

AMERICAN MUSEUM NOVITATES

PUBLISHED BY THE AMERICAN MUSEUM OF NATURAL HISTORY
CITY OF NEW YORK FEBRUARY 9, 1950 NUMBER 1451

A REVISION OF NORTH AMERICAN SHARKS ALLIED TO THE GENUS *CARCHARHINUS*¹

BY STEWART SPRINGER

Unpublished results of field studies made at Bimini in 1948 and in the Gulf of Mexico and the Caribbean in 1948 and 1949 have provided new indications of phylogenetic relationships of carcharhinid sharks and permit a fresh approach to the taxonomic problems of the group. Subdivision of *Carcharhinus* by the particular alternative character, the presence or absence of a middorsal skin ridge, was first used as a criterion for the identification of species of *Carcharhinus* by Nichols and Breder² (1927, pp. 15-16), and was noted by Bigelow and Schroeder (1948, p. 322) as the only one that might form a basis for a sharp-cut subdivision of the genus. This splits *Carcharhinus* into two major groups that coincide with groups recognizable from the point of view of ecology. However, both subgroups become more convenient categories with further revision. The partial revision of the genera undertaken here is necessarily made with little reference to species of regions outside the western north Atlantic. It is hoped that the outline of characteristics will encourage and aid work towards a complete revision of the Carcharhinidae into convenient natural categories. Incomplete lists of species found

¹ A contribution of the Lerner Marine Laboratory of the American Museum of Natural History.

² Partly in error for *Carcharhinus obscurus* noted as having "no ridge on back." *Eulamia obscurus* (= *Carcharhinus obscurus*) has frequently been confused with *Carcharhinus leucas* (= *C. commersonii*), a species without a middorsal ridge, in identification of specimens from the northeastern coast of the United States. Both forms occur in the vicinity of New York Harbor, but this is near the northern limit of the range of *leucas*.

outside the western north Atlantic and referred to genera discussed here are made up from results of examinations of some specimens in the collection of the United States National Museum, a small collection made by Price M. French on the Pacific coast of Panama, and also from the literature but with particular reference to publications of Bigelow and Schroeder (1948), Whitley (several reports, see bibliography), and Beebe and Tee-Van (1941).

KEY TO WESTERN NORTH ATLANTIC GENERA OF
CARCHARHINIDAE WITHOUT SPIRACLES

1. Labial grooves extending along the sides of the jaws for a distance as great, or nearly as great, as one-half the diameter of the eye. *Scoliodon* Müller and Henle
Labial grooves very short or absent. 2
2. No trace of a ridge in the skin between the first and second dorsal fins. 3
Middorsal ridge present (in fresh or well-preserved specimens). 6
3. Second dorsal fin relatively small, its area much less than half the area of the first dorsal. 4
Second dorsal fin large, its area nearly half as great, or in some cases nearly as great, as the area of the first dorsal. 8
4. Midpoint of base of first dorsal nearer to insertion of pelvics than to axil of pectoral. *Prionace* Cantor
Midpoint of base of first dorsal nearer to axil of the pectoral than to insertion of the pelvics. 5
5. Upper jaw teeth finely or coarsely serrate; gill slits of moderate length, the longest less than half the length of the base of the first dorsal. *Carcharhinus* Blainville
Upper jaw teeth smooth edged; gill slits relatively long, the longest nearly half the length of the base of the first dorsal. *Aprionodon* Gill
6. Tips of pectorals and of the first dorsal broadly rounded in adults. *Pterolamia*, new genus
Tips of pectorals and first dorsal acuminate. 7
7. Cusps of upper jaw teeth serrate. *Eulamia* Gill
Cusps of upper jaw teeth smooth, bases dentate. *Hypoprion* Müller and Henle
8. Snout short and broadly rounded. *Negaprion* Whitley
Snout relatively long, pointed. *Isogomphodon* Gill

GENUS ISOGOMPHODON GILL

Isogomphodon GILL, 1862, Ann. Lyc. Nat. Hist. New York, vol. 7, p. 401; type species, *Carcharias oxyrhynchus* Müller and Henle, 1841.

The type species, *oxyrhynchus*, is not well known. It differs from its western Atlantic relatives in having a larger number of tooth rows, 49 in the upper jaw of the type. The teeth are similar in the upper and lower jaws, serrate, and have narrow

cusps on broad bases. The type species is also characterized by a relatively large second dorsal fin, broad pectorals, and a pointed snout. In addition to the type species, the genus probably includes the oriental *Carcharias temminckii* of Müller and Henle.

GENUS **NEGAPRION** WHITLEY

Negaprion WHITLEY, 1940, Fishes of Australia, Part 1, The sharks, etc., Sydney, p. 111; type species, *Aprionodon acutidens queenslandicus* Whitley, 1939, Australian Zool., vol. 9, p. 233.

Species referred to *Negaprion* are *Aprionodon queenslandicus* of Whitley, *Carcharias acutidens* of Rüppell, and *Hypoprion brevirostris* of Poey. *Carcharias fronto* of Jordon and Gilbert is regarded as a synonym of *brevirostris*.

GENUS **APRIONODON** GILL

Aprionodon GILL, 1862, Ann. Lyc. Nat. Hist. New York, vol. 7, pp. 400, 401, 411; type species, *Aprionodon punctatus* Gill, equals *Carcharias isodon* Müller and Henle, 1841.

Aprionodon is represented in the western north Atlantic by the type species, *isodon*, a form rare in collections. This shark has appeared in relatively large numbers in less than 10 fathoms off Salerno, Florida, during December and January in 1945, 1947, 1948, and in January, 1949, but has not been taken in other months. No doubt the species appears every year, but adults are too small to be of interest to the commercial fishery and runs last only a few days, usually during the Christmas holidays. It appears likely that *Aprionodon* is common for short periods from Long Island to Texas and that winter runs on the Florida coast are a phenomenon of the breeding cycle.

In a sample of 20 adult females of *Aprionodon* taken off Salerno on December 28, the total length ranged from 58 to 61 inches. Of this lot, 13 had from one to six embryos, 17 to 19 inches long. The seven remaining had ovarian eggs about 15 mm. in diameter and enlarged flaccid oviducts indicating recent birth of young. In other collections at Salerno, adult males from 55 to 60 inches long were taken. It is evident from this and other data that the *Aprionodon* of the Florida runs produce typically six young about 19 inches long in December and January, and that a yolk-sac placenta is formed during the development of the embryos. Schools of adults of either sex appear in inshore waters near Salerno, but mixed schools have not yet been encountered.

Immature *Aprionodon* have been taken on hook and line by the writer, although uncommonly. These were caught at night in anchorages on the west coast of Florida and on the coast of Mississippi and gave the impression of being timid or uninterested feeders. The Salerno adults were taken by gill nets of a type infrequently used in the southeastern states. From fishing experience and from the various records available, there is neither positive nor negative evidence that *Aprionodon* is absent from moderate depths on the southeastern coasts at any season, nor is there evidence that the species migrates for long distances. Mature specimens from the Gulf of Mexico have not been taken for examination nor are they mentioned in the literature. As a complication, comparison of new-born summer young from the coast of Texas with winter late embryos from Salerno indicates that there are two American forms of *Aprionodon* and that the Texas and north Gulf of Mexico population may represent an undescribed species. This illustrates a condition frequent in tropical carcharhinid sharks, in that structurally differing but closely allied pairs of forms occur and that a feature of this kind of complex is a winter breeding season for one form and a summer breeding season for the other. For the few well-known species, gestation periods for tropical carcharhinid sharks are more than six months. But since the geographical ranges of pairs of forms overlap and since the meager life history data have not been correlated with minor structural differences, the status of these pairs of forms has not been determined.

Aprionodon differs from *Carcharhinus*, as defined here, only in that it has longer gill slits and smooth-edged teeth. It is structurally close to the black-tips included in *Carcharhinus*. A generic arrangement (as here) that leaves the black-tips in the genus *Carcharhinus* while placing the smooth-toothed sharks in a separate genus, *Aprionodon*, is admitted to be unsatisfactory. But because of the large number of inadequately described species of these genera, it seems undesirable to attempt further revision without examination of representative material from regions other than the western north Atlantic.

GENUS **CARCHARHINUS** BLAINVILLE

Carcharhinus BLAINVILLE, 1816, Bull. Soc. Philom. Paris, vol. 8, p. 121; 1816, Jour. Phys. Chem. Hist. Nat., vol. 83, p. 264; in Vieillot, 1825, Faune Française, p. 88; type species, *Carcharhinus commersonii* Blainville, 1816, 1825.

Since *commersonii* is a compound of *leucas* of Müller and Henle and *longimanus* of Poey, *Carcharias leucas* Müller and Henle is designated the genosyntype.

GENERIC CHARACTERS

Carcharhinidae without spiracles; caudal peduncle without lateral ridges; precaudal pits above and below, the upper usually stronger; first dorsal fin approximately triangular, its apex not broadly rounded in adults; second dorsal fin much smaller than first dorsal, its area less than half the area of the first dorsal; upper labial grooves short or obsolete, no lower labial grooves; no ridge in the skin between the two dorsal fins; midpoint of base of first dorsal nearer the axil of the pectoral than the insertion of the pelvics; gill openings moderate, the longest less than half the length of the base of the first dorsal; eyes relatively small; development viviparous, a yolk-sac placenta formed; number of young at birth fewer than 16, moderately large in comparison with the adult; teeth of upper jaw with finely or coarsely serrate cusps.

DISCUSSION

Carcharhinus includes several natural subgroups and remains the repository for an assortment of poorly defined forms of uncertain relationship. Its separation from either *Aprionodon* or *Prionace* is not clear cut. The black-tips of tropical America, *Carcharhinus limbatus* (Müller and Henle), *C. maculipinnis* (Poey), and *C. aethalorus* (Jordan and Gilbert), appear to be representative of a group with world-wide distribution in tropical seas. The Pacific species *aethalorus* is close to *maculipinnis* in size and in the shape of the teeth of the lower jaw. The status of the smaller Pacific black-tip is uncertain. It has been described as *Carcharhinus natator* Meek and Hildebrand, but evidently the populations on the Atlantic and Pacific sides of Panama show no structural differences. The Florida-Antillean *C. limbatus* in series comparison with Texas specimens of similar size has a longer snout and extremes from the two localities are quite different in superficial appearance. The available evidence suggests that *natator* is a subspecies of *limbatus* and that its range extends from unknown limits in Pacific tropical American waters along the Atlantic mainland coasts from the Orinoco to the Mississippi where it intergrades with the typical *limbatus*. The Atlantic American black-tips are active sharks that tend to form large migratory schools.

Summer and winter ranges of these species have not yet been defined, and specimens have not been taken in deep water.

Small species of *Carcharhinus* such as *C. acronotus* (Poey) and *C. porosus* Ranzani are not well known, and their relationships are not clear. These two species are littoral. Both show strong habitat preference, *porosus* for mud bottom near the mouths of large rivers from the Mississippi to the Amazon, and *acronotus* for sand or coral mud bottom from Pensacola through the West Indies to the coast of South America. *Carcharhinus velox* Gilbert, from the Pacific coast of Panama, is the only member of the genus known to me that has transverse nasal apertures.

The type species, *Carcharhinus leucas*, is a large (adults 7 to 9 feet long), heavy-bodied, blunt-headed, and small-eyed form that is common in shallow water and reaches peak abundance near the mouths of large rivers during its summer breeding season. The young frequent bays and are more common where the water is slightly brackish. The adults appear in great concentration near the mouth of the Mississippi from May through July and produce their young there. The species disappears from inshore waters of the north Gulf of Mexico with the onset of cold weather and becomes relatively more abundant then along the Florida coast in the vicinity of the Florida Keys. At the mouth of the Orinoco River adults are found in considerable numbers, but there and in the Caribbean data are not available to show whether the species is migratory. *C. nicaraguensis* (Gill and Bransford) of Lake Nicaragua and *C. azureus* (Gilbert and Starks) are closely allied to *leucas*. The oriental *Carcharhinus gangeticus* (Müller and Henle) also probably belongs to this group.

GENUS **PRIONACE** CANTOR

Prionace CANTOR, 1849, Jour. Asiatic Soc. Bengal, vol. 18, p. 1381; type species, *Squalus glaucus* Linnaeus, 1758.

This form has not been certainly reported from the coasts of Florida, the Gulf of Mexico, or the Caribbean. About Florida and the Bahamas the partly pelagic ridge-back *Eulamia floridanus* may occasionally be confused with it.

GENUS **SCOLIODON** MÜLLER AND HENLE

Scoliodon MÜLLER AND HENLE, 1837, Sitz. Ber. Akad. Wiss., Berlin, p. 114; 1841, Systematische Beschreibung der Plagiostomen, p. 28; type species, *Carcharias (Scoliodon) laticaudus* Müller and Henle, 1837.

The tropical Atlantic American species, *Scoliodon terra-novae* (Richardson) and *S. lalandii* (Müller and Henle), have an overlapping distribution. However, the writer has observed unmixed breeding populations of *terra-novae* on the Mississippi coast and of *lalandii* near the mouth of the Orinoco. Bigelow and Schroeder (1948, pp. 295-303) include *lalandii* as a synonym of *terra-novae* and in their description state that the species has no middorsal ridge. A preserved specimen at hand of the sharp-snouted (*lalandii*) form shows a middorsal ridge clearly. Off Bimini, adults of the broad-snouted form (*terra-novae*) were taken at night at the surface several miles off the Bahama Bank shelf over a depth of more than 200 fathoms and were characterized by an interdorsal ridge as well as unusually vivid markings of white spots and white edges on the fins. On the other hand, my notes on examination of some fresh specimens of *terra-novae* from the Mississippi coast include the statement, "no interdorsal ridge." It seems evident that our present knowledge about *Scoliodon* is not sufficient to make use of the skin ridge as a specific character or to reach the conclusion that the morphological differences of western north Atlantic specimens result from variation within a single species.

PTEROLAMIA, NEW GENUS

TYPE SPECIES: *Squalus longimanus* Poey (1861, *Memorias*, vol. 2, p. 338); *Prionodon longimanus* Poey (1861, *Memorias*, vol. 2, pl. 19, figs. 9, 10).

GENERIC CHARACTERS

Carcharhinidae without spiracles; caudal peduncle without lateral ridges; first dorsal fin rounded at its apex in adults as well as in young; a ridge in the skin between the dorsal fins, often inconspicuous but present at all ages; second dorsal fin much smaller than the first dorsal; pectoral fins very long, their tips rounded in adults; teeth of upper jaw subtriangular, their outer margins progressively more concave towards the angles of the jaws, serrate; teeth of lower jaw narrower on broad bases, erect, cusps finely serrate.

DISCUSSION

Apparently *longimanus* is the only species described from the western north Atlantic. A second species, probably belonging to

this genus, is *Carcharias insularum* of Snyder, described from the Hawaiian Islands. *Pterolamia longimanus* is a little-known, pelagic species.

GENUS *EULAMIA* GILL

Eulamia GILL, 1862, Ann. Lyc. Nat. Hist. New York, vol. 7, p. 401 (name), p. 410 (diagnosis); type species, *Carcharias (Prionodon) milberti* Müller and Henle, 1841.

GENERIC CHARACTERS

Carcharhinidae without spiracles; caudal peduncle without lateral ridges; nasal apertures oblique; first dorsal fin not rounded at the tip in adults; a ridge in the skin extending for some part of the distance between the first and second dorsal fins¹; second dorsal fin much smaller than the first dorsal; pectorals strong (stiff), narrow and falcate in the young, falcate or not falcate in adults, their tips acuminate; teeth of upper and lower jaws dissimilar; teeth of upper jaw with wider cusps, the cusps somewhat flattened, with serrate edges, frequently but not always subtriangular; teeth of lower jaw with narrow lanceolate cusps on broad bases, serrate or finely serrate; viviparous species, fewer than 16 proportionately large young to the litter, a yolk-sac placenta formed; moderate to large species, adults of species of the western north Atlantic 6 to 12 feet long.

KEY TO *Eulamia* OF THE WESTERN NORTH ATLANTIC

1. Denticles imbricate; pectoral fins of adults notably falcate; second dorsal fin low, its area much less than the area of the anal fin. 4

¹ The ridge-backs are not only difficult to identify but are not well known. Some of the confusion in the classification of the Carcharhinidae comes from failure to recognize the ridge as a reliable, convenient, and therefore important characteristic of a natural group. The ridge is not conspicuous but is always discernible in fresh specimens of *Eulamia*. Specimens exposed to the sun after death for a prolonged period or specimens preserved in such a way that the skin shrinks or stretches may fail to show the ridge. The type specimen of *Carcharias lamiella* Jordan and Gilbert is an immature example and does not now show any indication of the presence of a middorsal ridge. Nevertheless, in the opinion of the writer, *lamiella* is a ridge-back form and properly in the genus *Eulamia* as restricted here. It is unfortunate that young specimens of large carcharhinid sharks are difficult to identify or are unidentifiable if poorly preserved, especially since nearly all type specimens of the larger forms are late embryos or young. It is suggested that the weakness in the system of definition of species in this group can best be remedied by more thorough description and diagnosis based on series including adults.

- Denticles not imbricate; pectoral fins of adults with only slight concavity of distal margins; second dorsal fin relatively high, its area as great, or nearly as great, as the area of the anal fin.....2
2. Length of snout (from front of mouth) of adults less than width of mouth; origin of first dorsal in advance of the free inner posterior angle of the pectoral; large teeth of the first two rows of the upper jaw, counting from the symphyseals, about as high as the width of their bases.....3
- Length of snout (from front of mouth) of adults about equal to width of mouth; origin of first dorsal over, or nearly over, the free inner angle of the pectoral; large teeth of the first two rows of the upper jaw, counting from the symphyseals, about one and one-half times as high as the width of their bases.....*Eulamia altima*, new species
3. Denticles heavy, with strong ridges, close set, not showing much skin area between denticles; American range, north and northeast coasts of South America, and probably the coast of Central America in the Caribbean as far as the Yucatan Channel.....*Eulamia plumbeus* (Nardo)
- Denticles lighter in structure, with wider spaces between; range, Atlantic coast of the United States from Cape Cod to the Bahamas, Cuba, and the east Gulf of Mexico, probably migratory throughout its range.....*Eulamia milberti* (Müller and Henle)
4. Number of tooth rows in half the upper jaw and not including the symphyseals typically 13 or 14, rarely 12 or 15; pectoral fins thin, light in weight. 5
- Number of tooth rows in half the upper jaw and not including the symphyseals typically 15 or 16, frequently 14 (in *obscurus*) or 17 (in *floridanus*) but never 13; pectoral fins heavy.....6
5. Second dorsal fin low, free corner of fin more than twice as long as vertical height of fin.....*Eulamia falciformis* (Müller and Henle)
- Second dorsal fin higher, its free corner less than twice as long as its vertical height.....*Eulamia springeri* Bigelow and Schroeder
6. Denticles small, their ridges and apical points weak, skin relatively smooth; larger teeth of the upper jaw usually notched on both margins, serration coarser and stronger at the notches; second dorsal fin low.....*Eulamia floridanus* (Bigelow, Schroeder, and Springer)
- Denticles large, their ridges and apical points strong, skin relatively rough; teeth of upper jaw notched on their outer margins; second dorsal fin higher.....*Eulamia obscurus* (Lesueur)

***Eulamia altima*, new species**

HOLOTYPE: An immature female, 52 inches long, taken off Cosgrove Reef, Florida Keys, April 2, 1947, in 95 fathoms, U.S.N.M. No. 133828.

DESCRIPTION: A *Eulamia* with a ridge in the skin extending for some part of the distance between the two dorsal fins; head long; snout long, its length from the front of the mouth about equal to the width of the mouth, its tip broadly rounded, but little flattened; nasal apertures oblique, large, located about halfway between the tip of the snout and the orbit, set in longitudinal

depressions or channels about as wide as the apertures; nasal flap moderate, not very slender or pointed; eyes moderate, the diameter about equal to one-half the height of the first gill opening; gill slits moderate, the first four of nearly equal height, the fifth shorter by one-third; pectoral fins moderately wide, slightly falcate (holotype is immature; adults have pectorals not notably falcate), inserted under fourth gill opening; first dorsal fin moderate, its apex not broadly and regularly rounded, its origin near a vertical through the free inner posterior angle of the pectoral; second dorsal fin not very low, its area only a little less than the area of the anal; anal fin with a deep notch; insertion of the pelvic fins nearer the base of the anal than the base of the first dorsal; denticles small, not imbricate, without projecting points, with three ridges and sometimes with two additional lateral ridges visible under higher magnifications; teeth of upper jaw in 15-2-15 rows; teeth of lower jaw in 14-1-14 rows; upper symphyseals hooked, their cusps almost crossing; teeth of upper jaw serrate, the first two rows, counting from the symphyseals, isosceles about one and one-half times as high as the width of their bases; the teeth of rows 5 to 8 of the upper jaw with wider bases and with cusps slightly inclined towards the angles of the jaws, their height as great as, or greater than, the width of their bases; the teeth of rows 9 to 15 of the upper jaw progressively lower, smaller, and with deeper lateral notches; teeth of lower jaw with narrow cusps on broad bases, erect, very finely serrate; color in life light gray above, whitish below, lower sides of pectoral tips darker.

DIAGNOSIS: *Eulamia altima* is a large species. The mean total length of 11 adult males from Bimini and south Florida was 94.6 inches (85 to 105 inches), and the mean length of 15 adult females was 99.8 inches (89 to 111 inches). The species resembles *E. milberti*, although it is slightly larger. It is sufficiently different in outward appearance so that it has acquired a common name, Knopp's Shark, in the Florida shark fishery where it makes up a substantial portion of the catch from bottom-set lines in more than 50 fathoms. The head and snout of *altima* are longer than in *milberti*, and the first dorsal fin is not so high. The comparatively longer head, shorter post-pelvic trunk, the longer snout with prominent nasal channels, in combination with the high erect teeth, triangular near the symphyseals, serve to set *altima* off from all the other ridge-backs of the Caribbean region. The teeth of *altima* are very much like those of an adult specimen from

the Pacific coast of Panama provisionally identified as *E. galapagensis*, but in *altima* the snout is longer and heavier.

Eulamia altima belongs to the subdivision of the genus having non-imbricate denticles with more or less skin showing in the denticle interspaces. Skin samples from a point about midway between the pectoral and the first dorsal of an adult *altima* collected off Bimini had denticles approximately 0.3 by 0.4 mm. as compared to 0.45 by 0.7 for denticles from a similar sample of skin from *milberti*. Both *altima* and *milberti* show scattered, opaque, turquoise-colored denticles in living adults, but *altima* specimens have not been observed to exhibit the iridescent quality to be seen in the skin of living *milberti* out of water. Typical denticles of both species are five-ridged in adults, but in *altima* the lateral ridges are very weak, inconspicuous, and near the denticle rims. A form common on the north coast of South America, provisionally identified as *E. plumbeus*, differs from *milberti* in having larger, heavier, and more closely spaced denticles and is consequently well separated from *altima*.

The denticles of *Eulamia floridanus* are imbricate and have such weak ridges and points that the skin is smoother to the touch than the skin of *altima*. The denticles of other allied West Indian species, *falciformis*, *obscurus*, and *floridanus*, are imbricate and have strong ridges with posteriorly projecting points. Also, *falciformis*, *obscurus*, and *floridanus* differ from *altima* in having lower second dorsal fins and falcate pectorals as adults.

The dusky shark, *Eulamia obscurus*, is represented in the western north Atlantic and Caribbean region by two forms with overlapping geographical distribution, but the available material is not sufficient to show whether or not there are two species. The dusky shark is a large form that reaches maturity at a length of about 9 feet and attains lengths of more than 11 feet. The reef sharks, *falciformis* and *springeri*, need more study for determination of the status and characteristics of each form.

RANGE: *Eulamia altima* appears to be the most common large shark of the edges of the continental shelf in the West Indian region. It has been taken off Bimini, on the coast of Florida from off Cape Canaveral to Tortugas, off the coasts of Nicaragua and Costa Rica, and in the deep water in the Dragon's Mouth at the entrance to the Gulf of Paria. On the east coast of Florida both adults and immature have been taken off Fort Pierce in 75 fathoms. Embryos 24 inches long, seven in one litter and eight in

another, were collected in May off Salerno, Florida. Embryos 23 inches long were collected from the Dragon's Mouth in April. At Salerno, *altima* has been taken, although rarely, in depths as shallow as 20 fathoms. In the deeper parts of its range *altima* is often taken along with *Hypoprion signatus*, but apparently it is rare in depths as great as 200 fathoms or in lesser depths than 50 fathoms. It evidently does not frequent the surface as does the semi-pelagic *Eulamia floridanus*, nor are the young known to appear on the relatively shallow offshore banks as do the young of *floridanus*.

SPECIES REFERRED TO *Eulamia*

It seems probable that *Eulamia* as restricted here includes a larger number of species than any other genus of sharks. It is also very likely that a large number of species remain undescribed, and certainly many are inadequately described. These sharks are numerically dominant in the tropics and subtropics outside bays and shallows. Some species appear to be pelagic to a greater extent than generally realized. About Florida and northward they tend to form very large schools and are strongly migratory. Their movements are greatly influenced by water temperatures, and each species appears to have narrowly circumscribed preferences in habitat, nursery grounds, and feeding.

Very little of the literature on sharks outside the western north Atlantic includes descriptions sufficiently detailed to permit identification of sharks of this genus. An exception to this is some of the recent work of Whitley on sharks of Australia. However, *Eulamia* as used here is restricted to ridge-backed forms, whereas Whitley's comparable group is apparently the subgenus *Galeolamnoides* Whitley, 1934. The Australian species *Carcharias macrurus* of Ramsay and Ogilby, *Carcharias stevensi* of Ogilby, *Galeolamna eblis* of Whitley, and *Galeolamna dorsalis* of Whitley are among those that may belong in this genus as restricted. Australian species allied to *Eulamia* are evidently more numerous and varied than West Indian species and present a very difficult problem in classification, the more so since carcharhinid sharks of the rest of the Pacific are so little known. Notes on specimens examined by the writer and provisionally identified place the Pacific species *Carcharias lamiella* of Jordan and Gilbert, *Carcharias galapagensis* of Snodgrass and Heller, *Carcharias dussumieri* of

Müller and Henle, and *Carcharias japonicus* of Jordan and Fowler in this genus.

GENUS **HYPOPRION** MÜLLER AND HENLE

Hypoprion MÜLLER AND HENLE, 1841, Systematische Beschreibung der Plagiostomen, Berlin, p. 34; type species, *Carcharias (Hypoprion) maculoti* Müller and Henle, 1841, designated by Jordan and Gilbert, 1883, Bull. U. S. Natl. Mus., vol. 16, p. 61.

The distinction between *Hypoprion* and *Eulamia* has been made primarily on the basis of the structure of the teeth (see key to genera), but it seems probable that better generic definitions can be found. *Hypoprion signatus* Poey, the only species known from the western north Atlantic, is rarely taken in less than 100 fathoms, and its most striking feature in life is the presence of large green eyes. The fins of *signatus* are proportionately smaller than in species of *Eulamia*, and *signatus* has a longer and more pointed snout than any other large, West Indian, carcharhinid shark.

LITERATURE CITED

- BEEBE, WILLIAM, AND JOHN TEE-VAN
1941. Fishes from the tropical eastern Pacific. Part 2, Sharks. Zoologica, vol. 26, pp. 89-122, pls. 1-2.
- BIGELOW, HENRY B., AND WILLIAM C. SCHROEDER
1948. Fishes of the western north Atlantic. Mem. Sears Found. Marine Res., no. 1, pt. 1, pp. 59-546.
- NICHOLS, J. T., AND C. M. BREDER, JR.
1927. The marine fishes of New York and southern New England. Zoologica, vol. 9, pp. 1-192.
- WHITLEY, G. P.
1939. Taxonomic notes on the sharks and rays. Australian Zool., vol. 9, pt. 3, pp. 227-262, pls. 20-22.
1940. The fishes of Australia, Part 1, Sharks, etc. Sydney, Royal Zoological Society of New South Wales, pp. 1-280.
1943. Ichthyological descriptions and notes. Proc. Linnean Soc. New South Wales, vol. 68, pts. 3-4, pp. 114-144.
1944. New sharks and fishes from Western Australia. Australian Zool., vol. 10, pt. 3, pp. 252-273.

