Trout Culture in Ceylon

THE recent treatise of Mr. Philip Fowke, Superintendent of the Ceylon Fishing Club's Hatchery at Nuwara Eliya, on "Trout Culture in Ceylon"[1] should prove of special interest for all connected with Trout Culture in India. The work is of special significance as it is the first of its kind that deals in a comprehensive manner with trout culture in Indian waters (*sensu lato*); the information regarding the cultivation of trout in these waters so far published is contained in a number of short and scattered articles in various journals and is not easily available.

The author has confined himself to the culture of the Rainbow Trout, as Brown Trout are not bred in the Ceylon Hatcheries, partly owing to the comparatively higher temperature of the water, but mainly owing to the fact that in Ceylon the cock and hen fish are never in season at the same time. The latter is a very important point for pisciculturists, as workers are liable to fertilise ripe ova with unripe milt with disastrous results.

Mr. Fowke deals with the culture of the Rainbows in eleven sections: Introduction of Trout in Ceylon, Spawning and Stripping, Hatchery, Nursery Ponds, Conditioning and Transport of Fry, Transport of Eyed Ova, Care of Streams, and finally, the Wanderings of the Rainbow Trout. After giving a brief description of the Nuwara Eliya Hatchery and how Trout were introduced in Ceylon, the author discusses in detail the spawning and stripping operations and gives an account of the origin and history of artificial fertilisation and up-to-date hatching methods. He directs particular attention to the desirability of removing dead eggs daily before eyeing without disturbing or injuring the remainder, as this has been the main reason of the great success of piscicultural operations with the Rainbow Trout in Ceylon.

In the section on Mortality of Trout, a brief account is given of the various diseases that attack young and old fish in Ceylon. This subject, although widely studied in America and Europe, has, owing to the lack of research facilities in the hatcheries, received very little attention in India. The account of the construction of Fry and Nursery Ponds, Conditioning and Transportation of Fry and Ova, though mainly based on the conditions in Ceylon, should prove of value to pisciculturists in various parts of India also. The great success achieved in transporting fry without changing the water in Ceylon is very interesting.

In the section dealing with the care of streams, the outstanding features are the choice of waters for the Brown and the Rainbow Trouts, the methods for providing and conserving food and the marking of fish for studying their movements, growth, etc. Special reference is necessary to the observations on the wanderings of the Rainbow Trout in Ceylon. It was till recently a puzzle to all trout culturists in India as to why the Rainbows disappear from all waters. The author has now shown that what is regarded as the freshwater Rainbow is in reality a different species, the *Salmo rivularis* or *gairdnerii* or the steelhead which is an anadromus fish. The number of lateral line scales, which, according to the author, is a character of considerable diagnostic value, serves to distinguish this species from the purely freshwater *Salmo shasta*. It would thus appear that the disappearance of Rainbow from Kulu and some of the Kashmir Trout streams may in reality be due to the instinctive migratory habits of the species, as all the Rainbows introduced in India proper are the progeny of the same stock. The author suggests that efforts shoud be made to produce a strain of Rainbows from which the wandering instinct has been eliminated, but before any step is taken in this direction it is important to determine the nature and extent of the wandering of the species. In this connection, it is very significant that the U.S. Bureau of Fisheries, in co-operation with the State of California, is rearing several strains of Rainbows in the hope of eliminating the wandering instinct. In this connection, a question arises as to which factor or factors determine the wandering habit of this species, since it spawns freely in fresh-waters and also finds plenty of suitable food in this *milieu*.

The descriptive account is accompanied by a number of beautiful illustrations of filtering, hatching and distributing troughs; pools, lakes, fry and nursery ponds, etc.,

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[1] *Ceylon Jour. of Sci.*, Sec. C, *Fisheries*, Nov. 21, 1938, 6.

and a layout plan of the Nuwara Eliya Hatchery. The author is to be congratulated on the production of a treatise which should not only be of great interest to all those interested in Trout Culture in tropical waters, but also serve as a work of reference in all Trout Hatcheries.

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Larvicidal Fishes and Their Identification

MALARIA is one of the major scourges of India and its prevention and cure have engaged the attention of the Medical and Public Health authorities in India for well over quarter of a century. The problem of the prevention of Malaria is many-sided, but from the time of the discovery by Sir Ronald Ross that the Anopheline mosquito was the carrier of the malarial parasites, it has been the aim of the authorities to control the incidence of Malaria by controlling the breeding of the carrier-mosquitoes in various ways. It has been known for many years now that some species of Indian freshwater fishes have a special preference for mosquito larvæ as food, and that their introduction into tanks, ponds and wells would go a long way to control the mosquito population in the neighbourhood of human dwellings. Medical men naturally turned their attention to the fishes of the aquatic areas in which mosquitoes bred, but found themselves in difficulties in the identification of the fishes. The only standard works on the Fishes of India were none too easy to refer to, burdened as they were with a mass of technical details, and the result was that fishes were often wrongly identified, sometimes not at all. The medical man, who is a field-worker interested in the control of Malaria by the use of larvicidal fishes, would appreciate a simple guide to the identification of freshwater fishes in India. In respect to this, *Health Bulletin No.* 12, *Malaria Bureau No.* 4 (Second Edition, Revised and Enlarged), pp. 1–47, pls. i–vii (1938), by Dr. S. L. Hora and the late Mr. D. D. Mukerji, of the Zoological Survey of India, seems amply to fulfil the needs of medical men in the field. The *Bulletin* bears the title "Table for the Identification of Indian Freshwater Fishes, with descriptions of certain families and observations on the relative utility of the probable Larvivorous Fishes of India"—a sufficiently self-explanatory title which renders a review somewhat superfluous. Nevertheless, the value of a neat and useful compendium of information on Indian Freshwater Fishes, like the present *Bulletin*, will hardly suffer by emphasis on its merits.

To the medical man in the field with the best will in the world, a reference to a well-arranged identification table of Indian Fishes would be of little help if he has not only to face terms like "procumbent predorsal spine" or "pro-current caudo-dorsal", but also to find the structures referred to in the fish under examination. The few pages devoted to the explanation of the principal terms and of the modes of measurements used in the description of a fish are, therefore, a very useful prelude to the Table of Identification which, with the eleven clear sketches of the external morphology of fishes (text-figures 1–11), renders the task of identification easy. The Table deals with 59 families of fishes, of which 11 are known to be larvivorous. The generic identification of the larvivorous families of fishes is facilitated by the inclusion of keys in footnotes, but a separate generic key of the Cyprinidæ is given as this family includes several genera of potential utility in anti-malarial work. The three appendices which follow are at least as valuable as the Table of Identification. Appendix I contains descriptions of exotic and Indian families of probable larvivorous fishes with information of value to those interested in mosquito-control work, *printed in italics* or in **thick type**. Appendix II contains notes on the relative importance of the various exotic and indigenous species of fish as destroyers of mosquito larvæ, and deplores the fact that no serious attempt has been made in this country to elucidate the value of exotic and Indian species of fish as destroyers of mosquito larvæ under Indian field conditions. A useful list of references on Malaria and mosquito control and on larvicidal fish follows. In Appendix III it is pointed out that the rough identification of the fish in the field should, in many cases, be followed by expert identification which is possible only in institutions with large reference collections of fish and literature such as are available in the Indian Museum. The collection and preservation of fish, simple as they appear, need a little expert guidance, and the authors give in this appendix a few simple directions as to how fish may be