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Anchovia landivarensis, A New Species of Anchovy (Pisces: Engraulidae) from Belize, Central America, With Comments On Related Species[1]

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ABSTRACT

Anchovia landivarensis n. sp. is described from Belize on the basis of eight specimens. The new species is shown to be most closely related to *A. surinamensis* from South America. *A. landivarensis* is sympatric with *A. clupeoides* in Belize. The Belize population of *A. clupeoides* is compared with various other populations from the western Atlantic. *A. nigra* is reviewed and considered to be a subspecies of *A. clupeoides*.

INTRODUCTION

Eight specimens of a new species of *Anchovia* were collected at Belize City, Belize, Central America. Three specimens were taken 457 m. S.-S.E. off Belize City with a 4.8 m. otter trawl over a mud bottom in 3 - 5 m. of water on August 1, 1972 by D.W. Greenfield, T. Greenfield, and R. Woods; four specimens were taken 547 - .8 km. off Belize City with the otter trawl over a similar bottom on April 18, 1973 by D.W. Greenfield, T. Greenfield, M. Drew, A. Drew, D. Wildrick, and J. Russo; one specimen was taken at the beach over a sand-mud bottom in 1 m. of water at St. John's College, Belize City in a 15.3 m. beach seine on July 3, 1973 by D.W. Greenfield, T. Greenfield, and the A.U.I.E. Tropical Ecology class.

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METHODS

Counts and measurements follow Hildebrand (1963). Measurements were made using dial calipers to the nearest 0.1 mm., and are expressed as percent of standard length. Counts were made with the aid of radiographs. Measurements and some counts were not made on all individuals in large series of *A. clupeoides* from Belize, thus numbers of specimens examined in tables do not always agree. Counts and measurements for *A. surinamensis* are from Whitehead (1973). In addition we have examined three specimens used by Whitehead. Specimens have been deposited at the following museums: Belize Fisheries Office (BFO), British Museum of Natural History (BMNH), California Academy of Sciences (CAS), Field Museum of Natural History (FMNH), Gulf Coast Research Laboratory (GCRL), University of Michigan Museum of Zoology (UMMZ), U.S. National Museum (USNM).

MATERIAL EXAMINED

Anchovia clupeoides – USNM 104293 (2), Brazil; USNM 125473 (3), Puerto Rico; FMNH 3233 (1), Puerto Rico; USNM 30138 (1), Jamaica; USNM 30113 (2), Jamaica; USNM 102101 (2), Jamaica; USNM 79601 (19), Panama; USNM 121767 (10), Venezuela; UF 13973 (17), Guatemala, Lake Izabal; FMNH 80409 (97), Belize; FMNH 80411 (2), Belize; FMNH 80410 (8), Belize.

Anchovia nigra – USNM 121762 (1), paratype, Venezuela; USNM 121764 (2), paratypes, Venezuela; USNM 121765 (3), paratypes, Venezuela; USNM 121766 (2), paratypes, Venezuela; FMNH 71707 (4), Venezuela.

Anchovia surinamensis – FMNH 53931 (1), Guyana; BMNH 1963.4.18.35 (1), Guyana; BMNH 1971.6.21.5 (1), Guyana.

Anchovia landivarensis – see type material.

Anchovia landivarensis n. sp. Figure 1, Table 1.

Holotype. – FMNH 80407, 106.7 mm. SL, April 18, 1973.

Paratypes. – FMNH 80408, 110.9 mm., April 18, 1973; BFO, 72.2 mm., August 1, 1972; BM(NH) 1975.10.9.1, 100.0 mm., April 18, 1973; CAS 33643, 97.5 mm., April 18, 1973; USNM 214696, 107.4 mm., August 1, 1972; UMMZ 197412, 68.4 mm., August 1, 1972; GCRL 14095, 83.2 mm., July 3, 1973.

Diagnosis. – May be distinguished from the Pacific coast species *A. macrolepidota* (Kner & Steind.), *A. magdalena* (Hild.), *A. rastralis* (Jord. & Everm.),

and the Atlantic coast species *A. clupeoides* (Swainson) and *A. nigra* Schultz by having a short maxilla, not reaching to the mandibular articulation, its tip blunt, not projecting beyond the tip of the 2nd supramaxilla. It may be further separated from *A. clupeoides* (including the nominal *A. nigra*) by possessing 23 - 26 anal-fin elements and 41 - 51 gill rakers on the lower arch, whereas *A. clupeoides* has 26 - 34 anal-fin elements and 90 or more gill rakers on the lower arch. *A. landivarensis* may be separated from *A. surinamensis* (Bleeker) by possessing more vertebrae (40-41, modally 41 *vs.* 38-39, modally 38 for the 3 specimens of *A. surinamensis* examined), more dorsal-fin elements (15-16, modally 15 *vs.* 12-15), fewer anal-fin elements (23-26, modally 25 *vs.* 25-28, modally 26), more pectoral-fin rays (15-16, modally 16 *vs.* 12-14), and fewer gill rakers on the lower arch (41-51, modally 49 *vs.* 47-62, modally 53). *A. landivarensis* further differs from *A. surinamensis* by having a shorter pectoral fin (14.8-17.1, X = 16.0 *vs.* 17.6-20.7), a longer dorsal-fin base (13.2-17.3, X = 15.4 *vs.* 12.2-13.4), and a shorter anal-fin base (19.1-23.8, X = 22.1 *vs.* 27.3-30.4).

Description. – Data for the holotype are presented first, followed in parentheses by the range and mean or mode for the entire type series. Dorsal-fin elements 16 (15-16, modally 15); anal-fin elements 26 (23-26, modally 25); pectoral-fin elements 16 (15-16, modally 16); vertebrae 41 (40-41, modally 41); gill rakers on the lower limb 49 (41-51, modally 49).

Length of head 29.8 (29.5-31.3, X = 30.5); greatest depth of body 31.9 (26.4-32.2, X = 29.7); snout length 3.7 (3.7-5.8, X = 4.6); eye diameter 7.8 (7.2-8.7, X = 7.9); bony interorbital width 6.4 (5.6-6.4, X = 6.0); postorbital length 18.7 (18.1-19.7, X = 18.8); length of upper jaw 22.7 (18.2-24.1, X = 21.4); length of lower jaw 18.3 (15.7-19.8, X = 17.6); pectoral-fin length 16.2 (14.8-17.1, X = 16.0); length of anal-fin base 22.5 (19.1-23.8, X = 22.1); length of dorsal-fin base 17.3 (13.2 17.3, X = 15.4); predorsal-fin distance 53.7 (49.7-53.7, X = 51.4); prepelvic-fin distance 48.3 (47.5-49.2, X = 48.5); preanal-fin distance 66.2 (61.7-67.2, X = 64.9); prepectoral-fin distance 30.2 (29.3-31.7, X = 30.9); length of pelvic fin 9.9 (8.0-11.2, X = 9.7); distance from pelvic-fin insertion to anal-fin origin 19.6 (16.9-19.6, X = 18.1); distance from pectoral-fin insertion to pelvic-fin insertion 16.9 (16.9-18.3, X = 17.5); caudal peduncle length 16.0 (15.1-17.6, X = 16.4); caudal peduncle depth 10.6 (9.6-10.9, X = 10.4).

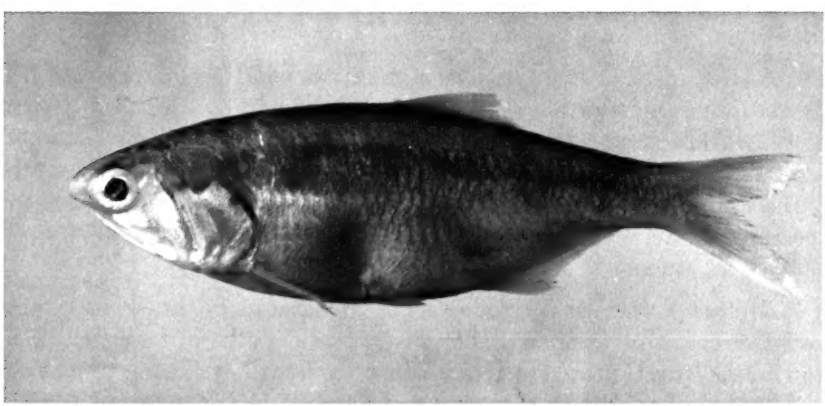

FIG. 1. Holotype of *Anchovia landivarensis* (FMNH 80407).

Color in alcohol. – Ground color light tan, silver lateral stripe faded to grey, narrower than width of eye, bordered above and below by tan stripe. Iris, cheek, jaws, lower three-fourths of opercle and ventral half of body silver. A dark grey-black band on dorsal surface of body, extending from the nape posteriorly on either side of dorsal fin to the caudal peduncle. A black crescent above each eye. Black melanophores concentrated over brain. Snout with scattered melanophores. Pectoral and pelvic fins pallid. Dorsal fin with a few scattered melanophores on the fin rays. Caudal fin with rows of melanophores concentrated on fin rays.

Name. – Named for Landivar, the region of Belize City where St. John's College is located, in recognition of the assistance provided to us by the faculty and staff of the College in the study of Belizean fishes.

Remarks. – Whitehead (1973), in his discussion of the clupeoid fishes of the Guianas, clarified the limits of the genus *Anchovia* and presented a key to the species. He recognized two species from the Atlantic coasts of Central and South America, *A. surinamensis* (Bleeker) (synonyms= *A. pallida, A. venezuelae,* and *A. potiana*) and *A. clupeoides* (Swainson) including two subspecies, *A. clupeoides clupeoides* (Swainson) and *A. clupeoides nigra* Schultz [synonyms=*Engraulis productus* and *A. nigra, sensu* Schultz (1949) and Hildebrand (1963)]. *A. landivarensis,* known only from Belize, is the third species of *Anchovia* from the tropical Atlantic coasts of the Americas. *A. landivarensis* appears to be most closely related to *A. surinamensis* and can be considered to be its northern counterpart. Unlike *A. surinamensis,* this species has never been taken in fresh waters, however, the waters off Belize City tend to be brackish due to the outflow of the Belize River. The only engraulids that have been taken in the fresh waters of Belize are *Anchoviella belizensis* Thomerson and Greenfield and *Anchoa cayorum* (Fowler).

Anchovia landivarensis is sympatric with *A. clupeoides* off Belize City: three paratypes collected on August 1, 1972 were taken with two specimens of *A. clupeoides,* and the paratype taken on July 3, 1973 was taken with eight specimens of *A. clupeoides. A. clupeoides* is by far the more common of the two species, 97 specimens having been taken in a single collection at St. John's College on August 2, 1971.

Anchovia clupeoides ranges from the islands of the West Indies and the coast of Central America (Belize) southward to Panamá, and along the South American coast to Brazil, at least to Recife and probably to Río de Janèiro and São Paulo (Hildebrand, 1963). Hildebrand (1963) included Lake Rogagua, Bolivia in the range of

TABLE 1 Comparison of counts for *Anchovia landivarensis*, *A. surinamensis*, *A. clupeoides clupeoides*, and *A. clupeoides nigra*.

	Anal-fin Rays												Vertebrae					
	23	24	25	26	27	28	29	30	31	32	33	34	38	39	40	41	42	43
A. landivarensis																		
Belize	2	1	3	2											1	7		
A. surinamensis																		
Guyana			1	9	7	3							2	1				
A. clupeoides nigra																		
Venezuela					1	1	2	5	2	1					9			
A. clupeoides clupeoides																		
Puerto Rico								1	1	2							2	2
Jamaica								1		1	3						4	1
Belize				1	-	1	4	20	24	14	13	1				1	26	8
Guatemala								1	2	9	3	1				1	16	
Panama							2	2	5	8	2				1	1	15	2
Venezula								1	2	1	4	2					5	5
Brazil									2								1	1
TOTAL *A. clupeoides clupeoides*				1		1	6	26	36	35	15	4			1	3	69	19

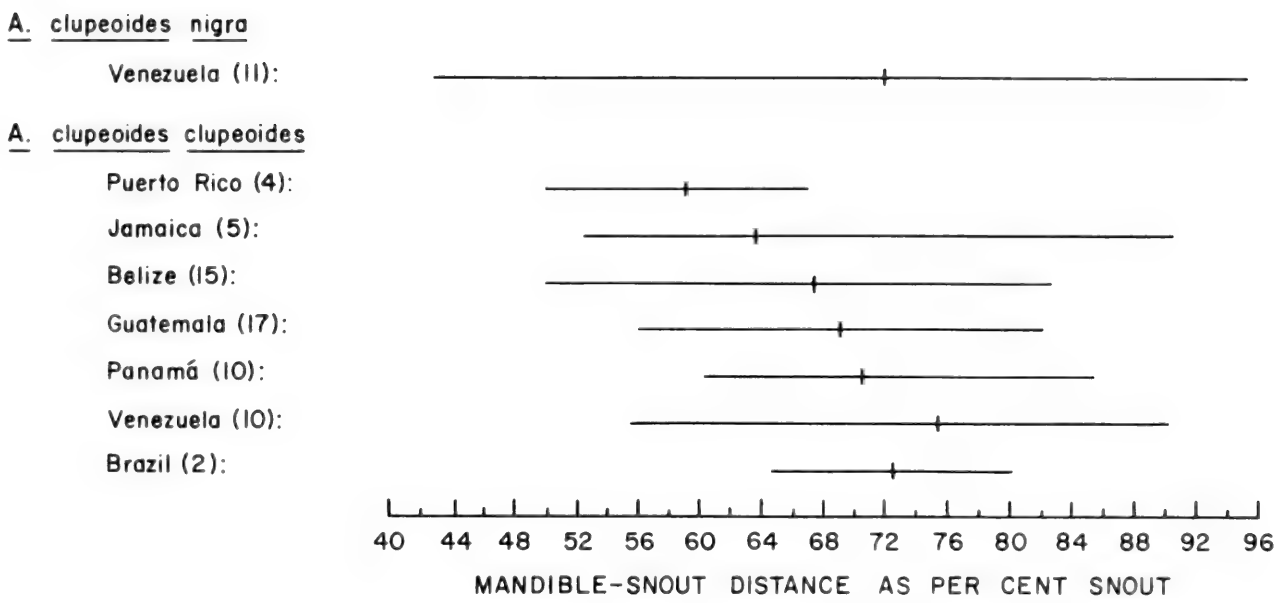

FIG. 2. Mandible-snout distance as per cent snout in various populations of *Anchovia clupeoides*.

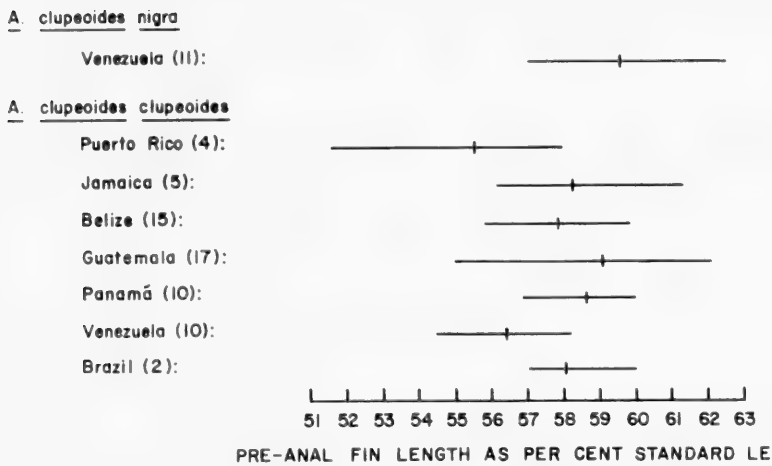

FIG. 3. Preanal-fin length as per cent standard length in various populations of *Anchovia clupeoides*.

A. clupeoides, "...one specimen (CAS 9398) from Lake Rogagua, Bolivia, seems to be this species." This specimen, CAS 30584 (formerly IU 9398), is apparently from Puerto Rico. Ms. Pearl M. Sonoda has checked the Indiana University catalog and found the following entry for IU 9398: "1 specimen, *Stolephorus productus*, Ponce, 31 Jan. 1899." Indiana University received this specimen from the U.S. Fish Commission along with other Puerto Rican fishes. Ms. Sonoda reports, "A handwritten label (in pencil) in the jar does read: 9398 *Lycengraulis poeyi*, Lake Rogoagua, [sic] Bolivia, N.E. Pearson. At the time Hildebrand examined and identified the specimen tagged 9398 as *Anchovia clupeoides*, there must have been another specimen in the jar because his note reads: 'Large specimen is *Anchovia clupeoides*. S.F.H.' The Bolivia locality could have referred to the other specimen but unfortunately the other specimen was removed from the jar and I haven't been able to locate it. There is an IU 17354 entry, *Lycengraulis poeyi*, Lake Rogoagua, [sic] Bolivia, N.E. Pearson, Nov. 1921. Pearson collected in the 1920's and IU 9398 was cataloged long before then so the Ponce locality appears to be correct for that specimen."

The Belize population of *A. clupeoides* was compared with various other populations taken throughout its range. No significant differences between populations were seen (table 1; figs. 2, 3).

Schultz (1949) described *Anchovia nigra* from Lake Maracaibo, Venezuela, and distinguished it from *A. clupeoides* by a lower range

of vertebrae (39-41 *vs.* 42-43) and anal-fin rays (28-32 *vs.* 30-35), a longer cheek, more slender body (3.5-4.2 *vs.* 3.3-3.7), shorter postorbital length (5.2-5.6 *vs.* 5.4-6.4), and a more posterior placement of the anal and pelvic fins. Hildebrand (1963) recognized *A. nigra* as a valid species, but used only three of Schultz's characters: the anal-fin count, vertebral count, and position of the pelvic fins. Hildebrand used as an additional character the distance that the snout projects beyond the mandible (projecting about half its length in *A. clupeoides* and 67 per cent of its length in *A. nigra*). Whitehead (1973) compared *A. nigra* with a single specimen of *A. clupeoides* from Trinidad and concluded, "It seems most likely that the fresh and brackish *A. nigra* is merely a form of the marine and wide-spread *A. clupeoides*," thereby giving the Lake Maracaibo population subspecific status, but without further comment.

A comparison of the distance that the snout projects beyond the mandible in all of the populations demonstrated that in the Lake Maracaibo population the values were highly variable and the range encompassed the ranges of all other populations (fig. 2). The position of the anal fin in the Lake Maracaibo population is not unique (fig. 3). An analysis of the position of the pelvic fins showed that of the 12 specimens examined from Lake Maracaibo, nine had the pelvic fins closer to the pectoral fin than to the anal fin and three were equidistant. Of the 73 specimens examined from other localities, 21 had the pelvic fins closer to the pectoral fins, 26 were equidistant, and 26 had the pelvic fins closer to the origin of the anal fin. Thus none of the morphometric criteria used for the separation of *A. nigra* and *A. clupeoides* are valid.

The proposed differences in number of anal-fin rays between *A. nigra* and *A. clupeoides* are not supported by examination of larger samples of *A. clupeoides*. Schultz (1949) and Hildebrand (1963) gave a range of 28-32 (mode 30) for *A. nigra*, and we obtained a range of 27-32 (mode 30) for the 12 specimens examined. The range for *A. clupeoides* was given as 30-35 (mode 33) by those authors, whereas we obtained a range of 26-34 (mode 32).

Schultz (1949) recorded a range of 39-41 vertebrae for *A. nigra* with a strong mode of 40; all nine specimens we examined had 40 vertebrae. *A. clupeoides* from locations other than Lake Maracaibo had 40-43 vertebrae with a mode of 42. The modal differences in number of vertebrae are apparently not due to the fresh-water environment as specimens of *A. clupeoides* from Lake Izabal, Guatemala exhibited a range of 41-42 with a strong mode of 42. The

low vertebral number of the Lake Maracaibo population has apparently been present for a number of years, as all individuals in a 1911 collection (FMNH 71707-4 spec.) had 40 vertebrae, and the collections reported by Schultz (1949) were taken in 1942.

The only character which separates the Lake Maracaibo population from other populations of *A. clupeoides* in the Western Atlantic is the number of vertebrae. Using the coefficient of difference to determine the validity of this character in separating the populations (Mayr, 1969), a value of 1.927 is obtained, which is well above the level proposed by Mayr for subspecific recognition. The low number of vertebrae may be the result of environmental conditions, i.e., high temperatures and low salinities, during early developmental stages of the fishes in Lake Maracaibo; however, lacking experimental evidence we cautiously regard the differences in vertebral number as a reflection of genetic differences and retain the Lake Maracaibo population as a separate subspecies, *A. clupeoides nigra*.

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