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THREE NEW SHARK RECORDS FROM THE GULF OF MEXICO

By HENRY B. BIGELOW, W. C. SCHROEDER and STEWART SPRINGER[1]

The trawlings recently carried out by "Oregon" of the U. S. Fish and Wildlife Service in the Gulf of Mexico have yielded two specimens of *Etmopterus pusillus* (Lowe) 1839, one of *Centrophorus granulosus* (Bloch and Schneider) 1801, and one of *Dalatias licha* (Bonnaterre) 1788, sharks that had long been known in the eastern side of the Atlantic, but which had not been reported previously from the Gulf, though one specimen of *Dalatias* has been taken on the northern edge of Georges Bank.

As the Gulf of Mexico specimens of *E. pusillus* and of *C. granulosus* are the first of their kinds to be reported from the western side of the Atlantic or tributary waters, brief accounts follow to emphasize such of their diagnostic characters as may not be immediately apparent from the accompanying illustrations (Figs. 1, 2), and to justify our identifications of them.

Genus ETMOPTERUS Rafinesque 1810

Type species *Squalus spinax*, Linnaeus 1758

Whitley (1939, p. 266) has recently revived the genus *Acanthidium* Lowe 1839, type species *Centrina nigra* Lowe 1834 which, in 1839, Lowe renamed *Acanthidium pusillum*, thinking it separable generically from *Etmopterus* Rafinesque 1810, type species *Squalus spinax* Linnaeus 1758. But the differences in fin-characters cited by Whitley do not seem to us sufficient to justify this separation. And the specific name *niger* is preoccu-

[1] Contribution No. 787. Woods Hole Oceanographic Institution.

pied in *Etmopterus* by *nigrum* (Cloquet) 1820,[1] p. 93 and various subsequent authors, proposed as a substitute for *spinax* Linnaeus 1758.

ETMOPTERUS PUSILLUS (Lowe) 1839

Study material. Male, 445 mm. long, U. S. Nat. Mus. No. 157835, and female of 458 mm., Mus. Comp. Zool. No. 39572, northern part of Gulf of Mexico, "Oregon" Station 1281, Lat. 29°13′ N., Long. 87°54′ W., in 250 fathoms. Also female 278 mm. long, Madeira (Mus. Comp. Zool. No. 1026), and female of 167 mm., off Equatorial West Africa, Lat. 6°08′ S., Long. 11°24′ E., Mus. Comp. Zool. No. 38002, received through the kindness of Dr. Max Poll.

The Gulf of Mexico specimens agree so closely with those with which we have compared them, from Madeira and from tropical West Africa that we have no hesitation in referring them to the same species.

The morphological feature the most sharply diagnostic for *pusillus,* among its genus-mates of the Equatorial and North Atlantic, of the Mediterranean and of the Gulf of Mexico, is that the denticles on the sides of its trunk are low, truncate, the great majority with concave crowns, but an occasional denticle flat, or perhaps even weakly convex, on a conspicuously 4-radiate base.[2] In these respects they contrast with the slender, bristle-like denticles of *E. spinax* (Linnaeus) 1758 and of *E. schultzi* (Bigelow, Schroeder and Springer 1953, fig. 9G), with the stouter, more thorn-like denticles of *E. hillianus* Poey 1861 (Bigelow and Schroeder 1948, p. 489, fig. 92B), of *E. polli* (Bigelow, Schroeder and Springer, 1953, fig. 7 C) and of *E. princeps* (see Bigelow, Schroeder and Springer, 1953, figs. 8 E, 8 F), and with the more conical claw-like denticles of *E. virens* (Bigelow, Schroeder and Springer 1953, fig. 10 D, E).

The color, also, of *E. pusillus* is distinctive. It recalls *E. princeps,* Collett 1904, of higher latitudes in both sides of the Atlantic, and *E. schultzi* Bigelow, Schroeder and Springer 1953, of the Gulf of Mexico, in the uniformly dark slaty to black-

[1] Garman (1913, p. 223) credits the earliest use of *niger* in this connection to Gunner 1763, but we have not been in a position to verify this citation.

[2] Our earlier characterization of them as a whole (Bigelow, Schroeder and Springer 1953, p. 240) as "flat or weakly convex" was an evident misstatement.

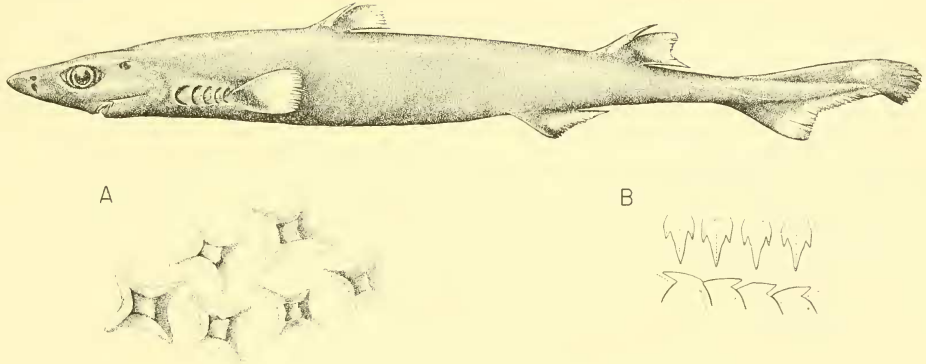

Fig. 1. *Etmopterus pusillus* (Lowe), 1839. Female, 458 mm. long, northern part of Gulf of Mexico. "Oregon" Sta. 1281, Mus. Comp. Zool. No. 39572. *A*, group of dermal denticles from below first dorsal fin, x about 40; *B*, upper and lower teeth at center of jaw, x about 5.

ish hue of its trunk not only below, but above as well (except for the pale intraocular spot mentioned below), and in the lack of definitely outlined paler and darker areas on its sides. But the outer part of its pectoral fins, with the rear part of its two dorsal fins are white and more translucent, which is not the case either in *princeps,* in *schultzi,* or in any other *Etmopterus* for that matter, that is known yet from the North Atlantic, from the Mediterranean, or from the Gulf of Mexico. This very conspicuous feature of *pusillus* is shown on Lowe's (1843, Pl. 6) original illustration of it (as *Acanthidium pusillum*) ; also on the colored illustration by Braganza (1904, Pl. 2, fig. 2, as *E. pusillus*).

Other features that in combination are diagnostic for *pusillus* are : that the upper margin of its caudal fin is only about as long as from the tip of the snout to the level of the second pair of gill openings; that the distance from the rear end of the bases of its pelvic fins to the origin of the lower side of its caudal fin is shorter than from the tip of the snout to the level of the first pair of gill openings; that the rear end of the base of its first dorsal fin is much nearer to a perpendicular at the axils of the pectoral fins than to a perpendicular at the origin of the pelvic fins; that the margins of its pectoral fins are not deeply fringed normally as they are in *E. schultzi* (Bigelow, Schroeder and Springer 1953, fig. 9 D) ; that the anterior edge of the first pair of gill openings is not concave enough to expose the tips of the gill-folds as it is in *E. princeps* (see Bigelow, Schroeder and Springer 1953, fig. 8 D) ; and that the upper surface of the head is marked between the eyes with a pale yellowish spot, as it is in *E. polli,* in *E. schultzi,* in *E. virens,* and in *E. spinax,* (where there is also a white spot "above the hind part of each orbit," Garman 1913, p. 224), but not in *E. princeps.*

Two species of *Etmopterus, schultzi* and *virens,* Bigelow, Schroeder and Springer 1953, had been known previously in the Gulf. The discovery of *pusillus* there now increases the local list to three. And a fourth member of the genus (*hillianus* Poey 1861) is to be expected there for it has been found widespread in Cuban waters and in the West Indian region, and has been recorded from as far to the northward as the offing of Chesapeake Bay.

E. pusillus, originally reported from Madeira, has since been

recorded from various localities in the eastern side of the Atlantic between Equatorial West Africa (Lat. 6°08′S, see above) and the coast of Portugal, the Cape Verde Islands, the Canaries and the Azores. Earlier reports of it from the West Indian region, listed elsewhere (Bigelow and Schroeder 1948, p. 493), seem actually to have been based on *E. hillianus*.

The discovery that *pusillus* occurs in the Gulf of Mexico shows that its range parallels that of *Centrophorus granulosus* (p. 9), also that of *C. uyato* Rafinesque 1810, which had been known only from the Mediterranean and from the eastern side of the Atlantic in low and mid-latitudes until 1951-1952, when "Oregon" trawled 2 specimens of it in the Gulf (Bigelow, Schroeder and Springer, 1953, p. 227).

Tanaka (1912, pl. 22; p. 88) also, has referred to *pusillus* the Japanese shark that was earlier described and pictured by Pietschmann (1907, p. 395; 1908, p. 654, pl. 1, fig. 2, pl. 2, fig. 2) as *E. frontimaculatus*. But while the latter agrees with *pusillus* in the nature of its dermal denticles (Pietschmann, 1908, p. 657, text figs. 1, 2), it differs from *pusillus* in a more rearward position of the first dorsal fin (relative to the positions of the pectoral and pelvic fins), in a relatively longer interspace between the pelvic and caudal fins, and in color pattern, with the lower surface of its head, its belly, and a definitely outlined area above and anterior to each pelvic fin much darker than the upper part of its sides. A further difference is that the lower surface is as densely clothed with denticles as are the sides and back in *pusillus* whereas it is largely naked in the Japanese species.

Genus CENTROPHORUS Müller and Henle 1837

Type species *Squalus granulosus* Bloch and Schneider 1801

CENTROPHORUS GRANULOSUS (Bloch and Schneider) 1801

Study material. Female 922 mm. long from northern part of Gulf of Mexico, Lat. 29°15′N., Long. 88°18′W., "Oregon" Sta. 1246, 200-210 fathoms, U. S. Nat. Mus. No. 157833; also skin of a male, 855 mm. long, eastern Atlantic, exact locality not known, Mus. Comp. Zool. No. 662.

Fig. 2. *Centrophorus granulosus* (Bloch and Schneider), 1801. Female, 922 mm. long, northern part of Gulf of Mexico. "Oregon" Sta. 1246, U. S. Nat. Mus., No. 157833. *A*, lower surface of anterior part of head; *B*, upper and lower tooth band, left hand side of jaw, x about 1.7; *C*, cutting edge of 5th lower right hand tooth, x about 7, to show serrations; *D*, dermal denticles from side below first dorsal fin, x about 11.

The most evident diagnostic features that set apart *C. granulosus* (with *C. machiquensis* Maul 1955) from the other two species of its genus (*squamosus* Bonnaterre 1788 and *uyato* Rafinesque 1810) that are known from the North Atlantic province are: that the inner corner of its pectoral fins is greatly extended and narrowly pointed (Fig. 2); that the interspace between its two dorsal fins is longer than the head (to origin of pectoral fins) by a distance nearly as long as the eye; that the denticles on the sides of the body are low, block-like with the ridges on the outer surface converging rearward, closely spaced in quincuncial arrangement, but not overlapping (Fig. 2, *D*); and that the upper teeth are erect and nearly symmetrical all along the central part of the jaw (Fig. 2, B). In *granulosus* also, as in *squamosus,* the cutting edge of the lower teeth is partially serrate, but so finely so that this feature is visible only on careful examination under a lens (Fig. 2, *C*). In *uyato,* on the contrary, the lower teeth are smooth-edged, like the uppers.

Proportional dimensions, in per cent of total length, of female, 922 mm. long, northern part of Gulf of Mexico, U. S. Nat. Mus. No. 157833.

Trunk at origin of pectoral. Breadth 9.7, height 10.8.
Snout length in front of. Outer nostrils 2.8; mouth 9.1; eye 4.9
Eye. Horizontal diameter 4.9.
Mouth. Breadth 7.9.
Nostrils. Distance between inner ends 3.6.
Spiracles. Distance between inner ends 7.0.
Labial furrows, upper. Length 5.4; distance between inner ends 6.4.
Gill openings, lengths. 1st 2.6; 2nd 2.7; 3rd 2.8; 4th 3.0; 5th 3.3.
First dorsal fin. Vertical height 5.4; length of base 11.1; base rearward from anterior beginning of spine 8.5; diagonal from emergence of spine to rear end of base 7.1; free rear margin of fin 6.9.
Second dorsal fin. Vertical height 5.0; length of base 7.0; base rearward from anterior beginning of spine 5.7; diagonal from emergence of spine to rear end of base 5.4; free rear margin of fin 4.5.
Caudal fin. Upper margin 20.3; lower anterior margin 12.3.
Pectoral fin. Outer margin 12.9; inner margin 13.2; greatest width 7.6.

Distance from snout to. 1st gill opening 16.8; to origin of 1st dorsal spine 34.8; to origin of 2nd dorsal spine 69.2; upper caudal 79.7; pectoral 22.2; pelvics 58.7.

Interspace between. Anterior beginning 1st dorsal spine to 2nd dorsal spine 34.4; rear tip of 1st dorsal fin to rear tip of 2nd dorsal 29.5; 2nd dorsal and caudal 6.0; pelvics and caudal 13.4.

Distance from origin to origin of. Pectoral and pelvics 37.6; pelvics and caudal 18.1.

Head, to origin of pectoral fins, about 28 per cent of trunk to origin of upper side of caudal fin; snout moderately rounded, its length in front of snout about ⅓ of head to origin of pectorals; eye about 22 per cent as long as head; distance from level of front of eyes to tip of snout about as long as eye; spiracle about ¼ as long as eye, its anterior edge only slightly posterior to rear corner of eye. Nostrils a little less than ½ as long as distance between nostrils, approximately transverse, the outer ends posterior to level of tip of snout by a distance a little shorter than distance between nostrils. Anterior nasal flap short, narrowly triangular. Distance between nostrils a little less than ½ as great as from tip of snout to mouth. Mouth very low-arched, its gape when closed occupying about ⅕ of breadth of head at level of outer corners of mouth. Distance between inner ends of nasal furrows about 1.8 times as long as between nostrils. Longest gill opening (5th) is almost as long as distance between nostrils.

Teeth $\frac{40}{15\text{-}1\text{-}15}$, of shapes illustrated in Figure 2, *B;* uppers with the post-functional (outermost) row partly lost, followed by a nearly vertical functional row and then by an oblique backward pointing row that will be next in service; lowers with two rows visible from outside the mouth, one of which is functional, 16 teeth pointing to the right hand side, of which one is a median tooth, and 15 teeth pointing to the left hand side; cutting edge of some of the lowers with microscopically fine and somewhat irregular serrations (Fig. 2, *C*) but others merely somewhat irregular, a difference probably due to wear. Dermal denticles on sides of body sessile, block-like, sub-quadrate, with the more acute corner directed rearward, closely spaced in quincuncial pattern but not overlapping, the crown weakly convex or flat, its anterior ½ to ⅔ with (usually) 5-7 low ridges, converging rearward (Fig. 2, *D*), the outermost pair the longest.

Denticles at mid-level of side below first dorsal fin averaging about 0.9 mm. long.

Length of base of first dorsal fin, measured from point of emergence from skin of anterior side of first dorsal spine, about 1.3 times as long as base of second dorsal fin, similarly measured. Interspace between rear end of base of first dorsal and point of emergence of second dorsal spine longer than head (to origin of pectorals) by a distance about equal to length of eye and about 7½ times as long as between nostrils. Exposed portion of first dorsal spine about 1⅓ times as long as that of second spine, the second spine reaching about mid-way along the free anterior margin of the fin. Interspace between rear end of base of second dorsal fin and origin of upper side of caudal fin about as long as base of second dorsal fin measured from point of emergence, from skin, of anterior edge of second dorsal spine.

Upper edge of caudal fin about as long as from tip of snout to level of fourth pair of gill openings, its lower edge with obtuse subterminal notch and rounded lower anterior lobe. Interspace between origin of lower edge of caudal fin and rear ends of bases of pelvic fins about ⅗ as long as from tip of snout to level of 5th pair of gill openings. Origin of pelvic fins (in female) anterior to a perpendicular at emergence of anterior edge of second dorsal spine, by an amount about equal to interspace between origin of lower edge of caudal fin and rear ends of bases of pelvic fins. Pectorals with inner corner greatly extended and narrowly pointed, reaching rearward (when laid back) nearly to a perpendicular from rear base of first dorsal fin.

Sharks referable with certainty to *granulosus*, not to *uyato* which Rey (1928, p. 436) considered synonymous with it, had previously been recorded in the Mediterranean, off the coast of Portugal, and at Madeira (specimen in British Museum; Günther 1870, p. 421). The capture of a typical *granulosus* in the Gulf now shows that its Atlantic range parallels that of *C. uyato* Rafinesque 1810, which was recently found to occur in the Gulf (Bigelow, Schroeder and Springer 1953, p. 227). The third species of *Centrophorus* that is known from the Atlantic (*squamosus* Bonnaterre 1788) has so far been reported only off the coast of Portugal and northward to southwestern Iceland and the vicinity of the Faroes.

Pietschmann (1908, pp. 663-667) credits *granulosus* to Japan also, from his comparison of two Japanese specimens with *granulosus* from the Mediterranean. But the eventual decision, whether the northwestern Pacific *Centrophorus* of this general character is indeed indistinguishable from the Atlantic-Mediterranean *granulosus,* is best postponed until a larger number of specimens have been examined, critically, with this question in mind.

Genus DALATIAS Rafinesque 1810

DALATIAS LICHA (Bonnaterre) 1788

Study material. Female 845 mm. long from northern part of Gulf of Mexico, Lat. 28°25′N., Long. 86°02′W., "Oregon" Sta. 1275, 225 fathoms, U. S. Nat. Mus. No. 157834.

The specific identification of this specimen as *D. licha* is so evident, from its close agreement in bodily form, fin characters, teeth, and denticles with the Georges Bank specimen described and pictured previously (Bigelow and Schroeder 1948, p. 502, figs. 96, 97) that no further account seems called for here.

As the only previous record for this shark in the western Atlantic was this Georges Bank example, the capture of one in the northern part of the Gulf of Mexico widely expands its known range.

In the eastern side of the mid and north Atlantic the known range of *D. licha* extends from Equatorial West Africa (Rio de Oro) to the Irish Atlantic slope, including the Mediterranean. And it is doubtful whether the representatives of the genus that have been reported from South Africa, from the New Zealand-Australian region and from Japan can be separated specifically from *D. licha* of the Atlantic. (For discussion, see Bigelow and Schroeder 1948, p. 501).

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