PART XXIII.

THE SPONGE FISHERY AND TRADE.

By RICHARD RATHBUN.

a.—COMMERCIAL IMPORTANCE OF SPONGES.

1. General review of the sponge trade.

b.—THE FLORIDA SPONGE FISHERY.

2. The sponge grounds.
3. The sponging vessels and their outfit.
4. Methods of conducting the sponge fishery.
5. Origin of the Florida sponge fishery.
6. The danger of overfishing: artificial propagation of sponges.

c.—THE BAHAMA SPONGE FISHERY.

7. The methods of the fishery.

d.—THE MEDITERRANEAN SPONGE FISHERY.

8. The methods of the fishery.

e.—THE SPONGE TRADE.

9. Character and extent of the New York sponge trade.
10. Origin and growth of the New York sponge trade.
11. Fraudulent practices.

PART XXIII.

THE SPONGE FISHERY AND TRADE.

By RICHARD RATHBUN.

(a) THE COMMERCIAL IMPORTANCE OF SPONGES.

1. GENERAL REVIEW OF THE SPONGE INDUSTRY.

The sponge trade of the United States is very extensive, and supplies are obtained from all the principal sponge-producing regions of the world, not the least important of which is the coast of Florida.

As previously described,* all of the various grades of commercial sponges belong to a single genus, called *Spongia*, and, according to an eminent authority on the subject, may be divided into four natural species, including at least nine sub-species and a great number of varieties. One of these species, the *Spongia graminea*, an inferior grade of the grass sponges, is peculiar to Florida, but the other three species are common to both the Old World and the American grounds. They are as follows: *Spongia officinalis*, including the Levant toilet sponge and the Turkey cup sponge of the east, and the glove sponge of Florida and the Bahamas; *Spongia equina*, containing the horse sponge, the Venetian bath sponge and the Gherbis sponge of the Mediterranean, and the noted sheepswool sponge, the velvet sponge, and a portion of the grass sponges of American waters; *Spongia aqaricina*, including the Mediterranean Zimocca sponge, and the American yellow sponge and "hard head."

The several varieties of sponges, based upon differences in structure, and the numerous qualities, resulting in part from the diverse influences of environment during growth, have given rise to the many commercial grades, according to which sponges are classified and sold in the markets. The Florida grades, strangely enough, have never been increased in number above the six sub-species recognized by naturalists as belonging to that region, and they are designated under five names—the same term, grass sponge, having been applied to two of the subspecies. These grades, arranged about in the order of their value, are as follows: Sheepswool, velvet, yellow, grass, and glove. The sheepswool sponges are by far the finest in texture of any of the American grades, but the relative qualities of the other grades are not always clearly defined; at least the dealers differ greatly in their opinions regarding them, and the market quotations do not always place them in the same order. The Bahama sponges, although identical subspecifically with the Florida, and including the same five principal grades, are still further subdivided, making a total of about fifteen grades recognized by the New York dealers. The secondary divisions are based

---

* Section I, of this report, Part V.

mainly on differences in shape and on the comparative openness of the texture. The Mediterranean grades number as many as twenty-five, in the classification of some of the New York importers, but not a few of these must be founded on differences of slight importance.

The finest grades of sponges are the so-called Turkish sponges of the Mediterranean, the wholesale prices of which range from about $5 to $50 per pound. Next in quality are the sheepswool sponges of Florida and the Bahamas, bringing from $1.50 to $2.25 per pound. Notwithstanding this great difference in price between the Turkish and the sheepswool sponges, it is not now generally considered that the latter is so inferior in quality to the former as their respective market values would appear to indicate, and for many of the nicer purposes for which sponges are used, the Florida sheepswool grade is often preferred. The sheepswool sponges are not quite so fine and close in texture, but they are equally elastic and far more durable, and when properly prepared, greatly outlast the Turkish sponges. The fact that the latter are more carefully bleached, and therefore generally present a cleaner appearance, and also that they are an imported article adds greatly to their value in the opinion of most persons. The American trade in foreign sponges is very extensive, all of the New York sponge houses engaging in it, while two or more deal in no other kinds.

The Florida sheepswool sponges are now regarded more favorably in the New York market than the Bahama sponges of the same name, the difference in quality being due, it is said, partly to the character and mode of growth, and partly to the method of preparation. Although belonging to the same species, the texture of the former is naturally somewhat the finer, and the masses grow in better and more compact shapes. An examination of a large assortment of Bahama sheepswool sponges as received from the producers will show that a considerable percentage are pierced from below by large and irregular cavities, which sometimes penetrate nearly to the top These are said to be mainly produced by the irregular character of the bottom on which they grow, but they probably also arise from a natural tendency to form a more open structure than the Florida sponges.

This grading of sponges according to compactness or solidity of structure is also recognized in classifiying the Turkish and other Mediterranean varieties. For instance, the Turkish sponges are first graded according to their texture, into fine, coarse, &c. Then the finer and other grades are again sorted with reference to shape and solidity, the rounder and more compact forms being regarded as the best, while those of a flattened or very irregular shape, or with many large holes, are considered as inferior. So great is the difference between these several divisions of each grade, as determined by shape and solidity, that while the best shapes and structures of the finest-textured Turkish sponges sell sometimes at as high a price as $50 a pound, the inferior shapes and loose structures of the same texture bring but a few dollars a pound. Shape and solidity as well as texture must, therefore, be considered in grading sponges of all varieties, and many of the numerous grades of foreign sponges are formed in this manner.

Marketable sponges range in weight from about 1 ounce to 1 pound, but the smaller sizes within these limits are most in demand. The supply of good grade sponges, of both the Florida and foreign varieties, is unequal to the demand, and very many more could be sold annually than the fishing grounds have yet been made to yield. One dealer informs us that the demand upon him for the better qualities of Florida sponges is ten times greater than he can supply. There are, therefore, no indications at present of an overstocked market, but the question naturally arises as to whether there is not great danger of the fishing grounds becoming exhausted from the continuous drains being made upon them. Certain sections of the Florida coast, which have been most diligently fished over, have become more or less depleted, but new and extensive grounds

are being constantly discovered and the yield has not varied greatly from year to year. Still, there is strong foundation in fact for the belief expressed by many, that the present indiscriminate fishing will, sooner or later, result unfavorably for the Florida coast at least, and several of the New York buyers have expressed a desire for immediate legislation prohibiting the taking of the better qualities of sponges under a certain size, that size to be equivalent to a weight of about 1½ ounces. In this manner the younger growths would be protected, and the future supplies of large specimens would be more or less insured. This subject is one which merits prompt attention and it derives an additional interest from the recent successful attempts at artificial sponge culture about Key West.

Sponges have hitherto been bought and sold in large quantities entirely by weight, but some of the New York dealers advocate their sale by count, in order to circumvent certain fraudulent practices which are now largely indulged in, such as sanding and liming, and also because of their well known absorptive qualities causing them to weigh much more in moist climates than in dry. This new method of buying and selling has already been started to a slight extent.

At the fishing ports, of which Key West is the principal one in Florida, the sponges brought in by the vessels are, after drying, graded by the agent, each grade being packed separately in bales or cases, and are then ready for shipment to market. New York is the only distributing center for Florida sponges, and receives nearly all the foreign sponges imported into this country.

Sponges are used for a great variety of domestic and professional purposes, the most of which are familiar to every one. The clippings and small specimens are frequently employed for stuffing mattresses, cushions, &c., and also for packing, and in the manufacture of certain coarse kinds of cloth. In upholstery work its chief defect is its tendency to absorb moisture in wet weather, as previously noted.

There is an import duty on all grades of foreign sponges of 20 per cent. *ad valorem*. The wholesale prices of Mediterranean sponges in this country range from 50 cents to $50 per pound; of Bahama sponges, from 10 cents to $1.60 per pound; and of Florida sponges, from 15 cents to $2.25 per pound. The lower grades of Florida sponges range in price mainly from 35 to 50 cents per pound; and the better grades, or sheepswool sponges, from $1.25 to $2.25 per pound.

(*b*) THE FLORIDA SPONGE FISHERY.*

2. THE SPONGE GROUNDS.

The Florida sponge-grounds form three separate and elongate stretches along the southern and western coasts of the State. The first includes nearly all of the Florida reefs; the second extends from Anclote Keys to Cedar Keys; and the third from just north of Cedar Keys to Saint Mark's in Apalachee Bay. The Florida reef-grounds have a linear extent of about 120 miles, beginning near Key Biscayne in the northeast, and ending in the south, at northwest channel, just west of Key West. The northwestern half of the grounds is very narrow, having an average width of only about 5 miles and being limited to the outer side of the reefs. At about the Matacumbe Reefs, the grounds broaden out so as to cover the entire width of the reefs, which are much broader here than at the north. The entire southern half of the grounds

* The account of the Florida sponge fishery—including the sponge grounds, the sponging vessels, and the methods of conducting the fishery—has been furnished mostly by Mr. Silas Stearns, of Pensacola, who made a special study of the subject, in 1879 and 1880, in the interest of the U. S. Fish Commission, and a large part of his report is copied verbatim.

has more or less the same breadth which is about 13 or 14 miles. The second sponge-ground begins just south of Anclote Keys, with a breadth of 7 or 8 miles but rapidly broadens out toward the north to a width of 15 miles, which it maintains from a point about opposite Bay Fort to Sea Horse Reef, just south of Cedar Keys. The total length of this sponging-ground is about 60 geographical miles; its distance from the shore varies somewhat; at the south the inner edge approaches within 4 or 5 miles of the main land, and comes close upon Anclote Keys; but throughout the remainder of its extent it is distant 6 to 8 miles from the shore, until it touches the shallow bottom and reefs of Cedar Keys. The depth of water on these grounds, as indicated on the Coast Survey charts, ranges from 3 to 6 fathoms, but many portions are undoubtedly shallower than this. The northern ground, which maintains a nearly uniform width throughout, is about 70 miles long by about 15 miles broad. It approaches to within about 5 miles of the shore, and terminates just off the mouth of Saint Mark's River; the depth of the water is the same as upon the next one to the south, from 3 to 6 fathoms.

The total area of the Florida sponging-grounds, which are now being worked, including also those that were formerly fished upon but have since been more or less abandoned, may be roughly stated at about 3,000 square geographical miles. This probably does not include all of the sponge-grounds occurring in Florida waters, for the fact that new areas are being constantly discovered would indicate that there might still be more to find, and it is certain that no very strenuous efforts have yet been made to extend the grounds already known, the discovery of new ones having generally been made by accident.

3. THE SPONGING VESSELS AND THEIR OUTFITS.

GENERAL ACCOUNT.—The sponge fishery of the Florida coast differs greatly from that of the Mediterranean, in that sponges are not obtained by divers, but by means of hooks fastened at the end of a long pole and managed from a small boat. In the former region, small vessels of from 5 to 50 tons measurement are employed to visit the grounds, to afford quarters for the men, and to bring home the catch. These vessels are mostly of light draught and schooner rigged, having proportionately large decks on which to carry boats, working gear, and the sponges as they are taken. The holds are of considerable size for storing dried sponges, and the cabins generally small, indicating a sacrifice of comfort to working room. Each vessel carries, according to its size, from five to fifteen men, one as cook and the remainder (always an even number) as fishermen, and also a small yawl-boat to every two fishermen to be used by them in securing the sponges. In addition to the implements for taking sponges, they are provided with a sufficient quantity of provisions, wood and water for the trip, lasting from four to eight weeks.

The working outfit of a Florida sponging vessel consists simply of a few small yawl-boats called dingies, and a supply of sponge-hooks and sponge-glasses. Many of the dingies are built by the fishermen themselves; they are from 12 to 15 feet long, and 4 to 5 feet wide, and are built of the lightest and strongest material obtainable, the frame of mulberry or white oak, and the planking of juniper or southern white cedar. The idea is to have the boats light enough to enable two men to haul them in and out over the side of a vessel, and yet strong enough to withstand the rough handling to which they are subjected, and to safely carry the rather heavy load resulting from a half day's catch. While gathering sponges it is necessary to scull the dingy from the stern, and, for convenience in so doing, the following form of sculling-notch has been introduced: A piece of oak plank about 6 inches wide and a foot long is notched at one end to fit an oar, and inserted at the other between two guiding strips securely fastened to the stern sheet. This

sculling-notch is placed at one side of the center of the stern sheet and is made to be easily removable in order that it may be taken out of the way when not needed.

The sponge-hooks are made of iron, with three curved prongs, measuring in total width about 5 or 6 inches. The entire length of a hook is about 8 inches, the upper end being made into a strong socket for the insertion of a pole.

The sponge-glass as originally constructed consisted of a small, square, wooden box having a glass bottom. More recently, however, this form has given way to an ordinary wooden water-bucket, the wooden bottom of which is replaced by one of plain window glass fastened in by means of putty; the inside of the bucket is painted a dark color. In using a sponge-glass, it is placed upright on the surface of the water and the head is thrust down into it is far as convenient. In this way very small objects can be distinctly made out on the bottom even at a considerable depth. It is customary to leave the handle or bail on the bucket, and allow it to pass around the neck when in use, so that when a sponge is discovered the sponger is not delayed in grasping his hook and bringing it into play.

THE KEY WEST FLEET.—The sponging-vessels of Key West are the pride of that place and with good reason, as they are trim and fast sailers. They rank next after the fishing-smacks in size, ranging in measurement from 5 to 45 tons, and are nearly all schooner rigged. Many of them were built or rebuilt at Key West or in that vicinity, and like the smacks are strongly put together. The frames are made of Madeira wood, red cedar, and dogwood, and the planking of yellow pine or cypress. Before being painted, every outside seam and crack in the hull is filled with beeswax to render it tight and form a smooth surface. The masts, sails, rigging, and iron work are all of the best quality and all neatly fitted. In shape they are rather wide for schooners, but being shallow and loaded with canvas, work well under sail. The mainsail and jib are of the ordinary shape, but the foresail is generally a "lug" sail, that is having no boom, and so wide as to extend aft beyond the mainmast. Otherwise it is similar to the foresail ordinarily used on schooners.

These vessels are all of light draught and provided with center-boards. The hold, from the after end of the center-board to the bow, is entirely clear and unobstructed to afford ample space for the storage of sponges, boats, and hooks. The cabin, extending from the bulkhead at the after end of the center-board to the stern, is generally a small affair with but few conveniences, and is composed almost entirely of sleeping compartments for the large crews that live on board. The trunk of the cabin is therefore very small in proportion to the size of the deck, the hatches being also small as well as the bitts and windlass gear forward. Cooking is done on deck, on a stove that is boxed up and kept between the masts. When ready to start for the sponge reefs, there is but little empty space anywhere on board; the decks are crowded with boats and men, and with piles of spare ropes, anchors, sponge poles, water glasses, &c., while below is stored a large quantity of wood, water, and provisions. The sponging-vessels of Key West are quite as expensive to build as the fishing-smacks, and according to the statements of several builders and owners cost on an average about $3,000 complete, for a vessel of 15 tons.

The Key West sponging-fleet consisted in 1879 of 86 vessels, all but five of which were schooner rigged, the balance being sloops. The combined measurement of this fleet, with the exception of four vessels the tonnage of which was not ascertained, was 1,105½ tons. The tonnage of each vessel ranged from about 5 to 45 tons. Two vessels were under 5 tons; thirty-six between 5 and 10 tons; thirty-five between 10 and 20 tons; three between 20 and 30 tons; two between 30 and 40 tons; and four between 40 and 45 tons. The total value of the vessels of the fleet was $151,350. The crews numbered most commonly either five, seven, nine, or eleven men each; the total number of men in the combined crews of the entire fleet was seven hundred and forty-four. The majority

of these were Americans and a large percentage negroes; the remainder were either from the British West Indies or of unknown origin. In addition to the vessels described above, there are many small boats which fish for sponges about the reefs.

The Key West vessels are divided into two distinct fleets, one called the "Bay Fleet" being composed of the larger vessels that cruise on that part of the coast lying between Anclote Keys and Saint Mark's, and the other called the "Reef Fleet" consisting entirely of the smaller vessels that gather sponges on the reefs from Key West to Cape Florida. The vessels of the bay fleet are gone from home from one to three months according to their capacity and the success of their cruise, while those of the reef fleet are absent from one to two weeks only.

The bay fleet vessels send out two men with each dingy, one to scull and one to hook the sponges, but those fishing on the reefs assign only one man to a dingy, and he can easily manage both the sculling and the hooking as the reef areas are smooth, clear, and shoal, and the currents not strong.

THE APALACHICOLA FLEET.—The vessels engaged in the sponge fishery from this port are all of small size and light draught, and are mostly schooner-rigged in the ordinary American style. Many of them were formerly owned in Pensacola or New Orleans, where they were probably built, while others were built up from large ship's boats, and small yachts.

Taken as a class they are rough and homely, and rather poor sailers, thus contrasting strongly with the Key West fleet. The total number of vessels in the Apalachicola fleet in 1879 was sixteen, one being sloop-rigged, the remainder schooner-rigged; they ranged in size from 5½ to 36½ tons, the total measurement amounting to 154¾ tons. The combined crews numbered 84 men.

In addition to this fleet of vessels there were a few small open boats engaged in sponging from Apalachicola, which were not entered upon the custom-house books. The estimated value of the sixteen vessels of the regular sponging fleet was $10,700, or at the rate of about $71.30 per ton; and of the small open boats about $800. The outfit of these sponging vessels consisted of *some forty dingies (two or three to each vessel), valued at $35 each, or $1,400 for the entire number*; and of sponge-hooks and sponge-glasses, estimated to be worth about $100. The total amount of capital invested in the sponge industry at Apalachicola in 1879 was, therefore, about $13,000.

4. METHOD OF CONDUCTING THE SPONGE FISHERY.

GENERAL ACCOUNT, INCLUDING KEY WEST.—The Florida sponge fishery may be carried on throughout nearly the entire year, providing the weather continues favorable. The principal season for work is from May or June until the last of August, for during that period the water is generally smoother and clearer than at other periods; but it sometimes happens that the best conditions of water occur in winter, and at such times the fishery can be conducted with great success. The winter sponge fishery, when it can be carried on continuously, is said to be even more profitable than the summer, for the fishermen claim that sponges average larger in the winter than in the summer, though they cannot account for the fact. Decomposition does not begin in cold weather for three or four days after the sponges are taken. During the usually stormy months of September, October, and March, nearly all the vessels are laid up, for the owners, being unable to insure them, are unwilling to risk them off the coast for such long periods when heavy gales may spring up at any time.

At the commencement of a fishing season, the owners of vessels appoint their captains, who, in turn, select their crews. As soon as the crew and outfit of a vessel are ready, it sails from port

and in from one to three days is on the fishing-ground and at work. The cook remains on board, keeps the vessel under way, and prepares the meals, while the spongers pair off into the dingies. Of the two men who occupy each dingy, one is called the "sculler," and the other the "hooker." The former stands in the stern of the boat and sculls it slowly and steadily forward, being prepared to stop it and hold it exactly in place at a moment's notice from the "hooker," or "bowman," who kneels down amidships, or at the bow, with the upper half of his body projecting over the side. The duty of the latter is to scan the bottom, and, as soon as a sponge of sufficient value comes into view, to fasten into it by means of his long sponge-hook, and bring it to the surface. It is very evident that both "sculler" and "hooker" must be men of considerable experience and dexterity in their respective occupations, in order to work together advantageously. The instant a sponge is sighted, the boat must stop, and without a moment's delay the hooked pole must be plunged downwards, sometimes to a depth of 25 to 35 feet, with sufficient accuracy to pierce an object which at the most is only a few inches in diameter. As might be expected, the task of hooking sponges is rendered much more difficult, when, as frequently happens, the water is rough or clouded by sediment. To make his position more comfortable and prevent sores and blisters, the hooker ties sponges about his knees where they would come in contact with the bottom of the boat, and also across his chest to raise it above the rail. His posture is an exceedingly tiresome one, lying as he does with his head and shoulders over the rail, and he must retain it all day.

Formerly, when sponges were collected only in shallow water, no difficulty was experienced in detecting them with the unaided eye, but of late years, since they have been gathered most abundantly in depths of 20 to 35 feet, it has become necessary to make use of the sponge-glass already described. The "hooker," wearing the handle of this rude glass about his neck, has both hands left free, when he wishes to use the pole, which his companion first hands to him, having started it over the side of the boat. In addition to his skill in detecting a small object on the bottom, and bringing it to the surface, he must be able to tell at sight whether it is a valuable sponge or not; and if not, pass it by. Some sponges grow so firmly attached to the bottom that it is almost impossible to pull them off with the hook. Instances are cited where the hooker, in his strenuous efforts to loosen such a specimen from the bottom, has actually pulled the bow of his boat under the water and caused it to partially fill. Sheepswool sponges are said to be the most difficult to detach, and yellow sponges the easiest of those growing in moderate depths of water. When a small sponge, attached to a large one is taken, it is pulled off and thrown back. These sponges are said not to attach themselves again but to remain loose at the bottom, and to be rolled about by the movement of the water. When they are again taken, showing no point of attachment, they are called "rolling johns." The useful sponges taken by the fishermen are the so-called sheepswool, boat, yellow, grass, and glove sponges; and the worthless ones which they sometimes hook, are termed by them "loggerhead," "bastard sheepswool," bastard yellow," and "finger sponge."

The gathering of sponges from the depths in which the fishery is now mainly carried on, on the west coast of Florida, is very hard work, and only the strongest and most skillful men can succeed. Capt. Ben Pearson, of the schooner Champion, and others, state that they hook up the sponges from 30 and 36 feet of water. When working in such depths as these, they have to contend with stronger currents and rougher water than in shoaler localities, and in addition there is the unwieldiness of so long a pole. Sponges from those depths are, however, superior in quality to those from inshore.

Collecting goes on at all times when the water is smooth and clear—conditions not always met with. Some of the Key West spongers have partially removed the inconveniences of rough water by distributing oil over the surface, and are thus enabled to work more continuously. A tea-

spoonful of oil, it is said, will produce a smooth surface for as long a time as a small boat cares to work in one spot. Shark oil is considered the best for this purpose, though no reason for it is given. In summer many Key West people kill the nurse-shark and try out the liver for this oil, which sells at $1 a gallon. During the day the dingies work steadily along the reefs, picking up sponges here and there, until dinner-time or night arrives, when they return to the vessel. When on the sponging-grounds the men breakfast at daylight, and soon after are in their boats, prepared for work. At dinner-time—12 o'clock—the cook blows a horn to recall them, and after a short rest the work continues until sunset. Should a boat wish to regain its vessel at any other time, in order to leave sponges, an oar is hoisted blade up as a signal, whereupon the cook sails the vessel to that vicinity. As soon as the sponges are brought on board, they are spread carefully over the deck of the vessel in their natural upright position, so as to allow the slimy matter, called "gurry" by the spongers, to run off easily. During the first stages of decomposition they smell strongly of ammonia, and are extremely noxious to most persons unaccustomed to the odor. Later the ammonia scent disappears, leaving a stronger one very similar to that of decaying seaweeds. The fishermen say that after having endured this stench for a few days they do not notice it at all.

Some of the larger of the sponging-fleet remain at anchor on the "grounds" through the night, but the majority run inshore, a distance of 10 or 15 miles.

It is the general custom among them to go to the place for curing their catch every Friday night, carrying with them the results of a week's work. Each vessel has one or more crawls (an inclosure of stakes 8 or 10 feet square, situated in water 2 or 3 feet deep) at the rendezvous. A small island, called Rock Island, located a short distance southeast of Saint Mark's River, and near the sponging-grounds, is the principal place for these crawls and is visited by both Key West and Apalachicola vessels. The latter have a number of crawls near the Saint Mark's light-house, and the former have them scattered all along the coast from Rock Island to the Anclote Keys. Many of the reef fleet have their crawls at Key West and cure the sponges at home.

The Saturdays are passed in depositing the past week's catch, and cleansing the deposit of the week before. Sponges as kept on deck will generally die and lose the greater part of their gelatinous matter in one or two days; therefore, when thrown into the crawls, the chief part of the curing to be done is the removal of the outside skin or covering. In cold weather they live much longer than when it is warm, and it is sometimes difficult to cure them properly in winter. Vessels at Rock Island have sometimes been unable to cure their catch there and have brought them all home to die and then be cured.

In summer, and when they are dead at the time they are placed in the crawl, the week's soaking that they undergo softens all the remaining slime and skin they contain, and a little squeezing and beating with a short, heavy stick, called a "bruiser," suffices to cleanse them perfectly. They are squeezed as dry as possible and thrown into a dingy, to be strung on rope-yarns 6 feet long, in the form of bunches, which are first strung up to allow the sponges to bleach and dry, and afterwards stowed in the hold. As soon as dry they are in condition to sell to the wholesale merchants of Key West and Apalachicola.

When vessels have crawls in company and employ a watchman, the cured sponges are left ashore until they are ready to start home, otherwise they are carried in the hold. Until within a year or two a watchman for the crawls was not considered necessary, but so much thieving was done that the spongers were finally obliged to resort to this method of protection. Each vessel pays her share towards the watchman's expenses and wages.

Sponging-vessels spend from one to two months on a trip, the state of the weather and the

amount of provisions on board influencing their stay on the "grounds." The results of the trips vary quite as much as with other fishing-vessels, fair winds, clear water, experience, and skill, all being indispensable to success. On some trips hardly enough sponges are secured to pay expenses; on others the men's shares amount to fair wages, and again they will share several hundred dollars for four to six weeks' work. On an average they make rather more than almost any other class of fishermen.

The share arrangements are as follows: On Apalachicola vessels, the owners of vessels furnish the whole outfit, pay one-third of the provision bill, and receive one-third of the net proceeds of the trip, leaving the crew to pay two-thirds of the provision bill and to share two-thirds of the net proceeds. When the members of the crew are not equally experienced and expert, the best men, such as the captain, cook, and the "hookers" draw whole shares and the others half or three-quarters of a share each. The captain usually receives additional remuneration from the owners. On Key West vessels the owners furnish the complete outfit including provisions, and take one-half of the result of the trip, thus leaving a clear half to be divided equally among the crew. The captains are paid a certain commission by the owners. As an illustration of the profits sometimes made in this fishery it may not be out of place to mention here one or two successful trips. During the winter of 1879-'80, the schooner Competitor, of Key West, of 44 tons, carrying about eighteen men, made a trip of eight weeks and stocked $4,200. The same season the schooner Lone Star, of Key West, 15 tons, carrying seven men, made a six or seven weeks' trip, and stocked $1,935, and many others did quite as well. During the month of January, 1880, the spongers had unprecedented success having brought in large loads of fine deep-water sponges that sold for two dollars and more per pound for the best quality (sheepswool); before that, the average price had been one dollar per pound for the first quality.

As soon as a vessel arrives in port with a catch the sponges are carried on shore and piled on the wharf, each variety or quality by itself. At Apalachicola, where there is but one dealer, they are inspected and purchased at any time during the day that is most convenient to him, but at Key West, where there are several dealers, there are certain times for inspecting and other times for buying these lots. During the forenoon the dealers examine them carefully, and cleverly estimate their worth by eye and touch in handling them. They are so expert that they can correctly judge the weight of a bunch of sponges by lifting it, and know perfectly the value of textures by sight; it is remarkable to see the accurate judgment of several of the largest purchasers. A choice lot being offered, each party separately examines it and makes a bid, and very often a party of three or more purchasers will not vary ten pounds in a lot of several hundred pounds, and the amounts offered will not vary five dollars. As they go over the lots they place a value upon them of which they keep a record on paper. During the afternoon when all the spongers are on shore for the day, a man sells them at auction, lot by lot, to those whose papers show the highest bids. Cash is paid at once, and the crews are not delayed in getting their shares, but are able to start off on another trip in about a week from the time of their arrival.

The principal varieties sold in these markets are called "sheepswool," "yellow," and "grass" sponges. The "sheepswool" sponge is the best quality; its texture is fine, soft, and very strong, and it sells for from $1.25 to $3 per pound, the average price being about $1.75 per pound for the best quality. The "yellow" sponge is of fine but not strong texture, and is not so soft and durable as the variety just named. It sells for 25, 30, or 40 cents per pound. The "grass" sponge is of very fine and hard texture, but is not durable and is usually so irregular in shape that it is torn easily. It does not sell for any set price per pound, and the few that come to market are sold by

the lot at a price that would not exceed 8 or 12 cents per pound. A few of the small velvet sponges are obtained and sold for a high price.

As the buyers of sponges require them to be very dry when buying by the pound, and as they are not always landed in that condition, a price per bunch is sometimes agreed upon. The bunches weigh from one-half to one pound each, and the price varies considerably, depending upon the quality, size, and success in cleaning and bleaching. It is the buyer's intention to obtain a pound of sponges in this way for less than when buying by the pound. There is supposed to be a difference of about 10 cents per pound in favor of the buyer when sold by the bunch, in the case of the best qualities. Several thousand dollars were paid out weekly for sponges in 1879. Twenty-two thousand dollars cash were paid for sponges during two weeks in June of that year, and the sponge trade of Key West from January 1 to March 1, 1879, amounted to $76,500.

The dealers of both Apalachicola and Key West buy for wholesale firms of New York and receive a commission as compensation. They are kept informed of the state of the New York market, and make their bids accordingly. The packing-houses are roomy and dry buildings, where large quantities of sponges can be hung up and kept dry. As soon as a lot of them is taken in, they are put through a process called "liming," that is to say, they are dipped in a weak solution of lime and sea-water, after which they are hung up out of doors to dry. Then they are stored away in the loft until needed.

The "liming" gives sponges a bright yellow color which adds to their value, but when not properly done, as by the excessive use of lime, the tissues are injured and the sponges become rotten and worthless. There is no doubt that even a little lime injures a sponge, and any considerable quantity adds greatly to its weight.

They are not "limed" at Apalachicola because the fresh water of that vicinity has a bad effect upon them; consequently it is not uncommon that quantities from that place are reshipped from New York to Key West simply to be "limed." As soon as "limed" they are laid out to dry, and they must be thoroughly dried, for if left together damp they soon become ruined. Long spells of rainy weather sometimes cause the dealer to lose thousands of dollars' worth of sponges, for they become damp, turn red, and finally decay; but now some of the dealers have lofts, or upper stories to their houses, where sponges can be hung up and kept dry in all weather. For convenience in handling, the sponges are strung in bunches; otherwise such large quantities could not be managed as they are.

After this process is completed sponges are trimmed, sorted, and packed. Preparatory to being trimmed, boys beat them with mallets so as to remove all particles of stone, shells, or other hard substances that would dull the shears. The trimming is done with sheep-shears, and all the uneven parts and ragged edges are cut off. After this an experienced man sorts out each variety and quality, weighing them in large crockery-crates in lots of 100 or 120 pounds each. These lots are then placed under a hydraulic press and formed into compact bales, measuring about 30 inches long, 18 inches wide, and 18 inches thick, which are covered with bagging and corded securely. In this form they go to the wholesale dealers of the country. The "trimmings" of the sponges are saved, and when a sufficient quantity has accumulated, are baled up in the same manner as the others, and shipped to New York to be used in upholstery work.

The sponge trade has steadily increased since it was first started, and at present constitutes a large business. During 1879, not as much was done as in 1878, because of the unusually boisterous winter, and the so-called poisoned water, which destroyed a great many sponges about the "reefs" which the reef fleet would have brought in; 1880 was also considered a poor year, as the total

sales at Key West amounted to only about $180,000, while the average annual sales have been about $200,000.

APALACHICOLA.—The crawls of the Apalachicola spongers were, until 1880, mostly located on Rock Island, a small island situated 17 miles southeast of Saint Mark's light-house and about 2 miles from the main-land.

In 1880, trouble arising between the spongers of Apalachicola and those of Ocklockony, the former built new crawls in the immediate vicinity of Saint Mark's light-house, but they still resort to their old crawls to some extent.

In 1879 there was but one dealer in sponges at Apalachicola, who sold entirely to New York parties. After purchasing from the vessels, the sponges are strung on cords and hung in the sunshine until perfectly dry, after which they are transferred to the packing-room, cleaned of the small fragments of coral-rock adhering to them, and then trimmed as at Key West. The sheepswool sponges are graded according to size, into large, medium, and small, but all sizes of yellow sponges are packed and shipped together. The method of weighing, pressing, and baling is the same as that practiced at Key West. The dimensions of the bales are about 36 inches by 18 inches by 18 inches, and their weight from 80 to 125 pounds. The clippings are treated in the same manner.

The prices paid to the fishermen for sponges in 1879 was from $1 to $1.10 per pound for sheepswool, and from 20 to 30 cents per pound for yellow. The total catch of the Apalachicola fleet for 1879, was estimated as follows: 18,000 pounds of sheepswool sponges, worth $18,000; 8,000 pounds of yellow sponges, worth $2,000; total value, $20,000.

The Apalachicola fishermen have carried on the sponge fishery to this extent for only about four years. When this fishery was first started only a few small boats owned in Apalachicola engaged in it, but the number of vessels and men increased from year to year until about four years ago, when the fleet reached its present size. Although no record of the amount of sponges taken during the past four or five years has been kept, the catch for 1879, which was somewhat under that for the year or two previous, is supposed to have been an average one.

CEDAR KEYS.—Although situated close to valuable sponge-grounds, and favorably located for engaging in the sponge fishery and trade, nothing of any importance has yet been attempted in this line from Cedar Keys. The summer of 1879 was the first in which sponges were sold at that place. A small schooner of 5½ tons, with a crew of five men, made one or two trips that season between Cedar Keys and Tampa Bay, and a few other lots were brought in, the entire amount probably not exceeding 1,000 pounds.

SAINT MARK'S.—While this place is not directly interested in the sponge fishery it furnishes a few men to the Apalachicola fleet. Sponges occur at the mouth of Saint Mark's River, and on either side of it, at distances of not more than 15 to 20 miles from town, and could be easily obtained. At the light-house there is a sponge-crawl, used, in 1880, by Apalachicola vessels. Previously their sponges had been cleaned every year at Rock Island, but in 1880 trouble arose between the men of the Apalachicola fleet and those of the Ocklockony, with respect to the watchmen employed at that place, whose fees for service were paid at the rate of $2 for every dingy or $1 for every fisherman, the cook being exempt. The dispute resulted in the Apalachicola fleet resorting to the mouth of Saint Mark's River, where no other watch was needed than that volunteered by the light-house keeper. After the sponges had been macerated and cleansed in the water, they were spread out on the ground about the light-house, and left until thoroughly dry, when they were stored in the holds of the vessels. No frames are used for drying the sponges, either at Saint Mark's light-house or at Rock Island.

5. ORIGIN OF THE FLORIDA SPONGE FISHERY.

Mr. Silas Stearns furnishes the following historical sketch of the Florida sponge fishery:

Prior to 1850 all of the sponges used in the United States came either from the Mediterranean Sea or the Bahama Islands, but about that time attention was first called to the abundant sponge growths occurring on the reefs of South Florida. The people of Key West had used these sponges for many years in their houses and about their boats, but considered them of little or no commercial value, and did not discriminate between the different varieties. In or about the year 1852, specimens of the most durable variety of Florida sponges, the so-called "sheepswool", were secured and prepared for market, and were found to compare very favorably with many of the Mediterranean grades. After this, the Key West firms of Samuel Kemp & Sons and Brown & Curry bought all the sponges brought in at the rate of 10 cents per pound. At first the business was little understood, and, from want of capital, the proper vessels, and working gear, it advanced but slowly. As foreign sponges became more costly, however, the demand for Florida sponges rapidly increased, and the profits became so tempting as to induce the Key West merchants to engage in the business much more extensively than before. Key West was nearer the sponge-grounds than any other moneyed city of the Gulf Coast, and moreover, its people were, as a class, accustomed to a sea-faring life. It was natural, therefore, that it should take the lead in the Florida sponge fishery, and year after year they have added to their fleet of sponging vessels, and to the number of their packing-houses, until now the business has assumed large proportions, and has become a source of great profit to the Key West merchants.

About the year 1870, Apalachicola first sent out several vessels to gather sponges, in consequence of the discovery of rich sponge-grounds between Saint Mark's and Cedar Keys. Before that time sponging had been entirely confined to the neighborhood of the Florida reefs. The discovery of this section and of a similar one between Cedar Keys and Anclote Keys gave a new impetus to the industry, for it was found that a greater quantity of a superior quality of sponges could be obtained from these regions by the same means employed about Key West, and the longer distance to be traveled by the Apalachicola vessels was not regarded as an important obstacle to the trade.

6. THE DANGERS OF OVERFISHING; ARTIFICIAL PROPAGATION OF SPONGES.

DANGER OF EXHAUSTING THE SPONGE-GROUNDS.—More than 75 per cent. in value of all the Florida sponges marketed are of the finest or sheepswool variety. Formerly only the larger specimens of the sheepswool sponges were taken by the fishermen, but when, from overfishing, the supply of large sponges became greatly diminished on the grounds then being worked, they began to bring in every size, down to the very smallest that could be sold, and a much larger quantity of the small and inferior specimens are now seen in the markets. Notwithstanding this indiscriminate fishing the annual yield has not increased during the past four or five years, and the receipts at the New York market have continued about the same. This condition of affairs, unless the facts have been overstated, does not promise well for the future of the Florida sponge fishery, and we can but hope that steps will be taken to thoroughly investigate the subject with the view of preventing, if need be, the destruction of so valuable an industry. The sponge, like the oyster, is a stationary animal, and is also restricted in its distribution to certain limited areas, which are favorable to its growth. The supply is entirely dependent upon the yield of these few grounds, and is in no way influenced by migrations from without. This renders it possible for a sufficiently large fishing fleet to completely exhaust the supply in a comparatively short time,

although it is doubtful if the regular fleet is yet extensive enough to accomplish such a result. A scheme to provide for a rotation in the grounds fished over, from year to year, would appear to offer the best methods of preserving the supply, and might be easily arranged. In this manner each section would be allowed a certain period (the number of years to be determined by experiment) in which to recover its growth, and the danger of permanent injury would be avoided. Such a course is pursued in connection with many of the oyster-banks of the Connecticut coast, with most beneficial results.

It is claimed that some of the Key West buyers have encouraged the spongers in their indiscriminate fishing, and that they are largely to blame for the inferior character of much of the present supply. In an editorial, in one of its issues for 1880, the "Oil, Paint, and Drug Reporter", of New York, published the following remarks upon this subject:

"The medium and large sponges therefore bring considerably advanced prices, while the small ones are more or less a loss to the merchant. These irregular sizes have led to frauds in packing, it being a common practice with many to 'top off' their bales with good sizes, and make up the bulk with small ones. Thus an annoying evil has grown into the trade, despite the strenuous efforts of the honest dealers to prevent it; but still more serious results seem to promise for the future, in the entire exhaustion of these fisheries, which have hitherto afforded a field for an important industry. It is evident that the constant scouring of the reefs will have the same effect upon them that would occur to oyster-beds if they were constantly dredged, or upon game preserves if they were not protected for certain periods each year from the ravages of the sportsman."

Natural causes sometimes occasion great injury to the sponge-grounds, as in the case of the so-called "Poisoned waters," which, although occurring at irregular and generally long intervals, appear to destroy nearly every living thing in the area within their influence. Not only are the free-swimming fishes thus affected, but also all the lower forms of life, attached to or growing upon the bottom. According to Mr. Ernest Ingersoll, this plague was severely felt in 1844, 1854, 1878, and 1880, and also occurred to some extent in the intervening periods. Several theories have been advanced to account for its appearance. Some think it is due to the overflow of swamp waters from the mainland, but others trace its origin to subterranean causes of volcanic origin, giving rise to poisonous gases, which ascend and pollute the waters. The latter belief is strengthened by the fact that the poisoned waters of 1878 and 1880 were immediately preceded by earthquake shocks, felt throughout the southwestern part of Florida. Mr. Ingersoll's account of the fatality in 1878, so far as concerns the sponges, is as follows:

"The earliest indication of it was the floating up of vast quantities of dead sponges, chiefly 'loggerheads.' All of those seen by Mr. Brady were less than 40 miles north of Key West, in what is known as 'The Bay,' nor has anything of the sort been seen at any time outside (*i. e.*, southward or eastward) of the Florida Reefs; but it was soon discovered that all the hitherto profitable sponging-grounds lying off the coast as far north nearly as Cedar Keys, and particularly off the Anclotes, had been ruined. These grounds are only now beginning to show signs of reproductiveness in sponges. The abandonment of these sponging-grounds from the reefs to Cedar Keys, during the three or four years following this attack, entails a loss which it is hard to estimate, because partially compensated in the increased price of the article in the market, due to its consequent scarcity; and because at all times the product there is an uncertain quantity; but I hazard the opinion that $100,000 would not repair the damage to this business interest alone. Had it not been for the fortunate discovery just at that time of the sponge tracts off Rock Island, northward of the Suwanee River, almost a famine in this article would have ensued."

THE ARTIFICIAL PROPAGATION OF SPONGES.

The threatened depletion of portions of the Florida sponge-grounds by overfishing has suggested the interesting problem as to whether sponges might not be propagated artificially, with as much success as has been attained with respect to many species of edible fishes. In the Adriatic Sea of Southern Europe, where the finest grades of sponges are obtained, successful experiments in this direction were carried on from 1863 to 1872, and the conclusion was reached that sponges could be profitably cultivated, though only after a considerable outlay in the beginning. The results tended to prove that about seven years were required for a small fragment or cutting of sponge, measuring about 1 or 2 cubic inches, to attain a marketable size, and that, therefore, during the first seven years of such an enterprise, there must be a continued expenditure of money, with no returns. On the other hand, the Florida fishermen have contended that the Florida sponges grow much more rapidly and reach a fair size within a comparatively short period. Recent experiments, made since this report was first written, have confirmed these surmises of the fishermen, and have proved almost beyond question the practicability of sponge culture on the Florida coast.

SPONGE CULTURE IN FLORIDA.—The first trials were made at Key West, by the agent of Messrs. McKesson & Robbins, sponge dealers of New York, who have recently contributed to the U. S. National Museum four specimens of the sheepswool variety showing the first fruit of this important work. We have not been able to obtain a detailed report of these experiments, but from a letter written at Key West, and kindly furnished by Messrs. McKesson & Robbins, the following brief account has been prepared:

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 2½ 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 2½ 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 tide-ways, 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.

SPONGE CULTURE IN EUROPE.—The experiments in the Adriatic Sea were carried on by Mr. Buccich at the island of Lesina, on the coast of Dalmatia, and the results obtained were embodied in a report by Dr. Emil von Marenzeller, published in Vienna in 1878.* This report is so important and contains so many valuable suggestions that might be utilized in connection with future

* Die Aufzucht des Badeschwammes aus Theilstücken.

experiments on the coast of Florida, that we reproduce here certain portions of it, which have been translated by Mr. Herman Jacobson.

"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 wood-work 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 are easily 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, while during the warm

* "*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.

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. Sponges which have been cut will again grow together. Those cuttings which have only a single cut surface will soonest grow fast to their new base, stone, wood, &c. Mr. Buccich thinks that during a calm lasting twenty-four consecutive hours, cuttings could 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 flag-stones, 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 of 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 '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 up on pegs this or any similar instrument cannot 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 twenty-four pegs, each with three cuttings a piece, such an apparatus can hold one hundred and forty-four 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 wood-work 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 to 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 cannot 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 indi-

cate 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 profitableness 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, cannot 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."

(c) THE BAHAMA SPONGE FISHERY.

7. THE METHODS OF THE FISHERY.

The Bahama sponge fishery is carried on in very much the same manner as the Florida, the sponges being procured by means of hooks attached to long poles. Negroes perform most of the work, and according to all accounts, the Bahama vessels and their outfit are inferior to those of Key West. The following brief notes made by Dr. Edward Palmer during a recent trip to the Bahamas were furnished by Prof. Alpheus Hyatt, of Boston, and will be found of interest in connection with the foregoing account of the Florida fishery:

Five hundred or more licensed crafts, of 10 to 25 tons burden each, are engaged in the Bahama sponge fishery. These boats are mostly schooner-rigged, and carry from two to four yawls a piece, each of which is manned by two persons, one as sculler, the other as hooker. The sponge-glasses are square or round, and the sponge-hooks two pronged. The crawls in which the sponges are macerated are in from 6 to 10 feet of water and are constructed by driving stakes into the sand. The sponges are left in them about a week. At the beginning of the season the owners select the captains and crews and furnish the outfit, but at the close of each trip they take from

the proceeds the cost of the outfit and one-third of the remainder, two-thirds being divided among the captain and crew. Formerly the owner of the vessel or the captain sold the sponges, which for convenience' sake were strung in fathom lengths, by weight. Now, however, the law and usage require that sponges shall be strung in lengths called strands, each size and grade by itself. The owners are also obliged to select a person to act as agent for the sale, which is conducted in about the same manner as at Key West, the bids being made in writing. The agent's fee is taken from the joint proceeds of the cargo. Bidders take care in estimating, to deduct enough to cover the loss or waste in clipping. Nassau is the headquarters of the Bahama sponge industry, which is one of the most important enterprises of those islands. During the arrival of cargoes from the sponging-grounds and the sales of sponges, everything is excitement. Sponges are graded at Nassau as sheepswool, velvet, glove, reef, hardhead, yellow, and grass. Of late years many of the Bahama sponging-vessels have carried on their operations in waters adjacent to the coast of Cuba, for which they are obliged to pay a license fee to the Spanish authorities.

(*d*) THE MEDITERRANEAN SPONGE FISHERY.

8. THE METHODS OF THE FISHERY.

The method of conducting the Mediterranean sponge fishery differs greatly from that practiced in America, the sponges being mostly obtained from deeper water and by diving. Professor Hyatt describes the fishery briefly as follows:

"The diver goes either in diving armor or naked. The naked diver is carried down by a broad flat stone of marble of about 25 pounds weight, which he holds at arm's length in front of him, and which he uses to guide his flight, to protect his head when he first strikes, and to keep him down when he walks on the bottom. Fifteen to twenty fathoms is the average depth; but for depths beyond this up to 40 fathoms which is reached in the Mediterranean, more preparation is necessary. The man standing naked in the boat, with the greatest earnestness practices inflating his chest to the utmost for about ten minutes, and when the blood is thoroughly oxygenated by this means, seizes the stone and plunges headlong into the sea. The tremendous pressure of the water, at the depth of even 15 fathoms, is such as to cause bleeding at the nose and mouth when divers first begin the season; and only the most expert attempt greater depths. Two minutes is the usual duration of the dive, and three and a half the utmost extent of endurance. The skin of the shoulders is, in habitual divers, burnt off by the action of the sun and salt water; and the hair is of a greenish or greenish-brown during the height of the summer, returning to the natural black only in the winter time after diving has ceased to be profitable." Each diver has a net bag hanging down in front, and held in place by a cord extending around the neck. Into this he puts the sponges as he pulls them from the bottom, and when it is full or before, in case he has remained too long upon the bottom, he jerks the rope and is quickly pulled to the surface. A dredge consisting of a rectangular iron frame with a net bag behind it, something like the naturalist's dredge, is also used for procuring the deeper water Mediterranean sponges. In shallow water Mediterranean sponges are sometimes taken with a hooked pole as in Florida, but all the sponges growing in such localities are of a coarse and inferior character. "The Mediterranean sponges are prepared with greater care than ours, being beaten or trodden out after the killing, and not allowed to take care of themselves at all."

(e) THE SPONGE TRADE.

9. CHARACTER AND EXTENT OF THE NEW YORK SPONGE TRADE.

New York City is the principal port of entry in this country for all sponges, both foreign and domestic. A few other places receive small quantities of foreign sponges from time to time, generally brought in by sea-captains on private speculation, but all the regular importing and receiving houses are located in New York. The other ports which receive occasional supplies of foreign sponges are, according to the custom-house records, Boston, Philadelphia, Baltimore, New Orleans, and San Francisco. The same records show that during the past sixteen years the custom-house valuation of sponges imported into New York City, was about $1,700,000; while the importations at all of the other places combined, during the same period, amounted to only about $200,000. The quantity of Florida sponges received at New York City for the year 1879 was about 205,000 pounds, valued at something over $200,000.

There are eight principal sponge-houses in New York City, of which six deal in all the foreign and domestic grades, the remaining two importing the Mediterranean kinds only. It can be safely said that nearly all the Florida sponges sold pass through New York. None are exported direct from Key West, and only about $10,000 worth are exported annually from New York to foreign countries, principally England, France, and Germany. About one-half of the Bahama sponges exported yearly from Nassau come to this country, the remainder going to Europe. Some Bahama sponges are also sent to New York for shipment to Europe.

According to the statements of several New York dealers, the quantity of Bahama sponges imported into New York is, by bulk, two or three times as great as the quantity of sponges brought there from Florida, and the imports of Mediterranean sponges equal, in the same way, the combined quantities of Bahama and Florida sponges received. Florida and Bahama sponges are sent to New York mostly in tightly compressed bales weighing from 30 to 200 pounds apiece, but a few are also received in cases, weighing from 20 to 125 pounds each. Mediterranean sponges are imported in wooden cases, weighing 25, 50, and 100 pounds each. The Florida sponges are shipped to New York mostly by steamer.

The wholesale prices of the various grades of sponges were given as follows in the New York market quotations for 1880:

Table showing the wholesale prices of sponges in New York City in 1880.

Name of grade.	Price per pound.		Name of grade.	Price per pound.	
Glove	$0 25 to	$0 75	Reef, No. 1	$1 00 to	$1 30
Slate	45	80	Conpee, bathing	1 40	2 10
Carriage, yellow	35	65	Small bathing	1 00	1 50
Velvet	65	85	Forme	1 50	3 00
Nassau sheepswool	1 40	1 60	Zimocca, small	1 15	1 25
Florida sheepswool, unbleached	2 00	2 25	Zimocca, small and medium	2 00	2 40
Florida sheepswool, bleached	1 75	2 00	Fotters	2 75	3 00
Reef, No. 2	80	95			

From this table it will be noted that some sponges are graded according to the uses to which they are put, and also that the more costly foreign grades are entirely omitted, probably because of their great variation in price, dependent upon their size and shape.

10. THE ORIGIN AND GROWTH OF THE NEW YORK SPONGE TRADE.

The following interesting account of the introduction of Florida sponges into this country and the subsequent growth of that industry, in connection with the introduction of Bahama sponges into France, is furnished by Mr. A. Isaacs, of New York. the oldest regular sponge dealer in the United States:

About the year 1840, a brother-in-law of Mr. Isaacs, Mr. Hayman, of Paris, who had been traveling in the United States and West Indies, sailed from Jamaica for Europe, but was wrecked on one of the Bahama Islands, near Nassau. Being detained there for some time, awaiting a vessel to carry him home, his attention was attracted by the great number of sponges in use among the natives, all of which, he was informed, came from the waters surrounding the island. Although wholly unacquainted with the sponge industry, and not knowing what might be the value of Bahama sponges in a country where the Mediterranean sponges had long been used, he decided to carry some home with him and to place them upon the market. Accordingly, when he sailed, he took with him about 500 or 600 selected specimens, which cost him from 5 to 10 cents a pound. He had no difficulty in disposing of them, and at once made arrangements through the French consul at Nassau for additional supplies.

Mr. Isaacs became associated with Mr. Hayman in the Paris house, but after remaining with him about seven years, or until 1849, he came to New York to engage in the same business, which, he was informed, had not yet received a start in this country. It was his intention to deal only in Bahama sponges, as he had done in Paris, but at that time he knew nothing of the value of the Florida sponges, and scarcely of their existence. When he arrived in New York, he found that no regular importation of Mediterranean sponges had yet begun, but the trade had been carried on in a very small way to supply the druggists with the finer qualities, for which only was there then a demand. He also learned that Bahama sponges were not regularly imported, the best quality selling for only 10 cents a pound, and that several cargoes of sponges from the southern part of Florida had been brought to New York, but had found no sale. There was thus presented to him every indication of a good opening in an important and profitable industry, which he determined to start himself.

After he had been in the country over a year, he ascertained that the shipping firm of S. B. Fish & Co., *in South street, New York, had received sometime before a large quantity of Florida* sponges, which they could not dispose of at any price. He visited their storehouse and found two lofts filled with loose Florida sponges, which a careful inspection showed him to be, if anything, superior to the Bahama sponges, in which he had dealt in Paris. The Messrs. Fish & Co., were about to throw the entire lot away, as they had no use for them, and glad to dispose of them at any sum, allowed Mr. Isaacs to set his own price. He gave them from 8 to 15 cents a pound, according to quality, and soon afterwards went to Key West to arrange for regular supplies. He was recommended to the same parties in Key West that had sent the sponges to Fish & Co., and found them willing to accept his own price in order to start a trade, from which they had previously realized nothing. He offered them 22 cents for the best grade, or sheepswool sponges, delivered in New York, and lower prices for the several inferior grades, and his offer was accepted.

Mr. Isaacs also began at the same time the importation of Mediterranean and Bahama sponges. For fourteen years he continued in the sponge trade in New York City without competition, but since then several other large houses have started, and now six principal firms deal in Florida as well as foreign sponges, while two others limit themselves entirely to importing the European varieties.

11. FRAUDULENT PRACTICES.

In connection with the sponge trade, several fraudulent practices have grown up, to the great annoyance of honest dealers, and strenuous efforts are now being made to check them. The two most serious are the so-called "liming" and "sanding" processes, which greatly increase the weight of sponges, and, thereby, their cost to the retail buyer.

The liming of sponges is a bleaching process, and consists in soaking the sponges in a solution of lime and sea-water. It was resorted to primarily for the purpose of improving the appearance of the sponges and giving them a lighter and brighter color. The use of the bleaching agent, however, results in great injury to their fibrous structure, and renders the sponges less durable. It has also been observed that a large percentage of the lime is generally left in the sponges from insufficient washing, and this tends to increase their weight to the financial gain of the bleacher. As these facts have become known to the trade and to people generally, the demand for bleached sponges has fallen off considerably, and it is now generally regarded that the liming process is continued partly for dishonest purposes. Our remarks on this subject apply more especially to the Florida sponges, regarding which we have the most definite information; but almost all the foreign sponges received at New York, and particularly those imported from Europe, are more thoroughly bleached than our own, and the practice of sanding is as fully understood on the other side of the Atlantic as it is here.

The liming of Florida sponges is done solely at Key West, as it is said the process has never proved successful at Apalachicola. All the sponges from the latter place have been shipped unbleached to New York, but Key West dealers claim that these same sponges are sometimes sent to them from New York for bleaching.

The sanding process consists in mixing with the sponges before packing a certain quantity of fine sand, which increases their weight from 25 to even 100 per cent., according to the amount used. Sponges are so exceedingly light in themselves and so open in texture that a large quantity of sand can be easily added without making any appreciable difference in their appearance; in fact, the quantity of sand required to double the weight of a sponge is so small that its presence in the sponge might almost seem to be a natural result of the curing of sponges on the beaches. The method of preparing sponges in Florida does not, however, require that any appreciable amount of sand should be left in them, and the handling to which sponges are subjected after removal from the beaches precludes their containing much sand unless it has been put there for unfair purposes. The sanding of sponges originated in Europe, and the process has only recently been introduced into this country.

The following editorial from the "Oil, Paint, and Drug Reporter," of New York, for April 21, 1880, gives a graphic description of these evils:

"Reports come to us from sources which we deem authentic beyond question that within the past week or ten days there have been shipments from Cedar Keys to Key West, Florida, of 25 barrels of quick-sand for the use of packers of sponges, one or two of whom are working with closed doors. To affirm from these reports that the packers in question were sanding their sponges would not perhaps be justifiable, yet the rest of the trade are disposed to regard that as a fact, and the reports certainly admit of that construction. The sponge business is in a position to be put upon a fair square footing, more readily than any other branch of trade we know of. The number of houses engaged in the trade is not large, and they have the means of readily forming a combination for the purpose of establishing uniform and honest methods in their business instead of retaining the contradictory, misleading, and senseless practices which now prevail,

and having themselves exposed to the dishonest ones which may so easily creep in. It is in connection with the Florida sponge trade that the most serious evils exist, and these above all others could be most handily remedied. The selling of sponges by weight, without reference to their size, is a practice which, while it cannot be deemed in any respect fraudulent, is most unsatisfactory to the purchaser, and fails to discriminate fairly between good, sizable sponges and the smaller and less valuable ones. A change could easily be made which would make the price depend more upon the actual value of the sponge, and this would have the effect not only of giving buyers what they wanted, but of checking the shipments of undersized sponges—an evil to which we have hitherto alluded in these columns, as being likely to exhaust the fisheries in time.

"The bleaching of sponges is more of a fraud upon the consumers. Doubtless this process is honestly carried on by some packers, but it is oftener taken advantage of as the means of weighting the sponges by leaving in them a greater or less percentage of the lime employed as a bleaching agent. Throughout this process the inexperienced consumer is easily duped. A bleached sponge has the appearance of being superior to an unbleached one, and might be purchased in preference, though its absolute inferiority becomes at once apparent upon use. The sanding of sponges is a clear and unmitigated fraud. It is a cheat upon the purchaser and its practice casts a stigma upon the entire trade, and will sooner or later bring into disrepute the very excellent Florida sheepswool sponge to which it is now chiefly applied. We caution the buyers of sponges to guard well against purchasing any packing which is not guaranteed to be entirely free from sand or lime or any extraneous matter. There is a disposition among the majority of the sponge houses, we believe, to root out the existing evils in their trade and especially those which are absolutely fraudulent. This they can readily do, and they will have no alternative if buyers will insist upon such a guarantee as we have suggested."

Other fraudulent practices charged upon the dishonest sponge trade are the substitution of Bahama, Mexican, or Cuban grades of sheepswool sponges for the Florida, which latter bring from one-third to one-half more in price than the same kinds of sponges grown in other American waters. Recently large numbers of small and inferior sheepswool sponges have been packed in the interior of bales made up on the outside of the better grades. This has resulted, as before described, from the falling off in the catch of large sponges, and the taking of all sizes by the fishermen. The inferior grades of sponges are not subject to fraudulent practices, the supply being much greater than the demand, and the prices low.