A PRELIMINARY NOTE ON THE SPAWNING GROUNDS AND BIONOMICS OF THE SO-CALLED INDIAN SHAD, *HILSA ILISHA* (HAMILTON), IN THE RIVER GANGES.

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CONTENTS.

HISTORICAL.

Sir K. G. Gupta in his final report on the Fisheries of Bengal, dated the 27th January 1908, devoted a section to " The Shad in India " and after describing its distribution, ancient close season, fisheries, etc., concluded as follows :—

" Very strenuous efforts must also be made to observe the reproductive functions of the *hilsa* and ascertain their spawning grounds, so that when their anadromous character has been established hatching stations may be opened to introduce artificial propagation for replenishing our rivers."

In his general account of the species he stated that :

" As in France, the fishermen of Bengal believe that the *hilsa* does not spawn in the rivers, in proof of which it is asserted that no fry or young ones have ever been caught or seen."[1]

As a result of Sir K. G. Gupta's recommendations, Dr. J. Travis Jenkins was appointed Fishery Adviser to the Government of Bengal in 1908, and though his principal work was to carry out a regular fishing survey of the Bay of Bengal, he seems to have been entrusted at the same time with investigations regarding the life-history of *Hilsa*. In 1910, Jenkins published a short note on " The Spawning of Hilsa ", and from the well known fact that *Hilsa* are full of roe in the rains and spent from December to February concluded that they must have deposited their spawn in the rivers. The banks of the river at Sara Ghat, Rajmahal, Khulna, Bagerhat, Monghyr and Kooshtea were netted with fine meshed nets for the fry of *Hilsa*, but without any success. From

[1] According to Day (1873, p. 35) the opinion of the Madras fishermen is that ova of *Hilsa* are deposited in the river water, and whilst being carried out to sea become vivified. These observations are fully borne out by the results recently obtained both in Madras and Bengal.

the market at Monghyr, however, a single specimen of *Hilsa*, 6 cm. long, was obtained towards the end of September and from this Jenkins concluded that :

" It would appear that the *Hilsa* spawns in the Ganges somewhere above Monghyr and careful investigation should be carried on during September and October in suitable localities above that place."

After these somewhat disappointing results, it seems that an organised search for the spawning grounds of *Hilsa* was abandoned, and more attention directed to the artificial propagation of the species on the lines adopted in America for Shad (*vide* Southwell 1914, 1918). A hatchery station was established at Monghyr, but all attempts at artificial propagation proved futile. However, as a result of these experiments, Southwell (1914, p. 5) came to the following conclusions :

" I think there can be no doubt that there are several breeding grounds in the Ganges, and it is quite likely that the spawning grounds change from year to year. Old *hilsa* probably spawn in the higher reaches of the river, while younger *hilsa*, more susceptible to the changes involved in the transition from the sea to fresh water, probably spawn lower down the river."[1]

In the Annual Report of the Department of Fisheries, Bengal, Bihar and Orissa, for the year ending 31st March 1919, Dr. Baini Prashad again recorded the failure of artificial fertilisation and hatching of the *Hilsa* eggs, but a distinct advance was reported in the knowledge concerning habits, distribution, etc., of the species. It was stated that :

" Investigations regarding the distribution and habits of *hilsa* were carried on in the rivers of the Khulna district, in the Hooghly, at Madaripur, Goalundo, Dacca, Rajmahal, Bankipur, Buxar and a number of other places in the two provinces. These enquiries show that *hilsa* are available practically at all times of the year in the rivers and in the Gangetic Delta. This fact casts a very grave doubt on the generalisations of the previous observers regarding the migrations of *hilsa* during the rainy season, when, as was stated, the muddy water incited the fish to ascend into fresh-water streams for breeding. The results of our enquiries during the past year do not allow of the assumption of the *hilsa* being a true anadromous fish."

In 1920, the Department of Fisheries, Bengal, Bihar and Orissa, was abolished and so far as I am aware no further work on the *Hilsa* problem from Bengal has been reported since. In 1933, however, Mr. Robert S. Finlow, Director of Agriculture, Bengal, in his note on the scheme for the reorganisation of a Fishery Department in Bengal, summed up the position of *Hilsa* enquiry in Bengal as follows :

" Apart from carp, *hilsa* is much the most important fish caught in inland waters. As is well known, the *hilsa* belongs to the herring family, and its home is in the sea, but, like the salmon, the *hilsa* migrates into adjacent rivers to spawn. So far attempts to locate the spawning grounds of *hilsa* have failed, and attempts at artificial fertilization have also been unsuccessful. On the other hand, the fingerling of the *hilsa* has been identified in the *Jatka*, a small fish less than 6" long, found in the Buriganga, Lakhya and Meghna rivers in the Eastern Bengal in February-March. It is probable therefore that the main spawning grounds of the *hilsa* are in Eastern Bengal, and investigation to this end, particularly in the Lakhya, Buriganga, Torag and Meghna rivers, should from a definite item of the work of the Fishery Department.

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[1] Reference may here be made to the following observation of Day (1873, p. 22). Writing about the migratory habits of *Hilsa* he says :—

" There seem to be two classes of this fish which ascend the large rivers : those below one year of age, and which do not appear to breed, or if they do, it is at the very end of the year, or commencement of the succeeding one ; secondly, there are those which breed at the commencement of, or during the monsoon."

These observations indicate that *Hilsa* practically breed in the rivers throughout the year, and that probably the young have to make a much longer journey upstream to attain sexual maturity.

Artificial breeding of the *hilsa* should also be persevered with. The fish appears to be peculiarly delicate and, when spawning, to die almost instantaneously on being taken from the water. At the same time, eggs have undoubtedly been fertilized both in Bengal and in Madras, and final success may prove to be largely a matter of technique. In the Bengal experiments, the development of fungoid growth seemed to be a very adverse factor. Perhaps the use of filtered water in the Macdonald jars would mitigate this disadvantage."

Mention may also be made of the observations contained in Mr. K. C. De's " Report on the Fisheries of Eastern Bengal and Assam " He stated that :

" The *hilsa* is found in the sea and in all the principal rivers, at practically all times of the year. It is also found in the *bhils* and *haors* during the flood, when they communicate with the greater rivers. ..... The spawning takes place in October and November, and the spent fish are caught in winter. But some fishermen have assured me that individual fish with roes have been found all through the year.. .... Nothing definite is known about the spawning. Some fishermen hold that they do not spawn in the rivers, while others believe that the young fish hatched from the ova deposited in the rivers are stunted in growth and do not bear roes. Some told me that the *hilsa* spawns in the Hakalaki *hoar* in Sylhet, but careful enquiries made there have proved this information to be incorrect. As the ova of *hilsa*, and also young fish, have been seen in the rivers, there can be no doubt that they spawn in the rivers. ... .. Like the other herrings, it is a surface-swimmer, and is not ordinarily found at a depth below 12 feet. It cannot be reared in tanks."

From the summary of the results given above, it is clear that since 1908, when Sir K. G. Gupta made a forceful recommendation regarding the urgent necessity of an investigation into the life-history of *Hilsa* with a view to establish hatcheries for the artificial propagation of the species, very little advance has been made with regard to the bionomics of the species in Bengal waters. The investigations of all these years, however, raised doubts into the true anadromous nature of the species and brought to light the probable occurrence of the young ones of *Hilsa* in the rivers of Eastern Bengal. The Madras Fisheries Department (*vide* Raj) has, however, through patient research extending over a quarter of a century, made considerable progress in locating the probable spawning grounds of *Hilsa* in Madras waters and has found indications of the probable rate of growth of the species. The results of these investigations are referred to in a comparative way in the following account.

HILSA INVESTIGATIONS AT THE CALCUTTA CORPORATION WATERWORKS AT PULTA.

In 1936, the Zoological Survey of India was requested by the Corporation of Calcutta to carry out biological investigations at the Corporation's Waterworks at Pulta. A preliminary collection of the fauna of the Waterworks was made in May 1936, but later, from September 1936 to February 1938, further collections were regularly made, almost month by month, with a view to determine the seasonal variations in the fauna of the filter-beds. From the very beginning a large number of young Clupeoids of various genera were found in the beds, but their specific determination was not undertaken till the adults were found in the settling tanks in great abundance a few months later. During the rainy season of 1937 male and female specimens of *Hilsa* with ripe gonads were collected from the Waterworks and it seemed probable, therefore, that the fish may actually be breeding in these waters, but no direct

observations on the spawning of the species were made. Day (1873, pp. 13, 36) states that *Hilsa* "never breeds in tanks or canals", but gives no reasons for his views. Attention may, however, be directed to the fact that the Killarney Shad of Great Britain spends its whole life in lakes without ever migrating to the sea (Trewavas, 1938). This occurrence lends considerable support to the assumption that *Hilsa* may also be capable of breeding in the extensive tanks of the Waterworks. The mature males and females can readily be recognised by the depth of their bodies; the females, though of a somewhat smaller size, are much deeper and bulkier.

The abundance of young *Hilsa* in an isolated settling-tank (Pucca Settling Tank No. 4), when it is emptied once a year in autumn for cleaning, shows that the various tanks of the Waterworks receive their supply of *Hilsa* directly from the river Hooghly and that the fish is capable of thriving well in confined waters and of even attaining full maturity in the two other series of connected settling tanks. The above observations, especially when coupled with the fact that fish can only enter the waterworks either as eggs or very minute larval forms, indicate that the breeding grounds of *Hilsa* could not be at a very great distance from the position of the intake pipes of the Waterworks in the river Hooghly.

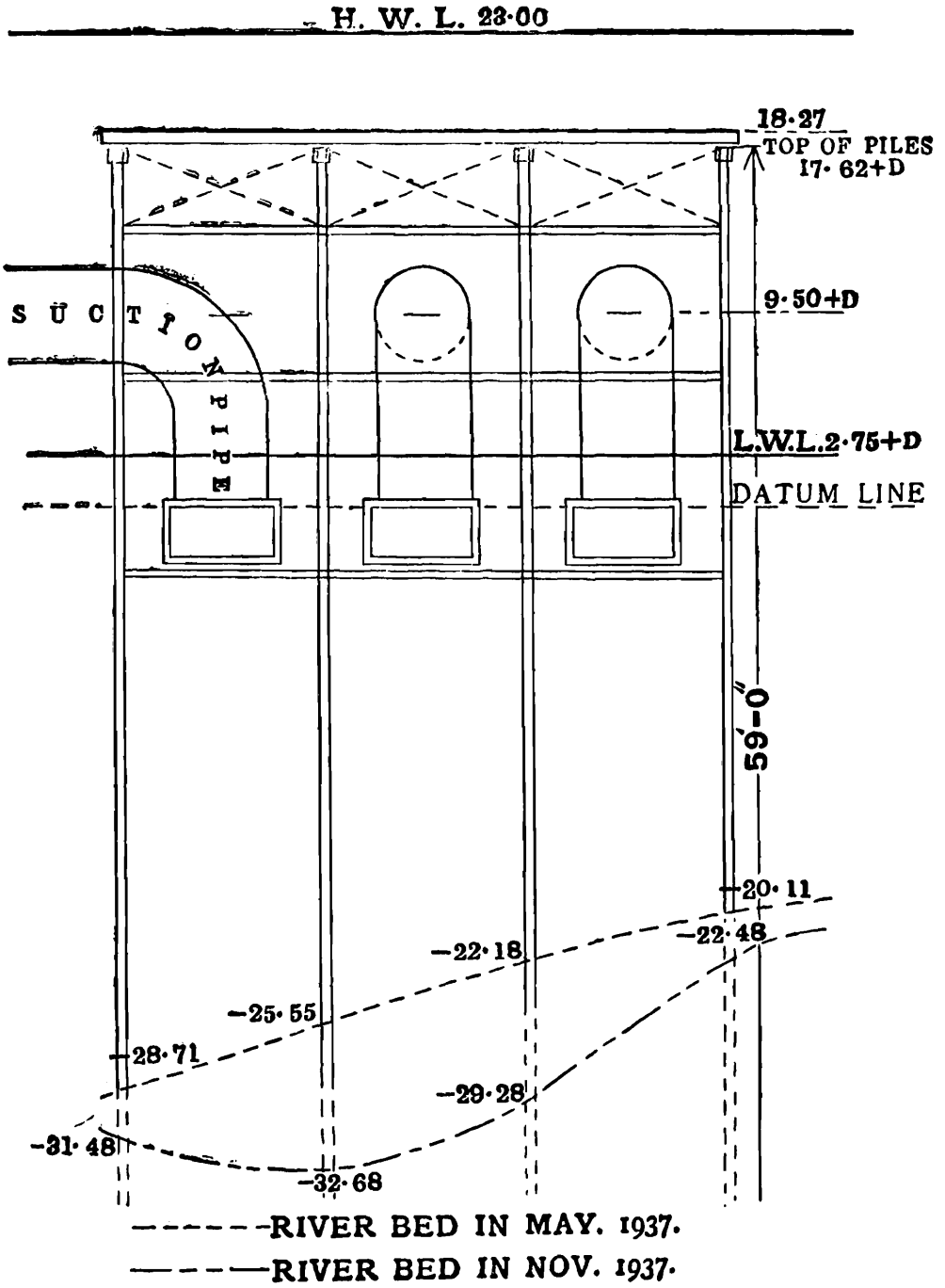
In connection with the growth of *Hilsa* in confined waters reference may also be made to the Administration Report of the Madras Fisheries Department for 1936-37 which contains observations on the bionomics of the fish similar to those made at Pulta. It is stated that:

"Young *Hilsa* not only reside in the lower reaches of rivers but frequently congregate from accident or inclination in tanks and ponds connected with the breeding reaches of such rivers.[1] In the Bahur tank watered by the Ponnaiyar river, which is one of the South Indian rivers in which *Hilsa* breed, a large collection of young *Hilsa* measuring from 16·3 cm. to 22·5 cm. was obtained in May 1936 when the tank ran dry. As the tank runs dry annually direct evidence of the growth rate of *Hilsa* in the tank is available. Since the tank received its supply for the year between 24th August 1935 and 14th September 1935 there is conclusive evidence that the *Hilsa* fry bred in the Ponnaiyar river that summer had grown in the tank to sizes ranging from 16·3 cm. to 22·5 cm."

Life history of Hilsa in the Waterworks at Pulta.—At the Pulta Waterworks about 90 million gallons of river water is pumped daily into the settling tanks through 5 pipes—one 36″ pipe, one 48″ pipe and three 54″ pipes. All the pipes are, however, not in commission at the same time. The mouths of the pipes are directed downwards. The three larger pipes are protected by an iron grating with bars one inch apart, while the other two pipes are provided with valve-like structures which prevent any large object from entering the pipes. It is thus seen that though large objects cannot be sucked into these pipes, fishes a few inches in length and less than one inch in thickness can enter into the pipes. In the actual centrifugal pumps, however, there is only a quarter inch space between the impellers and their covers so that larger objects are invariably crushed and only eggs or very young larvae can

[1] Day (1873, p. 23) also observed that in Sind *Hilsa* are not to be found about the end of September or commencement of October. He noted, however, that they may be "taken in *dhands*, stagnant pieces of water or canals, due to some accidental cause or unnatural obstruction having obliged them to turn aside from their natural breeding-grounds."

pass through intact to the settling tanks. This was tested by making several collections of the fauna from the river water soon after it had passed through the pumps ; in all samples only very minute objects were obtained. This means that *Hilsa* enters the Waterworks from the river either in the egg stage or as very young larvae. It must also be remembered that the crushing of the larger objects increases the nutrient value of the water and is thus conducive to the development of rich planktonic life in the tanks of the Waterworks.



TEXT-FIG. 1.—Section of new jetty for 54" pipes, Calcutta Corporation Waterworks, Pulta.

The form of the river bed in the region of the intake pipes undergoes considerable changes at different seasons of the year, but the depth of the river below the level of the mouth of the pipes, known as Datum Line, is generally more than 20 feet ; the low water level is 2·75 feet

and the high water level 23 feet above the Datum Line. As the mouths of the pipes are directed downwards there is every likelihood of the bottom fauna being stirred up and sucked into the pipes, and correspondingly less chance of the floating organisms entering the pipes. As noted above, during experiments for the artificial propagation of *Hilsa* eggs have been fertilised both in Madras and Bengal, and it has been definitely ascertained that after fertilisation they sink deep in the water and begin to float or rest just near the bottom. The average diameter of *Hilsa* eggs was found by Jenkins to vary from 0·4 mm. to 0·63 mm.; they would thus be very suitable objects to enter the intake pipes, pass through the centrifugal pumps and to be dispersed throughout the Waterworks. The young *Hilsa* probably feed near the bottom on planktonic organisms (*vide infra*, p. 155) and owing to their tendency to flow down with the current (*vide* p. 154) are liable to be carried to the filter-beds. Young *Hilsa* were found in the beds from April to November, though they were most abundant from August to November. On the 30th September 1937, 58 young *Hilsa* were collected from one bed; their average length was 59 mm. and they ranged in length from 36 mm. to 70 mm. Again on the 22nd November 1937, 57 specimens of young *Hilsa* were obtained from the beds; their average length was 50·3 mm. and they ranged from 33 mm. to 81 mm. in length. The filter-beds are dried up and cleaned at intervals of 30 to 60 days, so the young do not get very much chance to grow any bigger. The size of young *Hilsa* found in the beds varied from 30 mm. to 90 mm. in length. There would thus seem to be considerable justification for believing that *Hilsa* probably breeds during a considerable part of the year, though, from the collections made, its peak period of breeding can definitely be placed during the rainy season.

Rate of growth of Hilsa.—The isolated Pucca Settling Tank No. 4 was emptied out for cleaning on the 21st November 1937, and a very large number of young *Hilsa* were collected from it. This tank had been charged on the 19th November 1936, so the largest specimen of *Hilsa* could at the most represent approximately one year's growth. Nine hundred specimens of *Hilsa* were measured and grouped into 10 mm. difference groups, as shown in the table below.

Table of Measurements of 900 Young Hilsa *Collected from the Pucca Settling Tank No. 4 on 21st November 1937, arranged in 10 mm. Difference Groups.*

Number of specimens.	Measurements in millimetres.
1	57
7	80—89
72	90—99
56	100—109
52	110—119
32	120—129
97	130—139
273	140—149
220	150—159
74	160—169
14	170—179
2	180—189

It must be borne in mind that owing to fishing, for fair-sized fishes, mostly with hands, very young specimens were not collected, although a number of *Hilsa* of about 57 mm. in length were taken out and kept in an aquarium for making coloured sketches. The 900 specimens ranged in length from 80 mm. to 180 mm. More than half of the specimens were between 140 mm. and 159 mm. and would thus represent the majority size or the frequency peak ; these individuals probably entered the Waterworks during the rainy season, the peak-period of breeding of the species. An analysis of the measurements further shows that specimens over 160 mm. represent the progeny of early spawners, while those below 130 mm. are probably the offspring of late spawners. From the sizes of the specimens found in the filter-beds it seems probable that during the first couple of months of its growth *Hilsa* attains a size of about 60 mm. and from the above analysis it would appear that between July-August, the peak-period of breeding, and November, when the tank was emptied, a period of 4 to 5 months, the fish had reached a size of about 160 mm. The *Hilsa* investigations of the Madras Fisheries Department have also shown that both in the Godavari and the Ponnaiyar rivers *Hilsa* attains only about 8 inches or so in the first year of its growth. In the Bahur tank connected with the latter river *Hilsa* is stated to have grown to a size of 163 mm. to 225 mm. between August-September 1935 and May 1936, a period of about 9 months. Owing to the very favourable conditions of growth in the Waterworks at Pulta, probably the rate of growth of the species is somewhat higher in these waters, as a size of 160 mm. was attained in 4 to 5 months. This is also evident from the fact that the adult *Hilsa* of the Waterworks are considerably larger than those found in the river Hooghly, though they are of a very inferior quality as food. There is, however, sufficient presumptive evidence to corroborate the findings of the Madras Fisheries Department that *Hilsa* attains full sexual maturity in about two years' time. According to Day (1873, p. 22) also *Hilsa* attains sexual maturity in its second year.

HILSA INVESTIGATIONS IN THE RIVER HOOGHLY NEAR THE PULTA WATERWORKS AND AT NAWABGUNGE.

During the rainy season of 1937, attempts were made to collect plankton at different depths near the Pulta Jettys, but the currents were so strong and the amount of suspended silt so great that the plankton nets could not function properly. Collections were then made along the bank of the river, but no *Hilsa* eggs or larvae were found. At this time of the year only large-meshed nets are used by the fishermen, so an examination of their catches was not helpful. When the waters begin to fall, very fine-meshed nets are employed to collect young fish from the river. Unfortunately I did not make any observations in October, but a visit to the Nawabgunge fish *ghat* (a landing place) on November 26, 1937, showed that baskets full of young *Hilsa* were being sold at about 6 pice per seer. The fish were about 20 mm. to 40 mm. in length and weighed 35 to a tola (about 7 drams or a little more than $\frac{2}{5}$ of an ounce). At the time of my visit there were 3 boats at the *ghat* and they had on board 10 baskets of young *Hilsa*. Each basket on

a very conservative average contained about 10 seers of fish. Thus on a rough calculation approximately 280,000 young *Hilsa* were being sold for about 9 rupees. On December 18, a lot of 53 young *Hilsa* were collected by my colleague Dr. B. N. Chopra from Nawabgunge; they weighed 6½ tolas or 8 fish to a tola and ranged from 30 mm. to 71 mm. in length with an average length of 52·5 mm. By December 23, young *Hilsa* in the catches from the river had decreased, and only 234 specimens were collected from 3 boats. By the 11th February 1938, the young *Hilsa* had become very rare in catches and only 4 specimens—43-57 mm. in length—were obtained. The catches of young *Hilsa* and the absence of adult ones in the Hooghly near Calcutta from November to February show that after spawning the adults do not reside in this portion of the river and that the young are caught in thier migration downstream to the estuaries. The average size of the young fish at Nawabgunge from November to February, especially when compared with that of the young ones collected from the Pucca Settling Tank No. 4, also indicates that they are migrants from above and do not reside in this portion of the river. It may be mentioned that in the upper reaches of the river near Shantipore, uninterrupted *Hilsa* fishery goes on even during the post-monsoon months; these probably are the breeding grounds of the species in the river Hooghly.

The Madras Fisheries Department has already recorded the occurrence of young *Hilsa*, from 2 to 4 inches in length, in the Cauvery after the subsidence of the floods in the months of October and November. The study of the fishery in 1933-34 in the Godavari from the Dowlaishweram anicut to the sea proved the existence of *Hilsa* of varying sizes throughout the year and it was definitely established that young *Hilsa* up to 8¼ inches in length reside in the lower reaches of the river and do not go to the sea. In the case of the Ganges similar observations were made by Prashad in 1919 when he cast some doubts on the true anadromous nature of the fish.[1] The Madras Fisheries Department, through a series of observations carried over a number of years, has more or less proved :

> "(1) that Hilsa take two years to grow to the adult size, (2) that the fish spend the first two years of their life in the lower reaches of rivers and go to the sea only in the third year, and (3) that when they leave the river they do not go far into the sea but move about in shoals in the shallow flats close to river mouths and their neighbourhood." (Report for 1935-36, p. 38).

Observations made in the river Hooghly show that the fish run up during floods for breeding purposes and breed throughout the range of their distribution in the river and its connected waters. This is evident from the fact that Jenkins obtained a young *Hilsa* as high up in the river as Monghyr. According to Southwell (1914), old *Hilsa* going up the river for the second or the third time spawn in the higher reaches; while younger *Hilsa* making their first trip upwards, and thus being more susceptible to changes in salinity, spawn in the lower portions of the river. According to Day (1873, p. 22), however, the young immature specimens below one year stay in the river for a much longer period

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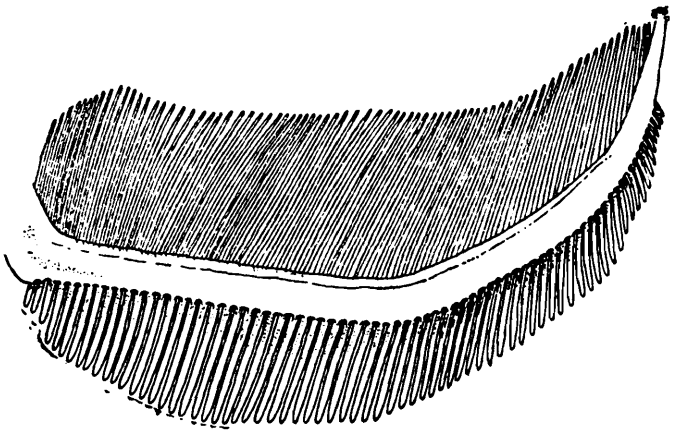
[1] In describing the colouration of the species, Day (*Fish. India*, p. 640, 1878) records to have taken young specimens of *Hilsa* in the Sunderbunds below 10 inches in length.

and only spwan towards the end of the first year of their life or in the second year. The actual breeding probably takes place in mid-water; the eggs drop to the bottom and soon after hatching the young begin to migrate downstream. Though the peak period of breeding lies in the rainy season, some fish that may have gone high up, stay in the river throughout the year and the breeding goes on for a considerable part of the year. It may here be noted that some fishermen of Eastern Bengal assured Mr. K. C. De that individual fish with roes have been found all through the year. Fish going higher up the river to breed will take a considerable time to make the return journey, and thus give rise to the post-monsoon fishery of the species in the river. Such a course of events would also explain the observations of De and Prashad that the fish resides in the river throughout the year.

The present-day migrations of *Hilsa* are thus of a very limited order; it is now primarily an estuarine fish which runs up the rivers during floods for breeding purposes. In this respect it cannot be regarded as a true anadromous species, as already pointed out by Prashad. As the rivers of the west coast of India, with the exception of the Indus, are short and without any extensive estuaries, *Hilsa* is not found along the west coast except in the Indus.

FOOD OF YOUNG *HILSA*.

As judged by the stomach contents, the young of *Hilsa* between 20 mm. and 40 mm. in length feed mostly on diatoms, and sparingly on Copepods, Daphnia and Ostracods. Older specimens up to 100 mm. in length were found to feed on the smaller crustaceans enumerated above and also on insects, such as Coriixid bugs, Chironomid larvae, etc., and Polyzoa. Still older specimens up to 150 mm. in length included small shrimps in their menu. Dr. Ramaswami Naidu has informed me that even adults feed mostly on diatomes with a mixture of few *Daphnia*



TEXT-FIG. 2.—Lower half of first left gill-arch of a young specimen of *Hilsa ilisha* (Ham). ×2½.

Length of specimen without the caudal 120 mm. The actual number of gill-rakers on this portion of the arch was 156, but 95 could be shown in the drawing.

and Ostracods. Both in the case of the Waterworks and river specimens a few sand particles were invariably found in the stomach contents which showed that the young of the species probably feed near

the bottom. According to De, adult *Hilsa* is a surface swimmer, and is not ordinarily found at a depth below 12 feet.

The above account of the feeding habits of *Hilsa* is corroborated by the nature of its gill-rakers, which are setose, long, slender and close-set. In appearance they recall the baleen plates of the Whalebone Whales which are also used for straining minute organisms from water. On the first arch the number of gill-rakers is approximately 270 (90+ 180). The gill-rakers are considerably longer than the gill-filaments. In a specimen 118 mm. in length without the caudal the longest gill-raker was about 7 mm. in length.

In its feeding habits and the nature of gill-rakers *Hilsa* corresponds very closely with the Allis Shad (*Alosa alosa*) of European waters.

HATCHERIES FOR *HILSA*.

The Department of Fisheries, Bengal, Bihar and Orissa, and the Madras Fisheries Department have paid considerable attention in the past and the latter Department has still on its programme as a major item the artificial propagation of *Hilsa*. From the records available it appears that no success in this line of work has been achieved so far, in spite of repeated attempts and elaborate arrangements made both in Bengal and Madras. In view of the fact that after the floods millions of young *Hilsa* are caught from the river Hooghly, it seems that there is no need at present to augment the numbers of this fish through artificial fecundation. There would, however, seem to be an urgent necessity to preserve the natural stock by prohibiting the catching of young *Hilsa* through legislation during the months of October and November. During the monsoon months the fishermen do not catch small fish and during March to May owing to stormy weather fishing in the river is not possible on a number of days. These meteorological conditions thus provide a natural protection to the young in their migration downstream during these periods. As regards this fishery in Madras, it is not possible for me to express an opinion, but as there is a close similarity between the habits of *Hilsa* in the Hooghly and the South Indian rivers, it may also be found advantageous in that province to pay more attention to the proper conservation of the fishery rather than to the establishment of *Hilsa* hatcheries.

SUMMARY.

An historical review of the *Hilsa* investigations in Bengal is given and attention is directed to the work of the Madras Fisheries Department on the same subject. It has now been definitely established that *Hilsa* reside in the rivers, mostly in the estuaries, and rarely go out to the sea. Thus the fish, as pointed out by Prashad, is not to be regarded as a true anadromous species.

The probable course of the life-history of *Hilsa* from the egg or minute larval stage to the adult stage in the Calcutta Corporation Waterworks at Pulta is traced, and evidence is adduced to show that the supply of larval *Hilsa* is obtained from the river Hooghly year after year. The occurrence of young *Hilsa* in the filter-beds during a greater part of

the year shows that the fish probably breeds in the river over an extensive period, though its peak-period of breeding occurs during the rainy season. From the occurrence of ripe males and females in the Waterworks during the rainy season, it is presumed that the fish can probably breed in confined waters also. The probable rate of growth of the species in the Waterworks is indicated.

Failure to find eggs and very young stages of *Hilsa* in the river Hooghly with the help of plankton nets and by collecting along the banks is recorded. A regular fishery of young *Hilsa* in November is reported from an examination of catches made in the river at Nawabgunge near Calcutta. From the size of young specimens collected at Nawabgunge during November to February it is inferred that the young fish do not reside in the river but pass down to the estuaries. The probable life-history of *Hilsa* in the river is indicated and considerable support is lent to the biological observations already made by the Madras Fisheries Department. Observations on the food of young *Hilsa* and on the establishment of hatcheries for the artificial propagation of the species are made. From the destruction of young *Hilsa* on a vast scale in the river Hooghly, it is suggested that attention should be paid to the conservation of the *Hilsa* fisheries rather than to the establishment of hatcheries for the artificial breeding of this fish.

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