

An account of the hydrographical conditions of this part of the Baltic shows the peculiar features of the sea fishery. In the chapter dealing with the different kinds of fish, the author points out the importance and the possibility of developing the herring fishery. This fish forms more than 50 per cent. of the total catch of fish in both countries. The author justly criticises the statistical figures for the herring fishery in Esthonia and is of the opinion that the whole coast of both countries, which now-a-days produces about 15,000 tons of herrings, can produce much more with increased intensity and better organisation of the fishery. — Very valuable details are to be found in the short but very cleverly made accounts of other fishes, especially the sprat, salmon and flounder.

The statistical figures, carefully examined by the author, lead to the conclusion, that now-a-days the whole coast of both countries produces about 31,000 tons of fish, of the value of about 5½ Millions shillings yearly.

The descriptions of fishing gear, methods of fishing and boats show that the fishery, here retaining in many cases primitive forms has chiefly the character of a coastal fishery.

The account of the ports and the administrative division of the coast terminates this very valuable and interesting paper, which forms one part of the large work on the sea fishery in Northern Europe. From that account one conclusion clearly emerges, that in such countries as the two which are treated in the work of Prof. SCHNEIDER, the actual state of the fishery indicates the greatest possibilities for development. M. S.

PAUL S. GALTSOFF. Experimental study of the Function of the Oyster Gills and its bearing on the Problems of Oyster Culture and Sanitary Control of the Oyster Industry. — Bulletin of Bureau of Fisheries XLIV. Document No. 1035. Washington 1928.

Though the importance of efficient administration of measures designed to deal with cultural problems and the sanitary control of shellfish cannot be overrated, they must obviously be based on sound scientific knowledge.

The research described in this paper was undertaken by Prof. GALTSOFF to fill part of a gap in our knowledge of the physiology of the American oyster (*Ostrea virginica*) and relates to a function which has an important bearing on practical problems.

The capacity of the oyster and other shellfish for filtering water has long attracted the attention of investigators. Various methods have been employed for measuring the strength of currents produced by plankton feeding organisms, but the results differ for the same organism to a remarkable extent, and practically no attention has been given to the influence of temperature. These methods are reviewed by Prof. GALTSOFF in an introductory section of this paper, in which he also devotes a few pages to the present position of bacteriological standards in the United States. He indicates that difficulties experienced there in connection with sanitary control are due partly to lack of knowledge of the relation between the temperature of polluted water and the degree of pollution of oysters taken from it, or of polluted oysters relaid in clean water. In this connection it

may be noted that Dr. DODGSON'S comprehensive "Report on Mussel Purification" deals fully with these problems and with bacteriological standards and methods, and it must be admitted that some of the difficulties experienced in the United States are due to methods which are open to grave criticism; such, for example, as the testing of shell liquor only, without including portions of the minced meats of the oysters under examination. On the other hand, the value of an understanding of the filtering function is amply confirmed by Dr. DODGSON'S observations in the case of the mussel; the rapid clearing of water by mussels under treatment being an immediate and sure indication that cleansing is proceeding normally. Prof. GALTISOFF'S experimental work deals with the effect of temperature on the rate of flow of water through the gills, with their filtering capacity, and with the action of the adductor muscle. For the gill investigation he has devised two direct methods, each meeting a special requirement. One, the tank method, enables the filtered water to be collected and examined and gives a direct reading of pressure. In the other, measurement of the rate of flow of water through a tube enables the volume passing through the gills, and the pressure, to be calculated from Poiseuille's formula connecting the factors which are involved. The mechanical work performed by the gills can also be arrived at.

Criticism may be made that the oysters were tested under highly abnormal conditions; the valves being forced and wedged apart, then a tube inserted between them, and the adjacent space packed. Incidentally, fuller details of this procedure might with advantage have been given. Susceptibility to mechanical disturbance was, however, shown to last only for a few minutes; the effect of preparing the oysters in this way may therefore be equally brief, and probably normal pressure is rapidly established in the gill cavities. Whether it be so or not, the two methods give comparable results, and in a series of many experiments, involving some thousands of readings, Prof. GALTISOFF has been able to establish a consistent relationship between temperature and current production by the gills, though individual oysters differ widely from each other in the amounts filtered under the same conditions, the variations increasing with the temperature. Increased rate of flow always accompanied rise in temperature within a certain range. In most of the oysters tested, current began at about 8° C., and in summer reached a maximum averaging 2.5 litres per hour between 25° and 30° C. The maximum amount recorded for one oyster was 3.9 litres per hour at 25° C., but another oyster at the same temperature produced a flow of only 0.9 litre. The commencement of current at about 8° C. occurs not only in oysters cooled in the summer but also in hibernating oysters (an expression seldom used in Europe, but widely employed in the United States). The difference between rate of flow with oysters tested in summer and in winter, at the same temperatures, is well marked; the increase with rise of temperature between 7° and 15° C. being very small in the winter. The presence of mucus clogging the lateral cilia of the gills in oysters taken from cold water is regarded by the author as being very probably the factor responsible for this result. In the matter of filtering water, it is possible that factors other than rate of ciliary movement are involved. The clearing of turbid water by mussels

in tanks has already been referred to. Dr. DODGSON has noted that the minimum time required to produce absolute clarity is independent of temperature, over a wide range from 1° C. to 16° C., the maximum amount filtered per mussel being no less than about 2 litres per hour. Such clearing is therefore not directly proportional to the rate of beat of the frontal cilia as determined by GRAY.

Prof. GALTSOFF found that a very large percentage of plankton organisms are filtered out by the gills, but under the conditions of his experiments up to nearly 90 per cent. of bacteria may pass through the oysters gills and be ejected.

By means of counterbalanced attachments to oyster shells, operating pens on a time recorder disc, he also investigated the opening and closing of a number of oysters, and concluded that there is no correlation between closures of shell and hours of darkness. Similar conclusions with *O. edulis* have been drawn by WEBB at Conway. The author found an average of open hours to be 17 out of the 24, there being no visible effect of temperature between 13° and 22° C.

In the practical application of this valuable work, caution is desirable. The production of dejecta by the gills does not necessarily connote activity of cilia lining the gut. A clear distinction between material rejected by the gills ("pseudo-faeces") and true faeces is desirable. Production of the latter is good evidence of satisfactory activity of the whole organism. This indication, in support of suitable bacteriological tests, has been used by WEBB, who has found the critical temperature for the cleansing of *O. edulis* to be identical with that at which Prof. GALTSOFF noted definite currents to begin in the gill cavity, viz. 8° C., but the pseudo-faeces are produced from about 4° to 5° C.

The author concludes from his results that temperature is an important factor in growth and fattening also.

Prof. GALTSOFF may be congratulated on having attacked problems with success by direct methods which present considerable practical difficulties. He has obtained valuable results, and if improved methods are discovered later, by which the rate of flow produced by oyster gills be found to exceed his figures, the practical value of his work will still remain. The paper makes interesting reading, and includes a useful summary and bibliography.

H. P. S.

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