

XLII.—THE RESULTS OF THE LONDON FISHERIES EXHIBITION IN THEIR PRACTICAL VALUE FOR GERMANY.*

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In consequence of the successful Fishery Exposition arranged four years ago in Berlin by the German Fishery Association, public interest in this subject began to be awakened also in England, which had not been well represented at the Berlin Exposition. After small exhibitions had been held in Norwich in 1881, and in Edinburgh in 1882, a most imposing International Fisheries Exhibition was, in May, 1883, opened in London by His Royal Highness the Prince of Wales. This exhibition formed the principal object of interest to visitors to London for half a year, was visited by 2,500,000 persons, produced a perfect flood of ichthyological literature, and directed the attention of the great public in the most energetic manner to the importance of the fishing industries.

Acknowledging that in the sea-fisheries, to which the London Exhibition was principally devoted, we could in no wise compete with other nations, Germany was not represented by an exhibit; but by the aid of the ministry of agriculture the German Fishery Association was enabled to send a number of reporters to London, in order to study the exhibition and examine what might be of practical value for Germany.

THE SEA-FISHERIES.—The principal point of attraction, and the subject best represented, was, of course, the great sea-fisheries, an industry yielding in the United States an annual income of 450,000,000 marks [\$107,100,000], in England of 240,000,000 marks [\$57,120,000], in France 80,000,000 [\$19,040,000], and in Norway 25,000,000 [\$5,950,000]. Unfortunately the results of our German sea-fisheries are very insignificant when compared with these figures, although a sea rich in fish—the North Sea—washes a long stretch of our coast, and although we are not much farther from the rich fishing-grounds than most other nations (and even nearer than some) which annually catch there several million marks' worth of fish.

THE BEAM-TRAWL.—The most important fishing apparatus for flat-fish and round-fish, which furnishes the greater portion of the 140,000 tons of fish annually consumed in London, is the beam-trawl, a net which

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was introduced in England only about sixty years ago, and which, though in a smaller form, has been in use on the German North Sea coast for a long time and is known by the name of "*kurre*." The trawl-net, a funnel-shaped bag, measuring 100 feet in length, and having an opening of from 30 to 50 feet, is fastened to a beam resting on runners, and being heavily weighted is dragged along the bottom of the sea by a sailing vessel or steamer. Thirty years ago Grimsby had only one trawl-net, while now it has from 600 to 700, which are taken to sea in much larger vessels than formerly, having a crew of 6 or 7 men each. In 1845 Hull had 21 fishing vessels, of 570 tons, valued at 128,500 marks [\$30,583], while in 1883 there were engaged in the trawl-fisheries 417 vessels, of 29,233 tons, with 9 steamers and ice-vessels, valued at 11,000,000 marks [\$2,618,000]. In all England there are at present engaged in these fisheries 3,000 sailing vessels and steamers. The capital invested in this industry is 300,000,000 marks [\$71,400,000], and the annual income therefrom is upwards of 70,000,000 marks [\$16,660,000]. The total crews of this vast fishing-fleet number from 15,000 to 20,000 men, and as many are employed on shore in preparing, packing, and shipping fish.

DECREASE OF THE FISHERIES.—For flat-fish and cod, at a considerable depth, up to 100 meters [55 fathoms], the trawl-net is well suited, but undoubtedly does great damage near the coast by destroying enormous masses of young flat-fish which are not yet fit for use. The trawl-fishers themselves grant that frequently as many tons of crushed young fry are thrown overboard as are caught for the market. Hundreds of thousands of hundredweights of young flat-fish are annually used as manure, and people may say what they please about the inexhaustibility of the sea, yet it is an undeniable fact that, as in the Baltic since the introduction of the "*zeese*" [a net resembling the trawl net], the size of flounders has decreased to an alarming degree, so in the North Sea the flat-fish seem to be constantly growing smaller as the number of trawl-nets increases; that many places where generally large quantities of flat-fish were caught are hardly visited any more by these fish; and that, although there is a considerable increase in the number of fish brought into the market, this increase does not bear the due proportion to the increase of the fishing industries. There is, consequently, a tendency in England to limit the use of the trawl-net near the coast, and various experiments have been made to diminish the hurtfulness of this net. Among these attempts we must mention the one made by De Caux, and exhibited at Berlin in 1880, which consisted of replacing the trawl-heads by wheels, and stringing large wooden balls on the bottom rope so as to prevent it from cutting too deeply into the bottom, and to let it glide over places overgrown with plants without injuring the vegetation.

MESHES OF NETS.—It is a serious drawback that the meshes of the trawl-net, which, at the back part of the net, are generally 4 centimeters

[1½ inches] wide, are drawn out into a long and narrow shape when the net is in use, so that—especially if some sea-weeds or mud get into the net—they will not let even the smallest fish pass through. Mr. Schreiber, of Lowestoft, has attempted to remedy this by sewing into the meshes of the net a number of large metal rings to form holes, which are constantly open, and through which the young fry may escape. Still better is an invention made by De Caux and Read, by which the meshes at the back part of the net are made wider, and in addition it is sometimes spread over hoops, so that all the meshes are kept open while the net is in use. Thus, the sand or mud which has entered the net is constantly washed out by the current, a way of escape is opened for the young fry, and the hauling of the net is greatly facilitated. Trawls of this kind are, therefore, urgently recommended, and it should be taken into serious consideration whether the same change could not be made in our "*kurren*," "*keittel*," and "*zeesen*."

THE SEINE FISHERIES.—These are nothing like so extensive in England as the trawl fisheries, but nevertheless they yield a considerable quantity of fish, especially herring and mackerel. In Scotland there were engaged in these fisheries, in 1880, 70,000 persons and 15,000 boats, and in 1881 the Scotch herring fisheries alone yielded 200,000 tons, valued at 44,000,000 marks [\$10,472,000]. The seine fisheries have been considerably improved by the introduction of machine-made cotton nets, which are lighter, cheaper, and more durable than nets made of hemp or flax. A vessel which would formerly take out 950 meters [about 1,040 yards] of netting of a depth of 6 or 7 meters now takes 3,300 meters [about 3,609 yards] with a depth of 10 meters [about 32½ feet], which do not weigh any more than the 950 meters; and such a vessel has a total net area of 33,000, instead of 6,000 square meters, as formerly. In 1879 Germany imported from Scotland, Norway, and Holland in all 1,274,146 barrels of herring, valued at nearly 32,000,000 marks [\$7,616,000]—herring which were caught in the North Sea, and which might just as well have been caught by German fishermen. Of the 745,000 barrels of herring exported from Scotland in 1881, Germany bought no less than 632,000 barrels.

SCOTCH FISHERIES.—It is true that the conditions are not so favorable for German high-sea fisheries as they are in Scotland, where, owing to the short distance between the fishing-grounds and the coast, small boats can be used in the fisheries; but then we are as favorably situated in this respect as the Netherlands, and German fishing-vessels could go to the places where herring are principally caught, just as well as English and Scotch trawlers can fish all the way from Texel to Heligoland and Harnsreef.

If the attempts at herring-fisheries, made from Emden again and again for nearly three centuries, have not led to any satisfactory results, in spite of considerable subsidies from the Government, the reason therefor must probably be found in the circumstance that these fisheries have

been conducted on too small a scale. If our sea-fisheries are to compete successfully with the enormous fisheries of other countries great capitalists should interest themselves in the matter. Considering the expensive material, favorable results will never be obtained with little capital. A herring-lugger of 100 tons costs 29,000 marks [\$6,902], the outfit for trawling 7,000 marks [\$1,666], and the two sets of nets which are required 10,000 marks [\$2,380]. With a small capital, and the small number of ten or twelve vessels, the loss of a single lugger, or poor fisheries, which are more likely to occur with a small fleet of fishing-vessels than with a large one, which can go over a much larger area, may have the most serious consequences. English fishery associations and some private individuals therefore work with entirely different means. During my stay in London Mr. Burdett-Coutts equipped a fleet of from 60 to 70 large vessels, which were accompanied by 3 or 4 steamers to convey the fish quickly to the markets and supply the fishermen with food, ice, &c. According to the data contained in a very interesting treatise by His Royal Highness the Duke of Edinburgh, on the English sea-fisheries, one of the largest fish-dealers owns about 200 large vessels, of which from 140 to 150 are constantly employed, and are accompanied by 5 or 6 steamers, furnishing in 1881 for the London market 15,000 tons of fish, valued at 5,500,000 marks [\$1,309,000]. Whenever great capitalists in Germany will invest their capital in the sea-fisheries, as they have done in the great steamship lines, we may hope to reap a rich harvest in the North Sea, to give good employment to thousands of persons, and educate a large number of experienced sailors, a circumstance the importance of which cannot be undervalued in view of the fact that sailing vessels are constantly being thrown more and more into the background by steamers.

For improving our sea-fisheries, however, it would not be sufficient to find the means for equipping a large fishing-fleet; we would also need ports accessible at all times, and as near as possible to the fishing-grounds. As the construction of harbors is very expensive, a project by Greenway Thomas, exhibited at the London Exhibition, for constructing cheap harbors in any place, even in the middle of the sea, deserves to be carefully examined.

A FLOATING WAVE-BREAKER.—In this project for fishing-ports, which are to serve merely as temporary places for anchoring and as places of refuge, Greenway Thomas starts from the well-known fact that the water of the sea is violently agitated only near the surface, while at a depth of 5 meters [16.4 feet] the water is comparatively calm. His floating wave-breakers, hollow triangular prisms, made of pieces of sheet iron soldered together firmly, therefore draw only from 3 to 5 meters of water; their breadth is 10 meters, and the two sides exposed to the waves are slightly concave. These wave-breakers are anchored at intervals of 10 meters. If the waves roll against a row of such apparatus, each one of them does not have to sustain the full pressure of the water like a firm mole,

but it splits the waves like the prow of a vessel, and the concave sides lead one portion of the waves to the right and another to the left. As the same takes place at every one of these apparatus the waters from the right side of the one and from the left side of the other are drawn toward each other, mutually break their force, and at the same time prevent from going any farther that part of the wave which rolls against the space between two prisms, thus producing calm water back of the apparatus. While in other harbors a mole costs £1,000,000 sterling per mile, Greenway Thomas calculates that a mile of his wave-breakers would only cost from £10,000 to £30,000 [\$50,000 to \$150,000]. It would not be difficult to construct of such apparatus places of refuge near small fishing-stations, where, owing to the great expense, other harbors could never be constructed. On coasts where at certain seasons there is a good deal of moving ice, Greenway Thomas's wave-breakers might be taken up and stowed away safely before winter sets in.

FLOATING HARBORS.—In a similar manner Leeds has projected floating harbors, which, located on the principal fishing-grounds, could receive a large number of vessels and could be furnished with tanks for live fish, store-houses for nets and other apparatus, ice houses, &c. Thereby many accidents would be avoided which, as the Duke of Edinburgh remarks, occur in transporting the fish-boxes from the fishing-vessels to the steamers; and the fishermen would not be obliged to be inactive for some time, till the fish which they have caught have been taken up by the steamers, of which there is frequently not a sufficient number on hand.

ICING.—For keeping fresh fish, cold is nowhere in Europe employed in such a rational manner as in America, where fish are kept fresh for weeks and months in large storehouses which are constantly kept cool by ice-machines, thereby preventing any loss if the number of fish caught has been larger than the immediate demand, and enabling dealers to supply the markets regularly, even if at times the fisheries have not been very successful. In America common fish are frozen hard, just as in Russia, while the finer kind of fish, in order not to lose any of their delicate flavor, are only cooled off a little above the freezing point.

FREIGHT RATES.—For the transportation of fish we use cold only in a very primitive manner, by packing the fish in baskets between layers of ice. Thereby the weight is considerably increased, the freight becomes more expensive, and by the melting of the ice the fish become watery and lose their flavor. The general introduction of ice-cars, such as we have on some European railroads, would make it unnecessary to pack the fish in ice; they would keep better and the cost of freight would be diminished. The wholesale transportation of cheap salt-water fish to the interior of Germany has thus far been made almost impossible by the high rates of freight on the railroads. That it is possible to transport fish at much cheaper rates, we see in America,

where ordinary and express trains carry enormous quantities of fish and other products of the sea in suitable ice-cars for enormous distances, and bring these wholesome and cheap articles of food within the reach of the masses in the interior of the country. It is not to be supposed that the American railroad companies transport fish at a loss to themselves merely to please the great public; and if such a thing is possible in America, it can certainly be also done in Europe. Complaint is also made in England, where thousands of tons of fish are regularly shipped by railroad, that the freight rates are exorbitant, the Great Western Railroad, for instance, charging eight times as much freight for fish as for coal, while other English railroads charge at least three times as much for sprats and herring as for coal. Fine fish, such as salmon, sole, &c., which are eaten only by the wealthier classes, can stand a high freight-rate, which is not the case with the more common fish which are to serve as food for the masses. If, as is frequently the case, the freight charges exceed the value of the fish, the inland towns will have to do without fish, while on the coast, after the local demand has been satisfied, enormous masses of fish are either not caught at all, or, if caught, are used only as manure.

PRESERVED FISH.—The manufacture in Germany of preserved fish, by which its original cost is greatly increased, leaves much to be desired. There was in London a very full exhibit of fish preserved in various ways. The progress in this direction made in some coast-towns of Schleswig-Holstein and Pomerania, especially in the matter of smoking and pickling fish, should be an encouragement to our entire coast population; and we would urge our manufacturers to make a careful study of the many different articles in this line prepared in foreign countries, so as enable them to offer a greater variety to our German public. In all these factories special attention should be given to a rational use of all the refuse for oil, glue, and guano, whereby not only the running expenses are covered, but which also frequently yields a considerable surplus.

DANGERS TO FISHERMEN.—Mechanicians emulate each other in the most commendable manner in protecting fishermen against the many dangers which threaten them in their difficult calling. Thus, a large number of machines for hauling in nets was exhibited, which, worked by hand or by steam, easily and rapidly do a work which was otherwise both laborious and dangerous. These machines are in general use in England, and will undoubtedly meet with universal approval among those of our fishermen who have to handle large nets.

Regard for the easy handling of the nets requires that the fishing vessels should have as low a railing as possible, which cannot afford shelter to the men who are employed on the deck, so that in a rough sea they often have to move on their knees and elbows, in spite of which men are frequently washed overboard. Even in calm weather, if the deck should be covered with ice, the mere slipping of a foot may cause

the loss of a man, and but too often one such loss brings about the loss of the whole vessel, which in stormy weather can no longer be managed by the diminished crew. To prevent such accidents, Mr. Gunn, of Galspie, has invented an apparatus which, in spite of the proverbial carelessness of fishermen, has been favorably received by them and has met with the approval of competent judges. It consists of a movable railing, made of strong iron bars, which can be put up or taken down with one move, and which forms an excellent protection for the crew. This apparatus, which can easily be put up on any open or covered vessel and is not at all in the way, costs for a large fishing cutter measuring 50 feet in length and costing 30,000 marks [\$7,140] only 200 marks [\$47.60], and cannot be too strongly recommended to fishermen.

CORK-COAL.—Of special importance to fishermen I consider a preparation exhibited by De la Sala, of Seville, in the Spanish department of the exhibition, viz., cork-coal. The specific weight of this mass is much less than that of cork. This material, which is particularly recommended for safety-belts, is especially suited to take the place of the inconvenient and expensive cork-jackets, which are very much disliked by the fishermen, and to furnish them with convenient and warm clothes which do not hinder them in their work, which can therefore be worn at all times, and will prevent a person from sinking. For preparing cork-coal any cheap refuse of corks can be used, which after having been turned to coal can easily be pulverized and put in the lining of clothes. Some experiments which I made show that cork-coal in water can bear 10 to 12 times its weight, almost three times as much as the same weight of cork, and does not absorb near so much water. As a stout man with thick clothing when in the water weighs only 6 or 7 pounds, from 300 to 400 grams [about 13 oz.] of cork-coal inserted in the lining of his jacket or vest are sufficient to keep him afloat. I have had a number of such clothes made and distributed them among fishermen for the purpose of having them tried.

LOOSENING FROM THE DAVITS.—In stormy weather great difficulty is frequently experienced in getting the boats loosened from the davits in time, and especially in getting them off both hooks at the same instant. If this is not done quickly, the waves may throw the boat against the side of the vessel and dash it to pieces, and if a hook is loosened prematurely, the boat hanging to the other hook may in a stormy sea easily assume a vertical position and throw the men out. Among the many contrivances aiming at an easy and simultaneous loosening of the connections, that exhibited by Sample & Ward seems the most suitable, because based simply on the principles of gravity and of the lever. This simple apparatus can be attached to any boat at a very trifling expense, and can be covered so completely, that there is no chance of its being damaged.

In case a vessel which can no longer be managed properly is to be turned head against the waves, and is in this way to be placed in the

most favorable position, and if the common anchor cannot be cast either because the water is too deep or for some other reason, so-called floating anchors are frequently employed, which, quickly put together from pieces of wood-work and sail-cloth and attached to a rope, and being thrown overboard, drift more slowly than the vessel, and therefore bring it into the desired position. A simple and cheap anchor of this kind, which when folded together takes up but very little room and is therefore well adapted to fishing-boats, and is always ready for use, was exhibited by Bullivant.

OILING THE WAVES.—Even ancient writers speak of the use of oil for calming the waves of the sea; it is well known that whalers and, on a small scale some of our fishing vessels, calm the water within a wide circumference by the oil dripping from them; but not until recently has a beginning been made of putting this knowledge to more general use. The construction of pipe-lines for oil at the bottom of the Peterhead harbor, through which oil is pumped in order to make it easier for ships to enter the harbor in stormy weather, has proved very successful. Small oil apparatus carried on board vessels and boats, which, especially when the boats are to be let down, calm the waters around the vessel and which are said to protect the boats against strong waves, were exhibited by Bowman of Huntly, and the reports concerning them were exceedingly favorable. I have had some of these apparatus made and given them to some fishermen on our coast for a trial.

INSURANCE.—In England special attention is justly paid to the improvement of the social condition of the fishermen, and it was pointed out repeatedly, especially by His Royal Highness the Duke of Edinburgh, how necessary it is to urge the fishermen to insure their lives, and mutually to insure their boats and nets; which precaution unfortunately meets with but little favor among those whose sole property consists in boats and nets. In England private aid is extended on the most liberal scale in every calamity; and, as regards popularizing the insurance referred to above, some clergymen in the fishing villages have been untiring in their efforts. A work by De Caux on the insurance of fishermen was awarded a prize by the jury, and will soon appear in print. Years ago an attempt was made to start an insurance association among our Baltic fishermen, who often suffer severely from the loss of their lines and nets, but unfortunately the project was abandoned owing to the circumstance that it was very difficult to estimate the damage.

SALMON.—Of the English fresh-water fish, the salmon alone is of any economical importance. In consequence of the planting of young salmon, the construction of numerous salmon-ways, and the time when it is prohibited to catch salmon—one hundred and fifty days per annum, besides forty-eight hours every week—the salmon fisheries have everywhere increased very considerably. Thus, in a small Irish river, the Moy, which had been rendered accessible to the salmon only by the con-

struction of a pass, and which had been stocked with several hundreds of thousands of artificially hatched fish, the rent of the fisheries after a few years yielded the large sum of £27,000 sterling [about \$135,000]. On a still larger scale are the results which have been reached by the artificial hatching of salmon in America, as in the Sacramento River, where, according to Prof. Spencer F. Baird, the yield was annually increased by 5,000,000 pounds, and where more salmon are caught than can be used by the numerous factories for preparing fish. In Germany, likewise, the young salmon which have been planted here and there, though on a very modest scale, have proved a decided success, making it exceedingly desirable to pursue energetically this path, which has been recognized as the right one for increasing the number of these fish.

SUMMER SPAWNERS.—For feeding the masses, however, the fish which spawn in summer, and which are found in our numerous rivers and lakes, are, for Germany, of far greater importance than the salmonoids. Their propagation is easier, can be accomplished without any special apparatus, and is even now very successfully carried on in many places in Germany. I was much interested, when in London, to learn from reports from distant countries that, contrary to the opinions that the increase of fish which spawn in summer is a mere useless play, the fishermen are not in the least to blame as regards the decrease of fish in our inland waters, but that this is caused simply by river improvements and the pollution of the water; yet in localities where river improvements and the pollution of the water are unknown the number of fish has been noticeably decreased simply by too exhaustive fishing. In Canada, for example, lakes 400 to 500 miles long have been depleted of fish from this cause, and in the Volga the size of the various kinds of sturgeon has decreased for the same reason; so that the weight of the roe, which, comparatively speaking, is much greater in large than in small fish, and which twenty years ago was one nineteenth of the total weight of the body, has decreased steadily, until it is now only one forty-fourth. Facts like these ought to cause serious thoughts, even with those people from whom we are accustomed to hear again and again that, compared to the destruction of fry and fish by natural enemies, the violence of man is without any noticeable influence as regards the number of fish; the same people, strange to say, complain in one and the same breath, that if the fisheries are limited the number of fish will become too great, and that consequently the individual fish can no longer reach their proper size. In making such assertions people have hardly thought of the last conclusions to be drawn therefrom, viz., that in the inclosed waters of thinly populated districts all fish must become dwarfed.

POLLUTIONS.—The hurtful influence of river improvements and the pollution of water by factories, &c., can, of course, not be denied, and everywhere efforts are made to keep the waters pure without interfering with the manufacturing interests. At the London Exhibition the Na-

tive Guano Company exhibited a working model of their so-called A B C process for cleaning filthy water, by which astonishing results are obtained, and which deserves the fullest examination.

DEEP-SEA RESEARCH.—In all the speeches and treatises called forth by the exhibition, constant stress is laid on the circumstance that for promoting the fisheries, and especially as a basis for legislation, there is needed an intimate knowledge of the waters, the nature of the bottom, depth, vegetation, and fauna, and on the other hand an exhaustive study of the biological conditions of fish, their distribution, places of sojourn, migrations, food, and propagation. My deceased teacher and friend, Prof. August Müller, deserves special credit for having, as early as 1858, in a paper read at a meeting of the Berlin Acclimatization Society, pointed out the absolute necessity for such investigations, and urged their vigorous prosecution by the Government, through the appointment of special officers, and the establishment of experimental stations. The correctness of his views has since been generally recognized. In Prussia the Scientific Commission for investigating the German Seas has produced some excellent works; private individuals and fishery associations have devoted all their efforts to the solution of similar problems; and in many other countries naturalists and practical fishermen emulate with each other in their endeavors to solve many problems of the highest importance to the fisheries. Even at the Berlin Exposition we had occasion to admire the excellent Norwegian maps showing the varying temperature and depth of the Polar Sea; and in London numerous similar works had been placed on exhibition by different countries, among them one of special interest to us in Germany, the magnificent atlas of the North Sea, by Captain Olsen, which, in about fifty sheets, shows the varying depths, character of the bottom, direction and velocity of the tides, fishing-grounds, and, in a particularly clear and instructive manner, the distribution of some forty of the more important species of fish.

GERMANY SHOULD IMITATE THE UNITED STATES.—If such investigations, as to the necessity of which there is at the present time not the slightest doubt, are to be carried on successfully and rapidly, they must not be left to the occasional liberality of private individuals or associations, or be given as a mere side occupation to men whose time is otherwise employed, and who can devote thereto only a few leisure hours; but such investigations require the full and undivided labor of persons specially appointed for this purpose. If it has once been recognized that the sea and inland fisheries are of vast economical importance to Germany, and if, by careful experiments on a small scale carried on for a number of years, people have become convinced of the successful results which accompany the rational cultivation of our water area, the time has arrived to pursue the same object on a large scale. In this respect the United States Commission of Fish and Fisheries may well serve as a model. Already at the Berlin Exposition this Commission

showed that it had far outstripped all similar efforts made by other countries, and obtained the prize of honor given by His Majesty the Emperor, and in London the prize was unanimously accorded to it as being the model institution of this kind. From America we may learn that liberal appropriations for promoting the fisheries bear a rich interest.

Allow me, therefore, to conclude by expressing the hope, that as during the last decades agriculture and industry have been powerfully promoted by the wise measures of the Government, the German sea and inland fisheries may likewise flourish and reach a high degree of development, thus contributing their share towards increasing the welfare and honor of our country.