

cause of the acquired green color of the clam is the same as that of the oyster; that, as in that animal, it is diffuse; is absorbed from the vegetable food consumed by the animal; that it is allied to, if not the same as, phycoeyanin; that it is harmless, as has been experimentally demonstrated in the case of the oyster. There is also no reason why green clams should not be as freely consumed as food as green-fleshed oysters, which are valued all the more by the epicures of Paris and London because they are so discolored, in the belief that such a change of color improves their flavor.

WASHINGTON, January 8, 1885.

EXPLANATION OF THE FIGURE.

Side view of the soft parts of the common clam or mannanoso (*Mya arenaria*) in the position in which it is found in life, with the left valve and mantle of the left side removed and the left half of the siphon cut away, so as to expose its incurrent and excurrent canals.

a, anterior, *a'*, posterior adductor muscles; *b*, body-mass; *cl*, cloacal cavity, continuous posteriorly with the suprabranchial chamber; *e*, wrinkled horny epidermis of siphon; *f*, foot; *g*, gills; *h*, heart; *m*, cut edge of the border of the mantle where it is continuous with that of the left side; *o*, mouth; *p*, palps or lips; *p o*, pedal opening in the mantle, through which the foot is extended; *r*, rectum; *s*, incurrent siphonal canal; *s'*, excurrent siphonal canal (the arrows indicate the direction of the current flowing in and out of the mantle chambers of the animal); *u*, umbo next the hinge of the right valve; *v*, vent or anus, which opens into the cloaca.

42.—THE MIGRATION OF SALMON (*SALMO SALAR* L.) IN THE BALTIC.*

By JUDGE FIEDLER.

As most people know, the salmon-fishery in Denmark is limited in territory; only at and below Bornholm and Christiansøe has there been carried on from time immemorial quite a considerable hook-fishery for great salmon. The salmon-weirs in Gudena and Skjerna, at Kolding, Veile, and many places, all have greater importance for the capture of sea-trout (*Salmo trutta*) than for the salmon itself (*Salmo salar*), for which the streams of our little country are too small and shallow to furnish the desired spawning-grounds. It is only on the island of Bornholm that they are found in a little rivulet and a few larger brooks, which might furnish a refuge for the sea-trout, but are not suitable as spawning-places for the salmon, and there is no information that the salmon ever came into them for the purpose of spawning. The salmon which are caught off Born-

* Comments in *Nordisk Aarskrift for Fiskeri*, 1884, upon "*Laxens (Salmo salar L.) Vandringar i Osternsjön*," by Professor Andreas Johan Malmgren, in *Norsk Fiskeritidende*, Part II, April, 1885; pp. 210-215. Translated from the Danish by FARLETON H. BEAN, M. D. For Professor Malmgren's article, see Bull. U. S. F. C., 1884, pp. 322-323.—EDITOR.

holm, whether great salmon or small salmon, must have been hatched in the places closely bordering thereon, and migrated there from the numerous streams and rivers of Sweden and Finland emptying into the Gulfs of Bothnia and Finland; certainly also from the Russian, Polish, and German rivers—for example, the Oder—which flow into the eastern portion of the Baltic; for there is absolutely no reason for accepting the assertion of many Bornholm fishermen that the salmon breeds also in the sea in that vicinity, which assertion is supported by the statement that the water is fresh enough for the capture of small salmon, reaching, in a solitary case, three-quarters of a pound in weight, and they say that they have frequently seen salmon eggs on the algæ and the small stones associated with them on the sea bottom. Other things are necessary besides fresh water to furnish a suitable spawning-place for salmon; and the supposed salmon eggs which have been shown to me for some years on *Fucus* were certainly something very different. The presence of small salmon, which is traced far to the westward in the Baltic, even into the southern portion of the Great Belt, shows simply that the young salmon can leave the place of their birth earlier to develop into the adult condition in the sea. For a detailed description of the Bornholm salmon-fishery attention may be called to a treatise written by V. Skrydstrup, school inspector, which is printed in the Norwegian Fishery Journal, volume 2, page 15 *et seq.* Since the capture of salmon in Denmark, as a matter of course, is necessarily much smaller than in Sweden and Finland, and as the greatest portion of our catch is exported whole, it is not to be wondered at that we fail to find such hooks in the salmon taken as occur so frequently in the neighboring countries mentioned, and which Professor Malmgren has had the opportunity of bringing to light; and still it appears probable that they must occur off Bornholm, which lies within the usual range of the salmon and so near to the North German coast of the Baltic. However, it may be due as much or perhaps more to the want, in discoverers, of a knowledge of the scientific importance of such a find that nothing of the kind has been reported. At least nothing has come to my knowledge during the many years of my relation to the fisheries, and I have inquired vainly hitherto at Bornholm whether any such thing has occurred; but it is not impossible that this may have happened and gone unnoticed.

Under these circumstances it is fortunate that an accident enabled me to secure possession of a somewhat compressed brass hook which was found in a salmon weighing about eighteen pounds, caught late in April of this year in the Great Belt south of Korsör. This hook is, so far as indicated by its size and form, found, upon comparison, so entirely like the one described and figured by Malmgren as Fig. 2* that there can be no doubt that the salmon must have swallowed it and carried it from the North German coast of the Baltic. It differs from Fig. 2 only in having

* Bull. U. S. F. C., 1884, p. 323.

attached to it a slender line composed of six linen threads 13 inches in length from the hook to the place where it is broken, and $2\frac{1}{2}$ inches below the fracture is a lead sinker, without perceptible lettering, fastened in the same manner as in Fig. 3, but different from this in being $10\frac{1}{2}$ inches (not "a few" inches) distant from the hook. The salmon here mentioned was caught in a seine along with another of equal size and weight. The fishermen supposed them to be male and female. The salmon therefore extends its migration considerably farther than to the sea about Bornholm. It is worth while to add here besides, as something entirely unusual, that not a few great salmon have appeared this spring prepared to ascend the Great Belt, all caught in the seines set for herring, which are placed near the coasts, only far enough out to have the head of the net in a depth of from $2\frac{1}{2}$ to 4 fathoms, in the region from Karebæksminde to Korsør. The great salmon thus accidentally caught had, against their custom, gone into the shallow water, and we would appear to be justified in supposing from this that a larger number may have been in the deep water. Since within the memory of man, extending over a period of more than fifty years, so far as I can learn, a single great salmon is exceptionally caught at intervals of more than ten years in a seine. The greatly increased occurrence of salmon this year is a phenomenon which may possibly be attributed to the unusually mild winter, which kept the larger western portion of the Baltic, with its adjacent sounds and gulfs, free from ice all winter. Of the two salmon, weighing 16 pounds each, caught at Visserup on the last day of April, this year, I had the opportunity of opening one, and found it to be a female with the ovaries developed to a length of $5\frac{1}{4}$ inches, while the eggs were as large as mustard seed. In its alimentary canal no trace of food was found, and there was no evidence that it had taken any food for several days before its capture. It was a plump and vigorous fish, which seemed to have a stronger desire to gratify its roaming propensity than a necessity for obtaining sustenance. Small salmon appear here, sparingly to be sure, but still far more plentifully than great salmon, and usually in small schools. Thus there were caught at Visserup some years ago thirty-seven individuals at one time, weighing from 2 pounds to 6 pounds each. It appears to me that there is strong ground for attributing this circumstance to the fact that the salmon frequent the great Baltic basin westward of Bornholm much more regularly than is usually supposed; and I believe that the foregoing statement should encourage the fishermen of South Seeland and Smaaøerne to attempt salmon fishing along their coasts. When we consider the salableness of this valuable fish at high prices, and the comparatively small outlay for procuring the necessary apparatus, we shall see that not much of a return is required to make the fishery remunerative. At all events, the experiment, which so far as I know has not yet been undertaken in this direction, ought to be made. So far as concerns the statement of Malmgren that the salmon-fishery during the last ten years has increased considerably at Bornholm and on the North German coast of the Baltic, and his attributing

the increased supply of salmon in these places to the establishments for their preservation which have been instituted for the streams of Finland, this conclusion may, of course, be entirely justified; but so far as Bornholm is concerned, from which place I have recently obtained information from reliable men, I cannot omit adding a few words which are worthy of consideration in this connection.

It will be advantageous to distinguish between great salmon and small salmon (the last from 1 to 4 pounds). The first are caught almost exclusively in deep water by means of hooks; the latter, nearer to the shore in nets. The first are naturally the most valuable; the last, however, are salable at a weight of 2 pounds. Nevertheless it must be admitted that every measure looking toward the prevention of the capture of young salmon until they reach a weight of 5 or 6 pounds must be considered appropriate. Concerning the great salmon, the people of Bornholm do not recognize any advancement in the fishery in the last ten years; on the contrary, they maintain that there has been a decline, which manifests itself both in the yield and in the number of fishermen employed in the salmon-fishery. The last winter has indeed been somewhat better than the winter before, nevertheless it is said that many fishermen have not caught enough to repay them for the loss of apparatus. No new salmon boats have been built within the last year. Several decked boats have been reconstructed as well-boats for the cod-fishery (three from Nerøe alone), and the salmon-fishery, so far as these are concerned, must be considered ended. It is possible, they say, that the net fishery for small salmon may have increased somewhat of late years; but according to Skrydstrup, who wrote ten years ago (see *Nordisk Tidsskrift for Fiskeri*, vol. 2, p. 29), it was at that time unimportant, while at a still earlier period it was carried on more extensively. People do not now attach much importance to the belief that the decrease of small salmon is injurious to the fishery. According to my opinion, however, they mistake in this; and I find that there is every reason to recommend all contrivances that serve to restrict the capture of young salmon, and to postpone the fishing until the salmon are larger and heavier. In consequence of this I entirely agree with Professor Malmgren on the desirability of an international agreement for the prevention of the capture of young salmon in the Baltic. Although I do not overlook the difficulties in having the measures necessary to this end agreed upon and carried out, I think that much may be done by establishing a minimum size of mesh for the nets, whether they are used as set-nets or drag-nets, which will prevent the capture of small salmon under 3 or 4 pounds in weight. It seems that an agreement in this matter should not be difficult to reach. As for the efforts towards improving the Bornholm salmon-fishery by the aid of artificial hatching, the utility of this plan seems to be exceedingly doubtful, because of the circumstance already mentioned, that the island lacks rivers and contains only some small streams which are well enough adapted for the reception of trout but not for salmon.