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Guentherus altivela Osorio, the first ateleopodid fish reported from the eastern Pacific Ocean

by

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Abstract: *Guentherus altivela*, long known from the west coast of Africa, is described from 14 specimens collected off the Pacific coast of Costa Rica and Panamá. The eastern Pacific form is remarkably similar to literature descriptions and comparative material of the eastern Atlantic form. The Pacific population has a smaller mean number of anal rays (74.0 vs. 78.1), and a slightly longer head, upper jaw and first free pelvic rays.

The present discovery fills a major gap in the cosmopolitan distribution of the Ateleopodidae. It is suggested that *G. altivela* is a trans-Atlantic species which populated the eastern Pacific before the last emergence of the Central American land bridge; its eventual discovery in the western Atlantic could be expected.

The ateleopodid fishes are grouped into four genera, with perhaps eight valid species reported from widely scattered localities in tropical and sub-tropical waters: *Ateleopus* from Japan and southeast Asia, *Parateleopus* from Hawaii, *Ijimaia* from the eastern Atlantic, Japan, the Hawaiian Islands and Cuba, and *Guentherus* from the eastern Atlantic and eastern Pacific.

Since about 1970, shrimp trawlers on the Pacific coast of Costa Rica have begun fishing below 200 m, sometimes reaching depths of 330 m. The fauna at these depths is poorly sampled and several noteworthy finds have been made. One of these is *Guentherus altivela,* the first eastern Pacific record for the family. Fourteen specimens, ranging from postlarvae to large adults have now been taken off Costa Rica and Panamá. *G. altivela* was previously known only from the west coast of Africa and has not yet been reported from the western Atlantic.

This paper describes the Central American specimens of *G. altivela* (the postlarva for the first time) and compares them to African material and literature descriptions.

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MATERIAL AND METHODS

The present study is based on 14 specimens of *G. altivela*, taken by bottom trawl off the Pacific coast of Central America. The largest specimen lacks a large part of the urosome, and was included only in part of the meristic analysis. Four other specimens from the west coast of Africa were used as comparative material.

Twelve body measurements were made on each specimen and are expressed in the text as times in standard length (SL) or times in head length. Considerable error was inevitable in the estimation of measurements involving soft parts due to the extremely gelatinous nature of the body of these fishes. Body proportions as thousandths of SL and meristic counts appear in Tables 1 and 2 respectively.

Collections are listed by country and general locality in the following manner: catalog number, other locality data (if any) with collection depth in meters (m), the date, and the number of specimens with their SL in millimeters (mm) in parentheses.

Specimens from the Pacific Ocean are deposited in the Museo de Zoología, Universidad de Costa Rica (UCR), Natural History Museum of Los Angeles Country (LACM), Gulf Coast Research Laboratory Museum (GCRL), and the Universidad de Panamá (UP). Comparative material from the west coast of Africa was borrowed from the South African Museum (SAM) and donated by the Institute of Oceanology, Moscow. All material is listed below.

EASTERN PACIFIC SPECIMENS

COSTA RICA

Off Cabo Blanco: UCR 762-1: 247 m, 24 April 1973, 1 (173.6 mm); UCR 763-1: 283 m, 2 April 1973, 1(most of tail missing, estimated SL 470 mm); LACM 36392-1: same data as UCR 763-1, 1(304 mm); UCR 817-1: 302 m, 9 April 1974, 2 (167.0 and 195.0 mm); LACM 36391-1: same data as UCR 817-1, 1(180.0 mm); UCR 1037-1: 247 m, 16 May 1974, 2 (125.0 and 135.0 mm).

Off Quepos: UCR 758-1: 283 m, 25 March 1973, 1(370 mm); UCR 815-1: 09°07.8'N, 84°12.5'W, 244 m, 16 October 1973, 1(104.5 mm); UCR 1036-1: 300 m, 17 April 1974, 1(152.0 mm).

PANAMA

Off Punta Jaqué: UP-548: 7.25 miles SW Punta Jaqué, 07°28'30''N, 78°17'30"W, 220 m, 5 September 1972, 1(173.0 mm); GCRL-11767: same data as UP-548, 2(109.3 and 146.6 mm).

EASTERN ATLANTIC SPECIMENS

NORTHWEST COAST OF AFRICA

Off Cap Blanc: UCR 1097-1: 21°21'N, 17°31'W, R/V Belogorsk, USSR, 395 m, 12 February 1974, 1(476.0 mm).

Off Tamzak: UCR 1098-1: 17°43'N. 16°42'W, R/V Zvezda Krima, USSR, 550-700 m, date unknown, 1(412.0 mm).

SOUTHWEST AFRICA

South of Pelgrave Point: UCR 1099-1: 21°29'S, 12°34'E, R/V 8014, USSR, 490-510 m, 25 March 1970, 1(268.8 mm).

West of Lüderitz Bay: SAM 24685: 366 m, date unknown, 1(287.0 mm).

GUENTHERUS ALTIVELA OSORIO

(Figs. 1-3)

Güntherus altivela Osório 1917, *Arquiv. Univ. Lisboa,* 4: 117, fig. 2.
Melanogloea ventralis Barnard 1941, *Ann. Rep. S. Afr. Mus.,* 1940: 10.
Anodontus mauritanicus Cervigón 1961, *Inv. Pesquera, Barcelona,* 19: 119, figs. 1-4.

TAXONOMIC HISTORY

Osório (1917) created the family Güntheridae for this species because of the posterior placement and structure of its pelvic fins—three free rays followed by a normal pelvic fin. His description is based on four specimens taken off Senegal. Subsequent writers have considered it an ateleopodid, and **Walters** (1963) pointed out the similarity of the pelvic structure of *G. altivela* to that found in young ateleopodids. **Barnard** (1941, 1948), unaware of Osório's description, redescribed the species as *Melanogloea ventralis* on the basis of one specimen from South Africa. Additional specimens were later taken off West Africa (**Cadenat,** 1960; as *Anodontus mauritanicus* Cervigón, 1961), and off Angola and South West Africa (**Franca & Ferreira,** 1967; **Penrith,** 1969).

Walters (1963) emended Osório's *Güntherus altivela* to *Guentherus altivelis.* The generic emendation is necessary in accordance with the International Code of Zoological Nomenclature, however Dr. Carl Hubbs *(in litt.)* has kindly pointed out that there is no justification to emend *altivela* to *altivelis,* although the latter would have been preferable. **Osório** (1917) did not explain the etymology of *altivela,* nor is there any evidence of a *lapsus calami.* The species-group name *altivela* may be considered a noun in apposition to the generic name, in which case the suffix is incorrect, but not emendable, for the singular noun *velum.* Since Osório did not indicate the derivation of *altivela,* the name could be regarded an arbitrary combination of letters and not emendable. In view of these observations, we see no reason to change the name from an assumed noun to an adjective form.

DESCRIPTION OF JUVENILES AND ADULTS

The following proportional measurements are based on specimens larger than 150 mm SL; smaller individuals are considered postlarvae and are treated separately. Meristic counts for all Pacific specimens, regardless of size, are included in the following description.

General: Entire body and head enveloped in spongy connective tissue and very thin skin. Body laterally compressed, of moderate depth. Trunk musculature weakly developed, tapering to weak caudal peduncle. Skeleton highly cartilaginous. Body depth between dorsal-fin origin and pelvic-fin origin 3.4-4.4 times in SL. Snout rounded, predorsal profile slightly convex or straight. Postdorsal profile formed by soft adipose fin; profile strongly convex in juveniles, much less so in large specimens. Preanal profile convex, pelvic girdle hanging loosely in thoracic position; ventral profile constricted at anus. Postanal profile convex, anal fin along entire length.

Head deep and much wider than body. Head length 2.9-3.2 times in SL. Eyes of moderate size, diameter of fleshy orbit 6.4-11.6 times in head length. Mouth opening large, and inferior to snout. Length of upper jaw 1.9-2.3 times in head length. Teeth absent in juveniles and adults. Gill rakers of moderate length, number not correlated with size. Gill rakers of upper limb counting rudiments (number of specimens in parentheses): 4(1), 5(9), 6(3). Gill rakers of lower limb (including angle): 18(2), 19(9), 21(1), 22(1). Total gill rakers: 23(1), 24(9), 25(1), 26(1), 27(1).

Lateral line straight, evident on close inspection as a series of small pores from gill opening to base of caudal fin. On largest specimen, pores marked by minute fleshy papillae; scattered papillae present also above lateral line. Lateral line canal passing through embedded tubular scales as described by **Barnard** (1948). No other scales present.

Dorsal fin far forward on body, slightly posterior to origin of pectoral fins; usually with 12 rays, range 12(10) and 13(2) rays. One apparently abnormal, but not obviously injured specimen, (UCR 1036-1) with a small dorsal fin of three rays (height 9.4 times in SL). Predorsal distance 2.2-2.8 times in SL. Height of dorsal fin, as distance from fin origin to tip of longest fin ray (usually third ray), 3.0-3.9 times in SL.

Anal fin commencing immediately posterior to vent, and extending to caudal fin base where it is confluent with caudal fin; range 70 (3), 71(1), 72(1), 73(1), 75(1), 76(3), 77(2), 79(1) rays. Preanal distance 1.6-2.2 times in SL. Length of base of anal fin 1.7-2.5 times in SL.

A gelatinous adipose fin arising behind dorsal fin as a thick dorsal extension of trunk musculature, and terminating at base of caudal fin as a thin flap. Width of adipose fin greatest at midpoint of its length; conspicuos in juveniles (Fig. 2), proportionately lower and thicker in adults (Fig. 3).

Pectoral fins about midway between dorsal and anal profiles; usually with 14 rays, range 12(2), 13(4), 14(7) rays. Length of pectoral fin (midpoint of base to tip of longest ray) 3.4-4.5 times in SL. Pelvic fin composed of 3 free anterior rays followed by normal pelvic fin; usually with 7 rays, range 6(1) and 7(11) rays; position thoracic, origin slightly in advance of pectoral fin base. Anteriormost free ray longest, 2.6-3.9 times in SL; apex expanded in fleshy compressed bulb with pointed tip. Second free ray shortest, without swollen tip. Third free ray of intermediate length; some subdistal swelling present. Remaining pelvic rays joined by interradial membranes, length (midpoint of base to tip of longest ray) 5.4-6.8 times in SL. Pelvic girdle cartilaginous, with a single median foramen and two posterolateral cornua each with dorsal antrose hook (cf. **Barnard,** 1948, fig. 5).

Caudal fin short and confluent with anal fin; usually with 10 rays, range 9(3), 10(8), 11(1). Total vertebrae of two postlarvae (GCRL-11767) 78 and 80.

Coloration: Fresh frozen specimens dark brown on head and body, underside as dark as dorsum. Lips brown, interior of mouth white. Brown on opercle, also present marginally around interior surface of opercle. Iris of eye black. Pectoral fins and median fins dark brown or black. Free pelvic rays white on young adults, brown on largest specimens; normal pelvic fin black.

DESCRIPTION OF POSTLARVAE

The smallest specimen collected (104.5 mm SL) was largely transparent in life with black blotches along the body and fins. Succeeding sizes from 109.3 to

146.6 mm SL display progressively more, although pale, pigmentation over the entire body and a gradual loss of the intense blackened areas. A specimen of 152.0 mm SL shows the darker adult coloration, no trace of dark spotting and a proportionately longer head and deeper body than the larval forms, and is consequently considered a juvenile specimen. I consider specimens in the size range 104.5-146.6 mm SL as true larval forms because their appearance and proportions are strikingly unlike those of juveniles and adults. Since these larvae have no yolk sac, they are more precisely termed "postlarvae" **(Hubbs,** 1943). **Barnard** (1948) described a similar young ateleopodid taken in a surface tow-net off Zanzibar as ". . .semi-transparent (similar to a *Leptocephalus* after preservation) . . .". The specimen had a total length of 223 mm and had black markings above the eye and on the dorsal, pectoral and anal fins. He tentatively referred it to *Ateleopus natalensis.*

General: Soft tissues of head and body gelatinous. Trunk musculature laterally compressed, skin and connective tissue envelope extending dorsally as a wide flap or adipose fin extending from base of dorsal fin to base of caudal fin. Body depth between dorsal-fin origin and pelvic-fin origin 5.0-6.8 times in SL.

Head much wider than body, head length 3.6-4.8 times in SL. Eyes well developed, diameter of fleshy orbit 5.8-7.0 times in head length. Snout rounded, mouth opening inferior to snout. Length of upper jaw 1.9-2.0 times in head length. Teeth absent.

Lateral line complete, conspicuous, clearly visible through transparent skin; tubular lateral line scales developed on smallest individual (104.5 mm SL).

Dorsal fin far forward on body, predorsal distance 2.9-3.9 times in SL. Height of dorsal fin 3.1-4.2 times in SL. Anal fin extending from vent to caudal-fin base. Preanal distance 2.0-3.0 times in SL. Length of anal-fin base 1.6-1.8 times in SL. Adipose fin high, from dorsal fin to caudal-fin base.

Pectoral fins 3.5-4.8 times in SL. Pelvic fin with three free rays anteriorly, length of first free ray 3.4-6.2 times in SL. Length of posterior pelvic rays (joined by membrane) 6.5-9.1 times in SL. Length of caudal fin 5.5-6.3 times in SL.

Coloration: The following description is based on a color photograph of the smallest postlarva (104.5 mm SL) kindly furnished by Frederick Berry. Head and body transparent with round black spots. Black blotches below and above eye, and on tip of snout, posterior extremity of lower jaw, opercle, top of head, and occiput. A row of large (two or three times eye diameter) round spots approximately along midline of body, a similar row along margin of adipose and anal fins. Distal third of anal-fin rays black. Region surrounding vent black.

Dorsal fin black. Axil and distal half of pectoral fin black. Free pelvic rays and base of other pelvic rays clear, distal three-quarters of pelvic fin black. Caudal fin clear.

The black spots become less intense, and small melanophores on entire head and body increase in number as larva approaches juvenile stage.

GEOGRAPHIC DISTRIBUTION

Guentherus altivela has been reported from northwestern Africa off the Sahara Desert and from South West Africa and South Africa **(Osório,** 1917; **Barnard,** 1941, 1948; **Cadenat,** 1960; **Cervigón,** 1961; **Franca & Ferreira,** 1967; **Penrith,** 1969). Depths ranging from 366-700 m were recorded.

The eastern Pacific specimens were taken off Cabo Blanco, at the tip of the Nicoya Peninsula, and off Quepos, Costa Rica and near Punta Jaqué, Panamá near the Colombian border (Fig. 4). Examples were trawled at depths ranging from 220-302 m. It is possible that the greater exploitation of deep waters in recent years by shrimp trawlers explains the absence of reports of *G. altivela* in Central American waters until now.

COMPARISON WITH ATLANTIC SPECIMENS

Franca & Ferreira (1967) described specimens of *Melanogloea ventralis* (=*G. altivela)* from the coast of Angola and compared literature accounts of the species and the nominal *Anodontus mauritanicus.* They noted the interspecific variation of numerous structural, meristic, proportional and color differences of the African geographic forms and concluded that they were conspecific.

TABLE 1

Proportions in thousandths of standard length of Guentherus altivela *Osório from the eastern tropical Pacific and eastern Atlantic Oceans*

	Pacific			Atlantic
Number of specimens	5	6	7	4
Standard length (mm)	104.5-146.6	152.0-195.0	304.0-370.8	268.8-476.0
Head length	207-281	310-345	338-350	264-335
Orbit diameter	32-44	38-53	29-35	24-33
Upper jaw length	105-136	138-162	173-186	135-170
Greatest body depth	146-199	227-297	239-268	229-297
Predorsal distance	258-343	336-432	392-454	359-406
Preanal distance	335-502	449-508	539-627	497-578
Length of dorsal fin	240-319	257-331	262-286	285-327
Length of anal-fin base	553-635	522-567	394-472	484-510
Length of pectoral fin	211-284	245-294	221-244	198-238
Length of pelvic fin	110-153	146-186	174-180	144-173
Length, first free pelvic ray	161-293	257-356	304-378	244-302
Length of caudal fin	114-181	134-178	122-129	107-128

TABLE 2

Meristic counts of Guentherus altivela *Osório. Data of the Atlantic form is based on four specimens and counts given in the literature*

	Pacific		Atlantic	
	range	$\overline{X}$	range	$\overline{X}$
Number of specimens	13		9-13	
Dorsal rays	11-13	12.2	11-13	12.0
Anal rays	70-79	74.0	77-83	78.1
Pectoral rays	12-14	13.4	12-14	12.7
Pelvic rays	9-10	9.9	10	10.0
Caudal rays	9-11	9.8	9-11	10.0
Upper gill rakers	4-6	5.3	5-6	5.3
Lower gill rakers	18-22	19.3	16-19	17.8
Total gill rakers	23-27	23.9	21-24	23.0

An analysis of the eastern Pacific examples of *G. altivela* reveals moderate intraspecific variation even from the rather small geographic region involved.

Proportional and meristic data of Pacific and Atlantic specimens are summarized in Tables 1 and 2 respectively. The body proportions of the Atlantic form are based solely on the four specimens at hand. Meristic counts for the Atlantic fishes are supplemented by data available in the literature, except where there is some question of the validity of the counts. The anal and caudal fins of *G. altivela* are confluent, thus authors may present a total count for both, or a separate count for each fin. **Barnard** (1948) reported 6 caudal rays, whereas all other authors, including ourselves, found 9-11 caudal rays; **Cervigón** (1961) reported that "La aleta anal es confluente con la caudal y tiene de 87 a 90 radios". Since these counts are well above the average given by other authors, we suspect this count is a sum of anal and caudal rays. The above-mentioned counts were not included in the ranges or means of meristics presented in Table 2. An average difference of 4.1 anal rays (Pacific forms $\bar{X} = 74.0$, Atlantic forms $\bar{X} = 78.1$) probably represents a valid difference between the Atlantic and Pacific populations. The Pacific form has a slightly greater number of gill rakers on the lower limb of the first gill arch which is reflected in a count of the total number of gill rakers, $\bar{X} = 23.9$ vs. $\bar{X} = 23.0$ for the four Atlantic specimens. Vertebral counts based on two Pacific specimens and one Atlantic individual were 78 and 80 vs. 77, respectively.

Other apparently real population differences involve three proportional measurements: the Atlantic specimens have slightly shorter heads, upper jaws, and first free pelvic rays with respect to SL (Table 1). To obviate size differences of the material used in this study, the proportional measurements were plotted against SL, but in only these three characters did the Atlantic and Pacific material fall into separate clusters. Juvenile and adult *G. altivela* from the Pacific have a dark brown body coloration, whereas the Atlantic specimens at hand are darker brown or nearly black. Literature descriptions note that Atlantic specimens exhibit color variations ranging from light brown to black. In view of the striking similarity of the Pacific form of *Guentherus* to the Atlantic stock, we consider them conspecific in spite of the exceptionally great geographic distribution of the species.

DISCUSSION

The family Ateleopodidae has a nearly cosmopolitan distribution whose species are concentrated principally in tropical and subtropical waters. This circumtropical pattern suggests that early members of the family occupied the large Tethys Sea which in early Tertiary combined the Indo-west Pacific, the Mediterranean, the tropical Atlantic, and the eastern Pacific faunas into one major unit **(Ekman,** 1953). It is not suprising now to discover a representative of the family in the eastern Pacific. It is presumed that gene flow was (or still is) maintained across the Atlantic by means of pelagic larvae; **Barnard** (1948) described such a larva for *Ateleopus.*

The presence of *G. altivela* in the eastern Atlantic and eastern Pacific suggests that it formerly inhabited both sides of the Atlantic and the western coast of the Americas before the establishment of the Central American land bridge. The alternative hypothesis of a Tethyan distribution for *Guentherus,* permitting genetic exchange via a trans-Pacific, Mediterranean and Tropical Atlantic route is unnecessary and would require the disappearance (or lack of collections) of *Guentherus* from a much larger area, as well as an extraordinarily slow evolutionary rate. There is no evidence, nor a need, to suppose that *Guentherus* at any time

utilized a southern route to pass from ocean to ocean around Cape Horn.

Two other ateleopodid genera, *Ateleopus* and *Ijimaia,* each contain several nominal species which have never been critically compared. The only reviewer of the family **(Howell Rivero,** 1935) suggested that of the five nominal species of *Ateleopus,* probably only two were valid species. The abnormal specimen of *G. altivela* with only three dorsal rays (although with no apparent damage) brings to mind the genus *Parateleopus,* known only from the type specimen and distinguished from *Ateleopus* only in having three dorsal rays and a pointed snout. When more specimens of ateleopodids become available, comparative studies may result in the recognition of fewer, but wider-ranging species. Certainly the rate of evolutionary change is quite slow in the group, and in other benthic fish from mid-depths. The eastern Pacific population of *G. altivela* has been isolated from the Atlantic stock at least since the formation of the Central American land bridge, between two and ten million years ago, and yet no trenchant differences are evident.

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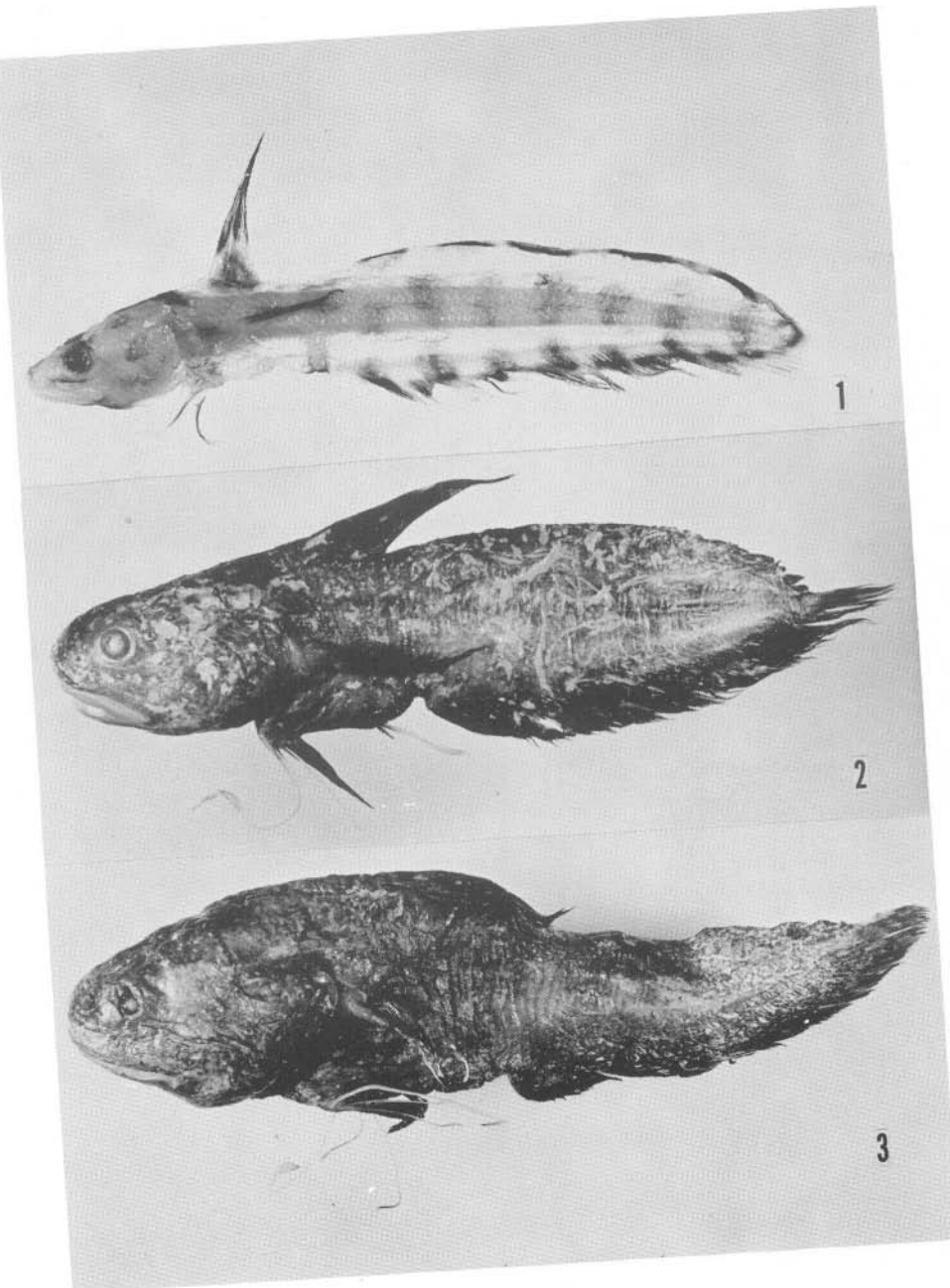
Fig. 1. *Guentherus altivela* Osório, UCR 815-1, a postlarva 104.5 mm SL collected off Quepos, Costa Rica.

Fig. 2. *Guentherus altivela* Osório, UCR 762-1, a juvenile 173.6 mm SL collected off Cabo Blanco, Costa Rica.

Fig. 3. *Guentherus altivela* Osório, UCR 758-1, an adult 370.8 mm SL collected off Quepos, Costa Rica.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RESUMEN

Con base en el estudio de 14 ejemplares, se informa por primera vez sobre la presencia en el Pacífico de Costa Rica y Panamá del ateleopódido *Guentherus altivela*. Esta especie es conocida de la costa oeste de Africa. La especie del Pacífico oriental es semejante a las descripciones en la literatura y especímenes del Atlántico oriental. Los individuos del Pacífico presentan un promedio menor de radios anales (74,0 vs. 78,1), así como longitudes ligeramente mayores de la cabeza, la mandíbula superior y los primeros radios pélvicos que los correspondientes al material del Atlántico. La presencia de esta especie en el Pacífico de Centroamérica completa el círculo de la distribución cosmopolita de la familia Ateleopodidae. Se supone que *G. altivela* es una especie transatlántica que pobló el Pacífico este antes de la última emergencia de tierras del puente centroamericano; es muy posible su descubrimiento eventual en el Atlántico oeste.

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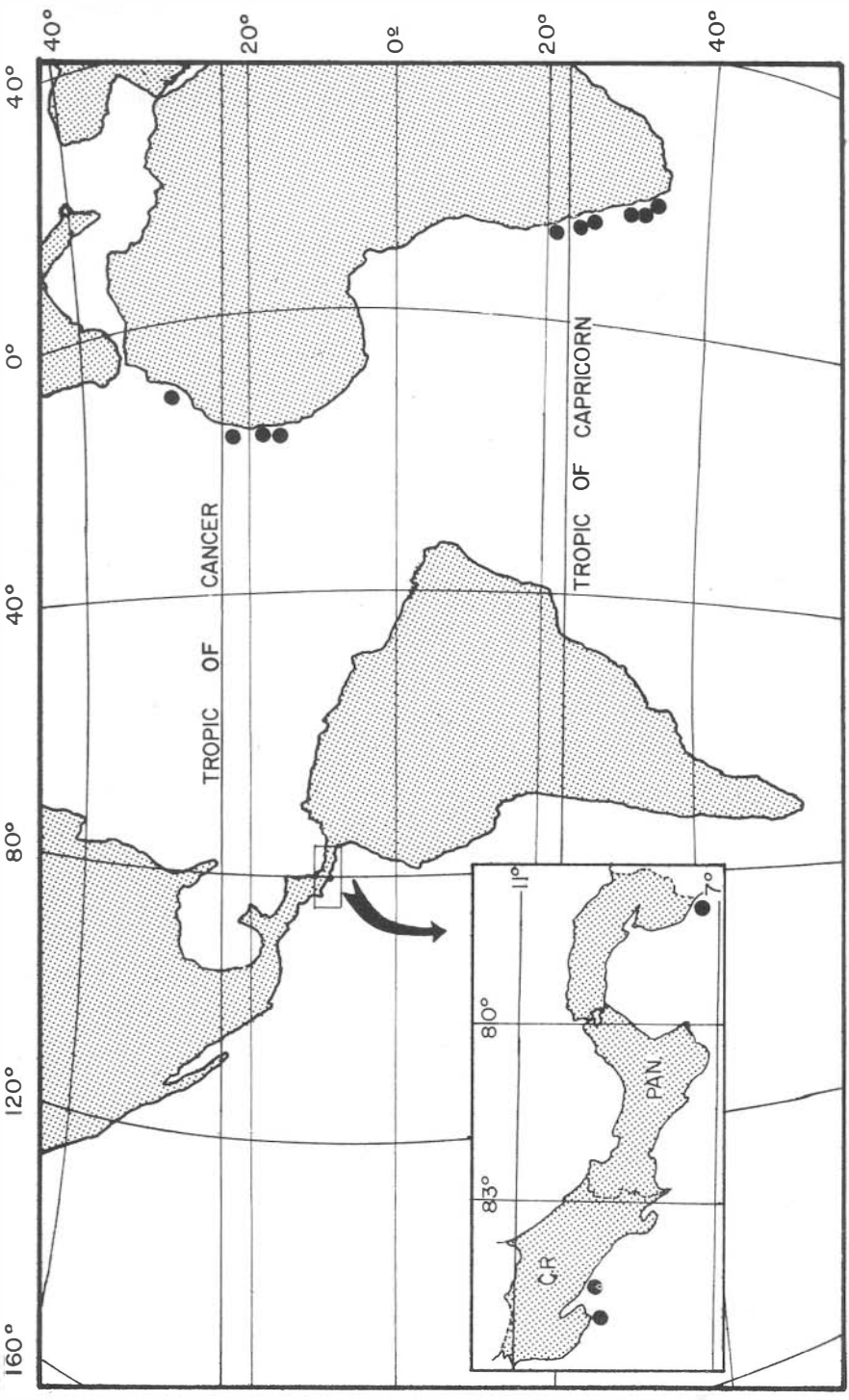
Fig. 4. Map showing Atlantic and Pacific collecting localities of *Guentherus altivela*.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