# THE FISH FAUNA OF FLORIDA.

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There is perhaps no State in the Union whose fishes have attracted more general attention than have those of Florida. The interest in the fishes of this State is shared by the commercial fishermen, the angler, and the ichthyologist. The number of species that are sought because of their commercial value is far greater than in any other section of America. Those that are of interest to the angler are more numerous than any other State can boast, while the richness and peculiarities of the fish fauna of Florida have made this State a fascinating field to the ichthyologist and student of geographic distribution.

Before entering upon the detailed discussion of the fish fauna let us notice for a moment a few of the more important geographic and cl matological factors of the State, for these are the features which determine the character of the fish fauna of any region.

Florida is the most southern of all the States, the entire State lying south of the thirty-first parallel. Its most southern point is in latitude 24° 30′, about 1° 30′ farther south than any other point of our territory. In longitude it extends from the eightieth meridian to that of 87° 30′. It will be thus seen that the State extends through 6½ degrees of latitude (nearly 400 miles) and 7½ degrees of longitude (or about 400 miles). It has relatively and actually by far the greatest shore line of any State, the total being not fewer than 1,200 miles, or more than 1 mile of shore line for every 5 square miles of territory—in fact, about 230 more miles of sea front than it could have if it were a square island.

Though Florida has not the diversified geographic features possessed by many other States, such as Georgia, which give it mountain torrent, upland river, and lowland marsh, nevertheless its numerous lakes and rivers are not without variety. Some of the streams are more or less turbid, some clear and cold, others temperate, and others warm. All are rich in water vegetation, which invariably implies a rich fauna as well, and the vast Everglades present conditions hardly to be duplicated elsewhere in America.

The more than 1,200 miles of coast line present great diversity as to nature of shore and temperature of water. There are to be found on the Florida coast almost any kind of shore one may desire; vast areas of mud flats in some places, long reaches of clean sand and shallow water in others, rocky shores with shallow tide pools, a multitude of narrow, shallow channels and mangrove islands, and the great chain of Florida Keys, among which a wide diversity of conditions is found, such as great mud flats, large fields of algæ, forests of gorgonians, great sponge-grounds, coral reefs, etc., not duplicated anywhere on our coast.

From the relatively cool waters of Pensacola and Fernandina the temperature gradually rises southward until we reach the Keys, where it becomes noticeably higher on account of the Gulf Stream as it sweeps through the Florida Straits and up the eastern coast. Nowhere else on our coast is the influence of the Gulf Stream so great, and nowhere else does the fauna of tropical seas extend so far north. Indeed, among the Florida Keys we find the nearest approach to tropical conditions to be found anywhere in the United States.

It is remarkable that the rich fish fauna of Florida did not attract the attention of students earlier than it did. Prior to 1870, scarcely anything was known concerning the fishes of the State. So far as we have been able to learn from an examination of ichthyological literature the earliest references to Florida fishes are those of Mark Catesby in 1754, LeSueur in 1824, and Holbrook in 1855 and 1856. Catesby's Natural History of Carolina, Florida, and the Bahama Islands, a mammoth work of two volumes, royal folio, with 220 colored plates, contains a few references to Florida fishes, but this was before the beginning of binomial nomenclature (which dates from 1758), and no names were given. In 1824 Messrs. Maclure, Say, Ord, and Peale, of the Philadelphia Academy, all great men in the early history of science in America, made a trip to Florida and brought back with them dried specimens of one ray and one skate. These were described in the same year by LeSueur as *Raia sabina* and *Raia desmarestia*, but are now known as *Dasyatis sabina* (one of the most common rays on the Florida coasts) and *Raja eglanteria*, the brier skate, less common than the other species. These, so far as we have been able to learn, are the first fishes ever described from Florida localities.

In 1856 Dr. John Edward Holbrook published an "Account of several species of fishes observed in Florida, Georgia, etc." In this paper 6 species were credited to the St. Johns River, 5 species of sunfishes and 1 darter, all of which were described as new, but not one of which proved to be so. In 1855 Holbrook published the first edition of his Ichthyology of South Carolina, and in 1860 the second edition of the same work appeared. In this work 12 species are referred to definite Florida localities in the first edition and 22 in the second, one of the latter (*Esox ravenelli=Lucius americanus*) being described as new.

In the twenty years following the appearance of the first edition of Holbrook's Ichthyology little or nothing was added to our knowledge of the fishes of Florida. Not until 1878 was any serious or considerable study made of the fishes of this State. In that year Mr. Silas Stearns, of the Pensacola Fish and Ice Company, began sending specimens of Florida fishes to the U. S. National Museum. The first specimen was described by Goode & Bean as the type of a new species, the blanquillo (*Caulolatilus microps*), a near relative of the noted tilefish, whose sudden appearance in myriads in the Gulf Stream about the same time and whose as sudden disappearance in 1882 remain to this day among the marvels of the natural history of fishes.

In the winter of 1877–78 Mr. Stearns began a most active and intelligent study of the distribution and habits of the fishes of the Gulf coast of Florida. Particular attention was paid to the food-fishes and the fishes found on the Snapper Banks. Specimens of the various species were sent to the National Museum, which formed the basis of numerous important papers by Goode & Bean, Jordan, and Stearns.

I wish to call special attention to the work done by Mr. Stearns. It was of very great importance and deserves more than a passing notice. During the few leisure hours of an active business life Mr. Stearns found time to make a study of the natural

history of the fishes of the Gulf coast which even to this day constitutes the bulk of our knowledge of many of the species of that region. He made invaluable collections, containing many species new to science, and his own direct contributions to the literature of Florida fishes, published in the Fishery Industries reports of the Tenth Census, may well serve as models for writers on natural-history subjects. The untimely death of Mr. Stearns in 1888 was a severe loss to science as well as to the State of Florida.

Since 1878 a number of persons have done more or less collecting in Florida; among them the following may be mentioned: Dr. J. W. Velie, in Clearwater Harbor and vicinity; Dr. J. A. Henshall, from Biscayne Bay around the coast to Tampa; Dr. Jordan, at Pensacola, Cedar Keys, and Key West; Dr. O. P. Hay, about Captiva Pass; the vessels of the Fish Commission, at the Tortugas, on the Snapper Banks, and elsewhere along the Gulf coast; Messrs. A. J. Woolman and L. J. Rettger, in the streams of the western part of the State; Mr. Einar Lönnberg, in the fresh waters about Orlando; Mr. Charles H. Bollman and the writer, at Pensacola and on the Snapper Banks; Mr. Barton A. Bean and the writer, in Indian River and Lake Worth; Dr. H. M. Smith, in Biscayne Bay; Dr. William C. Kendall, in the St. Johns River; and Dr. Kendall and the writer, about Biscayne Bay, Key West, Tampa, and Tarpon Springs. The characteristics of the fish fauna of the other portions of the State are almost wholly unknown; and our knowledge of those regions which have received some attention is far from satisfactory. New species and new and important facts about known ones are discovered each time any investigations are made in any part of the State. A vast amount of work remains to be done before we may consider our knowledge of the fishes of Florida even approximately complete.

## THE FISHES OF FLORIDA.

The total number of species of fishes known from Floridian waters is about 600, or about one-fifth of the entire fish fauna of America north of Panama. This number is far larger than can be found in any other section of our country, and is due to the diversity and peculiarities of the climatic conditions already mentioned. The Florida fish fauna may be regarded as made up of at least five more or less distinct faunas: (*a*) the salt-water fauna of our South Atlantic States, (*b*) the subtropical fauna of the Florida Keys, (*c*) the Gulf of Mexico fauna, (*d*) the fresh-water fauna of the southern portion of the Lower Mississippi Valley, and (*e*) the fresh-water fauna of the Everglades.

These, of course, overlap more or less, and in a consideration of the entire fish fauna of America these regions would not be regarded as constituting distinct faunal areas; but for our present purpose they may properly be considered as fairly distinct. From Fernandina southward to Biscayne Bay are found most of the species characteristic of the coast south of Cape Hatteras. From Biscayne Bay to Key West and the Tortugas is found a fish fauna marvelous in its multitude of species and in their richness of coloration.

Among the fishes of this region which deserve special mention are the great numbers of groupers, snappers, grunts, and porgies, all important food-fishes; the many labroid species, such as the hogfish, pudding-wife, and the various parrot-fishes, all remarkable for their brilliant coloration; the many species of pipefishes, the tangs, angel-fish, and chætodonts, among them several of the most gorgeous of American fishes.

The fish fauna of the Florida Keys resembles that of Cuba very closely. Nearly all the food and game fishes at Key West are also found at Havana. The warm waters of the Keys serve as a more or less effective barrier to the passage of fishes living in colder water. As a result many species are found on the east coast of Florida which do not occur on the Gulf coast, and vice versa. There are so many species found on the west coast of Florida that are not known from the east side that the two coasts may be regarded as having separate faunas. This west-coast fauna extends from the "bay" to Pensacola and beyond, and is not essentially different from that found elsewhere on the Gulf coast.

In the fresh waters of the northern part of the State the fishes are essentially the same as occur in the streams and ponds of the other Gulf States, and include several species of minnows, sunfishes, catfishes, suckers, *Amia*, and a few darters. From the little that is known about the fresh-water fishes of the extreme southern part of the State, it is believed that the species are to a large extent distinct and peculiar to that region. There is great need, however, of further investigation in this region.

Of the 600 species of fishes credited to Florida waters about 51 are fresh-water species, 20 may be regarded as brackish-water species, and the remaining 529 constitute the salt-water fish fauna of the State.

## FRESH-WATER SPECIES.

The number of fresh-water species known from the State is not large. They belong to the following families:

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|---|---|---|---|
| *Petromyzonidæ* (Lampreys) | 1 | *Pœciliidæ* (Killifishes) | 13 |
| *Lepisosteidæ* (Gars) | 3 | *Aphredoderidæ* (Pirate Perch) | 1 |
| *Amiidæ* (Bowfins) | 1 | *Atherinidæ* (Silversides) | 1 |
| *Siluridæ* (Catfish) | 8 | *Elassomidæ* (Pygmy Sunfishes) | 1 |
| *Catostomidæ* (Suckers) | 1 | *Centrarchidæ* (Sunfish and Bass) | 10 |
| *Cyprinidæ* (Minnows) | 7 | *Percidæ* (Darters) | 2 |
| *Luciidæ* (Pikes) | 2 | | |

Of these 51 species the only ones of commercial importance are the catfishes, pikes, sunfishes, and the large-mouthed black bass. This list is remarkable in that it contains so few of the *Catostomidæ*, *Cyprinidæ*, and *Percidæ*. Each of these is a very large family, the approximate number of species of each in American waters being as follows: *Catostomidæ*, 70; *Cyprinidæ*, 227; *Percidæ*, 88.

The most southern locality in Florida from which specimens of fresh-water species have been obtained is Miami, 8 species having been collected there in the Miami and Little rivers in 1896. Doubtless many additional species will be discovered when the waters of the State are more thoroughly explored. The regions which promise the richest and most important results are the Everglades, the lakes in the interior south of Lake George, and the streams crossing the northern boundary of the State.

## BRACKISH-WATER SPECIES.

In this category may be included all those species which live habitually in brackish water, those more truly salt-water species which are also found more or less commonly in brackish and even fresh water, and also those more truly fresh-water species which are occasionally found in brackish water. In this division will fall, of course, all anadromous and catadromous species, such as the shad and the common eel. The family

having the greatest number of species in this division is the *Pœciliidæ*, preeminently the family of brackish-water fishes. Florida contains 21 species of this family, of which at least 8 live habitually in brackish water and each of the other 13 may occasionally occur there. This family is worthy of note as containing the smallest known fish, *Heterandria formosa*, which is less than an inch in length.

Two species of shad are known from Florida. On the east coast the common shad (*Alosa sapidissima*) is a common and valued species. It occurs regularly and in considerable numbers in the St. Johns and St. Marys rivers and rarely in the Indian River. It is not positively known to occur in any other waters of the State. At Pensacola a few young shad were obtained by Dr. Jordan in 1882 and provisionally identified as a species distinct from the common shad, but no name was given to them and no description published. In the spring of 1896 an unusually large run of shad occurred in the Black Warrior River at Tuscaloosa, Ala., and specimens were sent to the United States Fish Commission for identification. They proved to be different from the common shad and a new and undescribed species, to which the name *Alosa alabamæ* was given by Jordan and Evermann. When studying these specimens I also studied those from Pensacola (now in the United States National Museum) and found them identical with the Alabama shad.

Shad have been reported from various west Florida rivers, particularly the Suwanee, Apalachicola, and Escambia rivers. It is not positively known what species these may be, but it is more than likely that they are the Alabama shad. An actual examination of specimens from these rivers will be necessary to determine the matter, and the United States Fish Commission would be glad to receive specimens from anyone who has an opportunity to collect them.

## SALT-WATER SPECIES.

The great majority of Florida fishes are, of course, salt-water species, there being not fewer than 529 species, distributed among many families and genera. On the east coast approximately 175 species are found, among the Florida Keys 290, and on the west coast about 300. Several important species are found throughout these three regions. Key West is the most important and interesting of all Florida localities as regards the number of species, about 250 species being known from there, of which about 100 are food-fishes of greater or less importance. The richness of Key West in food-fishes will be seen when we recall the total number of food-fishes in each of the other important fishery regions of the United States, as shown in the following list:

| | | | |
|---|---|---|---|
| South Atlantic States | 55 | Pacific States | 40 |
| Middle Atlantic States | 50 | Great Lakes | 16 |
| New England States | 48 | Gulf States (Florida excepted) | 42 |

The more important species handled at Key West are the grunts (6 species), the porgies (5 species), the groupers (8 species), the snappers (4 species), the hogfish, kingfish, Spanish mackerel, the carangoids (8 species), and the mullets (3 species). Besides these there are some 60 or 70 species which for one reason or another are less important but are nevertheless handled to some extent. A great many, perhaps a majority, of the food-fishes at Key West occur also about Cuba and may be seen in the Havana market.

The method of handling fish at Key West is unique, and calculated to conserve the fisheries of that region to the fullest extent. Practically all of the fishing is done with hook and line, and every fishing boat has a well into which the fish are placed. All salable fish are brought to market in the wells of the vessels and kept alive until sold. The prospective purchaser visits the fish wharf, selects from some one of the boats the fish he desires, and it is then killed and dressed by the fisherman. This excellent method insures perfectly fresh fish to the purchaser, and few or no fish are lost or wasted.

There is no other place in the United States where one can study live fishes so satisfactorily as at Key West. Fishing boats are lying at the fish wharf at all times and in their wells may be seen specimens of numerous species, many of them of brilliant coloration; and by going out with the fishermen upon the bars and coral reefs one may, by the aid of a water glass, spend many hours observing and studying a multitude of fishes and other interesting forms as they disport themselves in the clear waters beneath the boat.

## FOOD-FISHES OF FLORIDA.

While the waters in the vicinity of Key West are wonderfully rich in species of fishes used as food, not all the food-fishes of Florida are found there. The shad does not occur there; neither does the black bass nor any of the fresh-water species; nor do we find there, except possibly as stragglers, the spotted sea trout, the red drum, spot, whiting, pompon, flasher, and perhaps still other species known from Indian River. Additional species are known from Pensacola which do not occur at Key West. The total number of different species of food-fish now known to occur in the waters of Florida is approximately 140, divided among 36 different families, as follows:

| | | | |
|---|---|---|---|
| *Acipenseridæ* (Sturgeon) | 1 | *Pomatomidæ* (Bluefish) | 1 |
| *Siluridæ* (Catfishes) | 4 | *Centrarchidæ* (Sunfishes and Black Bass) | 10 |
| *Catostomidæ* (Suckers) | 2 | *Centropomidæ* (Robalos) | 1 |
| *Cyprinidæ* (Minnows) | 1 | *Serranidæ* (Sea Bass) | 10 |
| *Anguillidæ* (Eels) | 1 | *Lobotidæ* (Triple-tails) | 1 |
| *Elopidæ* (Tarpons) | 2 | *Lutianidæ* (Snappers) | 8 |
| *Albulidæ* (Lady-fishes) | 1 | *Hæmulidæ* (Grunts) | 12 |
| *Clupeidæ* (Herrings) | 8 | *Sparidæ* (Porgies) | 12 |
| *Luciidæ* (Pikes) | 2 | *Gerridæ* (Mojarras) | 4 |
| *Esocidæ* (Needle-fishes) | 2 | *Kyphosidæ* (Rudder-fishes) | 1 |
| *Hemiramphidæ* (Balaos) | 4 | *Sciænidæ* (Croakers) | 11 |
| *Mugilidæ* (Mullets) | 4 | *Labridæ* (Wrasse-fishes) | 1 |
| *Sphyrænidæ* (Barracudas) | 2 | *Scaridæ* (Parrot-fishes) | 2 |
| *Polynemidæ* (Threadfins) | 1 | *Ephippidæ* (Angel-fishes) | 1 |
| *Holocentridæ* (Squirrel-fishes) | 1 | *Chætodontidæ* (Butterfly-fishes) | 3 |
| *Scombridæ* (Mackerels) | 4 | *Teuthiididæ* (Tangs) | 3 |
| *Trichiuridæ* (Cutlas-fishes) | 1 | *Scorpænidæ* (Rockfishes) | 1 |
| *Carangidæ* | 14 | *Pleuronectidæ* | 4 |

This large number represents about one-twentieth of the entire fish fauna of America north of the equator.

The value to the State of these commercial fishes will doubtless be set forth in other papers to be presented at this Congress, and need not be dwelt upon here. Suffice to say that the money value of the annual fish output of the State is, in round numbers, not less than $1,000,000.

## THE GAME-FISHES OF FLORIDA.

The fame of the game-fishes of the State of Florida extends throughout America, and beyond. Wherever there are anglers and rod and gun clubs, the prowess of the "silver king" is known and talked about. The one great hope of every angler is that he may go to Florida and kill a tarpon before his fishing days are over. But while the tarpon or silver king is the king of the game-fishes of this State, it is by no means the only game-fish. Some of the largest black bass known have been caught in Florida waters. The sunfishes are the largest of their kind. The ladyfish and the bonefish are thought by many to equal their relative, the tarpon, in real game qualities. Trolling for kingfish, jack, crevallé, bluefish, Spanish mackerel, and spotted sea trout, at Indian River, Lake Worth, Key West, or Biscayne Bay, furnishes sport of the most exciting kind; while still fishing for sheepshead and mangrove snappers at Indian River Inlet; for chubs, porgies, porkfish, yellow-tails, snappers, and grunts at Key West; or for red snappers, red groupers, and others of their kin on the Snapper Banks, furnishes sufficient variety to please any angler, in whatever mood he may chance to be. I have fished in every State and Territory in the Union but three, and from Siberia and Bering Sea to the gulfs of California and Mexico, and, all things considered, regard Florida as unequaled in the richness and variety of its attractions for all sorts of sport with rod and reel.

## THE NECESSITY OF A BIOLOGICAL STATION IN FLORIDA.

The only station for biological research on the coast of the United States which receives Government support is that at Woods Hole, Massachusetts. While it has never received the support which it should, and has never been fully equipped, it has nevertheless been one of the most important centers for biological study in this country. The location is in many regards admirable. In addition to a rich local fauna and flora, many forms of marine animal and plant life are brought there by the Gulf Stream, thereby greatly increasing the variety of life in that vicinity. But the station is kept open only for a few months during the summer, the winters being too severe for satisfactory work.

The ideal marine biological station must be located at some point not only where the local fauna and flora are rich both in species and individuals, but where the climatic conditions will permit investigations and observations to be carried on throughout the year. The region should also be one in which are found in abundance many of the species of animals and plants which are of special interest to biologists, those the study of whose development and life-history will add greatly to our knowledge of the relationships of the larger groups.

There is no other place on our coast where these conditions are so fully met as on the southern coast of Florida. The climatic conditions are all that could be desired. Investigations could be carried on throughout the year. The waters fairly teem with hundreds of species of fishes, mollusks, crustaceans, echinoderms, corals, sponges, marine algæ, and many other groups, while the abundance of individuals of many of the species is marvelous; and, what is of prime importance, many of the species are permanently resident and can be observed and collected at any time throughout the year, thus enabling the investigator to make a study of the complete life-history of the species.

Without even mentioning the numerous purely scientific problems of deep interest to the embryologist which could be studied under most favorable conditions at such a station, I wish to call attention to a few of the many investigations which are sure to prove of great economic importance and which can be conducted here to the best advantage. I may mention the following:

1. The spawning habits of the numerous food-fishes of the coast and the possibility of their artificial propagation.

2. The food of the various species of fishes.

3. The life-histories of the manatee, alligator, crocodile, and the several species of turtles, and the development of methods for increasing their commercial value.

4. Experimentation regarding the artificial cultivation of the commercial sponges.

There is not a marine species of Florida fish whose life history is fully known. We are ignorant of the habits of even the most common and important species. Take even such an important fish as the pompano; we know absolutely nothing of the time, place, and manner of spawning, the habits or food of the young, and the possibility of propagating the species artificially; and we are quite as ignorant concerning the bluefish, red drum, spotted sea trout, sheepshead, red snapper, and all of the numerous other snappers, groupers, grunts, and porgies. It is not at all unreasonable to suppose that a study of these species would show that many of them can be cultivated artificially, and the time will doubtless come, and all too soon, when artificial propagation will have to be resorted to to save some of these fishes from practical extinction. It is the part of wisdom to develop the methods requisite for conserving the fisheries and have them perfected and ready for use before any serious diminution begins.

No study has ever been made of the food of any of these food-fishes or the many others which swarm in Floridian waters. Except in the most general way we know nothing of the interrelations existing among these various species, and the conditions favorable or unfavorable to the well-being of the useful species.

The life-history of the manatee has never been critically studied, and we have doubtless underestimated the importance of its preservation. The same is true of the alligator, crocodile, porpoise, and the several species of turtles found on the Florida coast, all of which are animals of commercial value and of unusual interest to the naturalist.

The discovery and perfecting of methods by which the various commercial sponges of Florida may be cultivated artificially furnish a field for investigation which will prove fascinating in the highest degree and will doubtless yield results of the greatest economic importance.

Each and every one of the lines of investigation indicated is important and worthy of serious attention. Some of them have already been too long neglected. These problems are legitimate fields of investigation.

The establishment of a station for biological research at some point on the coast of Florida is abundantly justified upon both scientific and economic grounds, and should receive the early and serious attention of the General Government and the Commonwealth of Florida.

WASHINGTON, D. C.