

'This anglers' paradise of ours was created about seventy years ago by the pioneers of trout acclimatization, but almost the entire responsibility for its maintenance (*i.e.*, the provision of suitable habitats in our numerous streams and lakes with conditions favourable for the propagation of new generations of trout and for their adequate nourishment at all stages of growth) fell upon a generously responsive Nature—Nature that remained for many years in a state primeval and unspoiled. But this is no longer the case; and this is the reason for the increase in the difficulties connected with fishery maintenance, difficulties that are also intensified by the great increase in the number, skill, and mobility of our anglers. Some of the difficulties arise from factors inimical to the maintenance of ideal fishing-waters that are inevitable and unavoidable as occupation and cultivation of lands and industrial developments bring about changes in the character of water-sheds, river-beds and banks, and, in degrees that vary from place to place and from time to time, in the flow and quality of the water itself. It is necessary, however, to distinguish between changes that are inevitable and those which could be minimized, if not entirely avoided, by taking thought and taking steps based on understanding.

Pollution of Rivers.

A great deal of the pollution that has found its way into some of our fishing-waters from sawmills, dairy factories, abattoirs, wool-scouring works, sheep-dips, and other sources of noxious or putrefiable material could have been avoided, and probably would have been avoided, if those responsible had been aware of the harm they were doing and had been given any guidance as to methods of dealing with their trade wastes otherwise than by letting them go into a conveniently adjacent stream. One might almost say that such mischief has been done absent-mindedly. For very many years there have been laws and regulations, on paper, which prescribe penalties for pollution, but they have been largely unaccompanied by any provision by which offences may be detected. Polluting effects which may bring about a considerable degree of deterioration in a fishing-water often act insidiously over a long period and are not detectable as a poacher who takes fish by illegal methods is detectable. To penalize after an offence has been committed and proved is, in any case, not the ideal way of dealing with the problem, but it is the only way of dealing with it for which legal and administrative provision has been made up to the present.

A not inconsiderable part of the work of our District Inspectors has been the observation and study of existing sources of pollution, taking prosecutions where clear evidence of material damage is obtained. Our main object, however, has been to find out by what practicable methods the pollution can be prevented, and advising accordingly. There is much work still to be done in this direction. However, with accelerating industrial development, it would appear that the time is ripe for giving consideration to legislation by which those who are contemplating the establishment of any plant that will produce waste material that would be detrimental if allowed to find its way into a neighbouring stream may be required to make in their plans satisfactory provision for the disposal of their wastes so that the stream may not be contaminated or liable to contamination.

RESEARCH.

Fresh-water Fisheries.

The two fresh-water biologists on the staff of the Fisheries Laboratory have continued their investigations along the lines described in the annual report for last year. A second report by Mr. D. F. Hobbs, which is in the press as Fisheries Bulletin No. 8 at the time of writing and will probably be issued before this report is printed, is on "Natural Reproduction of Trout in New Zealand and its Relation to Density of Population," and gives the results of a continuation of the research which was the subject of the paper published in 1937 as Fisheries Bulletin No. 6. It describes observations on the natural reproduction of brown and rainbow trout in 64 streams belonging to 10 river systems in Southland and in the North Island. From a study of losses up to successive points of development among the ova or alevins (trout larvæ) in samples from 542 redds, estimates have been made of approximate mortality of embryos until hatching and of larval fish until their emergence from the shingle or gravel of the stream-bed as fry. It was ascertained that, as observed in the river systems previously studied in Canterbury and Westland, the losses were generally low. Percentage losses of ova ascertained from 9 river systems were 3.2, 4.6, 5.5, 6.1, 6.8, 9.4, 11.4, 12.9, and 29.3. Larval mortalities were found to be very low, the dead recovered amounting to 0.27 per cent. of 141,935 specimens. Additional losses, not measured, may have occurred through the removal of ova and larval fish from redds either by flood action or by later spawners. The depth at which eggs are buried, the stability of areas selected for oviposition, and observations on sample series of redds indicate that most eggs are safeguarded from the effects of normal floods.

The conditions trout require for spawning are very special and, rather than spawn in unsuitable places, late spawners will use sites previously used by earlier fish. In congested spawning areas losses result from the precipitation of silt in old redds, the diversion of current from them, and from the dislodgment of older eggs as more fish spawn.

In the later part of his paper Mr. Hobbs discusses the factors capable of controlling the density of a population of fish or other animals. He shows that trout in New Zealand have become established where satisfactory facilities for reproduction exist. Since, whether artificial stocking is still regularly carried on or not, stocks in all the streams examined have increased to a stage where the numerical abundance of mature fish is such that all available spawning-grounds are so intensively used that a proportion of redds are superimposed on earlier ones, with attendant loss, it is inferred that introductions of trout have been successful largely according to the extent to which facilities for reproduction exist. It is pointed out that cases were not found where growth of population had been arrested before losses by superimposition commence. The inference is made that this is an indication that

* In the Rotorua and Taupo districts the functions of an acclimatization society are exercised, under the authority of the Animals Protection and Game Act, by the Department of Internal Affairs, which also has special powers and duties in connection with the waters and fisheries of those districts under statutes passed with regard to Native lands.