

THE RELATION OF BIRDS TO AGRICULTURE IN NEW ZEALAND.

IV. THE INSECTIVOROUS SMALL BIRDS.

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AMONG the bird inhabitants of any country there is a certain number of kinds of small birds which live entirely on insects and other small forms of life, without exhibiting any failings which might detract from the benefits they confer on agriculture. The present article deals with some dozen species of indigenous birds which in this manner represent a summation of all that is beneficial in bird-life so far as the war against insect pests is concerned.

In Canada there has recently been secured exact numerical evidence of the value of insectivorous birds (Dunstan, 1922). The white-marked tussock-moth (*Hemerocampa leucostigma* S. and A.) is perhaps the worst pest of shade trees of all kinds throughout eastern Canada. In an investigation into methods of control it was found that "the type of infestation in the cities differed greatly from that found in the woods"—that is, under natural conditions. In the cities periodic outbreaks, in which the caterpillars appeared as a veritable plague, seemed almost inevitable, but in the forest "the insect was always present in small numbers, evenly distributed, but never in a state of outbreak." To ascertain the cause of this surprising difference a year was spent in the woods, and the insect studied under natural conditions from egg to adult. The insect passes the winter in the egg stage, in masses deposited on the branches of trees and in crevices of the bark, and it was found that a very large percentage of these egg masses was searched out and destroyed by birds. In the cities, on the other hand, in the absence of insectivorous birds, the egg masses went almost entirely free. To obtain an accurate estimate of the part played by birds in thus helping to keep this pest in check, caterpillars and pupæ (resting stage) were exposed and watched. On the basis of these experiments it was demonstrated that over 80 per cent. of the eggs laid under natural conditions were devoured by birds. Nor did their work cease here, for over 11 per cent. of the caterpillars which hatched from the surviving eggs were discovered and eaten by the same assiduous searchers. Finally, of those caterpillars which escaped to spin their cocoons, 30 per cent. were destroyed by predaceous enemies, among which the birds were of no mean importance.

Such a case as this is typical of the activities of the insectivorous birds. They are to be ranked among the greatest of those forces which tend to restore the balance of nature when a favourable set of circumstances has allowed the abnormal increase of any particular insect pest. Since the whole of man's relation to his environment may be summed up as an upsetting of the balance of nature and an attempt to escape the consequences, it follows that the insectivorous birds must be ranked among his most efficient allies, without which, in the long-run, it is difficult to imagine how vegetation could survive.