

## ARTIFICIAL SALMON BREEDING IN SUTHERLAND.

HAVING heard from Baron Von Bunsen that the English exhibits in the Berlin Fishery Exhibition were painfully scanty, I wrote to my friend, Mr. H. Wright, secretary to His Grace the Duke of Sutherland, to ask him kindly to send over some illustrations of the Duke's salmon fisheries in Sutherlandshire. Mr. Wright has sent me a beautiful water-colour drawing, from the pencil of the Rev. Mr. Joss, of the Duke's salmon breeding establishment at Brora, together with a plan, etc., and the following interesting account. These exhibits are off to Berlin at once.

FRANK BUCKLAND.

The artificial breeding of salmon has been conducted on a large scale by the Duke of Sutherland since the year 1872.

The number of ova collected annually has varied from 600,000 to 800,000 (in 1873 it reached 1,105,000).

There are six or seven breeding stations, the largest being situated on Loch Brora. I send you sketch of Loch Brora breeding-house.

The hatching has been most successful, varying from 60 to 90 per cent. of the ova deposited.

Altogether an average of half a million of young fish have been distributed amongst the rivers of Sutherland.

Nevertheless the catch of fish at the various fisheries has not appreciably increased, but in several rivers the average weight has been raised by about 2lb. per fish. This is probably due to the introduction of the larger breeds of fish from the Tay, the Tweed, and the Rhine.

The mode of proceeding in collecting the ova from the parent fish is graphically described in Mr. Dunbar's report on the Duke of Sutherland's salmon breeding establishment for 1873, quoted from the foreman's notes, as follows:—

"When we are catching the fish to get ova, if we get a male fish with plenty of milt in him, and no female, we tie him to a stick or a bush in the water till we get a female; or if we get a female first we do the same with her until we get one of each sex. Sometimes we have to lead one up stream a long distance. We then put about 1½ inches of water in a pail and squeeze in the ova, or if there is much ova in the female we take part and give her a rest in the water, and apply some milt as quickly as possible. After the female has had a few minutes' rest we take the remainder from her into the same pail and apply more milt; then we let it stand for six or seven minutes before clearing off the milt. It is no use having too much milt, so long as there is enough to colour the water."

Upon one occasion, however, when considerable difficulty was experienced in finding "ripe" males, a quantity of milt was carried in a pail a distance of three or four miles. Females were then caught, and the ova impregnated by the milt turned out to be properly fertilised.

The ova are deposited in boxes, some of which contain gravel, but others are without. Practically, no difference is perceived in the results under these two conditions. The fish hatch out, and do as well in the one case as in the other.

The time at which the ova arrive at maturity varies according to the temperature of the water.

In the Brora houses the eyes begin to show in the ova in from fifty-six to sixty days, whilst in the Halladale house, where the water is soft and derived from a spring, and of a uniform temperature of 40deg. to 48deg. Fah., the eyes could be seen in thirty days, and in sixty-one days from the time they are deposited hatching commences, whereas in the Brora houses they take from 100 to 125 days on account of the lower temperature of the water.

A higher temperature than 50deg. Fah. is injurious, as it brings them forward too quickly, and the fish become sickly.

When the umbilical bag has become absorbed (about the month of June) the young fish are distributed amongst the various rivers. They are carried in pails, each holding from 3,000 to 4,000 fish, and are conveyed in carriages often forty and fifty miles. The water is changed as often as practicable—say every ten miles—and whenever the young fish show symptoms of languor they are revived by blowing air through the water by means of bellows. Perfect success has attended this operation, the loss rarely exceeding one or two per cent.