

thought that the large masses of algae (*Fucus* sp.) that covered the beach had protected the animals.

At Middelfart also, where the ice period was relatively short, few dead animals were found — mainly *Mytilus edulis*.

The author is of opinion that the continuous cold is the direct cause of the death of the "surface" forms; for the animals living in the sand he thinks that suffocation is the reason. A. D.

A. C. JOHANSEN. Mortality among Porpoises, Fish and the larger Crustaceans in the waters around Denmark in Severe Winters. Rep. Dan. Biol. Station no. XXXV, Copenhagen 1929.

In this paper the Director of the Danish Biological Station, Dr. A. C. JOHANSEN, has accumulated all observations available as to dead fish and other animals in the Danish waters, with especial regard to the severe winter 1928/29. In the south-eastern part of the North Sea dead soles were caught at 15 to 25 fathoms in the last half of March and in April<sup>1</sup>).

Along the shores of Jutland no dead fish were found, but dead specimens of *Cancer pagurus* and *Portunus holsatus* often occurred in great numbers.

In the Baltic dead porpoises were taken in hundreds by the motor trawlers in the deep water near Bornholm, in which place the waters had been open nearly the whole winter. As porpoises are not normally abundant in this locality, it is thought that these specimens had congregated there when trying to escape the ice in the Belts.

From the Danish part of the Skagerrack no dead fish were reported, nor from the deeper parts of the Kattegat. From the shallow parts, however, dead cod and plaice were reported, as well as young brill.

In the Belt sea dead fish — especially cod, haddock, plaice and flounder — were caught, often in great numbers, in the nets in some places only, mainly in the waters to the S.W. of Ærø. On the beaches eels also were found, of which 250 to 300 kg. were secured in one place.

In the fjords and other narrow waters dead eels and frequently *Gobius niger*, *Zoarces viviparus*, *Pleuronectes flesus*, *Gadus callarias*, *Clupea sprattus* and others were found in great quantities.

The author is of opinion that the cause of death generally is the cold water. In some cases (the porpoises) it is the ice itself, but in others it is want of oxygen, as, for example, in the waters S.W. of Ærø. In those waters the oxygen is often entirely absent, as is the case in many narrow waters.

The area where dead fish were found is generally very limited, and the author is of opinion that the stock of fish has not been seriously injured. Perhaps the most affected is the eel. A. D.

H. O. BULL. Studies on Conditioned Responses in Fishes. Part II. Journ. Marine Biol. Assoc. N. S., vol. XVI, no. 2, Plymouth 1930, p. 615—637.

In this second paper Mr. BULL continues his experiments on training fishes to react in a special way to special sense-impressions.

<sup>1</sup>) J. du Conseil Vol. IV, Nr. 3 J. R. LUMBY and G. T. ATKINSON: On the unusual Mortality amongst Fish during March and April 1929 in the North Sea.

Thus, a wrasse (*Crenilabrus melops*), that had previously been trained to enter a bottle for food when a tuning-fork was vibrating, now had to learn to enter another bottle when an electric buzzer was sounding. When it seemed that the fish had learnt the difference, critical experiments proved, however, that it had reacted not to the difference of the sounds themselves but to their different positions in the aquarium.

A plaice (*Pleuronectus platessa*), a coal fish (*Gadus virens*) and a cod (*Gadus callarias*) learnt to go to a food box in the aquarium when a light was turned on above another part of it.

Interesting experiments were done on the gustatory sensations of blennies. Two specimens of *Blennius gattorugine* could be trained to come out of their jar to a feeding place in the aquarium when a 0.5 per cent. or a 0.4 per cent. extract of *Nereis* was brought into the jar, and one of them continued to react even when the solution was diluted to 0.01 per cent. A *Blennius pholis* could not be taught to react to artificial musk, but learnt to react positively to a 0.5 per cent. extract of *Mytilus* and then showed the same reaction when this extract was diluted to 0.0075 per cent. With lower concentrations no reaction could be obtained. Another *Bl. pholis* learnt to react to the same concentration of an extract of *Patella*. No Blenny could be trained to react to artificial musk.

According to Mr. BULL one of the principal objects of his investigations was to compare his results with those of other investigators on the dog. To me it seems that it would be more important to compare them with the results obtained by other investigators who worked with fishes. Thus, STETTER trained several fresh-water fishes to react differently to different tones or sounds, STRIECK trained *Phoxinus laevis* to react to sugar, vinegar, quinine or NaCl and to non-biological odourous substances like skatol, cumarine and musk, etc. It certainly would improve the importance of Mr. BULL'S results if in a future paper he would take more account of the work which other investigators have done in the same line with other fishes.

J. A. BIERENS DE HAAN.

J. H. ORTON. Experiments in the Sea on the Growth-inhibitive and Preservative Value of Poisonous Paints and other substances. *Journal of the Marine Biol. Assoc. N. S.* Vol. XVI, no. 2. Plymouth 1930.

This voluminous paper is chiefly concerned with a comparison of certain proprietary anti-fouling paints referred to by number, and subsequently analysed in the Government Laboratory. They were painted on wood and on scallop shells (*Pecten maximus*), and exposed in various situations near Plymouth. The paints differed very considerably in their action, some having hardly any effect in inhibiting the growth of marine animals and plants. Analysis showed the best paints to be those with a high proportion of copper, with or without arsenic. Thus, in an appended report of the Government Chemist, a certain green paint is recorded as containing 14.8 per cent. of cupric oxide and 5.0 per cent. of arsenious oxide, but no cuprous oxide. The copper appeared to be present partly as insoluble basic sulphate and partly as SCHEELLE'S green (acetoarsenite of copper). Another active paint was reddish in colour and contained 11.8 per cent. of cuprous