

more dramatic than another I have witnessed in an ever-green forest of the Rocky Mountain region, where a tribe was gathered under the great pines, and the temple of light from the blazing fire was walled by the darkness of midnight, and in the midst of the temple stood the wise old man, telling in simple, savage language the story of *Ta-wáts*, when he conquered the sun and established the seasons and the days. In that pre-Columbian time, before the advent of white men, all the Indian tribes of North America gathered on winter nights by the shores of the seas, where the tides beat in solemn rhythm, by the shores of the great lakes, where the waves dashed against frozen beaches, and by the banks of the rivers flowing ever in solemn mystery—each in its own temple of illumined space—and listened to the story of its own supreme gods, the ancients of time" (p. 40).

A detailed notice of the other more important papers in this volume must be reserved for a future occasion.

A. H. KEANE

THE FISHERIES EXHIBITION

WE are gratified to see the very thorough way in which the management of the Fisheries Exhibition are endeavouring to carry out their plans. It is evident that the scientific aspects of the wide and important subject will have a fair amount of attention; and we are glad to think that in this direction advice has been sought in the right quarter. In the Exhibition itself those interested in the science of the subject will find much to attract them. Last week (p. 156) we gave a list of subjects which have been settled for conferences, and among those who have consented to read papers, we find such names as Professor Huxley on Fish Diseases, Professor Ray Lankester on the Scientific Results of the Exhibition, Professor Brown Goode on the Fisheries of the United States, Professor Hubrecht on Oyster Culture and Fisheries, Sir Henry Thompson on Fish as Food, Dr. F. Day on the Food of Fishes, Mr. R. H. Scott on Storm Warnings. Further, we are glad to see that a series of handbooks has been arranged for on subjects cognate to the Exhibition. Among them are a few by men of scientific standing, and likely to be of real scientific importance; we hope it may not yet be too late to secure the preparation of a few more handbooks or reports of a similar character. Among the handbooks arranged for, six will be published this month, and the remainder in July. Those of special interest to science are, "The Life History of Fishes," by Prof. H. N. Moseley; "Fish Culture" and "Indian Fish and Fishing," by Dr. Francis Day; "Food Fishes," by Mr. G. B. Howes; "Marine and Freshwater Fishes of the British Isles," by Mr. Saville Kent; "Curious Sea Creatures," by Mr. Henry Lee.

The conferences were introduced on Monday by an interesting lecture by Prof. Huxley, a report of which we give below, and this was followed on Tuesday by a carefully prepared paper by the Duke of Edinburgh, on British Fisheries and Fishermen, read by the Prince of Wales. The real interest which the leading members of the Royal family take in the Exhibition has no doubt done much to contribute to its success. It was to be expected that the German Ambassador would show his appreciation of the importance of science to an industry of such magnitude as that of fishing, and he aptly pointed out how important was the didactic and scientific work at last commenced.

With the general concurrence of opinion in high quarters as to the value of the scientific aspects of the Exhibition, and of the great services which science may render in bringing about the practical objects which are aimed at, we of course heartily concur. It is admitted on all hands that the haphazard way in which our fisheries have hitherto been carried on has led to the worst results, the

extinction almost of some important fishes and mollusks, the bad condition of others, and the dearth of what might be the cheapest and most plentiful of foods. In recent years science has done something to remedy this state of things, and it will be well for our fisheries, and therefore for the welfare of a large portion of our population, if the Fisheries Exhibition leads to still more being done in this direction. So far the Exhibition has been an immense success; half a million of people have already visited it, and thus the educational results are likely to be widespread.

Prof. Huxley, in opening the proceedings, said:—

It is doubtful whether any branch of industry can lay claim to greater antiquity than that of fishery. The origin would seem to be coeval with the earliest efforts of human ingenuity; for the oldest monuments of antiquity show us the fisherman in full possession of the implements of his calling; and even those tribes of savages who have reached neither the pastoral nor the agricultural stages of civilisation are skilled in the fabrication and in the use of the hook, the fish-spear, and the net. Nor is it easy to exaggerate the influence which the industry thus early practised and brought to a considerable degree of perfection has directly and indirectly exerted upon the destinies of mankind, and especially upon those of the nations of Europe. In our quarter of the globe, at any rate, fishery has been the foster-mother of navigation and commerce, the disseminator of the germs of civilisation. Having glanced at the development of the industries connected with fishing, more especially by the Phœnicians, he continued:—"These few remarks must suffice to indicate the wide field of interesting research which fisheries offer to the philosophical historian, and I pass on to speak of the fisheries from the point of view of our present practical interests. The supply of food is, in the long run, the chief of these interests. Every nation has its anxiety on this score, but the question presses most heavily on those who, like ourselves, are constantly and rapidly adding to the population of a limited area, and who require more food than that area can possibly supply. Under these circumstances, it is satisfactory to reflect that the sea which shuts us in at the same time opens up to us supplies of food of almost unlimited extent. In reference to the relation which the fisheries bore to the total supply of food of those who had easy access to the sea, he quoted the following paragraph from the Report of the Fisheries Commissioners, 1866:—"The produce of the sea around our coasts bears a far higher proportion to that of the land than is generally imagined. The most frequented fishing-grounds are much more prolific of food than the same extent of the richest land. Once in a year an acre of good land, carefully tilled, produces a ton of corn or two or three hundredweight of meat or cheese. The same area at the bottom of the sea in the best fishing-grounds yields a greater weight of food to the persevering fisherman every week in the year. Five vessels belonging to the same source in a single night's fishing brought in seventeen tons' weight of fish, an amount of wholesome food equal in weight to that of fifty cattle or 300 sheep. The ground which these vessels covered during the night's fishing could not have exceeded an area of fifty acres." My colleagues and I made this statement a good many years ago. I have recently tried to discover what yield may be expected, not from the best natural fishing-grounds, but from piscicultural operations. At Comacchio, close to the embouchure of the Po in the Adriatic, there is a great shallow lagoon which covers some 70,000 acres, and in which pisciculture has been practised in a very ingenious manner for many centuries. The fish cultivated are eels, gray mullet, atherines, and soles; and, according to the figures given by M. Coste, the average yield for the sixteen years from 1798 to 1813 amounted to 5 cwt. per acre—that is to say, double the weight of cheese or meat which could have been obtained from the same area of good pasture land in the same time. Thus the seas around us are not only important sources of food, but they may be made still more important by the artificial development of their resources. But this Exhibition has brought another possibility within the range of practically interesting questions. A short time ago a visitor to the market might have seen fresh trout from New Zealand lying side by side with fresh salmon from Scandinavia and from the lakes and rivers of North America. Steam and refrigerating apparatus combined have made it possible for us to draw upon the whole world for our supplies of fresh fish. In my boyhood "Newcastle" was the furthest source of the

salmon cried about the streets of London, and that was generally pickled. My son, or at any rate my grandson, whenever he goes to buy fish, may be offered his choice between a fresh salmon from Ontario and another from Tasmania. The fishing industry being thus important and thus ancient, it is singular that it can hardly be said to have kept pace with the rapid improvement of almost every other branch of industrial occupation in modern times. If we contrast the progress of fishery with that of agriculture, for example, the comparison is not favourable to fishery. Within the last quarter of a century, or somewhat more, agriculture has been completely revolutionised, partly by scientific investigations into the conditions under which domestic animals and cultivated plants thrive, and partly by the application of mechanical contrivances and of steam as a motive power to agricultural processes. The same causes have produced such changes as have taken place in fishery, but progress has been much slower. It is now somewhat more than twenty years since I was first called upon to interest myself especially in the sea fisheries. And my astonishment was great when I discovered that the practical fisherman, as a rule, knew nothing whatever about fish, except the way to catch them. In answer to questions relating to the habits, the food, and the mode of propagation of fish—points, be it observed, of fundamental importance in any attempt to regulate fishing rationally—I usually met with vague and often absurd guesses in the place of positive knowledge. The Royal Commission, of which I was a member in 1864 and 1865, was issued chiefly on account of the allegation by the line fishermen that the trawlers destroy the spawn of the white fish—cod, haddock, whiting, and the like. But, in point of fact, the spawn which was produced in support of this allegation consisted of all sorts of soft marine organisms except fish. And if the men of practice had then known what the men of science have since discovered, that the eggs of cod, haddock, and plaice float at the top of the sea, they would have spared themselves and their fellow-fishermen, the trawlers, a great deal of unnecessary trouble and irritation. Thanks to the labours of Sars in the Scandinavian seas, of the German Fishery Commission in the Baltic and North Seas, and of the United States Fishery Commission in American waters, we now possess a great deal of accurate information about several of the most important of the food fishes, and the foundations of a scientific knowledge of the fisheries have been laid. But we are still very far behind scientific agriculture, and, as to the application of machinery and of steam to fishery operations, in this country at any rate, a commencement has been made, but hardly more. The relative backwardness of the fishing industry made a great impression on my colleagues and myself in the course of the inquiries of the Royal Commission to which I have referred; and I beg permission to quote some remarks on this subject which are to be found in our Report issued in 1866:—"When we consider the amount of care which has been bestowed on the improvement of agriculture, the national societies which are established for promoting it, and the scientific knowledge and engineering skill which have been enlisted in its aid, it seems strange that the sea fisheries have hitherto attracted so little of the public attention. There are few means of enterprise that present better chances of profit than our sea fisheries, and no object of greater utility could be named than the development of enterprise, skill, and mechanical ingenuity which might be elicited by the periodical exhibitions and publications of an influential society specially devoted to the British fisheries." Taking this Exhibition, the third of its kind, as evidence that the public attention to fisheries for which they hoped had been attained, he remarked that the conference opened that day formed an entirely new feature of such exhibitions, and expressed a hope that there was in them a germ of that which, by due process of evolution, might become a great society, having for its object the welfare and the development of the fisheries of these islands. He presently turned to the question whether fisheries are exhaustible; and, if so, whether anything can be done to prevent their exhaustion. He did not think it possible to give a categorical answer. There were fisheries and fisheries; but he had no doubt that there were some fisheries which were exhaustible. Instancing the salmon rivers, he said it was quite clear that those who would protect the fish must address themselves to man, who was reachable by force of law; and that it not only might be possible, but it was actually practicable, to so regulate the action of man with regard to a salmon river that no such process of extirpation should take place. But if we turned to the great sea fisheries, such as cod and herring fisheries, the case was entirely altered. Those who have watched

the fisheries off the Lofoden Isles on the coast of Norway, say that the coming in of the cod in January and February is one of the most wonderful sights in the world; that the cod form what is called a "cod mountain," which may occupy a vertical height of from 20 to 30 fathoms—that is to say, 120 to 130 feet, in the sea; and that the shoals of enormous extent keep on coming in in great numbers from the westward and southward for a period of something like two months. The number of these fish is so prodigious that Prof. Sars, the most admirable authority, from whom I quote these details, tells us that when the fishermen let down their loaded lines, they feel the weight knocking against the bodies of the codfish for a long time before it gets to the bottom. I have made a computation, with the details of which I will not trouble you, which leads to this result, that if you allow the fish each of them four feet in length, and let them be a yard apart, there will be in a square mile of such shoals something like 120 million fish. I believe I am greatly understating the actual number, for I believe the fish lie much closer; but I would beg your attention to the bearing of this underestimate, because I do not know that the Lofoden fishery has ever yielded more than 30 million fish in a good season; and so far as I am aware the whole of the Norwegian fisheries, great as they are, do not yield more than 70 millions. So you will observe that one of these multitudinous shoals would be sufficient to supply all the fisheries of Norway completely, and to leave a large balance behind. And that is not all. These facts about the cod apply also to the herring; for not only Prof. Sars, but all observers who are familiar with the life of the cod when it has attained a considerable size, tell us that the main food of the cod is the herring, so that these 120 million of cod in the square mile have to be fed with herring, and it is easy to see, if you allow them only one herring a day, that the quantity of herring which they will want in the course of a week will be something like 840 million. Now I believe the whole Norwegian herring fishery has never reached the figure of 400 million fish—that is to say, one half the fish which this great shoal of codfish eats in a week would supply the whole of the Norwegian fisheries. On these and other grounds it seemed to him that this class of fisheries—cod, herring, pilchard, mackerel, &c.—might be regarded as inexhaustible. But he should not venture to say this of the whole of the sea fisheries—of the oyster fisheries, for example. Here, again, the operations of man become exceedingly important. Regarding the regulation as to close time for oysters as alone absolutely futile for the purpose of protection, he urged that the more logical provisions of government supervision in Denmark, France, and elsewhere, were impracticable of application beyond the three-mile limit of this country. It was under this conviction that the Commission to which he referred recommended the abolition of all restrictive measures. In conclusion, he pointed out how heavily this question bore on the social condition of the fisherman. Every act of legislation with regard to the fisherman created a new offence. If the common welfare and the common interest, said Prof. Huxley, can be clearly shown to render such regulations desirable or necessary, then of course fishermen must put up with this as they put up with anything else—as we all put up with such restrictions. But supposing that no good case is made out, supposing that regulations of this kind are made on insufficient inquiry and based on insufficient understanding of the circumstances of the case, then I am free to confess that I think those who make such laws deserve very much severer penalties than those who break them.

THE SCIENTIFIC WORK OF THE "VEGA"¹

THE volume we have before us—the first of a series—contains the results of the scientific observations made during the cruise of the *Vega*, and to say this is obviously to indicate that it contains a rich supply of most valuable information as to that part of the Arctic Ocean which extends along the coasts of Siberia, which appears in the shape of a series of elaborate papers on different departments of natural history of the Arctic regions. Several parts of this volume are already known. Such are the "Reports to Dr. Oscar Dickson" written by Baron Nordenskjöld during the expedition, and read throughout the civilised

¹ "Vega-Expeditionens Vetenskapliga Iakttagelser, bearbetade af deltagare i resan och andra forskare, utgifna af A. E. Nordenkjöld." Vol. I. Part 1. (Stockholm, 1882.)