

- (2) The trays must be at very low level—just about 1 ft. above the low-water level of mean spring tides.
- (3) Heavy-gauge material, well galvanized, is necessary for the grid of the tray, and the frame and supports must be as teredo-proof as possible.
- (4) Oysters must be removed and sold as soon as possible and a fresh crop of poor stuff put on the tray, so as to get as many crops as possible.
- (5) Trays must be in deep enough water to ensure that even at their low level there is at least 2 ft. clearance under them. This is a difficult problem in many of our waters, as one cannot block up any fairways with trays, and unless one gets into the fairway it is impossible to get the required working-depths. Manaia is the only place I know where all these conditions prevail."

It is proposed for the time being to concentrate the experimental tray-work at Manaia, as this locality shows most promise of successful results being obtained. The concentration of work at one place will also facilitate more frequent surveillance and observation.

An experiment is being conducted to ascertain the effects of transplanting rock-oysters to a position below the level of low tide.

The conclusion arrived at from experiments in collecting oyster-spat on stakes (which is carried out commercially in Australia for the provision of oysters for fattening on trays) is that success is dependent upon utilizing timber that will retain its bark in salt water for at least three years and at the same time be resistant in teredo ("ship-worm"). All the experimental stakes which we have so far tried have failed to fulfil these requirements. It may be possible to overcome this difficulty by using stakes made of fibro-cement or coated with cement, and it is proposed to try this out on an experimental scale.

An all-important practical consideration with regard to this cultivation work is the question of the cost of material and labour. Due regard to this point is being paid in all the experiments conducted.

The concrete slabs placed at various "stations" early in 1930 to enable more definite observations to be made, both on the natural development and ecology of rock-oysters and on the effects of various cultivational treatments, have been examined periodically. Some interesting records have been made, but it is too early to draw any conclusions at this stage. There are eighty-four of these slabs in the Hauraki Gulf, fifty-four on the Coromandel Beds, forty-eight in the Kaipara, and thirty-six in the Bay of Islands.

#### MARINE FISHES.

Measurements of commercial catches and observations on the food of snapper in continuation of the work done in previous years have been made by Captain Daniel as opportunity offered in the course of his fishery patrols. He has also carried on tow-netting during the spawning seasons of snapper, flounders, and dabs in continuation of his previous work to determine the distribution of the floating eggs of these species. In the course of this work he has found anchovy-eggs occurring in some abundance between Waiheke and Kawau. This is the species the young of which, together with young sardines at the same "post-larval" stage, as mentioned in last year's report, provide a "whitebait" fishery off Northcote, in Auckland Harbour, when the young fish at a size of about 2 in. migrate to shallow waters.

In connection with the study of the flounder and dab fisheries of the Hauraki Gulf Captain Daniel is also making records of the condition with regard to sexual ripeness of fish taken by the fishing-vessels. He has also collected samples of otoliths from flounders and dabs for study by the Marine Biologist with a view to determining the age and growth-rate of these species. These points have an important bearing on the problems of depletion and the question of size-limits.

An interesting variation in the incidence of spawning has been observed in the past year. In 1929 the flounders (*Rhombosolea leporina*) were about a month earlier than the dabs (*Rhombosolea plebeia*) in their spawning, and were mostly spent by the end of September. In 1930 the spawning of the dabs preceded that of the flounders.

*Statistics.*—Besides conducting the oyster observations and experiments and dealing with the biological material from the Hauraki Gulf fisheries above mentioned, the Marine Biologist, Mr. M. W. Young, has devoted much time to the tabulation and study of statistical material from fishermen's log-books and other commercial returns.

#### WHITEBAIT INVESTIGATIONS.

During the year Captain Hayes has continued his observations of the spawning of *Galaxias attenuatus* on the Manawatu River, to which reference was made in my last annual report.

We now have a record of continuous observations of the spawning of this species in the Manawatu from March, 1930, till May, 1931. The following are the periods in each month when spawning has taken place, the ova being deposited among the herbage on the banks of the estuary above the level of high water of ordinary tides:—

- 1930—March 17th and 18th (full moon on 15th); April 13th, 14th, and 15th (full moon on 13th); April 29th and 30th (new moon on 29th); May 13th, 14th, and 15th (full moon on 13th); May 29th and 30th (new moon on 28th).
- 1931—January 8th, 9th, and 10th (full moon on 5th); February 6th, 7th, and 8th (full moon on 3rd); March, 7th, 8th, and 9th (full moon on 4th); April, 5th, 6th, and 7th (full moon on 3rd); April 19th and 20th (new moon on 18th); May 4th, 5th, and 6th (full moon on 2nd); May 19th and 20th (new moon on 18th).

It will be noticed that in relation to the dates of full moon or new moon (or the theoretical dates of the highest tide consequent upon these phases) spawning activities in 1931 were later than in 1930. This is ascribed to the fact that the spring tides of 1931 were higher than average, presumably owing to meteorological conditions.