

# YALE PEABODY MUSEUM

P.O. BOX 208118 | NEW HAVEN CT 06520-8118 USA | PEABODY.YALE. EDU

## JOURNAL OF MARINE RESEARCH

The *Journal of Marine Research*, one of the oldest journals in American marine science, published important peer-reviewed original research on a broad array of topics in physical, biological, and chemical oceanography vital to the academic oceanographic community in the long and rich tradition of the Sears Foundation for Marine Research at Yale University.

An archive of all issues from 1937 to 2021 (Volume 1–79) are available through EliScholar, a digital platform for scholarly publishing provided by Yale University Library at <https://elischolar.library.yale.edu/>.

Requests for permission to clear rights for use of this content should be directed to the authors, their estates, or other representatives. The *Journal of Marine Research* has no contact information beyond the affiliations listed in the published articles. We ask that you provide attribution to the *Journal of Marine Research*.

Yale University provides access to these materials for educational and research purposes only. Copyright or other proprietary rights to content contained in this document may be held by individuals or entities other than, or in addition to, Yale University. You are solely responsible for determining the ownership of the copyright, and for obtaining permission for your intended use. Yale University makes no warranty that your distribution, reproduction, or other use of these materials will not infringe the rights of third parties.



This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License.  
<https://creativecommons.org/licenses/by-nc-sa/4.0/>



# NEW GENERA AND SPECIES OF BATOID FISHES<sup>1</sup>

BY

HENRY B. BIGELOW AND WILLIAM C. SCHROEDER

*Museum of Comparative Zoölogy  
Harvard University  
Cambridge, Massachusetts*

and

*Woods Hole Oceanographic Institution<sup>2</sup>  
Woods Hole, Massachusetts*

## INTRODUCTION

The trawling campaigns carried out by the research vessel ATLANTIS of the Woods Hole Oceanographic Institution along the north and south coasts of Cuba during the winter of 1938 and spring of 1939, under the joint auspices of the University of Havana and of Harvard University, brought to light along the 200-500 fathom zone an abundant population of small skates (Family Rajidae), the existence of which had not previously been suspected there. Their discovery emphasizes the desirability of a more thorough exploration of the benthonic fish-fauna, especially for elasmobranchs of this general depth zone in the West Indian region as a whole, as well as at greater depths along the North American slope. The necessity of assigning these Cuban skates—representing several new species—to their correct taxonomic positions calls for some discussion of generic definitions within the large troublesome family to which they belong.

Some of them, with one other skate that has long been known, form a homogeneous group that is characterized by the shortness of the rostral projection from the cranium; a new genus, *Breviraja*, is proposed for these.

Two others of the new Cuban skates are of more general interest, for they illustrate an extreme modification of the pelvic fins. These fins, among elasmobranch fishes as a whole, diverge but little from what may be regarded as their primitive state, for they retain the broad base, have but little power of independent motion, and their outer margins are only moderately deeply concave, if at all so. However, each of the pelvics of these two Cuban skates is subdivided into

<sup>1</sup> Drawings by E. N. Fischer.

<sup>2</sup> Contribution No. 447 from the Woods Hole Oceanographic Institution.

two entirely separate lobes; the anterior lobe is slender, limb-like and arises independently from the lower surface of the disc, while the posterior one is much broader and fin-like, its anterior edge merging with the inner posterior margin of the corresponding pectoral fin. This modification of the pelvis is shared by two species of Rajidae from the Natal Coast of South Africa,<sup>3</sup> by the little-known genus *Anacanthobatis* Von Bonde and Swart (1924: 18, pl. 23) from Natal, and by one genus (*Typhlonarke*) of electric rays; otherwise it appears to be unique among batoids so far as known. Moreover, in these two Cuban species the modification of the pelvis is accompanied by a short extension rearward of each lateral bar of the pelvic arch itself beyond the point of articulations of the most posterior of the three or four radial cartilages borne by it; furthermore, the first two or three radials that are ordinarily borne along the anterior part of the basipterygial cartilage have been lost. The resultant gap (Fig. 1) corresponds to the external gap between the two subdivisions of the pelvic fin. Thus, the anterior pelvic division includes only the three or four radials that arise directly from the pelvis itself, whereas in all other skates, in which the condition in this regard is known, the anterior division includes these radials as well as the first two or three radials that are borne along the anterior part of the basipterygial cartilage. This specialization of the pelvic skeleton and fin is so remarkable that we have no hesitation in invoking it as the basis for a new genus, for which we propose the name *Cruriraja*, roughly translatable as "skates with legs."

A second major departure from the usual elasmobranch morphology is found in the conformation of the nostril of the little electric ray from the Pacific Coast of Central America, described as *Discopyge ommata* Jordan and Gilbert (1890). In all other electric rays, so far as known, the nostril is a simple aperture, more or less narrowed but not interrupted in its midsector. We have checked this feature in *Torpedo*, in *Narcine*, in *Hypnos*, in *Benthobatis* and in *Narke*. Such is the usual state of the nostril among the batoids as a whole, and no essential departure from this condition seems to have been reported previously for any elasmobranch. However, examination of a female and a male of *D. ommata*, loaned us by John Tee-Van of the New York Zoological Society, shows that each of the nostrils is divided into two separate apertures by a cross bridge about midway of its length. The outer of the two apertures constitutes the exposed and visible part of the nostril, whereas the inner aperture is entirely roofed over by the joint curtain-

<sup>3</sup> *Raja parcomaculata* and *R. durbanensis* Von Bonde and Swart (1924: 9, 11, pl. 21, fig. 2, pl. 22, fig. 1).

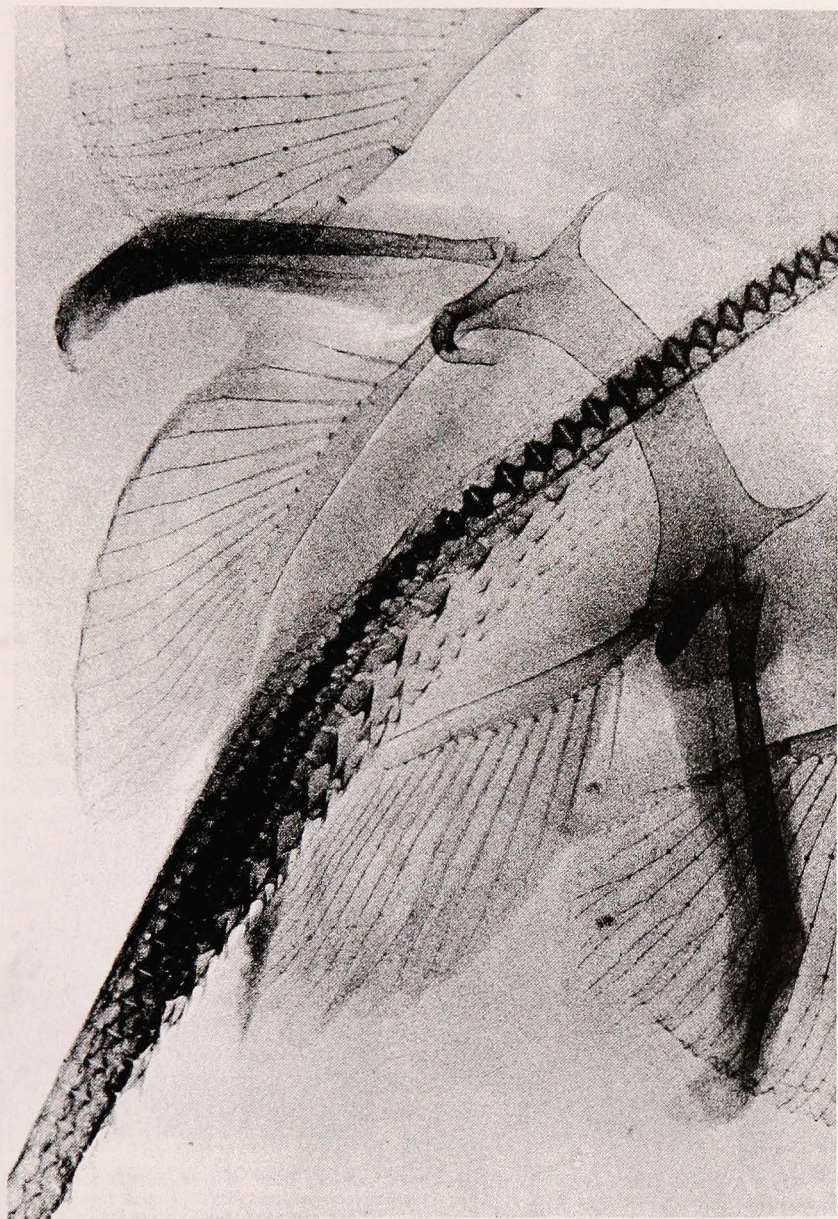


Figure 1. *Cruriraja poeyi*, sp. nov., female, type, 328 mm. long, Harv. Mus. Comp. Zool. No. 36324. X-ray photograph unretouched, showing the gap between radials borne on the pelvis and those on the anterior part of the basipterygial cartilage.

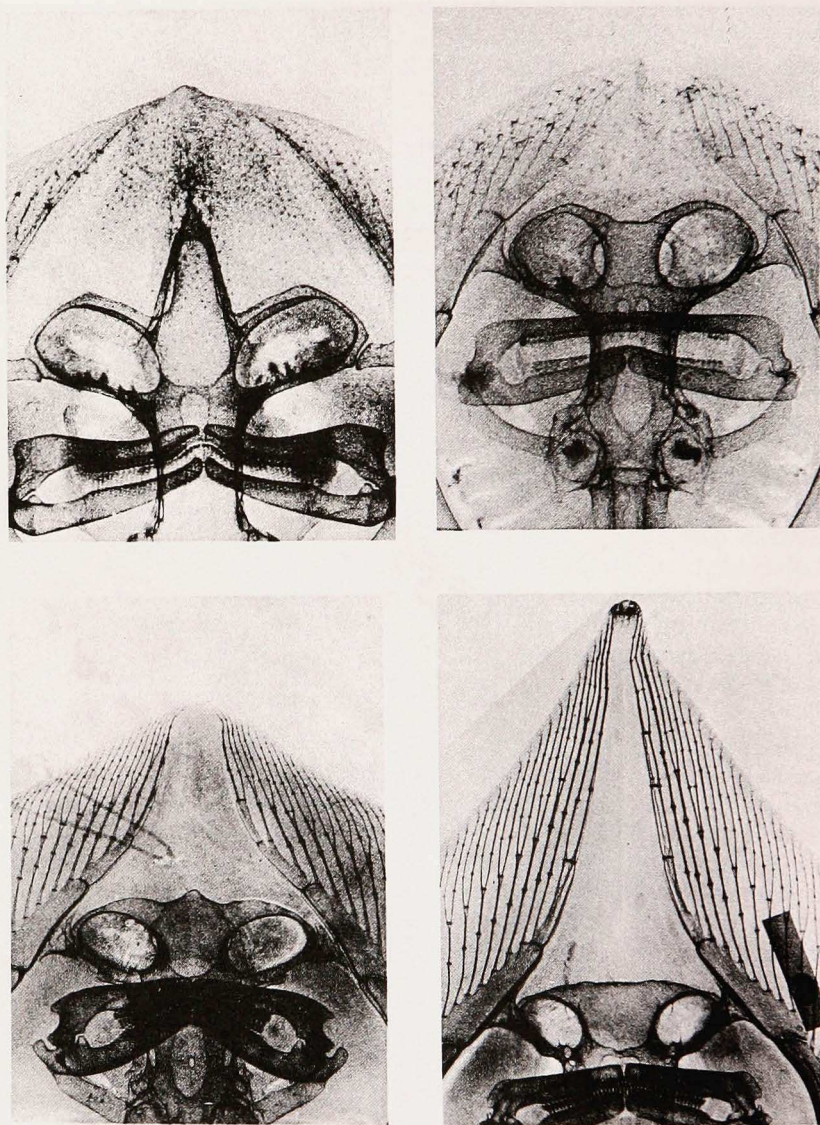


Figure 2. X-ray photographs, slightly retouched, showing front of cranium and rostral cartilage, where present, together with forward extension of pectoral rays. Upper left, *Breviraja colesi*, sp. nov. (Harv. Mus. Comp. Zool. No. 36374); upper right, *Psammobatis scobina* (Philippi, 1857), female, about 190 mm. long, from Uruguay (U. S. Nat. Mus. No. 86721); lower left, *Sympterygia microps* (Günther, 1880), female, about 475 mm. long, off Buenos Aires, Argentina (U. S. Nat. Mus. No. 55579); lower right, *Sympterygia bonaparti*, Müller and Henle (1841), female, from Argentina (U. S. Nat. Mus. No. 53437).

like expansion of the margin of the nostril and is wholly concealed unless the latter be lifted. This character, with the others listed below, sets *D. ommata* so sharply apart from all its relatives that it is necessary to establish for it a third new genus, *Diplobatis*.

## FAMILY RAJIDAE

### SKATES

Two genera of skates are so obviously set apart—the new *Cruriraja* by its pelvic fins and *Dactylobatus* Bean and Weed (1909) by the spatulate extension of the outer margin of each of its pectoral fins—that there is no danger of confusing them with any other known members of their family. The great majority of the remaining rajids—and they are many—fall in two categories as regards the degree of development of the rostral cartilage:

A. Those in which the rostral projection from the front of the cranium extends beyond the tips of the anterior radials of the pectoral fins, very nearly to the tip of the snout;

B. Those in which the rostral cartilage is either nonexistent or only very faintly indicated, and in which the snout region is supported by the forward extension of the pectoral rays on either side, aided more or less by ligamentous bands or sheets reaching forward from the anterior face of the cranium.

The species in category A (with rostral cartilage extending beyond pectoral rays) are so many, and those from different seas so closely resemble one another in many cases, that it would be a boon to students of fishes of the sea bottom if they could be grouped generically by any criteria that would be easy to see or to feel and at the same time give reasonably sharp alternative characters. However, all of the characters that have been proposed for this purpose, such as length and shape of snout, presence or absence of caudal fin-membrane, relative positions of dorsal fins on the tail, spination, and structures of claspers in adult males, have proved to intergrade so completely that there seems no escape from referring all the known members of this group to the old genus *Raja* of Linnaeus (1758).

The members of category B (*i. e.*, either those in which the rostral projection from the cranium is lacking altogether, [Fig. 2, upper and lower right] or in which it is represented by a very slight elevation only [Fig. 2, lower left]) are perhaps separable with reasonable sharpness into two genera, *Sympterygia* Müller and Henle (1841) and *Psammobatis* Günther (1870), according to the degree of concavity of the outer margins of the pelvises, as indicated in the following key. But critical intercomparison, especially of longer known species with those recently

described from Peru (Hildebrand, 1946: 82), may prove that complete gradation exists between these extremes, in which case the older name *Sympterygia* will have precedence.

The Cuban collection now reveals the existence of a third category of typical skates, which includes several small species in which the rostral cartilage, while definitely developed, falls short of the tips of the pectoral rays (Fig. 2, upper left) and hence falls shorter still of the tip of the snout. Examination of the Museum of Comparative Zoology collections shows that *Raja plutonia* Garman (1881, 236; 1913: 335, pl. 18, fig. 1) from the upper part of the Continental Slope in the offing of South Carolina also falls in this category in respect to its rostral cartilage. In fact, Garman, in his original account of this species, remarked that the rostral cartilage did not extend to the end of the snout.

Furthermore, we have yet to see a skate, large or small, fresh or preserved, or from whatever ocean, that cannot readily be referred to one or the other of these three categories. The presence or absence of a rostral cartilage, and its length relative to the pectoral rays if present, is easily determined by touch and, in most cases, by viewing it against a strong light; such examination is possible even for large specimens, while x-ray photographs are even more revealing. Such being the case, we now propose for this category with short rostral cartilage the new genus *Breviraja*.

#### KEY TO GENERA OF RAJIDAE

- 1a. Middle rays of pectorals prolonged as spatulate extensions of disc.  
*Dactylobatus* Bean and Weed (1909).
- 1b. Middle rays of pectorals not prolonged.
  - 2a. Anterior lobes of pelvics in the form of slender, limb-like structures, entirely separate, externally, from the posterior lobes, and arising independently from the lower surface of disc.  
*Cruriraja*, gen. nov., p. 549.
  - 2b. Anterior lobes of pelvics fin-like (as are the posterior lobes) and continuously connected with the posterior lobes along outer margin of fin.
    - 3a. Anterior face of cranium with a definite rostral process, longer or shorter.
      - 4a. Tip of rostral process extending forward beyond level of tips of anterior rays of pectorals very nearly to extreme tip of snout.  
*Raja* Linnaeus (1758).
      - 4b. Tip of rostral process falling short of level of tips of anterior rays of pectorals, and falling shorter still of extreme tip of snout.  
*Breviraja*, gen. nov., p. 558.
  - 3b. Anterior face of cranium without a definite rostral process, or at most with only a very slight elevation, or even concave in some cases.

- 5a. Outer margins of pelvics so deeply concave that the fins are divided. *Psammobatis* Günther (1870).<sup>4</sup>
- 5b. Outer margins of pelvics only very weakly concave, the fins not divided. *Sympterygia* Müller and Henle, 1841.

*Cruriraja*,<sup>5</sup> GEN. NOV.

*Generic characters.* Rajidae with outer margin of pelvic so deeply notched that the anterior division is entirely cut off from the remainder of the fin, thus forming a separate limb-like structure that arises independently from the lower surface of the disc some little distance inward from the edge of the disc; inner posterior margin of pectoral continuous with anterior margin of posterior division of pelvic. Anterior division of pelvic subcylindrical, slender, tapering toward the tip, stiff proximally but softer distally, of three articulated segments, with the stoutness of its musculature toward the base suggesting considerable powers of movement; its support is given by the first stout radial and the succeeding two or three slender radials, all of which are articulated to the pelvic arch. Posterior lobe of pelvic fin-like, supported by about 18 radials only, the gap resulting from the loss of the anterior two or three radials that are ordinarily borne along the anterior part of the basipterygial cartilage corresponds in position to the interspace seen, externally, between the anterior and posterior subdivisions of the pelvic fin. Characters otherwise as in *Raja*.

The function of the limb-like specialization of the anterior part of the pelvic fin is not known. It may be tactile, as are the feeler-like pelvics of the hakes of the gadoid genus *Urophycis*, or it may assist in the progress of its owner over the bottom.

Type species. *Cruriraja atlantis* Bigelow and Schroeder (p. 550), the type specimen, Harv. Mus. Comp. Zool., No. 36320; ATLANTIS Station 3468, Lat. 23° 11' N, Long. 81° 23' W, off the north central coast of Cuba; 375 fathoms.

KEY TO KNOWN SPECIES OF *Cruriraja*

- 1a. Interspace between 1st and 2nd dorsal fins at least 1.5 times as long as base of 1st dorsal. *atlantis*, sp. nov., p. 550.
- 1b. Interspace between 1st and 2nd dorsal fins not more than about half as long as base of 1st dorsal.

<sup>4</sup> *Malacorhina* Garman (1877) is clearly a synonym of *Psammobatis*, as pointed out by Regan (1914: 22) and by Norman (1937: 33). This appears to apply equally to *Irolita* Whitley, 1931.

<sup>5</sup> From the latin *crus*, a leg or limb, and *Raja*, the generic name of the typical skates.



- 2a. Large thorns on head and from posterior part of disc out along tail, but no large thorns along midbelt of back between levels of spiracles and outer corners of pectorals. *poeyi*, sp. nov., p. 555.
- 2b. Large thorns in an unbroken series along midline of back from close behind level of spiracles rearward along disc and tail.
- 3a. A group of thorns on tip of snout, others along anterior half of rostral ridge, and two thorns in the interspace between the two dorsal fins.  
*parcomaculata* Bonde and Swart (1924). Off Natal Coast, S. Africa; 298 fathoms.
- 3b. No thorns on tip of snout, along rostral ridge, or in the interspace between the two dorsals.  
*durbanensis* Bonde and Swart (1924). Off Natal Coast, S. Africa; 420 fathoms.

*Cruriraja atlantis*, sp. nov.

Figures 3, 4

*Distinctive Characters.* The complete subdivision of its pelvic fins separates *C. atlantis* from other known members of the family Rajidae except for its genus mates *C. poeyi*, *C. parcomaculata* and *C. durbanensis*; and the great width of the interspace between its first and second dorsal fins marks it off from all three of these species. The fact that the upper surface of its disc is nearly uniformly covered with small prickles further separates it from *poeyi*; the rounded outer corners of its disc distinguish it from *parcomaculata*; and the several rows of enlarged thorns on its tail separate it from *durbanensis*, which has a single row from nuchal region to first dorsal when young and a single row falling short of first dorsal in older examples.

*Description.* Proportional dimensions in per cent of total length. Female, type, 332 mm. long, with disc 175 mm. wide. Harv. Mus. Comp. Zool. No. 36320.

*Disc:* length 40.7; breadth 52.7.

*Snout length in front of:* orbit 9.5; mouth 12.3.

*Orbits:* longest diameter 5; breadth between 2.6.

*Spiracles:* length 2.6; breadth between 6.3.

*Mouth:* breadth 5.6.

*Nostrils:* breadth between 5.1.

*Gill openings:* distance between 1st 11.9; 5th 6.6; lengths 1st 1.1; 3rd 1.3; 5th 1.0.

*Distance:* snout to cloaca (middle) 38.0; cloaca (middle) to tip of tail 62.0.

*First dorsal fin:* vertical height 2.4; length of base 3.6.

*Second dorsal fin:* vertical height 1.8; length of base 3.8.

*Interspace between:* 1st and 2nd dorsals 9.0; 2nd dorsal and tip of tail 4.4.

*Pelvics:* length of anterior margin 9.0.

Disc 1.3 times as broad as long, its anterior angle (tip of snout to level of anterior margins of orbits) about  $94^\circ$ , the anterior margins very slightly sinuous, weakly convex opposite orbits; the outer posterior and inner margins gently convex, the outer corners narrowly rounded, the axis of greatest breadth 70% of distance rearward from tip of snout toward axils of pectorals. Rostral cartilage narrow, extending nearly to tip of snout. Pectoral rays terminating anteriorly half-way between orbits and tip of snout. Snout sharp-tipped, its length in front of orbits 1.9 times as long as orbit, its length in front of mouth 2.4 times as long as distance between nostrils. Orbit twice as long as interorbital space and as length of spiracle. Mouth very slightly curved, without a noticeable bow in center. Posterior margin of nasal curtain weakly and irregularly fringed, the outer posterior margin of nostril smooth. Distance between inner ends of 5th pair of gill openings 1.3 times as great as distance between nostrils.

Teeth in 42 series in upper jaw, probably the same in lower, arranged in quincunx, with a low and rather blunt median cusp.

Anterior lobe of pelvic (entirely separated from posterior lobe) fleshy, limb-like, slightly longer than posterior lobe, with two radials besides the first stout one, which is of three segments. Posterior lobe continuous with pectoral, with 18 radials, its outer margin slightly wavy and moderately convex, inner margin straight or slightly concave. Tips of pelvics angular, extending back about  $\frac{1}{4}$  the distance from axils of pectorals toward 1st dorsal.

Tail slender, 1.1 times as long from center of cloaca to origin of 1st dorsal as from tip of snout to cloaca, 1.4 times as long to 2nd dorsal, and 1.6 times as long to tip. First and 2nd dorsals similar in shape and about equal in size; interspace between 1st and 2nd dorsals 2.5 times as long as base of 1st dorsal. Base of 2nd dorsal about as long as base of 1st dorsal; distance from rear end of base of 2nd dorsal to origin of caudal fin-membrane about  $\frac{1}{2}$  as long as base of 2nd dorsal; distance from 2nd dorsal to tip of tail slightly greater than length of base of 2nd dorsal. A membranous fold, low down on side of tail, originates anterior to 1st dorsal by a distance about equal to base of latter, very narrow anteriorly, gradually widening rearward to maximum breadth opposite origin of 2nd dorsal and to tip of tail.

Entire upper surface of disc thickly and evenly set with small prickles, except for extreme tip of snout and a narrow band along outer posterior margin of each pectoral. Somewhat larger prickles

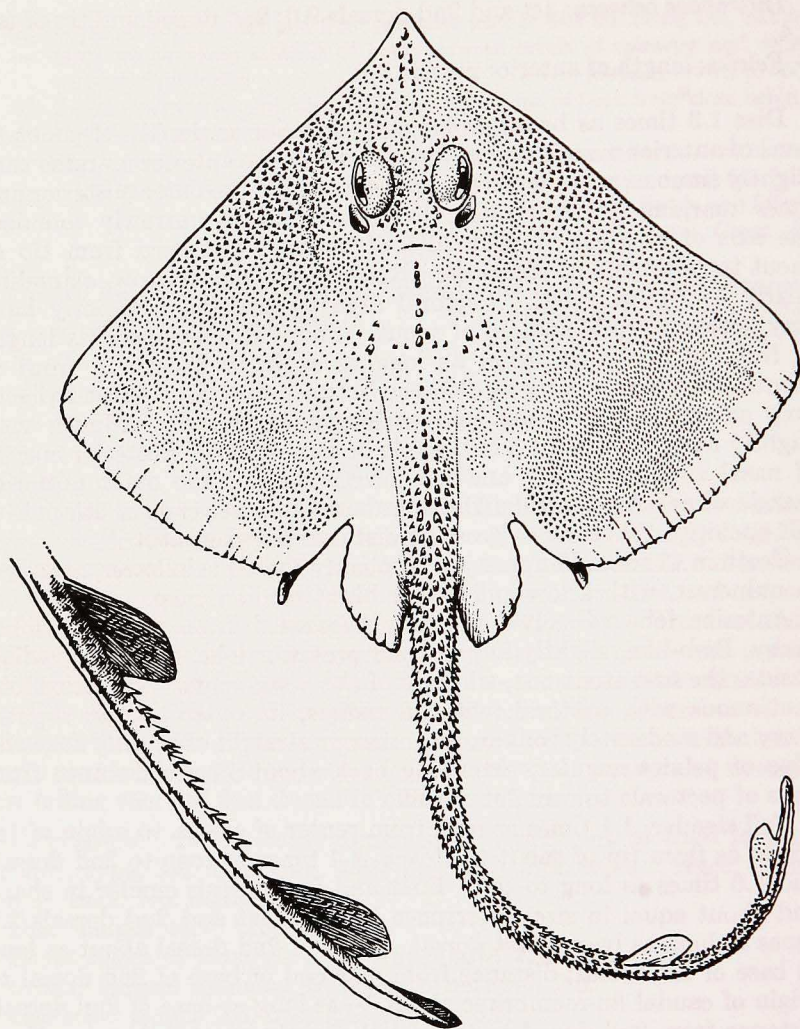


Figure 3. *Cruriraja atlantis*, sp. nov., female, type 332 mm. long (Harv. Mus. Comp. Zool. No. 36320),  $\times 0.6$ . Dorsal fins and caudal fin membrane,  $\times 1.2$ .

in the area opposite orbits, mostly with stellate bases so close together as to almost touch. Skin over eyes also prickly. Two or three rows of thorns on anterior part of rostral process. Inner margin of eye with an uninterrupted row of 11 thorns, besides 1 thorn posteriorly toward median line of back. Two or 3 low stout thorns on each scapular

region. Midbelt of disc with a median row of 7 from nuchal region to pectoral girdle, followed by several very small thorns posterior to latter, increasing in size rearward. Also 1 or 2 additional rows of thorns on either side of middle row from a little in advance of axils

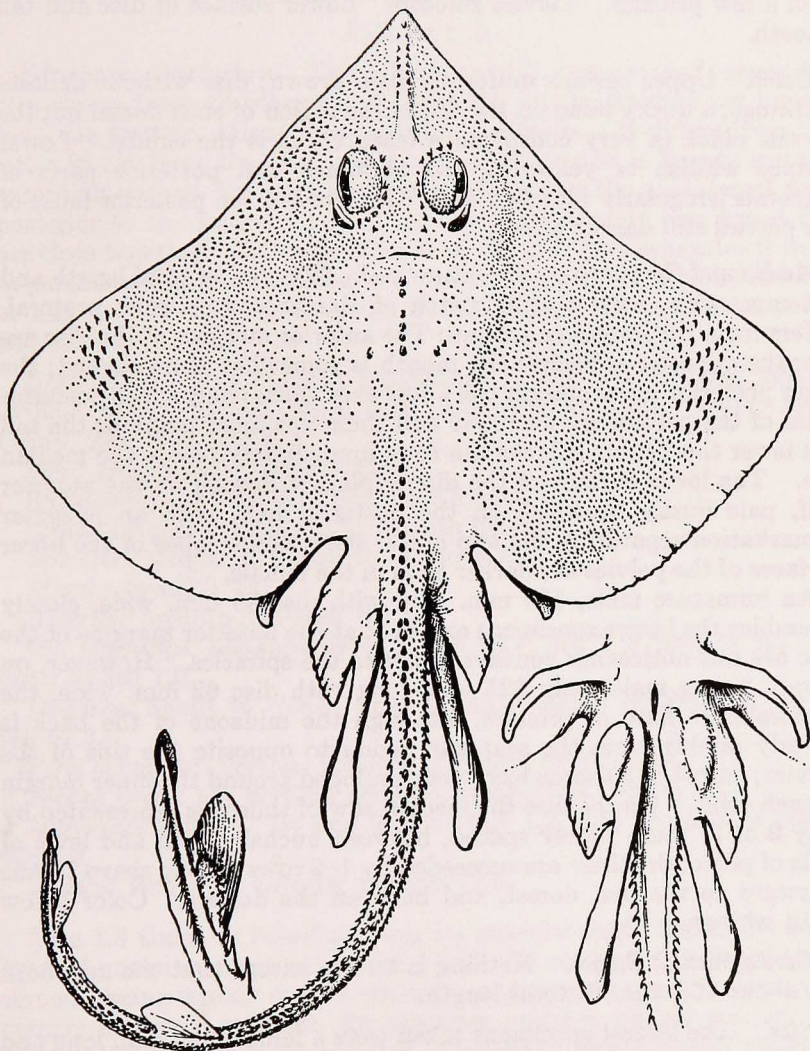


Figure 4. *Cruriraja atlantis*, sp. nov., male, 297 mm. long (Harv. Mus. Comp. Zool. No. 36321),  $\times 0.7$ . Pelvic fins and claspers,  $\times 0.7$ ; second dorsal fin and caudal fin membrane,  $\times 1.5$ .

of pectorals. Tail very thorny above and on sides, with 6 or 7 rows along anterior part, but with only 2 or 3 rows approaching the 1st dorsal; 1 or 2 rows between dorsals, succeeded by smaller prickles along sides of tail to a point opposite rear end of base of 2nd dorsal. Dorsals with a few prickles. Pelvics smooth. Lower surface of disc and tail smooth.

*Color.* Upper surface uniformly pale brown; disc without definite markings; a dusky band on the tail in the region of each dorsal fin; the dorsals black (a very conspicuous feature), as is the caudal. Lower surface whitish or yellowish, the abdomen and posterior parts of pectorals irregularly blotched with dark brown, the posterior lobes of the pelvics still darker brown.

*Additional Specimens.* A mature male, 297 mm. in total length and 161 mm. wide, with a small patch of alar thorns on each pectoral, differs from the female as follows: The anterior margins of the disc are concave opposite spiracles; the mouth is somewhat more curved; the outer posterior nasal margin has a few very short fringes; the posterior lobes of the pelvics are narrower and their tips more pointed; the tail has fewer thorns, for it lacks the rows immediately beside the median one. The lower surface of the disc is plain yellowish on the anterior half, pale dusky brownish on the posterior half, with an irregular demarkation separating the two areas; the anterior lobes of the lower surfaces of the pelvics are darker than in the female.

An immature male, 160 mm. long with disc 85 mm. wide, closely resembles the larger specimens except that the anterior margins of the disc are not noticeably concave opposite the spiracles. However, on a very young male, only 125 mm. long with disc 62 mm. wide, the pectorals are bare of prickles, although the midzone of the back is already prickly from the scapular region to opposite the tips of the pelvics; only 4 or 5 thorns have yet developed around the inner margin of each orbit. On the disc the median row of thorns is represented by only 2 or 3, these widely spaced, between nuchal region and level of axils of pectorals; these are succeeded by 1-2 rows of long sharp thorns rearward to the first dorsal, and between the dorsals. Color below plain whitish.

*Developmental Stages.* Nothing is known except that the new-born are about 100 mm. in total length.

*Size.* The largest specimens taken were a female 332 mm. long and a mature male 297 mm. Our collection contains 12 specimens, nine males and three females, 100 to 332 mm. in total length, with discs 50 to 175 mm. wide.

*Habits.* This is a deep-water species, all the specimens thus far having been taken in depths of 280 to 425 fathoms.

*Range.* Known only from off the north central coast of Cuba.

*Cruriraja poeyi*, sp. nov.

Figures 1, 5

*Distinctive Characters.* The pelvic fins of *C. poeyi* make it separable at a glance from all other members of the family Rajidae yet known from the western Atlantic, except for *C. atlantis*. It differs from the latter in the facts that the upper surface of its disc is largely smooth excepting around the eyes and snout and along the mid-dorsal zone posterior to the scapular region, and furthermore, its two dorsal fins are close together. The smoothness of the disc also separates it from *C. parcomaculata* and *C. durbanensis* from South Africa, which are more or less covered with small spines in addition to the enlarged median and orbital thorns.

*Description.* Proportional dimensions in per cent of total length. Female, type, 328 mm. long, with disc 208 mm. wide. Harv. Mus. Comp. Zool No. 36324.

*Disc:* length 48.2; breadth 63.5.

*Snout length in front of:* orbit 12.2; mouth 14.0.

*Orbits:* longest diameter 5.2; breadth between 3.3.

*Spiracles:* length 2.7; breadth between 7.9.

*Mouth:* breadth 7.0.

*Nostrils:* breadth between 6.4.

*Gill Openings:* distance between 1st 13.7; 5th 7.6; lengths 1st 1.4; 3rd 1.5; 5th 1.0.

*Distance:* Snout to cloaca (middle) 42.7; cloaca (middle) to tip of tail 57.3.

*First dorsal fin:* vertical height 1.8; length of base 4.0.

*Second dorsal fin;* vertical height 1.8; length of base 4.6.

*Interspace between:* 1st and 2nd dorsals 1.2; 2nd dorsal and tip of tail 4.0.

*Pelvic:* length of anterior margin 12.5.

Disc 1.3 times as broad as long, its anterior angle (tip of snout to level of anterior margins of orbits)  $98^\circ$ , the anterior margins slightly sinuous, being weakly convex opposite anterior part of orbits, the outer corners narrowly rounded, the posterior margins weakly convex, the posterior corners broadly rounded, the inner margins nearly straight, and the axis of greatest breadth 67% of the distance back from the snout toward axils of pectorals. Rostral process very narrow, reaching

tip of snout, the anterior rays of pectorals falling well short. Snout pointed, its length in front of orbits 2.3 times as long as orbit, its length in front of mouth 2.2 times as long as breadth between nostrils. Orbit 1.6 times as long as distance between orbits and 1.9 times as long as spiracle. Mouth nearly straight. Nasal curtain fringed with a few very short knob-like lobes, the outer posterior margin of nostril smooth. Distance between inner ends of fifth gill openings 1.2 times as long as between nostrils.

Teeth in  $\frac{4}{4}$  series, close set, in quincunx, circular at base, with a low triangular cusp pointing inward excepting near corners of mouth

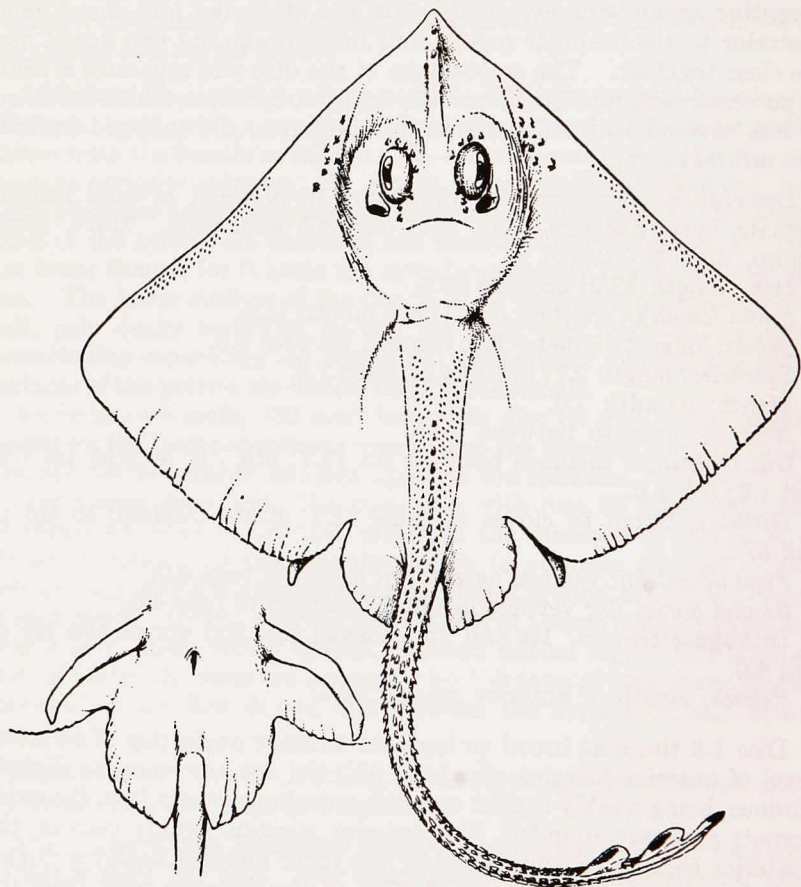


Figure 5. *Cruriraja poeyi*, sp. nov., female, type, 328 mm. long (Harv. Mus. Comp. Zool. No. 36324),  $\times 0.5$ . Pelvic fins,  $\times 0.5$ .

where cusps are usually lacking; the anterior rows worn nearly smooth.

Anterior lobe of pelvics about as long as posterior lobe. Outer margin of posterior lobe broadly rounded, its edge weakly scalloped, the inner margin nearly straight. Tips of pelvics moderately pointed, extending back about  $\frac{1}{4}$  the distance from axils of pectorals toward 1st dorsal.

Tail narrow, its length from center of cloaca to 1st dorsal equal to length from snout to cloaca, 1.1 times to 2nd dorsal, 1.3 times to tip. Dorsals close together, the interspace about  $\frac{1}{3}$  as long as base of 1st dorsal, which is about equal to base of 2nd and to length of caudal fin. A narrow membranous fold, beginning low down on each side of tail, extends from about midway between tips of pelvics and origin of 1st dorsal to opposite the middle of caudal; widest opposite dorsals.

Upper surface of disc prickly over a narrow band along anterior margins from opposite the middle of orbits nearly to outer corner of disc, and along mid-dorsal ridge from a little posterior to pectoral girdle rearward. A small patch of thorns near end of rostral ridge, 7 or 8 between orbit and margin of disc; 8 on one side and 7 on the other along inner margin of orbit, the series interrupted about midway; also, a median row extending rearward from about midway between pectoral girdle and level of axils of pectorals, flanked by 2 or 3 rows of smaller thorns from a little anterior to axils of pectorals. Otherwise naked, including skin over eyes. Tail conspicuously rough; 6-7 rows of thorns anterior to tips of pelvics, although no one row is exactly in the midline, and 4 rows posteriorly, the anterior tail thorns more closely spaced than those rearward; 2 pairs of opposing thorns between dorsals. Dorsals prickly, but caudal and pelvics smooth. Lower surface smooth.

*Color.* Upper surface pale coffee brown except for a translucent area on either side of rostral cartilage; anterior parts of dorsals and tip of caudal membrane black. Lower surface of disc of about same shade as above, somewhat mottled with paler and darker, with pale areas around the mouth and along the gill openings. Tail paler than disc.

*Additional Specimens.* A male, 327 mm. in total length with disc 197 mm. wide, differs from the female chiefly as follows: Anterior angle of disc more acute ( $86^\circ$ ); snout sharper; posterior margin of nasal curtain conspicuously fringed on one side but almost smooth on the other; teeth in 50 series in upper jaw, with longer and sharper cusps; pelvics narrower, with tips more pointed; claspers well developed, extending beyond tips of pelvics a distance equal to width of mouth; a



somewhat larger patch of malar thorns beside the orbits and a triangular patch of alar thorns on the outer parts of pectorals.

Several medium-sized specimens, 230 to 260 mm. long, with color better preserved, have roundish spots somewhat darker than the ground color; these are about half as large as the orbit and are scattered on the disc posterior to the spiracles, except along the outer posterior margins. A newborn specimen, 83 mm. in total length with disc 49 mm. wide, has a single median row of thorns from a little in advance of the axils of pectorals to the 1st dorsal. Seemingly these are lost with growth, and are replaced by one row on each side of the midline. There is also a single row low down on each side of the tail and a patch of prickles in the midzone from a little in advance of the axils of pectorals to a little posterior to the tips of the pelvics.

*Developmental Stages.* Nothing is known except that this skate, when newborn, is about 90 mm. in total length and closely resembles the adult.

*Size.* The largest specimen obtained was 328 mm. in total length. A male of about this size had well developed claspers, hence the total length reached by this species is probably not much greater than 400 mm. The collection contains 15 specimens, six males and nine females, 83 to 328 mm. long and 49 to 208 mm. wide; of these, 13 were trawled by the research vessel ATLANTIS and one by the U. S. Fisheries vessel ALBATROSS.

*Habits.* All specimens thus far known have been trawled in depths ranging from 210 to 475 fathoms, on hard sandy bottom.

*Range.* Known from off the north central and southwest central coasts of Cuba and off St. Augustine, Florida.

#### *Breviraja*, GEN. NOV.<sup>6</sup>

Rajidae with a rostral cartilage, but with the latter falling considerably short of the extremities of the anterior rays of the pectorals and hence short of the tip of the snout; the anterior pectoral rays of the two sides are either close together anteriorly or are farther separated. Characters otherwise as in *Raja*.

Type species, *Breviraja colesi* Bigelow and Schroeder, sp. nov.

Only one of the many species of the family previously described (*i. e.*, the *Raja plutonia* of Garman [1881]) is known with certainty to fall in this new genus. But the Cuban collections of the ATLANTIS include several new species that belong here, one of which is described below as type of the genus; the description and naming of the others will be postponed until a later occasion.

<sup>6</sup> From the latin "brevis," and *Raja*, the generic name of typical skates.

*Breviraja colesi*, sp. nov.

Figures 2 (upper left), 6

*Distinctive Characters.* Two characters, namely the lack of enlarged thorns in the mid-dorsal belt of the disc between the scapular region and the pelvic girdle, and a coloration which includes brownish roundish spots (some spots on the adult having pale centers), set off *B. colesi* from *B. plutonia* (Garman 1881), the only other skate yet described from the western Atlantic with pectoral rays extending forward beyond the rostral process.

*Description.* Proportional dimensions in per cent of total length. Female, type, 333 mm. long, and 160 mm. wide. Harv. Mus. Comp. Zool. No. 36374.

*Disc:* length 45.9; breadth 48.0.

*Snout length in front of:* orbit 9.8; mouth 11.2.

*Orbits:* longest diameter 4.5; breadth between 3.0.

*Spiracles:* length 2.8; breadth between 5.7.

*Mouth:* breadth 6.3.

*Nostrils:* breadth between 6.6.

*Gill openings:* distance between 1st 13.6; 5th 6.6; lengths 1st 1.8; 3rd 1.8; 5th 1.5.

*Distance:* snout to cloaca (middle) 41.4; cloaca (middle) to tip of tail 58.6.

*First dorsal fin:* vertical height 1.5; length of base 3.6.

*Second dorsal fin:* vertical height 1.5; length of base 3.6.

*Interspace between:* 1st and 2nd dorsals 0.0; 2nd dorsal and tip of tail 1.5.

*Pelvics:* length of anterior margin, 10.2.

Disc 1.05 times as broad as long, its anterior angle (snout to level of anterior end of rostral process)  $135^\circ$ , the anterior margins, outer corners, outer posterior margins, posterior corners and inner margins of disc all rounded, the outer corners most broadly so, the axis of greatest breadth 70% of the distance back from tip of snout toward axils of pectorals. Rostral process short, triangular, forming an angle of  $40^\circ$  (x-ray), extending rigidly for only  $\frac{2}{3}$  of the distance from center of mouth toward tip of snout. Pectoral rays extending forward well in advance of rigid rostral process. Snout blunt, with a small protuberance at tip, its length in front of orbits 2.16 times as long as orbit, its length in front of mouth 1.7 times as long as distance between nostrils. Orbit 1.5 times as long as distance between orbits and 1.6 times as long as spiracle. Mouth bowed centrally. Posterior margin

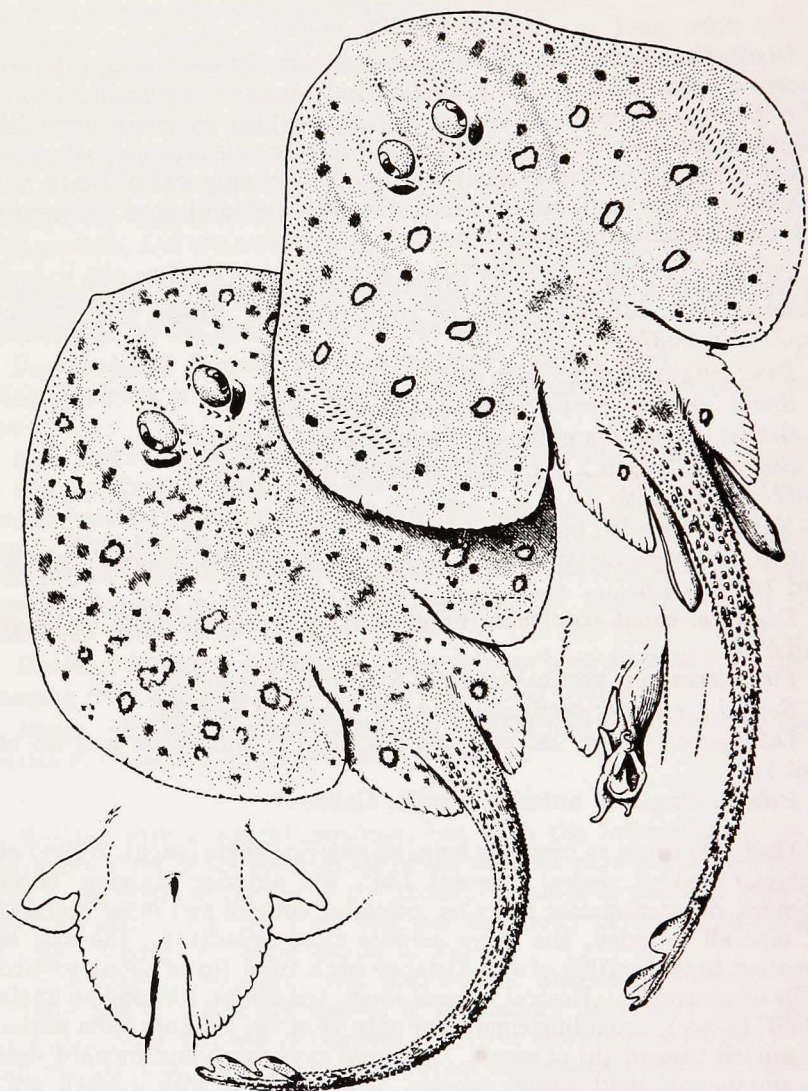


Figure 6. *Breviraja colesti*, sp. nov., female, type, 333 mm. long, and pelvic fins (Harv. Mus. Comp. Zool. No. 36374). Male, 320 mm. long (Harv. Mus. Comp. Zool. No. 36447); and clasper of a mature male; all  $\times 0.5$ .

of nasal curtain prominently fringed, the outer posterior margin of nostril finely so. Distance between 5th gill openings equal to distance between nostrils.

Teeth in 50 series in upper jaw, probably about the same in lower, close set, in quincunx, with a very small cusp on an ovate base.

Pelvics deeply notched, the anterior lobe with two radials besides the first stout one, which has three segments, its posterior margin slightly wavy, its anterior margin about  $\frac{2}{3}$  as long as distance from origin of pelvic to rear tip of lobe; the posterior lobe with 24 radials, its outer margin weakly scalloped and moderately convex, its inner margin nearly straight. Tips of pelvics narrowly rounded, extending back about  $\frac{3}{8}$  of the distance from axils of pectorals toward 1st dorsal.

Tail slender, its length from center of cloaca to origin of 1st dorsal 1.2 times as long as from tip of snout to cloaca, its length to 2nd dorsal 1.3 times and to tip 1.4 times. Dorsals confluent, the base of 1st dorsal as long as base of 2nd. Length of caudal membrane about  $\frac{2}{5}$  as long as base of 2nd dorsal. A thin and narrow lateral fold, originating on each side of tail a little beyond tips of pelvics, widens somewhat posteriorly and continues to extreme tip.

Upper surface of disc, including skin over eyes, rough with small close-set prickles except at margins around posterior angles where they are sparse. A narrow band of very small thorns (slightly larger than the prickles) along anterior margin from level of spiracles forward; a patch of small thorns over end of rostral process about  $\frac{2}{3}$  of distance from orbits toward tip of snout; inner margin of orbit to spiracle with 10 or 11 thorns, the row interrupted opposite middle of orbit; a median pair of thorns on nuchal region a little posterior to spiracles; 4 or 5 small thorns on each scapular region. An interrupted row of small thorns along midline of back—6 from the nuchal region to pectoral girdle, 6 more widely spaced to the level of the axils of pelvics, followed by 44 more closely crowded and less regularly arrayed along the tail to the origin of the 1st dorsal. Each side of tail with 2 or 3 irregular rows of larger thorns that become increasingly crowded rearward, and with smaller thorns extending from the level of 1st dorsal to the tip. Dorsals prickly on anterior half or  $\frac{2}{3}$  of fins. Pelvics with a few small prickles on central part of posterior lobe. Disc and tail smooth below.

*Color.* Upper surface of disc pale brown mottled with numerous irregular spots and blotches of darker brown, its outer part also with a variable number of larger roundish spots with pale centers and brown margins, one being situated on the center of each posterior pelvic lobe. Tail with various pale brown markings, some appearing as faint crossbars, its lateral membranous folds whitish. Upper

anterior part of each dorsal and anterior base of 1st dorsal with a bronze blotch. Lower surface of disc and of tail pale yellowish or whitish.

*Additional Specimens.* An immature female 150 mm. long has only 5 or 6 thorns around the inner margin of the orbit, 3 median thorns from the nuchal region to the pectoral girdle, and one only over each scapular region; the thorns on the tail are in more regular rows than in the adult female, and there are 7 or 8 obscure cross bars on the tail. A mature male 320 mm. long has the anterior margin of the disc slightly concave opposite and posterior to the spiracles, the outer angle of the pectorals are more broadly rounded and the tips of the pelvics are more narrowly rounded than on the female; also the tail is longer (1.6 times as long from center of cloaca to tip as from snout to cloaca). The outer margins of the disc opposite and in front of the orbits are armed with malar thorns, slightly larger than the prickles, and there are 2 to 3 rows of alar spines near the outer angles of the pectorals, the extreme length of the rows being a little greater than the distance between the outer ends of the spiracles. The male resembles the female in general coloration, but it has fewer blotches and spots and lacks the blotch at the base of the first dorsal.

*Developmental Stages.* Nothing is known except that a very young specimen, with disc only 43 mm. wide, bears a close resemblance to the adults.

*Size.* This species apparently does not reach a length of more than 400 mm., the largest female taken being 333 mm. long, while a mature male was only 320 mm. We have eight specimens of this species, four males and four females, 80 to 333 mm. in total length, with discs 43 to 160 mm. wide, all trawled by the research vessel ATLANTIS.

*Habits.* All specimens thus far known have been trawled in depths ranging from 200 to 285 fathoms.

*Range.* Known from Cochinas Bay on the south coast of Cuba, and off Matanzas and Santa Clara Provinces of the north coast.

## FAMILY TORPEDINIDAE

### ELECTRIC RAYS WITH TWO DORSAL FINs

#### *Diplobatis*, GEN. NOV.<sup>7</sup>

Figures 7, 8 (right), 9

*Generic characters.* Torpedinidae with each nostril subdivided about midway of its length into two separate apertures by a cross bridge of

<sup>7</sup> διπλοος, double, referring to the structure of the nostril, and βατις, a skate or ray.

stiff tissue; outer aperture exposed but the inner entirely roofed over by the joint nasal curtain. *Diplobatis* falls with *Narcine* in most of its other characters; *i. e.*, narrow protractile mouth with labial cartilages at the corners, normally developed eyes with rather prominent orbits, relatively long tail with lateral folds, pelvics entirely separate one from the other and free from the sides of the tail at their extreme tips, and nasal curtain much wider than long. However, the relationship of its tooth bands to its thick, fleshy lips affords a second generic charac-

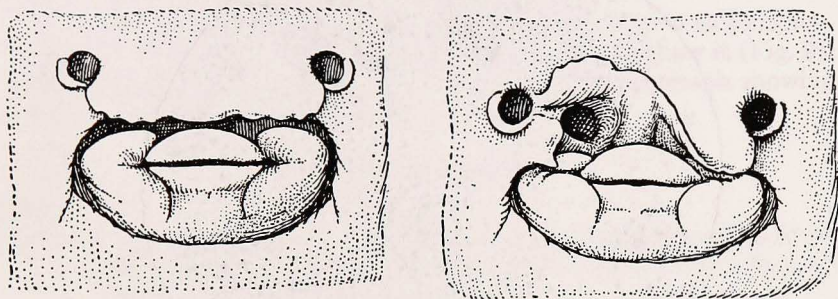


Figure 7. *Diplobatis ommata*, female, about 98 mm. wide; left, mouth and nostril with nasal curtain lifted only enough to show shape of upper lip; right, with right-hand side of nasal curtain rolled back to show the transverse division of the nasal aperture.  $\times 2.75$ .

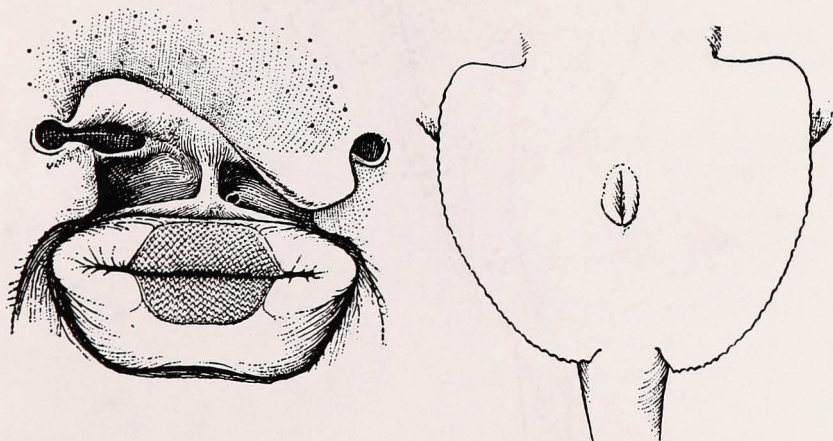


Figure 8. Left, *Narcine brasiliensis*, specimen 218 mm. wide, mouth and nostril with nasal curtain rolled back to show single nasal aperture, and extension of dental bands over the lips,  $\times 1.33$ ; right, *Diplobatis ommata*, ventral view of pelvic fins of female, about 98 mm. wide,  $\times 0.7$ .

ter; its teeth are entirely concealed when the mouth is retracted and closed, while the median sector of each lip, corresponding in its side-wise extent to the sidewise extension of the tooth bands within the mouth, is marked off at either end by a deep transverse groove when

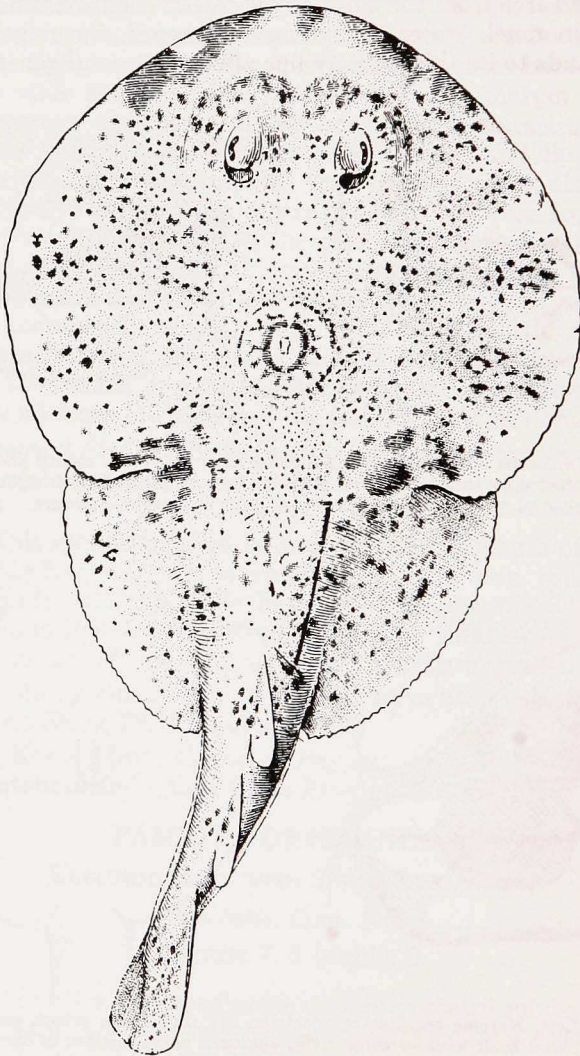


Figure 9. *Diplobatis ommata*, female, about 98 mm. wide, to show color pattern.

the mouth is retracted. In all other genera of the family in which the mouth is protractile,<sup>8</sup> the tooth bands extend so far forward and the median sectors of the lips are so thin (anteroposteriorly) that several of the anterior rows of teeth are fully exposed even when the mouth is tightly closed. And in them the lips are not crossed by definite transverse grooves corresponding with the lateral limits of the tooth bands, even when the mouth is fully retracted (Fig. 8). The type species is *Discopyge ommata* Jordan and Gilbert (1890), of which *Narcine ommata* Clark (1936) appears to be a synonym; Pacific Coast of America, Gulf of California to Panama.

The color pattern of this interesting little electric ray is so conspicuous and so characteristic that we include a drawing to show it (Fig. 9); see Beebe and Tee-Van (1941, pl. 1, Fig. 2.) for a photograph showing a very similar pattern for a male specimen.

## REFERENCES

## BEAN, B. A. AND A. C. WEED

1909. Description of a new skate (*Dactylobatus armatus*) from deep water off the southern Atlantic Coast of the United States. Proc. U. S. nat. Mus., 36: 459-461, pl. 38.

## BEEBE, C. WILLIAM AND JOHN TEE-VAN

1941. Eastern Pacific Expeditions of the New York Zoological Society. XXVIII. Fishes from the tropical eastern Pacific. [From Cedros Island, Lower California, south to the Galápagos Islands and northern Peru]. Part 3. Rays, mantas and chimaeras. Zoologica, N. Y., 26: 245-280.

## CLARK, H. W.

1936. The Templeton Crocker Expedition of the California Academy of Sciences, 1932. New and noteworthy fishes. Proc. Calif. Acad. Sci., (4) 21: 383-396.

## GARMAN, S. W.

1877. On the pelvis and external sexual organs of selachians, with especial references to the new genera *Potamotrygon* and *Disceus* (with descriptions). Proc. Boston Soc. nat. Hist., 19: 197-215.
1881. Reports on the results of dredging, under the supervision of Alexander Agassiz, along the Atlantic Coast of the United States. Report on the selachians. Bull. Mus. comp. Zool. Harv., 8 (11): 231-237.
1913. The Plagiostomia (sharks, skates, and rays). Mem. Harv. Mus. comp. Zool., 36: i-xiii + 1-515; Atlas, 75 pls.

## GÜNTHER, ALBERT

1870. Catalogue of the fishes in the British Museum. Taylor and Francis, London, 8. xxv-549 pp.

## HENLE, F. G. J.

1834. Ueber *Narcine*. G. Eichler, Berlin. 44 pp., 4 pls.

<sup>8</sup> Genera *Narcine*, *Benthobatus*, *Discopyge*, and *Heteronarce* (probably).



**HILDEBRAND, S. F.**

1946. A descriptive catalog of the shore fishes of Peru. Bull. U. S. nat. Mus., 189: 1-530.

**JORDAN, D. S. AND C. H. GILBERT**

1890. In D. S. Jordan and C. H. Bollman: Scientific results of explorations by the U. S. Fish Commission Steamer Albatross. IV. Descriptions of new species of fishes collected at the Galápagos Islands and along the coast of the United States of Colombia, 1887-88. Proc. U. S. nat. Mus., 12: 149-183.

**LINNÉ, CARL VON**

1758. Systema naturae per regna tria naturae . . . editio decima, reformata. Laurentii Salvii Holmiae. 1. 824 pp.

**MÜLLER, JOHANNES AND JOKOB HENLE**

1841. Systematische Beschreibung der Plagiostomen. Von Veit und Comp., Berlin. xxii-200 pp., 60 pls.

**NORMAN, J. R.**

1937. Coast fishes. Part II. The Patagonian region. 'Discovery' Rep., 16: 1-150, pls. 1-5.

**REGAN, C. T.**

1914. Fishes. Nat. Hist. Rep. Brit. Antarc. ("Terra Nova") Exped. 1910-1913. Zool., 1: 1-54, pls. 1-13.

**VON BONDE, C. AND D. B. SWART**

1924. The platysomia (skates and rays) collected by the S. S. "Pickle." Rep. Fish. Mar. Biol. Surv., S. Afr. (1922) 3, Spec. Rep. 5: 1-22.

**WHITLEY, G. P.**

1931. Studies in ichthyology. 4. Rec. Aust. Mus., 18 (3): 96-133, pls. 11-16.