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54TH CONGRESS, }
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THE FISH AND FISHERIES OF THE COASTAL WATERS OF
FLORIDA.

JANUARY 28, 1897.—Referred to the Committee on Fisheries and ordered to be
printed.

The VICE-PRESIDENT presented the following

LETTER FROM THE COMMISSIONER OF FISH AND FISHERIES,
TRANSMITTING, IN RESPONSE TO SENATE RESOLUTION OF
FEBRUARY 15, 1895, A REPORT ON THE FISH AND FISHERIES
OF THE COASTAL WATERS OF FLORIDA.

UNITED STATES COMMISSION OF FISH AND FISHERIES,
Washington, D. C., January 28, 1897.

SIR: I have the honor to transmit the accompanying report on the
fish and fisheries of the coastal waters of Florida, in accordance with
the following Senate resolution of February 15, 1895:

Resolved, That the Commissioner of Fisheries is hereby directed to make inquiry
in reference to the extent, methods, and present condition of the coast fisheries of
Florida—more particularly the sponge and oyster fisheries—and to report as to the
desirability of establishing a station for investigation, experiment, and fish-culture
at some suitable point on the coast.

Investigations pursuant to the resolution of the Senate were begun
in 1895 under the direction of the late Commissioner, but it was not
feasible to complete the inquiries until the present year, when a party
consisting of Dr. Hugh M. Smith, Prof. Barton W. Evermann, Mr.
John N. Cobb, and Dr. W. C. Kendall, of this Commission, visited the
southeastern and western coasts of the State, made observations, and
collected information on which this report is in part based. Previous
investigations had been conducted on the east coast of Florida in the
years 1895 and 1896, which put the Commission in possession of data
regarding the extent and condition of the fisheries of that region.
Reference is made to the following recent reports on the Florida fish-
eries relating to the subject under consideration: "Notes on Biscayne
Bay, with reference to its adaptability as the site of a marine hatching
and experiment station," which appears in the report of this Commis-
sion for 1895, and "The fisheries of Indian River, Florida,"* being a

* Printed as S. Doc. 46, Fifty-fourth Congress, second session.

report of the Commissioner of Fish and Fisheries transmitted to the Senate on January 5, 1897, in accordance with the act approved March 2, 1895, making appropriations for the sundry civil expenses of the Government for 1896, a clause of which directs "the Commissioner of Fisheries to make special investigation relative to the extermination of migratory fishes of the Indian River, Florida."

The following report deals first with the natural-history features of the Florida fisheries, and then considers the general importance of the industry and the extent, leading aspects, and condition of the fisheries in each of the prominent fishing regions or centers. The question of establishing a Government hatching and experiment station on the Florida coast is discussed.

This opportunity is taken to invite special attention to the value of the fishery resources of Florida and the necessity for action on the part of the State that will place the fisheries on a more substantial basis and assist the development of the industry without depleting the resources. To this end some suggestions are offered which seem warranted by the investigations recently made.

Very respectfully,

J. J. BRICE,
Commissioner.

To the PRESIDENT OF THE SENATE.

THE COAST FISHERIES OF FLORIDA.

GENERAL IMPORTANCE AND EXTENT.

Fishing is one of the most prominent industries of Florida, and in some parts of the State is of greater importance than any other branch of business. In comparison with other States the rank of Florida is tenth. Massachusetts, Maryland, New York, Virginia, New Jersey, California, Alaska, Maine, and Connecticut are the only States which surpass Florida in the value of their fishery products, and the margin between some of these whose fisheries have about attained the height of their development is so small that they will doubtless be outranked by Florida within a comparatively few years.

No State has a greater variety of valuable food-fishes and other water animals than Florida, and in few, if any, States do they exist in such abundance and under such favorable conditions for capture. Besides an immense assortment of food-fishes, there are valuable reptilian, crustacean, molluscan, and other resources. The fisheries are, with few exceptions, only imperfectly developed along most parts of the coast. With a coast line exceeding 3,500 miles in length (following indentations and including islands), the fishing is largely concentrated in a few places, leaving unoccupied long stretches of coast with ample supplies of fish, etc., awaiting the time when increase in population and extension of transportation facilities will make new demands on the water resources.

Florida is the only State having a sponge fishery, which is one of the most prominent branches of the fishing industry. Other fisheries in which Florida leads are the mullet fishery, the red-snapper fishery, the pompano fishery, the kingfish fishery, and the green-turtle fishery. Besides these, there are important fisheries for squeteague, grunts, minor snappers, sheepshead, groupers, Spanish mackerel, red drum, and oysters.

The principal coast fishing centers of Florida are Key West, Tampa, St. Petersburg, Cedar Keys, Apalachicola, Pensacola, Jacksonville, Fernandina, the Indian River region, and Lake Worth. By far the most extensive fisheries are prosecuted from Key West and Pensacola. The west coast maintains much more prominent fisheries than the east coast, and takes precedence in the yield of every important product.

The approximate extent of the commercial fisheries of the coastal waters of Florida at the present time is as follows:

Persons employed	6, 100
Capital invested	\$1, 300, 000
Annual value of catch.....	\$1, 200, 000

COMMERCIAL SPONGES OF FLORIDA.

SPONGE-GROUNDS.

The Florida sponge-grounds are in three principal localities: Vicinity of Rock Island, Anclote Key, and the Florida Keys.

The Rock Island grounds extend along the coast from Cedar Keys to Apalachee Bay, a distance of about 90 miles, and sponges are found in greater or less abundance over the entire region. The best grounds are said to lie off Piney Point between latitude $29^{\circ} 40'$ and $29^{\circ} 50'$, or just above Deadman Bay at the mouth of the Steinhatchee River. Other good grounds are in Ocilla Bay off the mouth of the Ocilla River, and above the mouth of the Suwanee River at a place called Pepperfish Key. Sponges are reported to be abundant in Suwanee Bay, but the water is seldom clear enough to permit their being seen.

The Anclote grounds extend from the vicinity of Johns Pass, just below Clearwater Harbor, to Cedar Keys. The best ground at present is St. Martin Reef, lying off Homosassa and Crystal River, between latitude $28^{\circ} 40'$ and $28^{\circ} 50'$. The center of this ground is crossed by the 83d meridian. Southwest of St. Martin Reef is what is known as the "New Ground," where excellent sponges are obtained in 42 to 45 feet of water. Another center of abundance is said to lie off Bayport. Nearly the entire region between Johns Pass and Cedar Keys, however, is regarded as good sponging-ground if not too closely fished. That portion off the Anclote Keys would be particularly productive if allowed to recuperate. It is believed by many that sponges are abundant off Egmont Key at the mouth of Tampa Bay, but the water is rarely clear enough to permit the grounds to be worked. South of Tampa Bay commercial sponges do not occur in sufficient numbers to justify the working of this coast until after passing Cape Sable.

The Florida Keys grounds extend from Key West eastward and northeastward at least as far as Cape Florida. On these grounds the sponges are found in the shallow water among the keys and along the reefs in all suitable places.

Good grounds are about the Matecumbe Keys, Stirrup Key, Bahia Honda, and Horseshoe Cove. The greater part of Biscayne Bay is an excellent sponging-ground.

SPECIES.

The commercial sponges of Florida are regarded as belonging to five different species. They all belong to the genus *Spongia*, and, named in the order of their importance, are as follows:

1. The Sheepswool Sponge, *Spongia equina glossypina*.
2. The Yellow Sponge, *Spongia agaricina*.
3. The Grass Sponge, *Spongia graminea*.
4. The Velvet Sponge, *Spongia equina meandriformis*.
5. The Glove Sponge, *Spongia officinalis tubulifera*.

Several varieties of these sponges have been described and numerous grades of each are recognized by the dealers.

SHEEPSWOL SPONGE.

The sheepswool sponge is found at various places along the Florida coast from Apalachicola on the west to Cape Florida and the head of Biscayne Bay on the east. The centers of greatest abundance are near Cedar Keys and Anclote Keys, though the entire region from off St. Marks to Charlotte Harbor produces this species. This is commonly called "the bay," and sponges from here are known as "bay sponges."

Below Charlotte Harbor the sheepswool is not found in any abundance until beyond Key West among the Florida Keys. Important grounds are about Knight Key, Bahía Honda, Matecumbe, and in Biscayne Bay.

The best quality of sheepswool sponges comes from the Anclote and Rock Island grounds. These are regarded by many as the best of all sponges. According to some, the key sheepswool were formerly regarded as the best, but now those obtained there seem to have deteriorated in quality. The best key sponges are said to come from the vicinity of Matecumbe Keys.

The sheepswool sponge grows upon hard, rocky, or barry bottom; in the shallower water, however, it is frequently found on grassy bottom. It is rarely found on soft mud or sandy bottom, and appears not to thrive under such conditions. The hard, rocky bottom is usually, perhaps always, of coral growth or origin.

The majority of the sheepswool sponges now obtained are secured in water ranging in depth from 30 to 50 feet. Some are found in water as shallow as 10 or 12 feet, but they are kept pretty closely fished out in these shallow depths. Formerly the principal and best grounds were in shallow water, but it is now found necessary to resort to deeper and deeper water year after year.

Whether the sheepswool sponge grows in any abundance at greater depths than about 50 feet is not definitely known. The method by which the sponges are secured is such as can not be applied in a depth greater than 50 feet. The majority of the spongers believe, however, that sponges grow in abundance beyond a depth of 50 feet. On the other hand, some think that, on the Florida coast, the commercial sponges do not occur in any numbers at greater depths than 50 or 60 feet. It is held by these that in depths greater than this the bottom is chiefly of sand and consequently unsuited to the growth of sponges. This opinion is based upon the observed fact that the better kinds of sponges, while doing well in shallow water if upon rock bottom, do not thrive upon sand bottom at the same depths, and the further fact that such investigations as have been made along the Florida coast show that the rock bottom upon which the sponges thrive does not ordinarily reach greater depths than 60 feet, but that beyond that depth a sand or mud bottom is found. Sufficient experiments in securing sponges by diving have not been made to throw much light upon this question.

According to Mr. E. J. Arapian, who possesses a wide and intimate acquaintance with all the important sponging-grounds of the world,

the commercial sponges of the east coast of Africa are obtained in depths as great as 110 feet, but there the bottom is of rock; the bars are much larger and more uniformly solid, while our bars are limited in area and surrounded by sand. The African bars are said to be of solid, flint-like rock, while those of Florida are broken and discontinuous.

The sheepswool is not only the most important commercially of all the Florida sponges, but is by some regarded as the most abundant species; others say that the grass and the yellow are really more numerous, though, owing to their less commercial value, fewer are marketed.

The sheepswool sponge attains quite a large size. Some have been found weighing as much as 3 to 4½ pounds. However frequently this may have occurred formerly, sponges of that size are rarely, if ever, seen now. Those obtained now run from 4 to 12 inches, or occasionally 15 inches, in diameter. The average size probably does not exceed 8 to 10 inches in diameter and 8 inches in height. One of the Key West buyers estimates that those being brought in now average about 12 to 16 to the pound.

The form of the individual sponge is said not to change much as the sponge gets older, but to remain essentially the same, however long the sponge may be permitted to remain unmolested. Any important irregularities in form or departure from the typical shape are due to interference with its growth through crowding or contact with other objects. On the whole, the sheepswool is probably the most regular and uniform in shape of any of the sponges. It is said to grow pretty well scattered, rather than in colonies, interspersed among gorgonians, corals, and other sponges.

Accurate information regarding the rate of growth of the sheepswool sponge is not as complete as might be desired. It is believed by many observers to grow the most rapidly of any of the sponges. Some experiments performed and observations made by Mr. J. T. Sawyer and others lead them to believe that this species may, under favorable conditions, grow from the beginning to one-tenth of a pound weight in six months.

As illustrating the short-sighted policy of the spongers in pulling the sponges just so soon as they have attained the minimum lawful size and even sooner, a case may be cited in which 1,250 sheepswool sponges were sold for \$5. If these 1,250 small sponges could have been allowed to grow for six months longer it is estimated that they would have sold for at least \$390.

The opinion that this sponge will grow from the spat to good commercial size in one year is practically unanimous. The spongers all testify that grounds which were thoroughly fished out one year are found to yield large numbers of commercial sponges twelve months thereafter.

It does not appear that sponges have many natural enemies. Many persons more or less conversant with the business think that crabs do some damage. The spongers say that in many instances, when the

sponge is brought up on the hook, a crab is found occupying a cavity in the base of the sponge, and it is generally believed that the crustacean has eaten the sponge tissue away, thus forming the cavity which it may afterwards occupy; others think that the crab finds the cavity already existing and simply uses it as a place of retreat, and this would seem to be the more reasonable view.

The greatest injury to the sponges, according to the spongers, is that caused by the so-called "black water" or "poison water." Just what this is does not seem to be definitely known, although knowledge of the occurrence of the phenomenon dates back many years. The more prevalent opinion is that heavy rains cause a strong flow of fresh water from off the land into the sea, and this water, being heavily impregnated with decaying vegetable matter and spreading out over the sponge-grounds, poisons the sea water and kills the sponges. It is claimed that the poison water always follows immediately after unusually heavy and continued rains. An objection urged against this belief is that this water, being fresh, merely spreads out over the surface and does not reach the sponges except in very shallow water. Those who hold this view maintain that the failure of the sponging vessels to bring in good fares at the time of the prevalence of the black water is not because the sponges have been killed, but because the spongers are unable to see them through the colored water. Attempts have even been made to devise a water glass which would enable the sponger to see the sponges below the black water. Some are inclined to the belief that the poison water comes not from the land, but rather from subterranean eruptions. It is claimed that sponges have been really killed in this way only once in the last twenty-five years.

A peculiar malady among the sponges between Knight Key and Cape Sable occurred in 1895. It is said that the sponges appeared all right until brought to the surface of the water, when the whole inside would drop out, leaving nothing but a mere shell. What could have caused the decay of the inside no one has yet been able to explain. According to one witness, these sponges were hollowed out when brought up, and usually a crab was found occupying the cavity.

Whatever the black water may be and whatever may be its effect, it is certain that the sheepswool sponge is decreasing in numbers very rapidly. All are agreed upon this point, and the cause of the decrease is not difficult to understand. While 500 bunches are now considered a good cargo, a few years ago 1,000 to 1,500 or even 1,800 bunches were often brought in at a single trip. The decrease continues from year to year, the bulk of the fishing is done in deeper and deeper water, and the sponges are harder to get each succeeding year. Grounds which are fished out one year are visited and raked over again the next year, without giving them sufficient time to recuperate.

The present law of the State of Florida governing the matter makes it unlawful to take any sponge under 4 inches in diameter. It is

admitted, however, that this provision is not enforced. According to this law the size of a sponge is determined by taking its diameter, measuring across the top of the sponge, no attention being given to the height. Some dealers think that the minimum size should be increased to 5 inches, and all are in favor of enforcing the law.

VELVET SPONGE.

This species is more limited in its distribution than the sheepswool, is more rare than any of the other commercial sponges, and seems to be decreasing more rapidly than any other. It is found rarely, if at all, on the Rock Island or Anclote grounds, but seems to be confined to the vicinity of the reef and the keys between Key West and Biscayne Bay. The best beds are said to lie about the Matecumbe Keys and between the reef and the chain of keys in what is known as the Hawks Channel. It usually grows on live coral bottom, in rather shallow water. The depths given by different persons vary from 3 to 25 feet, with 15 to 18 feet as the usual depth. It is said to grow in all sorts of shapes, and is consequently less regular or uniform than other species. In size it runs from 3 to 12 inches in diameter, the average being about 8 inches. It probably grows less rapidly than the sheepswool, though some of the spongers say that it will reach a commercial size in a year.

YELLOW SPONGE.

The distribution of the yellow sponge seems to be nearly the same as that of the sheepswool. It grows on the same bottom with the sheepswool and grass sponges on the Rock Island and Anclote grounds and among the keys. It is probably most abundant among the keys. All agree, however, that those from the keys are of much better quality than those from "down the bay," as they are much softer and tougher. It is found usually on rock bottom, interspersed among the sheepswool, though it often grows on grassy bottom with the grass sponge.

Among the keys it is found in 3 to 10 feet of water, while elsewhere it usually occurs at greater depths. In size those gathered range from about 4 to 8 inches in diameter. It is a very common species, ranking next in abundance to the grass sponge.

Among the keys it is said to be decreasing very rapidly, but, owing to the poorer quality of those found down the bay, it is not much sought after there, and is probably not decreasing so rapidly.

GRASS SPONGE.

This is the most abundant of all the Florida sponges, and is found on each of the three important sponging-grounds. Large numbers come from Rock Island and the Anclote grounds, as well as from among the keys and Biscayne Bay. The best beds on the Anclote grounds are said to be off Bayport and Big Bank, about 25 or 30 miles north of Tarpon Springs. The sponges from these grounds are of superior quality, though many claim that the best grass sponges come from the keys.

Among the keys and in Biscayne Bay the grass sponge is obtained in 3 to 10 feet of water, while on the west coast it is found in water somewhat deeper. It grows on either rock or sand bottom, but usually upon the former. It is more easily obtained than the sheepswool, chiefly, no doubt, because it is more abundant in shallow water.

There seems to be more variation in the form of this sponge than in the other species. It is usually more or less cup-shaped and can readily be distinguished. It seems to attain a very large size, perhaps larger than any other species. The small grass sponges, 4 or 5 inches in diameter, are of little or no commercial value.

A decrease in abundance is reported for this as for the other species.

GLOVE SPONGE.

The glove sponge is the most circumscribed in its distribution of any of the Florida commercial sponges. It is abundant among the keys from Key West to Biscayne Bay, but probably does not occur on the Anclote or Rock Island grounds. It is common about Key West in rather shallow water. The usual depth at which it is obtained is 3 to 10 feet, though it occurs in deeper water. It grows on rock or barry bottom, mixed with the yellow and the sheepswool sponges. Its rate of growth is about the same as that of the sheepswool. Commercially the glove is the least important of any of the species, and for that reason it probably has not suffered so greatly from overfishing.

SPONGE-CULTURE.

The artificial propagation of sponges has never received much attention in Florida. A number of years ago Mr. J. Fogarty, of Key West, carried on a series of experiments in propagating sponges from clippings. An account of these experiments has been given* as follows:

The sponges were all raised from cuttings; the localities in which they were planted were not the most favorable for sponge development, and their growth was, therefore, less rapid and perfect than might otherwise have been the case. They were fastened to the bottom, in a depth of about $2\frac{1}{2}$ feet of water, by means of wires or sticks running through them. The four specimens sent to Washington were allowed to remain down a period of about six months before they were removed. Fully four months elapsed before they recovered from the injury done them in the cutting, which removes the outer "skin" along the edges of the section, and the actual growth exhibited was for about two months only. The original height of each of the cuttings was about $2\frac{1}{2}$ inches. One was planted in a cove or bight, where there was little or no current, and its increase in size was very slight. The other specimens were placed in tideways, and have grown to from four to six times their former bulk. Two hundred and sixteen specimens in all were planted at the same date, and at the last accounts those that remained were doing finely. The chief obstacle to the artificial cultivation of sponges at Key West arises from the fact that the sponge fishermen infest every part of the region where sponges are likely to grow, and there is no legal protection for the would-be culturist against intruders. The enactment of judicious laws bearing upon this subject by the State of Florida, or the granting of special privileges conferring the right to occupy certain prescribed areas for sponge propagation, would undoubtedly tend to increase the annual production of this important fishery.

* Fishery Industries of the United States, sec. v, vol. 2, p. 832.

In the same volume of the Fishery Industries report is given a full account of the very extended experiments which were carried on by Mr. Buccich at the island of Lesina, in the Adriatic Sea, on the coast of Dalmatia. This report contains so much important information that it is proper to give a summary of it here.

After Prof. O. Schmidt, in an article in the *Wiener Zeitung*, and in his work on the sponges of the Adriatic,* had expressed the opinion "that if a perfectly fresh sponge is cut into suitable pieces, and if these pieces, properly protected, are again placed in the sea, they will grow, and finally develop into complete sponges," the government and a number of prominent merchants of Trieste had some experiments made during 1863-1872, and established a station on the bay of Socolizza, at the northeastern point of the island of Lesina, which in May, 1867, was placed under the direction of Mr. Buccich. This establishment was closed in November, 1872, as its continuance became impossible, because, in spite of Mr. Buccich's oral and written remonstrances, it was continually disturbed by the fishing nets and was actually robbed several times. A species of worm which destroyed the woodwork appeared harmless compared to the hostile attitude of the population, which showed an utter want of respect for the property of other persons, and manifested deep-rooted prejudices against any innovations, as well as a reluctance to break with old habits.

The most favorable season for raising sponges from cuttings is winter. It is true that the growth of the sponge and the new formations on the cut sides goes on slower in winter than in summer, but a high temperature of the air often endangers the entire crop, on account of the tendency of the sponges to rot. In winter a sponge may remain on the dry land for several hours, while in summer it will perish in a few minutes, especially if it has been injured and if it is not constantly moistened with sea water. Mr. Buccich exposed sponge cuttings to the air in a shady place for eight hours during February, when the temperature of the air was 48° F., and still they all took root.

The best localities are bays, where the waves are not too strong, but where the surface is not entirely smooth either, with a rocky bottom covered with green algæ and exposed to a gentle current. It is a well-established principle that the mouths of streams and rivers and of subterranean springs should be avoided. The fresh color of the algæ is a sure indication that the choice of locality has been fortunate. The worst enemy of sponge-culture is mud. Under certain circumstances it would be well to close the entrance to the bay to vessels by a chain.

The sponges which are to be cut should be very carefully gathered by experienced persons. * * * The sponges are brought up either with their base—and this is the most favorable way—or they must be torn from the base, which operation frequently tends to injure them. * * * In gathering sponges for cutting, it is entirely unnecessary to select nice looking specimens, for misshaped pieces which would be worthless in trade are just as good for this purpose as beautifully rounded ones. These latter should not be cut, but should be reserved for the trade. * * *

Mr. Buccich found that it was not expedient to place the sponges, as they were gradually gathered, into a vessel, to keep them there until they were to be cut, because they were injured by pressing against each other or by being shaken too violently. He therefore provisionally fastens them with wooden pegs to the inner side of a sort of fish box, which is held in tow by the fishing boat. If the sponges are injured, the injured portions should be immediately removed; the remainder is likewise fastened with wooden pegs, either as it is, or subdivided into large pieces.

When the temperature is low during the cold season, the sponges can be prepared for raising as soon as the place is reached where the process is to be carried on,

* "*Die Spongien des adriatischen Meeres*," Leipzig, 1862, p. 22. See also O. Schmidt, "*Supplement der Spongien des adriatischen Meeres*," Leipzig, 1864, p. 24; and especially Brehm, "*Thierleben*," 2d edition, vol. 10, Lower Animals, by O. Schmidt, 1878, p. 534.

while during the warm season it will be found profitable to wait a little in order to see whether there are any indications of putrefaction. This can be recognized by the darker color and the softening of the respective portions. If anything of the kind is noticed, the sponge should be watched to see to what extent the process of disintegration has progressed. Small sponges will almost entirely fall a prey to it, while in large ones the evil may be confined within certain limits. The cutting should be done rapidly, either with a common knife or—as Mr. Buccich found more advantageous—with a blade resembling a fine saw, which is less liable to be injured by the many foreign bodies inclosed in sponges. In cutting, the sponge had best be laid on a small board moistened with sea water. The size of the cuttings is generally about 26 square millimeters. It is well if every piece has as large a surface as possible of intact outer skin. The cuttings should be fastened immediately to those objects where they are expected to grow.

A healthy piece of sponge soon grows firmly on any object with which it is brought in close contact. The sponges which have been cut will again grow together. Those cuttings which have only a single cut surface will soon grow fast to their new base, stone, wood, etc. Mr. Buccich thinks that during a calm lasting twenty-four consecutive hours, cuttings should simply be sowed on a rocky bottom and would soon grow. He has seen pieces laid on gently slanting rocks grow fast to them during a perfect calm. Induced thereby, and also by the natural occurrence of sponges, Mr. Buccich tried flagstones, about 53 millimeters thick, as a basis. He bored holes in them and fastened the cuttings by means of wooden pegs, which were driven into the holes; but it soon became apparent that the mud and sand at the bottom, perhaps also the excess of light, were injurious to the further growth of the sponges. Experience has shown that light and mud are among the worst enemies of the sponge, and their influence must be avoided or limited by every possible means. Stones form the natural basis of sponges. They are cheap, and are not attacked by the *Teredo*.

Originally, Prof. O. Schmidt used wooden boxes, closed on all sides but perforated, to whose inner sides the pieces of sponge were fastened with metal or wooden pegs. This exceedingly simple arrangement did not prove efficient, because the boxes when let down into the deep water became full of mud, and the holes being stopped up no light whatever could enter. The sponges began to look pale and sickly. It is not good to fasten them with metal pegs, for it seemed to retard their growth. The rust which forms very soon causes the pieces of sponge to become loose, and will ultimately destroy them. Laths or boards placed obliquely, on whose upper side there were floating contrivances in the shape of tables, to the lower side of which the sponges were fastened, were likewise used. With the former the want of covering was keenly felt, and with the latter the rays of the sun proved injurious, as well as all the different little objects floating on the surface of the water which may be grouped together under the collective name of "dirt." Mr. Buccich at first prepared an apparatus consisting of two boards crossing each other at right angles, with a third board serving as a sort of lid, and after this had proved unsatisfactory he adopted the apparatus which I shall now describe, and which he preferred to all others because the cuttings were exposed on all sides to the sea water and assumed the favorite round form. This apparatus consisted of two boards, 63 centimeters long and 40 centimeters broad, one forming the bottom and the other the lid. Both were kept in a parallel position, one above the other, at a distance of about 42 centimeters, by two props about 11 centimeters distant from each other, between which stones may be placed as ballast. On the outer side of the lid there was a handle. Both boards had holes at a distance of 12 centimeters from each other, the total number of holes in each board, therefore, being 24. Mr. Buccich did not fasten the pieces of sponge singly to the apparatus, but he placed several of them on one peg and then stuck the pegs in the holes. For these pegs he used bamboo, whose hard, smooth bark defies all attacks of worms. These pegs were 42 centimeters long, and perforated horizontally, the holes being at the distance of 12 centimeters from each

other, and the lower end was split. Three pieces of sponge were put on each peg and pushed up high enough to be above the horizontal holes, through which a wooden peg was pushed, thus fully securing the sponges.

If the pieces of sponge are simply to be fastened with wooden pegs, a three-cornered stiletto will suffice for making the holes in sponges; but when they are to be strung upon pegs this or any similar instrument can not be used, because too great a pressure would have to be exercised to make a sufficiently large opening for the passage of the pegs. Any pressure will injure the sponges to some degree, and to limit its extent or force as much as possible should be the first object. Mr. Buccich bored the holes with a trepan 6 millimeters wide, fastened to a vertical turning table, which was kept in rapid motion by a fly wheel. One hand pressed the sponge lightly against the trepan, the other turned the wheel, and the operation was finished in a few seconds. The hole in this manner is perfectly smooth, none of the fibers have been pulled out, and none of the sarcode has flowed out. As soon as a peg has been furnished with sponge cuttings, its split end is stuck in one of the holes of the apparatus and a wedge is driven through the crack. As lid and bottom hold 24 pegs, each with 3 cuttings apiece, such an apparatus can hold 144 cuttings. During this whole process the sponges should be continually moistened with sea water, especially during summer. As soon as an apparatus has been filled it should immediately be let down into the water if the temperature is high, while in winter a delay will not prove injurious. The letting down and raising of the apparatus had best be done by means of a small anchor, and it should be let down to a depth of 5 to 7 meters. Mr. Buccich does not consider it necessary to have the apparatus suspended from a sort of scaffolding. All the woodwork should be well tarred, as this will prove the only, though by no means always efficient, protection against worms. The *Teredo* does not only cause an increase in the capital to be employed, because it makes new apparatus necessary from time to time, but it also diminishes the results, because the pegs will gradually get loose and fall off. It would, therefore, be best to dispense with wood altogether, and either construct the apparatus of stone, taking the necessary precautions against mud and excess of light, or construct Mr. Buccich's exceedingly practical apparatus of iron.

If, after three or four weeks, the sponges have grown firmly to their base, they are sure to develop successfully. Their most characteristic tendency is the desire to grow round. In order to facilitate this in all directions, Mr. Buccich strung the sponges on pegs. As regards the development of the sponge cuttings within certain given periods, we have only very imperfect information, as it was impossible to make continued undisturbed observations. Mr. Buccich says that the cuttings grow two or three times their original size during the first year. He also mentions that the cuttings grew better during the first and fourth year than during the second and third. It is his opinion that, although some pieces will grow to a considerable size in five years, it will require seven years to raise completely matured sponges which are fit to become an article of merchandise. I can not pass by the fact that besides well-developed and growing sponges there were some which outwardly looked perfectly healthy, but had ceased growing.

In conclusion, Mr. Buccich discusses the question whether the enterprise can, on the whole, be called profitable, and says that he must answer it in the affirmative. He thinks that if all the lessons taught by experience are carefully observed, the cuttings will always develop successfully, and that the loss would at most be 10 per cent, taking into account unexpected accidents and the stationary character of some of the sponges. Calculating the expense of an establishment for 5,000 sponges at 300 florins and the loss at 10 per cent, the price realized by 4,500 sponges would indicate the profits. Mr. Buccich calculates the value of 4,500 sponges at 900 florins. This sum is, in my opinion, much too high, as the wholesale sponge-dealers in Trieste receive an average price of 8 and a maximum price of 10 florins per kilogram of Dalmatian sponges.

Sponges fetching the price given by Mr. Buccich ought to have a very considerable size, and their slow growth justifies the supposition that even after seven years they will not yet have reached that size. It must also be taken into account that the market value of sponges which have been raised on pegs is one-third less than that of naturally grown ones, on account of the hole in the center. The profitable-ness of sponge-culture would be far more evident if there was not such a long interval between planting and harvesting—in other words, if the sponges would grow more rapidly. This was certainly looked for when the enterprise was started; but it is dispiriting to have to wait for your crop for seven long years. And, in order that when that period has been reached there may be crops every year, it will be necessary to invest the same annual amount of capital for a period of seven years. The apparatus, moreover, is not so simple that every fisherman could easily construct it himself, for experience has shown that wood, which would be the easiest material for working, can not be used on account of the ravages of the *Teredo*.

As far as our present knowledge goes, it is certain that sponge-culture will not be profitable for poor men, but that it can only be carried on successfully on a very large scale, either by wealthy individuals or by joint-stock companies. It would be very encouraging to know more concerning the progressive development of the sponge in its natural condition, and especially to know that this development was just as slow as that of the cuttings. Prof. O. Schmidt inclined to this opinion. But if it should prove erroneous, it would be more than questionable whether it is profitable to cut to pieces a sponge which uncut would have quicker reached the same size and weight than all the cuttings together in seven years. Under such circumstances sponge-culture had better be confined to the transformation of flat, and therefore worthless, sponges into round ones, which, though small, would find a ready market. Possibly several especially misshaped pieces of sponge might be made to grow together and form larger and better-shaped ones. The experiments made by Cavolini and those of Mr. Buccich, above mentioned, show that there is no difficulty in doing this.

Recently Mr. Ralph M. Munroe, of Coconut Grove, Fla., carried on an extended series of experiments in Biscayne Bay, an interesting account of which is given in the report on that region already alluded to.

These experiments by Mr. Fogarty and Mr. Munroe seem to demonstrate conclusively that the Florida sheepswool sponges grow very much more rapidly than did those experimented with by Mr. Buccich. Their cuttings grew to good commercial size in six months' time, and this agrees with the observations of all the dealers and spongers who were consulted about the matter.

This rapid growth of the sheepswool sponge and the high degree of success attained in the experiments which have been tried show very clearly that the artificial propagation of sponges in Florida by means of clippings is entirely practicable. That the adoption of methods of artificial sponge-culture would inure greatly to the benefit of the Florida sponge industry scarcely admits of question. Not only would it permit an expansion of the trade and fishery in the interests of the dealers, vessel-owners, and fishermen, but it would furnish employment to many other people, put the sponge business on a more substantial and permanent basis, and invite new capital. It should not be difficult to secure proper legislation on the part of the State by means of which the industry would be advanced and the interests of all concerned properly guarded.

MR. ARAPIAN ON THE FLORIDA SPONGES.

In compliance with a request, Mr. E. J. Arapian, the well-known sponge-dealer of Key West, furnished the following interesting and valuable information concerning the commercial Florida sponges. Mr. Arapian has been in the sponge business for many years, and is familiar not only with the sponge-grounds of Florida, but with those of other parts of the world:

Distribution.—Sponges on the coasts of Florida are to be found starting from Biscayne Bay and vicinity, on the southeast of Florida, and around all the keys in south Florida, more or less in places; then, proceeding toward the west coast of Florida, they are found at Gasparilla Island, Osprey, New Pass, Sarasota Key, Mullet Key, Sand Key, Clearwater Key, Long Island, Anclote Keys, up to Cedar Keys, and from Cedar Keys up to Apalachicola Bay.

The fiber of sponges of the same species found on the above-mentioned sponge bars differs somewhat, according to the location of these bars. Those from a place called Fishbone Key sponge-grounds are of much thicker fiber, and thereby stronger and much heavier in weight than sponges gathered at other places. Fishbone Key is about 25 miles from Cedar Keys. At Pepperfish Key, about 12 miles from Fishbone Key, the sponges are also of thick tissue or fiber and of heavy weight, but not quite as much so as those from Fishbone Key. At another place, called Ocella Bay, in contrast to the two above-mentioned places, sponges are of very thin fiber; therefore of light weight. Ocella Bay is about 40 miles northwest of Pepperfish Key.

Character of the bottom.—The bottom on which sponges grow is of a ridgy or undulating rock, which looks alive to the eye, so to say, and is invariably covered with a species of short moss and tall sea feathers. The rocky bottoms on which there is no growth of moss and sea feathers have always been found to be bare of sponges also. This moss is of several colors, viz, either red, brown, or white.

It is my impression that the root of a sponge is of the same color as the rock on which the said sponge has been growing. It has certainly been noticed that every species of sponge, in its natural condition, and before being artificially bleached, has either a red or a brown or a white colored root, which corresponds with the color of the rock on which the sponges have been growing. It is also my belief that the color of the sea moss and the sea feathers is the same as that of the rock on which such moss and sea feathers are growing. If the bottom is of red rock, the sponges growing on it will also have red roots, and the sea moss growing on the same rock will be of red color. If the bottom is of brown or white rock, the roots of the sponges growing on it, as well as the sea moss, will have the same colors.

Depth of water.—Sponges are to be found at present at a depth of from 12 feet to about 50 feet. In deeper waters the bed rocks are generally scattered, few in number, and of short extent. The bed rocks in deeper waters than 56 feet seem to be of a different nature, and barren. The bottom on the west coast of Florida is generally sandy at greater depths than 56 feet, according to the general reports of the oldest of the sponge fishermen here.

Abundance.—Sponges are still abundant on the coast of Florida, but the almost continual bad weather at sea during the last three years has prevented the securing of as large quantities as formerly.

Relative size.—The different species of sponges in Florida waters attain sometimes quite large proportions. The species called sheepswool, yellow, and grass sponges attain the largest sizes. There are frequently seen sheepswool sponges measuring 15 inches in diameter by 20 inches in depth. The heaviest sheepswool sponge that I have come across weighed 17 pounds. It was secured in the Northwest Channel near Key West. Other species, as the glove sponge and the hardhead sponge, do not usually grow to larger sizes than 8 inches in diameter and 4 to 5 inches in depth. Some few larger specimens have been secured at times, however.

Enemies.—I do not know of any, but it is the prevailing opinion here, among sponge fishermen, that during some years poisonous water comes out of the Suwanee River near Cedar Keys, and that this water runs into the sponge-grounds near by and then kills the sponges. The fishermen state that some years they have found many sponges floating loose on the surface at the sponge-grounds in the vicinity of Cedar Keys. This opinion may perhaps be correct, but personally I do not share it, because I do not think that even if poisonous water was actually flowing out of the Suwanee River it could reach the sponge-grounds at sea, nearly 50 miles from the mouth of that river, and that the said poisonous water could then sink to a depth of at least 30 feet to reach and injure the sponge bottom. I am inclined to believe that some submarine convulsions, perhaps, are the cause of these uprootings of the sponges which have been found floating loose on the surface of the water at times.

As one of the causes injurious to the growth and propagation of the sponges, I would mention submarine diving apparatus. This is the greatest enemy to the growth of the sponges, as has been proved by its continual use on the grounds of the Archipelago Islands in Europe and on the east coast of Africa, in both of which places the submarine diving has left the grounds almost entirely bare. The iron shoes of the divers walking on the sponge beds in the bottom are said to have killed the sponges. Up to a few years ago the sponge gathering in the Archipelago Islands in Europe had been performed by the means of iron hooks attached to long poles, in the same method as it is used in Florida at present, and also by means of naked divers. Some few years back, however, someone has introduced the use of the submarine diving apparatus for sponge gathering in the Archipelago Islands.

Soon after the extensive sponge-grounds on the east coast of Africa were discovered, and the submarine diving apparatus was put to use there at a lively rate by the Greek sponge fishermen of the Archipelago Islands. The consequence was that inside of a few years the submarine diving fleet, which had started gathering the sponges first on the east coast of Africa, at the depth of only 8 to 10 feet, were obliged to dive at greater depths gradually in order to find the sponges, and inside of a few years they had cleaned out almost the whole extent of the newly discovered and extensive sponge-grounds to the depths of 70 to 80 feet. I understand that lately they are obliged to dive to the depth of 100 feet and more in order to find the sponges. These experiments and solid facts are sufficient to convince one that submarine diving for the sponge with diving apparatus is extremely injurious to the life and growth of sponges, and I believe it is its greatest enemy. Sponges do not grow any more on the grounds on which the submarine diver's shoes have walked.

Decrease or increase in recent years.—Since 1892 there has been a gradual and marked decrease in the quantity of sponges gathered yearly in Florida waters, owing principally to the almost continual bad weather at sea, and secondly to the careless and continual gathering of very young and small-sized sponges by the fishermen, which naturally tends to hurt the growing crops.

Sponge cultivation.—Regarding the artificial culture of the sponges, I would say that experiments, some of which have been on a large and very costly scale, have been tried unsuccessfully by some merchants of Trieste, and others in Europe. These experiments have been made on the sponge-grounds of the Archipelago Islands, in the Mediterranean Sea, and in every instance they have proved a failure. The methods employed have been to use the small cuttings from a live sponge and to fasten these cuttings to the rocks by the means of a wire. Submarine divers have been necessary to perform the work of this so-called planting of the sponges; the cutting of the sponge and the planting of same were performed by these divers while under water, and without bringing the cuttings to the surface.

The only practical and successful method I can think of regarding the cultivation of sponges is to let nature do its work by allowing it sufficient time. This can be done by dividing the area of the sponge-grounds at sea into squares each of 100 miles, more or less, and then allowing the fishermen to gather sponges only in certain squares each season of the year.

According to all reports, on some grounds sponges grow much faster than on others. They have been noticed to grow to full size inside of four months in certain localities along this coast, while at other localities it takes young sponges at least six months to grow to full size. This fact can be put to advantage by restricting sponge gathering during several months on certain grounds, during which time the sponge fishermen can gather the sponges on the other parts of this coast. However, as it is necessary to the sponge fishermen to have not only good weather but also clear water, so as to enable them to see the bottom and to locate the sponges, it may happen that when they are out on their expeditions they may meet with muddy water on the unrestricted sponge-grounds of the season, while on the restricted grounds during that season the water may be clear and just in condition to allow them to locate and to gather the sponges. However, as the benefit that sponge fishermen could derive from the above restriction of certain grounds during certain seasons of the year would soon be important and lasting, it seems to me that no proper objections could be offered to the method.

Legislation needed.—The legislation needed for the protection of the sponge beds on the coasts of Florida would be to reach the three following essential points:

1. To divide the sponge-grounds on the coast of Florida into sections or squares of 100 miles, more or less, each, and to allow the gathering of the sponges on each section at certain intervals of time only, thus leaving the sponges which are on the other sections or squares at rest during that time, to grow and to reach the seeding sizes.
2. To prevent the gathering of small or undersized sponges.
3. To forbid the use of the submarine diving apparatus on the sponge beds, so as to prevent parties who at any time may perhaps undertake the use of some to the injury of the sponge beds.

OYSTERS.

The oyster does not occur on the coast of southern Florida in any abundance, but on both coasts in the northern part of the State important beds are found. At various places on the east coast, between Fernandina and Biscayne Bay, are grounds which are worked to some extent, those in Nassau County being the most extensive and productive. The beds in Indian River are sufficiently important to supply the local demand and furnish a considerable surplus for shipment. The best beds are apparently in the southern end of the river.

Oysters are not known to occur in any numbers in Lake Worth, but in Biscayne Bay there are beds which can probably be made to produce a fair yield. Below Biscayne Bay no oysters of commercial value are known until Charlotte Harbor is reached, on the west coast. It should be stated, however, that this portion of the coast has never been systematically examined for the purpose of locating any oyster beds that may exist. It is not at all improbable that such an examination would show the existence in that region of oyster-grounds of some value.

The most southern beds of importance on the west coast are located at the mouth of Manatee River, in Sarasota Bay, and at Cape Haze, in Charlotte Harbor. Besides these, there are other small beds at various places along this coast which are worked to some extent. The supply from all these beds is said to be steadily decreasing, and it is the general opinion that unless something is done to protect the beds they will soon become entirely depleted. Some years ago Tampa drew its supply principally from Old Tampa Bay, but the beds at that place became entirely depleted and have not been worked at all for the last

few years. Some attempts have been made at planting oysters about the mouth of the Manatee River, but, owing to the absence of any protection from the State, the matter was not gone into very extensively.

There are some native oysters about the mouth of Anclote River, and Mr. H. A. Smeltz, of Tarpon Springs, has done something toward improving and increasing the supply. Mr. Smeltz's experiments were carried on between the Pitblachascootie and Anclote rivers, whose mouths are about 5 miles apart. In 1892 he planted several bushels of Chesapeake Bay oysters, scattering them among the native oysters. To facilitate the fixation of spat, he drove a number of stakes at different places on and about the beds. These stakes were of yellow pine, cedar, and palmetto, one inch thick and of various widths, and were placed upright, generally on mud bottom. About 400 stakes were set at various times from April to July, 1893. Those set in May and June collected the largest number of spat; about equal numbers were collected by those put down in April and July, but considerably less than by those set out in May and June. Spat collected upon these stakes in April grew to good-sized edible oysters by the February following.

Besides making the small plant of Chesapeake Bay oysters, Mr. Smeltz transplanted to his grounds the native oyster from several different places along the Florida coast, and was surprised to find that the seed oysters from the Chesapeake proved the more hardy. The topography of the beds with which Mr. Smeltz has been experimenting, as well as the salinity of the water, seem quite favorable, and with proper protection these grounds would be very productive. Stealing oysters from the beds has been of such frequent occurrence that Mr. Smeltz has practically discontinued his attempts to improve the beds.

Small beds of native oysters are found at various places on this part of the coast. They were at one time very extensive beds, but are now practically depleted. The oysters are said to have been of good shape and excellent quality.

The next beds above Anclote Keys are about the mouth of Crystal River, some 40 miles up the coast. These beds are not of great extent, but have long been noted for the good quality of their oysters. They have been worked so assiduously during the last few years that they are said to be showing signs of depletion. They are worked chiefly by people living at the towns of Crystal River and Homosassa.

On the coast of Levy County oyster beds of considerable importance are found. The best are said to be in No. 4 Channel, between Cedar and Derrick keys, connecting Wacassassee and Suwanee bays; on Pelican Reef Bar, which runs from just above No. 4 Bar up Suwanee Bay about $2\frac{1}{2}$ miles; on Fishbone Bar, which extends from the north side of Suwanee River up the coast several miles; on Corrigan Reef, which runs for 4 miles south of Cedar Key, and on the Wacassassee Bar, near the mouth of the river of the same name. The best of all of these are the beds in No. 4 Channel.

These beds have been very productive, but all agree that the demand made upon them has been too great and that it is now much more difficult to obtain a boat load than formerly. Attempts have been made at transplanting by Mr. William H. Anderson, of Cedar Keys, and the results were very satisfactory until stealing the oysters from his bar became too frequent. The laws of the State do not afford adequate protection to those who strive to increase the natural output of the beds, and all who have experimented in that line have become discouraged and given up the matter. The recent severe freezes and the great storm of September, 1896, also did much toward destroying the oyster beds of this region.

There are a few small beds in what is known as Spring Creek Bay, near Shell Point, in Wakulla County, but they have not as yet been much worked. Small beds near Carrabelle are fished to some extent.

Perhaps the most important, as well as the most extensive, oyster-grounds on the Florida coast are those in Apalachicola Bay and vicinity. These grounds have recently been carefully surveyed by the U. S. Fish Commission steamer *Fish Hawk*, and are the subject of a special report.* The most important beds are said to be on Sneeds, Peters, Bulkhead, East Hole, Porter, North Lump, Greenpoint, and Lilly bars.

The general opinion among those consulted is that the supply of oysters in this region is steadily decreasing, yet there are those who deny that any considerable decrease has occurred. The causes of the decrease are several, among which may be mentioned freezes, severe storms, and the method of fishing. Many of the oyster beds are said to be out of water at extreme low tide, and a severe freeze occurring at that time kills the oysters. Recent storms swept many oysters off the beds on to mud bottom, where they smothered.

It was found that most of the dealers, as well as the oystermen, are in favor of the State leasing the beds to those who desire them. By this means they believe that the yield can be greatly increased.

Valuable oyster-grounds exist along the coast west of Apalachicola, the most extensive being in St. Andrews, Escambia, East, and Perdido bays. Considerable quantities of oysters are taken in St. Andrews Bay, but owing to their very thin shells they can not be shipped to distant points, and most of them are consequently used locally or at Pensacola. No particular change in the condition of these beds has occurred. The important oyster-grounds in the vicinity of Pensacola have suffered greatly from natural causes. The principal beds were almost wholly destroyed in July, 1896, by a storm which swept some of the reefs clean and flooded others with mud; an accompanying freshet did further damage to the surviving oysters. The demand in this section is in excess of the natural supply, and the planting of oysters has been carried on, although to only a limited extent. This business would doubtless develop much more rapidly if the planters

* Report of a survey of the oyster regions of St. Vincent Sound, Apalachicola Bay, and St. George Sound, Florida. By Lieut. Franklin Swift, U. S. N. (Report United States Fish Commission, 1896.)

were protected in their rights. The depredations of poachers, combined with losses incurred from storms, have greatly hampered the plan of increasing the supply by cultivation, and the tendency is to abandon the business unless ample protection is afforded.

FISHES.

During the conduct of the investigations covered by this report the food-fishes of the principal fishing centers of Florida were studied, with the object of determining the food-fishes of the different sections, the relative abundance, distribution, spawning habits, food, and enemies of each. Information was sought regarding the present abundance, size, and condition of the various species as compared with former years. The chief inquiries were made in Indian River, Lake Worth, Biscayne Bay, at Key West, Tampa, and Tarpon Springs.

As regards the number of species of fishes handled by the fishermen, Key West is by far the most important fishing center in Florida. This is due to the fact that in the waters about Key West are found more species of fishes which are used for food than can be found at any other single locality in the United States. If to the food-fishes of Key West are added all the other species found there, a list of more than 225 species known from that region is obtained. The species which are used as food are not fewer than 100 in number.

The investigations indicate that there has been no serious decrease in the abundance of any of the food-fishes of this region. The methods are calculated to conserve the fisheries to the fullest extent. Few fishes are lost for want of a market. Only such as are thought salable are brought into market, and there they are kept alive until they are sold. So long as these methods continue, no serious diminution is likely to occur with any of the numerous food-fishes of Key West.

The more important food-fishes of Key West are briefly discussed in the following pages. The different species are considered by groups approximately in the order of their commercial value. The common names given are those in use among the Key West fishermen. The Spanish names in use among the Cuban fishermen of Key West are given in many cases.

1. Grunt. Common Grunt. White Grunt, or Ronco, *Hamulon plumieri* (Lacépède).

The most abundant of all the Key West food-fishes, and caught all the year round, the best season being during the fall. Their spawning season is during August and September, at which time they gather up into schools on shoal, feathery, rock bottom, where they spawn. Each roe is from 1 to 2 inches in length. The eggs are said to be "gritty" to the touch and about the size of a No. 10 shot. When ripe they separate and flow freely from the fish. When done spawning the schools break up and the fish scatter. They are so abundant, however, that they can usually be found in large numbers anywhere on suitable bottom. The best fishing is always on rock bottom, Crawfish Bar being one of the best grounds.

These fish grow to about 18 inches in length and a maximum weight of 4 pounds. They are not often seen, however, weighing more than 2 pounds, and the average weight does not exceed one-third of a pound.

2. **Yellow Grunt or Ronco Amarillo**, *Hamulon sciurus* (Shaw). Less common than the preceding species, but very plentiful. Found in schools on rock bottom. One fisherman reports that he has often caught 500 to 600 in a single day. It is most common in summer: cold is said to affect it seriously. The best fishing for this species is in August. The best bait is a long worm which the fishermen get from the stem of a tall grass which grows on the bars. The yellow grunt reaches a weight of 1 pound or less. Nothing could be learned concerning its spawning habits, except that it probably spawns in August.
3. **Margate-fish**, *Hamulon album* Cuvier & Valenciennes. The origin of the common name of this fish is not generally understood. It appears, however, to have been derived from Margate, a seaport and watering-place in Kent, England, situated on the Isle of Thanet, 64 miles east by south of London. Some of the fishermen of the Bahamas came originally from Margate and applied the name to one of the fishes which they found in the Bahamas. Many of the Bahama fishermen (Conehs) have come to Key West and brought the name with them. The name Margate is, at Key West, sometimes corrupted into "Margat" and "Margaret," while in Biscayne Bay it is "Margat," "Market," or "Margarite." The Margate-fish is a common and important species at Key West. It reaches a weight of 8 or 10 pounds, the average being about 4 to 6 pounds. It is found in deeper water than the preceding species, and is said to be most abundant on the reef. It spawns early in the summer, probably in July, on rock bottom, at which time it is said to school. One intelligent fisherman says, however, that it does not school at Key West, though it does at the Bahamas. It is generally found on rock or barry bottom, around shoals. At night it comes into more shallow water to feed, crabs, crawfish, worms, etc., constituting the bulk of its food. The bait used for it is crawfish or crabs. Cold is said not to affect this fish to any great extent.
4. **Sailor's Choice**, *Hamulon parva* (Desmarest). This species, which is not the sailor's choice (*Lagodon rhomboides*) of the south Atlantic coast, is abundant about Key West. It collects into schools in July and August, at which time it spawns on rocky bottom. It reaches a weight of 2 pounds, the average being about half a pound. The best fishing for this species is in summer.
5. **French Grunt**, *Hamulon flavolineatum* (Desmarest). Not uncommon, but nothing of importance was learned regarding it.
6. **Tom-tate**, *Bathystoma rimator* (Jordan & Swain). Said to be common. Only a few examples noticed, and nothing was learned of its habits.
7. **Porkfish**, *Anisotremus virginicus* (Linnaeus). Common about Key West. It schools from June to August, which is the spawning season; found then about the shoals, but soon retires to deeper water. It spawns all through the channel about the shoals, and is then caught in greatest numbers. About a month after the spawning season immense numbers of young are seen on the shoals. This fish reaches a length of about a foot and a weight of 2 pounds. The average weight of those brought to market probably does not exceed one-third of a pound.
8. **Saucer-eyed Porgy**, *Calamus calamus* (Cuvier & Valenciennes). Common. The average weight is about half a pound, the maximum being about a pound. The principal fishing season for this species is in the winter, but it is taken throughout the year. Nothing was learned of its spawning habits.
9. **Little-head Porgy**, *Calamus proridens* Jordan & Gilbert. This species is found with the saucer-eye and is equally common. It reaches a weight of 2 pounds, the average being about half a pound.
10. **Sheepshead Porgy**, *Calamus penna* (Cuvier & Valenciennes). Common with the preceding, reaching a weight of 4 pounds, the average being about a pound. It is most abundant in winter.

11. **Grass Porgy**, *Calamus arctifrons* Goode & Bean. This species is also common about Key West. While all the other species of this genus are usually found on rock bottom, this is most abundant on grassy bottom, as its common name indicates. It seldom exceeds 2 pounds in weight, averaging not over half a pound.
12. **Jolt-head Porgy**, or **Bajonado**, *Calamus bajonado* (Bloch & Schneider). This is the most important of all the species of Key West porgies. It reaches a weight of 8 or 10 pounds, and an average of 5 or 6 pounds on the reef, but smaller in the "bay."* Its maximum length is about 2 feet. It frequents smooth, rock bottom, upon which it spawns in July and August. It is found throughout the year. At Miami the name of this fish is by some corrupted to "juffle-head porgy."
13. **Bream**, *Lagodon rhomboides* (Linnaeus). A common, small pan-fish.
14. **Bream**, *Archosargus unimaculatus* (Bloch). Less common than the preceding.
15. **Chub**, *Kyphosus sectatrix* (Linnaeus). Not widely distributed about Key West, but very abundant in certain places. It is found all the year round about the shoals in the channels, and is said to school in the summer. It attains a weight of 9 pounds, with an average of 3 or 4 pounds. It is one of the gamiest fishes of Key West and is well worth the angler's attention.
16. **Rock Hind**, *Epinephelus adscensionis* (Osbeck). Said to be very common on rocky elevations in deep water. It reaches a maximum weight of 15 or 16 pounds, but the average of those brought in does not exceed 2 or 3 pounds. It will take any kind of bait, and probably spawns in the fall.
17. **Nassau Grouper**, *Epinephelus striatus* (Bloch). Common; reaches a weight of 50 pounds or more, but those brought to the market seldom exceed 10 pounds. They are found all the year round and are said not to school.
18. **Red Grouper**, *Epinephelus morio* (Cuvier & Valenciennes). One of the important food-fishes of Key West. Found at all times, chiefly on rock bottom and about the reef. They are said not to school. The maximum weight is 20 to 25 pounds, the average from 8 to 15 pounds. They spawn in March among the rocks. They are voracious and will take any kind of bait.
19. **Black Grouper**, *Garrupa nigrita* (Holbrook). This large grouper is not uncommon about Key West. It reaches a weight of 400 or 500 pounds.
20. **Jewfish**, *Promicrops guttatus* (Linnaeus). This is one of the largest fishes of this region. The weight of those caught usually runs from 100 to 250 pounds, though the maximum is as great as 400 or 500 pounds. Those weighing more than 250 pounds do not sell well, as they are said to be too coarse and dry, without much fat. These fish are common in summer in rather shallow water about rocky shoals, old wrecks, and the like. Cold weather seems to drive them away into deeper water. They probably spawn in August, when they collect into schools and go to some place with rough, rocky bottom. One spawning-ground is said to be located in the channel about 1 mile from the fort. They feed upon crabs, crawfish, and fish. One example, weighing about 250 pounds, was seen.
21. **Yellow-fin Grouper**, *Mycteroperca venenosa* (Linnaeus). This grouper is not uncommon and is a good food-fish. Its maximum weight is about 20 pounds, the average about 6 pounds. It is present throughout the year.
22. **Scamp**, *Mycteroperca falcata phenax* Jordan & Swain. Common throughout the year; most abundant on the reef. It reaches a weight of 10 or 12 pounds, averaging about 2 or 3 pounds. Nothing was learned of its spawning habits.
23. **Gag**, *Mycteroperca microlepis* (Goode & Bean). Common; reaches a weight of 10 pounds or more, the average being about 2 pounds. It is found at all times, and is a good food-fish.

*At Key West the fishing-grounds of that portion of the Gulf of Mexico adjacent to the Florida coast are called "the bay."

24. **Gray Snapper**, *Neomamis griseus* (Linnaeus). This is the most abundant species of snapper found at Key West. A warm-water fish, found most abundantly in shallow water during the summer, retiring to deeper water during the winter. They always run in schools. They reach a length of 3 feet and a weight of 18 pounds, though the usual weight is 5 pounds or less. They spawn in July and August, usually on the shoals. The eggs are not adhesive, but separate from each other at spawning. Sardines and pilehards are the bait used for catching this fish. One of the best fishing-grounds is in Jack Channel, northwest from Key West.
25. **Dog Snapper**, *Neomamis joco* (Bloch & Schneider). Not very common. Reaches a weight of 20 pounds, the average being very much less. It is found most frequently in the fall and winter.
26. **Schoolmaster**, *Neomamis apoda* (Walbaum). This fish is rather scarce at Key West. The maximum size is said to be 7 or 8 pounds, the average 3 pounds for those caught on the reef, or one-third of a pound for those from the "bay."
27. **Mutton-fish or Pargo**, *Neomamis analis* (Cuvier & Valenciennes). One of the abundant and most valued food-fishes of Key West. They occasionally reach a weight of 25 pounds, but 15 to 18 pounds is as large as they usually get; the average is probably not over 5 pounds. They are found on rock bottom in 3 to 9 fathoms and are very gamy, taking the hook promptly and and fighting well. Found throughout the year, but scarcest in July and August, which is the spawning season. They school at spawning time. The eggs are nonadhesive and are about the size of a rice grain.
28. **Lane Snapper**, *Neomamis synagris* (Linnaeus). Abundant about Key West, reaching a weight of 4 pounds, the average being about half a pound. The best season for catching this species is during the winter. The spawning time is said to be in October, at which time they gather in schools.
29. **Yellow-tail or Rabirubia**, *Ocyurus chrysurus* (Bloch). Even more abundant than the lane snapper, and the principal fish served at the Key West hotels and boarding houses in the fall. Plentiful throughout the year, except during winter, when the cold drives them away. During the warmer weather they are found at depths of 2 fathoms and over; the best depth is 5 fathoms. Generally found around shoals where there is some mud bottom. July is the principal spawning season, when they are found about the reef all the way from Miami to the Tortugas. The yellow-tails are quite gamy. They are caught with sardine bait. They reach a length of 2 feet and a weight of 3 or 4 pounds or more. The average weight of those seen in the Key West market is not over a pound.
30. **Hogfish**, *Lachnolaimus maximus* (Walbaum). One of the common food-fishes, reaching a weight of 10 pounds, or an average of about 3 pounds. Found all the year round.
31. **Kingfish or Cero**, *Seomberomorus caralla* (Cuvier). This is, next to the grunt, the most important of the Key West food-fishes. Its flesh is firm and of excellent flavor. It usually appears in large numbers from November until April, when it is caught by trolling. The usual weight is about 10 pounds, sometimes reaching 50 pounds. The largest of which there is any record dressed 52 pounds. Examples weighing 40 pounds are not unusual. Said to school at spawning time, which is believed to be late in the winter.

According to Mr. William H. Abbott, who studied the fisheries in 1891, the average weight of kingfish, as caught by the fishermen of Key West, is about 6 pounds. The larger fish, weighing from 15 pounds upward, are never as abundant as those weighing under 15. When the fisherman desires to catch large kingfish, he directs his course to the inshore grounds, lying in about 3 fathoms of water and from $1\frac{1}{2}$ to 3 miles from shore, where the water is muddy; and when small ones are desired, the fishing is done farther offshore along the edge of the Gulf Stream, where the water is much clearer.

They are almost invariably found in two separate schools. The spawning grounds of the kingfish are "down the bay." The first of the winter a great many of the fish have large roes, but it is very seldom that one is taken that has a roe fully matured. If the weather has been very cold in the bay early in the fall, the kingfish will leave before they have spawned, and it is during such seasons that fish containing ripe spawn are most frequently taken.

32. **Spanish Mackerel**, *Scomberomorus regalis* (Bloch) and *Scomberomorus maculatus* (Mitchill). Both of these species occur at Key West, but are not distinguished by the fishermen. The former is probably the more abundant. They are both taken by trolling in the winter. The maximum size is said to be 12 pounds, the average about 3 pounds.
33. **Amber Jack or Amberfish**, *Seriola lalandi* Cuvier & Valenciennes. Not uncommon in the winter and an important fish. Maximum size 80 pounds or more, average about 35 pounds. Caught chiefly by trolling.
34. **Almicore or "Almaco,"** *Seriola dumerili* (Risso). Perhaps scarcely as common as the preceding. Maximum size 25 pounds, average 8 pounds. Taken in the winter by trolling.
35. **Jack**, *Caranx hippos* (Linnaeus). Common in winter. Reaches a weight of 3 or 4 pounds. It is taken either by trolling or bottom fishing.
36. **Runner**, *Caranx crysos* (Mitchill). Common in winter with the preceding and caught in same way.
37. **Horse-eye Jack**, *Caranx latus* Agassiz. Perhaps more common than either of the two preceding species. Goes in schools and is taken by trolling.
38. **Moonfish**, *Sclene vomer* (Linnaeus). Not uncommon in winter. Reaches a weight of 2 pounds and is regarded as an excellent fish. The average weight is a half pound or less.
39. **Pompano**, *Trachinotus carolinus* (Linnaeus). The pompano is taken about Key West only in winter, when the cold weather drives it south. It reaches a weight here of about 5 pounds, the average being about 1½ pounds. It is taken by hook and line and is, of course, regarded as an excellent food-fish.
40. **Permit**, *Trachinotus goodii* Jordan & Evermann. This species is not very common at Key West. It reaches a weight of 40 pounds, the average being about 8 pounds. It is taken in the winter both by hook and line and seine. The "permit" of Indian River is *Trachinotus falcatus*, a different species.
41. **Bluefish**, *Pomatomus saltatrix* (Linnaeus). The bluefish is not common at Key West. It is taken by trolling. The maximum size is 6 pounds, the average about 3 pounds.
42. **Black Angel**, *Pomacanthus arcuatus* (Linnaeus). Not uncommon. Reaches a weight of 6 pounds, or an average of 2 pounds. Found throughout the year.
43. **Yellow Angel**, *Angelicthys ciliaris* (Linnaeus). Perhaps more common than the preceding. Reaches about the same size.
44. **Tang**, *Teuthis hepatus* Linnaeus. Not uncommon. Reaches a weight of 2 pounds. This and two other species of tang (blue tang, *Teuthis curvulus*, and the ocean tang, *Teuthis bahianus*) are often taken with the "grain" or in traps.
45. **Common Mullet or Callifavor Mullet**, *Mugil cephalus* Linnaeus. This is the most abundant and most important mullet found at Key West. Others are the blueback or white mullet (*Mugil curema*) and the fantail mullet (*Mugil trichodon*). A fourth species, known as the red-eye mullet (*Mugil gaimardianus*), also occurs there, but not in abundance. The mullets are most common at Key West in the winter, when considerable quantities are taken. They are far less abundant here, however, than on either coast of the mainland.

There are many other species of fishes found at Key West which are used to a greater or less extent as food. Among them are the bonefish (*Albula vulpes*), tenpounder (*Elops saurus*), barracuda (*Sphyraena barra-*

uda), wahoo (*Acanthocybium solandri*), bonito (*Gymnosarda alleterata*), whiting (*Orthopristis chrysopterus*), and many others of less importance.

The fishes of Biscayne Bay are not very different from those of Key West. The chief difference lies in the fewer species at Biscayne Bay; many of the species used as food at Key West are either entirely absent or quite rare at Biscayne Bay. Commercial fishing in Biscayne Bay and vicinity has only recently begun, and it is improbable that overfishing will occur for some years yet. The fishes of the bay are considered in a report recently published by the Commission. The development of the fisheries of Lake Worth has only recently begun. The species there are essentially the same as those of Indian River, which have been discussed in the special report to the Senate already referred to.

The most prominent fish on the Florida coast between Key West and Pensacola is the mullet, which exists in incredible numbers and is taken in enormous quantities. Tampa is the principal receiving center for mullet on the west coast, and a large part of the mullet taken in the counties of Lee, De Soto, Manatee, and Hillsboro pass through the hands of Tampa dealers, together with large catches of other species.

The results of the methods here are far from satisfactory. During one day in November, 1896, several thousand mullet were seen thrown away at Tampa, because they were too badly spoiled for shipping. From the most reliable data that could be obtained, it is estimated that the annual loss of mullet on the west coast of Florida amounts to about 500,000 pounds. This loss is due to two principal causes, (1) adverse winds, preventing collecting vessels from returning promptly from the fishing-camps, and (2) the failure to supply the vessels with sufficient ice. Such waste is unfortunate and in large part unnecessary. Other species suffer in the same way to some extent, but the great loss is with the mullet.

Other prominent shallow-water fishes of the west coast are sheepshead, redfish, squeteague, Spanish mackerel, pompano, bluefish, ladyfish, and crevalle. These are generally distributed and abundant, and are represented in the catch at most of the fishing centers. The offshore fishing-grounds yield red snappers (*Neomantis aya*) and groupers (*Epinephelus morio*) in largest quantities. The fishery, which is centered at Pensacola, is prosecuted chiefly on the "snapper banks" in the Gulf of Mexico, although some fishing is done near shore and about the keys. The abundance of groupers is far in excess of the present demands, but the red snappers seem to be decreasing in numbers and fishing has to be done at greater distances from the land than formerly in order to produce satisfactory results. The abundance of the species is specially referred to in the chapter on the Pensacola fisheries. The red snapper is one of the most highly prized of the Florida fishes and ranks next to mullet in commercial value. It attains a weight of 40 pounds, but the average weight is not over 10 pounds.

REPTILES.

The most valuable reptiles of the United States are represented in the waters of Florida, and some of these occur there in greater abundance and are commercially more important than in any other State. The most prominent resources of this class are the alligator, diamond-back and other terrapins, and three species of very large turtles. The last named are the only important reptiles in the coastal waters and their annual value exceeds that of all the other products of this group.

The green turtle (*Chelonia mydas*), the most highly esteemed of the marine turtles, is found on the Atlantic seaboard from Long Island to Brazil, and hence along the entire length of the Florida coast, where it is especially common among the Florida keys. Overfishing and the destruction of its eggs have greatly reduced its abundance in this State, and the annual catch is now much less than formerly.

The green turtle breeds on the coast of Florida from April to July, during which time the female seeks the sandy shores of keys or the mainland in remote situations. She arrives at night, and with her flippers digs a hole 1 or 2 feet deep in the sand, above high-water mark, in which she proceeds to lay her eggs, numbering between 100 and 200. The turtle then scoops the sand back over the eggs, smooths the surface to effect concealment, and rapidly retreats to the water, leaving the eggs to hatch without further attention. The hatching occurs in a few weeks, and the young make their way to the water; many, however, fall a prey to carnivorous birds and perhaps other animals. The turtle returns two or three times to the same spot during the season, each time depositing the number of eggs stated, so that the total number of eggs laid by a full-grown turtle in a year is from 300 to 600. The green turtle attains an immense size. Examples weighing 600, 800, and even 1,000 pounds have been taken in Florida waters, although such large individuals are very rare, and the average weight in recent years is probably under 150 pounds. In some parts of the State, where fishing has been excessive, the average weight is much less than formerly; for example, on the east coast it is under 50 pounds.

The loggerhead turtle (*Thalasseochelys caretta*) occurs along the Atlantic coast from Virginia to Brazil, and is common on both the east and west coasts of Florida, although much less numerous than formerly. It is the least valuable of the marine turtles, and there is little demand for its flesh as food, although more eggs of this species are taken than any other. It reaches an immense weight, surpassing the green turtle in this respect. The maximum weight is 1,500 or 1,600 pounds, but the average weight in Florida is not much more than 200 pounds, although occasional examples weighing 600 pounds are taken. According to Mr. H. A. Smeltz, of Tarpon Springs, loggerhead turtles were very abundant some years ago in the vicinity of Stump Pass, De Soto County, where he made some interesting observations of their habits when they came ashore to lay their eggs at night during the

full moon in June. The female turtle proceeds some distance from the water, and without turning around scoops out a hole in the sand, using first one flipper and then another. Then, with the posterior part of the body over the excavation, the turtle begins laying the eggs. The latter are extruded in lots of 3, 4, or 5 at a time, with a short intermissions between the lots until the process is completed. The total number of eggs in each of 7 nests examined ranged from 80 to 115. When the full complement has been laid the turtle returns to the water, after carefully covering the eggs with sand. While engaged in laying, nothing can disturb the turtle or drive her away. Striking her with a stick or jumping up and down on her back apparently produced no effect on her.

It has been supposed by some that the turtle returns to the nest at the time the eggs are hatching in order to head the young to the water, but it seems probable that this view is not correct. It is true that the turtle returns in about three weeks, but this is for the purpose of laying more eggs, and this is repeated from four to six times during the season, so that as many as 700 eggs may be deposited by one animal. The eggs are thought to hatch in about three weeks, and the young would therefore appear at about the time the turtle returned for the next laying.

The hawksbill or tortoise-shell turtle (*Eretmochelys imbricata*) is found on the southern coasts of Florida, and thence to the West Indies, the Bermudas, and South America. The flesh is eaten to a slight extent, although it is not highly regarded, and the eggs are also gathered for food and for the manufacture of oil; but the great value of this turtle is in its horny covering, which is the tortoise shell of commerce.

The hawksbill turtle attains a smaller size than either the green or the loggerhead turtle, but large individuals are sometimes taken, and the maximum weight is probably over 400 pounds; on the Florida coast those with a greater weight than 100 pounds are not common. The shell of the smaller turtles is thin and of little use, but it increases in thickness and value with the size of the turtle.

CRUSTACEANS.

The crustacean resources of Florida include shrimp, crabs, and the spiny lobster or crawfish.

At least two species of shrimps (*Penaeus setiferus* and *P. brasiliensis*) are taken in the Florida fisheries, but the fishery is not important and the abundance and distribution of these animals are not known. In the coastal States, both to the north and west of Florida, shrimps are commercially valuable.

The stone crab (*Menippe mercenarius*) is found along the southern coast from Charleston to Key West and along the entire west coast of Florida. It lives in holes in the mud in estuaries and also in crevices in rocks. On the west coast of Florida it is found in cavities in rocks and in deep

holes which it excavates in the sand. It attains a large size, adults often measuring 7 or 8 inches across the shell. People living along the coast esteem it highly as an article of food, and considerable quantities are taken for sale and local consumption.

The common blue crab (*Callinectes hastatus*) is distributed along the entire coast of Florida in the bays and estuaries, and often in fresh-water rivers and lakes having close connection with the salt water. It lives in the shoal waters during the warmer months, but retires to deep water on the approach of cold weather. The period of spawning and shedding extends over several months, possibly the entire summer, for some individuals are found carrying spawn and others in a soft state during the whole season. While shedding its shell and until the new shell has become sufficiently hard to protect it, the crab remains hidden in the mud or among the seaweeds. The average size of the blue crab is about 6 inches across the shell. It is so generally abundant that people can, in most places, obtain all they desire without much trouble, and it has therefore given rise to no special fishery.

The spiny lobster (*Pandirus americanus*) is very abundant at Key West and generally among the Florida keys, where it lives on the bottom, concealed among the coral. It attains a length of more than a foot and has excellent food qualities, resembling in flavor the common lobster. It is at this time of commercial importance only at Key West, where large quantities are taken annually for food and for bait in the line fisheries.

FISHERIES OF THE NORTHEAST COAST.

That section of the Florida coast north of Indian River, comprising parts of the counties of Volusia, St. Johns, Duval, and Nassau, and containing the important cities of St. Augustine, Jacksonville, and Fernandina, has valuable salt-water fishery resources and interests. It was not feasible to canvass this section in the recent investigations of the Florida coast fisheries, but it is possible to make a statement of the nature and general extent of the fisheries based on inquiries conducted in 1891.

The most important fishery product of this section is the oyster, which is taken in all the counties named, but is most valuable in Nassau County, in which there is a large oyster fishery and canning business centering at Fernandina. The mullet is the most prominent of the fishes, the catch in Duval County being larger than in the other three counties combined. Other fishes of this region of noteworthy commercial importance are squeteague, channel bass, and sheepshead. Turtles, terrapins, shrimps, crabs, and clams are taken in small quantities. The principal part of the fish caught are taken in gill nets and seines, although cast nets, lines, and pound nets are also used.

In 1890 the fishing industry of this section gave employment to 493 fishermen and 150 shoresmen. The vessels and boats used numbered 329, with a value of \$11,655. The apparatus of capture was valued at

\$9,250, and the shore property and cash capital at \$34,340, making a total investment of \$55,245. The quantity of products taken was over 2,000,000 pounds, valued at \$49,585, the species being represented as follows: Channel bass, 129,955 pounds, \$4,201; mullet, 796,567 pounds, \$12.473; sheepshead, 87,500 pounds, \$2,761; squeteague, 180,049 pounds, \$6,235; other fish, 183,764 pounds, \$5,543; oysters, 93,350 bushels, \$13,300; turtles and terrapins, 19,350 pounds, \$2,150; shrimp, 62,625 pounds, \$2,397; and other products having a value of \$525.

FISHERIES OF INDIAN RIVER.

Previous report on this river.—The resources and fisheries of the Indian River have been considered in a special report submitted to the Senate on January 5, 1897, pursuant to a clause of the act making appropriations for sundry civil expenses of the Government for 1896, requiring "the Commissioner of Fisheries to make special investigation as to the extermination of migratory fishes of the Indian River of Florida." This report appears to render unnecessary at this time an extended account of the fisheries of this region. The examination of the river was made in January and February, 1896, by a party from this Commission, and the following information is abstracted from the report based on that inquiry.

Development of the fisheries.—The fisheries of this region have attained considerable prominence within a comparatively few years, and in 1895 contributed several million pounds of food-fish to the public markets. The business of taking green turtles antedates the civil war, but the fisheries proper did not begin until 1878, when a Connecticut vessel visited one of the inlets and caught fish for the Savannah market. It was not until 1886, however, after the river had been brought into railroad communication with Jacksonville, that the fisheries became regularly established. Prior to that time the river was almost inaccessible except by water: the surrounding country was very sparsely settled, and the very valuable fishery resources remained latent.

In 1885 an oyster business was started at Titusville at the head of the river, and in the following year a fishery was inaugurated at that place. The building of a second railroad to Titusville and its extension along the entire length of the river in 1893-1895, resulted in the establishment of new fishing stations farther and farther south, and led to a great increase in the industry. In 1895 there were 19 firms engaged in the fisheries of the river. These were located at Titusville, Cocoa, Eau Gallie, Melbourne, Sebastian, Fort Pierce, Eden, Jansen, and Stuart. The places at which the most extensive fishing centered are Fort Pierce, Titusville, Cocoa, and Eden.

As to the further increase of the fisheries of this body of water, the report cited states:

While the resources are great, the area of fishing-ground is comparatively limited, and the fishing firms realize that the present tendency to over-fishing will result in the ultimate destruction of their business, unless counteracted by the enforcement of certain restrictive laws or adequate artificial propagation.

Fishery resources.—The water animals of this region which are the object of special fisheries are the pompano, mullet, turtle, and oyster. Besides the fishes named, a number of others are caught incidentally and in the aggregate amount to a large quantity. Compared with more southern parts of Florida, the resources of Indian River are not remarkably varied, although a number of fishes, etc., having recognized food qualities, which are now regarded as of little value, will doubtless be utilized in time. Only about 20 species of marketable fishes are prominently represented in the catch of the Indian River fishermen; among these are the bluefish, sheepshead, trout or squeteague, redfish or red drum, black drum, whiting, crevalle, sergeant-fish, mangrove snapper, permit, croaker, and Spanish mackerel.

More than half of the quantity of fish taken for market consists of mullet, which is very abundant, but less so than on the west coast of the State. The fish abounds throughout the river, but the principal catch is taken in the upper part. The poor price commanded by the fish has deterred the fisherman of the lower river from taking as many as the conditions warrant.

The pompano is the most highly esteemed fish of the river. It is taken at all seasons, although most plentiful during the fall and winter. After the excessively cold weather of February, 1895, the pompano became very scarce, and up to the end of January, 1896, had not appeared in its former abundance. The catch in 1895 was much less than for a number of years. In the opinion of some of the fishermen, overfishing has led to a decrease in the abundance of pompano, while others regard the present scarcity as largely the result of natural causes.

Such fishes as sheepshead, sea trout, channel bass, snappers, crevalle, black drum, etc., which are locally known as bottom fish, are generally plentiful in all parts of the river and have apparently undergone no diminution in numbers in recent years. The most highly esteemed of the bottom fishes is the sheepshead. In quantity of catch it ranks next to the mullet, and in value it is exceeded only by the mullet and the pompano. Bluefish and Spanish mackerel are ordinarily scarce; at times, however, these fish enter the river in considerable numbers.

The only reptilian product of the Indian River fisheries is the green turtle. It is not common, and in the past two or three years has undergone a noticeable decrease in abundance, while the average weight has also diminished. The turtle is found in the river at all times, but the principal fishing season is between November and March.

Oysters of good size and flavor occur in various parts of Indian River and are one of the principal fishery resources, although they have had comparatively little attention. Their further utilization appears to be one of the chief lines along which the development of the Indian River fisheries will take place.

Crabs are abundant, but are not utilized. These and other crustaceans—such as shrimp—will no doubt in time receive the attention of commercial fishermen.

Indian River originally abounded in alligators, but owing to very active hunting operations during the past ten years they have become very scarce and do not now support an industry.

Fishing apparatus and methods.—Most of the fishing is done with gill nets, which are of two kinds, according to whether they are set for mullet or pompano. A few seines are hauled for bottom fish, large-meshed nets are employed for turtles, and tongs are used for oysters.

Mullet fishing is carried on along the entire length of the river, and is the most important branch of the industry. It is most extensively prosecuted from Titusville, Cocoa, and Fort Pierce. Mullet gill nets are about 250 yards long and 12 to 14 feet deep. The 58 nets used in 1895 had a combined length of 46,800 feet, or about 9 miles. These nets are thrown around the schools of mullet seen jumping at the surface, and the fish become meshed by being frightened after the ends of the net are brought together. The catch consisted of over 1,600,000 pounds, with a market value of about \$12,000.

Pompano fishing in 1895 was most extensive at Titusville, Fort Pierce, and Eden. The nets used are 200 or 250 yards long, but a number of nets are often fastened together, forming pieces from 600 to 2,000 yards long. The 163 pompano nets employed in 1895 were 115,500 feet, or nearly 22 miles, long. The mesh is relatively large (5½ to 6 inches), and owing to this fact and the peculiar shape of the pompano the fish are not gilled but are caught by the pectoral and ventral fins, and also by a short spine in front of the dorsal fin. Pompano fishing is done only at night, and preferably when there is no moon. If the fish can see the netting, they will avoid it. The nets are left to drift several hours before being visited. Besides pompano, bluefish, sheepshead, sea trout, redfish, snappers, and crevalle are incidentally taken. The pompano catch in 1895 was only 149,000 pounds, but the value, \$9,475, was nearly as much as that of the mullet, which was taken in ten times the quantity.

Turtle fishing is not extensively carried on. It is regularly followed only from Sebastian, Fort Pierce, and Eden, but turtles are incidentally caught in nets at a number of other points on the river. Turtle nets are like gill nets, but have a very large mesh and are constructed of coarse thread. They are from 85 to 115 yards long. Turtles are caught by being entangled in the meshes, some of the nets being fastened to stakes, while others are left to drift freely. In 1895 the number of turtles taken on the river was 519, having a weight of about 18,900 pounds; their value was \$1,320. It is apparent from the comparative statistics available that turtle fishing on the Indian River is much less productive than in previous years.

The oyster industry, while not of great importance, is more extensive than any other branch of the fisheries with the exception of the gill-net fishery. It is followed from Titusville, Cocoa, Eau Gallie, and Fort Pierce, the oysters being taken with tongs from natural beds in the

vicinity of the places named. The yield in 1895 was a little over 6,000 bushels, with a value of \$2,115. Twenty-nine persons were engaged in the business. The conditions seem very favorable for the expansion of the oyster industry, provided cognizance is taken of the methods which in other States have proved satisfactory, namely, the allotment of land for oyster cultivation, the spreading of oysters on prepared grounds, the planting of seed and cultch, etc.

Statistics of the fisheries.—In 1895 the fisheries of Indian River gave employment to 254 persons. These were distributed as follows among the different branches:

How engaged.	Number.
General fisheries	172
Oyster fishery.....	29
Turtle fishery.....	12
Preparing products.....	41
Total.....	254

The capital invested in the Indian River fisheries in 1895 was \$41,512, representing vessels, boats, apparatus, and shore property, as follows:

Item.	Number.	Value.
Vessels	2	\$1,400
Boats	106	5,390
Gill nets.....	221	7,400
Turtle nets	66	660
Seines	2	265
Tongs	26	182
Shore and accessory property.....		16,115
Cash capital		10,100
Total		41,512

The aggregate quantity of fishery products of the Indian River in 1895 was 2,659,815 pounds, having a value of \$37,657. The catch was made up as follows:

Species.	Pounds.	Value.
Black drum.....	10,900	\$140
Bluefish.....	33,086	703
Channel bass or red drum.....	142,400	2,115
Crevaille	14,700	184
Flournders	9,000	136
Mangrove snapper.....	76,900	1,137
Mullet, fresh.....	1,585,869	11,501
Mullet, salted.....	25,000	750
Pompano	149,111	9,475
Sailor's choice.....	11,560	157
Sheepshead.....	301,141	4,445
Spanish mackerel.....	1,100	66
Trout.....	200,735	2,872
Whiting.....	25,300	375
Other fish.....	11,516	166
Turtles.....	* 18,909	1,320
Oysters (meats).....	† 42,588	2,115
Total.....	2,659,815	37,657

*519 in number.

† 6,084 bushels.

FISHERIES OF LAKE WORTH.

Origin and development.—Although turtle fishing has been prosecuted in this so-called lake for a number of years, the fisheries owe their origin to the extension of the railroad to this section from the Indian River in 1894 and the opening of large hotels in the winter of 1894-95. Lake Worth is a shallow arm of the sea, 22 miles long and from $\frac{1}{2}$ to $1\frac{1}{4}$ miles wide; $4\frac{1}{2}$ miles from its northern end it is connected with the ocean by a narrow inlet. The lake has been a somewhat important fishing-ground for net and seine fishermen, and the adjacent ocean has also been resorted to by line fishermen. Fish are very abundant throughout the lake at times, but it is not yet known whether the supply in such a shallow and narrow body of water will permit the expansion of the industry or even continue to support the fisheries in their present extent.

Fishery resources.—Among the principal fish which enter Lake Worth and which are taken by the fishermen are sheepshead, bluefish, pompano, Spanish mackerel, mangrove snapper, groupers, redfish, spotted squeteague, sailor's choice, and croaker. The tarpon and many species having no commercial value at present also frequent the lake. The pompano, bluefish, and Spanish mackerel are the most highly prized of the fishes. These come in from the ocean in December and remain three or four months; by April most of them have returned to the ocean. Since the building of a railroad bridge across Lake Worth at West Palmbeach (at about the middle of the length of the lake), it is reported that the pompano is not found in the southern part, which formerly had some of the best fishing-grounds. The other fishes are in the lake in more or less abundance at all seasons. The green turtle is found in limited numbers and of small size, 25 pounds being the average weight.

The principal fishes obtained in ocean fishing off Lake Worth are sheepshead, Spanish mackerel, kingfish, redfish, groupers, bluefish, red snapper, and mutton-fish, all of which are comparatively abundant.

Fishing apparatus, methods, and season.—Within the lake the apparatus used consists of gill nets and haul seines for fish and nets for turtles; in the ocean only hand lines are employed. A small vessel belonging in this section fished for turtles off the Biscayne Bay region in 1895.

The gill-net fishing is mostly done at the northern end of the lake. The nets are about 400 yards long and 30 meshes deep, the size of the mesh being $5\frac{1}{4}$ to 6 inches. The 4 nets used in 1894 took 24,900 pounds of fish, valued at \$857, and the 7 nets in 1895 secured 45,173 pounds, valued at \$1,423. The fish taken in largest quantities is the sheepshead, but the most valuable species is the pompano.

The principal seining is done near the ends of the lake and in the small coves that exist along the lake shores, the same fishermen who use seines also operating gill nets. The seines are about 500 yards

long, 10 feet deep, and have a 2-inch-stretch mesh. Two seines were used in 1894 and 3 in 1895, chiefly in winter. The most prominent species taken are pompano, sheepshead, and bluefish, in the order named, but a great many others are caught in small quantities. The yield in 1894 was 37,600 pounds, worth \$1,036, and in 1895 was 53,680 pounds, valued at \$1,604.

The local turtle fishing is not important. Only 126 turtles were taken in 1894 and 153 in 1895. The fishing each year was done by 6 fishermen, who employed 24 nets. The latter are similar to those in the Indian River. They are set at all seasons, being fastened to stakes and visited night and morning. This branch yielded \$238 in 1894 and \$269 in 1895.

The line fishing in the ocean from Palmbeach is mostly of a semi-professional character, being done chiefly by boatmen engaged in taking out pleasure parties of sportsmen and tourists during the winter months. The catch is largely sheepshead, although bluefish, snappers, muttonfish, kingfish, groupers, Spanish mackerel, and other species are also taken in considerable quantities. In 1894 this fishery yielded 45,500 pounds, valued at \$1,208, and in 1895, 90,852 pounds, worth \$2,422.

About two-thirds of the catch is shipped by rail to northern markets, and the remainder is sold locally to hotels, etc. In 1895 about 165 tons of ice were consumed in the preservation of fish prior to and during shipment; this quantity of ice cost the fishermen and dealers \$990.

Extent of the fisheries.—The following tables show the extent of the fisheries of the Lake Worth region in 1894 and 1895. In the latter year 70 persons are shown to have been engaged in the industry, \$3,965 was invested, and 193,548 pounds of products were taken, having a value of \$5,718.

Persons employed.

How engaged.	1894.	1895.
Gill-net and seine fishing	8	14
Turtle fishing	6	6
Line fishing	30	50
Total	44	70

Vessels, boats, apparatus, etc.

Items.	1894.		1895.	
	No.	Value.	No.	Value.
Boats	24	\$800	38	\$1,250
Gill nets	4	200	7	350
Seines	2	200	3	300
Turtle nets	24	240	24	240
Lines	60	15	100	25
Shore property		1,300		1,800
Total		2,755		3,965

Products.

Apparatus.	Species.	1894.		1895.	
		Pounds.	Value.	Pounds.	Value.
Gill nets.....	Sheepshead	11,700	\$176	22,800	\$342
	Pompano	8,200	581	12,500	875
	Bluefish	4,400	88	7,873	158
	Spanish mackerel	100	5	500	25
	Mangrove snapper	300	5	900	14
	Redfish	100	2	600	9
			24,900	857	45,173
Seines	Sheepshead	20,400	306	25,200	378
	Pompano	8,100	567	13,500	945
	Bluefish	5,100	102	6,200	124
	Spanish mackerel	300	15	700	35
	Mangrove snapper	400	6	1,300	20
	Squeteague	500	7	980	15
	Redfish	200	3	400	6
	Grouper	1,100	17	1,900	29
	Croaker	600	9	1,100	16
	Sailor's choice	500	8	1,200	18
	Flounders	400	6	1,200	18
		37,600	1,046	53,680	1,604
Lines	Sheepshead	29,800	447	59,300	889
	Bluefish	4,100	205	8,400	420
	Spanish mackerel	1,600	80	3,100	155
	Grouper	1,700	85	3,252	163
	Kingfish	2,700	135	5,500	275
	Red snapper	1,200	60	2,200	110
	Mutton-fish	2,500	125	5,300	265
	Angel-fish	900	45	2,000	100
	Others	1,000	26	1,800	45
			45,500	1,208	90,852
Turtle nets	Green turtle.....	3,407	238	3,843	269
	Grand total.....	111,407	3,349	193,548	5,718

FISHERIES OF BISCAYNE BAY.

The remoteness from the markets and the absence of shipping facilities for perishable products like fish have retarded the development of the fisheries of this section. The extension of the East Coast Railroad from Lake Worth to Biscayne Bay and the establishment of steamer connections with Key West, which occurred in 1896, will, however, undoubtedly give an impetus to the fishing industry of this region, and it has already led to some expansion of the fish trade. There are a number of reasons why this part of Florida should greatly extend its fisheries in the next few years, now that it is in closer communication with other points of the State.

1. The general food-fish fisheries should increase in order to supply the new demands coming from a larger resident population and from the numerous winter visitors attracted by the salubrious climate of the Biscayne region. The inauguration of a fish trade with northern markets is also to be expected when satisfactory express rates are arranged.

2. Attention will doubtless soon be given to oyster planting and the utilization of the beds already in the bay. The oysters now used are brought from Indian River.

3. The bay should become the regular headquarters of many sponge and turtle vessels operating in the vicinity that now go to Key West

to land, sell, and ship their catch. For many years the bay has been temporarily resorted to by some vessels of this class. Cheaper supplies and more ready communication ought to produce quite an exodus of fishermen from Key West and other remote keys.

The commercial fisheries of this bay have never been important. When this region was visited by a representative of the Fish Commission in 1895, the only economic fishing ascertained to exist during the previous years was a limited business in turtles and line-caught fish, in addition to the sponging done by Key West vessels. By October, 1896, when the region was again visited by employees of the Commission, but few changes had taken place, although there had been a slight increase in the amount of local fishing and in the extent of the retail trade.

The principal fishing in the Biscayne Bay region is for sponges, which are practically all taken by Key West fishermen. Pens for the cleaning and bleaching of sponges have been located at various points around the bay. It is thought that sponge fishing in this section might be profitably undertaken by local fishermen.

The capture of green turtles is the most important fishery in which the people of the bay are engaged. In 1894, when the business was less extensive than formerly and the season very poor, a few boats belonging at Lemon City, Miami, and Cocoanut Grove spent a short time in turtle fishing in Biscayne Bay and on the adjacent reefs. The turtles are taken by means of nets and pegs. About 205 turtles, with an aggregate weight of 6,175 pounds, and with a value of about \$708, were caught in the year named, about 175 of these being secured in the bay. Turtles are sent in sailing vessels to Key West, whence they are shipped north. According to the fishermen's testimony, this fishery is much less remunerative than formerly, because of the increasing scarcity of the turtles. The green turtle, which is one of the most valuable of the water resources of Florida, has undergone a noteworthy diminution in abundance in this region within a comparatively few years, and it is generally thought that some protective legislation is necessary in order to preserve it from practical extinction. Mr. Ralph M. Munroe, of Cocoanut Grove, one of the best-informed persons on the bay, states that green turtles are now very scarce, and if their extermination is to be prevented they will have to be artificially propagated if the present indiscriminate methods are continued. Formerly they bred in large numbers in the bights of the keys forming the eastern boundary of the bay and young could frequently be seen. Now but few resort to this place to breed and the supply is practically exhausted.

Loggerhead turtles are comparatively abundant, but there is no regular fishery for them, and they are taken principally for family use. Several hundred, with an average weight of 300 pounds, are taken each year in the spring by people living around the bay. In 1894, however, this species was less plentiful than usual, and only about 100 were secured, against 300 or 400 in previous years. The eggs of this turtle are utilized in large quantities.

No fish are shipped from Biscayne Bay, those caught being sold to meet the local demand. All fishing is done with hand lines at the inlets or on the ocean reefs. Groupers and grunts constitute fully three-fourths of the catch, besides which there are taken porgies, yellow-tails, redfish, kingfish, Spanish mackerel, and numerous other varieties. In 1894 only four men made a business of taking fish for sale, and these caught only 11,000 pounds, valued at \$400.

In 1895 some impetus was given to the local fishing by the opening of a canal route between Lake Worth and Biscayne Bay. Eight persons were engaged during a part of the year in taking fish with hand lines and trap nets, and twenty-two others were employed in the turtle fishery. The investment in the fishing industry amounted to \$4,798, of which \$3,970 represented 2 vessels and 11 boats and \$828 the apparatus and accessories. The two vessels referred to were owned on Indian River and Lake Worth, and engaged in turtle fishing off Biscayne Bay in 1895. The aggregate yield of the fish was 86,282 pounds, valued at \$2,603. The turtle fishery yielded 425 green and hawksbill turtles and 436 pounds of tortoise shell, the whole having a value of \$3,076. The following table shows the quantity and value of each of the principal species:

Species.	Pounds.	Value.
Groupers	14, 100	\$744
Grunts	16, 600	272
Snappers	11, 500	733
Mutton-fish	1, 500	65
Yellow-tail	3, 500	162
Porgies	9, 900	217
Porkfish	1, 600	14
Sailor's choice	4, 300	61
Margate-fish	1, 287	92
Kingfish	8, 500	119
Hogfish	1, 100	45
Turbot	1, 115	36
Other fish	1, 280	43
Green turtle	30, 000	1, 505
Hawks-bill turtle	25, 000	276
Tortoise shell	436	1, 295
Total	131, 718	5, 679

For a detailed description of Biscayne Bay and an extended account of its fishery resources, fisheries, etc., reference is made to an article in the report of the Commissioner of Fish and Fisheries for 1895.

FISHERIES OF KEY WEST.

Importance and principal features.—The commercial fisheries centering at Key West are not only much more important and extensive than those of any other locality in Florida, but are also more valuable than the salt-water fisheries of all the rest of the State. This preeminence, which has been enjoyed for many years, is chiefly due to the rendezvousing of the numerous sponge fleet at this place and the discharging of the cargoes there, although the principal part of the catch is taken far from Key West. The local fisheries are, however, important, and

in some features surpass those of any other part of the State; the turtle fishery, the kingfish fishery, and the grunt fishery, for instance, are more extensive than at all other centers combined.

THE SPONGE FISHERY.

Importance.—The sponge fishery is of more importance to the citizens of Key West than any other branch of business. While less extensive than the manufacturing of cigars, it is in most respects more beneficial to the people who have property interests or are regular residents of the city. The outlay for supplies and utensils required by the numerous sponge fleet, amounting to \$100 or \$200 per vessel each trip, is no inconsiderable factor in the industrial condition of the place, while the large cash sums put in circulation by the sponge-buyers constitute the principal source of ready money for a large proportion of the population.

Apparatus and methods of the sponge fishery.—The sponge fishery at this time presents few new features that need be referred to at length. With one or two exceptions the methods and apparatus are the same that have been employed for many years and have been fully described in reports of the Commission.

The sponge fishery is carried on with vessels of a schooner or sloop rig ranging from 5 to 47 tons (averaging about 13 tons), which resort chiefly to the grounds in the Gulf of Mexico, and with smaller vessels, mostly sloops of less than 5 tons' burden, which make most of the catch on the grounds about the keys of the southern and eastern Florida coasts. The larger vessels carry from 5 to 13 men and the smaller ones from 3 to 5, the number almost always being odd. Two men go in each of the dingies or small boats from which the sponging is done, the odd man of the crew being left in charge of the vessel. The larger vessels have a market value of \$500 to \$4,500, exclusive of their outfit. The latter consists of boats, fuel, food, cooking utensils, and the sponge apparatus, and is valued at \$1,000 to \$1,500. The average value of the smaller vessels is about \$430, including outfit.

Sponges are all taken by means of a 3-toothed hook attached to a long pole. Poles of various lengths are used, to correspond with the different depths of water in which the sponging is done. Before the depletion of the shoaler grounds comparatively short poles were employed, but as the spongers have extended their operations into deeper and deeper water longer poles have been required, until at the present time the limit seems to have been reached in a length of 50 or 52 feet. On the larger vessels four or five different lengths of poles may be used, but on the small craft that frequent the shore grounds poles of one or two lengths (18 to 25 feet) are usually sufficient. A vessel with a crew of 11 men will have 15 or 18 poles and hooks, while a small shore-sponger will require only 2 or 3 poles.

About 1888 a slight change was made in the construction of the sponge-hook. This change was found to be necessary when, owing to

the depletion of the sponge-beds lying at a depth of 3 to 5 fathoms, the spongers were obliged to seek grounds farther from shore and in deeper water. In hooking the sponges in deep water it is not an easy matter to bring the light pole (one-half to 2 inches in diameter) to bear on the sponge, owing to the buoyant action of the water, the presence of strong currents, and the movements of the boat. In the efforts to overcome these difficulties it was found that by attaching weights to the pole near its lower end the work of the spongers was facilitated, and the use of weights in this way suggested the further improvement which has since been generally adopted, namely, the making of a sponge hook with a longer and much heavier shank than had been previously used. The so-called "long shanked hook" enables the sponger to more readily sink and keep in position the end of the pole, and is now used in all of the deep-water fishing, although in the fishing around the keys and in shallow water generally the shorter and lighter hook continues to be employed. Instead of having the shank only 6 inches in length, as is the case with the smaller hooks, the improved hook measures over 2 feet in the shank and weighs about 5 pounds against $1\frac{1}{2}$ to 2 pounds.

The only other apparatus required in taking sponges is the very simple but effective water-glass. This is an ordinary water-bucket, the bottom of which has been replaced with glass. By means of it the sponger is able to distinguish objects on the bottom with great clearness, even in comparatively deep water, and he finds it is an essential article in all of the sponging now carried on, except in shallow water. One glass is the complement of each boat. While one man is steadying or propelling the boat with an oar, the other member of the crew leans over the side of the boat and manipulates the water-glass and the pole, and as the sponges are brought into view by the aid of the glass, he detaches them by inserting the hook beneath them and pulls them to the surface. When a sponge that has been loosened from the bottom becomes separated from the hook great difficulty is experienced in securing it, and it may become what the spongers call a "roller" or "rolling John."

When first taken from the water the sponges are black and slimy. The essential treatment they subsequently receive before being sold consists (1) in exposing them to the action of the sun and air on the vessel's deck until they are killed, which usually requires several days; (2) in placing them for about a week in the crawls or pens where the decay of the gurry or animal matter that began on the vessel is continued; (3) in beating the sponges while wet with a wooden paddle to drive out the decomposed animal matter and in scraping with a knife those sponges to which the black scum still adheres; (4) in squeezing them to force out the remaining gurry and water and placing them on shore; (5) in stringing them by means of a large needle threaded with coarse twine and tying them in bunches about 5 feet in circumference. Some attention is given to the selection of sponges of similar size and

quality in making up the different bunches, but the main point in view is to put on just enough damp sponges to fill the string.

The use of the Mediterranean diving system in the Florida sponge fishery has been experimentally tried. This was suggested by the necessity for extending the operations into comparatively deep water and by the possibility of finding sponges in abundance in water too deep to be reached with poles. In 1884, Mr. E. J. Arapian, of Key West, engaged three Greek sponge-divers to come to Florida and try the same methods employed in the Grecian Archipelago and elsewhere in the Mediterranean Sea in taking sponges. An experienced diver from New York was also employed in conjunction with the Greeks. It is reported that a thorough test of the feasibility of this method was made and that it was found impracticable, although the evident disloyalty of the foreign divers to their employer may have had considerable effect on the outcome of the experiment. The principal reasons for abandoning this attempt to introduce improved methods into the fishery are said to have been as follows: (1) The expense of maintaining a crew of divers (the salary of each being \$150 per month) was out of proportion to the value of the sponges taken. (2) It is stated that sponges were not found anywhere in very dense beds, and that a hooker could secure more sponges than a diver on the same grounds and in the same time. (3) The uneven character of the bottom is reported to be unfavorable for divers. (4) The heavy and cumbersome diving apparatus had the effect of destroying the growth of young sponges, a result that had been observed in Europe and in Turkey, and had led to the passage of a law prohibiting the use of the diving method on the sponge-grounds.

In 1889, a law was enacted by the Florida legislature, which is still in force, forbidding the taking of sponges by diving either with or without diving suits.

The discovery of a method of utilizing the sponge-grounds now beyond the reach of the hookers in water, say, from 50 to 75 feet deep, would prove a great boon to the sponge industry. Not the least important outcome of such a discovery would be the opportunity afforded the shallower grounds to recuperate by the diversion of the spongers' operations. In this connection, attention may be drawn to the advisability of experimenting with an apparatus constructed on the principle of the so-called "deep-water oyster tongs," by means of which oyster-beds beyond the reach of the ordinary tongs become readily accessible.

The tongs in question, of which there are several types, consist essentially of two curved iron bars riveted together near the middle, to permit free motion. These are attached on one extremity to the teeth and cradles, and on the other to the ropes by means of which the apparatus is lowered and raised. Beneath the crossing point of the two arms a weight is suspended. To the upper bar of one side an iron link or loop is attached by means of a staple, and on the lower bar, just below the link, is a small iron peg or stud, over which the link fits when the teeth are separated to their widest extent. When oystering begins, the arms

are locked by means of the loop and peg and the tongs lowered to the bottom. By suddenly dropping the tongs from the height of a few feet from the bottom the loop slips off the pin by virtue of the weight referred to, and the teeth will then approach each other when the ropes are hauled taut. The weight and the loop and peg may however, if desired, be dispensed with by attaching a line to the crossing point of the two arms and placing weights at the upper ends of the latter, the tongs being lowered by means of the middle line and kept open by the weights mentioned.

The great simplicity of this apparatus is an argument in favor of its use in the oyster fishery and suggests its employment in the sponge fishery. It is open to the objection of being somewhat heavier than the ordinary oyster tongs and in deep water requires the use of a small windlass attached to the mast or elsewhere on the boat, by means of which it can be raised and lowered. The cost complete is about \$15. If the principle embodied in this apparatus is found to be adapted to the sponge fishery, a modification in the line of lightness and cheapness could doubtless be made. The number of teeth and the carrying capacity of the tongs required in the oyster fishery might be reduced and the apparatus made to consist practically of two opposing hooks, such as are now used in the sponge fishery.

The sponge-grounds and their condition.—The principal grounds resorted to by the larger sponge vessels are known as the "bay grounds," and are located off the west coast of Florida, between Anclote Keys and Apalachee Bay. The region around Anclote Keys is known as the "Anclote grounds," north of which are the "Rock Island grounds." The small vessels usually frequent the waters around the keys, between Key West and Cape Florida.

The chief feature regarding the sponge-grounds to be noted at this time is the continued extension of operations into deeper water consequent on the depletion of the more shallow grounds. In the vicinity of Anclote Keys the grounds in 10 to 12 feet of water were exhausted before the civil war, but during the war the sponge beds had a chance to recuperate and later afforded some good fishing. They were very soon depleted, however, and have not since borne sponges in any noteworthy quantities. This is the general history of the "bay grounds." Deeper and deeper bottom has to be resorted to in order to make the fishery profitable, until now some fishing is done in water as deep as 45 feet, which seems to be about the maximum depth in which it will be possible to employ the present methods. The usual depth at which sheeps-wool sponges are now taken is about 30 feet.

Occasionally good fares are taken on the inshore and key grounds. The latter, in depths of 10 to 20 feet, seem to recuperate more rapidly than the bay grounds and produce excellent crops some seasons, but they have in general shown the same depletion as the other grounds, and the spongers have to work over a larger area and more assiduously than was necessary a few years ago.

Even the deepest grounds now frequented are showing the effects of overfishing, and would doubtless soon prove nonproductive of marketable sponges if the weather and water were always favorable to the spongers, the preservation of the beds depending on the prevalence of storms or muddy water during some seasons or parts of seasons.

The most valuable of the Florida sponges—the sheepswool—has naturally had its abundance on the bay and key grounds most markedly affected by unrestricted fishing, but all of the other species of marketable sponges have also been gathered beyond the recuperative powers of the grounds. The valuable velvet sponge, which is obtained on the Florida reef, has become comparatively scarce. The yellow sponge, which is taken in considerable quantity on the Rock Island grounds, but is of best quality on the key grounds, is decreasing like the sheepswool. Even the cheap grass and glove sponges, which come principally from the keys, are not so abundant as formerly.

Good sheepswool grounds are reported to exist between Key West and Cape Romano. The sponges are said to be abundant and of very good quality. This region is not extensively fished on, however, as the water is usually muddy, and it is only one year in five that the water is clear enough to permit of fishing.

Condition and extent of the fishery.—The Key West sponge fishery during the year 1895 presented about the average condition in recent years. The excessive fishing on the beds of the best grades of sponges has necessitated the seeking of the deeper grounds, where the additional labor required, supplemented by rather unfavorable weather, has resulted in a somewhat short catch.

During the winter season of 1895-96 the prevalence of bad weather at sea for several months compelled spongers to work on the inshore grounds, where sponges are chiefly small. The result was that the cargoes contained a large proportion of sponges of a proscribed size—less than 4 inches across the top—and this led the State authorities to warn the fishermen against further violation of the law. The short crop, combined with the active demand for sponges on the part of purchasing agents of New York firms, raised the price of sponges to a very high figure, notwithstanding the small size of a great many of the sponges.

The hurricane of September 29, 1896, did considerable injury to the sponge fishery. A number of sponge vessels engaged in the bay fishery were lost, with their crews; some were driven a number of miles into the woods, and others were sunk and otherwise damaged while at anchor. A Key West sponge-dealer, writing under date of October 10, 1896, to the Oil, Paint, and Drug Reporter, of New York, made the following references to the effects of the storm and the outlook for the fishery during the winter of 1896-97:

During the past fortnight events that are bound to leave their mark in the history of the Florida sponge fishery have happened. You have learned of the hurricane that struck the west coast of Florida, during which the damages to the sponge fleet have been very great. Several of the vessels have been thrown into the woods in the

vicinity of Cedar Keys, while 17 vessels of the fleet are not heard from up to the present writing. It is supposed that these vessels and their crews have been lost at sea, 40 bodies having been washed ashore at Cedar Keys. Under the above circumstances the owners of vessels and the ship chandlers are feeling very much discouraged, as from their past experience of hurricanes and severe storms they all know that since this last hurricane the undertow of the sea will make the water very muddy at the sponge-grounds of Rock Island and Anclote for a long time to come; and thus it will add to the general difficulties and risks of the business.

The Rock Island sponge fleet, that had returned to Key West just before the hurricane, has again made a broken trip. Only half a dozen vessels brought in from 140 to 300 bunches of wool sponges each. The balance of the vessels have not succeeded in securing more than from 40 to 80 bunches of sponges each, which quantity is, as you understand, next to nothing. The trouble is actually that the sponge-grounds on the west coast of Florida are getting bare of sponges in most places, as the fishermen for several years past have kept pulling up the small-size sponges, and naturally this action has killed the growth and the seeds of the sponges. Besides this, some submarine convulsions are said to have taken place from time to time which uproot the sponges. Many sponges have been found at times floating loose on the surface, of fairly good sizes, and all rotten. Some of the old sponge fishermen here attribute this to some poisonous waters coming out of some rivers on the west coast. I think the first theory is the more likely cause, but be it as it may sponges are not to be found now on most of the sponge bars on which five or six years ago the vessels could secure a load of fine sponges inside of two or three weeks of good weather and clear water at sea. At present, although the vessels meet very often with good weather and clear water, they can not find sponges in most places where they used to secure rapid and successful crops.

The December crop is generally the most successful crop of the year, but vessel owners now feel discouraged, and while some of them are preparing their vessels to send them out to the Rock Island sponge-grounds, a large majority of them are not willing to risk the expenses necessary to send out their vessels. They think it is a hopeless case for a successful crop of sponges, and they say that they will save money by leaving their vessels at their anchorage. The situation, therefore, is very gloomy for a good supply of Florida sponges until the month of June, 1897, at which time the vessels may succeed in securing a supply of Rock Island sponges.

It has rarely happened in recent years that two successful seasons have come together. This was last the case in the winters of 1889-90 and 1890-91. According to Mr. B. J. Arapian, one of the principal Key West sponge-dealers, the season from October, 1890, to March, 1891, was the best in the history of the industry, and the crop was the largest ever obtained. Up to 1890 a crop of sheepswool sponges worth \$70,000 to \$100,000 was considered large. In December, 1890, the Key West sponge dealers bought sponges to the value of about \$160,000 from vessels that had been on the grounds in October, November, and December, and within six weeks the vessels were back at Key West with another trip of sponges, which sold for about \$135,000. These sponges were chiefly from the same grounds off Cedar Keys and Apalachicola that had been resorted to the previous season, when the weather was good and the water was clear, and the catch was said to have been larger than for ten years or more. They were of fine quality and were mostly from water 35 to 40 feet deep. This noteworthy catch evidently depended on a growth of sponges in one season and strikingly illustrates their rapid growth under favorable conditions.

The Key West sponge fleet in 1895 consisted of 99 vessels of 5 tons and over, and about 183 vessels of under 5 tons' measurement. The vessels sufficiently large to take out customs papers had a combined tonnage of 1,204, carried 825 men, and were worth, with their boats, apparatus, and outfit, \$216,754. Eighty-six of these vessels were schooners and 13 were sloops. The smaller vessels carried 594 men and had an aggregate value of \$36,330, including boats, apparatus, etc. It is thus seen that 1,419 fishermen were employed in the Key West sponge fishery in 1895, and the capital invested was \$253,084.

From information furnished by the dealers who bought the catch of the Key West sponge vessels, it appears that in 1895 the yield of all kinds of sponges was 280,372 pounds, having a first value of \$344,015, this being an average price of \$1.23 per pound. The quantity and value of the different kinds of sponges were as follows:

Species.	Pounds.	Value.
Sheepswool.....	207,717	\$320,785
Yellow.....	28,454	11,566
Grass.....	20,249	5,162
Glove.....	14,857	2,882
Velvet.....	7,825	2,990
Others.....	1,270	630
Total.....	280,372	344,015

The Rock Island fishing in the fall and winter of 1896 was very poor, the season being almost a total failure. The vessels that arrived at Key West from the bay grounds in December had exceedingly limited cargoes, and the fishing, as a whole, did not pay expenses.

THE SPONGE TRADE.

Nearly the entire catch of the Key West spongers is sold locally to regular dealers, the only exception being a small quantity of sponges sometimes sold at points on the west coast of Florida nearer the sponge grounds than Key West.

The method adopted by the spongers for disposing of their cargoes is the one that has prevailed since the beginning of the business. The sponges from a given vessel are unloaded on a wharf and, after being inspected by the buyers, are bid on, as in regular auctions. The buyers however, have only one bid on each cargo, and make a written tender to the crier, who announces the different bids after all are submitted. No opportunity is afforded the buyers to weigh the sponges, and the calculation of the quantity of each species and grade of sponge and the probable value of the cargo has to be made rapidly from a mere glance at each bunch.

It can be readily understood that when a vessel load of sponges consists of half a dozen or more qualities, each with a different market price, great discretion is required to gauge its value even approximately. The most experienced buyers sometimes make costly mistakes,

as there is usually great demand for the sponges, and in order to secure them the aim is to bid as high as practicable. It is possible to make or lose hundreds of dollars on a single cargo. The bids of well-informed buyers often vary greatly on the same lot of sponges. As an example of this, reference may be made to a cargo sold in January, 1896. This consisted of 402 bunches of Rock Island sheepswool sponges of inferior quality and small size, and the bids of six buyers were \$411, \$427, \$469, \$512, \$540, and \$857. The next lot sold on the same day contained 206 bunches of sponges of good size and quality from the same ground; the highest bid on this was \$277. The owner and crew of the vessel of which these sponges were the cargo were naturally dissatisfied with this bid and refused to sell for less than \$500.

From many points of view this anomalous method is so unsatisfactory to both seller and buyer that it is strange it has not long since been discarded. The wide fluctuations in prices make the business uncertain, and, in the language of the dealers, the present buying of sponges is little different from gambling or a lottery.

In 1895, the number of regular dealers or buyers at Key West was nine. These employed 65 laborers and teamsters in clipping, packing, and hauling sponges. The buildings occupied by the dealers were valued with their fixtures at \$16,825, and the land on which they rested had an estimated value of \$42,300. The teams and drays more or less regularly required by the business had a value of \$2,150. The amount of cash capital required to conduct the trade was \$135,000. The total investment in this branch was therefore \$196,275. The quantity of sponges bought by dealers corresponds very closely with the quantity caught by the fleet. The quantity and cost of the sponges purchased in 1895 amounted to 267,810 pounds and \$321,020, the different species being represented to the following extent:

Species.	Pounds.	Cost.
Sheepswool	195,569	\$207,895
Yellow	28,084	11,473
Grass	20,205	5,150
Velvet	7,825	2,990
Others	16,127	3,512
Total	267,810	321,020

The loss in weight occasioned by the cleaning and trimming of sponges is generally reported as about 8 per cent, considering all kinds of sponges. Some lots will lose only 3 per cent, but such a low figure is rarely attained. This waste is no unimportant item, since in 1895 it amounted to about 20,000 pounds, worth, at \$1.20 per pound, \$24,000. A part of this loss, however, is recovered. Some of the dealers make no account of the clippings, but the softer parts of the sheepswool clippings are now being generally saved and utilized for various purposes, the wholesale value being about 5 cents a pound.

THE MARKET FISHERIES.

Importance.—Next in importance to the sponge fishery are the various branches of the industry comprehended under the general name of market fisheries, and consisting in the taking of food-fishes chiefly for local sale in a fresh condition. The number of persons who thus find employment, the number of boats and the quantity of apparatus used, and the amount and value of the catch make this branch not only of great consequence to Key West, but one of the most extensive in the State. This fishing is done from small welled-vessels, known as smackees, and carrying on an average two men. Hand lines of various kinds, adapted to the nature of the various species sought, are the apparatus principally employed; a number of other means of capture are used incidentally. The prominent branches of the market fisheries are the fishery for the smaller bottom fishes, the red-snapper fishery, and the kingfish fishery.

The bottom fishery.—The most extensive of the market fisheries is that for bottom fishes, carried on by a numerous fleet of well smacks. A few schooners (5 in 1895) barely large enough to take out custom-house papers, engage in this fishery, and some of the sponge vessels are at times so employed, but most of the vessels are of only 2 or 3 tons register. The fishing is carried on throughout the year, but is more assiduously followed in winter than in summer.

The fish par excellence of this fishery are the grunts (*Hemulon*), which constitute fully one-third of the yield. The two principal species are the white grunt and the yellow grunt. These are found in extraordinary abundance at all seasons and on numerous grounds, and their size, cheapness (4 or 5 for 10 cents), and food qualities make them very popular. Numerous other desirable fishes are taken more or less throughout the year. In fact, a greater variety of food-fish are caught by the Key West line fishermen than are obtained in any other similar fishery in the United States. Those which deserve mention are the red grouper, black grouper, Nassau grouper, rock hind, jewfish, muttonfish, gray snapper, lane snapper, margate-fish, angelfishes, yellow-tail, porgies, chub, hogfish, porkfish, sailor's choice, and bream.

Notwithstanding the very large annual catch, amounting to about 1,500,000 pounds, the resources appear to have undergone no noteworthy depletion, and the vastness of the grounds and the abundance of the ground fishes will certainly permit a very much more extensive fishery than is now prosecuted. The principal grounds frequented by the smaller boats are in the Northwest Channel, but there are numerous other grounds in the vicinity where good fishing for the smaller fishes may be had. The best fishing for groupers, mutton-fish, snappers, and porgies is on the reef extending from Marquesas Rock to Rebecca Shoals; as this region is a considerable distance from Key West, it is only visited by the larger boats.

The question of bait, which in the line fisheries of many places is a very serious one, seldom causes any concern to the Key West fishermen. Suitable bait in almost limitless abundance is easily and conveniently obtained. The principal bait products are the rock lobster or crawfish and small fishes known locally as "sardines," "shad," and "pilehards." The meat of the conch is also used to some extent. The crawfish are taken by spearing, seining, and trapping, and the small fish are caught by means of improvised seines made of gunny sacks. In 1895 the small fish used for bait had an approximate weight of 121,000 pounds, with a market value of \$3,025; the crawfish employed for the same purpose amounted to 126,000 pounds (equivalent to about the same number of these crustaceans), worth \$2,720.

The most interesting feature of the Key West market line fisheries is that the fish are kept alive in wells while the boats are on the fishing-grounds and are transferred to live-cars or live-boxes after reaching market. The consumer is thus enabled to select his fish and have them killed on the spot, thus being sure that the fish is fresh. This method prevents the waste that too often characterizes the fisheries, as the fishermen do not take more fish than they can readily sell and do not start on a trip until the catch of the previous trip is disposed of.

The bottom fishery in 1895 was engaged in by about 105 persons; the number of boats employed was 91, and the catch, amounting to about 1,475,000 pounds, was valued at \$58,901.

The kingfish and red-snapper fisheries.—The most prominent market fishery carried on during a definite time and for special fish is that for kingfish. The time of arrival of kingfish in this region and its abundance each fall are determined largely by the weather. The fish is not expected until after a "norther," and is apt to be most abundant during a severe winter with frequent northerly gales. In the early part of the season, which extends from about October 15 to March 15, the kingfish is sought as far north and east as Cape Florida, but after November 15 it is usually present in large numbers in the vicinity of Key West. The fish are caught from within a short distance of the keys to the edge of the Gulf Stream, but the principal grounds are from above Love Key to Sombrero Key.

Trolling is the method of capture employed in this fishery, a 36-thread cotton line, about 10 fathoms long, being used. Four lines, worth about 40 cents each, constitute the complement of each boat. When the fish are biting fast, the line may be shortened to 5 fathoms or even 2 fathoms. The preferred bait is a triangular strip of skin from the side of a kingfish.

When the catch is sold for local consumption, the fish are eviscerated and cut into steaks. If these are not sold the first day after being caught, they are lightly salted and dried in the sun, when they will keep for several weeks in favorable weather. The principal part of the catch has, however, usually been destined for the Cuban trade, the fishermen delivering the fish round to dealers, who packed them in ice and

shipped them to Havana by the regular steamer, which makes two trips a week from Key West.

The quantity of kingfish taken in 1895 was 420,000 pounds, valued at \$7,000. The Cuban war has necessarily embarrassed the fishery, and the recent imposition of prohibitive duties on fish going to Havana has seriously affected the business and been much felt by the fishermen. The local consumption is far exceeded by the catch, and Cuba has been the only outlet for the surplus. Even when comparatively large shipments were made to Havana the fishermen were very desirous of extending their markets, as they did not take as many fish as they could, but only enough for the home market and to satisfy the Cuban demand. A number of other fish are incidentally taken in the kingfish fishery, the principal ones being amberfish, large groupers, and red snappers.

At times there has been quite an important fishery for red snappers carried on from Key West, but the fishery is not regularly followed, and in 1895 was unimportant. There are a dozen or more banks accessible to Key West fishermen on which red snappers are found in greater or less abundance at the proper season, but the fishery has been less profitable than the kingfish fishery, and has only been extensively followed when kingfish were scarce. The market for kingfish in Cuba does not extend to red snappers, and after the local Key West demands are supplied there is no other way in which to dispose of the catch. A very large red-snapper fishery could no doubt be carried on from Key West if the facilities for marketing the catch warranted it. This fishery is prosecuted, as a rule, by the same large boats that engage in the kingfish fishery. The inquiries of the Fish Commission in 1891 showed that the quantity of red snappers taken by the Key West fishermen in the two preceding years were about 100,000 pounds and 20,000 pounds, respectively, while in 1895 only 8,400 pounds were caught.

Other market fisheries.—Among the minor branches of the market fisheries are the mullet fishery, the crab fishery, the crawfish fishery, and the clam fishery.

A small mullet fishery is carried on by means of gill nets, although some mullet are also taken in cast nets and seines. The demand for mullet is not large, and in 1895 the fishery yielded only 43,800 pounds, valued at \$1,372. During July, August, September, and October three small boats, equipped with gill nets, engaged in this fishery, going out early in the morning and returning by noon. The fish are handled by boys, who peddle them about the city.

A few seines are hauled on sandy beaches and smooth shoals by Key West fishermen. The catch consists largely of bonefish, grunts, groupers, moonfish, and snappers, the first-named species predominating. Most of the seines are operated very irregularly. The owners usually rent them to anyone who desires to fish, and thus frequently a dozen persons have used one seine during a year.

The bottom fishermen at times use trail lines for Spanish mackerel, runners, jacks, bluefish, barraenda, and other surface-swimming fish. The catch in this way is small.

A few small wire traps or pots of a peculiar type, introduced from the Bahama Islands, are used by the Key West bottom fishermen; in 1895, 24 of these, with an average value of \$3, were set. They are baited with crawfish or fish and are set chiefly on reefs in convenient places. Although they are not operated with great regularity and take mostly small fish, their annual catch is considerable, amounting in 1895, according to the best estimates obtainable, to 92,745 pounds, worth \$3,900. The fish composing the catch are chiefly grunts, angel-fish, chub, small groupers and snappers, hogfish, porkfish, porgies, yellow-tail, tang, and turbot.

Crawfish are taken for food in the same manner they are obtained for bait—that is, with “grains,” dip nets, etc. The local sales in 1895 were 31,500 pounds, valued at \$630. A small fishery for stone crabs is carried on. The crabs are drawn from their holes by means of hooks. The taking of conchs for food and bait is unimportant; \$30 worth of conch meats represents the extent of the business in 1895, in addition to which five pearls, valued at \$85, were secured.

An unimportant fishery for hard clams or quahogs is carried on from Key West. The clams are gathered by hand on Pavilion Key, near the mainland of Monroe County, and sold at Key West. The demand is limited and only one small vessel is engaged in the business, making three or four trips a year. The number taken in 1895 was 3,600, for which \$36 was received. The clams are of large size and the supply is far in excess of the present needs.

Statistical summary of the market fisheries.—In 1895 the foregoing fisheries gave employment to 136 persons. The number of boats used was 97, valued, with their outfits, at \$14,641. The following table shows the quantity and value of the products of the Key West market fisheries in 1895, including those used for bait. This branch is seen to have yielded nearly 2,500,000 pounds of fish, etc., with a value to the fishermen of over \$80,000.

Species.	Pounds.	Value.	Species.	Pounds.	Value.
Amber-fish	18, 600	\$620	Porgies	98, 200	\$2, 450
Angel-fish	34, 100	1, 410	Red snapper	8, 400	240
Barracuda	31, 000	1, 240	Other snappers	59, 334	2, 416
Bluefish	9, 240	770	Sailor's choice	20, 179	2, 020
Bon-fish	70, 000	2, 100	Schoolmaster	6, 400	160
Chub	3, 000	180	Spanish mackerel	34, 650	1, 155
Groupers	95, 350	2, 102	Sheepshead	9, 252	417
Grunts	605, 480	14, 082	Yellow-tail	64, 880	6, 475
Hogfish	81, 600	3, 480	Other fish	123, 136	11, 675
Jack and runner	97, 500	3, 250	Sardines, etc	121, 000	3, 025
Jewish fish	16, 000	425	Crawfish	157, 500	3, 150
Kingfish	420, 000	7, 000	Conch	500	a 115
Margate-fish	13, 500	785	Crabs	6, 240	208
Mullet	43, 800	1, 372	Clams	1, 800	36
Mutton-fish	196, 600	6, 890			
Porkfish	11, 962	1, 196	Total	2, 454, 233	80, 444

a Includes \$85, the value of 5 pearls.

Possibility of increasing the industry.—Opportunity for a very large expansion of the fishing industry of Key West is believed to exist, and warrants the attention of capitalists and fish-dealers. With a phenomenal abundance and variety of some of the finest food-fishes of the Atlantic coast, which may be readily caught at little expense, there is practically no outside trade. It is this feature that most forcibly appeals to one who is considering the increase of the industry, and it is in the augmentation of the export trade in fresh fish that the most important development must take place.

The remote situation of Key West has, of course, retarded the development of any outside business in perishable products, with the exception of the kingfish trade with Cuba (now discontinued) and some small shipments in winter by way of Tampa. The rather poor shipping facilities and the costliness of ice have also been factors in the non-expansion of the fisheries.

Careful inquiries, however, indicate that even with the present conditions a fish business may be carried on with New York that will prove profitable to the local dealers who may engage in the enterprise, to the men who catch the fish, and indirectly to the entire community.

Most of those interested in the fishing business of Key West think that the attempt to establish a fresh-fish trade with northern markets would be successful, and several people have considered or are now considering the matter of engaging in such an enterprise. It is reported that an experimental shipment of Spanish mackerel, pompano, or some other choice fish a number of years ago netted several hundred dollars.

The only shipping facility from Key West to the north that can now be considered in this connection is that afforded by the steamship line to New York, although it is possible that the railroads terminating at Tampa on the west coast and Miami on the east coast may be utilized if sufficiently low rates can be given. The New York steamers make regular weekly trips, requiring four days for the passage from Key West (Friday to Tuesday). The present rate on fish is 40 cents per 100 pounds. By the use of refrigerators, or even by the employment of large quantities of ice, the fish would no doubt arrive in good condition. The present wholesale price of ice at Key West is \$7.50 a ton.

To make the shipping of fresh fish from Key West to New York profitable the business should probably be restricted to the winter months, say from November to March, when there is a comparative scarcity of salt-water fishes in the northern markets. At first the shipments might have to include only fishes now well known in the east, such as bluefish, sheepshead, kingfish, Spanish mackerel, pompano, red snapper, and the like, but there is no reason to doubt that in time all of the desirable local species could be profitably disposed of.

The value for canning purposes of the fish known locally as "pilchard," "herring," and "anchovy," which exist in great abundance in this region, should not be overlooked.

The spiny lobster or crawfish, which is extremely abundant, would doubtless meet with sale in a fresh condition in the northern markets after its food value became known, and it would undoubtedly prove a satisfactory substitute for the common lobster. The crawfish of the California coast, which closely resembles the Florida species, has been canned in limited quantities and is consumed fresh in very large numbers.

THE TURTLE FISHERY.

This is one of the most prominent of the Key West fisheries, ranking next to the sponge and bottom fisheries in number of persons engaged and value of products. While quite important, this fishery is much less valuable than formerly, owing to the decrease in the supply.

In 1895 this fishery gave employment to 76 persons, of whom 27 were on registered vessels and 49 on open sailboats or small sloops. The number of vessels and boats used was 29. The crews of some of the vessels numbered 5 men, but on the small boats only 2 men were carried. The apparatus consisted chiefly of nets, of which 54 were set, but some turtling was done by means of pegs.

Three species of turtles are caught, namely, the green, the loggerhead, and the hawksbill, but the green turtle is the most important. The average weight of the last is between 125 and 275 pounds. The loggerhead turtle, while quite common, is not sought to any great extent, as in food value it is inferior to the green, and is not in demand for shipment. It exceeds the green turtle in size. A few hawksbill turtles are taken each year. They average about 80 pounds in weight, although many small ones are caught. Their flesh has little value, but their shell (which is the tortoise shell of commerce) brings a high price. The average weight of the shell is about $3\frac{1}{2}$ pounds, and it is worth from \$2 to \$4.50 per pound, depending on the quality.

The grounds extend for many miles along the keys, and also include the coast of the mainland of Monroe County and the Straits of Florida. The principal region is from Marquesas Key, 30 miles west of Key West, to Alligator Light, on the east coast; there is also good turtling in the Bay of Florida—that part of the Gulf of Mexico intervening between the western keys and the mainland.

Fishing is carried on throughout the year. Crawls or pens are located at convenient places, in which the turtles are kept pending collection and transportation to Key West, whence most of them are sent by steamer to New York. At Key West the turtles are sold at public auction, and are bought by agents of New York houses. Pending sale or shipment the turtles are kept in large pens near the docks.

Quite a business is done in loggerhead-turtle eggs. These are either taken from the female turtles that have been caught for market or are dug up from the sand where they have been buried by the turtles. The eggs taken directly from the female are yellow in color and bring the best price; those that have been laid are white and sell for about

half the price of the others; the average value is 1 cent each; the eggs weigh about a pound to a dozen, and are $1\frac{1}{2}$ inches in diameter. The number gathered in 1895 was over 45,000.

At Key West and throughout the key region there is the same testimony as to the decrease of green turtles, owing to excessive fishing. It is now much more difficult than formerly to obtain a good fare, and the boats are compelled to range over a wider territory. The opinion is freely expressed that unless something is done the business will cease to be remunerative. The fishermen comment upon the fact that for the past few years the green turtles have not been depositing their eggs on Key West and the adjacent keys. It is very probable that this is owing to the excessive hunting of this species, and that they now deposit their eggs on the more distant and inaccessible keys. This has cut off quite an important and profitable business, as the gathering of green-turtle eggs—which are better liked than those of the loggerhead—was carried on by a number of people.

The results of the turtle fishery in 1895 are shown in the following table. The 410,142 pounds of products taken are seen to have had a market value at Key West of \$19,957.

Products.	Pounds.	Value.
Green turtles	337,400	\$16,870
Loggerhead turtles	25,000	200
Hawksbill turtles	40,280	403
Tortoise shell	712	1,674
Turtle eggs	6,750	810
Total	410,142	19,957

FISHERIES OF TAMPA AND TRIBUTARY SECTIONS.¹

Tampa's importance as a fishing center.—Owing to its exceedingly favorable situation and its railroad and steamship lines, which afford ample facilities for the rapid shipping of fishery products in every direction, Tampa has become the most important fishing and distributing center for fresh fish on the Florida coast, with the exception of Pensacola. There are only two bays on the west coast of the State which permit easy access to large vessels; these are Escambia Bay, on which Pensacola is located, and Tampa Bay, on an arm of which, called Hillsboro Bay, Tampa is situated. Tampa is now the receiving center for most of the fish taken in Hillsboro, Manatee, and Lee counties, and also for a large part of the catch of De Soto County. Considerable fresh-fish trade, however, is carried on at St. Petersburg on Tampa Bay, in Hillsboro County, and at Punta Gorda, on Charlotte Harbor, in De Soto County, both of these places being railroad termini. The railroad companies have directly encouraged the fishing industry by giving reasonable rates; in 1895, they contemplated an advance of

¹Includes the counties of Hillsboro, Manatee, Lee, De Soto, and Pasco.

the rates on fish, but desisted on the representations of the Tampa dealers, who showed that there had been a large increase in the shipment by rail during the past few years and that Tampa would be unable to compete with other places in supplying certain sections if the shipping prices were raised.

One of the statements prepared by the dealers for the information of the railroad companies was the following table, showing the combined fresh-fish rail shipments by the three wholesale dealers during the month of October, from 1890 to 1895, inclusive:

Year.	Barrels.	Equivalent pounds.
October, 1890.....	875	175,000
1891.....	940	188,000
1892.....	1,125	225,000
1893.....	1,270	254,000
1894.....	1,583	316,600
1895.....	1,712	342,400

From the most accurate data obtainable, it appears that in 1895 over 4,000,000 pounds of fresh fish alone were shipped by rail from Tampa, to which should be added the very large trade in salt mullet, oysters, and other fishery products.

Most of the fish brought into Tampa are from fishing-camps located between Clearwater (Hillsboro County) and Naples (Lee County). A large number of small vessels are employed in taking the catch from the camps to the city. The camps are most numerous around the entrance to Charlotte Harbor and Caloosahatchee River, Grove City, St. James City, and Punta Rassa being the most important centers. Hunter Point, near the entrance to Tampa Bay, is a very important camp region. The camps consist of collections of cheap wooden buildings, sometimes constructed over the water on piling, but usually on the mainland or keys on leased ground, convenient to the fishing-grounds.

The mullet fishery gives to Tampa its chief importance as a fishing center, and is much more extensive than all other fisheries combined; but numerous other fish are taken, and there are sponge, turtle, oyster, and alligator fisheries in this region.

The mullet fishery.—In the extensive region under consideration, this fishery in 1895 gave employment to 699 fishermen, who employed 356 gill nets (with an aggregate length of 225,520 feet) and 162 seines and stop nets (with a combined length of 75,450 feet). The boats and vessels used in catching and transporting the fish numbered 526. The value of the apparatus was \$14,907, and of the vessels and boats was \$98,554. The transporting fleet numbered 36 vessels and carried 87 men. The results of the fishery were as follows: 8,183,539 pounds of fresh mullet, worth \$74,133; 2,182,556 pounds of salt mullet, worth \$36,505; and 138,400 pounds of salt mullet roe, worth \$9,895.

The stop net is the most important apparatus used in the capture of mullet. It is in reality a seine from 300 to 500 feet long, with a 3-inch mesh. During high water it is secured to stakes across the entrance

to small indentations and creeks, and at low water prevents the fish from escaping. The regular haul seines for mullet are about 750 feet long and have a 3-inch mesh. The mesh of the gill nets is $3\frac{3}{4}$ inches.

Mullet fishing is done more or less throughout the year, but is most extensive during fall and early winter, when the fish have matured roe, are in the best condition, and are most abundant.

An immense quantity of the mullet secured at the fishing stations is salted and either sold in the surrounding territory or shipped to Tampa, St. Petersburg, or Punta Gorda, to be distributed by rail. Prior to 1896 large quantities of salt mullet were sent in sailing vessels and steamers to Havana, but this trade has been practically abandoned owing to the excessively high tariff imposed on imported fish as a consequence of the Cuban war. The salt-fish trade with Cuba has heretofore been virtually controlled by Americans, but it has now fallen into the hands of the Cubans, who visit the Florida coast in their vessels and fish along the shores of the State. Although fishing in State waters by foreign vessels is prohibited, the sparse population and the general absence of revenue cutters make it easy for the Spanish subjects to ply their business uninterruptedly; they often come into the bays to fish, and sometimes even prepare their fish on the shore. This condition of affairs has greatly injured the local salt-mullet fishery.

There is considerable waste in the mullet fishery, owing to the softening of the fish during transportation from the fishing-camps to the markets. If the vessels carrying the fish are delayed by head winds or calms, the whole cargo may be lost, as some of the stations are nearly 200 miles from Tampa. Insufficient ice is also a factor in the spoiling of fish. Careful inquiry among the Tampa dealers shows that during the principal mullet season, from September to December, inclusive, over 200,000 pounds of mullet are thrown away annually at that place, and it is estimated that the annual loss at other places on the west coast is over 300,000 pounds. These spoiled fish do not enter into the statement of the catch. Some of the loss is retrieved, however, by laying aside the ripe females and extracting their roe, which is salted.

The general gill-net and seine fishing.—Besides the gill nets used especially for mullet, there are pompano and Spanish mackerel nets, which are operated in conjunction with the mullet fishery. The pompano nets have a mesh of 4 to 5 inches, the mackerel nets a mesh of 3 or $3\frac{1}{2}$ inches, their length being from 450 to 850 feet. Besides the fish for which the nets are particularly set, numerous others are taken which, in the aggregate, are more important than the two species named; among these are bluefish, redfish, black drum, sheepshead, grunts, and trout. In 1895 the number of pompano nets in use was 80, with a value of \$2,680; the Spanish mackerel nets numbered 70 and were worth \$2,625. The fishery was most extensive at Punta Gorda and at the camps in Manatee County. The catch, a detailed statement of which follows, including those fish taken incidentally in the mullet fishery, amounted to 1,627,015 pounds, for which the fishermen received \$45,573.

Species.	Pounds.	Value.
Angel-fish	17, 100	\$235
Bluefish	89, 376	1, 786
Channel bass	243, 420	3, 613
Crevallé	14, 594	219
Grunts	23, 000	345
Pompano, fresh	246, 887	13, 563
Pompano, salted	28, 000	1, 680
Sailor's choice or pinfish	39, 202	588
Sheepshead	344, 602	5, 167
Snappers, gray, and others	31, 333	480
Spanish mackerel, fresh	237, 989	10, 930
Spanish mackerel, salted	20, 000	1, 210
Trout	265, 968	5, 353
Other fish	25, 544	404
Total	1, 627, 015	45, 573

In the haul seines and stop nets operated primarily for mullet, considerable quantities of other fish are caught, the species being practically the same as taken in the foregoing gill-net fishery. The fish thus incidentally secured in 1895, as shown in the following table, aggregated 269,084 pounds and had a value of \$5,494.

Species.	Pounds.	Value.
Bluefish	29, 008	\$580
Channel bass	67, 103	1, 007
Crevallé	6, 015	91
Drum	28, 000	425
Flounders	6, 000	90
Grunts	13, 210	198
Pigfish	3, 000	45
Pompano, fresh	5, 100	281
Pompano, salted	800	48
Sailor's choice or pinfish	2, 000	30
Sheepshead	48, 748	777
Snappers, gray, etc.	5, 100	102
Spanish mackerel	24, 000	1, 200
Trout	31, 660	620
Total	269, 084	5, 494

Red-snapper fishing.—In 1895 a Tampa vessel of 17 tons burden, carrying 5 men, made a number of trips to the red-snapper banks, located about 75 miles southwest of Egmont Key Light, at the entrance of Tampa Bay. These trips were remarkably successful, and it is probable that other vessels will soon enter this fishery. The catch amounted to 300,000 pounds of red snappers, having a value of \$9,000, and 24,000 pounds of groupers, worth \$360.

Turtle fishing.—The turtle fishing in this extensive section is quite limited. It is reported that in the Tampa region the green turtles are nearly all killed off and that it does not now pay to follow the business, although in 1890, when an investigation of the west Florida fisheries was made by the United States Fish Commission, the fishery was comparatively important. In 1895 one small vessel from Tampa and two boats from Punta Rassa engaged in hunting turtles during a part of the year, four nets being used. The aggregate catch was 9,375 pounds (representing 55 turtles), valued at \$563.

Alligator and otter hunting.—In Hillsboro, De Soto, and Lee counties considerable alligator and otter hunting is carried on by white men and Indians. The alligator industry is much less extensive than formerly, owing to excessive hunting of the alligators, which are being rapidly killed off, but the hunting of otters is now receiving more than usual attention, the otters having undergone a noteworthy increase in the past few years. The reason generally assigned for the increase in the number of otters is the decrease in the alligators, which are said to be the principal enemies of the otters.

In 1895, according to information obtained from the dealers in the three counties named who handled the alligator and otter skins, 214 persons were engaged in the business; their investment in boats, guns, traps, etc., was \$7,421; and their product amounted to 16,750 alligator skins, valued at \$11,925, and 2,750 otter pelts, worth \$13,750.

The oyster industry.—Although the taking of oysters is one of the principal branches of the fisheries of this section, the business is far from being as extensive as the resources seem to warrant. The question of maintaining the supply and developing the industry is one of the most important related to the fisheries to which the attention of the people of this region can be drawn.

The principal oyster beds of the counties of Hillsboro, Manatee, and De Soto are located in Hillsboro Bay, at and near the mouth of Manatee River, in Sarasota Bay, and at Cape Haze in Charlotte Harbor. There are isolated oyster beds along the entire coast, but the foregoing are those which have up to this time been the chief source of supply.

Opinions differ as to whether the oysters are becoming scarcer, although most of the dealers and oystermen think they are decreasing each year. Some time ago Tampa drew most of its oyster supply from Old Tampa Bay, but the beds in that place are so depleted that it has not paid to work them for several years.

Most of the oystering is done from Tampa, although there is considerable oyster business at Punta Gorda. In 1895, 77 persons were engaged in taking oysters. These used vessels, boats, and apparatus (tongs) valued at \$3,958. The product, amounting to 70,384 bushels, was worth \$21,334, an average price of about 30 cents a bushel.

During the past few years some efforts at private oyster-culture have been made, consisting in the planting of seed oysters in Hillsboro Bay and on the worked-out Manatee beds, but the enterprise has thus far been unsatisfactory, owing to the robbery of the beds.

Clams are found in Sarasota Bay and elsewhere, but owing to the limited demand no regular fishery has been established and only a few thousand are taken annually.

The sponge fishery and trade.—The sponge business of this section centers at Tarpon Springs, in Hillsboro County, on the Anclote River. This river affords a good harbor, is adjacent to the Anclote sponge-grounds, and is the rendezvous of a large number of sponge vessels

belonging at various places from Key West to Apalachicola. Nearly 100 "crawls," in which the sponges are cleaned, have been built near by. Quite a fleet of vessels that take out custom-house papers at Tampa, Cedar Keys, and elsewhere are owned at Tarpon Springs, although the principal part of the sponges landed here are from outside vessels.

The sponge industry of Tarpon Springs (or Anclote) is more extensive than that of any other place on the Florida coast except Key West. The recent increase in the business has been noteworthy, and it seems probable that the favorable position of the place with reference to the sponge-grounds will result in a still further development of the industry, which will make Tarpon Springs a formidable rival of Key West.

The sponge vessels which may be credited to this section in 1895 numbered 13. Their tonnage ranged from 6 to 20, and their crews consisted of 7 to 13 men. They are equipped similarly to the Key West vessels as to dingees, hooks, poles, water glasses, etc. The aggregate value of these vessels, with their outfits, was \$23,340, and their combined crews numbered 125, fully 90 per cent of whom were negroes from the Bahama Islands. The stock of the vessels was from a few hundred dollars to over \$4,800, depending on the number of trips and other contingencies, the average being about \$1,800.

Besides the vessels of over 5 tons burden, there are a few others that engage in the sponge fishery in this region. These usually carry 3 or 5 men, and their catch is correspondingly small.

The foregoing fleet was augmented in the latter part of 1895 and in 1896 by a number of sponge vessels from Key West that were permanently transferred to this district, several of which have been credited to Key West in 1895.

The quantity of sponges taken by the sponge fleet of this section in 1895 was 18,393 pounds, valued at \$30,875. The following table shows the extent to which each kind of sponge was represented in the catch. As will be seen, the quantity of other sponges besides the sheepswool taken in this section is insignificant. In quality the sheepswool sponges which enter into the trade of Tarpon Springs are unsurpassed and are worth considerably more per pound than are the sheepswool sponges handled at Key West, owing to the admixture of the less valuable key sponges at the latter place.

Species.	Pounds.	Value.
Sheepswool.....	17,188	\$30,559
Yellow.....	465	102
Grass.....	740	214
Total.....	18,393	30,875

The lay on the Tarpon Springs vessels is somewhat different to that at Key West. The owner supplies the provisions and other outfit of the vessel and receives one-half the gross sales, the crew sharing the other half equally. The captain, however, is paid 8 per cent of the

vessel's share, and the hookers are given a quarter share by the owner in addition to their regular shares. The cost of the outfit per trip is about \$100. and from one to five trips are made each season.

In 1895 and 1896 there were three sponge dealers or buyers at Tarpon Springs. These had their sponge-houses near the mouth of Anclote River, a number of miles below Tarpon Springs. The sponges are sold at auction, as they are at Key West, and the prices are practically the same as at that place. The purchases of these dealers in 1895 amounted to about \$60,000, and consisted of sponges caught not only by local vessels but by those from Key West, Apalachicola, and elsewhere.

Statistical summary.—In 1895 the fishing industry of this section gave employment to 1,251 persons. The vessels engaged in taking or transporting fishery products numbered 37, and had an aggregate tonnage of 402.35; these and 746 boats used in the shore fisheries were valued at \$113,671. The value of the apparatus of capture was \$24,209, and that of the shore and accessory property and cash capital was \$107,695. The total investment in the industry was thus \$245,675. The catch, amounting in value to \$259,508, was divided as follows among the different classes of products:

Fish	\$181,061
Oysters	21,334
Alligators and otters.....	25,675
Sponges	30,875
Turtles	563

FISHERIES OF CEDAR KEYS.

Geographical features and prominent fisheries of Cedar Keys.—At one time Cedar Keys seemed destined to occupy the first place as a fishing center on the west coast of the Florida peninsula, as it was the terminus of the only railway reaching the Gulf except one running to Pensacola. This advantage was lost, however, by the building of railway lines to Homosassa, St. Petersburg, Tampa, and Punta Gorda, and the fisheries, while important, are much less valuable than at a number of other points. Cedar Keys is located several miles from the mainland, on a key of the same name. The railroad is built partly on piles and partly on small keys. Owing to this necessary method of construction, communication is liable to interruption by storms washing away part of the tracks. Several such storms have occurred in the past few years; the worst of these was in September, 1896, when a great deal of damage was done to property in the town, especially to fish-houses on the wharf, and most of the railroad was washed away, the place being without rail communication for nearly two months.

The principal features of the fishing industry of Cedar Keys are the mullet, oyster, and terrapin fishing and the wholesale fish and oyster trades. The place is also the shipping point for the mullet and other fish taken at camps along the coast brought in by transporting vessels. The wholesale trade is in the hands of seven firms; two firms handle fish, oysters, and turtles, and five handle oysters exclusively.

The oyster industry.—Oysters are found in considerable abundance in the vicinity of Cedar Keys. The principal grounds are as follows: No. 4 Channel, between Cedar and Derrick keys, connecting Suwanee and Waccassee bays; Pelican Reef Bar, which extends from No. 4 Channel $2\frac{1}{2}$ miles up Suwanee Bay; Fishbone Bar, which extends several miles up the coast from the north side of Suwanee River; Corrigan Reef, which runs south from Cedar Keys a distance of about 4 miles, and Waccassee Bar, near the mouth of Waccassee River. The first of these is the best and most productive ground in this entire region, the beds occupying nearly 4 miles of the channel. Owing to excessive tonging, the supply has been decreasing for some years, and in 1895 the output was nearly 50 per cent less than in 1890.

In 1892 a Cedar Keys citizen leased a bar about 2 miles north of Cedar Keys, near the mainland, and the same year planted a number of small oysters taken from the natural beds. He continued this each year up to and including 1895, but suffered so much in the last two years from the depredations of tongers that he was compelled to abandon the business. What the tongers left on the bar were washed away in the great storm of September, 1896. All of the oyster-dealers and a number of the tongers are advocates of the system of increasing the supply by the formation of artificial beds, and it is probable that most of those interested will soon be believers in this system, as the natural beds become more and more exhausted.

In 1895 the oyster industry of Cedar Keys gave employment to 50 tongers; the boats used numbered 40, valued, with outfit and apparatus, at \$1,040. The product consisted of 3,200 barrels of oysters, worth \$1,870, or 19 $\frac{1}{2}$ cents a bushel.

The sponge industry.—Although the best sponge grounds in the Gulf of Mexico are located adjacent to Cedar Keys, the sponge fishery has received but little attention from the people, and in 1895 there was no sponge trade in the town. A number of vessels that were documented at Cedar Keys engaged in the sponge fishery from Tarpon Springs, but no sponges were landed locally. In 1890 one local vessel landed 4,160 pounds of sponges valued at \$5,000. In 1878 the business of purchasing and preparing sponges was begun at Cedar Keys, but was discontinued after a few years, and only spasmodic attempts to reestablish the trade have since been made. A favorable opportunity appears to exist for carrying on an extensive sponge business at this place.

The gill-net fishery.—This is the most prominent of the Cedar Keys fisheries. More persons are employed in it than in all the other fisheries combined, and the product greatly exceeds that of the other branches. A very large variety of valuable food-fish is taken, although the mullet is the principal species. In 1895 this fishery gave employment to 108 fishermen, in addition to whom 39 persons were engaged in transporting the catch to market; 30 of the latter, however, were in other fisheries. The fishing boats numbered 48, and were valued at \$1,440; the transporting boats consisted of 15 sailboats (used in the turtle fishery) and

3 small vessels (one of which was in the hand-line fishery). The value of the two vessels that were in no other branch was \$3,580, including outfits. The gill nets numbered 50; they had a 3 $\frac{3}{4}$ -inch mesh, and the average length was 576 feet; their total value was \$1,146.

This fishery resulted in the capture of nearly 1,500,000 pounds of fish, having a value to the fishermen of \$22,555. Over two-thirds of the catch were mullet. Following is a table showing the quantity and value of the different species:

Species.	Pounds.	Value.
Bluefish.....	19,900	\$448
Channel bass.....	75,000	1,125
Croaker.....	1,109	22
Drum.....	9,855	197
Mangrove snapper.....	9,531	191
Mullet, fresh.....	974,068	14,676
Mullet, salt.....	126,000	1,620
Pompano.....	1,200	24
Sailor's choice.....	26,000	520
Sheepshead.....	119,782	1,198
Trout.....	109,421	2,462
Other fish.....	2,674	72
Total.....	1,474,540	22,555

Hand-line fishing.—The taking of fish by means of hand lines is an unimportant branch of the Cedar Keys fisheries. In 1895 some 15 semi-professionals, using hand lines from the railroad dock and from rowboats, caught sheepshead, Spanish mackerel, and trout, and 3 fishermen in a small schooner (of 15 tons) caught red snappers and groupers. The yield, which amounted to 59,724 pounds, was valued at \$1,097, and was divided as follows: Sheepshead, 11,114 pounds; Spanish mackerel, 4,000 pounds; trout, 15,810 pounds; red snappers, 8,800 pounds; groupers, 20,000 pounds.

Sturgeon and shad in the Suwanee River.—Sturgeon are found in nearly all of the rivers of the west Florida coast at certain seasons of the year, but very little attention is given to this valuable fish. In 1895 a Cedar Keys dealer sent a small party of fishermen with gill nets to the Suwanee River to make trials for fish and determine the best parts of the river for fishing. It was not expected that much would be done that year, as the visit was rather late, but as a result of the observations then made the matter was taken up again in November, 1896, fishing was actively begun, and a number of sturgeon had been secured at the time of the investigation.

In June, 1892, the Fish Commission made a plant of 750,000 shad fry in the Suwanee River, and on several occasions the catching of mature fish has been reported from that stream, but the results have been so meager that it was not supposed the experiment had been successful. The sturgeon fishermen who made a prospective trip to this river in 1895 reported that they had seen large quantities of shad going up the stream, and that they had caught a few and identified them as the "white shad" of the Atlantic coast. As some of these men were

formerly engaged in shad fishing on Albemarle Sound, it is probable that they were correct in their identification. This year the sturgeon fishermen intend to use a number of shad gill nets in connection with their sturgeon fishing, and are in hopes of making profitable catches. A drawback to the use of nets on this river is the great number of stumps and sunken logs which interfere with the fishing. If shad are caught in paying quantities, it is probable that an effort will be made to improve the bed of the river in certain spots that are favorable for the use of drift gill nets.

Turtle and terrapin fishing.—In 1895 the taking of green turtles was engaged in by 42 Cedar Keys fishermen. These used 28 sail and row boats, valued at \$5,405, and 43 turtle nets, worth \$1,290. The number of turtles taken was 2,651, weighing 107,610 pounds and valued at \$6,981. The average weight was only 40 pounds. In 1890 113 turtle nets were used in this place; these took 89,958 pounds of turtle, having a value of \$6,297. The turtle fishermen and larger boys of Cedar Keys make quite a business of getting terrapins, which are usually caught with the hands. About 30 cents apiece is the average price received by the fishermen. In 1895 the catch amounted to 11,400 pounds, valued at \$1,250. This was an increase over 1890, when the output was 4,180 pounds. The average weight of the terrapins is 3 pounds.

Summary of Cedar Keys fisheries.—In 1895 the fisheries of this place gave employment to 246 persons; of these, 230 were in the fisheries proper, 6 were engaged in transporting fishery products to market, and 10 were employed in various capacities on shore. The aggregate capital invested in this industry was \$26,651. The leading items in the investment were 123 vessels and boats valued at \$13,910, apparatus of capture worth \$2,702, shore and accessory property valued at \$1,539, and cash capital \$8,500. The fishery products weighed 1,726,658 pounds, and had a value of \$33,888; of this sum, fishes represented \$23,652, reptiles \$8,231, and mollusks \$2,005.

The foregoing figures do not include the sponge vessels which take out papers at the Cedar Keys custom-house, but are owned or make their headquarters elsewhere.

THE FISHERIES OF APALACHICOLA AND VICINITY.

General character and extent.—The fisheries prosecuted from Apalachicola, Carrabelle, and other points in Franklin County are of a varied character and in the aggregate are quite important, although no single branch is of special prominence. The principal fisheries are the sponge, oyster, and mullet, although a number of other fish are taken in comparatively large quantities with gill nets, seines, and other apparatus. Apalachicola ranks next to Key West and Pensacola in the value of its fisheries, and this prominence seems quite remarkable in view of the exceedingly poor facilities for shipping the catch. The establishment of railroad communication, which is now assured, will greatly increase the fishing industry of Apalachicola and vicinity, as the resources are

sufficiently great to permit a very large expansion of the fisheries over their present extent.

The oyster industry.—There are probably more extensive natural oyster-grounds in the vicinity of Apalachicola than elsewhere on the west Florida coast. The physical features of the entire coast of Franklin County are very favorable for oysters, a series of islands and reefs forming protected bays and sounds which have an abundant growth of oysters and are admirably adapted to oyster cultivation.

The oyster-grounds have been rather seriously damaged by natural causes within the past two or three years and their productiveness has been impaired, as shown by the comparative statistics available. The approximate location and extent of some of the principal grounds in the Apalachicola region are as follows:

Sneed Bar: This, the most important bed, is located east of Apalachicola in St. George Sound near East Point. It is about $2\frac{1}{4}$ miles long and one-quarter of a mile wide. There are no evidences of decrease on this ground. The freezes in December, 1894, and February, 1895, affected only the edges of the bed near the shore, but the hurricane of 1894 swept a great many oysters off the bar into deep water, where they were smothered in the mud.

Peter Bar: This ground is about 3 miles east of Sneed Bar, and is 2 miles long but quite narrow. It was ruined during the hurricane of 1894 and the two freezes mentioned. No oysters are now taken from it.

Bulkhead Bar: This ground lies south of Sneed Bar, and is practically a continuation of the latter. It is about a mile long and one-half to three-quarters of a mile wide. Only a few oysters are taken from it. It was affected somewhat by the hurricane of 1894.

East Hole Bar: This bar is south of Bulkhead Bar and is somewhat over a mile long and from one-quarter to one-half of a mile wide. The extreme cold in 1894 and 1895 killed some oysters, and the hurricane also did considerable damage. Oysters are taken from this ground every year.

Porter Bar: This lies east of Sneed Bar. It is several miles in length but quite narrow. A few years ago it was one of the most important oyster-grounds in this region, but its productiveness has been greatly reduced by the natural phenomena mentioned.

Silby Bar: This lies southeast from Porter Bar, near St. George Island. It is about half a mile long and very narrow. The oysters taken from this ground have been used chiefly for canning, as they have a thin shell which prevents their being shipped to any great distance. The supply is reported to be increasing, probably on account of the small amount of tonging recently carried on.

West of the Apalachicola River, in St. Vincent Sound and the western end of St. George Sound, there are a number of small bars containing oysters of good quality, but the supply has been greatly reduced by storms and excessive tonging. Northeast of Apalachicola, in Apalachicola Bay, there are good oyster-grounds, the most important

being the St. Mark Bars. The oysters from these bars are very large, and during the winter of 1895-96 a number of lots, when shucked, yielded about $1\frac{1}{4}$ gallons of meats to the bushel.

In 1895 and 1896, the United States Fish Commission steamer *Fish Hawk* made a survey of the oyster-grounds in the vicinity of Apalachicola. The report of the investigations will appear in the United States Fish Commission Report for 1896.

While natural agencies have undoubtedly done some injury to the oyster-grounds, excessive tonging without any efforts to replenish the beds has been a potent factor in the decrease. It has been the practice of many of the oystermen to move out into deep water to cull their catch; in this way all the spat and small oysters adhering to the old shells are destroyed, by being covered with mud, and the beds are further damaged by the removal of the materials to which new spat may adhere. This appears to have been done in violation of law, as there is a statute prohibiting the culling of oysters anywhere except over the bed from which the oysters were taken.

While some of the fishermen of this section say there has been no decrease in the oyster supply, the majority of those interested think differently, and the investigations of the Commission substantiate the latter view. The quantity of oysters taken in Franklin County in 1895 was only 27 per cent that in 1890. This decrease was in part due to a reduction in the extent of the canning business, which consumes a large quantity of oysters. There were two canneries in operation in 1890 and only one in 1895, but one of the main reasons for shutting down one of the canneries was the fact that the supply was not sufficient to keep both canneries running on full time. The manager of the cannery now in operation states that no difficulty is experienced in getting enough oysters for his purposes, but that he is compelled to use a quality that is inferior to that previously utilized, owing to the depletion of the best grounds.

No attempts have been made to cultivate oysters in this county, but the conditions are very favorable for oyster planting, and the Commission's investigations have shown a large area suitable for this purpose.

In 1895 the oyster industry of Apalachicola and Carrabelle gave employment to 168 persons; of these, 128 were engaged in tonging and 40 in the canning business or in other capacities on shore. The vessels and boats used numbered 56 and were valued at \$8,935. The apparatus with which the oysters were taken (93 pairs of tongs) was valued at \$635. The quantity of oysters taken was 60,389 bushels, for which the oystermen received \$14,101, an average price of 23 cents a bushel. In 1890 the oyster output of this county was 218,326 bushels, having a value of \$36,971—an average of 17 cents a bushel.

The sponge industry.—The sponge fishery of Apalachicola is engaged in by a small fleet of vessels and decked boats, with an average size of less than 6 tons. Only 7 of the fleet in 1895 were large enough to take

out custom-house papers, the others, 11 in number, being of 3 or 4 tons burden. The vessels and boats, without their apparatus and outfit, had a value of \$7,420. The crews numbered 86.

The Apalachicola sponge vessels usually go to the Rock Island grounds early in the season, then to Sea Horse Key, off Cedar Keys, then down the coast to the Anclote region. The grounds between Sea Horse Key and Anclote are those most resorted to. Most of the catch is sold to Tarpon Springs dealers. Nearly all of the sponge vessels engage in oystering a part of the year, and several of them are also employed in transporting fish.

The product of the sponge fishery of Apalachicola in 1895 was 7,356 pounds of sponges, almost all of the sheepswool variety, for which the dealers paid \$11,981.

There are two sponge-dealers at Apalachicola who handle chiefly the catch of the local fleet. One of these also makes purchases at Anclote, where the principal part of this business was done in 1895. The handling of sponges gave employment to 19 persons. The value of the sponge warehouses and fixtures was about \$4,150. The cost price of the sponges purchased in 1895 was \$16,267. This sum, however, does not represent the value of the Apalachicola sponge fishery, as some of the vessels did not sell to local dealers and as the latter bought from outside vessels.

Seine and gill-net fishing.—The taking of fish by means of seines and drift gill nets is the most prominent feature of the fishing industry of Apalachicola and Carrabelle; more persons find employment in this branch, more capital is invested therein, and more products are taken than in any other fishery. The fishery is more extensive at Apalachicola than at Carrabelle.

In 1895 the number of persons who engaged in this form of fishing was 335; 147 of these used gill nets and 255 used seines, 67 persons employing both kinds of apparatus. The gill nets numbered 69, had an aggregate length of 44,400 feet, and were valued at \$1,895; the mesh is from 3 to 3½ inches. Forty seines were operated; these had a combined length of 26,955 feet, and were worth \$3,280; the mesh was 2½ to 3 inches. In the setting and hauling of the nets and seines, 78 sailboats and 53 rowboats were used, and in transferring the catch from the fishing-grounds to the markets 19 small vessels were employed; the investment in boats and vessels was \$10,200.

The principal fishes taken in the seine and gill-net fisheries of this county are mullet, sheepshead, Spanish mackerel, pompano, trout, redfish, spot, and whiting, a number of others being secured in small quantities. The mullet is the leading species, and is sold in very large quantities in a fresh and salted condition. The principal season for mullet is October and November, when the fish are near the shores, and are mostly taken in seines; in August and September the most of the catch is in gill nets, the fish then being in deep water. The principal spawning time of the mullet in this section is December, although

ripe fish are found as late as February. The trout or squeteague ranks next to the mullet in value. It is taken in largest quantities during cold weather, when it congregates in deep holes and may be readily caught with a seine, while in warm weather the schools scatter. The sheepshead is most common from December to the last of March. The best season for pompano is from April 15 to May 15, and for Spanish mackerel from March 15 to May 1, though some pompano are taken in October and November. The redfish or channel bass is taken principally in February, March, and April.

Among the food-fishes of Franklin County that are not now utilized, although abundant, are pinfish, sturgeon, and catfish. Large quantities of pinfish are taken each year, but as there is no sale for them they are thrown back into the water. Sturgeon are reported to be very common in the rivers, but they are not sought. There are immense quantities of catfish in the streams, but their food value is not appreciated, and up to 1896 no attention was paid to them. In this year, however, an Apalachicola dealer began to purchase and ship them to various parts of the country.

The yield of these fisheries in 1895 was over 3,000,000 pounds, with a value to the fishermen of more than \$73,000. The quantity taken with seines was nearly double that obtained with gill nets. Mullet, fresh, salted, and in the form of roe, constituted five-sixths the quantity and eight-ninths the value of the catch. The importance of each product is shown in the following summary of the yield:

Species.	Pounds.	Value.
Angel-fish	100	\$2
Blue-fish	410	11
Channel bass	42,865	721
Drum	800	12
Flounders	300	6
Kingfish	600	30
Mullet, fresh	932,012	11,072
Mullet, salted	1,524,000	47,146
Mullet roe, fresh	2,150	215
Mullet roe, salted	60,200	6,020
Pigfish	500	25
Pompano, fresh	903	28
Pompano, salted	5,000	250
Sheepshead, fresh	24,570	633
Sheepshead, salted	3,000	90
Spanish mackerel	1,320	37
Spots	3,400	93
Trout, fresh	359,600	5,459
Trout, salted	40,000	1,600
Whiting	1,300	20
Total	3,013,030	73,470

The red-snapper fishery.—A little fishing for red snappers and groupers was carried on from Carrabelle in 1895, a small sloop and a small schooner, each with 3 men, being employed. It is reported that one of the finest snapper banks off the Florida coast is located a few miles southeast of Dog Island, which is about 9 miles from Carrabelle. Owing to the very shoal water in the entrance to the harbor of this place, only

very small boats can reach the wharves. The fishery, however, can not be successfully carried on except by boats large enough to remain on the grounds in moderate storms. The fishery, which was inaugurated in 1895, proved a failure, owing to the draft of water of the vessels employed, only 5,000 pounds of snappers and 2,500 pounds of groupers being landed. The fishery was not resumed in 1896.

Line fishing.—Besides the small snapper fishery alluded to, line fishing for both fresh-water and salt-water fishes is carried on from this county, and is a branch of considerable importance. The prominent salt-water species are sheepshead, trout, and redfish. The fresh-water fishes are black bass and other species of the same family found in the Apalachicola and New rivers.

In 1895 the line fishery for salt-water species was followed by 18 persons and for fresh-water species by 21 persons. The number of boats used was 39, valued, with their equipment, at \$854. The catch, amounting to 54,600 pounds of salt-water fish valued at \$1,010, and 43,400 pounds of fresh-water fish worth \$1,897, was divided as follows among the different species: Redfish, 21,000 pounds, \$365; sheepshead, 12,100 pounds, \$217; trout, 18,000 pounds, \$340; Spanish mackerel, 3,500 pounds, \$88; black bass, 12,300 pounds, \$465; bream, 17,300 pounds, \$796; perch, 13,800 pounds, \$636.

Alligator and other hunting.—A small business in hunting alligators and otters for their skins is carried on from Apalachicola and Carrabelle. At the former place 21 persons and at the latter 17 persons engaged in this branch in 1895. Thirty-two boats, valued at \$640, were used. The apparatus, consisting of guns for alligators and traps for otters, was valued at \$506. The hunting is done in the fresh waters adjacent to the coast. Neither of the animals sought is as abundant as formerly, and the year's work resulted in the taking of only 550 alligators, whose hides were worth \$285, and 186 otters, whose pelts had a value of \$713.

Turtle fishing.—At Carrabelle an unimportant turtle fishery is prosecuted. In 1895 3 men in a small vessel, equipped with 3 turtle nets, sought turtles during a part of the year, frequenting grounds on the coast of Franklin County. Only 110 green turtles were obtained. These had an aggregate weight of 3,850 pounds, and yielded the fishermen \$270, or 7 cents a pound.

FISHERIES OF PENSACOLA.

General character and importance.—Next to Key West Pensacola is the most prominent of the Florida fishing centers. Besides a vessel line fishery that is more extensive than any other in the State, Pensacola supports important shore fisheries with lines, seines, etc., and also an oyster fishery. The city is favorably located in respect to the important fishing banks, and has ample railroad facilities for shipping the products to eastern, northern, and western points.

The red-snapper fishery.—It is this fishery which gives to Pensacola its chief importance as a fishing center and has brought the place into prominent notice from a fishing standpoint. The taking of red snappers here not only reaches larger proportions than elsewhere in the United States, but the product is many times greater than at all other centers combined.

The red-snapper fishery is essentially a vessel fishery, although it is engaged in by a few small sailboats which frequent the nearer grounds. The snapper vessels now employed vary in size from 5 to 54 tons and carry from 5 to 10 men. Their average size is about 29 tons and their average crew is 7. Their average value, inclusive of outfit, is \$5,587. With a very few exceptions they are schooner-rigged, only 2 sloops being employed in 1895. Each vessel carries two or more boats, from which a part of the fishing is done.

The lines used are valued at about \$1 each. The usual complement is 2 to each man of the crew, besides which 3 or 4 lines to a man are kept in reserve. The boats engaged in the shore snapper fishery carry about 5 men each and are valued at \$125 on an average. The lines are fewer and less expensive than those used in the vessel fishery.

During the six warmer months of each year the snapper vessels resort to those banks lying between Ship Island and Tortugas, and during the remainder of the year on the great Campeche Bank, lying off the coast of Yucatan. Snappers could probably be caught off the Florida coast during the colder months were it not for the very unsettled weather there encountered. On the Campeche Bank good weather prevails, the water is warmer, and the snappers can be caught with great facility. The location, depth, extent, and general character of the various fishing-grounds for snappers have been fully described in a number of reports of the Commission.¹ The bait used in the snapper fishery consists entirely of pieces of fish, the principal species being snappers, groupers, bluefish, sharks, lady-fish, menhaden, and other fish found on the banks. Salted lady-fish is a favorite and much-used bait. Some of the bait is carried from shore, but a fair proportion is caught on the fishing-grounds.

The usual time consumed on a trip to the more distant banks is two weeks, but a vessel may return from the nearer grounds in a week, or less. The average number of trips during a season is now about 22. Necessary repairs to the vessels and inclement weather occasion delays.

A change in the method of conducting this fishery has taken place in comparatively recent years. Ten years ago many of the vessels were well-smacks, and the fish as caught were placed in wells and landed

¹ See especially the following:

Report of the discovery and investigation of the fishing-grounds made by the Fish Commission steamer *Albatross* during the cruise along the Atlantic Coast and in the Gulf of Mexico, with notes on the Gulf fisheries. Report U. S. Fish Com., 1885.

Report upon an investigation of the fishing-grounds off the west coast of Florida. Bulletin U. S. Fish Commission, 1890.

The red-snapper fishery. Fisheries and Fishery Industries of the United States, Sec. V, vol. 1, 1887.

alive. In 1890 the well-smack had nearly gone out of use at Pensacola, and as repairs became necessary the vessels were made over into tight-bottom craft, and by 1895 there were no vessels of this class belonging at Pensacola. It is reported that they were given up owing to the losses sustained in bringing the fish from the cold water of the Gulf to the warmer waters encountered near shore. With the tight-bottomed vessels the fishing may be done in deeper water, and larger fares are obtained than when welled vessels were used. Now, as soon as the fish are caught they are killed and packed in ice in storage compartments near the center of the vessel. The larger vessels have storage room for 4,500 or 5,000 fish, the capacity of the others being proportionate to their size.

The arrangement between the vessel-owners and fishermen is as follows: The owners furnish the ice and bait, and when a vessel returns these items are deducted from the gross value of the fish. Of the remaining stock, 40 per cent is set aside as the vessel's share; out of the 60 per cent, the cost of the provisions and lines is taken. The balance is then divided among the men in the following proportions: The captain, first hand, and cook get $1\frac{1}{3}$ shares each; other members of the crew 1 share each. The captain also receives 15 per cent of the vessel's share as a bonus. If a vessel has a broken trip or a poor catch, and has not secured enough fish to pay the expenses of a trip, the owners, on account of the difficulty of getting good crews, usually make no effort to collect the balance due them, as it has been found that under other treatment the crews are liable to give up their situations on returning with a small fare.

The cost of fitting out a vessel for red-snapper fishing is considerable. In addition to the lines and dories, the expense for ice, bait, fuel, provisions, and general stores for each trip of a large-sized vessel is about \$175: ice, at \$8 per ton, being the largest item.

Up to 1895 the snapper catch was divided into the following grades by the Pensacola dealers: Small snappers, or "rats," which weigh $3\frac{1}{2}$ pounds or less; medium snappers, which weigh more than $3\frac{1}{2}$ pounds and up to 7 pounds; large snappers, or "counts," which weigh over 7 pounds and average 10 pounds. The prices received by the fishermen for the various sizes were $4\frac{1}{2}$ cents a pound for the small, $3\frac{1}{2}$ cents a pound for the medium, 25 cents each for the large for the first 600, and 20 cents each for the remainder. On June 15, 1895, a new schedule of prices went into effect and this still prevails; it is as follows: For all snappers under 7 pounds in weight, $3\frac{1}{2}$ cents a pound; for all snappers over that weight, 20 cents each for the first 1,000, 15 cents each for the second 1,000, and 10 cents each for the remainder. The price of groupers to the fishermen has remained at 1 cent a pound.

In 1895 the snapper fishery centering at Pensacola gave employment to 42 vessels, with an aggregate tonnage of 1,209.62 and with a value, including outfits, of \$234,650. The number of sailboats employed was

12, with a value of \$1,500. The value of the lines, hooks, and leads used was \$1,114. The number of persons who engaged in the fishery was 280 on the vessels and 60 on the boats. The yield, amounting to 5,163,532 pounds, was valued at \$155,714, and was divided as follows between the vessel and shore fisheries and snappers and groupers:

	Pounds.	Value.
Red snappers:		
Caught by vessels.....	4,587,715	\$144,855
Caught by boats.....	195,815	6,959
Total.....	4,783,530	151,814
Groupers:		
Caught by vessels.....	358,514	3,685
Caught by boats.....	21,488	215
Total.....	380,002	3,900
Grand total.....	5,163,532	155,714

The history of the Pensacola snapper fishery during the past twenty years shows an almost unbroken annual increase in the number of vessels engaged, a consequent increase in the persons finding employment, and an augmented catch. During the season of 1874-75, the first year for which statistics are available, there were 11 snapper vessels at Pensacola. Their tonnage was 328, and their crews numbered 60. The subsequent growth of the fishery to 1895, when it was more extensive than in any other year, is shown in the following table, which covers all vessels that regularly landed their fares at Pensacola. A few vessels, each year, owned in other places, have made their headquarters at this port.

Year.	Number of vessels.	Tonnage.	Number of men.	Year.	Number of vessels.	Tonnage.	Number of men.
1875.....	11	328.22	60	1883.....	24	662.91	133
1876.....	13	376.95	71	1884.....	25	577.96	140
1877.....	11	323.47	57	1885.....	27	751.56	163
1878.....	10	297.10	54	1886.....	33	1,149.10	231
1879.....	11	282.12	60	1889.....	35	980.25	218
1880.....	14	302.11	71	1890.....	34	973.65	218
1881.....	21	458.03	108	1895.....	42	1,209.62	280
1882.....	26	732.39	150				

During a severe storm on July 7, 1896, the fishing fleet of Pensacola suffered some damage. Two snapper vessels of one company and 4 of another company were sunk at their docks. They were, however, raised and repaired at considerable expense.

The aggregate catch of red snappers by the fleet rendezvousing at Pensacola is known for the years 1889, 1890, and 1895, and may be given approximately for 1880 and 1884. The following comparative summary, with the average catch per vessel and per man, is quite instructive. The statistics show a steady increase in the yield, the output for 1895 being more than three times as large as in 1880. It appears that in 1880 the average catch of snappers to a vessel was

103,571 pounds and to a man 20,423 pounds, while in 1895 the averages were 109,231 pounds and 16,385 pounds, respectively. The apparent inconsistency of a diminished catch per man associated with an increased catch per vessel is explained by an average increase of about two men per vessel between 1880 and 1895.

Comparative summary of the Pensacola red snapper catch.

Year.	Pounds.	Average catch.	
		Per vessel.	Per man.
1880.....	1,450,000	103,571	20,423
1884.....	2,380,800	95,232	17,006
1889.....	3,554,176	101,548	16,304
1890.....	4,144,842	121,907	19,013
1895.....	4,587,715	109,231	16,385

These bare figures do not suggest that there has been any noteworthy diminution in the snapper supply, but when considered in connection with an increased carrying capacity of the vessels and a more assiduous prosecution of the fishery, the more recent years show a decided decline. Had the conditions been the same, and had the fishermen in 1890 and 1895 made the same average catch as did those in 1880, the aggregate output of the fishery in 1890 and 1895 would have been 5,252,000 pounds and 6,766,000 pounds, respectively. In September, 1890, the Pensacola dealers issued the following joint circular to the trade, in which the decrease in the snapper supply was referred to:

On and after October 1, 1890, the price of all sizes of red snappers will be advanced one-half cent per pound from the prices now in use. The growing scarcity of red snappers, and the increased cost of catching these fish, has compelled us to make this advance. For a year past our smacks and crews have been doing a starvation business. Where formerly they were able to land a fare of fish three or four times a month, they can now only make two trips a month. They are now obliged to go from 200 to 400 miles from Pensacola to find fish in paying quantities.

The seine and gill-net fisheries.—Next to the taking of red snappers, the seine fishery is the most important branch of the fishing industry of Pensacola. In it both vessels and boats are employed, although by far the more extensive fishing is done from small boats, only two vessels being used in 1895.

The seines are hauled for what are known as "beach fish," consisting chiefly of bluefish, mullet, and Spanish mackerel, although a large variety of fishes is taken. The seines, which are about 500 feet long and worth from \$100 to \$150 each, have a 2½-inch mesh and are operated by five or six men.

In 1895 the number of persons engaged in this fishery in Pensacola, Warrenton, and the adjacent bays was 147, of whom 17 were in the vessel fishery. The number of seines in use was 29, with an aggregate length of 18,360 feet and a value of \$3,075. The tonnage of the 2 vessels aggregated 42.74. These were worth, with their outfits, \$3,400. The boats employed numbered 26 and were worth \$1,640.

The following table shows the quantity and value of the fishes taken in the Pensacola seine fishery in 1895. From this it will be seen that considerably more than half of the catch consisted of mullet. Of the 1,071,414 pounds credited to this fishery, 1,030,000 pounds were taken in the boat fishery and only about 41,000 pounds in the vessel fishery.

Species.	Pounds.	Value.
Bluefish	83,202	\$1,656
Channel bass	9,825	153
Mullet	612,071	7,981
Pompano	17,908	1,099
Sheepshead	40,662	764
Spanish mackerel	107,430	4,877
Spot	15,695	297
Trout	38,949	1,514
Jurel	63,388	761
Yellow-tail	9,010	119
Angel-fish	14,386	181
Crevalle	14,165	138
Bream	7,180	223
Lady-fish	22,655	227
Whiting	7,689	77
Other fish	6,659	135
Mobilians (terrapins)	440	14
Total	1,071,414	20,216

There is a gill-net fishery, carried on principally for mullet, which is of comparatively little importance. In 1895 it was engaged in by 18 persons, who operated 9 gill nets from 9 boats. The nets had an aggregate length of 4,320 feet, a 3½-inch mesh, and were valued at \$1,118. The quantity and value of the species taken were as follows: Bluefish, 3,199 pounds, \$132; channel bass, 922 pounds, \$13; mullet, 86,558 pounds, \$1,155; Spanish mackerel, 5,844 pounds, \$292; trout, 6,440 pounds, \$226.

Spanish mackerel and pompano have been decreasing in this vicinity during the past few years. Fifteen years ago pompano were very abundant, and brought better prices than they do now. At the opening of the season the dealers have paid as much as \$1 per fish. When the price dropped to 15 cents per fish the fishermen became discouraged. The present price is only 5 cents a pound, or about 10 cents per fish.

An apparent relation has been observed between the abundance of bluefish on the Atlantic coast and in the Gulf of Mexico. About ten years ago, when there was a period of scarcity of bluefish on the eastern seaboard, these fish were very abundant in the Gulf, but as soon as they reappeared in numbers on the Atlantic Coast they became scarce on the west coast of Florida.

The oyster industry.—Although much less extensive than some of the other fisheries of Pensacola, the oyster fishery is of considerable importance and possesses some interesting features. The oysters are taken for market from both natural and cultivated grounds.

The principal natural oyster beds in the vicinity of Pensacola are in Escambia and East bays, oysters of excellent quality being found on all the reefs and bars. The supply of marketable oysters on these grounds,

however, has never been very large, not even enough being taken to meet the demands of the local market. Owing to excessive tonging and the effects of storms, the supply has been steadily decreasing. The heavy storm of July 7, 1896, was especially destructive, and nearly effected the ruin of all the beds in both bays by sweeping some of the reefs clean and by flooding the others with mud. Accompanying the storm was a heavy rainfall which caused the Escambia and other rivers emptying into the bays to rise to a great height, making the water on the oyster-grounds so fresh that most of the oysters that had survived the storm were killed. The greatest damage was done in Escambia Bay. In the fall and winter of 1896-97, almost the only places where oysters could be secured were in East Bay and Blackwater Bay, an offshoot of East Bay, where the beds were somewhat protected.

Perdido Bay, which is on the line dividing Florida and Alabama, at one time contained a number of good oyster beds which yielded a large supply each year. The entrance to the bay from the Gulf is quite tortuous and some years ago in an effort to straighten it by cutting new channels through several points, it is reported that the water was made too salty and the oysters died. The few oysters still surviving do not pay for the labor of tonging.

The decrease in the productiveness of the natural beds has led to the institution of oyster-culture, and it seems probable that the business of the future will depend largely on cultivation. It is stated that oyster-planting in this region began in 1888, when one person planted about 6,000 bushels on prepared ground in Escambia Bay and Santa Rosa Sound; in the two following years 7,500 and 12,000 bushels of seed, respectively, were planted. The seed were obtained in Escambia, East, and St. Andrews bays. From this the business increased until now there are a number of persons having beds of cultivated oysters in the vicinity of Pensacola. The bottom on nearly all sides of Escambia Bay is from 6 to 10 feet deep, and is a mixture of sand and mud that is thought to be well adapted to the raising of oysters.

No difficulty has been experienced in the business except that of keeping poachers off the beds. The stealing of oysters became such a nuisance and caused so much loss that owners of cultivated beds joined together for mutual protection and had several trespassers arrested and convicted. Lately the legislature passed a law providing that the owner of the shore front is the only one who can establish an artificial bed; he is allowed to take up 200 yards of shore extending out to the main channel. As a large part of the land along these bays belongs to nonresident persons who purchased it for the timber and who have no inclination to engage in oyster-culture, this law renders unavailable considerable good bottom. The planting of oysters and the claiming of ownership in the beds so planted is not popular among the tongers of Pensacola, and it would appear that sufficient protection is not afforded by the State. The artificial beds suffered equally with the natural grounds during the storm of July 7, 1896, and it is possible

that some of the owners will not replant, especially as their business has entailed heavy losses up to the present.

In 1895 the oyster fishery of Pensacola and the adjacent bays gave employment to 66 persons, who used 34 sailboats and took 21,850 bushels of oysters having a value of \$6,916. The oysters are all taken by means of tongs. The capital invested in this business, exclusive of the value of the oyster beds, was \$4,112.

Statistical recapitulation.—The fishing industry centering at Pensacola had the following extent in 1895: Persons employed, 535; vessels, 42, valued at \$234,650; boats, 99, valued at \$6,940; value of apparatus of capture, \$1,521; value of shore property and cash capital, \$112,805; total investment, \$358,916; pounds of products taken, 6,490,889; value of the catch, \$184,664.

STATISTICS OF THE FLORIDA FISHERIES.

In the following series of tables, the extent of the fishing industry of the coastal waters of Florida is shown in detail by counties. The figures relate to the calendar year 1895, with the exception of those pertaining to the northeast coast, as explained in the preceding text.

The county tables will be found to differ in some minor respects from the figures credited to the principal regions, in the discussion of which the object was to show the importance of the fishing centering there, without regard to county limits.

Table showing by counties the persons employed in the coast fisheries of Florida.

Counties.	On ves- sels fishing.	On ves- sels trans- porting.	In shore fisheries.	Shores- men and prepara- tors.	Total.
<i>East coast.</i>					
Brevard		2	211	41	254
Dade	12		88	1	101
Duval			199		199
Nassau		4	126	150	260
St. John			80	15	95
Volusia			84	5	89
Total	12	6	788	192	998
<i>West coast.</i>					
Citrus			70	7	77
Calhoun			32	1	33
De Soto		14	230	25	269
Escambia	267		226	29	522
Franklin	54		574	92	720
Hernando			40	2	42
Hillsboro	117	26	303	25	471
Lafayette			32	2	34
Lee			267	9	276
Levy	18	6	238	10	272
Manatee		7	180	9	196
Monroe	839	10	716	76	1,641
Pasco			10		10
Santa Rosa	6		3		9
Taylor			136	3	139
Wakulla			200	9	209
Washington	26		196	14	236
Total	1,327	63	3,453	313	5,156
Grand total	1,339	69	4,241	505	6,154

Table showing by counties the vessels, boats, apparatus, etc., employed in the coast fisheries of Florida.

Counties.	Vessels.								Boats.	
	Fishing.				Transporting.				No.	Value.
	No.	Tonnage.	Value.	Value of outfit.	No.	Tonnage.	Value.	Value of outfit.		
<i>East coast.</i>										
Brevard	1	8.09	\$375	\$25					107	\$6,390
Dade	2	18.21	1,800	125					53	3,295
Duval									97	2,350
Nassau					2	28.96	\$750	\$240	119	4,911
St. Johns									52	1,410
Volusia									59	1,994
Total	3	26.30	2,175	150	2	28.96	750	240	487	20,350
<i>West coast.</i>										
Calhoun									15	390
Citrus									43	1,260
De Soto					7	51.33	4,550	3,409	140	10,382
Escambia	37	1,116.66	95,775	123,360					99	6,940
Franklin	12	89.63	6,970	2,196					292	22,465
Hernando									20	700
Hillsboro	14	168.87	15,500	8,550	12	140.97	22,050	5,310	181	9,465
Lafayette									16	480
Lee									218	7,560
Levy	2	22.41	3,200	1,275	2	20.15	2,700	880	123	8,855
Manatee					2	18.77	2,200	1,320	202	17,640
Monroe	112	1,273.46	135,257	89,625	2	50.99	4,000	500	280	49,911
Pasco									2	10
Santa Rosa	1	13.29	1,200	1,478					2	200
Taylor									68	1,700
Wakulla									113	3,420
Washington	5	58.57	5,300	2,561					78	3,540
Total	183	2,742.89	263,292	229,045	25	282.21	35,500	11,419	1,892	144,918
Grand total.....	186	2,769.19	265,377	229,195	27	311.17	36,250	11,659	2,379	165,268

Counties.	Apparatus of capture.											
	Seines.			Gill nets.			Turtle nets.		Cast nets.		Pound nets and trap nets.	
	No.	Length (feet).	Value.	No.	Length (feet).	Value.	No.	Value.	No.	Value.	No.	Value.
<i>East coast.</i>												
Brevard	2	3,825	\$265	221	162,300	\$7,400	66	\$660				
Dade	3	4,500	300	7	8,400	359	46	1,000			1	\$3
Duval	13	2,925	580	119	114,150	4,745			100	\$509	1	400
Nassau	9	2,700	180	3	1,800	120			19	100		
St. Johns	7	1,205	150	14	2,400	190			30	150		
Volusia	11	4,125	450	35	15,750	980	50	250	20	110	3	60
Total	45	19,280	1,925	399	304,800	13,785	162	1,910	169	860	5	463
<i>West coast.</i>												
Calhoun	4	3,000	400									
Citrus				27	16,200	540						
De Soto				143	110,050	3,592						
Escambia	26	16,740	2,700	9	4,320	360						
Franklin	40	26,955	3,280	69	44,400	1,895	3	90	27	150		
Hernando				20	12,000	440						
Hillsboro	38	21,225	1,070	111	52,107	3,244	2	55				
Lafayette				16	10,800	352						
Lee	45	23,850	2,370	48	25,300	1,499	2	55				
Levy				50	28,800	1,146	43	1,290				
Manatee	78	30,150	2,350	206	149,400	6,094						
Monroe	13	2,040	199	3	540	54	54	1,890	27	180	24	72
Pasco	1	225	25	2	450	19						
Santa Rosa	2	1,080	250									
Taylor				68	45,900	1,496						
Wakulla	7	3,675	210	54	20,250	810						
Washington	32	18,900	4,705	4	2,400	100			6	35		
Total	286	147,840	17,559	830	522,917	21,641	104	3,380	60	365	24	72
Grand total.....	331	167,120	19,484	1,229	827,717	35,426	266	5,290	229	1,225	29	535

Table showing by counties the vessels, boats, apparatus, etc., employed in the coast fisheries of Florida—Continued.

Counties.	Apparatus of capture—continued.									
	Lines.		Tongs.		Guns.		Otter traps.		Value of sponge books and glasses.	Value of minor apparatus.
	No.	Value.	No.	Value.	No.	Value.	No.	Value.		
<i>East coast.</i>										
Brevard			26	\$182						
Dade	256	\$49								
Duval	250	25	12	60						
Nassau	100	10	14	70						
St. Johns	200	20	5	20						
Volusia	180	20	14	60						
Total	986	124	71	392						
<i>West coast.</i>										
Calhoun	24	5								
Citrus			20	160						
De Soto			6	48	44	\$600	15	\$9		
Escambia	1,271	1,114	39	347						
Franklin	90	36	93	625	33	495	17	11	\$270	
Hillsboro	50	50	5	40	20	300	20	12	326	
Lee					150	2,250	150	90		
Levy	60	22	30	240					87	\$4
Manatee			8	64						
Monroe	685	163							3,047	108
Santa Rosa	24	22								
Wakulla	30	5	4	32	50	750				
Washington	48	44	20	160						
Total	2,282	1,461	225	1,726	297	4,455	202	122	3,730	112
Grand total	3,268	1,585	296	2,118	297	4,455	202	122	3,730	112

Counties.	Value of shore and accessory property.	Cash capital.	Total investment.
<i>East coast.</i>			
Brevard	\$16,115	\$10,100	\$41,512
Dade	1,841	1,000	9,763
Duval	8,650	5,000	22,310
Nassau	10,500	5,000	21,881
St. Johns	2,150	800	4,890
Volusia	1,740	500	6,164
Total	40,996	22,400	106,520
<i>West coast.</i>			
Calhoun	50		845
Citrus	430		2,390
De Soto	1,500	15,000	39,150
Escambia	42,805	70,000	343,401
Franklin	14,138	33,500	86,131
Hernando	50		1,190
Hillsboro	20,555	50,000	136,527
Lafayette	100		932
Lee	2,100	12,000	27,924
Levy	1,539	8,500	29,738
Manatee	1,100		30,768
Monroe	68,305	125,000	488,311
Pasco	440		494
Santa Rosa	100		3,250
Taylor	280		3,476
Wakulla	1,118	3,000	9,345
Washington	3,100		19,545
Total	157,710	327,000	1,223,417
Grand total	198,706	349,400	1,329,937

Table showing by counties the quantities and values of products of coast fisheries of Florida.

Species.	East coast.									
	Brevard.		Dade.		Duval.		Nassau.		St. Johns.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Amber-fish			1,280	\$59						
Angel-fish			2,100	105						
Bluefish	33,086	\$703	22,473	702	4,130	\$160				
Channel bass	142,400	2,115	2,300	35	63,354	2,040	11,172	\$556	22,109	\$840
Crevalle	14,700	184								
Drum	10,900	140			10,950	115	12,000	125	5,000	50
Flounders	9,000	136	1,200	18						
Groupers	800	12	19,252	936						
Grunts			17,887	364						
Hogfish			1,100	45						
Kingfish			14,000	394						
Mullet, fresh	1,585,869	11,501			563,516	8,453	1,310	52	23,618	690
Mullet, salted	25,000	750								
Pompano	149,111	9,475	26,000	1,820						
Porgies			9,900	217						
Porkfish			1,600	14						
Sailor's choice	11,560	157	5,500	79						
Sheepshead	301,141	4,445	107,300	1,609	28,100	1,194	3,600	175	9,000	332
Snappers, red			12,200	810						
Snappers, gray and others	76,900	1,137	5,200	134						
Spanish mackerel	1,100	66	4,300	215						
Spots and croakers	3,500	46	1,100	16	6,020	180	5,113	250	3,000	122
Trout	209,735	2,872	980	15	83,985	2,520	27,290	1,345	39,234	1,555
Whiting	25,300	375			6,020	180	5,000	250	3,000	115
Yellow tail			3,500	162						
Other fish	7,216	108	6,815	303	66,635	1,990	7,386	335	30,080	1,155
Crabs					1,200	30	1,300	89	1,200	65
Shrimps					16,600	662	40,000	1,500	2,025	85
Turtles, green	18,909	1,320	33,813	1,774					2,000	200
Turtles, hawksbill			25,000	276						
Tortoise shell			436	1,295						
Terrapius					1,350	225	9,000	1,200		
Oysters	42,588	2,115			21,000	900	556,500	8,175	42,000	1,800
Clams									4,800	300
Total	2,659,815	37,657	325,266	11,397	887,860	18,649	679,671	14,043	187,066	7,309

Species.	East coast—continued.				West coast.					
	Volusia.		Total for east coast.		Calhoun.		Citrus.		De Soto.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Amber-fish			1,280	\$59						
Angel-fish			2,100	105						
Bluefish			59,689	1,565					9,164	\$182
Channel bass	28,320	\$765	274,655	6,351			800	\$13	70,000	1,050
Crevalle			14,700	184						
Drum			38,850	430						
Flounders			10,200	154						
Groupers			20,052	948						
Grunts			17,887	364						
Hogfish			1,100	45						
Kingfish			14,000	394						
Mullet, fresh	185,523	2,497	2,359,836	23,193	13,000	\$260	68,218	1,024	1,710,964	25,664
Mullet, salted	22,600	781	47,600	1,531	104,000	3,380	25,000	750	150,000	3,000
Mullet roe, salted					8,000	800			1,500	105
Pompano, fresh			175,111	11,295			312	12	80,915	4,655
Pompano, salted					5,000	250				
Porgies			9,900	217						
Porkfish			1,600	14						
Sailor's choice			17,060	236						
Sheepshead	36,800	1,060	495,941	8,815			22,200	334	100,000	1,500
Snappers, red			12,200	810						
Snappers, gray and others			82,100	1,271			6,323	127	2,000	40
Spanish mackerel, fresh			5,400	281					153,900	6,876
Spanish mackerel, salted					1,100	50				
Spots and croakers			18,733	614						
Trout	29,540	815	281,764	9,122			14,210	320	70,340	1,407
Trout, salted					8,100	324				
Whiting			39,320	920						
Yellow-tail			3,500	162						

Table showing by counties the quantities and values of products of the coast fisheries of Florida—Continued.

Species.	East coast—continued.				West coast—continued.					
	Volusia.		Total for east coast.		Calhoun.		Citrus.		De Soto.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Other fish	19,430	\$516	137,562	\$4,407	27,000	\$1,170				
Crabs			3,700	175						
Shrimps	4,000	150	62,625	2,397						
Turtles, green	7,000	525	61,752	3,819						
Turtles, hawksbill			25,000	276						
Tortoise shell			436	1,295						
Terrapins			10,350	1,425						
Alligator hides										\$525
Otter skins										1,750
Oysters	33,950	2,425	696,038	15,415			8,295	\$234	50,288	3,544
Clams	800	50	5,600	350						
Total	367,963	9,584	5,107,641	98,639	166,200	6,234	145,368	2,814	2,402,071	50,298

Species.	West coast—continued.									
	Lee.		Levy.		Manatee.		Monroe.		Pasco.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Lbs.	Value.
Amber-fish							18,600	\$620		
Angel-fish	2,000	\$35					27,600	1,280		
Barracuda							31,000	1,240		
Blue-fish	12,000	240	19,900	\$448	50,115	\$1,002	9,240	770		
Bon-fish or lady-fish							70,000	2,100		
Channel bass	43,000	645	75,000	1,125	98,000	1,470			400	\$20
Crevalle					8,094	122	97,500	3,250		
Drum			9,855	197	15,000	225				
Flounders					12,000	184				
Grouper			20,000	200			105,380	2,527		
Grunts			814	16	13,210	198	618,980	15,867		
Hogfish							81,600	3,480		
Kingfish							420,000	7,000		
Mullet, fresh	276,800	3,291	974,068	14,676	3,385,353	25,684	43,800	1,372	200	7
Mullet, salted	1,522,780	27,843	126,000	1,620	345,000	3,470			7,800	170
Mullet roe, salted	106,000	7,620			18,100	1,267				
Pompano, fresh	18,167	908	1,200	24	31,100	1,711	105,000	10,500		
Pompano, salted	10,000	600			18,000	1,080				
Porgies							98,200	2,450		
Porkfish							11,962	1,196		
Sailor's choice	2,100	32	26,000	520	15,102	226	20,179	2,020		
Sheepshead	73,142	1,097	130,896	1,366	81,213	1,219	9,252	417	300	30
Snappers, red			8,800	213			8,400	240		
Snappers, gray and others										
Spanish mackerel, fresh	1,000	15	9,531	191	11,000	165	262,334	9,466		
Spanish mackerel, salted	3,400	170	4,950	198	30,203	1,510	34,650	1,155		
Spots and croakers			1,109	22						
Trout	22,000	440	125,231	2,818	99,000	1,980	310	31	500	50
Whiting			600	12						
Yellow-tail							64,880	6,475		
Other fish			310	6			148,326	4,479		
Crawfish							157,500	3,150		
Crabs							6,240	208		
Turtles, green	4,375	263	107,610	6,981			337,400	16,870		
Turtles, hawksbill							40,280	403		
Turtles, loggerhead							25,000	200		
Turtle eggs							6,750	810		
Tortoise shell							712	1,674		
Terrapins			11,400	1,250						
Alligator hides	8,400									
Otter skins	10,000									
Sponge, sheepswool			2,048	3,707			207,717	320,785		
Sponge, yellow							28,454	11,566		
Sponge, grass							20,249	5,162		
Sponge, glove							14,857	2,882		
Sponge, velvet							7,825	2,990		
Sponge, other							1,270	630		
Oysters			67,200	1,870	1,400	150				
Clams			6,184	135			900	36		
Conchs							500	115		
Total	2,104,764	62,159	1,728,706	37,595	4,243,890	42,313	3,142,847	445,416	9,200	277

Table showing by counties the quantities and values of products of the coast fisheries of Florida—Continued.

West coast—continued.

Species.	Escambia.		Franklin.		Hernando.		Hillsboro.		Lafayette.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Angel fish	14,486	\$181	100	\$2			15,103	\$200		
Bluefish	86,401	1,788	410	11			47,105	912		
Bonfish	22,655	227								
Channel bass	10,747	168	63,865	1,086	3,005	\$45	99,523	1,455		
Crevalle	77,552	899					12,515	188		
Drum			800	12			13,009	200		
Flounders	754	31	300	46			18,444	277		
Groupers	350,502	3,605	2,500	25			24,000	36		
Grunts							23,000	345		
Kingfish	383	15	600	30						
Mullet, fresh	87,348	1,180	970,012	11,827	110,000	1,375	2,810,222	19,488	100,000	\$2,200
Mullet, salted	611,311	7,956	1,524,009	47,146	43,000	1,299	156,976	2,022	103,596	3,108
Mullet roe, fresh			2,150	215						
Mullet roe, salted			60,200	6,020			12,800	903	8,000	800
Pompano, fresh	17,908	1,099	903	28			121,895	6,570		
Pompano, salted			5,000	250			800	48		
Sailor's choice							24,000	360		
Sheepshead, fresh	40,062	764	46,670	850	6,213	93	138,965	2,128	3,100	62
Sheepshead, salted			3,000	90						
Snappers, red	4,365,163	138,917	5,000	200			300,060	9,000		
Snappers, gray and others					1,000	20	22,433	362		
Spanish mackerel, fresh	112,274	5,169	4,820	125			71,486	3,574		
Spots and croakers	19,695	367	3,400	93						
Trout, fresh	45,389	1,740	377,600	5,799	21,000	473	105,628	2,146	9,414	377
Trout, salted			40,000	1,600						
Whiting	7,680	77	1,300	20						
Yellow-tail	9,010	119								
Other fish	8,722	241	43,900	1,922			4,190	78		
Turtles, green			3,850	270			5,000	300		
Terrapins	440	14								
Alligator hides				285				3,000		
Otter skins				713				2,000		
Sponge, sheepswool			6,368	11,763			15,139	26,852		
Sponge, yellow			590	130			465	102		
Sponge, grass			398	88			740	214		
Oysters	152,950	6,916	422,723	14,101			441,000	17,610		
Total	6,042,022	171,472	3,590,459	104,707	184,218	3,296	4,484,276	100,754	224,110	6,547

West coast—continued.

Species.	Santa Rosa.		Taylor		Wakulla.		Washington.		Total for west coast.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Amber fish									18,600	\$620
Angel fish									59,286	1,698
Barracuda									31,000	1,240
Bluefish	10,000	\$200					21,951	\$439	266,286	6,022
Bonfish	1,300	13					29,268	293	123,223	2,633
Channel bass	5,550	74			23,207	\$339	4,480	61	497,577	7,549
Crevalle	1,100	17					22,442	231	219,204	4,707
Drum									38,655	634
Flounders	325	13			500	9	403	16	32,706	539
Groupers	7,000	70					22,500	225	531,882	7,012
Grunts					3,910	60			659,914	16,486
Hogfish									81,600	3,480
Kingfish									420,983	7,043
Mullet, fresh	49,000	657	881,768	\$12,230	728,900	7,289	101,300	1,351	12,310,953	129,575
Mullet, salted			243,148	7,294	244,500	6,113	507,023	15,210	5,714,134	130,372
Mullet roe, fresh									2,150	215
Mullet roe, salted			2,900	290	14,200	1,420	67,361	6,736	290,061	25,961
Pompano, fresh	4,800	314			900	45	12,472	732	395,482	26,598
Pompano, salted							25,300	1,265	64,100	3,493
Porgies									98,200	2,450
Porkfish									11,962	1,196
Sailor's choice									87,381	3,158
Sheepshead, fresh	7,145	143			9,157	138	7,769	155	676,714	10,296
Sheepshead, salted										
Snappers, red	68,114	2,384					4,137	124	7,137	214
Snappers, gray and others							130,919	3,582	4,686,396	154,536
Total									315,631	10,386

Table showing by counties the quantities and values of products of the coast fisheries of Florida—Continued.

Species.	West coast—continued.									
	Santa Rosa.		Taylor.		Wakulla.		Washington.		Total for west coast.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Spanish mackerel, fresh.....	22,500	\$1,125			800	\$24	32,160	\$1,248	474,143	\$21,174
Spanish mackerel, salted.....							19,940	908	41,040	2,168
Spots and croakers.....									26,613	520
Trout, fresh.....	1,300	20			1,109	18			911,177	18,048
Trout, salted.....	5,100	179			12,890	204	2,565	84	87,923	3,517
Whiting.....							39,823	1,593	9,589	109
Yellow-tail.....									73,890	6,594
Other fish.....	814	12			5,840	117	1,636	29	240,648	8,054
Crawfish.....									157,500	3,150
Crabs.....									6,240	208
Turtles, green.....									458,235	24,684
Turtles, hawksbill.....									40,280	403
Turtles, loggerhead.....									25,000	200
Turtle eggs.....									6,750	810
Tortoise shell.....									712	1,674
Terrapins.....									11,840	1,264
Alligator hides.....						240				12,450
Otter skins.....						18				14,481
Sponge, sheepswool.....									231,272	363,107
Sponge, yellow.....									29,509	11,798
Sponge, grass.....									21,387	5,464
Sponge, glove.....									14,857	2,882
Sponge, velvet.....									7,825	2,990
Sponge, other.....									1,270	630
Oysters.....					14,700	350	35,070	1,503	1,193,626	66,308
Clams.....									7,084	171
Conchs.....									500	115
Total.....	184,048	5,221	1,127,816	\$19,814	1,060,613	16,384	1,088,519	35,785	31,929,127	1,111,086

RECAPITULATION.

Species.	Grand total, east and west coasts.		Species.	Grand total, east and west coasts.	
	Pounds.	Value.		Pounds.	Value.
Amber-fish.....	19,880	\$679	Spots and croakers.....	45,346	\$1,134
Angel-fish.....	61,386	1,803	Trout, fresh.....	1,292,941	27,170
Barracuda.....	31,000	1,240	Trout, salted.....	87,923	3,517
Bluefish.....	325,975	7,587	Whiting.....	48,909	1,029
Bonfish or lady-fish.....	123,223	2,633	Yellow-tail.....	77,390	6,756
Channel bass or redfish.....	772,232	13,900	Other fish.....	378,210	12,641
Crevalle.....	233,904	4,891	Crawfish.....	157,500	3,150
Drum.....	77,505	1,064	Crabs.....	9,940	323
Flounders.....	42,906	693	Shrimps.....	62,625	2,397
Groupers.....	551,934	7,960	Turtles, green.....	519,987	28,503
Grunts.....	677,801	16,850	Turtles, hawksbill.....	65,280	679
Hogfish.....	82,700	3,525	Turtles, loggerhead.....	25,000	200
Kingfish.....	434,983	7,437	Turtle eggs.....	6,750	810
Mullet, fresh.....	14,670,789	152,768	Tortoise shell.....	1,148	2,969
Mullet, salted.....	5,761,734	131,903	Terrapins.....	22,190	2,689
Mullet roe, fresh.....	2,150	215	Alligator hides.....		12,450
Mullet roe, salted.....	299,061	25,961	Otter skins.....		14,481
Pompano, fresh.....	570,593	37,893	Sponge, sheepswool.....	231,272	363,107
Pompano, salted.....	64,100	3,493	Sponge, yellow.....	29,509	11,798
Porgies.....	108,100	2,667	Sponge, grass.....	21,387	5,464
Porkfish.....	13,562	1,210	Sponge, glove.....	14,857	2,882
Sailor's choice or pinfish.....	104,441	3,394	Sponge, velvet.....	7,825	2,990
Sheepshead, fresh.....	1,172,655	19,111	Sponge, other.....	1,270	630
Sheepshead, salted.....	7,137	214	Oysters.....	1,889,664	61,723
Snappers, red.....	4,898,596	155,346	Clams.....	12,684	521
Snappers, gray and others.....	397,731	11,657	Conchs.....	500	* 115
Spanish mackerel, fresh.....	479,543	21,455			
Spanish mackerel, salted.....	41,040	2,168	Total.....	37,036,768	1,209,725

* Includes \$85, the value of pearls.

CONCLUSIONS AND SUGGESTIONS.

The important water resources within the borders of Florida and along the shores of the State must always be the main dependence of a comparatively large part of the population and one of the chief attractions to the visitors who annually resort to this region for health and pleasure; and if these are to be preserved some legislation is necessary. Already the alligator, one of the most interesting and valuable of the water animals of Florida, is rapidly approaching extinction owing to the unrestricted and often wanton killing during recent years, and other important products may share the impending fate of the alligator unless proper attention is bestowed on the question of their protection.

FISHES.

The only fishery for food-fishes that seems to be unnecessarily destructive is that for mullet, the most important of the State's fishery products. If the supply of this species is to be maintained a close season should be established, covering its principal spawning period. This might have to vary somewhat on the two coasts.

TURTLES.

The green turtle, one of the most valuable of the State's fishery products, needs protection to prevent its extermination. For a term of years, at least, the animal should be unmolested during the period when it seeks the shores to lay its eggs. There should be a minimum limit of weight for turtles that are taken to be shipped or sold locally, in order that the destruction of immature turtles may be prevented. The pernicious and destructive practice of gathering the eggs of this and the loggerhead turtle should be prohibited.

OYSTERS.

Experience has shown that the preservation of the oyster supply rests largely on the leasing or selling of grounds on which oyster cultivation may be practiced. The oyster resources of Florida are not unlimited, and it appears desirable to provide for their preservation and development by encouraging oyster-culture by private individuals. The present Florida law has in it much to commend and seems to make adequate provision, under present requirements, for oyster planting and the protection of natural grounds, but it may in time need revision in order to provide for the more general inauguration of artificial cultivation. It is essential, however, that those to whom planting privileges are granted should be fully protected in their rights.

SPONGES.

The methods employed in the sponge fishery of Florida seriously affect the permanency of the industry, and it is believed that the interests of all concerned would be greatly promoted if changes were made in the present laws governing this fishery, such as the following:

To increase from 4 to 5 inches the minimum size of sponges which may be lawfully taken, and to enforce the law against the selling of

undersized sponges; to permit the Florida Keys and Biscayne Bay grounds to be fished only during a specified part of any period of twelve months; to permit the Anclote and Rock Island grounds each to be fished only once in any period of twenty-four months, so arranging it, however, that the Anclote grounds may be worked one year and the Rock Island the next; to provide for the artificial cultivation of sponges in certain prescribed localities among the Florida Keys and Biscayne Bay by protecting those who wish to go into the business in the exclusive use of certain areas.

ESTABLISHMENT OF A BIOLOGICAL AND FISH-CULTURAL STATION.

Under the terms of the Senate resolution the Commissioner of Fisheries is directed "to report as to the advisability of establishing a station for investigation, experiment, and fish-culture at some suitable point on the coast." Many reasons make desirable the establishment of an experiment station at some point on the coast of Florida or the Gulf States. The number of important food-fishes on the Florida coast is greater than on any other coast section of the United States. Very little is known regarding the migrations, spawning habits, etc., of any of these numerous species, and nothing in the way of their artificial propagation has been attempted. From what is known of the nature of the eggs of the mullet, it is reasonably certain that a method for artificially hatching that species may be devised without special difficulty, yet the discovery and development of any such method remain to be made. Methods for the artificial propagation of several of the other valuable water products can also doubtless be developed.

The abundance on the Florida coast of other forms of animal life besides fishes, such as mollusks, crustaceans, and reptiles, is very great. Some of these are already of much importance, either as food or bait. A biological study of many of these forms would certainly prove of great commercial value as well as of scientific interest.

The field for experimentation with the various species of Florida sponges is practically a virgin one, whose cultivation promises economic results of vast importance. The careful development of a practical method by which sponges may be grown artificially either from cuttings or from eggs is worthy of the most serious attention. The means for extending and replenishing the natural sponge beds is a matter that should also receive consideration.

A station for the investigation of these and related questions might be advantageously established at some point on Biscayne Bay, at Key West, near Tarpon Springs, on Tampa Bay, or elsewhere on the Gulf coast. At the outset the most essential thing in connection with the establishment of such a station and the necessary studies would be the employment of a number of competent experts to carry on the investigations. In the beginning, at least, the equipment in the way of buildings, appliances, etc., need be neither extensive nor costly.



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