

directly or indirectly fresh-water insect life; I say indirectly because the larger fish may feed on smaller fish which, in their turn, feed upon the insect life. This reminds me of the cycle which I learnt when as a student of zoology I was studying marine zoology in the Irish sea, indicating how man indirectly feeds upon mud. Mud forms the food of diatoms, which, in turn, are eaten by small marine molluscs and crustacea, and upon these the fishes great and small feed, both directly and indirectly; finally man eats the fishes. Thus nutrition links up the chain of organic life and we see how dependent we and other forms of life are on lower or intermediate forms.

Fresh-water insects are chiefly confined to the shallower portions of fresh water. Here we find the larval stages of May-flies, caddis flies, dragon-flies, stone-flies and water-beetles, etc. They are comparatively soft-bodied and are readily eaten by fishes, both young and old. In the deeper waters, the species differ. Here the larvae of the Chironomid gnats may be found usually in the mud. Some of these Chironomid larvae have been called 'blood-worms' on account of their red colour. The free swimming colourless larvae, known as 'Phantom larvae,' of the *C. thra* gnats are found at various depths. The majority of these insect larvae show various modifications of structure and function which enable them to lead the aquatic life to which they have become adapted. Except in the case of water-beetles and certain water-bugs, they cannot breathe the air and so their respiratory apparatus has been modified in such a manner as to enable them, like fishes, to breathe by means of gills. Some are provided with rows of leaf-like gills, others with filamentous gills; the bodies of some are flattened and they cling to stones, others such as the *Trichoptera* larva or 'caddis worms' shelter their soft, and to the fish, succulent bodies in protective cases of varied and amazing design and construction. The assumption of an aquatic life has led to the development of extraordinary methods of feeding, respiration and protection.

All aquatic insects are by no means useful in relation to fish culture. Certain of them on account of their carnivorous habits are positively inimical. The fierce larvae of the *Dytiscid* water-beetles with their claw-like sucking jaws dearly love a juicy young fish, and certain of the water-bugs will not hesitate to attack young fishes several times their own size. When they do not prey upon the fishes themselves they devour their more defenceless insect congeners.

The extent to which fresh-water fishes feed upon aquatic insect life will be apparent to any fisherman possessing a little knowledge of insects, if he will only examine the contents of the stomachs of such fish as the trout. In this connection,

Insect Food
of Fish