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A New Moray Eel (Muraenidae: *Gymnothorax*) from Oceanic Islands of the South Pacific[1]

ROBERT J. LAVENBERG[2]

ABSTRACT: A new moray of the genus *Gymnothorax* is illustrated and described from 69 individuals taken from oceanic islands and atolls in the subtropical South Pacific Ocean. It differs from all other *Gymnothorax* except the Atlantic *G. bacalladoi* in having a single branchial pore. The new species of *Gymnothorax* may be distinguished from *G. bacalladoi* by having fewer preanal vertebrae (48–53 rather than 54–56), more total vertebrae (138–146 rather than 130–131), a single rather than a double row of vomerine teeth, and fewer teeth in the inner maxillary tooth row. The new species appears to be allied to *G. bacalladoi* and *G. panamensis* based on coloration and dentition.

RECENT RECORDS OF a common eastern Pacific moray eel, *Gymnothorax panamensis* (Steindachner, 1876), at oceanic islands across the subtropical South Pacific Ocean, including Lord Howe Island off Australia (Allen et al. 1976), Ducie Atoll (Rehder and Randall 1975), and Rapa (Randall et al. 1990), have been puzzling. *Gymnothorax panamensis* has long been considered an eastern Pacific endemic, ranging from the Gulf of California to Easter Island (Randall and McCosker 1975). Could it possibly be an Indo-West-Pacific species that has colonized the eastern Pacific, or an eastern Pacific eel invading the Indo-Pacific? I borrowed insular South Pacific specimens of this eel from the Bishop Museum to confirm its identity and, if correct, to determine how its distribution might contribute to western Pacific–eastern Pacific zoogeography.

Superficially these plain-colored morays appear to be *Gymnothorax panamensis*, with the characteristic black eye ring and white blotches around the last two infraorbital pores and last three mandibular pores—a pattern noted by Steindachner (1876) in his original description. However, upon closer inspection, the numbers of branchial pores and vertebrae of these morays are clearly different from the counts of pores and vertebrae of *G. panamensis*. The South Pacific morays are distinctive in having one branchial pore. A search of the literature on morays revealed that only one other species of *Gymnothorax* (sensu lato) has the branchial pore condition reduced to a single pore: *G. bacalladoi* (Böhlke and Brito, 1987), a species known only from around the Canary Islands in the North-central Atlantic. *Gymnothorax bacalladoi* and *G. panamensis* have similar facial coloration, but are easily distinguished from one another by the number of branchial pores, one versus two, respectively. Furthermore, the number and arrangement of vertebrae in *G. bacalladoi* and *G. panamensis* differ, especially in the predorsal region.

All of the morays identified as *G. panamensis* from South Pacific oceanic sites have been examined (Randall and McCosker 1975, Allen et al. 1976, Randall et al. 1990), and all are similar to *G. bacalladoi*. However, they differ from *G. bacalladoi* in the number and arrangement of teeth on the vomer. In *G. bacalladoi* the vomer is armed with 9–15 low, conical, unequal-sized biserially arranged teeth, whereas in the South Pacific morays the vomer has 6–8 conical, equal-sized uniserially arranged teeth. In view of these features I propose that these South Pacific oceanic island populations of *Gymnothorax* represent a new species.

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[2] Section of Fishes, Natural History Museum of Los Angeles County, 900 Exposition Boulevard, Los Angeles, California 90007-4000.

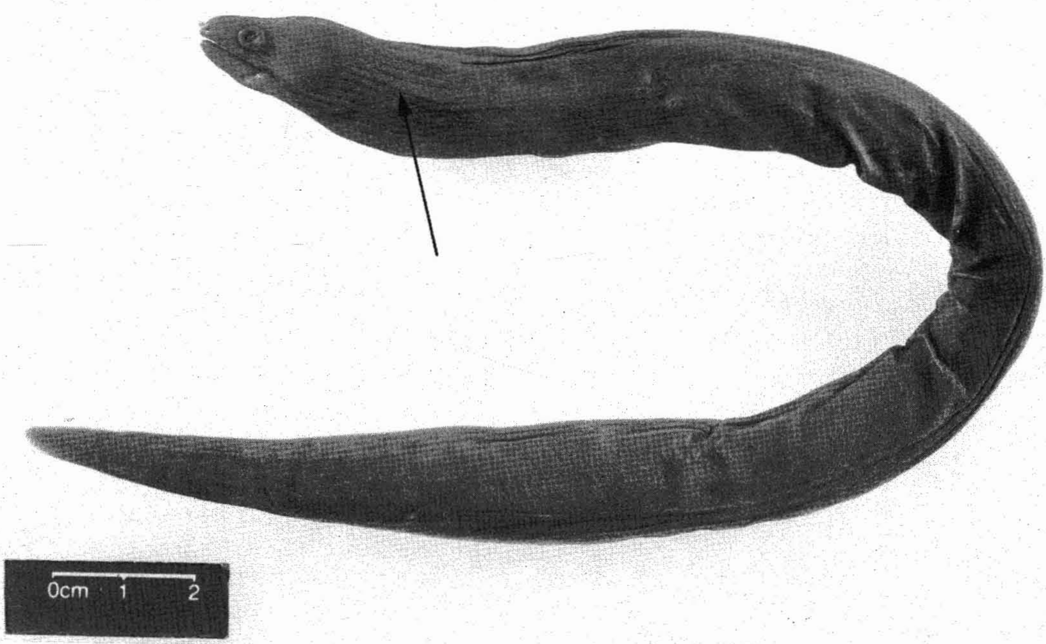

FIGURE 1. *Gymnothorax australicola*, holotype, LACM 6560-48, 307 mm total length; arrow identifies location of the single branchial pore. Photograph by D. Meier, LACM.

METHODS AND ABBREVIATIONS

Anatomical terms, morphometric methods, and meristic characters and their abbreviations conform to those of Böhlke (1989). Vertebral formulae are as defined by Böhlke (1982). Cranial pores are as defined by Smith and Kanazawa (1977). All measurements are expressed in millimeters (mm), and length is total length (TL) throughout. Institutional acronyms follow Leviton et al. (1985).

SYSTEMATIC TREATMENT

Gymnothorax australicola Lavenberg, n. sp.
Figures 1–2, Tables 1–4

Gymnothorax panamensis (non Steindachner), Randall and McCosker, 1975: 15; Allen et al., 1976: 376; Randall et al., 1990: 6

HOLOTYPE: LACM 6560-48, 1(307), Easter Island, Anakena Cove, E side 100 m NE of sand beach, 27° 03.5′ S, 109° 19.5′ W, 4.5 m, among 1- to 2.5-m boulders, some coral, brown algae, water temperature 69°F, rotenone, 1 October 1958, Ramsey Parks and crew of the ketch *Chiriqui*.

PARATYPES: LACM 6560-45, 17(99-320), Easter Island, data as for holotype. UCR 2195-1, 1(288), Easter Island, data as for holotype. ANSP 165743, 1(253), Easter Island, data as for holotype. BPBM 12262, 1(257), Ducie Atoll, NW side of small boat passage, coral rock bottom with patches of gravel and coarse sand, 0.3–1.3 m, rotenone, 14 January 1971, J. Randall, D. Cannoy, and S. Christian. BPBM 12872, 7(117-248), Rapa, E side of Tematapu Point, 3–6 m, rotenone, 31 January 1971, D. Cannoy, R. Costello, and A. Sinoto. BPBM 14945, 1(128), Lord Howe Island, off Phillip Rock, 30 m, rotenone, 26 February 1973, J. Randall, B. Goldman. BPBM 16844, 1(230), Pitcairn Island, off Bounty Bay, reef at edge of sand, little live coral substrata, 31–40 m, rotenone, 26 December 1970, J. Randall, D.

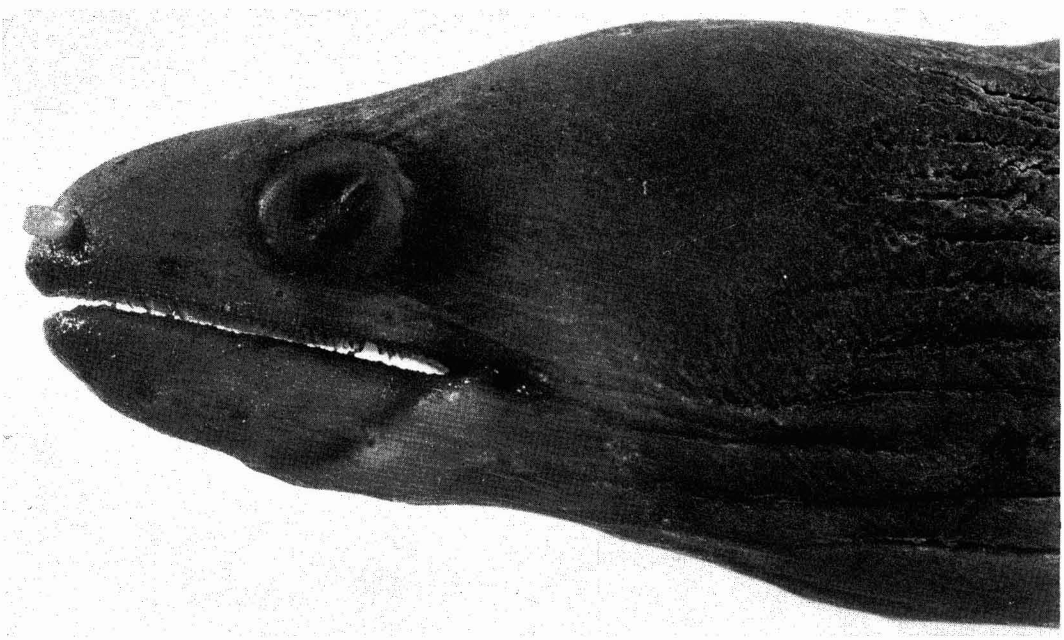

FIGURE 2. *Gymnothorax australicola*, holotype, LACM 6560-48, showing details of the pigment around the orbit and cranial pores. Photograph by D. Meier, LACM.

Cannoy, and D. Bryant. BPBM 16877, 5(180-305), Pitcairn Island, reef on N side off Gannet Ridge, 40–45 m, rotenone, 6 January 1971, J. Randall, D. Cannoy, J. Haywood, R. Costello, D. Bryant, and S. Christian. BPBM 17304, 5(79-179), Rapa, S side of Mei Point, 0–3 m, rotenone, 31 January 1971, J. Randall and D. Cannoy. BPBM 16975, 3(115-190), Pitcairn Island, off *The Rope*, pockets of sand among boulders, 6 m, rotenone, 23 December 1971[1970?], J. Randall, S. Christian, and N. Young. BPBM 17014, 1(290), Pitcairn Island, large tide pool near Christian's Point, rock and sand substrata, 0–1.3 m, rotenone, 31 December 1970, J. Randall, S. Christian, and N. Young. SIO 65-624, 2(225-275), eastern South Pacific, San Felix Island, NW side, 26° 17.3′ S, 80° 05.4′ W, 10 m, water temperature 62°F, chemfish ichthyocide, 5 December 1965, R. L. Wisner and party, *Anton Bruun* cruise 12, stat 30. SIO 65-626, 12(218-375), eastern South Pacific, San Felix Island, NW side, 26° 17.3′ S, 80° 05.4′ W, 9–12 m, chemfish ichthyocide, 0945–1115 hours, 6 December 1965, R. L. Wisner and party, *Anton Bruun* cruise 12, stat 33. SIO 65-628, 7(280-350), eastern South Pacific, San Felix Island, NW side, 26° 17.3′ S, 80° 05.4′ W, 7.5 m, chemfish ichthyocide, 1515–1645 hours, 6 December 1965, R. L. Wisner and party, *Anton Bruun* cruise 12, stat 35. SIO 65-629, 4(215-245), eastern South Pacific, San Felipe Island, W of San Felix Island at Cathedral Rocks, 26° 16.1′ S, 80° 06.3′ W, 34 m, chemfish ichthyocide, 1000–1130 hours, 7 December 1965, R. L. Wisner and party, *Anton Bruun* cruise 12, stat 36.

DIAGNOSIS: A plain-colored moray of the genus *Gymnothorax* that differs from all other species except *G. bacalladoi* in possessing a single branchial pore. However, *G. australicola* differs from *G. bacalladoi* in lacking the mottled brown coloration, in having uniserially arranged teeth on the vomer rather than more biserially arranged ones as in *G. bacalladoi*, in having fewer preanal vertebrae (48–53 rather than 54–56), in having more total vertebrae (138–146 rather than 130–131), and in having fewer teeth in the inner maxillary row than does *G. bacalladoi*. The orbit is ringed in black pigment and the posterior jaw pores of the infraorbital and mandibular series lie in white patches, a pattern similar to that of *G. bacalladoi* and *G. panamensis*. *Gymnothorax australicola* differs from *G. panamensis* in the branchial pore feature, in having fewer vertebrae in advance of the dorsal fin origin (3–6 in the new species and 7–16 in *G. panamensis*), and in having more total vertebrae (138–146 rather than 125–139). The mean vertebral formula of the new species is 3.7-50.6-141.5.

COUNTS AND MEASUREMENTS (IN MM) OF THE HOLOTYPE: Total vertebrae 141; predorsal vertebrae 3; preanal vertebrae 51. Head pores: supraorbital 1 (ethmoid) +2; infraorbital 4; mandibular 6; branchial 1. Total length 281; predorsal length 25.8; preanal length 111.0; head length 33.8; body depth at gill opening 15.0; body depth at anus 14.3; body width at gill opening 8.0; body width at anus 8.1; snout 5.3; upper jaw 9.8; orbit 3.2; interorbital width 3.9.

DESCRIPTION: See Table 1 for morphometric data and Tables 2–4 for vertebral counts. Body elongate, depth at anus 3.9–5.3% of TL, width slightly more compressed anteriorly at gills in juveniles, otherwise 2.4–3.7% of TL at anus; tail somewhat tapering. Origin of dorsal fin on head just in front of gill opening; origin of anal fin just behind anus, which is before midbody, preanal length 39.3–45.6% of TL. Head shape varies, usually elevated and muscular; snout and jaws short, upper and lower jaws of about equal length. Orbit of moderate size, 8.4–12.0% of HL, its center at or a little behind midjaws; interorbital space smooth, slightly convex, broader than orbit but narrower than snout. Anterior nostril in a narrow tube, flared anterolaterally, length of nostril tube about equal to pupil width; posterior nostril not tubular but with fleshy scalloped edges, usually just over anterior margin of pupil. Skin texture of head rugose, strongest on snout and along the jaw margins.

Pores on head well developed, varying in shape from round to elliptical. Ethmoid pore on tip of snout anteroventral to anterior nostril; 2 supraorbital pores on dorsal surface of snout, the first directly above the ethmoid pore at level of dorsal margin of anterior nostril, the second high on snout between anterior pore and posterior nostril, much closer to anterior nostril; 4 infraorbital pores, the first just behind anterior nostril at a level of its ventral margin, the second midway between anterior pore and posterior margin of orbit, the third below anterior margin of orbit, the fourth below posterior margin of orbit; 6 mandibular pores between jaw tip and rictus, the first smallest, at tip of jaws near symphysis, markedly elevated, the sixth just behind rictus. The single branchial pore lies in advance and above the level of gill opening, and about under the dorsal-fin origin. Gill opening a small elliptical opening, longer than wide, at about midbody.

Teeth strong, anterior outer teeth only slightly to moderately serrate; serrations stronger along posterior margins of teeth, posteriorly in the jaws. Upper jaws usually with 1 anterior median tooth (rarely 2) followed on each side by 5 outer intermaxillary teeth that increase in size posteriorly; these intermaxillary teeth stout, triangular, and slanted to slightly recurved posteriorly, the rear margin with a smooth basal hump, more noticeable anteriorly, and its edge more strongly serrate than the front margin. Maxillary teeth in two short rows, outer row of 16–22 close-set, short, triangular, smooth bladelike teeth of about uniform size, inner row of 9–12 well-spaced, long, "fingerlike," smooth teeth with bladelike tips. Two series of median teeth: anteriorly the intermaxillary teeth consist of 1 or 2 long slender fangs, between the 5 outer teeth, which are the largest of all teeth; and posteriorly a uniserial row of 5–7 low, conical, unequal-sized vomerine teeth, first tooth usually largest. Length of the vomerine tooth row about equal to or shorter than the maxillary tooth rows. Dentary teeth uniserial, 10–14 strong triangular teeth, largest ones anteriorly, occasionally 3 small teeth present along anterior margin of jaw tips medial to the first and second large teeth; serrate, strongest on posterior margin, posterior basal knob present on anterior teeth only.

TABLE 1

MEASUREMENTS OF *Gymnothorax australicola*, EXPRESSED AS PERCENTAGE OF EITHER TOTAL (TL) OR OF HEAD LENGTH (HL)

SPECIMEN	TL	H/TL	O/HL	IO/HL	S/HL	J/HL	O/TL	S/TL	J/TL	DG/TL	WG/TL	DA/TL	WA/TL	D/TL	PrA/TL	Tr/TL
LACM 6560-45	125	0.118	0.108	0.142	0.182	0.297	0.013	0.022	0.035	0.062	0.029	0.044	0.036	0.098	0.421	0.307
BPBM 16887	128	0.109	0.111	—	0.176	0.279	0.012	0.019	0.030	0.044	—	0.039	—	0.114	0.456	0.348
LACM 6560-45	161	0.120	0.098	0.113	0.144	0.258	0.012	0.017	0.031	0.060	0.025	0.053	0.027	0.102	0.416	0.306
BPBM 14945	184	0.121	0.099	—	0.158	0.333	0.012	0.019	0.040	0.060	—	0.042	—	0.121	0.414	0.293
SIO65-629	203	0.124	0.103	0.107	0.171	0.361	0.013	0.021	0.045	0.061	0.026	0.040	0.029	0.074	0.433	0.311
LACM 6560-45	208	0.119	0.105	0.146	0.174	0.312	0.013	0.021	0.037	0.063	0.029	0.050	0.028	0.093	0.409	0.300
SIO65-624	220	0.114	0.100	0.100	0.180	0.384	0.011	0.020	0.044	0.044	0.035	0.046	0.035	0.090	0.412	0.301
SIO65-629	245	0.120	0.119	0.119	0.180	0.373	0.014	0.022	0.045	0.060	0.028	0.045	0.032	0.098	0.445	0.333
BPBM 14945	249	0.116	0.087	—	0.167	0.295	0.010	0.019	0.034	0.055	—	0.047	—	0.123	0.423	0.310
BPBM 14945	250	0.104	0.120	—	0.189	0.328	0.012	0.020	0.034	0.053	—	0.050	—	0.114	0.416	0.318
LACM 6560-45	261	0.112	0.092	0.123	0.171	0.307	0.010	0.019	0.034	0.054	0.025	0.044	0.034	0.095	0.418	0.308
SIO65-624	267	0.129	0.116	0.116	0.169	0.328	0.015	0.022	0.042	0.061	0.037	0.045	0.028	0.094	0.418	0.301
SIO65-628	280	0.115	0.112	0.112	0.186	0.385	0.013	0.021	0.044	0.054	0.032	0.050	0.028	0.099	0.429	0.293
LACM 6560-48	281	0.120	0.095	0.115	0.157	0.290	0.011	0.019	0.035	0.053	0.028	0.051	0.029	0.092	0.395	0.280
LACM 6560-45	285	0.116	0.084	0.136	0.175	0.319	0.010	0.020	0.037	0.057	0.029	0.046	0.031	0.098	0.413	0.301
SIO65-628	300	0.111	0.099	0.117	0.174	0.405	0.011	0.019	0.045	0.055	0.026	0.051	0.030	0.086	0.413	0.288
BPBM 14945	301	0.115	0.098	—	0.179	0.340	0.011	0.021	0.039	0.057	—	0.048	—	0.114	0.449	0.334
BPBM 14945	315	0.116	0.090	—	0.175	0.342	0.010	0.020	0.040	0.056	—	0.042	—	0.110	0.412	0.297
LACM 6560-45	320	0.113	0.097	0.125	0.147	0.269	0.011	0.017	0.030	0.063	0.024	0.052	0.029	0.088	0.393	0.284
SIO65-628	346	0.123	0.106	0.125	0.208	0.394	0.013	0.025	0.048	0.062	0.034	0.045	0.033	0.100	0.439	0.316
Min. values		0.104	0.084	0.1	0.144	0.258	0.009	0.017	0.030	0.044	0.024	0.039	0.027	0.074	0.393	0.280
Max. values		0.129	0.119	0.146	0.208	0.405	0.015	0.025	0.048	0.063	0.037	0.053	0.036	0.123	0.456	0.348
Mean values		0.117	0.102	0.121	0.173	0.330	0.012	0.020	0.039	0.057	0.029	0.047	0.031	0.1	0.421	0.307

Abbreviations: H = head, O = orbit, IO = interorbital, S = snout, J = jaws, DG = depth at gill opening, WG = width at gill opening, DA = depth at anus, WA = width at anus, PrD = predorsal fin, PrA = preanal fin, Tr = trunk.—indicates data not taken.

TABLE 2

FREQUENCY DISTRIBUTION OF NUMBERS OF PREDORSAL VERTEBRAE IN *Gymnothorax australicola* AND *G. panamensis*

SPECIES	3	4	5	6	7	8	9	10	11	12	13	14	15	16
G. australicola														
San Felix Island	8	11	6	—	—	—	—	—	—	—	—	—	—	—
Easter Island	3	6	—	—	—	—	—	—	—	—	—	—	—	—
Rapa	4	6	2	—	—	—	—	—	—	—	—	—	—	—
Pitcairn	3	6	—	—	—	—	—	—	—	—	—	—	—	—
Ducie Atoll	—	1	—	—	—	—	—	—	—	—	—	—	—	—
Lord Howe Island	—	—	—	1	—	—	—	—	—	—	—	—	—	—
G. panamensis														
Clipperton	—	—	—	—	—	—	2	2	4	—	—	—	—	—
Costa Rica	—	—	—	—	—	—	—	—	2	4	3	—	—	—
Isla del Coco	—	—	—	—	—	—	—	1	2	2	—	—	—	—
Galápagos	—	—	—	—	1	3	4	5	5	1	—	—	—	1

TABLE 3

FREQUENCY DISTRIBUTION OF NUMBERS OF PREANAL VERTEBRAE IN *Gymnothorax australicola* AND *G. panamensis*

SPECIES	47	48	49	50	51	52	53	54	55
G. australicola									
San Felix Island	—	—	2	1	11	5	1	2	3
Easter Island	—	—	2	1	4	2	—	—	—
Rapa	—	—	—	3	7	2	—	—	—
Pitcairn	—	—	2	5	3	—	—	—	—
Ducie Atoll	—	—	—	—	1	—	—	—	—
Lord Howe Island	—	—	—	—	—	—	1	—	—
G. panamensis									
Clipperton	1	—	3	3	—	—	—	—	1
Costa Rica	—	3	5	1	—	—	—	—	—
Isla del Coco	1	1	2	1	—	—	—	—	—
Galápagos	—	3	3	8	5	—	—	—	—

COLOR: In alcohol preservative. Head, body, and fins brown, some individuals with pale or dark mottled lateral blotches; margins of fins only slightly darker, not noticeably darker on tail. Head with a prominent black ring around orbit, otherwise it is uniformly pigmented. Cranial pores anterior to the orbit (supraorbital, first two infraorbital, and first three mandibular pores) with a fine dark ring. Mouth and throat pale, little pigmented. Posterior jaw pores (last two infraorbital and last two to three mandibular) in conspicuous white blotches.

SIZE: The largest known specimen in the type series, 375 mm, was taken at San Felix Island, SIO65-626. Individuals as large as 366 mm are known from Easter Island, BPBM 6573. *Gymnothorax australicola* is a small species, probably not reaching lengths greater than 400 mm. Gravid individuals of lengths of 270 to 275, 281, and 223 to 263 were noted in SIO65-624, SIO65-628, and SIO65-626, respectively. Unhydrated ovarian eggs ranged from 0.85 to 1.0 mm diam. in specimens from SIO65-624 and SIO65-628, respectively, suggesting that spawning occurs in austral summer. At San Felix Island off Chile the eggs in all of the female specimens in SIO65-626 and SIO65-628 taken in December were well yolked and partially hydrated, suggesting that they were ready to spawn; SIO65-626 contained eight

TABLE 4

FREQUENCY DISTRIBUTION OF TOTAL NUMBERS OF VERTEBRAE IN *Gymnothorax australicola* AND *G. panamensis*

SPECIES	125	124	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148
G. australicola																									
San Felix Island	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	1	5	3	2	1	4	4	—	1	1
Easter Island	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	4	2	1	1	—	—	—	—
Rapa	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	4	1	2	2	—	1	—	—
Pitcairn	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	2	—	1	5	1	—	—	—	—	—
Ducie Atoll	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—
Lord Howe Island	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
G. panamensis																									
Clipperton	—	—	—	—	1	—	—	2	4	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Costa Rica	1	—	—	4	2	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Isla del Coco	1	3	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Galápagos	—	1	—	—	—	—	—	—	2	2	1	1	7	2	3	1	—	—	—	—	—	—	—	—	—

ripe males and four gravid females, while SIO65-628 contained two ripe males and five gravid females.

ETYMOLOGY: From the Latin *australis* (southern), and *cola* (inhabitant), in reference to the habitat of the species. A noun in apposition.

DISTRIBUTION: *Gymnothorax australicola* ranges from very shallow inshore depths of 0.3–1.3 m or tide pools (BPBM 12262, BPBM 17014) to depths of at least 45 m (BPBM 16877). Most specimens have been collected using rotenone and Scuba techniques.

Gymnothorax australicola is a wide-ranging trans-Pacific species that is tropical in the west, subtropical in the south, and subtropical-temperate in the east; known from Lord Howe Island (Allen et al. 1976), Rapa (Randall et al. 1990), Ducie Atoll in the Pitcairn Group (Rehder and Randall 1975), and Easter and San Felix Islands (Randall and McCosker 1975). The distributional track of this South Pacific moray, which extends across the Indian-Australian, Pacific, and Nazca plates, reflects a pattern of other Indo-West-Pacific groups that are suspected of dispersing eastward across the cold-temperate South Pacific Ocean to the islands of coastal Chile (McCosker 1970). A decapod crustacean, *Jasus frontalis* (Holthuis and Siversten 1967) and numerous nearshore fishes manifest this pattern (*Antennarius coccineus* [Pietsch and Grobecker 1987], aplodactylids, *Congiopodus*, *Genypterus*, and rhombosoleinaeids [Mead 1970], centrolophids of the genus *Seriolella* [Haedrich and Horn 1972], an ophichthid eel of the genus *Muraenichthys* [McCosker 1971], triglids of the genera *Pterygotrigla* and *Chelidonichthys* [Hubbs 1959], tripterygiids [Rosenblatt 1959], and *Parapercis*, *Gonorhynchus*, and *Monocentrus* [McCosker 1971]). The numbers of species among these Indo-West-Pacific fish groups diminish considerably from west to east across the cold-temperate South Pacific. This distributional pattern of suspected eastward movement is consistent with the predominant surface-water movements (i.e., in the same direction as that of the prevailing surface-current system). Yet, are the cold-temperate island habitats off Chile the geographical end point of a dispersal event (radiation), as Mead (1970) suggested?

Springer (1982) suggested that as the Hawaiian-Emperor chain islands evolved, other island groups formed concurrently close to the East Pacific rise on the southeastern portion of the Pacific Plate. Such a scenario could place numerous reef habitats across the subtropical South Pacific Ocean. Isolation of these southeastern sites might have resulted from the sinking of island groups in response to Pacific plate movement. Further, Springer (1982: 137) hypothesized "... that islands have been evolving on the Nazca plate near the east Pacific Rise at the latitude of Easter Island for several million years." If that is correct, then the rate of geological and oceanographic processes that contribute to the aging and subsequent drowning of these island groups could play an important role in regulating the potential amount of marine reef habitat. As long as sufficient habitat and adequately sized populations exist, then individuals could disperse and colonize nearby, newly formed habitat, as Springer (1982) suggested. The cold-temperate island habitats off Chile could then indeed represent end points of radiation across the Pacific. Vicariant events of island formation, geological and oceanographic processes leading to erosion and subsidence, and plate movement in conjunction with dispersal events doubtless have contributed to the present-day distribution patterns.

Gymnothorax panamensis remains an eastern Pacific endemic, principally distributed on the Cocos Plate but extending north into the Gulf of California and south to the Galápagos onto the Nazca Plate.

The presence of a closely related species, *Gymnothorax bacalladoi*, in the central tropical Atlantic Ocean suggests that this group of three closely related morays may be of Tethyan origin. *G. australicola* and *G. bacalladoi* are considered sister species on the basis of branchial pores, morphometrics, and vertebral numbers. Both are close to *G. panamensis* on the basis of dentition. Although Böhlke et al. (1989) recognized four subgenera of *Gymnothorax* in their treatment of western North Atlantic morays, they could not place *G. bacalladoi* among any of them, and questioned the placement of *G. panamensis* in the subgenus *Gymnothorax*. Likewise, *Gymnothorax australicola* cannot be allocated to any of the four subgenera recognized by Böhlke et al. (1989).

REMARKS

Gymnothorax australicola, like *G. bacalladoi*, has but one branchial pore, which distinguishes it from the normal two-pore condition common to all other species of *Gymnothorax* except *G. afer* with three or four (Böhlke and Brito 1987, Böhlke et al. 1989). Generic limits and relationships are beyond the scope of this study; the new species is placed in *Gymnothorax* as it possesses those features typical of the genus (see Böhlke et al. 1989).

Gymnothorax australicola has a general moray appearance and shape that is similar to that of *G. bacalladoi* and *G. panamensis*. Randall and McCosker (1975) overlooked the branchial pore condition or they doubtless would have recognized the distinctness of the Easter Island population; *G. panamensis* has two branchial pores. Independent of the branchial pore condition, all three of these species (*G. australicola*, *G. bacalladoi*, *G. panamensis*) have similar coloration and dentition. Their bodies are dark, ranging from medium to very dark brown, occasionally with pale scattered mottling; the orbit is ringed in black, and some of the infraorbital and mandibular cranial pores, usually the posterior ones, are set off in white or transparent blotches. The short maxilla and its biserial dentition is another feature common to these three species at least.

Morphometrically all three species have similar-sized head lengths, orbit widths, snout lengths, and jaw lengths, although the holotype of *G. bacalladoi* has jaws longer than *G. australicola* or *G. panamensis*. Furthermore, body depth, body width, and trunk length are similar in all three species. *Gymnothorax australicola* and *G. bacalladoi* differ from *G. panamensis* in having shorter predorsal lengths, reflecting the more anterior origin of the dorsal fin (7.4–12.3% of TL in *G. australicola*, 7.3–10.1% of TL in *G. bacalladoi*, and 13.1–25.8% of TL in *G. panamensis*). Furthermore, the anus is farther forward in *G. australicola* and *G. panamensis* than in *G. bacalladoi* (39.3–45.6% of TL in *G. australicola*, 33.3–45.2% of TL in *G. panamensis*, and 48.1–50.2% of TL in *G. bacalladoi*).

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LITERATURE CITED

ALLEN, G. R., D. F. HOESE, J. R. PAXTON, J. E. RANDALL, B. C. RUSSELL, W. A. STARCK II, F. H. TALBOT, and G. P. WHITLEY. 1976. Annotated checklist of the fishes of Lord Howe Island. Rec. Aust. Mus. 30 (15): 365–454.

BÖHLKE, E. B. 1982. Vertebral formulae for type specimens of eels (Pisces: Anguilliformes). Proc. Acad. Nat. Sci. Philadelphia 134: 31–49.

———. 1989. Methods and terminology. *In* E. B. Böhlke, ed. Fishes of the western North Atlantic. Sears Fdn. Mar. Res. Mem. (New Haven) 1(9): 1–7.

BÖHLKE, E. B., and A. BRITO. 1987. *Gymnothorax bacalladoi* [sic], a new moray from the Canary Islands (Pisces: Muraenidae). Proc. Acad. Nat. Sci. Philadelphia 139: 459–463.

BÖHLKE, E. B., J. E. MCCOSKER, and J. E. BÖHLKE. 1989. Family Muraenidae. *In* E. B. Böhlke, ed. Fishes of the western North Atlantic. Sears Fdn. Mar. Res. Mem. (New Haven) 1(9): 104–206.

HAEDRICH, R. L., and M. H. HORN. 1972. A key to the stromateoid fishes. Woods Hole Oceanogr. Inst. Tech. Rep. WHOI-72-15: 1–46.

HOLTHUIS, L. B., and E. SIVERSTEN. 1967. The Crustacea Decapoda, Mysidacea and Cirripedia of the Tristan da Cunha Archipelago with a revision of the "frontalis" subgroup of the genus *Jasus*. Results Norw. Sci. Exped. Tristan da Cunha 1937–1938, 52: 1–50.

HUBBS, C. L. 1959. Initial discoveries of fish faunas on seamounts and offshore banks in the eastern Pacific. Pac. Sci. 13(4): 311–316.

LEVITON, A. E., R. H. GIBBS, Jr., E. HEAD, and C. E. DAWSON. 1985. Standards in herpetology and ichthyology: Part 1. Standard symbolic codes for institutional resource collections in herpetology and ichthyology. Copeia 1983(3): 802–832.

MCCOSKER, J. E. 1970. A review of the eel genera *Leptenchelys* and *Muraenichthys*, with the description of a new genus, *Schismorhynchus*, and a new species, *Muraenichthys chilensis*. Pac. Sci. 24(4): 506–516.

———. 1971. A new species of *Parapercis* (Pisces: Mugiloididae) from the Juan Fernández Islands. Copeia 1971(4): 682–686.

MEAD, G. W. 1970. A history of south Pacific fishes. Pages 236–251 *in* Scientific Exploration of the South Pacific. National Academy of Sciences, Washington, D.C.

PIETSCH, T. W., and D. GROBECKER. 1987. Frogfishes of the world. Systematics, zoogeography, and behavioral ecology. Stanford University Press, Stanford, California.

RANDALL, J. E., and J. E. MCCOSKER. 1975. The eels of Easter Island with a description of a new moray. Nat. Hist. Mus. Los Angeles Cty Contrib. Sci. 264: 1–32.

RANDALL, J. E., C. L. SMITH, and F. N. FEINBERG. 1990. Report on fish collections

from Rapa, French Polynesia. Am. Mus. Novit. 2966: 1–44.
REHDER, H., and J. E. RANDALL. 1975. Ducie Atoll: Its history, physiography and biota. Atoll Res. Bull. 183: 1–40, and 29 figs.
ROSENBLATT, R. H. 1959. A revisionary study of the blennioid fish family Tripterygiidae. Ph.D. diss., University of California, Los Angeles.
SMITH, D. G., and R. H. KANAZAWA. 1977. Eight new species and a new genus of congrid eel from the western North Atlantic with redescriptions of *Ariosoma analis*, *Hildebrandia guppyi*, and *Rhechias vicinalis*. Bull. Mar. Sci. 27(3): 530–543.
SPRINGER, V. G. 1982. Pacific plate biogeography, with special reference to shorefishes. Smithson. Contrib. Zool. 367: 1–182.
STEINDACHNER, F. 1876. Ichthyologische beiträge (V). I. Zur fischfauna von Panama, Acapulco und Mazatlan. Sitzungsber. Akad. Wiss. Wien 74, bd. 1: 49–240.