

White-throated shags: (1) Crab, shrimps, and flounder; (2) three flounders and one bully; (3) three small fresh-water crayfish; (4) two fresh-water carp (*Carassius*); (5) empty.

The stomach of one small black shag (immature form of the above) examined was found to be full of shrimps, of which fifty whole undigested ones, besides fragmentary ones, were counted.

Summarizing results for these ten individuals of the small pied species we have: Five (50 per cent.) had eaten fish, five (50 per cent.) had eaten crustacea, and one (10 per cent.) was empty.

Three out of the ten had evidently resorted to the fresh-water for their hunting, although actually shot on the shores of Kaipara Harbour. It seems probable that the shags of this species may be regarded as a somewhat minor factor among the agencies adverse to the Kaipara fisheries. They are apparently just as partial to shrimps as to flounders, and are in the habit of picking up a living in fresh-water haunts, which in this part of the Dominion are of little or no interest to the trout fisherman. Above all, however, it may be said that, although by no means uncommon, the small pied and white-throated shags are not so numerous in the Kaipara Harbour district that they need be regarded as a serious menace to the fisheries.

The case is different with regard to the large pied shag. This species is abundant and might perhaps be truly considered as the commonest bird inhabitant of the Kaipara Harbour. It eats far more of the commercially important flounders and mullet than of the other fish less esteemed as human food, and its voracity is indicated by the size and quantity of fish taken for a single meal. The following are examples from the records of our operations: Two 4 in. flounders and two 6 in. mullet; one mullet, 12 $\frac{3}{4}$  in.; two mullet, one 10 in.; one mullet, over 14 in.; flounder, 9 in. long. The argument may be used—I myself put it to the fishermen—that shags have probably always been numerous in the Kaipara, while the shortage of flounders is a comparatively recent state of affairs, and is probably largely due to the operations of the fishing industry. However, granting that this is correct, we must admit that when the flounder population of the Kaipara Harbour was at its maximum the number of young produced was so enormous that a great deal of thinning out by predators such as shags was negligible or even beneficial to the stock. However, the flounder population of the Kaipara fishing-grounds is no longer at its maximum, but has been considerably depleted; therefore, the same vast quantities of young can no longer be produced. It follows then that the continuous depredations of a large shag population must constitute a proportionately larger drain upon the supply of marketable fish. I think that so far as the Kaipara is concerned it is impossible to conclude otherwise than that the flounder fisheries would be to some degree improved if the large pied shag population were considerably reduced. What are the approximate ratios between the total available flounder stock and the proportion which go to feed the shags on the one hand and to feed human beings on the other hand is a question to which an answer cannot be attempted until more investigational work is done. In the meantime our policy should be to get systematic evidence as to the actual abundance and distribution of these birds and as to their feeding habits throughout the year, as well as biological and statistical data about the fisheries. Any shag-killing operations which are undertaken should be organized with these ends in view, and should not be left entirely, if at all, to the guns of casual sportsmen or the fishermen's intermittent guerillas. Those with a due sense of responsibility will require facts in the first place, and slaughter only so far as it is justified by the facts. Those who are concerned as to the possibility of the extermination of this shag may rest assured that there is every indication that the pied shags of the Kaipara will hold their own for a very long time against the sort of intermittent warfare which has hitherto been waged against them. And if organized operations under proper authority are undertaken they would stop short as soon as the numbers of shags had been reduced to reasonable proportions.

With the full concurrence of the Marine Department two relatively rare species of marine shags—namely, the Stewart Island shag (*P. stewarti*) and the bronze shag (*P. chalconotus*) have recently been placed on the list of absolutely protected birds under the Animals Protection and Game Act by Order in Council dated 24th April, 1930.

#### FRESH-WATER RESEARCH.

Further noteworthy progress is to be recorded under this heading. The investigations upon trout problems made under the auspices of the Wellington and North Canterbury Acclimatization Societies were mentioned in last year's report. These local efforts have stimulated the interest of other societies concerned with the well-being of trout-fishing. At the conference of the New Zealand Acclimatization Societies Association, held in September, 1929, resolutions were passed by which a scheme was formulated for the co-operation of acclimatization societies throughout the Dominion in the work of fresh-water-fishery investigation. The societies represented at the conference undertook to contribute funds in proportion to their revenues and a central research committee was appointed to organize and supervise researches. This committee is as follows: Mr. L. O. H. Tripp, Wellington; Mr. M. H. Godby, North Canterbury; Mr. G. Howes, Otago; Mr. A. E. Heford, Chief Inspector of Fisheries (Chairman); Professor E. Percival (Director of Research); Mr. D. F. Hobbs (Research Secretary); Mr. E. J. C. Wiffen, Wellington (General Secretary).

It is hoped to secure the active and financial participation of the Government Departments (Marine and Internal Affairs) that are interested in fresh-water fisheries.

Those who have given any consideration to the question recognize that up to the present all the activities of the various bodies which have had to do with fresh-water fisheries in the Dominion have been pursued with a lack of scientific understanding of the conditions prevailing in the rivers and lakes under their control. It may be said in extenuation that this absence of scientific light was until recently fairly universal, and was not confined to New Zealand. In the older countries the conditions were more stable and the balance of nature already established. Nevertheless, organizations for research have been in active operation for some years in the fishery departments of all the civilized countries of the world. Here in New Zealand we have nature's balance thoroughly upset by the introduction of new predatory species in the form of different varieties of salmon and trout, and from