

- (4.) It is quite possible (as witness the narrow margin on the last occasion) that a shipment of ova might be unprocurable when required after fitting up the plant on board of a certain vessel.
- (5.) I was assured by the refrigerating engineer that the refrigerating-engines were run more during this voyage to cool the supply of water than when carrying a full cargo of mutton, and that the cost would amount to £3 a day. Of this the ova water took half.
- (6.) The fry cannot be reared in confinement, and any that hatched would have to be liberated in the ocean at once.
- (7.) The Shaw, Savill, and Albion Company most kindly, on the last occasion, gave the space required, allowed the vessel to call into Plymouth, and made no charge for the water-supply or cooling. In order to have any reasonable prospects of success it would be necessary to make a large shipment year by year, and the charges for the above obligations would greatly increase the cost of each shipment. The cost of transferring the plant from one vessel to another would be considerable, as it is very rarely that the same vessel would come direct to Port Chalmers on two successive trips at the right season of the year.
- (8.) The acclimatization of the herring presents an entirely different aspect to that of the turbot, lobster, and crab, inasmuch as it would be necessary to establish them around the coasts in such vast numbers as to create an altogether different class of fishing (drift-net) to any at present practised.

The Voyage.

As I had only returned from Plymouth the previous evening I did not join the "Waimana" until a little before sailing and whilst lying in the river off Gravesend. Owing to my absence since the previous Saturday I had been unable to supervise the final portion of the fitting-up of the fish-chamber. Everything was, however, in very satisfactory order. The "Waimana" left Gravesend at 3.30 p.m. on Saturday, the 11th January, and arrived off Plymouth at 6 p.m. next evening. During the passage down the Channel all tanks were thoroughly scrubbed out and the heavy deposit of Thames silt was got rid of. The coolers were tested, and the water for the herring-ova was brought down to 40° F. The shipment of lobsters, crabs, turbot, and ova were brought off by tender, and the "Waimana" left at 9 p.m. The temperature of the sea-water rose steadily, and by consistent watching no difficulty was experienced in keeping the ova and fishes at the desired degree. The fish and lobster water was allowed to rise to 63° F. for two days only, but as many of the crabs were somewhat distressed it was reduced to 56° F. and maintained at that throughout the voyage. The highest sea-temperature, 84° F., was reached in latitude 5° 47' N., and from this it steadily fell until reaching Cape Town on the 1st February. The water in the harbour was 57°. On leaving Cape Town the sea-water fell to 53° F. at 4.30 a.m., and rose to 61° at 9 a.m. and 71° at noon. For the next few days whilst passing through the Agulhas current the temperature was constantly varying and ranged between 72° and 62°. The water was somewhat cloudy at Cape Town. Before leaving the Agulhas current the temperature of the fish-water was reduced to 53°, a little below the usual 56°, so as not to cause too great a reduction on meeting the colder currents.

The lowest ocean temperature was recorded on the 13th February in latitude 47° 9' S., 96° 29' E. The experiment with the herring-ova was abandoned on the 14th February. The temperature gradually rose to 62° off the New South Wales coast, and then suddenly to 75° outside Sydney Heads. The vessel was detained in Sydney from the Friday evening to Tuesday morning. Captain Holmes and Mr. Arthur, Chief Engineer, had most kindly provided against this by filling two large clean ballast-tanks with sea-water. The sanitary pumps were changed over on to this supply on reaching the inner harbour, but on three occasions on the Saturday the pump lost its water and the supply-tanks became empty. The return of the water brought with it a deluge of rust and sediment each time, and it was decided to open the sea-cock slightly so as to keep the pump primed. The mortality whilst in the harbour was not excessive, but just before leaving all the stock was in a very low state; even many of the lobsters were lying over on their sides and backs and were quite limp. All soon recovered on receiving a liberal supply of sea-water.

The ocean temperature gradually fell, and when the coolers were shut off in Foveaux Strait the sea-water stood at 56.5° F. This was also the temperature of the water at Port Chalmers. The "Waimana" made fast to the wharf at Port Chalmers at 9 a.m. on Saturday, 1st March, after a prolonged passage of forty-nine days, and was met on arrival by Mr. G. M. Thomson, M.P., Mr. L. F. Ayson, Chief Inspector of Fisheries, and others. The large claws of the crabs and lobsters had already been secured, and they were at once conveyed to the ponds at the hatchery by the station launch, packed in the same baskets in which they were brought on board. The turbot were removed from the large tanks by means of small muslin nets, and transferred in large tubs to the tanks at the hatchery by the s.s. "Tarewai."

The cooling plant was designed and constructed by Messrs. J. and F. Hall, of Dartford, Kent. This consisted of two upright iron cylinders, each 4 ft. 6 in. high by 20 in. diameter. Each of these contained two coils of 1½ in. black-iron pipes. The sea-water was led into these at the top and escaped at the bottom, where a self-registering Kew-tested thermometer was fitted to show the temperature of the water. Each cylinder had two separate three-way cocks for the control of the flow of brine, and these were so arranged that the flow of brine could be reversed in the event of the water nearest the intake becoming frozen; it was, however, never necessary to do so. Mr. H. J. Ward, the manager of Messrs. Hall Limited, took a great interest in the experiment, and allowed one of his staff to accompany the vessel to Plymouth so as to see the plant in working-order. The brine system was so arranged that it could be turned on to the chamber itself if necessary, but this was not resorted to, as it was found that by keeping the door closed the temperature inside the room rarely exceeded 56° to 60° F. The plant proved as effective as