

THE TARPON AND LADY-FISH AND THEIR RELATIVES

BY THEODORE GILL

Data respecting the habits of the tarpon and lady-fish are here brought together from widely distant sources and the little information at hand respecting the habits of their relative, the *Pterothrissus* of Japan, is added. The statements here collected, it is hoped, may serve as hints to observers respecting facts to be looked for in the biology of those fishes.

The morphological or rather chief osteological characteristics of the types here considered have been recently investigated and elucidated by Dr. W. G. Ridewood in a well illustrated article "On the Cranial Osteology of the Fishes of the Families Elopidae and Albulidae" published in the Proceedings of the Zoölogical Society of London for 1904 (vol. II, pp. 35-81). The illustrations are so good and so much to the point that they are here reproduced. They show well the distinctive characterers of the genera as well as the common characteristics which evince the relationship of the Elopids and Albulids and distinguish them from the Clupeids to which the former have so strong but illusive likeness.

THE TARPON AND ITS FAMILY

One of the most remarkable of the families of fishes is that of the Elopids, and of that family the tarpon of the Floridian waters is the most notable. Yet comparatively little is known of the habits of any of the species. Much—very much—has been written about the tarpon, but most of it has been of a personal or subjective nature and not about the fish itself. To elicit new facts and indicate desiderata is the object of the present article. What is known may be briefly summarized.

I

The family of the Elopids (Elopidae) is composed of a few living fishes which have much superficial resemblance to the herring family; they have a compressed fusiform body, covered by smooth silvery cycloid scales; the head is bony and scaleless; the mouth and jaws nearly like those of Clupeids and more or less oblique; the dorsal is submedian and the other fins are essentially like those of the

herrings. The distinctive characteristics are the very numerous (22-30) branchiostegal rays, an unpaired gular plate or intergular plate or bone (also called "jugular plate") between the rami of the lower jaw, and the development of the parietal bones so that they connect along the middle of the skull and consequently superficially separate the frontal bones from the supraoccipital; the supramaxil-

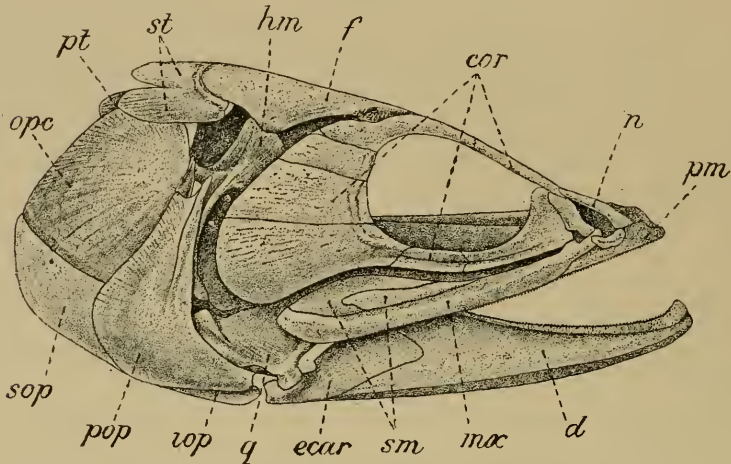


FIG. 1.—*Elops saurus*; skull from right side. (After Ridewood.)

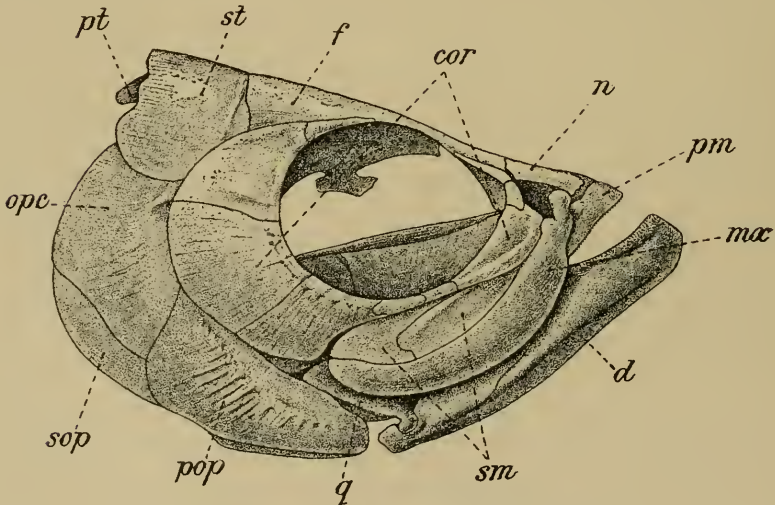


FIG. 2.—*Megalops cyprinoides*; skull from right side.

Figs. 1 and 2.—Elopoid skulls showing trend of mouth, composition of supramaxillaries (*sm.*), shape of circumorbital bones (*cor.*), etc. (After Ridewood.)

larvae are very large, each composed of three pieces, and mostly outside of but adjoining the suborbitals (*cor*); the circumorbitals are peculiarly modified, there being a well developed preorbital, followed by a narrow suborbital, above the supramaxillary, and then by broad ones beginning above the hinder portion of the supra-maxillary and continued back of the orbits. The parasphenoid bone is narrow.

The family of the Elopids, like that of the Chirocentrids, is a decadent one—one of the past rather than of the present. It was represented by numerous genera and still more numerous species during the Cretaceous epoch. Some of those were of large size, even exceeding the recent tarpon in dimensions, and almost all of them became extinct by the end of that period. The family was far less conspicuous during the Tertiary epoch, but as early as the Lower Eocene the still existing generic types *Elops* and *Megalops* made their appearance. At least remains of fishes found in the London Clay have been referred to these genera by A. Smith Woodward. Their later tertiary history is unknown.

The living species are few in number—only four—and belong to two very distinct groups which are usually considered the only genera—*Elops* and *Megalops*. These are distinguishable by a number of important characters.

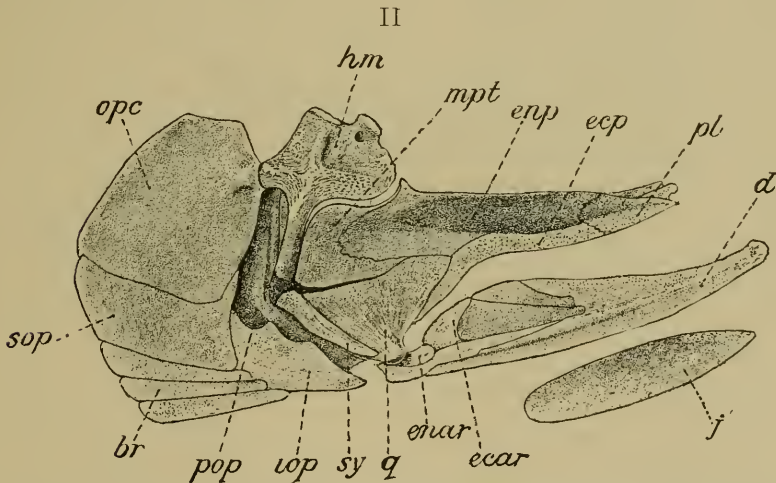


FIG. 3.—*Elops saurus*; hyopalatine arch, opercular bones, etc., with mandible; left side, mesial aspect. *j*, jugular plate, dorsal view. (After Ridewood.)

Elops, the genus which has given name to the family, has small scales, a small head, lower jaw not projecting, pseudobranchiæ

large, an oblong dorsal fin with the last ray not produced, and the anal fin small. Further, the head is slender and pike-like, the mouth not very oblique, the lower jaw especially slender and its articulation far behind, under the postorbitals, and the suspensorium angular, the hyomandibular being inclined backwards. It contains two species, the long known and wide-ranging *Elops saurus*, and the localized *Elops lacerta* of the Congo and western Africa.

The *Elops saurus* is common in the open sea along the coast of the southern United States and is best known as the ten-pounder, though it has received many other names.

The accepted name was current at least as early as the seventeenth century for Dampier, in his "Voyages to the Bay of Campeachy," for 1676 records (p. 71) "ten-pounders" among the fishes (including tarpons, parricootas, etc.) he found in "the lagunes, creeks and rivers." "Ten-pounders," he adds, "are shaped like mullets, but are so full of very small stiff bones, intermixt with the flesh that you can hardly eat them."

The species needs no further attention for the present at least.

III

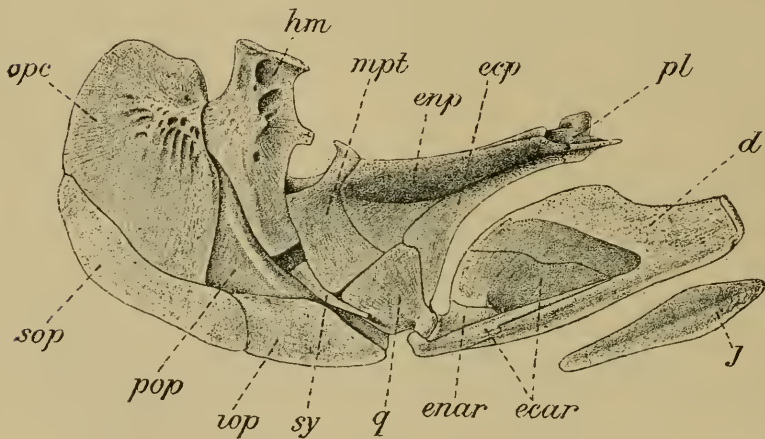


FIG. 4.—*Megalops cyprinoides*; hyopalatine arch, opercular bones, and mandible of left side, mesial aspect. *j*, jugular plate, dorsal view. (After Ridewood.)

The genus *Megalops* has very large scales (30 or more along the lateral line), the head is comparatively large and the lower jaw projecting; there are no pseudobranchiæ; the dorsal fin is inserted more or less behind the ventrals and its last ray is produced into an elongated "filament." In contrast also with *Elops* the head is short

and oblong by reason of the very oblique mouth, the lower jaw is abbreviated, truncated in front, and with the articular fossæ under the eyes, and the suspensoria are each continuous, the hyomandibulars being inclined forwards.

Two very distinct forms are known—so distinct indeed that they have been referred to different genera—the *Megalops cyprinoides* of the Indian Ocean and northern Australia and the *Megalops atlanticus* or celebrated tarpon of America.

The tarpon (*Megalops atlanticus*) has an elongated fusiform shape; the forehead slightly incurved (rather than straight) to the snout; the chin projects and is obliquely truncated; the dorsal (with twelve rays) is on the posterior half of the body, nearly midway between the ventrals and anal; its free margin is very sloping and incurved and its long hind ray reaches nearly to the vertical of the anal; the anal (with twenty rays) is about twice as long as the dorsal and falciform; the caudal fin has a very wide V-shaped emargination. The scales are in about forty-two oblique rows. It reaches a length of about six feet—sometimes more.

IV

The oldest form of the name seems to have been *Tarpon*; such is the guise it has in Dampier's "Voyages to the Bay of Campeachy" in 1675, and in Roman's "Concise Natural History of Florida" (1775). Dampier found that "the fish which they take near the shore with their nets are snooks, dog-fish and sometimes tarpon. The tarpon," he says, "is a large scaly fish, shaped much like a salmon, but somewhat flatter. 'Tis of a dull silver color, with scales as big as a half crown. A large *tarpon* will weight 25 or 30 pounds. 'Tis good, sweet, wholesome meat, and the flesh solid and firm. In its belly you shall find two large scallops of fat, weighing two or three pounds each. I never," continues Dampier, "knew any taken with hook or line; but are either with nets, or by striking them with harpoons, at which the Moskito-men are very expert." Such are the ideas of the fish gained by Dampier in its southern resorts. How different they are from those now prevalent in the United States will appear hereafter.

The name in most general use is *tarpon* and this may be considered to be the literary and accepted phase. *Tarpum* was also an early form, but is now obsolete. Along the Texan coast *Savanilla* is still in general use, but is gradually being superseded by tarpon on account of the influence of anglers. The apt descriptive name *Grande-écaille* (pronounced grandykye and meaning large-scale) was

given by the French settlers of Louisiana. Other names of still more limited use are *silver-fish* (Pensacola), and *jewfish* (Georgia and parts of Florida). Jewfish it shares with many other fishes, and another fish of Florida, a gigantic Serranid, is better known by the term. *Silver-king* is a euphemistic designation. *Caffum* is a name current in the island of Barbados.

V

The tarpon may be briefly defined as a littoral fish of warm American seas often entering into rivers and acclimated in some inland lakes.

The boating excursionist along some favored shore of Florida or Texas during the spring and summer months at least—perhaps during all but the winter months—may be startled by the sudden projection from the water of a silver-like mass, which, after describing a low arch, will splash into the water again at a distance of maybe twenty feet from the starting point; that mass is the tarpon, or the “silver king.” Florida and Texas are the states in whose waters the fish is most frequently seen, because there most looked for, but its range extends far beyond those coasts in all directions. In summer wanderers visit the north as far as Massachusetts, where large individuals of the “big-scale fish,” as they are there called, are “taken every year in traps at South Dartmouth” in the “latter part of September”; southward they may be found in Brazil and sporadically in Argentina. Around all the islands of and in the Caribbean Sea and Gulf of Mexico schools may be met with. Further, immigrants have found their way into rivers that enter into the tropical seas and the Lake of Nicaragua has long been famous as the home of the species.

Being essentially a warm water fish, it is only in the warm months that the tarpon is to be found at its northern and southern limits. On the approach of cold weather it retires towards the tropics. Along the southern Floridian coasts some “appear in February, increasing rapidly in numbers in March, April and May”; in Texas, “early in March.” At first they refuse the bait but “during the latter part of May and in June” bite freely. “About the first of December” they “disappear entirely” from the Texan waters. In the tropical seas they may be found always, and about Tampico, in Mexico, their “season is from November first to April, the time when the tarpon practically disappears from Florida and Texas.”

The tarpon is sensitive to sudden changes of temperature and especially to cold, and to such changes it is sometimes subject in

its northern range. During a cold wave which invaded Florida towards the end of January (26-27) 1905, according to a letter of E. J. Brown in "Forest and Stream," "the tarpon especially were affected by the cold." There were brought to "Lemon City between forty and fifty tarpon which had been so benumbed by the cold as to be easily speared by parties who were searching for them. The largest fish was in length seven feet one and three-quarters inches, girth thirty-nine and three-quarters inches, weight one hundred and ninety-four pounds. Several others were nearly this size. . . . The tarpon were salted, to be sent to Key West market, where there is a ready demand for them."

VI

That the tarpon is a most active fish may be inferred from its form which is especially adapted for swift and enduring action. Its life is spent in the enjoyment of its power and in pursuit of food; a carnivorous fish, it preys "eagerly upon schools of young fry, or any small fish that it is able to receive into its mouth, and in pursuit of which it ascends fresh-water rivers quite a long distance." The schools of mullets contribute largely to the great fish's supply. Such it attacks by darting upon them and generally seizing them tail foremost. Its frequent leaps into the air, like those of the salmon, seem to be mostly in sportive manifestation of its intense vitality and not for food or entirely from fear. C. F. Holder tells that one leaping tarpon "fell headlong" into a "boat, passing through the bottom"; that another leaped over man and boat; and that still another sprung up to the "deck of a steamer" and "fell headlong into a passenger's lap." Other wonderful tales are told of the activity of the tarpon. According to Holder (at second hand from another), a fish made an "initial leap of twelve feet" and followed this up "with six leaps all equally high." The same observer believed that "the ordinary height a tarpon leaps is from seven to eight feet." While leaping, its gill-covers are frequently spread out and its blood-red gills visible. Withal it sometimes goes into very shallow water and seeks out a quiet nook in which it may rest, "perfectly stationary," for quite a long time.

VII

The life history is very imperfectly known, but it does not appear to breed at any place along the continental coast of the United States, for none except large individuals have been recorded from those places most resorted to by anglers. For a very long time one of thirty pounds weight was the smallest obtained in Florida and

one of eleven pounds in Texas. It apparently demands a temperature and conditions which the reef-forming coral animals require and sheltered brackish or fresh water for oviposition. In such localities about Porto Rico, in February, 1899, Evermann and Marsh found not eggs, but very young, and there "it evidently breeds." Thirteen fry, "2.25 to 3.25 inches" long, were collected at Fajardo; at Hucares, "in the corner of a mangrove swamp" in "a small brackish pool of dark-colored water," "entirely separated from the ocean by a narrow strip of land, four from 7.5 to 11.5 inches long were seined." The smallest previously known was about nine inches long. All these are probably the young of the first year.

The very young or larvæ will doubtless be found to be, like those of *Elops* and *Albula*, elongate ribbon-like animals of translucent and colorless texture, with a very small head and small fins. They are probably so transparent that their eyes alone are apparent in the water unless a very close examination is made. The youngest of the specimens (2.25 inches long) observed by Evermann and Marsh, were probably not long before developed from the larval condition. Such are the little fishes to be looked for as the very young of the great tarpon.

Most of the large tarpons caught along the coasts of Florida and the Southern states have attained full maturity; of such the length is about six feet, and the weight approximates one hundred pounds; they are probably nearly or over three years old. Growth, however, is continued in some much beyond the average, one of three hundred and eighty three pounds, it is claimed, having been harpooned.

VIII

"The silver-king is the greatest of game fishes." So declare Evermann and Marsh, and they echo the belief of many. Volumes and countless articles in periodicals have been devoted to detail of its excellencies. Its activity and gameness are proportioned to its size. The northern salmon affords tame sport compared with the "silver-king." Those of the average full-grown size (six feet long and one hundred pounds in weight) are caught in numbers with the rod and line; one weighing two hundred and twenty-three pounds closes for the time the record of feats with the rod, and it took the captor "three hours and a half before it was brought to gaff."

The tarpon is now considered to have little or no edible value. It has, indeed, been declared by Schomburgk to be "considered a delicate eating" in Barbados, and in the United States has been experimented with occasionally; one (W. H. Burrall) who did so in

1874, declared (in *Forest and Stream*, II, p. 324) that it was very palatable, but his taste was exceptional. It has been frequently tried since but rejected for the table. An effort was made on one or two occasions in Massachusetts when considerable numbers had been caught, "to find a market for them," as at New Bedford, "but the people did not like them, owing to the toughness of the flesh." Holder's negro oarsman aptly replied to the suggestion that it was "the finest looking fish in the world," "Yes, Sa, hit looks fine, so does hay. I'd rather eat hay dan tarpon, yes, Suh, I would." It is truly, as Holder remarks, almost the only great game fish "which is utterly scorned as a food fish." Dampier's opinion, expressed in 1675, and that of some Barbadians, has not been adopted by modern gourmands. It is "full of numerous small bones, which is a great inconvenience," says Schomburgk. In almost all cases where it has given anything like satisfaction the fish was of small size, and the truth may be that small ones are tender and savory but large ones coarse and tough, like overgrown individuals of other species. The results of unprejudiced judgment are still wanting.

It may be recalled here, however, that the Indian congener of the tarpon, the ox-eye (*Megalops cyprinoides*) is, according to Saville Kent as well as others, "highly esteemed for food," and in the Malay archipelago, where it likewise abounds, it is cultivated in tanks after the same manner as the milk-fish, *Chanos salmoncus*.

Far from being sought by the fisherman for the market, the tarpon is detested by him. "The Pensacola seine fishermen dread it while dragging their seines, for they have known of persons having been killed or severely wounded by its leaping against them from the seine in which it was enclosed. Even when it does not jump over the cork line of the seine, it is quite likely to break through the netting before landing." Nevertheless even a dead tarpon yields some compensation for the trouble he gives. There is quite a demand for its great beautifully silvered scales, some of which may be as large as a lady's palm. They find customers who are willing to pay as high as from five to twenty-five cents apiece and they are made up in various ways to attract the winter visitors to Florida.

IX

A species congeneric with the tarpon, but not very closely related, is the *Megalops cyprinoides* which, indeed, is the type of the genus. It is a less slender fish and the outline of the back and head is different from that of the tarpon; further, the dorsal fin is not so far backward, that fin and the anal have more rays (dorsal, 19 to 21;

anal, 24 to 27), and the proportions of all the fins are more or less different. The size, also, is never so great as in the giant tarpons, for it rarely, if ever, attains to a length of more than five feet.

Like the tarpon, the Asiatic fish readily accommodates itself to fresh water. According to H. S. Thomas (1897), in India "they acclimatize very readily to fresh water, and grow fast," and also breed, he was told, "in ponds." The natives, too, "are fond of keeping them in ponds."

They are more prone to associate in schools or shoals—that is, close together like herring—than the tarpon, especially when young. Thomas came "across them coming up an estuary in a shoal, and it was like hauling in mackerel; and they run about the same size. There was a fish on as fast as ever you could get your line in the water. But the fun was very short-lived. It was in mid-stream, and they were all past the boat in a very little time." Thomas took them "on a May fly and a Carnatic Carp fly." In "30 minutes," "on a light trout rod," he "took six of three-quarters of a pound each, lost four among weeds, and had one fly bitten off. Some of them sprang a foot in air, and all fought well."

The fame of the tarpon has, in recent years, been reflected on its eastern relative and the lesser species has found advocates for its pursuit as a game fish. "Enthusiastic anglers disposed to initiate" angling for it as for the American fish are referred by T. Saville Kent (1897) to the *Badminton Magazine* for 1895 for information. "There can be no doubt, in the writer's opinion," that the Australian fish, popularly known as the ox-eye herring, possesses "the most conspicuous potentialities for sport," and "would yield equally exciting sport on the same lines." Unlike its American relative, too, there might be the after satisfaction of seeing it on the table for, according to Kent, the ox-eye affords "most excellent eating." In India, it is raised to some extent for the table in tanks.

THE LADY-FISH

The Albulids are unique in the development of two transverse rows of valves in the bulbus arteriosus in advance of the heart, in which respect there is an approximation to the Ganoids. The form and physiognomy are peculiar but there is more superficial resemblance to a whitefish (*Coregonus*) than to a herring; the body is fusiform but the dorsal arch much more curved forwards than the ventral; the scales are cycloid and brilliantly silvery; the head bony and scaleless, the snout prominent forwards; and the supramaxillaries are moderate, composed of only two pieces, and partly retractile

under the large preorbitals; the mouth is small and overhung by the prominent snout; the circumorbitals strongly contrast with those of the Elopids, a large horizontal preorbital being developed along

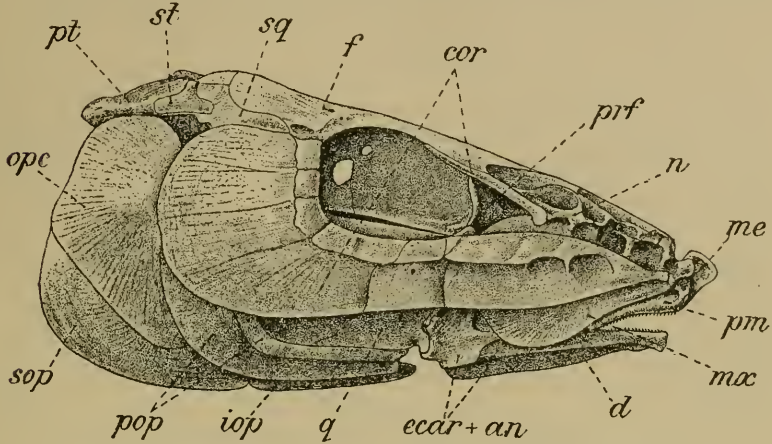


FIG. 5.—*Albula conorhynchus*; skull from right side. Showing the peculiar snout (*me.*), circumorbitals (*cor.*), etc. (After Ridewood.)

the side of the snout and this is followed by a short and equally wide suborbital, itself succeeded by wide, angular and postorbital bones, having a well defined sensory canal. According to Ridewood "there are in all twelve bones of" the circumorbital series. "The most anterior ones are curious, basket-like bones, not much wider than the sensory canals which they carry. The canals in this region are particularly large." There is no gular plate. The parasphenoid

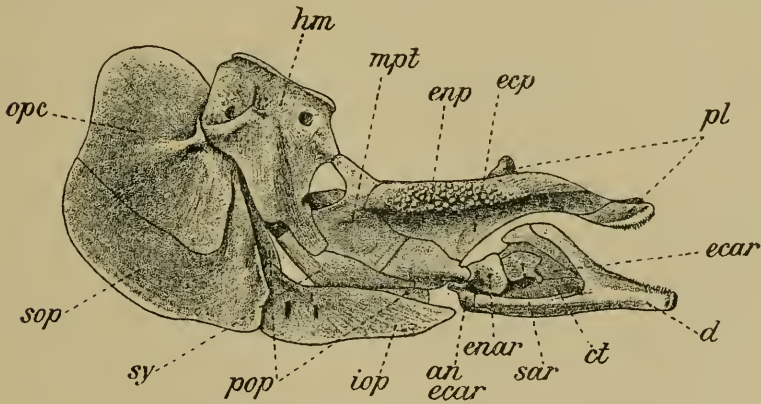


FIG. 6.—*Albula conorhynchus*; hyopalatine arch, opercular bones, and mandible, left side, mesial aspect. Showing the peculiar dental pavement of the entopterygoid bones, lower jaw, etc. (After Ridewood.)

bone is broad. Further the family is characterized by the villiform jaw and palatal teeth, pavement-like dentition of the hinder part of the mouth and wide parasphenoid bone.

I

The Albulids, like the Elopids, are an ancient family and representatives have existed from Cretaceous times to the present, although the affinities of the extinct forms have not been precisely determined. Remains of a fish that lived in the Lower and Middle Eocene and that was formerly called *Pisodus owenii* have been referred even to the genus *Albula*. In the present seas there is only one genus, *Albula*, represented by a single species, *Albula vulpes*.

It is found in almost every tropical sea, but it is not confined to such for individuals not a few extend their wanderings quite far beyond the tropical zone, occasionally even roaming northward to Massachusetts.

It attains a length of from a foot and a half to three feet and a weight of about three to ten pounds, but the average is far below the maximum mentioned.

II

Notwithstanding its wide geographical distribution, it is in truth a shore fish and seeks its food close to the shore or on muddy or sandy flats where shellfish—especially small bivalve shellfish—most abound. When the flood tide begins and “up to full tide” is the select time for feeding, and “flats in water varying from a depth of eight to ten inches,” a choice place for hunting for food. As the fishes feed in such shallow water, their heads go down and their tails come out of the water, and as they work in shorewards their dorsal fins cut the water, and the sunlight is reflected from their silvery sides.” The actions of the fish thus seen have suggested to some the name “grubber.”

There is a beautiful correlation between the fish's food and the structural means for assimilating it. The dentition as a whole is quite peculiar—unlike that of any other animal. The bony roof of the mouth is closed in by the juxtaposition of the parasphenoid and pterygoid bones and covered with roundish molar teeth and the floor of the mouth has opposed teeth so that the fish is well provided with the means for crushing the shells which it takes; externally is provision for finding and rooting them up in the projecting conic snout, which is so prominent as to have suggested one of its early names—*Conorhynchus* or cone-snout.

III

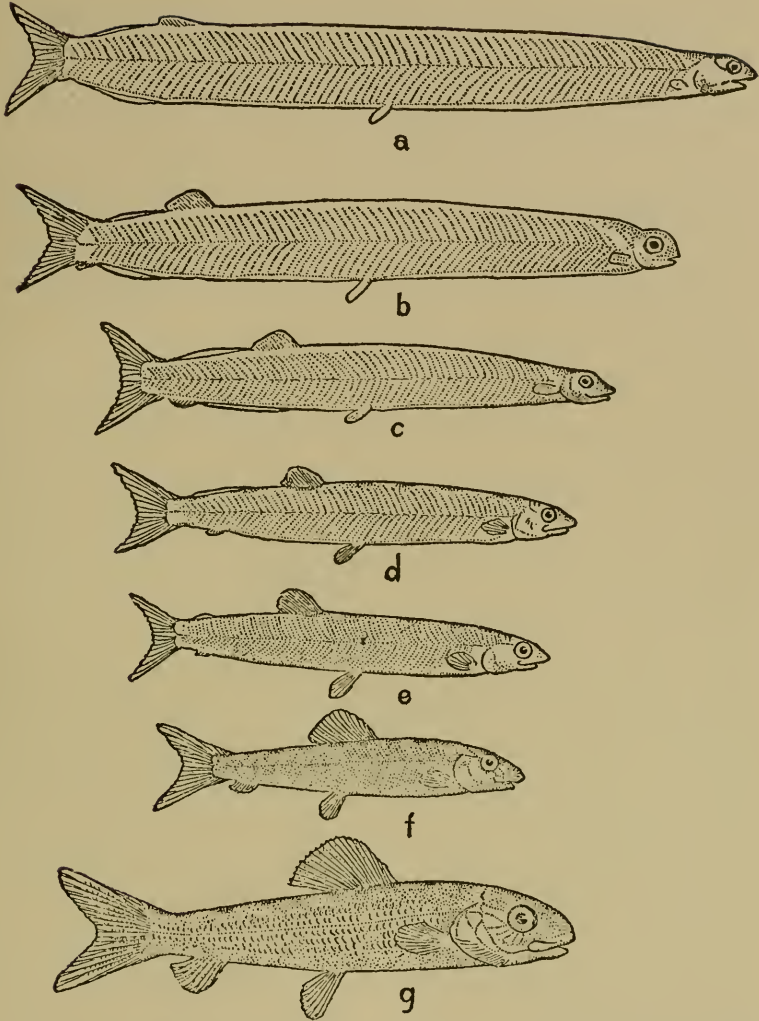


FIG. 7.—*Albula vulpes* (Linnæus). Transformation of the Ladyfish, from the translucent, loosely compacted larva to the smaller, firm-bodied young—slightly enlarged. Gulf of California. (After Gilbert and Jordan, Mss.)

A favorite region for the discharge of procreative duties is the Gulf of California. There the young may be found in immense quantities and they are "often thrown by the waves on the beach in great masses." But so different are those young from the mother fish that they would not be recognized by the casual observer. They are "elongate, band-shaped, with very small head and loose

transparent tissues." In the water in fact their eyes alone are visible. Gilbert tells that "from this condition they become gradually shorter and more compact, shrinking from three or three and a half inches in length to two inches." Then their form becomes much like that of maturity and from that stage they grow regularly till the proportions of ripe age are attained.¹

The various phases of this remarkable growth during which, with advancing days, the developing fish grows smaller and smaller, have all been found by Professor Gilbert and drawn under his direction.² Having at length shrunk to almost half the length of the longest esunculoid stage and acquired a roundness and compactness of body as well as shape of the adult, it starts anew in growth and continues till the size and other characteristics of the adult are attained. The history of the metamorphosis of the species is quite as remarkable as that of the butterfly. With diminishing length, with increased compactness, the myotomes or muscular folds grow closer together and less obvious, the dorsal fin and, to a less extent, the anal become better developed and advance towards the middle, and innumerable minor or, rather, less evident changes accompany such until the adult form in miniature is obtained.

IV

One of its haunts is "the waters of Biscayne Bay and those extending some 60 miles further south," and by residents of that shore it "is not known to be found anywhere" else. There probably, at least, it is angled for as much if not more than elsewhere and is quite generally regarded as the gamiest fish that swims. There near Miami, August Thomas (1903) verified to his own satisfaction the verdict of the neighborhood. He approached a school, as is generally done, in a boat with a guide.

"Your guide works the boat towards them carefully, for they are as timid as a deer, and once frightened are very difficult to approach. When within 50 or 60 feet, which is as close as it is possible to get without frightening the fish, you cast the bait to a spot in line with the direction the fish are working, and not nearer than

¹A brief notice of Prof. Gilbert's observations was communicated to Jordan and Evermann (I, 411), but Prof. Gilbert has informed the writer that his results are still unpublished. A figure of an esunculoid stage has been given by Boulenger (C. N. H., VII, 548) "after Gilbert," but otherwise no authority is mentioned.

²The writer is indebted to Professor Gilbert for a proof of the accompanying figure which is to be published in President Jordan's great forthcoming work on fishes.

20 or 30 feet to them. The bait is one of the shell-fish upon which the fish feed, and it must be absolutely fresh." This bait must be allowed to "lie immovable until the fish find it. The first indication is a slight nibble, for they are not vigorous biters, and they must be hooked, for they rarely hook themselves."

At length one is hooked. Then commences the sport. "From three to five hundred feet of line is taken out on the first rush, and this is often repeated twice or even three times, making from one thousand to fifteen hundred feet of line in all that is taken out in this manner. When these bursts of speed are over it is fight, fight, fight, every inch of the way to the boat, the runs growing shorter as the fish fails. When at length he sees the boat the mighty struggle comes, but not having strength to make a dash, he circles about the boat at a distance of from 10 to 20 feet, often making the circuit half a dozen times—when he finally comes alongside, belly up, he is dead—died as he had lived—dead game—and may be lifted into the boat with safety by the guide."

Fishes may be caught "from November to April, but it is at its best in December."

There is much diversity of opinion respecting the culinary characteristics of the lady-fish. Thomas thought that "as a table fish they have few equals, either planked or broiled." Goode, "from personal observation," testified that "its reputation is by no means a false one." In the Bermudas, too, "where large schools are taken" and where it is known as the Bone fish or Grubber, it is considered "a most excellent food-fish." Others, however, hold it in little esteem. Goode himself tells that along the southern coast of California where it is "found in some numbers," on account of "its beautiful color it sells readily, but it is not especially esteemed as a table-fish."

But it is by all with common consent exalted as a game fish. The celebrated angler Henshall, in 1884, declared that, of all the fishes he had caught in the Indian river inlet, "a bone-fish of about 3 pounds" gave more real sport than any of the others." He found that it "fights in the water and in the air like the black-bass, but mostly in the air—a silver shuttle."

THE GISU OR PTEROTHRISSUS OF JAPAN

A fish occurs in the deep sea off Japan, named gisu by the Japanese fishermen, which was considered to be the type of a peculiar family (*Bathythrissidæ*) related to the white fishes and other Salmonids by Günther but which later ichthyologists (Boulenger

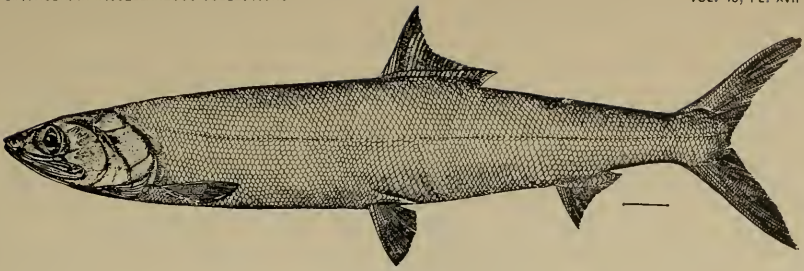
and Ridewood) have associated with the Albulids. It has been scientifically named *Pterothrissus gisu* and *Bathythrissa dorsalis* and may still be considered as the representative of an independent family, very closely related to the Albulids, but named Pterothrissidæ. The Pterothrissids are essentially like the Albulids but the branchiostegal rays are in reduced number (about six), the vomer and palatines are toothless, and the peculiar dentigerous bone which covers the basibranchials of the *Albula* is undeveloped. The dorsal fin is prolonged over most of the back and caudal region.

This family also is one of ancient origin, especially if Smith Woodward is correct in his statement that *Pterothrissus* "is not clearly distinguished from *Isticus*." Species of *Isticus* flourished in the seas whose deposits formed the upper Cretaceous beds of modern Westphalia and Mount Lebanon.

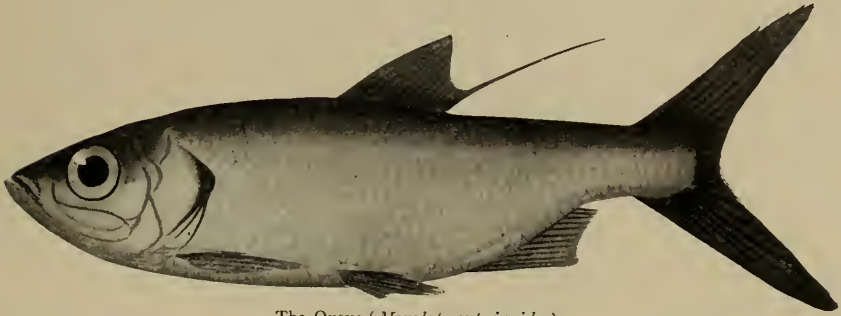
Only one species (*Pterothrissus gisu*) is known from existing seas; it is a deep-sea fish which occurs at depths of three hundred to four hundred fathoms off the Japanese archipelago. Nothing is known of its habits.

ABBREVIATIONS EMPLOYED IN THE LETTERING OF FIGURES (AFTER RIDEWOOD.)

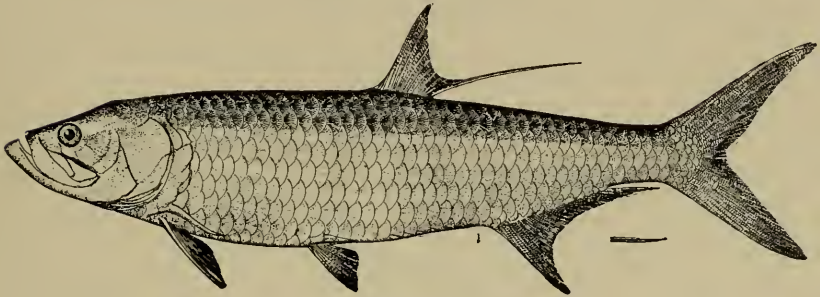
<i>al</i> , alisphenoid.	<i>mx</i> , maxilla.
<i>an</i> , angular.	<i>n</i> , nasal.
<i>bb</i> , dentigerous plate covering the basibranchials.	<i>op</i> , opisthotic.
<i>bo</i> , basioccipital.	<i>opc</i> , opercular.
<i>br</i> , branchiostegal rays.	<i>or</i> , orbitosphenoid.
<i>bs</i> , basiphenoid.	<i>p</i> , parietal.
<i>cb</i> , ceratobranchial.	<i>pb</i> , pharyngobranchial.
<i>ch</i> , ceratohyal.	<i>pl</i> , palatine.
<i>cor</i> , circumorbital bones.	<i>pm</i> , premaxilla.
<i>ct</i> , cartilage.	<i>prof</i> , postfrontal.
<i>d</i> , dentary.	<i>pop</i> , preopercular.
<i>eb</i> , epibranchial.	<i>prf</i> , prefrontal.
<i>ccar</i> , ectosteal articular.	<i>pro</i> , pro-otic.
<i>ccp</i> , ectopterygoid.	<i>ps</i> , parasphenoid.
<i>co</i> , exoccipital.	<i>pt</i> , post-temporal.
<i>ep</i> , epiotic.	<i>ptf</i> , posterior temporal fossa.
<i>f</i> , frontal.	<i>q</i> , quadrate.
<i>gh</i> , glossohyal.	<i>sar</i> , sesamoid articular.
<i>hb</i> , hypobranchial.	<i>sm</i> , surmaxilla.
<i>hh</i> , hypohyal.	<i>soc</i> , supraoccipital.
<i>hm</i> , hyomandibular.	<i>sop</i> , subopercular.
<i>ih</i> , interhyal.	<i>sp</i> , spicular bone.
<i>iop</i> , interopercular.	<i>sq</i> , squamosal.
<i>j</i> , jugular or gular plate.	<i>st</i> , supratemporal.
<i>mc</i> , mesethmoid.	<i>stf</i> , subtemporal fossa.
<i>mpt</i> , metapterygoid.	<i>sy</i> , symplectic.
	<i>v</i> , vomer.



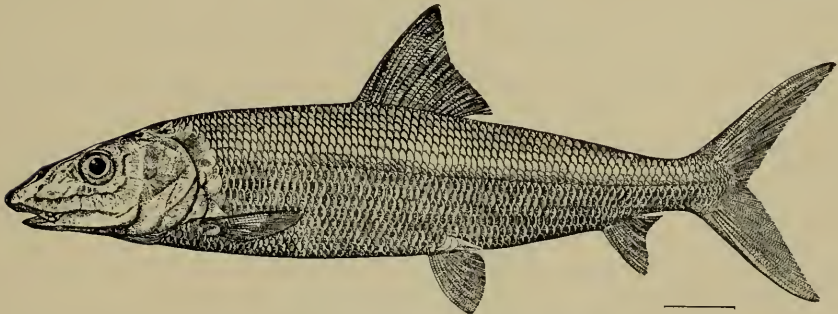
Ten-pounder (*Elops saurus*).



The Oxeye (*Megalops cyprinoides*).



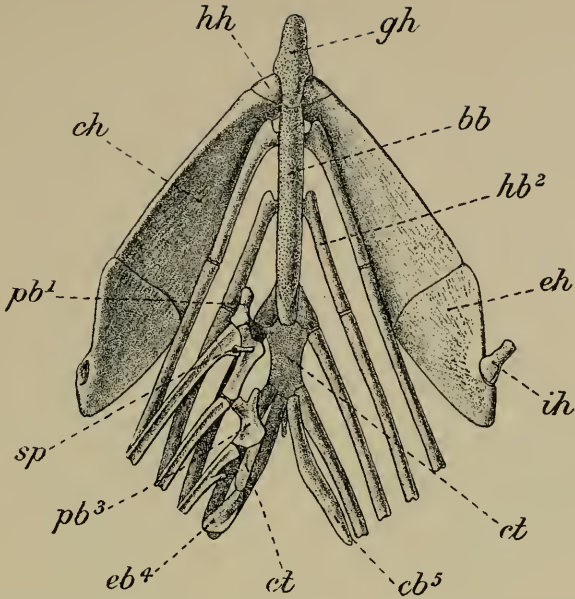
Tarpon (*Megalops atlanticus*).



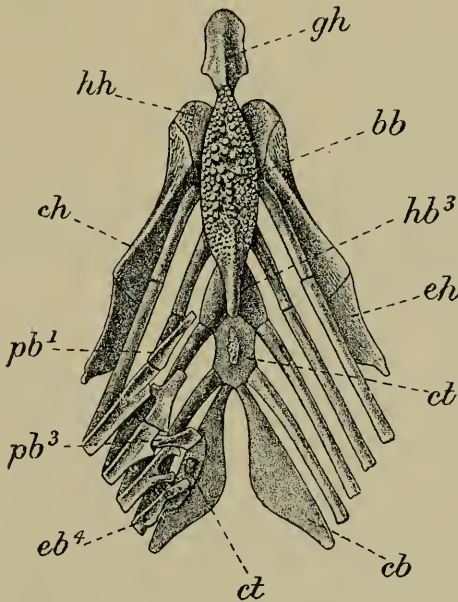
Ladyfish (*Allula vulpes*).



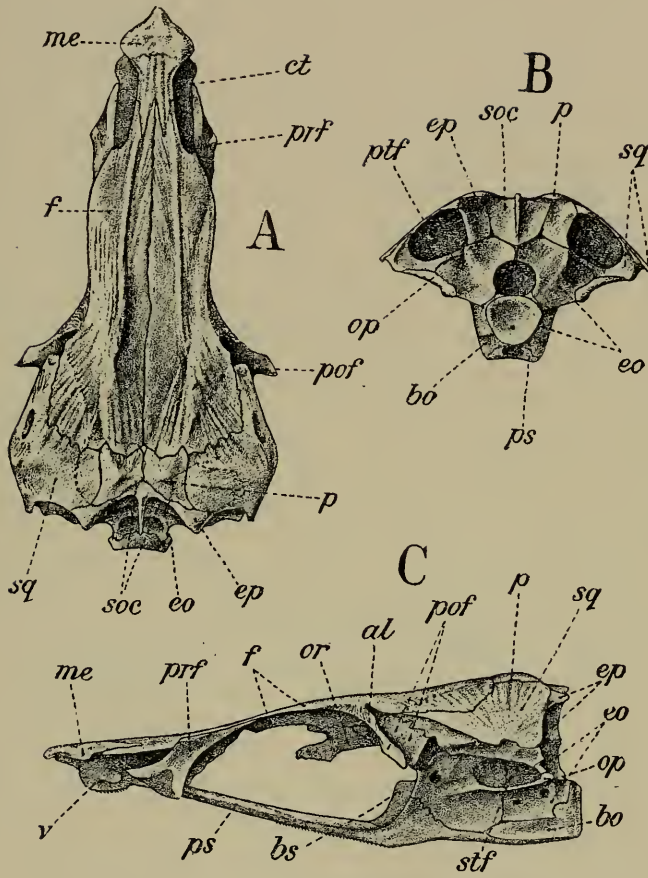
Gisu (*Pterothrissus gisu*).



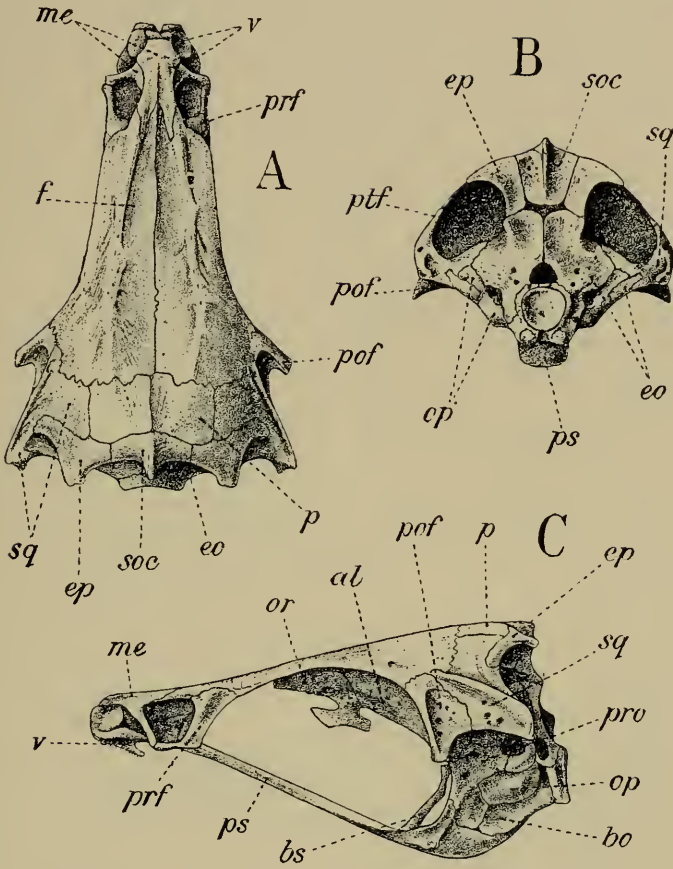
Elops saurus : hyobranchial skeleton from dorsal view. (The epibranchials and pharyngobranchials of the right side are not shown.)



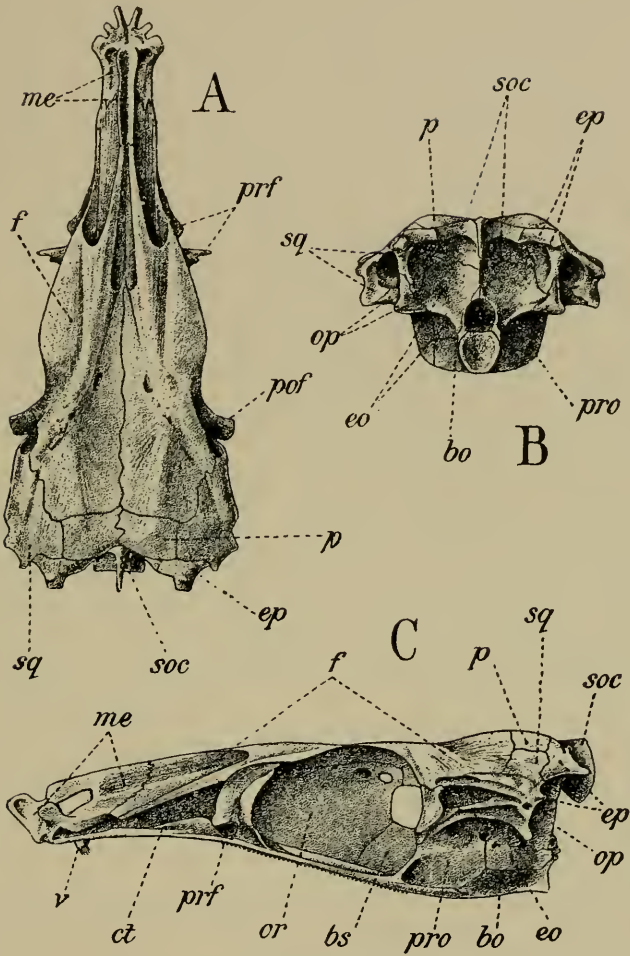
Albula conorhynchus : hyobranchial skeleton from dorsal view. (The epibranchials and pharyngobranchials of the right side are not shown.)



Elops saurus: cranium. A, dorsal view; B, back view; C, left side.



Megalops cyprinoides: cranium. A, dorsal view; B, back view; C, left side



Albula conorhynchus: cranium. A, dorsal view; B, back view; C, left side.

