

contents, were preserved in alcohol. Twelve of these stomachs were of about the same size, and contained on an average $5\frac{1}{2}$ drams of food; one was considerably larger, and contained 8 drams of food. The species composing the food varied in their relative abundance in the different stomachs, but in all cases the bulk of the contents consisted of copepods, and in some this group of crustaceans formed nearly the entire mass. *Pleuromma*, sp., was apparently the most common of the copepods, with *Oalanus*, sp., very abundant; *Candace pectinata* rare to common, and *Centropages typicus* rare. *Themisto bispinosa* was rare to common, and always conspicuous from its color; Macruran larvæ and young Schizopods occurred sparingly; *Sagitta* and *Spirialis*, sp., were abundant. Nematode parasites were common in nearly all the stomachs.

56.—NOTES ON CERTAIN FISHERY INDUSTRIES OF EASTPORT, MAINE, IN 1886.

By R. EDWARD EARLL.

I.—THE WINTER HERRING FISHERY AND THE FROZEN-HERRING TRADE.

The frozen-herring trade of the United States originated with Gloucester fishermen, who brought the first cargoes from Newfoundland in the winter of 1854-'55, and found a ready sale for them at Gloucester and Boston. Others soon engaged in the business, and within a few years quite a number of vessels were employed regularly in bringing frozen fish from Newfoundland to the New England markets.

The hardships encountered in the long and dangerous passage to and from the island during the winter months deterred many who would gladly have engaged in the business from visiting Newfoundland, and these began to look for localities nearer home from which they could purchase their fish. The abundance of herring at Eastport soon attracted the attention of this class, and about 1866 vessels in this trade began to come to this locality, which from its position warranted the using of smaller craft, and from its nearness to the market enabled them to make a much larger number of trips during the season. The greater competition, however, soon advanced the cost of fish so that the profits of the winter's work were usually no greater, if indeed as great, as if the vessels went to Newfoundland. The trade at Eastport has, however, gradually increased, and for the last ten years has had a very decided influence upon the prosperity of the fishermen on either side of the line separating Canada and the United States. The trade has varied considerably from year to year, owing to the mildness or severity of the winter, which has a decided influence upon the industry, a cold winter rendering it prosperous, while frequent thaws often result in serious loss to all concerned, and, owing to the risks incurred, cause buyers to re-

duce the price of the fish to so low a figure that fishermen are reluctant to catch them. The winter of 1885-'86 was, owing to its fluctuating temperature, a disastrous one, and buyers at Eastport as well as dealers in the larger markets, almost without exception, lost money in the business. Another element which has for the past few years seriously interfered with the demand for frozen herring is the practice adopted by dealers on the Great Lakes and elsewhere of artificially freezing any surplus of lake herring and other species taken in summer, and retaining them until cold weather sets in, when the refrigerators are opened and the fish are placed upon the market. Still another influence which has worked as disastrously as the one already mentioned is the development of large winter fisheries through the ice in the inland lakes of Manitoba, immense quantities of frozen fish being shipped from that region to the western markets, thus overstocking them and reducing the price of fish of all kinds. The winter fishery about Eastport, however, continues to be a very important one, furnishing employment to many men and to a large number of vessels and boats.

A law forbidding the capture of herring on their spawning grounds at the southern head of Grand Manan earlier than October 15 prevents fishing prior to that date, but as soon as the limitations are over a fleet of twenty to twenty-five vessels, mostly from that island and the New Brunswick shore in the vicinity of Eastport, with an equal number from St. John, visit the locality and engage in the fishery, gradually working to the northern end of the island as the season advances and the stormy weather sets in; these being joined by the local fishermen living at the northern end of the island, who set their nets from open boats within a short distance of the shore in the vicinity of their own homes. The principal fishing-grounds at this time however, are between Deer Island and Point Lepreaux, about 30 miles farther east, and in St. Andrew's Bay. The last-named place has less important fisheries than formerly; but the other grounds above mentioned are still the center of the fishery during the winter months. The vessels employed in the capture of the fish are for the most part of an inferior grade and of small size, fully 80 per cent being under 20 tons burden and the largest only 60 tons, while a vessel of over 40 tons is seldom employed. In addition to the vessels, a few of the fishermen living along the shores engage in the fishery from smaller craft and from open boats. The smallest vessels carry only two or three men, while the largest and best equipped may have a crew of ten. These are provided with small net-boats and an average of two nets to the man.

They proceed to the fishing-grounds and anchor in a convenient harbor, using the vessel as a home and workshop and as a storage place for the fish until they can be sold. The season in this locality begins about the 1st of December, and the Grand Manan fleet, which has been employed from the middle of October to November 15, having mended their nets and made preparations, join the fleet in fishing in this vicinity.

The vessels remain at anchor in the harbors, and the boats with the nets aboard are rowed out a few rods from the shore where the nets are sunk from 2 to 10 fathoms below the surface, according to the depth at which the herring are swimming. They are set with, rather than across, the tide, and if the current is strong they are placed singly, but if in comparatively still water two are usually fastened together and set as one. These are placed in the water late in the afternoon, and at the first gray of morning the fishermen start out to haul them. If herring are sufficiently plenty to warrant them in resetting their nets in the same place, they are underrun, the fish being removed and the nets again returned to the water to remain until the next morning, while the fishermen return to the vessel with the catch, or, if the weather will admit, at once spread the fish out upon the shore to be frozen. If, however, the herring are not found sufficiently abundant to satisfy the fishermen, the nets, with the herring still clinging to them, are drawn into the boat, after which they return to the vessel, which gets under way and proceeds to some other locality where it is hoped the fish will prove to be more abundant, the nets being overhauled while on the way and put in readiness for resetting in the afternoon.

The nets used are about 25 to 30 fathoms long, 3 to 4 fathoms deep, and average about $2\frac{1}{4}$ inches stretch mesh. Nets of good material and properly rigged cost about \$20 each. A vessel when properly equipped has two nets to the man, but many of the poorer ones carry an average of only one.

Early in the season, and at other times when the weather is warm, considerable difficulty is experienced in properly freezing the fish, but every opportunity is utilized, and if there is any indication that it will be cold during the night the fish are spread out thin upon the grass or gravel of the shore or upon some convenient wharf. The fishermen visit them frequently at night to stir them, so as to allow those underneath to be exposed and frozen. This is ordinarily done, when they are spread thickly, by kicking or moving them about with the feet, but if the weather is not very cold they are spread so lightly that it is not necessary to stir them.

As the first frozen herring brought to market usually bring a much higher figure than those brought later, an effort is made to utilize the first frosts for this purpose, and usually small lots are obtained by men fishing off the northern end of Grand Manan shortly after the middle of November. During the warmer weather of midwinter the fish are often kept in the hold of the vessel for two or three days until a suitable time for freezing arrives.

The fishermen usually carry their fish to Eastport for a market, but this is not always necessary, as quite a fleet of vessels are employed in moving about among them to purchase any quantity that they may have on hand. Some sell their catch daily, while others freeze their fish and

place them in the hold, retaining them for a number of days, so that the catch of a week or more is marketed at the same time.

The fishing continues until early in March, when the buyers are reluctant to purchase any considerable quantity owing to the uncertainty of the weather, which, if it should chance to be warm, might result in the loss of the entire shipment; but as the fish are plenty, the fishermen continue the fishing for from six to eight weeks, selling their catch to be smoked as hard herring or bloaters, or to be salted in barrels. The best fishing occurs during the mildest weather, for at this time the fish play closer inshore, and the nets can be more easily manipulated. During the coldest weather the fish go out into deeper water, and the fishermen are obliged to go farther for them. It is also claimed that strong winds from the north and northwest blows the food of the herring away from the shore, and the herring, which naturally follow it, must therefore be caught at a greater distance. The height of the fishing usually occurs in January, and more fish are perhaps caught during the January thaws than at any other period. The fish are sometimes so abundant that the nets become too heavily weighted with them to stand the strain, and are thus torn to pieces or carried to the bottom, where the fishermen are unable to secure them, and they thus prove a total loss. At such times the fishermen often visit their nets several times during the night to prevent their being overloaded, and enormous catches are frequently made.

Fishermen meeting with exceptional luck have been known to share \$50 a day for several consecutive days, but the crew that shares \$500 to the man between December 1 and the middle of March is considered to have had excellent success. The average will probably fall below \$300, and there are usually some fishermen who do not earn enough to pay for their gear and living expenses while engaged in the fishery.

In addition to the vessels employed in fishing, quite a number of larger vessels from Gloucester and other New England fishing ports are sent to the locality to be loaded with herring, which they carry to market. These remain at Eastport, and the fish brought in by the fishermen and collecting boats are stowed away loose in their holds until they are completely filled, when the hatches are put on and they start for the market.

The desire to get the herring to market as quickly as possible has led to quite a shipping trade by the regular steamers which ply between St. John and Boston. Fish intended to be shipped in this way are packed in barrels, and the steamers frequently carry upwards of a thousand barrels on a single trip. The average charges for transportation by steamer to Boston are from 20 to 30 cents a barrel, and to New York it usually costs about twice that amount; but by sailing vessels the charges average only about 12 cents to Boston and Gloucester, with 3 or 4 cents additional to New York.

During the season of 1885-'86 it is estimated that there were be-

tween one hundred and twenty-five and one hundred and fifty vessels engaged in the vicinity of Eastport in the capture of herring to supply the frozen-herring trade. The majority of these were owned by Canadian fishermen at Grand Manan, Deer Island, and the various fishing towns on the Bay of Fundy between the boundary line and St. John. Only thirty or forty vessels belonging to the United States were employed in fishing, though the carrying trade was practically controlled by New England vessels. During this season it is estimated by Mr. R. C. Green, a gentleman thoroughly familiar with the industry, that about 3,500,000 herring were shipped in barrels by steamer, and that between forty-five and fifty cargoes, averaging 300,000 fish each, were sent by vessel. The price paid during the winter varied considerably according to supply and demand. At one time it reached 90 cents per hundred fish, but during seasons of abundance the fishermen found difficulty in disposing of their catch at more than 20 or 25 cents. The average price is estimated at about 40 cents. From this estimate it will be seen that about 18,000,000 herring were shipped during the winter, these netting the fishermen about \$72,000. A trifle more than half of the entire catch is sent to Boston, from which point the frozen fish are distributed to the retail trade of the North and West. At least one-half of the remainder go to New York and adjacent cities, where they are purchased by the local dealers and by peddlers. The remaining shipments are divided between Gloucester and Portland, a majority of those sent to Gloucester being purchased by the vessel fishermen of that port to be used as bait in the winter cod, haddock, and halibut fisheries.

With the growth of the industry a disposition has been manifested on the part of the principal dealers of the larger cities to combine to control the trade, and combinations have been frequently formed by which it was hoped to obtain a monopoly of the business. Last year a herring company, in which the leading dealers of New York, Boston, and Gloucester were represented, was formed, and agents appointed to proceed to Eastport to purchase and ship the fish, while others were designated to receive and distribute them on their arrival in market. This company was practically successful in controlling the trade, and fully three-quarters of all the herring were handled by them, though owing to the changeable weather and the abundance of frozen lake herring, white-fish, and other species in the Western markets the business was not a success financially.

As the herring are intended for immediate consumption, our tariff laws admit them free of duty, even though they may be landed in Canadian bottoms. This allows the fish to be brought to Eastport by the Canadian fishermen engaged in catching them, and hence the complications resulting from the termination of the treaty of Washington do not seriously affect this fishery. The determination on the part of the Canadian government to prevent any Americans from fishing within 3 miles of its coast will, however, deter the small vessels from the

United States that have heretofore been employed in catching herring from continuing the business, but as the fleet has been small and the number of American fishermen employed quite limited, the result will not be of serious consequence. American vessels will still retain to a large extent the carrying trade, which is really of greater importance. If, on the other hand, our Government should see fit to impose a duty on the frozen fish caught by Canadians, it would result in great loss to the fishermen of Canada and would prove a hardship which they are not prepared to endure, for the fishermen of this locality are absolutely dependent upon this fishery during the winter months and a very large percentage of their entire income is derived from this source.

II.—THE PICKLED-HERRING TRADE.

The termination of the treaty of Washington and the consequent revival of duties on all kinds of prepared fish has had a very beneficial effect upon the pickled-herring trade of Eastport. As already stated, a large number of men are employed during the winter months in netting herring, which are spread out upon the shore to be frozen, and sold to be shipped in that condition to the principal New England markets; but during prolonged thaws in winter, and after the weather has moderated in spring to such an extent that the fish can not be thoroughly frozen, these continue fishing for herring, and very gladly dispose of their catch to vessels from Eastport that visit the different fishing centers in New Brunswick and purchase the fish fresh to be carried to Eastport, where they are salted and packed in barrels. The Canadian fishermen in this way find a market for their fish at a fair figure, when, if they were obliged to retain and salt them, the United States markets would be practically closed against them, as the duty would be such as to bar them out, for at present prices so small a margin would be left on salt herring and other low-priced fishes, after the duty was deducted, that the fishing would be unremunerative.

The duty, while seriously interfering with the work of the Canadian fishermen, is, on the other hand, very beneficial to the Americans, who buy the fish fresh and bring them to the United States, thus furnishing employment not only for their vessels, but also to American labor in salting and packing them, while the duty, which serves as a barrier to keep out the foreign-packed fish, advances the price to such a figure that those engaged in the business realize a very fair profit from it.

The principal supply of herring for pickling is obtained, as already stated, after the frozen-herring trade has closed in spring, while additional quantities are obtained in the fall from the vessels engaged in netting herring off Grand Manan before the weather has become cold enough to admit of freezing the fish, though a very large percentage of the herring caught at this time are prepared as bloaters.

During the year 1886 between 5,000 and 6,000 barrels of herring were pickled by the fishermen and dealers of Eastport and vicinity.

III.—THE PREPARATION OF BLOATER HERRING.

While the smoking of hard herring is very extensive, the bloater-herring business is important. Prior to the termination of the treaty of Washington, Grand Manan, Campobello Island, and other British islands in the vicinity put up considerable quantities of bloaters, which were shipped direct to Boston and New York; but the duty of half a cent per pound or 15 to 18 cents per box is so great, that they can no longer successfully compete with Americans, even though the price of material and labor is considerably cheaper. The principal supply of bloater herring is obtained between the middle of October and the last of November by the fleet of small vessels fishing off Grand Manan. The fish are taken in nets and lightly salted in the vessel's hold until such time as the American vessels that have been sent out to purchase them arrive. They are then transferred to these vessels and carried to Eastport, where they are soaked out, strung, and lightly smoked. They are next packed in boxes of 100 fish each, and shipped to Portland and Boston and other leading cities. Formerly the trade was almost exclusively with Portland, and the fish ultimately found their way to the Canadian markets; but of late increasing proportions are being shipped to the West, and Chicago now receives and distributes a large percentage of the products.

IV.—THE SMOKING OF FINNEN HADDIES.

Eastport was formerly more extensively employed in the preparation of finnen haddies than any other city in the United States except Portland. The trade was at its height between 1875 and 1882, when it gradually began to decline. During the years when the operations were most extensive large quantities of haddies were smoked, nearly all of them going to Portland, from which place they were distributed to the New England retail trade and to Canada; but the development of the sardine interests at Eastport have furnished employment to the American fishermen formerly engaged in catching the haddock, and these have found it desirable to remain on shore. It is also claimed that haddock are less abundant than formerly upon the grounds heretofore visited by the fishermen, who think the fish are now frequenting other localities.

Formerly large quantities were taken in St. Andrew's Bay, but now it is said that scarcely a dozen haddock could be obtained as the result of a day's fishing. The principal fishing-ground of recent years for Eastport fishermen has, however, been in the mouth of the Bay of Fundy to the eastward of Grand Manan, and in the vicinity of the Wolves. Here, too, it is claimed that the haddock have decreased considerably in abundance; but, while this may be true, the fact that those formerly engaged in catching them find employment in the sardine factories and in catching or handling the frozen herring, has probably had a more marked influence upon the haddock fisheries than any decrease

in the abundance of fish; for both the sardine and frozen-herring industries have assumed important proportions, and men find remunerative employment in connection with them, thus avoiding the exposures, dangers, and hardships to which they were formerly subjected when fishing for haddock. At present only two firms engage at all in smoking haddock; one of these preparing only sufficient quantities to supply the local trade, while the other smokes small quantities for shipment to Portland. Those best informed estimate that less than 25 tons of haddock were smoked at Eastport during the season of 1885-'86, the few sent out of the city being consigned to Portland dealers.

57.—THE AQUARIUM. A BRIEF EXPOSITION OF ITS PRINCIPLES AND MANAGEMENT.

By WILLIAM P. SEAL.

The history of the discovery and application of the principles of the aquarium is so well known that it is not worth while to repeat it here. Many books have been written upon the subject, all of them in a spirit of glowing enthusiasm, but generally lacking information upon the most essential points, and often grossly misleading as to elementary principles.

A well-managed aquarium requires but little attention, and is a delight to all lovers of nature. It is a living ever-changing picture. On the other hand, under improper conditions an aquarium is a trouble, and is not calculated to give pleasure to the refined and cultivated. Certain conditions are absolutely essential to the successful working of the aquarium. The most important of these is absolute purity in the tank or vessel used, and an abundance of light. When these primary conditions are not obtainable, discouragement and eventual failure are certain. The dealer in aquaria, in his eagerness to make a sale, may advise differently. There is probably no business which has been more abused by false statements and a withholding of the truth, or from ignorance of the subject, and none is more in need of plain truth telling to elevate it to the position it should occupy in affording a means of popular amusement and instruction.

When once properly understood the aquarium, with its varied and interesting forms of life—animal and vegetable—will become as common a feature of household adornment as are birds and flowers.

The newly-awakened general interest in biological research, or, in plainer words, the study of life, has opened up an extended field for the aquarium as the medium for observation of the habits, developments, and metamorphoses of animals and plants inhabiting the water. As an adjunct to the microscope for the amateur or for the specialist, it is an absolute necessity. For the young as a means of encouraging habits of observation and feelings of humanity, as something to give a sense