detected by subsequent examination of the eggs collected; and, from the practical point of view, it would be of little importance so long as the period of incubation approximately corresponds in the two cases, and the fry are to be placed on the same grounds. Sperms, no doubt, might occasionally pass, by their own movement, from one compartment to the other by the route indicated; but there is little apprehension on this account, as it is pretty certain, from the observations made with the plaice, that the eggs are impregnated by the attendant male at the moment of their ejection.

The Lemon Sole (Pleuronectes microcephalus).

This is one of the most valuable of the flat-fishes in Scottish waters. The spawning season extends from the end of April or beginning of May to the beginning of September; the spawning is greatest in July. While the "Garland" was carrying on her ordinary trawling-work, such specimens were preserved alive as seemed suitable for hatching purposes, and as many of these as could be accommodated were placed in the tidal pond. It was decided to collect the eggs of this fish in the tidal pond, and for this purpose a special arrangement has been made.

7. The Treatment of the Fry.

With the present arrangements, it is necessary to transfer the fry directly from the apparatus in which they are hatched to the fishing-grounds where they are to be placed, without the intervention of a period in rearing-ponds. The larval fishes, after emerging from the eggs, are retained in the hatching-boxes until the yolk is nearly absorbed and they are capable of eating; but without large enclosures, such as exist in pisciculture establishments for freshwater fishes, no attempt can be made to feed them; they are therefore placed in the sea while they are still in the larval stage. At this period, it need scarcely be said, the fry of flat-fishes resemble those of round fishes, such as cod or haddock. The eyes are placed one on either side of the head, and the body is symmetrical. The characteristic appearance of a flat-fish is absent; it is only after an interval of two months or so, which are passed in the surface waters, that this flattening is completed, and the young creature acquires the form and habits of the adult, and becomes fitted for life on the bottom. There can be no question that the destruction of the young from natural causes during this period of pelagic life is very great, and that a great step in advance would be made if it were possible to protect them artificially until they were about to complete the transformation which adapts them for a bottom life, and enables them to secure natural protection by resemblance to the ground on which they lie, and by burrowing. They are still, at this stage, very small, and multitudes could readily be dealt with. For the purpose of thus dealing with them it is necessary to have control of a large body of water, such as is shown in the sea-creeks on the plan (Fig. 1), in which many millions of fry could be simultaneously reared for the necessary period before planting them on the fishing-grounds. The supply of food naturally existing in such a volume of seawater could be largely increased by keeping various invertebrates, at the time when they are spawning, in tanks shown at A on the plan (Fig. 1). A reference to the plan will show that a flow of water from the spawning-pond could be maintained through these tanks into the creeks, which would thus receive a constant supply of water charged with embryos and minute organisms, upon which the young fishes live. The rearing of the young fishes in this way for a few weeks would very greatly increase the usefulness of the hatchery to the fishing industry.

8. The Capacity of the Hatchery.

The present hatching-house contains, as has been stated, sixteen of Dannevig's hatching apparatus, each of them capable of accommodating at one time about 5,000,000 cod-eggs, or 80,000,000 altogether. Since, during the continuance of the spawning season of any species, the hatching-boxes may be refilled at least twice—newly collected eggs replacing the fry which have been hatched and removed—the capacity of the present hatching apparatus may be stated as equal to about 160,000,000 cod-eggs during one season. Plaice-eggs are larger than those of the cod (about 1·6 mm. compared with 1·2 mm.), and a smaller number go to a box, but the number that might be dealt with in the course of the season may be stated at about 100,000,000. The eggs of the sole are about the same size as those of the cod, and those of the lemon sole and turbot slightly smaller, so that the working-capacity of the present apparatus in the course of a year may be put down at several hundred millions. Further, in arranging for the more costly parts of the hatchery care was taken to provide for sufficient water-supply and spawning-space for a much larger number of hatching apparatus. Dannevig's experience at Flödevig is that about 92 gallons of water are required per hour for each apparatus—that is, for about 5,000,000 cod-eggs. For sixteen apparatus the supply therefore requires to be about 1,500 gallons per hour, and, adding 800 gallons for the spawning-pond, the total quantity for 80,000,000 cod-eggs is about 2,300 gallons per hour. The pumps are, however, capable of throwing over 7,000 gallons per hour, and thus the quantity of spawn that may be dealt with may be more than doubled by a comparatively inexpensive extension of the hatching-house and increase in the number of apparatus.

The first year's work, so far, has been satisfactory. The boiler, pumps, water-wheel, and all the apparatus have been in continuous use without any hitch occurring; and the filtration of the water was accomplished without much trouble, and it has proved eminently suitable for hatching-work. The greatest difficulty, as has been said, was in procuring supplies of spawners in time to take full advantage of the spawning season. At the sea-fish hatcheries in the United States, Norway, and Newfoundland ample accommodation has been provided for large numbers of spawners—at Woods Hole, for instance, as many as 3,000 adult cod have been accommodated at one time. Thus, by obtaining, before the spawning season begins, the full number of adult fishes required to keep the hatchery going at its full working-capacity, the number of fry produced may be very largely increased, and at a trifling additional expense, since it costs almost as much to produce 50,000,000 as it does to produce 200,000,000.

(Diagram of Dunbar Fishery attached, Plate I.)

Woods Hole Marine Station, Mass. (Superintendent, E. F. Locke.) (Plate III.)

This hatchery is situated in a sheltered bay protected by an island outside. The following are the kinds of fish propagated there: Cod, lobster, flat-fish, tautog, sea-bass, and mackerel. In 1896 the number of eggs collected from all species amounted to 225,950,000, and the number of fry planted from these eggs was 165,284,000. Water for the hatchery is pumped up to a cistern with a 12-horse-power engine. The cistern holds 18,000 gallons, a quantity sufficient to supply the boxes with water for twenty-four hours, in case of repairs having to be made to the machinery. The bottom of the cistern is 6 ft. above the top of the boxes, so as to give the pressure required.

Fish of the different kinds dealt with are either netted by the United States Commission steamers or purchased from fishermen, who are paid a fair price to land the fish alive at the station. On arrival there the cod-fish are confined in crates which are moored inside a pond protected on all sides by a wharf, which breaks the force of the sea in stormy weather, and affords a sheltered place for handling the fish when taking the eggs.

The process of taking the eggs is similar to stripping trout or salmon, with this exception: that the eggs of the Salmonoids all separate from the ovaries at the same time, and the fish are stripped at the one operation; whereas cod only yield part of their eggs at a time. The mature eggs are taken, and the fish turned back once more into the crates, and in a few days they are stripped again. When the ovaries have discharged all their eggs the fish is released into the ocean. Of the cod-fish penned annually in the protected basin at Woods Hole only about a quarter yield good eggs. The dry method of fertilisation is generally used.