152.—ARTIFICIAL HATCHING OF SALT-WATER FISH AND LOBSTERS IN NORWAY.*

By G. M. DANNEVIG.

[From his report on the London Fisheries Exhibition.]

I take this opportunity to report briefly what has been done in Norway, and what we intend to do if the necessary funds can be raised. The establishment for hatching salt-water fish is now (1883) in course of construction and will be completed in autumn. The ground covered by the building is 1,200 square feet. This building, besides affording room for machinery, an office, &c., will have room enough to place apparatus sufficient for holding about 80,000,000 eggs. It is intended to put the establishment into operation as early in the spring of 1884 as possible; that is to say, as soon as mature roe can be obtained. It is of course impossible to foretell the result, and I must therefore repeat what I have stated frequently: "The possibility of hatching fish eggs has been demonstrated so frequently that we need not entertain any doubt on that subject." How far local circumstances on our coast will prove a hindrance, and how far the hatching, if successful, will improve the fisheries, are questions that can be answered only by experience; and it is therefore desirable that the experiments should be made on so large a scale that obvious results may be obtained. The experiments will in the beginning relate only to cod, but later it is the intention to extend them also to other salt-water fish. But as it would seem like poor economy to let an establishment like the one under construction stand idle during nine months of the year, when mature roe of good food-fish can be obtained at almost any time, the experiments will probably be continued during spring and summer by hatching flounders, and perhaps mackerel. Flounders for this purpose could easily be obtained from Denmark; and there is reason to suppose that eventually we shall succeed in importing impregnated roe instead of the live fish containing the roe. Attempts in this direction will be made during the coming winter; and it should be kept in mind what an immense advantage it would be to be able to ship the impregnated roe of salt-water fish in considerable quantities at a small expense.

The hatching of lobster eggs, however, should especially engage our attention during summer, all the more as the gathering of the roe may be carried on to any extent whatever and with very little expense; moreover, we get the roe already impregnated, and ready for our experiments, which of course is a matter of no little importance. The question as to the possibility of hatching lobster eggs after they have been separated from the mother lobster I consider as satisfactorily solved

* Translated from the Danish by HERMAN JACOBSON.

by some experiments made by me last summer; and I will here give a brief report on the same.

On July 8 I took about 200 eggs from a lobster which I had for some time kept in a small fish-tank. About two-thirds of these eggs I placed in a glass of water, over the open end of which I tied a piece of gauze, and then suspended the glass in the sea, bottom upward. As the roe of the lobster is heavier than water, it of course sunk down and remained lying on the gauze, thus coming in the closest possible contact with the water underneath. The remainder of the roe I kept in a vessel in my room, changing the water several times every day. Later I took some eggs of both portions every day and examined them under the microscope, returning them again to the two vessels. The result was as follows:

At the first examination a faint pulsating motion could be observed in several eggs, but no separate organ whence this motion originated could be noticed. The general color of the young was light gray, with numerous sharply defined streaks, patches, and points of a bright red color. The umbilical sac, of a dark green color, took up the fore part of the body, and had a deep indentation along the line of the back. The eyes were large, dark blue, and motionless. There were indications of feet and feelers. The animal lay curled up in the egg, the distinctly split tail passing between the eyes. Later it was noticed that as the development progressed the umbilical sac decreased in size, while the red color spread more and more. The pulsating motion also increased, the center of this motion appearing to be in the hindermost portion of the fore part of the body. On July 17, nine days after the roe had been taken from the mother lobster, the shells began to burst, and I deemed my task accomplished; but unfortunately the principal difficulties began at this time. As I stated before, I had suspended the glass with the eggs in the sea, but I made the grave mistake of suspending it over a grassy bottom instead of a rocky bottom, which is the proper place for young lobsters. The consequence was that a large number of all kinds of small animals gathered under the glass and penetrated through the gauze covering to the eggs inside the glass, where they created considerable disturbance. Several times I was obliged to take up the glass and clean the eggs; but as none of them appeared to suffer, I determined to carry my experiment to the end without changing the location of the eggs. When the young had left the outer protecting shell the conditions were changed, however, and the small animals, which heretofore had been quite harmless, destroyed one young lobster after the other, until on July 20 I gave up all hope of getting a single one beyond the first change of skin, and therefore placed all that remained in glycerine.

Thus far, however, the result was satisfactory, as my opinion that lobster eggs can be developed after they have been taken from the mother lobster was completely confirmed; and I have every reason to believe

that this useful crustacean may be hatched on a large scale if care is taken simply to have sufficiently salty and pure water, which may easily be obtained by means of a filtering apparatus. The current should always come from below, so as to carry away the small animals which may develop among the eggs. As, however, I could not consider the question as completely solved before I had observed young lobsters able to swim, I sent the directors of the Arendal branch of the Norwegian Fishery Association a report of my experiments, with the request to grant me the necessary funds for continuing and completing them. I did not receive the desired grant, and the question must therefore still be considered as partially unsolved. There is every probability, however, that the project is feasible; and the best and cheapest way to promote the lobster fisheries will probably be to hatch large quantities of young lobsters and place them in the open sea as soon as they are able to swim, which point, I think, they reach during the first change of skin.

HATCHERIES.—If we examine the reports of the inspector of fisheries on the Norwegian fish-hatcheries, we find but little to encourage us. It appears that prior to 1875, 142 hatcheries had been established in the inland districts, but that in 1875 only 33 were in operation, and that in 1874 only 17 were stocked with roe.

From later reports it appears that during the period from 1875 to 1879 the statistics of the Norwegian hatcheries are as follows:

IN NORWEGIAN HATCHERIES.

Year.	Number of hatcheries.	Number in operation.	Hatcheries for which the number of fry is given.	Number of fry.	Hatcheries for which no data are given.	Estimated number of fry in these hatcheries.	Total number of fry.
1875–'76	22	14	10	457,000	4	183,000	640,000
1876–'77	24	17	12	373,000	5	185,000	528,000
1877–'78	27	17	14	456,000	3	98,000	554,000
1878–'79	34	22	18	611,000	4	136,000	747,000
Average	27	17–18	13–14	475,250	4	150,500	617,250

IN THE SALMON STREAMS.

1875–'76	31	23	20	1,432,500	3	214,900	1,647,400
1876–'77	31	21	21	1,058,500			1,058,500
1877–'78	31	15	13	816,800	2	125,700	942,500
1878–'79	32	19	17	887,000	2	104,400	991,400
Average	31	19–20	18	1,048,700	2	148,333	1,159,700

Briefly stated, then, the facts are that in Norway, in the course of the last 25 years, about 200 hatcheries have been established; that during the period from 1875 to 1879 there were on an average 58 in existence, and that of these 37, or a little more than one-half, produced young fish. The annual average number of young fish during the period referred to would therefore be 30,600 per hatchery.

The entire production of young fish, both salmon and other freshwater fish, is therefore only about 1,750,000 per annum. If we compare our results with those obtained in Canada and the United States, we find the following:

Country.	Number of hatcheries.	Number of young fish per hatchery.	Total number of young fish per annum.
Norway	58	30,600	1,777,000
Canada	11	1,956,400	21,520,000
United States	9	2,222,200	20,000,000

This table will show at a glance where our mistake lies. We have too many and too imperfect hatcheries; and if, moreover, as is often the case, they are managed by inexperienced persons, who receive no salary, and who can barely spare the time to superintend the hatcheries, these discouraging results will surprise no one.

If the 58 hatcheries which are in operation were reduced to 10, and if these were located in favorable places and properly superintended by experienced men specially appointed for the purpose, the results would be much better, without necessitating a much greater expense. It is of course understood that the superintendents of these hatcheries should receive a suitable salary.

153.—SALMONIDÆ IN AUSTRALIA.*

By G. M. DANNEVIG.

[From his report on the London Fisheries Exhibition.]

In examining the list of the different kinds of fishes which are generally brought to market in Tasmania, and which form the principal food-fishes of the population, we find the name "*Salmo trutta*," and in the column of observations opposite this name we read: "Imported from Europe; now found everywhere."

The facts are as follows: The salmonoids, which are numerous and common throughout the northern hemisphere, were altogether wanting in Australian waters. As early as 1841 their importation from Europe was thought of, which, however, owing to the slow mode of transportation, seemed an undertaking fraught with insurmountable difficulties. In 1852 the first attempt was made, when the ship Columbus (bound to Tasmania) took out from London 50,000 eggs of salmon and salmon trout. The attempt proved an entire failure. The high temperature to which the eggs were exposed caused all of them to die in a comparatively short time. The next attempt was made in 1860. Impregnated roe was sent out in January by the ship Curling, with a quantity of ice,

*"*Salmonider i Australien.*" Translated from the Danish by HERMAN JACOBSON.