

## ROYAL SOCIETY.

DECEMBER, 1864.

IN order that the transactions of the Royal Society should present as complete a narrative as possible of the various attempts to introduce Salmon into the colony, the Council deem it advisable to print the following paper, which was read by Mr. M. Allport, on 5th August, 1862:—

The apparatus in which the Salmon Ova were deposited was placed between decks and was of two kinds—one hung on gimbals in the same manner as a mariner's compass, the other suspended on the principle of an ordinary swinging tray. Both were of wood,—the gimbal apparatus consisted of three shallow square boxes, one resting on the other, that on the top being the smallest and was fitted with trays, the bottoms of which were formed of parallel glass rods upon which the Ova were placed. The suspended apparatus consisted of a pyramid formed by three shallow square boxes placed one above the other in such a manner as to leave spaces between them, the lowest being four feet square, the bottoms of the trays in this being formed of perforated pure tin, on which rested one inch of gravel and in and upon the gravel the Ova were deposited. The suspended apparatus was varnished under the superintendence of Professor Pepper, Chemical Lecturer at the Polytechnic, the other by the Carpenter with common shell-lac varnish.

The water was admitted at the top of each apparatus and flowed from one tray to the other in such a manner that it entered at the bottom of one, gradually filled it, passed over the top to the next and out of the bottom of the second into a third, and so on, the object being that a stream of water might pass not only over the Spawn but under the glass rods in the one case, and through the gravel in the other; after passing out of the lowest trays the water flowed into receiving tanks and was again pumped up for use.

Two kinds of water tanks were used—one of wood lined with pure tin, the other of iron. For the purpose of cooling the water, 25 tons of Wenham Lake ice were packed in an ice-house, lined with lead, between decks. Above the ice-house, and partly on deck, was a wooden tank, lined with tin. This tank, like the ice-house, consisted of a double framework of timber filled in with charcoal. From this deck tank a pipe passed into and through the ice-house, thence into an iron tank, the top of which came through the bottom of the ice-house, and from the last-mentioned tank another pipe led to each apparatus.

The Ova placed in the trays (50,000 in number) was of various ages, the last having been taken from the parent fish on the 22nd of February, 14 days before the vessel sailed. In the ice-house a deal box was embedded (at the suggestion of a

friend of Mr. Youl's), containing wet moss and Ova; and Mr. Ramsbottom also placed in one of the trays in the suspended apparatus one fish just hatched.

On the 4th of March last the "Beautiful Star" left London, and on the 8th was compelled through stress of weather to put back to the Downs. The gimbal apparatus worked so badly that in this short period from six to seven thousand of the Ova died. The motion caused the Ova to roll backwards and forwards on the glass rods, bruising them against the sides of the trays and against each other. In addition to this, Mr. Ramsbottom perceived that the Ova were getting coated with a deposit from the shellac varnish, which was rapidly leaving the wood. The gimbal apparatus being clearly a failure, Mr. Ramsbottom carefully transferred the Ova from it into the suspended apparatus with a large spoon, in such a manner as never to leave it exposed to the air for an instant. On the 13th March the "Beautiful Star" left the Downs, and on the 16th the filler-in of the screw propeller was carried away, which compelled her to put back to Scilly for repairs. And here a new difficulty arose, the water from the iron tanks was found so impregnated with rust as to be coating both gravel and Ova with sediment. Mr. Ramsbottom had a rough filter made at Scilly which in a great measure remedied this evil. The vessel left Scilly on the 24th March, and encountered a furious gale in the Bay of Biscay on the 27th. Up to this time the suspended apparatus had worked well, but owing to the rapid pitching and rolling of the vessel and the weight of the apparatus it now became dangerous to approach it, and many times knocked against the beams of the deck overhead. This displaced the gravel in the trays destroying the Ova in large numbers and killing the one young Fish, which up to this time (23 days) had been in good health. To prevent this Mr. Ramsbottom fixed portions of an elastic india-rubber pipe, extending from the suspended apparatus to a weight on the deck below, and thus gradually checked the motion.

During the gale the bilge-water was dashed violently up the sides of the vessel between decks sprinkling the apparatus. This of itself would soon have destroyed the remaining Ova had not Mr. Ramsbottom's assistant covered the apparatus with blankets, and a recurrence of the same evil was prevented by lining the sides of the vessel with blankets and tarpaulins. Fine weather succeeded the gale, but it was manifest from the delays already experienced and the bad sailing qualities of the vessel that the ice could not hold out even to get through the tropics. At the end of April and beginning of May the temperature of the water began to rise and many of the Ova died on the point of hatching, a large number with the head of the fish protruding. On the 8th of May Mr. Ramsbottom, much against his will, was compelled to enter the ice-house to procure blocks of ice which he placed in the deck tank thus reducing the temperature of the water. After using a considerable quantity of the ice, Mr. Ramsbottom came upon

the deal box which had been placed in the ice-house, the lid being broken by the rolling about amongst the ice. Lifting out some of the moss Mr. Ramsbottom thought the Ova looked healthy, procured a vessel of clean water and placed Ova and moss together in it; to his utter astonishment he found 19 living and healthy Ova, which he carefully transferred to the trays in the suspended apparatus.

On the 17th May the ice was finished; on the same day the temperature of the water rose to  $65^{\circ}$ , and the last of the Ova died 74 days from the commencement of the voyage, and 88 days from the taking of the spawn from the fish. Towards the end of April from three to six of the Ova were hatched per day, and thirty of those hatched appeared in perfect health—one lived ten days. The Ova taken from the deal box in the ice-house lived nine hours longer than any of the others, and withstood a higher temperature. Before closing this short account of the voyage, I desire to express my conviction that no man could more earnestly have endeavored to carry the experiment to a successful issue than Mr. Ramsbottom, and I am personally indebted to him for the courtesy with which he has afforded me every information as to the cause of failure.

From the foregoing details, it is clear that however perfect the apparatus might have been the placing it in a vessel so unsuited for the purpose as the "Beautiful Star" was a fatal mistake. It was, in fact, consigning the Ova to utter destruction, and it would have been far better to have delayed the experiment till a suitable vessel could be found, even if we had waited five years.

The suspended apparatus is susceptible of very great improvement. It is so cumbrous and complicated as to be dangerous in a heavy sea.

The water had to flow over so large a surface in its passage through the trays from the top shallow box to the lowest that it rose  $3^{\circ}$  in temperature, a serious objection when we consider that every rise in temperature tends to hasten the hatching of the Ova. The two uppermost boxes of the suspended apparatus with a wider space between them, would have been far more manageable, as it would then have ridden clear of the beams; but I would suggest that even smaller and lighter boxes than these should be used, and that two or more sets might be hung in the space employed on any future occasion—the water being conducted to each by separate pipes from the ice-house.

Mr. Ramsbottom's father having observed that healthy Salmon Ova in their native rivers are frequently buried to a depth of eighteen inches in loose gravel, but that in such case there is always a current of water through the gravel, he arranged the trays and gravel in the suspended apparatus in such a manner as to imitate as nearly as possible their native beds in which spawn are deposited, and distributed the Ova amongst them and upon the gravel. Had it been possible to keep the apparatus steady, so as to communicate no other



motion to the water than that acquired by its own gravity, this plan would have no doubt succeeded admirably; but the rapid motion of the vessel caused such a disturbance in the water, and consequent rolling about of the gravel, as to bruise and kill most of those Ova buried in it, and to injure a large proportion of those resting upon it. An additional evil was, that the Ova so killed could not be removed without disturbing those on the surface; they gradually decomposed, and by tainting the water no doubt accelerated the death of the hatched fish, if not of the Ova.

To remedy all this Mr. Ramsbottom proposes to do away with the undercurrent altogether, to have only one layer of gravel, and to keep this layer fixed in its place by the very ingenious and simple contrivance of covering the bottom of the tray with wire loops between and amongst which the gravel rests securely packed. This wire should be of pure tin.

The arrangements for cooling the water were quite inefficient and caused great waste of ice. The water was led immediately from the deck tank by an iron pipe wrapped round with flannel into and through the ice-house and into the iron tank, the top of which protruded through the bottom of the ice-house. The water from the deck tank being comparatively warm soon melted the ice in the neighborhood of the conducting pipe, after which its temperature could not be materially altered in its passage through the ice-house. There was then a stream of comparatively warm water pouring into the iron tank at the bottom of the ice-house. The ice resting on this iron tank rapidly melted, letting down more ice to be melted as it came into contact with the tank till all above it was gone. That this action took place was fully proved, for Mr. Ramsbottom, on first entering the ice-house, found a vacant space extending from the top of the iron tank to the roof with the conducting pipe clear of ice.

This ought to have been foreseen and guarded against. No portion of the upper tank should be above the deck, as this must tend to increase the temperature of the water greatly. In the "Beautiful Star" it was impossible to avoid this as sufficient fall could not otherwise be obtained, but this is only an additional proof of her total unfitness. The pipe leading from the upper tank should be of small bore, several feet long and covered with some material, such as woollen cloth, which in the tropics could be constantly wet and from time to time powdered with some cheap deliquescent salt, the effect of which would be to reduce the temperature of the water materially before it entered the ice-house. The pipe upon entering the ice-house should first pass two or three times round the top of it on the principle of a worm in a still, and lastly once round the bottom, and thence directly, without the intervention of any tank, to the apparatus. I believe the upper tank might also be cheaply kept at a low temperature by the use of a moderate supply of deliquescent salt, even damping and the consequent evaporation would lower the temperature of the water a degree or two.

The water tanks should be of wood, lined with pure tin or with slates. The water from the iron tanks was filled with rust in a week, and, although filtered, is very likely to have held in minute suspension a considerable quantity of sediment. I strongly suspect that the slime so much complained of by Mr. Black in the former experiment was nothing but this deposit of rust, and not due to the presence of *confervæ* as supposed by him.

The water in the wooden tank lined with tin on board the "Beautiful Star" is as bright and well-tasted as on the day on which it was put on board.

Taking into consideration the pertinacity with which a portion of the Ova retained life for 74 days, in spite of the disastrous circumstances to which they were subjected on the recent voyage, I cannot doubt that salmon can and will be introduced into this colony. But to effect this no pains should be spared to obtain the services of a large clipper ship, and if the funds now remaining in the hands of the Commissioners are insufficient an appeal should be made to the Government of this and the neighboring colonies to supplement them. The Governments of Victoria and New Zealand have already borne a share in the undertaking, but the older colony of New South Wales has determined on trying the experiment for herself. I think it is to be regretted that the resources which might be made available for certain success should be thus divided, as success in this colony would at once ensure it in all others whose rivers are adapted for salmon.

