Spawning of *Hilsa.**

THE Indian Shad or *Hilsa* has long been favourably regarded as one of the most valuable Indian fish ; it is a fish of good appearance and taste, is widely distributed in the Province of Bengal and adjacent waters, is found nearly all the year round and in sufficient quantity to be the occasion of an important fishery.

Consequently it is an object of interest not only to professional zoologists but to the general public as well.

When we consider that its life-history has been wrapped in the mystery we have all the ingredients of a first-calss subject for investigation and this has been clearly recognised by all those who have taken part in the investigation of Indian fish and fisheries since the time of the late Sir. K. G. Gupta.

The *Hilsa* has long been regarded as an anadromous fish, that is, one which moves up the rivers from the sea or estuaries in order to spawn. Until the recent discoveries of Dr. Hora, which are described in the paper under review, practically nothing definite was known of the spawning habits and grounds of the *Hilsa*, though there was naturally much guess-work.

There is a considerable difference in the habits of those anadromous fish whose life-history is well known. Such as the various eels, the salmon, sea-trout, smelt and European Shads.

Even two members of the same family, such as the salmon and smelt are very different in their habits. The salmon goes up rivers as far as ever it can in order to spawn ; and smelt on the other hand, spawns at or about the place which is reached by the tide. Having spawned the smelt does not go further up the river.

There are two species of European Shad ; the Allice Shad and the Twaite Shad. The Allice Shad goes a long way up the rivers to spawn, in the case of the Rhine as far as Switzerland ; the Twaite Shad on the other hand, hardly wanders beyond the tidal influence where it also spawns. We know that the *Hilsa* goes a long way up the Ganges and is caught in the Son as far up as Dehri.

The late Sir K. G. Gupta and the late Dr. B. L. Chaudhuri made extensive tours and inquiries in Bengal in the cold weather of 1906-07 and devoted a lot of time to the *Hilsa*. As a result it was established that while *Hilsa* of marketable size could be obtained at some place or another practically at any time of the year, the young or small fish were practically unknown. Mr. K. C. De in his report on the *Fisheries of Eastern Bengal and Assam*, says : "The *Hilsa* is found in the sea and in all the principal rivers, at practically all times of the year."

The fact that no small *Hilsa* are caught in certain places is no proof they are not there since the meshes of the nets used by the fisherman may be too large to catch such small fish.

Even to-day it would probably be worth while to go over the notes made by Sir K. G. Gupta and Dr. Chaudhuri, but so far as one knows never published (for the period September 1906 to March 1907).

As a rule the fishermen say they have never seen the fry of the *Hilsa*, *e.g.*, at Kalagachia "We have not found any *hilsa* fry in the beels or rivers and I do not know where the *hilsa* spawn" and again at Hooghly "Have never seen *hilsa* ova anywhere or very young fry. *Hilsa* is always caught in deep water along the main current and never in shallow water."

On the other hand, the leading fisherman at Bangoan (Jessore) said, "We catch *hilsa* here in Jaishta and Ashar, but very seldom. We have occasionally seen *hilsa* fry 2" long, coming up in Jaishta and going down in Bhadra."

In spite of investigations made by several scientists no step forward was made until Dr. Hora discovered large numbers of very small *Hilsa*, obviously quite young larvæ, in the Calcutta Corporation Waterworks at Pulta. The results of Dr. Hora's investigations are given in the paper reviewed here.

In view of Dr. Hora's discovery of young fry of *Hilsa* both at Pulta and subsequently at Nawabgunge it is certainly remarkable that previous scientists left Calcutta to wander all over the Province to search unsuccessfully for what has now been found at their very doors. But this discovery does not exclude, as Dr. Hora will be the first to admit, that there may be other spawning grounds of the *Hilsa* further up the rivers and more remote from the sea.

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* "A Preliminary Note on the Spawning Grounds and Bionomics of the so-called Indian Shad, *Hilsa ilisha* (Hamilton) in the River Ganges," by Sunder Lal Hora, *Records Indian Museum*, 1938, **40**, Pt. II, 147-58.

We know that another Clupeoid, the herring itself, spawns under widely different conditions. The writer has observed the herring spawning in the fresh water of the river Schlei in Schleswig (Germany) and even in an arm cut off from a bay, in which the water has become quite fresh. On the other hand the same species, but may be a different race, spawns in deep and very salt water off the west coast of the British Isles.

As a result of Dr. Hora's discoveries a further question arises. Why does the *Hilsa* migrate up the Ganges as far as Bhagalpur and Monghyr and even up the Son to Dehri? Is this migration for food and is it entirely disassociated from the act of spawning? Or is it essentially a spawning migration?

Is it possible that there are two, or more, races or varieties of *Hilsa*, with different spawning grounds and habits? The fishermen can easily distinguish the male *Hilsa* (called *pait-hilsa* in Eastern Bengal) from the females which they brought to the writer when asked for "Unda-wallahs".

Dr. Hora calls his paper a "Preliminary Note", rightly so in our opinion, since it is to be hoped and expected that we may look for further papers on this most interesting problem, which he has already done so much to elucidate.

Another point to be cleared up is what is really the fish known to the fishermen as *Jatka* or *Jatkya*? According to Mr. K. C. De the *Jatkya* is the smallest of the herring family (*Clupea fimbriata*) and is found in the estuaries as high up as Goalundo from February to April. It is a pretty fish with a rather dark back and silvery sides shot with gold. From the similarity in shape, appearance and taste, the fishermen describe it as the young of the *Hilsa*.

According to Mr. Finlow, "The fingerling of the *Hilsa* has been identified as the *Jatka*, a small fish less than 6" long, found in the Buriganga, Lakhya and Meghna rivers in Eastern Bengal in February-March."

Now that the first and most difficult step has been taken by Dr. Hora in elucidating the mystery of the spawning of the *Hilsa* we await further discoveries in the near future and in particular the eggs and first larval stages.

In conclusion, the reviewer would fail in his duty if he omitted to congratulate Dr. Hora on the appearance of one of the most valuable and interesting, if not *the* most valuable and interesting, paper on Indian fish published for many years.

J. TRAVIS JENKINS.

CENTENARIES

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Gregory, James (1638-1675)

JAMES GREGORY, an eminent Scottish mathematician, was born in a parish near Aberdeen in November 1638. The Gregory family had produced many persons who distinguished themselves in science. James was the first and most eminent among them. In the next generation his own son was professor of physics and three of the thirty-two children of his brother David were good mathematicians. James' education began at the grammar school of Aberdeen and was completed at Merischal College. His scientific talent was discovered and encouraged by his elder brother David. From 1664 to 1667 he studied mathematics at Padua.

His Career

On his return to England in 1668 Gregory was elected a fellow of the Royal Society. Late in the same year he was appointed professor of mathematics in the University of St. Andrews. In 1674 he accepted the mathematics chair of the University of Edinburgh. He was the first "separate professor of mathematics, exclusively devoted to his subject, and not called upon to go through the drudgery of regenting..... (and) only required to give two public lectures a week to such students as wished to attend."

His Contributions

James Gregory was an inventor of the first order. The reflecting telescope universally employed in the eighteenth century, was first described in his *Optica promota* (1663). His chief mathematical contributions relate to (1) quadrature of circle and hyperbola, (2) use of convergent series to calculate logarithms and to find lengths of