

sardines pêchées sur les côtes de Californie. Pour cela on a d'abord cherché à délimiter l'emplacement des aires de pontes, à s'assurer que la situation de celles-ci variait peu d'une année à l'autre, à faire une étude quantitative des oeufs et des larves, à suivre ces dernières dans leurs migrations et leur croissance. Au cours de ces quatre années, 358 stations ont été effectuées couvrant une surface de 25,200 milles carrés.

Il a été reconnu que, si l'aire totale de ponte s'étend sur une largeur de 250 milles du Cap San Lucas au N. de San Francisco, l'aire principale de ponte est beaucoup plus réduite; large de 200 milles, longue de 100 milles, elle s'est trouvée chaque année localisée dans l'espace compris entre San Diego et Point Conception. Dans cette région, les captures accusent deux fois plus d'oeufs et de larves que dans toute l'étendue de l'aire de ponte. Une pareille concentration des reproducteurs sur une aussi faible étendue est tout-à-fait remarquable. Cela tient en grande partie aux conditions requises pour la ponte qui ne peut s'effectuer dans des eaux dont la température est inférieure à 15° C. L'importance de ce facteur se traduit d'ailleurs par les quelques fluctuations observées d'une année à l'autre dans la délimitation précise de l'aire principale de ponte qui s'étend plus au moins vers le large suivant que la température est plus (1930 et 1931) ou moins (1929 et 1932) élevée.

D'une ponte abondante, on ne peut déduire une bonne année de pêche qu'à la condition de suivre le sort des larves. C'est pourquoi on s'est employé à rechercher leur lieu de rassemblement. Le jeu des courants fait qu'elles sont entraînées vers le S. de Point Conception jusqu'au voisinage de Magdalena Bay. On peut en faire dans ces parages d'abondantes récoltes en pêchant à 15 brasses environ de profondeur, et suivre leurs transformations jusqu'à la taille de 35 mm., c'est-à-dire jusqu'à leur métamorphose.

Dans les jeunes stades, elles se nourrissent presque exclusivement de Copépodes, tandis que les Diatomées font la base de la nourriture des immatures et des adultes. Cela tient à ce que le filtre branchial n'est définitivement constitué et n'est apte à retenir les proies de faibles dimensions que lorsque l'alevin a dépassé 100 mm. de longueur. L'auteur suit avec soin ces modifications importantes et donne une description détaillée de l'oeuf et des stades larvaires et post-larvaires.

L. F.

C. F. Hickling. "The Natural History of the Hake, Pt. IV. Age-Determination and the Growth-Rate." Min. Agric. and Fish., Fish. Invest., Ser. II, Vol. XIII, No. 2, 1933. London, 1933.

In this, the fourth of his serial papers on the natural history of the Hake, Mr. Hickling sets out the conclusions he has reached on the difficult questions of age and growth-rate. The difficulty lies in the fact that in this species none of the methods usually available, otoliths, scales or length frequencies, is entirely satisfactory. Scale reading after a trial was rejected as unreliable. Of the otoliths only about 40 % could be read with confidence and a further 40 % read at all. The length frequency curves, drawn from the market measurements and from the catches of the research vessel, showed a series of modes which advanced in length from month to month and agreed fairly well in position with the sizes in successive years deduced from the otolith readings.

Using the last two methods of estimation the author deduces for the hake an average increase in length of a little under 9 cm. per annum for the first eight years of its life. The hake, unlike, for example, the plaice

and the herring, increases by approximately equal length increments for about eight years, after which its growth appears to slacken, the falling off being much more marked in the male than in the female, due in the author's opinion to the increasing strain of the development of the male gonad. The annual growth is shown to be seasonal, occurring mainly from April to July.

The almost complete absence from the trawls of one-year-old fish is believed to be due to a longer pelagic life than was previously suspected. The fish first appear in any considerable numbers, even in the sprat-mesh covers to the trawl, at an age of two years and a size of 18—20 cm.

Mr. Hickling makes no secret of the difficulties he has had with his material. For instance, from time to time many of the otoliths gave readings which did not tally with the groupings of the frequency curves and which could only be explained as misreadings. Again, on the voyage of the research vessel in 1930 small hake were consistently very scarce, contrary to expectations and to the results of other cruises. It is surmised that the net may have been fishing abnormally, though no other evidence of this can be adduced. In spite of such discrepancies, however, there seems to be an ample basis of indisputable facts to support the author's conclusions, nearly 26,000 otoliths having been examined and 54,000 fish measured from the cruises of the research vessel in addition to the market measurements.

Attention may be called to one observation, namely, that the measurements of the two-year-old fish, covering a range of 12 to 30 cm., do not in any one sample form a single frequency curve but tend to fall into groups, the modes of which are approximately similar in position, though not in magnitude, from sample to sample and from year to year. These groups, the author suggests, represent the offspring of the lunar spawning periods. If this hypothesis should prove to be valid it will be remarkable evidence of the uniformity of conditions of growth, not only over the whole area, but from year to year.

The consideration of the practical application of his conclusions, namely the forecasting of the future yields of the fishery, is postponed by the author to a future paper, but one point of considerable economic importance is referred to with reference to the avoidable destruction of unmarketable fish. It is calculated that the use of an 8 cm. mesh, in general use by steam trawlers when the paper was written, involved the rejection at sea, by Milford trawlers alone, of about 2½ millions of unsaleable small hake in a year. The substitution of a 10 cm. mesh, though not doing away completely with this rejection, would reduce it by about 60%, a saving of about 1½ million fish from this one port.

G. P. F.

R. A. McKenzie. "Cod Movements on the Canadian Atlantic Coast." Contrib. Canad. Biol. and Fish. Vol. VIII, No. 31. Toronto, 1934.

From 1925 to 1933 nearly nine thousand cod were marked by Canadian workers on the Atlantic Coast, and 727 cod were recaptured. Mr. McKenzie analyses the returns from four localities, in which he finds sufficient data.

In describing the data he divides the cod according to their movement. Thus a proportion of the stock in localities where the conditions were suitable throughout the year appeared not to move more than 20 km. and these are said to show "restricted migration". In other cases there may be orderly "extended migration" (as in the familiar case between Lofoten and Finmark) and other fish are shown to be "rovers", that is, exceptional fish