The Migration of the Anchovy.

Summary of a Report to the Council of the Association.

By

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The facts gathered up to the present time with regard to the occurrence of anchovies in the English Channel are briefly as follows:

In November, 1889,* large numbers of anchovies were reported to have been taken at Dover in the drift-nets used for sprat fishing. During the same month also numbers were taken by the sprat fishermen in Torbay, in seines.

In the following November, 1890, numbers of anchovies were brought in at Plymouth by pilchard fishermen, fishing to the south of the Eddystone. On November 26th one boat took 584, and on November 27th one took 500. During this autumn nothing was heard of anchovies at Torquay, and Mr. Matthias Dunn could not obtain any at Mevagissey.

The only anchovies brought to the Laboratory in the autumn of 1891 were caught on November 9th. On this occasion twenty-one fish were counted. No anchovies were reported from Torquay. Anchovy nets purchased by the Association were shot twenty-four times between September, 1891, and April, 1892, and thirty-one anchovies were taken, the largest catch being twenty on November 20th.

During the winter 1892–3 the number of anchovies obtained from fishing boats at Plymouth was sixty-one, of which number thirty-three were caught in November and December. The Association's nets were shot six times in November and December, and five anchovies were taken, all at one time (November 28th).

During the winter 1893–4 only eight anchovies were obtained from the Plymouth fishermen. The nets of the Association were

* This Journal, vol. i, N.S., p. 334.

shot once, but no anchovies were caught. No anchovies were reported from Torquay.

In November and December, 1894, twenty-seven anchovies were obtained from Plymouth fishermen. The Association's nets were shot five times in November, but no anchovies were caught, and it was definitely ascertained that none were taken at Torquay.

My general conclusions from the facts known concerning the anchovy are as follows:

It seems at present most probable that the anchovies which spawn on the Dutch coast in June and July are those which are found in the English Channel in autumn and winter. We do not know of any spawning places of this fish on the west coast of Europe, except the east side of the North Sea. The spawn has been observed in the Zuyder Zee and in the open sea near Nordeney by Ehrenbaum. We have not seen any anchovy spawn in the neighbourhood of Plymouth, and there is no evidence of the presence of anchovies in that locality in summer. But anchovies are caught on the French shore of the Bay of Biscay, at any rate in the southern part. We do not know if they spawn there. If, then, the anchovies in the Channel move north in summer when they spawn, how is it that their place is not taken by other anchovies coming up from the south?

The reply to this question is probably given by the peculiar distribution of summer and winter temperature. There is a much greater range of temperature in the shallow estuaries and basins on the coast of Holland than in the deeper water at the entrance to the English Channel. On the chart of temperatures of the Atlantic, published by the Meteorological Office, the August temperature near Plymouth is 61° to 62°, and outside the Frisian Islands it is marked 62°, 63°, and near Heligoland 65°. The temperature in the Zuyder Zee is higher in summer than that of the sea outside. We know from the Dutch observations that in 1887 the seven days' mean temperature at 7 p.m. in the Zuyder Zee in July varied from 62·6° to 66·2°. According to observations published by Mr. Dickson in this Journal, vol. ii, p. 276, the ten days' mean off Plymouth in July, 1891, was 57·2° to 57·4°. In the same year the seven days' mean of the surface water in the Zuyder Zee was in July 62·2° to 63·3°.

In 1892 the surface temperature in February, ten days' mean, according to Mr. Dickson, was 44·1° to 46·4°. In the Zuyder Zee for the same month it was 33·9° to 39·0°.

It is clear, therefore, that the water on the coast of Holland is warmer in summer and colder in winter than that of the English Channel. This explains why anchovies do not spawn in the Channel. A temperature equal to that on the coast of Holland in

summer is only obtained further south on the French coast, where anchovies are taken in summer, and where they probably spawn. We know that there are anchovies in autumn and winter at the western end of the English Channel; these, in order to reach a temperature high enough for spawning, must go either north or south. It seems probable that all these anchovies come from Holland and return thither.

In relation to this probable migration it is interesting to compare the statistics of the Dutch fishery with the evidence we have obtained of the varying abundance of anchovies in the neighbourhood of Plymouth. The following are the temperatures in July in the Zuyder Zee, and the total yield of the anchovy fishery in that sea in successive years:

	Temperature in July.	Ankers of Anchovies salted.
1882	14·7° to 16·7° C.	18,736
1889	16·8° to 18·9°	1,676
1890	15·4° to 18·3°	194,096
1891	16·8° to 17·3°	45,914
1892	16·2° to 17·7°	6,854
1893	17·7° to 20·1°	13,908

Now we first heard of anchovies in connection with the M. B. A. in November, 1889, when large numbers were seen at Dover, large numbers were taken in the sprat seines at Torquay, and samples were brought to the Laboratory by the pilchard fishers at Plymouth. In the previous summer very few had been caught in the Zuyder Zee, although the temperature in that summer was high. But in the following summer, with a similar temperature in the Zuyder Zee, one of the maximum catches was made there. In the winter of 1890 anchovies were abundant in the Channel; I obtained 1000 from pilchard-nets in two days in November, and again in the following summer a fairly large catch was made in the Zuyder Zee. In the winter of 1891 and 1892 anchovies were not plentiful off Plymouth, and in the following summers the catch in the Zuyder Zee was small.

The fact that so few anchovies were taken in the Zuyder Zee in 1889, while in the following autumn they were so abundant in the Channel, is difficult to reconcile with the theory that the winter anchovies in the Channel come from the coast of Holland. It is possible that there is another explanation, namely, that in warm winters the anchovies come northward to the Channel, and in a warm summer following pass up to the warm waters of the Dutch coast, where they are crowded together in narrow waters, and so give opportunity for a fishery. If this suggestion were correct the prosperity of the Zuyder Zee fishery would depend not, as Prof.

Hoffmann supposed, on the warm summer of the year before, but on the mildness of the winter in the Channel. This suggestion can be tested by an examination of the meteorological conditions during past years in comparison with the statistics of the Dutch fishery.

I would suggest that in future a careful record should be kept of the meteorological conditions, temperature of the sea, and number of anchovies obtained at Plymouth, in order that the law of the anchovy fisheries might be ascertained. I would further suggest that endeavours be made to obtain data concerning the natural history of the anchovy on the west coast of France, and north and west coasts of the Spanish Peninsula. We do not know at present whether the fish spawns there, and in what abundance it occurs at different seasons. If these matters have not yet been ascertained, it would not be difficult by communications in the proper quarters to get observations on them made by competent naturalists in the countries concerned, or it might even be advisable to send a naturalist from England for the purpose.

In conclusion I would say a few words on the question of an English anchovy fishery. As far as our evidence goes—and it is fairly extensive—there has been no possibility of a profitable fishery except in the years 1889 and 1890. In the former year a considerable number of anchovies could have been cured at Torquay, and in the latter a smaller number at Plymouth; but there is no indication that enough anchovies could be caught in the Channel to recompense the employment of special nets for their capture alone. My own opinion is that the fish are either too much scattered or too far from the coast to be caught in very large numbers. In Holland it is different; the fish are there crowded into a small area.

On the other hand, I think it would be advisable to ascertain whether small pilchards occur off the Cornish coast in summer in sufficient numbers to support a sardine industry like that of the west coast of France. The pilchard fishery is unprosperous, the market for large salted pilchards is bad. There is a factory at Mevagissey where large pilchards are imperfectly preserved as sardines, but the flavour of sardines depends on the size, as lamb is more delicate than mutton. If small pilchards are to be caught on the Cornish coast in large numbers in summer, there is no reason why the French sardine industry should not be extended to Cornwall, and prove a great boon to the population, whose resources in mining and fishing have been much reduced. To this end I would advise that our small-meshed nets be shot regularly throughout the months of April, May, June, July, August, and September, and all the results examined and recorded.