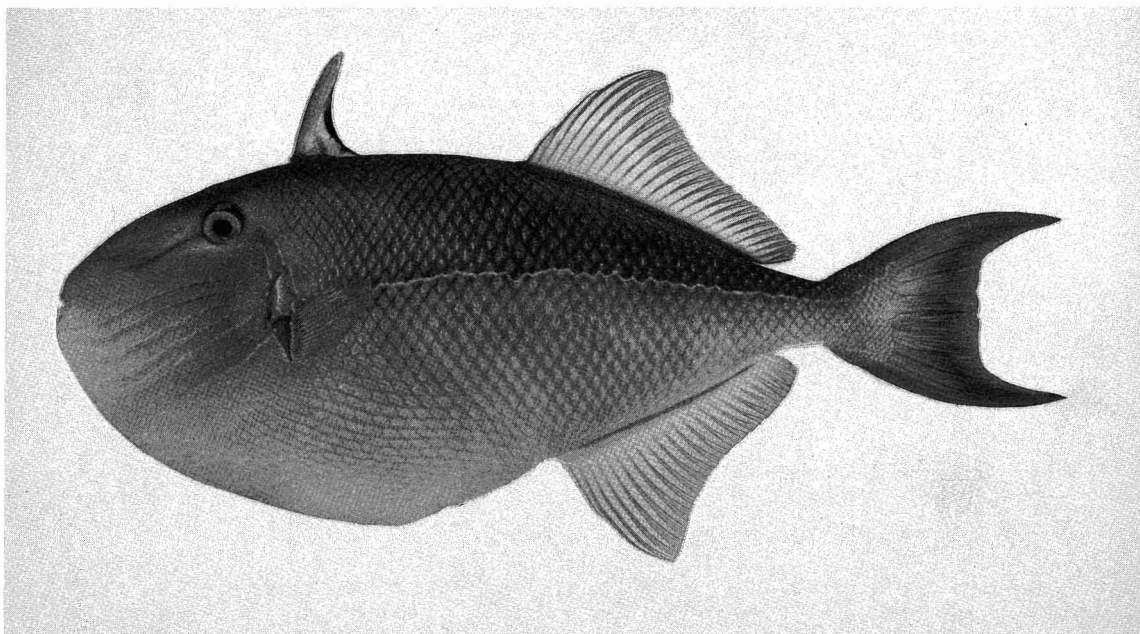


FIGURE 4. *Xanthichthys caeruleolineatus*, BPBM 37083, 273 mm SL, Kaho'olawe.

brown band edged in blue extending from upper pectoral base to eye; membrane of first dorsal fin white with a broad black distal margin; second dorsal and anal fins translucent whitish with dark brown rays; caudal fin dark reddish brown with a red submarginal band in each lobe; pectoral fins clear with light brown rays.

REMARKS: *Xanthichthys caeruleolineatus* was described from 18 specimens collected from the following localities: Tuamotu Archipelago, Line Islands, Marquesas Islands, Ocean Island, Minami-Tori-Shima (Marcus Island), Izu Islands, Ryukyu Islands, and the Agalega Islands in the western Indian Ocean. Wass (1984) reported observing several juveniles at depths of 40–60 m off Tutuila, American Samoa. Gloerfelt-Tarp and Kailola (1984:284, lower right figure) recorded the species from off southeastern Sumatra; Constant (1992:fig. 62) from the Galápagos Islands; Randall and Anderson (1993) from the Maldiv Islands; Allen and Smith-Vaniz (1994) from Cocos-Keeling Islands; and

Garrison (1996) from Isla del Coco, Costa Rica. Roger C. Steene (pers. comm.) identified the species from a videotape taken at close range in 30 m off a steep slope of Osprey Reef in the Coral Sea. With such a broad distribution, it is not surprising that it would be found in the Hawaiian Islands.

Our first specimen was collected by hook and line in 104 m northwest of Kaho'olawe by Henry Okamoto on 1 October 1993 (Figure 4). The second was caught by hook and line in 93 m off the Wai'anae coast of O'ahu by Kevin C. Landgraf from the NOAA ship *Townsend Cromwell* on 12 April 1994. We examined a third specimen, 250 mm, caught in 165 m off Punalu'u on the southeast coast of Hawai'i by David G. Nottage on 18 February 1995, but it was not retained. Richard L. Pyle observed an adult on the Kona coast of Hawai'i while diving in 92 m on 25 April 1996. Mike Severns observed a pair in 46 m at Molokini Island, Maui, in August 1997 and photographed one of them (Figure 5). A record of *X. aureomarginatus* from 101 m at Penguin Bank, Molokai

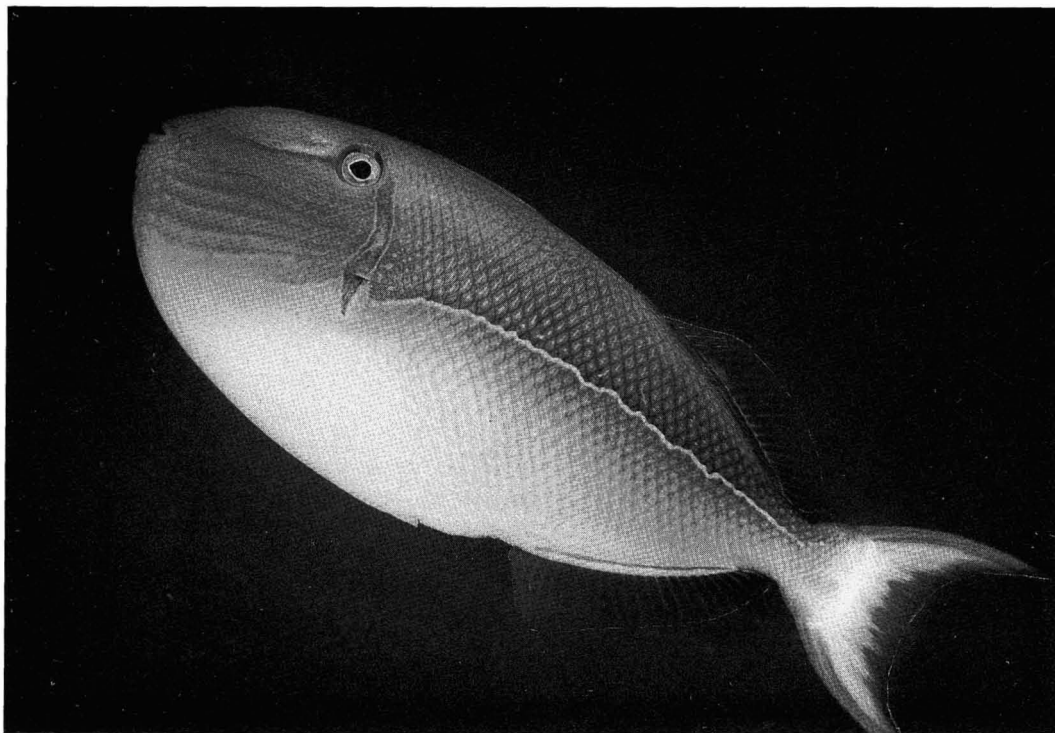


FIGURE 5. *Xanthichthys caeruleolineatus*, underwater photograph, 46 m, Molokini, Maui (Mike Severns).

(Chave and Mundy 1994), seems to have been a misidentification of *X. caeruleolineatus*.

We suggest that *Xanthichthys caeruleolineatus* is a resident species in Hawai'i, rather than a waif, but confirmation of this requires the collection of ripe adults, observation of spawning or nesting, or the collection of larvae. The recent discovery of the species in the Islands may be the result of increased deep diving and deep-water fishing with small hooks. Balistid fishes have small mouths; therefore, one needs a smaller hook for them than usually used when fishing for commercially important deeper-water fishes in Hawai'i such as lutjanids. The specimens of *X. caeruleolineatus* caught off Kaho'olawe and O'ahu were taken with small hooks intended to capture juveniles of species of *Pristipomoides*.

The depth of capture for non-Hawaiian specimens of *X. caeruleolineatus* ranged from 15 m at Minami-Tori-Shima to 200 m in the

Marquesas. Garrison's record from Isla del Coco was based on a photo taken in 41 m; however, she observed one individual ascend briefly to 13 m. She noted that the species was always seen below the thermocline.

The largest specimen recorded, the paratype of USNM 202851, 327 mm SL, is from Baker Island in the central Pacific.

The three Hawaiian species of *Xanthichthys* in Hawai'i are easily distinguished by their color. The two smaller species, *X. auromarginatus* and *X. mento*, are clearly sexually dichromatic (Randall et al. 1978).

The depths at which the three species have been found in Hawaiian waters, 8–161 m for *X. auromarginatus*, 6–131 m for *X. mento* (Chave and Mundy 1994), and 46–165 m for *X. caeruleolineatus* (15–200 m throughout its range), do not suggest any obvious habitat partitioning by depth. Actually, in the main Hawaiian Islands, there are depth differences when considering the usual depth at which

the species are found. *Xanthichthys auromarginatus* is the shallowest-dwelling species; it is easily observed by scuba divers in recreational diving depths (less than 40 m). *Xanthichthys mento* is rarely encountered in less than 60 m (although it may be seen in as little as 15–20 m in the cooler sea at the northwestern end of the Hawaiian Archipelago). We expect that the depth range of *X. caeruleolineatus* in Hawai'i will be extended to below 165 m.

MATERIAL EXAMINED: Tuamotu Archipelago, Manihi Atoll, BPBM 13211, holotype of *X. caeruleolineatus*, 245 mm. Indonesia, Sumatra (6° 12' S, 104° 41' E), BPBM 29340, 217 mm. Maldives Islands, Makunudu Atoll, BPBM 34713, 277 mm. Hawaiian Islands, Kaho'olawe, BPBM 37083, 273 mm; O'ahu, BPBM 37421, 210 mm.

Canthidermis sp.

Canthidermis rotundatus (non Procé) Fowler, 1928:449 (Hawaiian Islands).

DIAGNOSIS: Dorsal rays III + 27; anal rays 24; pectoral rays 16 (including upper rudimentary ray); longitudinal scale series 53 on one side, 55 on the other; gill rakers 35; body depth at anal-fin origin 1.7 in SL; head length 2.45 in SL; snout length 1.65 in head length; orbit diameter 4.45 in head length; caudal-peduncle depth 2.8 in head length; first dorsal spine broken; longest dorsal soft ray 1.8 in head length; longest anal soft ray 2.0 in head length; caudal fin 1.95 in standard length; pectoral fin 2.65 in head length. Color in alcohol uniform brown.

REMARKS: The diagnosis was taken from a single specimen of the genus *Canthidermis*, 93 mm SL, reported as collected in the Hawaiian Islands in 1836 by Dr. John K. Townsend, an ornithologist (Jordan and Evermann 1905:16). Two specimens were deposited at the Academy of Natural Sciences of Philadelphia, but only one (ANSP 802) is extant (provided on loan by William G. Saul of the Academy). It was first reported as *C. oculatus* (Gray) by Fowler (1900). Jordan and Evermann (1905:415) reidentified it as

C. angulosus (Quoy & Gaimard, 1824), now regarded as a synonym of *C. maculatus* (Bloch, 1786). Fowler (1928) reidentified it again as *C. rotundatus* (Procé, 1822). This species was described very briefly from a specimen from the Bay of Manila with a count of 26 dorsal rays, 21 anal rays, 14 pectoral rays, and the color brown with blackish spots. No type is in existence (M. L. Bauchot, pers. comm.). Without a scale count, it is difficult to assign this nominal species positively to any known species of *Canthidermis*. Berry and Baldwin (1966:460) placed *C. rotundatus* in the synonymy of *C. maculatus*. If Procé's counts of 26 dorsal rays and 21 anal rays for *C. rotundatus* were correct, it would be difficult to consider his specimen as *C. maculatus* because 26 is an unusually high count for the dorsal rays of this species and 21 the lowest anal-ray count (when a balistid count of dorsal rays is high, the anal-ray count is generally correspondingly high). In a review of *Canthidermis*, Fedoryako (1979), however, recognized *C. rotundatus* as one of five valid species of the genus; the others are the Atlantic *C. sufflamen* (Mitchill), the circumtropical *C. maculatus* (Bloch), the eastern Pacific *C. willughbeii* (Lay & Bennett, 1819), and *C. villosus* Fedoryako, n. sp. (type locality, Gulf of Aden). Gill and Randall (1997), however, have shown that *villosus* is a synonym of *C. macrolepis* (Boulenger). One wonders how Fedoryako decided to adopt the name *rotundatus* for the 39 Indian Ocean and western Pacific specimens he identified as this species, because none had 21 anal rays. In any event, the Hawaiian specimen identified as *C. rotundatus* by Fowler with a longitudinal scale count of 53–55 does not fit into the *C. rotundatus* of Fedoryako with a scale count of 42–47. In fact, we have not found any nominal species of *Canthidermis* from the Indian and Pacific Oceans with a combination of 27 dorsal rays, 24 anal rays, and 53–55 scales in longitudinal series. The holotype of *Canthidermis longissimus* (Hollard, 1854), with a type locality of Pacific Ocean, has the same dorsal- and anal-ray count, but the scale counts of 46 on one side and 47 on the other (provided by Martine Desoutter of the Museum National d'Histoire Naturelle)

are too low for the Hawaiian specimen. The one species of *Canthidermis* with the combination of dorsal, anal, and scale counts like the Hawaiian fish is *C. sufflamen* from the western Atlantic, thus suggesting the possibility that the Hawaiian locality may be an error. Attempts to find other specimens from the Hawaiian Islands with the same meristic data have not been successful. Four specimens in the Bishop Museum are all *C. maculatus*, as are 16 specimens in the collections of the Honolulu Laboratory of the National Marine Fisheries Service (NMFS), which

include ones taken at both ends of the Hawaiian chain (Hawai'i and the Hancock Seamounts to the northeast of Kure Atoll). We have transferred the loan of ANSP 802 to Anthony C. Gill, who has commenced a revision of the genus *Canthidermis*. He checked the holdings of *Canthidermis* in the Natural History Museum, London, and the National Museum of Natural History, Washington, D.C., and found none from the Indo-Pacific region with the same counts as the puzzling Hawaiian specimen.

KEY TO THE HAWAIIAN SPECIES OF BALISTIDAE

- 1a. A deep groove extending ventroanteriorly from eye; no prominent antrorse spinules posteriorly on side of body in three to five rows (spinules, if present, small and occurring in more than five rows) 3
- 1b. No deep groove extending ventroanteriorly from eye; three to five rows of prominent antrorse spinules posteriorly on side of body 2
- 2a. Three longitudinal rows of antrorse spinules posteriorly on side of body; no black bar across caudal peduncle extending forward in a wedge shape to below middle of second dorsal fin (Indo-Pacific) *Rhinecanthus aculeatus*
- 2b. Four or five (usually four) longitudinal rows of antrorse spinules posteriorly on side of body; a black bar across caudal peduncle extending forward in a wedge shape to a point below middle of second dorsal fin and enclosing spinules (Indo-Pacific) *Rhinecanthus rectangulus*
- 3a. A circular tympanum containing enlarged scales behind gill opening and above pectoral fin 4
- 3b. No tympanum containing enlarged scales behind gill opening 8
- 4a. Dorsal and ventral profiles of head strongly convex; dorsal soft rays 30–35; anal soft rays 27–31; ground color dark brown to black 5
- 4b. Dorsal and ventral profiles of head nearly straight; dorsal soft rays 27–30; anal soft rays 24–27; ground color grayish brown 6
- 5a. Caudal fin of adults deeply emarginate to lunate; head scale rows 20–25; pectoral rays (including upper rudimentary ray) modally 16; black with a pale blue line at base of soft dorsal and anal fins (circumtropical) *Melichthys niger*
- 5b. Caudal fin truncate to slightly emarginate; head scale rows 28–32; pectoral rays (including upper rudimentary ray) modally 15; dark brown, the soft dorsal and anal fins whitish with black margins, caudal fin white at base, shading outwardly to pink (Indo-Pacific) *Melichthys vidua*
- 6a. No longitudinal ridges or small spinules following scale rows posteriorly on side of body; longitudinal scale series 70–75; body very deep, depth at origin of anal fin 1.8–2.1 in SL (eastern Pacific and Hawaiian Islands) *Balistes polylepis*
- 6b. Longitudinal ridges or small spinules following scale rows posteriorly on side of body; longitudinal scale series 41–50; body not very deep, depth at origin of anal fin 2.3–2.8 in SL 7

- 7a. Two dark bars (yellow or dark brown in life) posteriorly on head, the first curving from lower pectoral base through eye, the second passing dorsally from upper pectoral base; edge of pelvic flap black; a white line from corner of mouth to anal-fin origin (Indo-Pacific) *Sufflamen bursa*
- 7b. No dark bars posteriorly on head; edge of pelvic flap not black; a narrow yellow band at base of lower lip; adult males with a narrow pale band passing posteriorly from corner of mouth across lower side of head (Indo-Pacific) .. *Sufflamen fraenatus*
- 8a. Five or six horizontal to slightly oblique grooves on lower side of head separating scale rows; third dorsal spine minute, not extending above dorsal profile of body. . 9
- 8b. No horizontal to oblique grooves on lower side of head; third dorsal spine extending well above dorsal profile of body when fin erect (pelagic in all warm seas) *Canthidermis maculatus*
- 9a. Dorsal soft rays 26–27; anal soft rays 23–25; an irregular blue line from pectoral axil to upper side of caudal peduncle; size to 327 mm SL (Indo-Pacific and tropical eastern Pacific) *Xanthichthys caeruleolineatus*
- 9b. Dorsal soft rays 27–32; anal soft rays 25–28; no blue line from pectoral axil to caudal peduncle; size not exceeding 240 mm SL 10
- 10a. Body depth at origin of anal fin 2.45–2.7 in SL; dorsal soft rays 27–30; anal soft rays 25–27; grooves on lower side of head not darkly pigmented; scales of body with a small whitish spot, the edges not dark (Indo-Pacific) .. *Xanthichthys auromarginatus*
- 10b. Body depth at origin of anal fin 2.8–3.4 in SL; dorsal soft rays 28–32; anal soft rays 27–28; grooves on lower side of head darkly pigmented in preserved specimens (blue in life); no whitish spot on scales of body (in life a blue dot on scales of male), edges dark brown, giving a crosshatch pattern to body (antitropical throughout the Pacific) *Xanthichthys mento*

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