NOTES

First Record of the Hawkfish *Cirrhitichthys oxycephalus* (Cirrhitidae) from Guam, Mariana Islands, with Notes on its Distribution and Ecology

A specimen of the hawkfish *Cirrhitichthys oxycephalus* (Bleeker) was collected and a second photographed (Fig. 1) recently from a depth of 2 m off Guam, Mariana Islands. This species is distributed widely (Table 1) in the tropical and subtropical Pacific and Indian oceans, and ranges from Panama to the Red Sea (Randall, 1963; Froiland, 1976; Springer, 1982; Russell, 1983). However, it has not been reported previously from the Mariana Islands, nor from other northwest Pacific localities, save for Taiwan (Shen and Lee, 1979). The collected specimen was kept for behavioral observations and maintained in aquaria (Department of Zoology, University of California, Berkeley, and Department of Biological Sciences, Illinois State University, Normal) prior to deposition in the University of Guam Marine Laboratory (UG) fish collection. Counts and measurements are from this specimen and follow Randall (1963).

Cirrhitichthys oxycephalus (Bleeker)

MATERIAL: UG 6278, sex undetermined, 60.9 mm SL, base of *Pocillopora edyouxi* coral head on coral pavement adjacent to a vertical drop-off, 2 m, Orote Pt. cliff-line, Guam, Mariana Islands, handnet, by T. J. Donaldson, 10 June, 1981.

DESCRIPTION: D. X, 12; A. III, 6; Pl i, 7, vi; scales cycloid, 42 along lateral line; 3 rows of scales above lateral line at middle of body; 8 scales below lateral line to origin of anal fin; gill rakers 5+1+9.

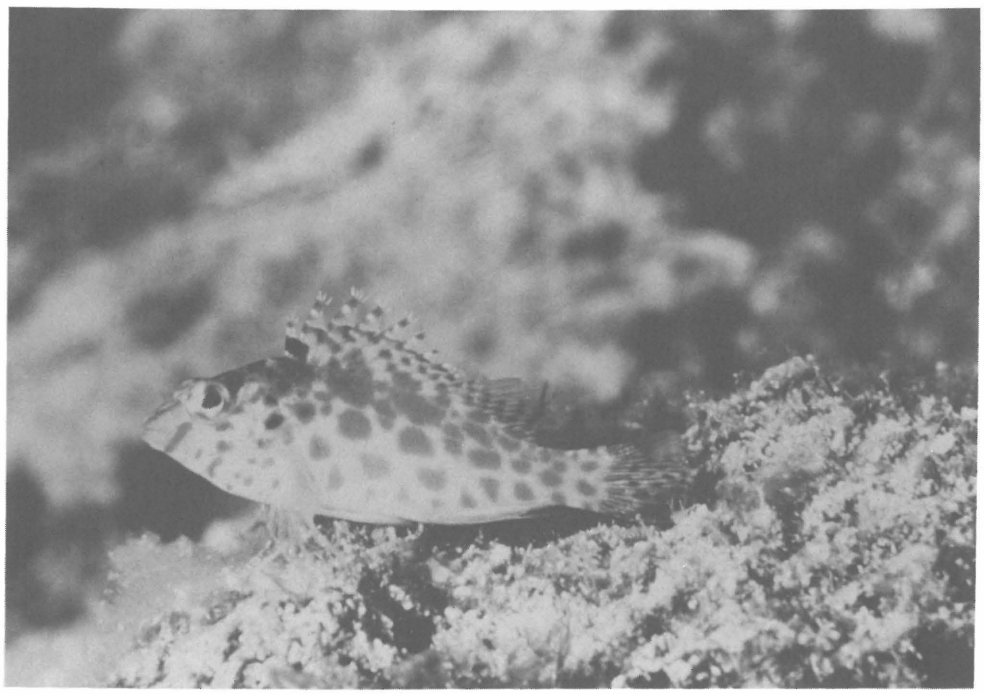

Fig. 1. *Cirrhitichthys oxycephalus* (ca. 35 mm SL), Orote Pt. cliff-line, Guam, Mariana Islands, in 2 m. Photograph by J. E. Randall.

Table 1. Known distribution of the hawkfish *Cirrhitichthys oxycephalus* (Bleeker).

Region	Locality	Source
East Pacific	Gulf of California	Thomson et al. (1979) and material examined in this report.
	Shepherd's Rocks, Baja California Sur, Mexico	Sight record from this report.
	Clipperton Island	Randall (1963)
	San Salvador Island, Galapagos Islands	Material examined in this report.
	Cocos Island	Randall (1963)
	Gorgona Island and Port Utria, Colombia	Randall (1963)
	Panama	Randall (1963)
	Costa Rica	Randall (1963)
Central Pacific	Marquesas Islands	Randall (1963)
	Christmas Island, Line Islands	Material examined in this report.
	Phoenix Islands	Randall (1963)
	Marshall Islands	Randall (1963)
	Gilbert Islands (Kiribati)	Randall (1963)
West Pacific	Fiji Islands	Randall (1963)
	Tulagi, Florida Island, Solomons Islands	Material examined in this report, and Randall (1963).
	Capricorn Group, Great Barrier Reef, Australia	Russell (1983)
	Kosrae, E. Caroline Islands	Sight record from this report.
	Kapingimaringi Atoll, E. Caroline Islands	Material examined in this report.
	Truk, E. Caroline Islands	Sight record from this report.
	Guam, Mariana Islands	New record
	Ulithi, W. Caroline Islands	Material examined in this report.
	Belau, W. Caroline Islands	Sight record from this report.
	Philippine Islands/East Indies	Randall (1963)
	Taiwan	Shen and Lee (1979)
Indian Ocean	East Indies	Randall (1963)
	Christmas Island, Australia	Allen and Steene (1979)
	Madras, India	Randall (1963)
	Maldive Islands	Froiland (1976)
	Grand Comore Island, Comore Islands	Material examined in this report.
	Andromache Reef, Kenya	Material examined in this report.
	Gold Mohar Bay, Gulf of Aden	Material examined in this report.
	Red Sea	Randall (1963)
	Mauritius	Randall (1963)

Depth of body 3.04 in standard length; snout 3.53 in head length; longest dorsal spine 1.79 in depth; bony interorbital space 2.36 in eye; median anterior part of interorbital space scaled; region between nostrils scaled; profile of head (excluding eye) with a marked indentation above eye; serrations on preopercle 18; preorbital scaled, its free hind edge without spines; maxillary ends slightly posterior to a vertical at front of eye; first dorsal soft ray prolonged; tips of pelvic fins extending beyond anus.

Color in life light brown to white with 4 rows (length-wise) of reddish-brown spots along body; a se-

ries of small reddish-brown spots interspersed between larger spots along the lateral line; dark reddish-brown spots, in 2 bands, running ventrally beneath eye; dark reddish-brown spots on nape and snout; a lone of 5 dark spots along opercle and interopercle; dorsal fin base marked by a series of small reddish-brown spots; dorsal fin spotted with dark brown; reddish-brown spots on caudal fin; pelvic and anal fins faintly red; pectoral fins faintly white; iris orange and ringed with brown.

REMARKS: Selected measurements were compared with those specimens collected previously from four areas of the East- and Indo-Pacific (Table 2) and deposited at the California Academy of Sciences (CAS) and Stanford University (SU, now at CAS). East Pacific specimens and localities include: San Jose del Cabo, Baja, Mexico (SU 17466), and San Salvador Island, Galapagos Islands (CAS 39252). Central Pacific specimens are all from Christmas Island, Line Islands (CAS 2245; CAS 24407). West Pacific specimens and localities include: Kapingamarangi Atoll, E. Caroline Islands (CAS 54334), Tulagi, Florida Islands, Solomon Islands (SU 5694), and Ulithi, W. Caroline Islands (CAS 51825). Indian Ocean specimens and localities include: Grand Comore Island, Comoro Islands (CAS 24519), Gold Mohar Bay, Aden (CAS 24522), and Andromarche Reef, Kenya (CAS 24515).

Slight differences in certain character measurements existed between the Guam specimen and those from the four major regions (Table 2). Four differences were slightly greater than the range of values: snout to origin of dorsal fin, length of anal fin base, length of pelvic spine, and length of last dorsal spine. The snout to origin of pelvic fin measurement was slightly less than the corresponding range of values while the measure of head length differed by as much as 12.3%. The maxilla extended beyond the eye in the Guam specimen, and also in all East Pacific, 2 Central Pacific, and 2 West Pacific specimens. The maxilla of 1 Central Pacific, 1 West Pacific, and all Indian Ocean specimens extended only as far as the center of the eye. Pelvic fin tips extended beyond the anus in all material examined with the exception of one Indian Ocean (Aden) specimen. Slight difference in the scalation of the preorbital also existed. Specimens from Guam, the East Pacific, and the West Pacific had a few preorbital scales; all Indian Ocean and 2 Central Pacific specimens lacked preorbital scales. Randall (1963) detected geographic variation in certain of these characters from Red Sea specimens. The maxilla extended almost to a vertical at the center of the eye. Dorsal spines and pectoral fins were shorter than those he examined from other regions and pelvic fins tended not to extend as far as the anus. Froiland (1976) reported variability in the above characters measured from a collection of *C. oxycephalus* made in the Maldive Islands, Indian Ocean. The length of the maxilla was variable with extensions ranging from a vertical in front of the eye to a vertical in the center of the eye. Dorsal spines tended to be longer, while pectoral and pelvic fins varied greatly in length.

It is difficult to detect any consistent differences in characters between populations of this species from different geographic regions. Major differences in the Guam specimen might result from its condition at the time of measurement and not geographic variation. Geographic variation detected in Red Sea specimens by Randall (1963) might be valid. However, the size and sex of these specimens was not indicated and it is possible that this variation may merely be a condition of size (growth with age), sexual dimorphism or degree of sexual maturity. If geographic variation in external morphology does exist, its detection will require examination of a larger series of specimens over a wide range in size and from a number of widespread localities.

Geographic variation might also exist in non-morphological characters, such as local distribution, ecology and behavior but is thus far unknown for this and other cirrhitid species. The following notes are offered in an attempt to demonstrate the potential for variation in these characters.

Throughout its range, *Cirrhitichthys oxycephalus* is associated with coral heads of shallow water (less than 40 m) reefs (Randall, 1963; Froiland, 1976; Thomson *et al.*, 1979; Allen and Steene, 1979). At Guam, the two specimens were observed on pavement at the base of *Pocillopora eydouxi* but never between or on top of the branches of this coral. Other cirrhitids associated with coral heads of this species included *Neocirrhites armatus* Castlenau, *Paracirrhites arcatus* (Cuvier), *P. forsteri* (Schneider), *P. hemistictus* (Gunther), and *Cirrhitichythys falco* Randall. Adult *N. armatus* and juveniles of the other species were usually found between the branches of *Pocillopora eydouxi* or other related species, while adult *Paracirrhites* spp. were found perched atop such coral heads. *Cirrhitichthys falco* occurred beneath these coral heads, usually in pairs (pers. obs., T. J. Donaldson; but see Amesbury and Myers, 1982).

One of us (RFM) made the following observations of *C. oxycephalus* inhabiting reefs in the Caroline Islands of Kosrae, Truk, and Belau. In Kosrae, a number of small *C. oxycephalus* were observed in the lagoon margin, the channel margin, and the outer reef habitats at depths of 3 to 6 m. This species was most abundant in coral-rich areas of the relatively sheltered

Table 2. Selected measurements (expressed as percent SL) and counts of *Cirrhitichthys oxcephalus* collected from Guam, Mariana Islands, compared with those of Eastern Pacific (EP), Central Pacific (CP), Western Pacific (WP), and Indian Ocean (IO) collections (see text for explanation).

Characters	Guam (UG 6278)	EP (n = 2)	CP (n = 3)	WP (n = 3)	IO (n = 3)
Standard length (mm)	60.9	50.0–73.5	49.5–55.5	47.2–65.5	47.0–52.0
Head length	23.7	30.7–32.7	30.6–34.8	34.4–36.0	31.9–34.7
Depth of body	32.9	33.2–36.1	35.1–38.9	31.3–34.5	34.7–37.5
Snout length	9.5	8.4–10.8	7.8–9.1	9.5–9.9	8.5–9.9
Width of body at gill opening	17.9	18.2–20.5	19.2–19.8	16.5–19.1	18.1–18.8
Eye diameter	6.9	5.2–8.2	7.8–9.9	7.6–9.5	7.5–8.5
Post-orbital length of head	16.4	9.7–15.4	11.7–13.5	16.0–19.7	14.9–18.3
Bony interorbital space length	8.2	8.8–10.1	7.1–8.1	6.0–6.9	6.9–7.9
Least depth of caudal peduncle	9.5	12.6–13.6	9.0–12.1	12.1–13.7	8.9–13.5
Length of caudal peduncle	13.6	12.0–12.5	10.8–16.5	12.7–15.3	13.5–18.0
Snout to origin of dorsal fin	37.4	31.3–36.2	32.3–33.0	30.5–35.6	28.9–35.1
Snout to origin of pelvic fin	37.4	40.0–41.5	41.4–45.6	38.2–44.9	40.4–42.6
Length of dorsal fin base	62.1	55.5–63.1	57.7–65.1	46.2–61.1	56.4–58.5
Length of anal fin base	22.2	15.1–15.6	12.1–15.5	14.6–21.6	15.8–16.4
Length of pectoral fin	32.2	31.8–34.9	33.3–38.8	32.8–33.9	36.2–40.4
Length of pelvic fin	22.0	24.4–25.2	22.2–23.5	21.2–26.7	22.1–26.6
Length of pelvic spine	18.6	14.5–18.2	16.2–17.5	12.3–18.1	16.4–17.8
Length of 1st dorsal spine	6.6	4.9–5.2	7.8–8.1	5.3–7.8	4.8–7.9
Length of longest (5th) dorsal spine	18.4	14.9–19.7	11.1–20.4	15.6–18.1	12.3–18.1
Length of last dorsal spine	17.4	10.2–12.0	12.6–14.6	12.9–16.4	9.6–13.9
Length of first dorsal soft ray	17.1	21.7–23.6	18.0–23.3	12.9–23.3	23.4–26.9
Length of last dorsal soft ray	11.0	12.4–12.8	10.8–12.1	7.6–12.1	11.9–13.5
Length of 1st anal spine	8.9	9.6–11.8	10.8–13.6	11.7–13.8	9.9–12.5

Length of last anal spine	19.1	12.8–18.7	14.4–18.2	15.0–22.9	16.4–21.8
Length of 1st anal ray	21.9	18.0–22.2	19.8–21.4	12.2–20.7	19.8–24.0
Length of last anal ray	12.9	11.9–16.0	14.1–19.4	14.8–23.6	13.5–15.9
Length of caudal fin	20.7	22.9–23.8	20.7–26.3	23.3–24.1	21.2–24.0
Dorsal rays	X, 12	X, 12	X, 12	X, 12	X, 12
Anal rays	III, 6	III, 6	III, 6	III, 6	III, 6
Pectoral rays	i, 7, vi	i, 7, vi	i, 7, vi	i, 7, vi	i, 7, vi
Gill rakers ($\bar{X}$)	5 + 1 + 9	4 + 1 + 10	4 + 1 + 10	5 + 1 + 9	5 + 1 + 10
Lateral line scales	42	45	44	41–43	44–45
Rows of scales above the lateral line*	3	3	3–4	3	3–4
Rows of scales below lateral line to origin of anal fin	8	10	9–10	10	10
Bony interorbital space width	1.8	1.9–2.1	2.7–3.6	0.8–1.5	1.0–1.5
Scales in median anterior part of interorbital region between nostrils	yes	yes	yes (2) no (1)	yes	yes
Serrations on preopercle	18	14–21	13–14	14–16	14–20
Preorbital scaled	yes	yes	yes (1) no (2)	yes	no
Free hind margin of preorbital with serrations	no	no	no	no	no
Maxilla ends posterior to or at center of eye	posterior	posterior	posterior (2) center (1)	posterior (2) center (1)	center
Pelvic fin tips extend beyond anus	yes	yes	yes	yes	yes (2) no (1)
Caudal fin slightly emarginate to truncate	yes	yes	yes	yes	yes
First dorsal soft ray prolonged	yes	yes	yes	yes	yes

* at midpoint of body

lagoon and channel margins where it was observed resting near the bases of coral heads or among the branches of the soft coral *Sinularia* sp. Larger specimens were observed and photographed at a depth of 3 m on the coral-encrusted mast of the shipwreck *Fujikawa Maru* in Truk lagoon, and along the outer dropoff of Ngemelis reef at a depth of approximately 10 m in Belau. *Paracirrhites arcatus* or *P. forsteri* were present and generally found resting on or near the tops of heads of various species of scleractinian corals in all of these areas, with the exception of the shipwreck in Truk lagoon where they may have been present, but were not noted. *Cirrhitichthys oxycephalus* inhabits *Pocillopora* spp. corals where the above-mentioned cirrhitids are absent. One of us (TJD) observed numerous adult and juvenile *C. oxycephalus* between coral head branches in shallow water (2–3 m) near Shepherd's Rocks, Cabo San Lucas, Baja California Sur, Mexico in 1982. Thresher (1984) reported that *C. oxycephalus* inhabited such coral heads in the Gulf of California and that spawning between males and haremic females occurred above these corals.

The specimen of *Cirrhitichthys oxycephalus* reported herein extends the known distribution of this species to Guam, Mariana Islands, where it is apparently rare. The morphological and perhaps behavioral and ecological similarities of this species with others of its genus, particularly *C. falco* Randall, *C. serratus* Randall, and *C. aprinus* (Cuvier), may contribute towards misidentification of this species in many areas. Additionally, on Guam at least, it is known only from a habitat that periodically experiences a high degree of wave activity, rendering access difficult. Further collections in such areas throughout the Mariana Islands should produce additional specimens of this interesting species.

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Reproductive Status of Some Guam Corals

There has recently been renewed interest in the sexual reproduction of scleractinians. The hypothesis that external fertilization and development is the most common mode of reproduction in corals (Kojis and