A New Engraulid Fish, *Anchoa walkeri,* from the Eastern Pacific Ocean, with a Note on the Validity of *Anchoa schultzi* Hildebrand[1]

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WITH THE ADDITION OF *Anchoa walkeri,* the eastern Pacific members of the family Engraulidae are represented by over 30 recognizable species. They are fairly common along both coasts of the Americas in temperate and tropical waters and they have played an important role as a forage fish and as a bait fish by the tuna fishing industry. Since bottom trawling and beach seining methods often yield large numbers of the various species of anchovies, specimens are fairly well represented in museum collections such as that of the University of California, Los Angeles.

The genus *Anchoa,* as defined by Hildebrand (1943, p. 29) includes an assemblage of forms not easily determined, but with series of well preserved specimens available for direct comparison, identifications can be made with a reasonably high degree of certainty. Certain characters, such as the silvery lateral stripe, usually altered by preservation, and body proportions that show a wide range of variation within a given species, often prove unsatisfactory. Characters frequently used for identification, such as body depth, head length, snout length, lengths of the various fins, eye size, and degree of pigmentation, usually change during growth and are difficult to evaluate as criteria for separation of the various closely related species.

Among the eastern Pacific members of the genus *Anchoa,* five forms are distinguished from the remaining species in having a large number of anal rays (usually 30–40), a long anal fin base (2.6–3.3 into standard length), and rarely more than 30 gill rakers on the lower limb of the first gill arch (Hildebrand, 1943). They are: *A. compressa* (Girard), *A. mundeoloides* (Breder), *A. panamensis* (Steindachner), *A. spinifer* (Cuvier and Valenciennes), and *A. walkeri* n. sp. A sixth species, *A. schultzi* Hildebrand, described from eight specimens collected from the upper Gulf of California, closely resembles *A. mundeoloides.* One of the authors (N. H. C. Chang), in an unpublished study comparing 105 specimens of *A. mundeoloides,* ranging in size from 57.7 to 150 mm standard length, with Hildebrand's original description of *A. schultzi,* has shown that the differences used to separate the two species are not valid. The width of the silvery lateral stripe, length and relative sharpness of the maxillary, body depth, and number of gill rakers are all characters subject to morphological or geographical variation. Therefore, we consider *A. schultzi* as a synonym of *A. mundeoloides.*

COUNTS AND MEASUREMENTS

The methods used in making counts and measurements for *A. walkeri* are essentially those described by Hildebrand (1963, p. 154) for the family Engraulidae, and by Hubbs and Lagler (1958, p. 8). Measurements are expressed in thousandths of standard length, with the value for the holotype given first, followed by the range in values for the paratypes shown in parentheses. All measurements are straight line measurements made with needle point dividers. The various counts were made with the aid of a binocular microscope. Since the scales are usually missing in preserved material, the scale counts were made by counting the scale pockets in a longitudinal series immediately above the silver lateral stripe. The vertebral counts were made from radiographs.

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The values given below for the paratypes are from 30 individuals selected at random from the original series of 305 specimens (UCLA W58-16). The holotype, USNM 204046, and 20 paratypes (76.0–86.0 mm), USNM 204047, have been deposited at the United States National Museum (USNM), and the remaining paratypes at the University of California, Los Angeles (UCLA).

Head length 265 (239–269); snout length 047 (039–050); diameter of orbit 072 (059–076); length of maxillary 235 (193–227); cheek length 104 (088–107); postorbital length of head 144 (133–152); length of pelvic fin 100 (082–104); length of pectoral fin 190 (147–187); length of pectoral axillary scale 098 (081–115); body depth 255 (228–273).

Gill rakers 16(16–18) + 19(19–22); dorsal fin rays 13(13–15); anal fin rays 31(30–35); pectoral fin rays 14(13–15); pelvic fin rays 7(7); longitudinal scales 37(36–40).

Number of vertebrae 40–43. The vertebral counts were taken from 47 specimens collected from Rio Muerto (UCLA W50–27) and Rio Mayo (UCLA W50–43), Sonora, Mexico.

Anchoa walkeri new species
Fig. 1

HOLOTYPE: USNM 204046, female, 89.5 mm standard length. Collected at San Blas, Nayarit, Mexico, by B. W. Walker and party with a 100-foot beach seine, 30 January 1958 (UCLA W58–16).

DIAGNOSIS: An *Anchoa* having 30 to 35 anal rays, 19 to 22 gill rakers on the lower limb of the first gill arch, a long slender maxillary extending slightly posterior to the margin of the opercle (Fig. 2 *A*), distal end of the maxillary fragile and sharply pointed, caudal fin with a dark margin, ovarian eggs elliptical.

DESCRIPTION: Body laterally compressed with the greatest thickness less than the depth of the caudal peduncle. Dorsal and ventral profile of body anterior to the dorsal fin evenly convex, the ventral profile slightly greater in curvature than the dorsal profile. Head moderately long, 3.7 to 4.0 in standard length, widest immediately posterior to eyes, 2.6 to 2.8 into head length. Snout short, evenly rounded, 5.2 to 5.6 in head length. Mouth inferior, lower jaw extending forward to slightly anterior to eye. Maxillary long, slender, and sharply pointed, 1.1 to 1.4 in head length, upper edge of distal portion slightly concave to flat, never convex. Teeth on maxillary small, evenly spaced, and fairly uniform in size, with the anterior teeth being slightly smaller. Length of cheek 2.8 to 3.0 in head length. Postorbital length of head 6.5 to 7.0 into standard length. Eye round, 3.5 to 4.0 in head length. Adipose tissue opaque, at anterior

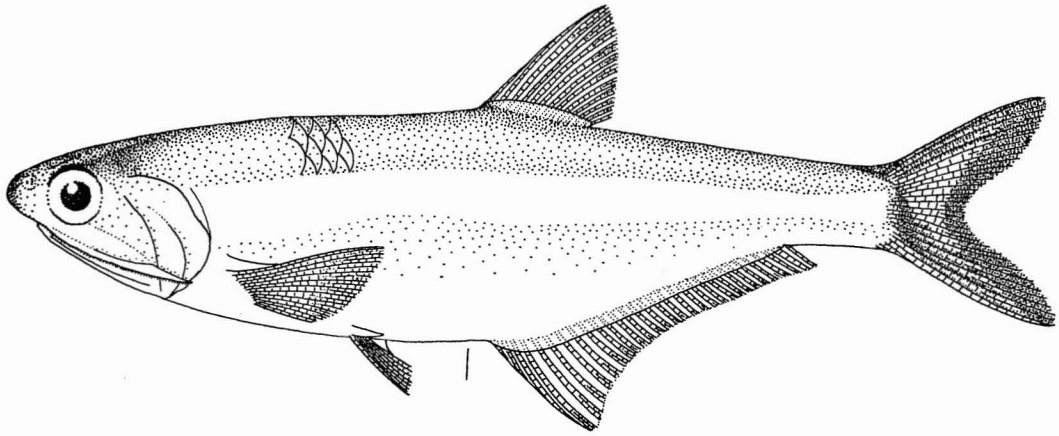

FIG. 1. *Anchoa walkeri,* n. sp., holotype, USNM 204046, 89.5 mm, collected from San Blas, Nayarit, Mexico, 30 January 1958, B. W. Walker and party.

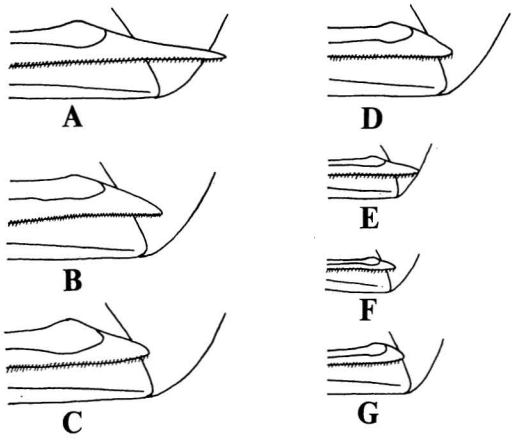

FIG. 2. The posterior point of the maxillary in relation to the joint of the mandible and opercular margin. *A. Anchoa walkeri* 95.5 mm. *B, A. panamensis* 110.0 mm. *C, A. compressa* 102.0 mm. *D, A. mundeoloides* 97.7 mm. *E, A. walkeri* 50.0 mm. *F, A. walkeri* 39.0 mm. *G, A. mundeoloides* 52 mm.

and posterior edge of orbit. Origin of dorsal 1.0 to 1.5 eye diameters nearer caudal fin base than tip of snout. Base of dorsal 8.4 to 9.1 into standard length. Origin of anal fin usually below anterior third of dorsal fin base, varying from directly below dorsal origin to below middle third of dorsal base. Anal fin base 3.0 to 3.4 in standard length. Height of dorsal fin equal to length of pectoral fin and slightly more than length of longest anal rays. Length of pectoral fin 1.4 to 1.6 into head length with the tip of the longest rays reaching to ¾ eye diameter posterior to pelvic fin base. Pelvics joined to ventral ridge by a thin membrane to about ⅔ length of longest rays. Length of pelvic fin 2.3 to 2.7 into head length. Tip of pelvic fin extending posterior to a point midway between pelvic base and origin of anal fin. Caudal fin forked, the longest rays 4.6 to 5.1 into standard length and slightly longer than longest pectoral rays. Gill rakers long and slender, the length of longest raker equal to or slightly greater than snout length. Scales cycloid, thin, deciduous, usually absent from preserved material. Axillary scale at upper pectoral fin base ⅓ length of longest pectoral rays. Axillary scale at upper pelvic fin base ½ length of longest pelvic rays. Eggs removed from gravid females are elliptical, 0.9 to 1.0 mm in length, the major axis into minor axis .530 to .638.

The largest specimen examined was 120 mm standard length; it was collected from San Felipe, Baja California (UCLA W54–365).

COLORATION OF PRESERVED SPECIMENS: Freshly preserved specimens whitish translucent, with the sides of the head and the lateral body stripe silver. Lateral stripe widest behind head, gradually tapering toward caudal peduncle where its width is ⅔ diameter of orbit. The dorsal margin of the lateral body stripe even, ventral margin somewhat sinuous. In older preserved specimens the silver color of the head and lateral body stripe may be partially to entirely lost, and the body may vary from light brown to straw colored. Back and top of head with scattered melanophores. Two narrow, parallel, dark lines on back between dorsal and caudal fins. A darker pigmented area on head running up and back from upper edge of orbit. Snout dusky with scattered melanophores extending over tip and onto undersurface but not reaching mouth. Upper edge of orbit with a narrow crescent of dark color extending down each side of eye to about midorbit level. Belly and lower sides colorless. Dorsal dusky to colorless, usually darker on anterior rays than remainder of fin. Anal light to colorless, occasionally dusky near base of rays. Paired fins colorless. Caudal fin with a distinct dark margin on posterior third; remainder of fin dusky with the upper and lower rays somewhat darker. A dark, often obscure bar at base of caudal rays running diagonally upward from lower caudal rays to top of caudal peduncle slightly anterior to upper caudal base.

COMPARISON: *Anchoa walkeri* may be distinguished from the other four species of eastern Pacific *Anchoa* having a long anal fin by the following combination of characters: long slender maxillary extending slightly posterior to the opercular margin, tip of maxillary fragile and sharply pointed, caudal fin with a distinct dark margin, ovarian egg elliptical.

Anchoa walkeri resembles *A. panamensis* in general appearance but may be distinguished from the latter by a long, pointed maxillary; the maxillary of *A. panamensis* rarely reaches

past the joint of the mandible (Fig. 2 *B*). *Anchoa walkeri* has a proportionally longer head (3.7 to 4.0 in standard length as opposed to 4.1 to 4.5 for *A. panamensis*) and fewer gill rakers (19 to 22 for *A. walkeri* and 18 to 25 for *A. panamensis*). The anal fin origin is below or slightly in advance of the dorsal origin in *A. panamensis,* while *A. walkeri* has the anal origin under the anterior third of the dorsal base.

Specimens of *A. walkeri* will usually key out as *A. mundeoloides* in Hildebrand's key (1943, p. 29) to the genus *Anchoa* (Peterson, 1956, p. 161). *Anchoa mundeoloides* has a shorter maxillary, rarely reaching past the joint of the mandible, with the end of the maxillary bluntly rounded (Fig. 2 *D* and *G*). The caudal fin coloration of *A. mundeoloides* is dusky overall and lacking the dark margin on the posterior third which is typical for *A. walkeri.* Eggs removed from gravid females of *A. walkeri* are elliptical, while eggs of *A. mundeoloides* are spherical in shape.

The total number of rakers on the first gill arch will distinguish *A. compressa* from *A. walkeri. Anchoa compressa* has a total of 42 to 51 gill rakers on the first arch, while *A. walkeri* never has more than 40. *Anchoa compressa* has a short blunt maxillary (Fig. 2 *C*) closely resembling the maxillary of *A. panamensis* and *A. mundeoloides,* and has the dusky caudal fin lacking a dark margin also typical in the latter two species. *Anchoa compressa* has a spherical ovarian egg.

Anchoa spinifer can be distinguished from the above four species by its high anal fin ray count of 35 to 40, low number of gill rakers (15 to 18) on the lower limb of the first gill arch and by the much longer head (3.6–4.0 in standard length). The caudal fin of larger specimens may have the dark margin found in *A. walkeri,* but the above characters will serve to separate the two forms.

HABITAT: Collection records indicate that *A. walkeri* is most commonly found in quite warm, murky waters near shore, and in bays often in the vicinity of river mouths. It is most frequently captured in beach seines or bottom trawls on sand, or sand and mud bottoms lacking rocks, vegetation, and strong currents. Two collections of *A. walkeri,* UCLA W50–43 and UCLA W53–273, were taken in shrimp trawls from areas with a recorded depth of 6 to 10 fathoms and 7 to 12 fathoms, respectively. Although these specimens may have been collected from these depths, they may also have been taken nearer the surface during setting or retrieving of the trawl net. A number of collections from Mexico, Honduras, Costa Rica, and Panama were taken in or near river mouths but no qualitative information was recorded concerning salinity. Hildebrand (1943, p. 29) and Miller (1960, p. 252) note that it is not unusual for anchovies to enter brackish water and ascend freshwater streams. One collection, UCLA W58–18 from Rio Santiago, Nayarit, Mexico, was made several miles up river from the ocean. The water was described as "fresh" with a slight current flowing toward the ocean. Other engraulids from this collection taken with *A. walkeri* were *A. curta* (Jordan and Gilbert), *A. lucida* (Jordan and Gilbert), and *A. mundeoloides.*

REMARKS: The characteristic pointed maxillary (Fig. 2 *A* and *E*) is usually sufficient to distinguish *A. walkeri* from other species of *Anchoa,* especially in specimens larger than 50 mm standard length. In smaller specimens the maxillary (Fig. 2 *F*) is bluntly rounded and does not extend far past the joint of the mandible, and it resembles closely the maxillary of specimens of the same size of *A. compressa, A. panamensis,* and *A. mundeoloides.*

Because of the small size of the maxillary teeth of most anchovies, it is not easy to use tooth characters for determining species without the aid of a binocular microscope. Although the differences are not great, the maxillary teeth of *A. walkeri* are slightly longer and more widely spaced than the maxillary teeth of *A. panamensis* and *A. mundeoloides,* and are about the same in size and spacing as the maxillary teeth of *A. compressa.* This character will prove useful for identifying damaged specimens, especially when correctly determined material of a comparable size is on hand for comparison.

Although the counts and proportional measurements are somewhat similar for the species mentioned (excluding *A. spinifer*), *A. walkeri*

appears to be most closely related to *A. panamensis* when supported by evidence such as the maxillary shape and shape of the ovarian egg. The maxillary of *A. panamensis* is more pointed and somewhat longer than that of *A. compressa* and *A. mundeoloides,* and it approaches most closely the longer and more fragile maxillary typical of *A. walkeri* than that of the latter two species. The ovarian eggs of *A. walkeri* and *A. panamensis* are elliptical in shape and typical for most engraulid fishes (Breder, 1943), while the eggs of *A. compressa* and *A. mundeoloides* are unusual in that they are spherical. The relative shape of the ovarian egg is difficult to evaluate as a taxonomic character, but nevertheless it may indicate that *A. walkeri* is more closely related to *A. panamensis* than to the other two species.

RANGE: From San Felipe, Baja California, to Bahia San Miguel, Panama.

DERIVATION OF NAME: It is a pleasure to name this species for Dr. Boyd W. Walker who encouraged the writing of this paper.

MATERIAL EXAMINED: Mexico; Golfo de California, Baja California: UCLA W54-365 5(79–120 mm), UCLA W55-34 2(96–98); Sonora: UCLA W50-27 27(72–102), UCLA W50-43 20(97–119), UCLA W52-30 114(82–111), UCLA W52-50 37(86–108), UCLA W58-52 1(72), UCLA W61-88 20(32–91); Sinaloa: UCLA W56-141 1(72), UCLA W58-46 1(96); Nayarit: UCLA W58-16 305(74–102), UCLA W58-18 135(73–106), UCLA W58-31 353(73–104), UCLA W58-33 41(73–105), UCLA W58-34 62(74–90), UCLA W58-35 169(70–103), UCLA W58-38 90(75–111), UCLA W58-40 36(74–98). Honduras: UCLA W51-165 1(85), UCLA W53-176 23(86–104). Costa Rica: UCLA W54-40 Series (24–54), UCLA W54-45 35(21–27), UCLA W54-81 45(71-89), UCLA W54-115 56(61-111). Panama: UCLA W53-273 1(107), UCLA W53-275 2(82), UCLA W53-312A 1(94), UCLA W54-325 3(72–83), UCLA W55-65 2(82–92), UCLA W58-56 1(89), UCLA W58-303 21(42–105), UCLA W58-304 27(59–95), UCLA W58-305 16(47–108).

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