

SESSIONAL PAPER No. 38b

Other investigations have shown that similar fluctuations in the different year-classes also take place in the stock of haddock and cod, and that the year 1904 had the same important influence regarding these species of fish. Immense numbers of young fish were produced which were of the greatest importance to the Norwegian fisheries, when they reached the age and size in which they are caught by the fishermen. The international investigations of the herring fisheries of the North Sea (the herring of the British coasts) have been summarized in the following words: "If we compare these results with the composition in point of age of the Norwegian race of herring, we find this similarity, that both races exhibit some remarkably rich year-classes, not, however, in both cases from the same year. There is probably also this point of difference, that the richness of these year-classes is more pronounced in the case of the Norwegian race than in that of the North Sea fish. The fluctuations in the herring fishery of the North Sea are therefore slighter than in those of the Norwegian waters."

From the point of view of the method of investigation, it must be regarded as a most striking and wonderful fact, that it is possible to collect a sample, say of some few hundred herrings, and then to find this sample really giving a representative picture of the composition, with regard to size and age, of the whole stock of incalculable millions of spawning herring in the sea. As I pointed out in my lecture in London, in 1907, before these investigations started, it seemed at first a bold suggestion to propose studying the fish supply along lines like these. A population can be counted; but who knows how many fish are in the sea? From the feeling of the magnitude and difficulty of the task, the scientists who took part in this work hesitated for many years before their definite belief in the representative character of the results grew so strong that they dared to regard the method and the results as sufficiently proved and fully established.

The essential question which had to be answered before this belief was strong enough to become a scientific conviction was, of course, this: "How large an amount of material was absolutely necessary to afford a representative picture?" We have during our work started from the point of view that no information could be obtained regarding this problem purely from theoretical or *a priori* considerations. No mathematician can calculate the number required for a representative sample of the Norwegian spring herring. This number depends above all on the question, how evenly mixed are the different sizes and ages in the stock of the spawning shoals, and the answer to this question can only be given through scientific tests and experience, that is, through the comparative study of a number of different samples. In my paper, often mentioned in the foregoing pages, I give the data for such a comparative study. Referring the reader to these facts, which since the paper was published, have been very much extended, I will here confine myself to one example, the result of the analyses of the samples of spring herring from the year 1914, as far as the 1904 year-class is concerned. In 1914 seven samples of spring herring were collected containing in all 1,933 herrings. The samples were collected from places along the west Norwegian coast, some places several hundred miles apart. Along all this distance the spring herring were spawning. The analysis gave the following result, as far as the 1904 year-class is concerned.

Number of individuals in the samples.	Percentage of year-class 1904.
175	52.6
305	58.4
44	59.1
565	62.3
354	60.7
289	50.2
201	61.2
Average.... 276	Average.... 57.8