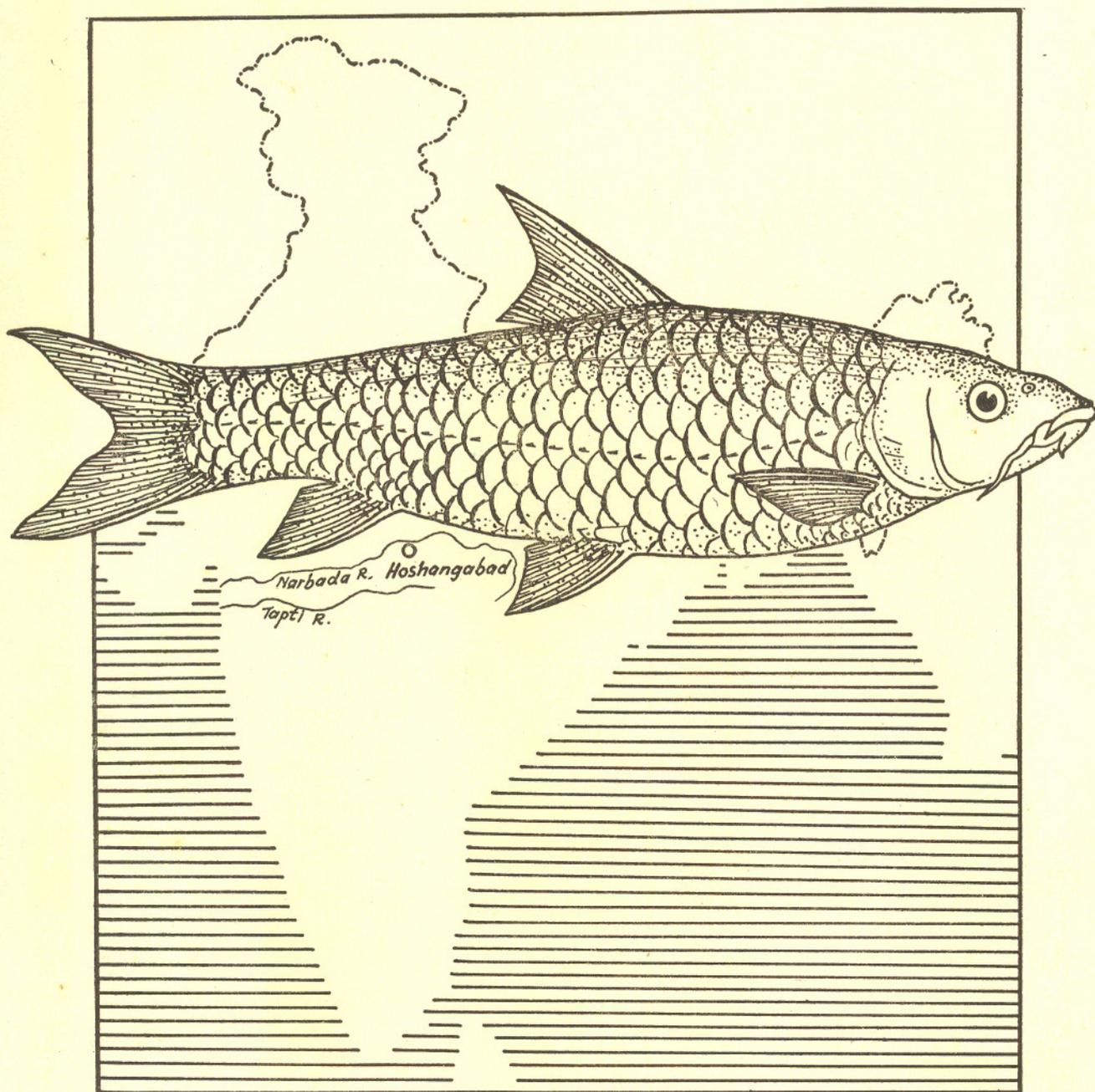


SURVEY OF THE FISH AND FISHERIES OF THE TAPTI RIVER



Survey Report No. 4
OCTOBER, 1967

GOVERNMENT OF INDIA
CENTRAL INLAND FISHERIES RESEARCH INSTITUTE
BARRACKPORE, WEST BENGAL
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OF THE TAPTI RIVER

By

S.J. Karamchandani & M.D. Pisolkar

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I. INTRODUCTION

Not unlike many other river drainages of India, the much needed information on the status of fishing industry of the Tapti river is totally lacking. Hence, as a part of the survey programme of Narbada-Tapti Unit of the Central Inland Fisheries Research Institute, Hoshangabad, fishery survey of the Tapti was conducted in 1959-60. During this survey, the 728-km river stretch was surveyed (i) to record data on the fish and fisheries of important fishing centres and fish markets located along its banks and (ii) to collect the statistics of fisherman population, fishing craft and gear from the entire stretch of the river, with a view to evaluate the potentiality of exploitable fisheries. In the monsoon seasons of 1961 and 1962, the lower stretch of the river in Gujarat State was also explored with a view to locating major carp seed resources. The present report embodies the information and data gathered during these surveys.

II. DESCRIPTION OF THE TAPTI RIVER DRAINAGE

The Tapti, also called Tapi or Tapati, is one of the two important westerly flowing rivers of peninsular India. Rising from the Vindhya mount of the Satpura range at an elevation of 670 to 1000 metres, it flows west-ward through Madhya Pradesh, Maharashtra and Gujarat States before falling into the Arabian Sea at Dumas near Surat in Gujarat State. It has a drainage area of about 48,000 sq km (see Map).

The source of Tapti river is said to be a holy tank of Moola-Tapti on the Satpura plateau, situated on $21^{\circ} 48'$ North and $78^{\circ} 15'$ East, about 3 km away from Mooltai in Betul district of Madhya Pradesh. Originating in Mooltai and flowing through the rocky gorges of the Satpura ranges in the Nema District, it opens out a few kilometres above Burhanpur town in Madhya Pradesh and courses through mountainous and dense forest regions of Maharashtra and Gujarat States. The upper stretch of the river is highly rocky and studded with boulders in some parts of Madhya Pradesh, Maharashtra and Gujarat States, while the river bed in the lower stretch in Gujarat State is mainly sandy

and strewn with pebbles. The main tributaries which join the Tapti along its entire course are Sapna, Purna, Girna, Buray, Gomai and Aner in Maharashtra State, and Nesu and Ajani in Gujarat State.

With a view to utilise the huge quantities of rain water for developing the regions of the lower Tapti valley and also to control the floods in Surat district, a weir has been constructed at Kakrapar in Mandvi Taluka of Surat district (Gujarat State). It is 680 metres long and 16.5 metres high. Under this project, a network of canals of about 1360 km is expected to irrigate about 324,000 hectares (8,00,000 acres) of land in the Surat district. Under another scheme known as Ukai project, the construction of a reservoir on Tapti river is in progress at Ukai in Songarh taluka, Surat District. The impounded water in the reservoir is intended to irrigate a total area of about 227,000 hectares (5,62,000 acres) of land in Surat and Broach districts. The Ukai project will also generate hydro-electric power and is one of the important multi-purpose projects.

III. FISH FAUNA OF THE TAPTI DRAINAGE

Hitherto, there does not appear to be any published account of fish fauna from the Tapti drainage. In the present report, a collection of 52 species of fish belonging to 30 genera under 14 families, listed in the Appendix, is recorded for the first time from the Tapti river. Of these fishes, about 35 species are known to be widely distributed in Indian waters.

IV. ZOOGEOGRAPHICAL NOTES ON SOME SPECIES

The collection of fishes from the Tapti river, as reported herein, comprises mostly common species. However, the occurrence of some species in the Tapti river has extended their range of distribution while a few other species are new locality records. The zoogeographic observations for these species are given below:

Barilius evezardi Day

This species appears to have very restricted distribution, as it is so far known to occur only in Krishna river near Poona (Day, 1878) and at Vijaywada (David, 1963). The occurrence of this form in Tapti river has extended its distribution to Satpura range and is the first record from this region.

Danio aequipinnatus (McClell)

Day (1878) mentions that the species is distributed in the Himalayas at Darjeeling and whole of the Assam districts as high as Suddya, the Naga and Garo hills, Tennasserim and the Deccan. According to Hora and Law (1941) and Hora and Nair (1941), Danio malabaricus (Jerdon) of Peninsular India and Ceylon and D. strigillifer Myers of North Burma and Peninsular India are synonymous with the North Indian D. aequipinnatus, suggesting an extension of its distribution to south India and Ceylon through western ghats. The presence of this species in the collections of the Tapti river within Satpura range appears to have some zoogeographical significance. It indicates that the Satpura range has served as a highway for the dispersal of Eastern Himalayan and Assam forms to the Western Ghats. Hora and Nair (1941) have first recorded this species from the Satpuras in the collections of Hoshangabad district. This is, therefore, the second record from the Satpuras.

Catla catla (Ham.)

The natural distribution of this species is from Sind and the Punjab in the north along upper India to Krishna river in the south and as far as Burma in the east (Jones and Sarojini, 1952). The authors (Karamchandani and Pisolkar, 1967) have recorded that this fish has been accidentally transplanted in the Tapti river. The collection of the spawn of this species from the lower reaches of this river in Gujarat State during the monsoon season of 1961 indicates that

it has not only established itself in certain stretches of the river but also successfully breeds there. Since this species is known to occur in the Narbada river (Rajan and Kaushik, 1958 and Karamchandani et al., 1967), its collection from Tapti river is the second record from the westerly flowing rivers of Peninsular India.

Labeo rohita (Ham.)

As stated by Jones and Sarojini (1952), its natural distribution is from Sind and the Punjab along upper India and Assam as far as Burma. It has also been reported to occur in the Godavari river (Alikunhi and Chaudhuri, 1951). This species has recently been recorded from the Narbada river (Karamchandani et al., 1967). Like Catla catla (Ham.), the occurrence of this species in the Tapti river is also ascribed to its accidental transplantation. Since the spawn of this species along with that of Catla catla (Ham.) was collected from the lower reaches of the Tapti river in Gujarat State during the monsoon season of 1961, it is believed that it has successfully established itself in the new habitat. The occurrence of this species in the Tapti river is the second record from the westerly flowing rivers of Peninsular India, the first being from Narbada river.

Crossocheilus latius latius (Ham.)

The distribution of this species is known all along the Himalayas and upto the Deolali Hills along the Satpuras. The recent records of this species are from the Ganga (Karamchandani, 1962), the Sone (Motwani and David, 1957), the Mahanadi (Job et al., 1955) and the Krishna (Hora and Misra, 1942; David, 1963). The collection of this species from the Tapti is the second record from the rivers of Satpura range, as it has been recorded recently from the Narbada river (Karamchandani et al., 1967).

Noemacheilus dayi Hora

This species has been merged with Noemacheilus denisonii Day (vide Rec. Ind. Mus., 43, p. 372) which is known to occur in the Neilgherry and Coorg Hills and rivers at their bases; Mysore and the Deccan (Day, 1878). Hora and Nair (1941) have recorded this species from the Satpura range in Hoshangabad district. Thus, its presence in the Tapti collection is the second record from the Satpuras. By these records, the distribution of this form has been extended further north up to the Satpuras.

Noemacheilus evezardi Day

The distribution of this species appears to be restricted to Peninsular India and Deccan. It is known to occur in western ghats, near Bombay, the Pachmarhi hills, the Bailadila range, Bastar State, Central Provinces and Travancore Hills (Hora and Law, 1941). This species was first recorded from the streams of Satpura range in Hoshangabad district by Hora and Nair (1941). The collection of this form from Tapti river is, therefore, the second record from the Satpuras.

Gagata itchkeea (Sykes)

The distribution of this species appears to be restricted to the rivers of the Deccan (Day, 1889). Hora and Law (1941) found this species in the Indian Museum collections representing Deolali, Poona and Satara (Bombay State) and Cauvery in Coorg State. It has also been recorded from the Krishna and Godavari (David, 1963) and Tungabhadra (Chacko and Kuriyan, 1948). Since this species has been collected from the Narbada river (Karamchandani and Desai, 1964; Karamchandani et al, 1967), it forms the second record from the rivers of Satpura range. Its distribution is thus further extended up to the Satpuras.

06.

Doryichthys cunculus (Ham.)

This species is distributed in the tidal rivers of Bengal and Orissa (Day, 1878). The collection of this species from the Tapti river is the first record from Satpura region. The occurrence of this form far away from its known range of distribution is of some zoogeographical interest.

V. FISHERIES

During the fishery survey conducted in the river stretches of Madhya Pradesh and Maharashtra States in winter months and Gujarat State in summer months, the fish landings were recorded at regular fish markets and a few small villages where fish is brought on weekly market days only. The information gathered during the survey has shown that fishing in the Tapti river is of an extremely diffused nature. Only a few big villages located on the river banks have regular fish markets and fish assembly centres, where fish is landed daily. The fish catches from various sections of the river are also disposed of at several small villages on market days. Most of these villages have one market day in a week. The fishermen from a particular section of the river take their catches on each day of a week to six or seven different villages to meet the weekly markets. Some of these small villages are situated at long distances, 15-20 km away from the landing centres.

(a) River stretch in Madhya Pradesh (North bank : 298 km; South bank : 235 km) : From this river stretch, the fish catches are brought to Burhanpur fish market daily and about 20 small villages on weekly market days. These markets are fed by about 138 fishing villages situated on both the banks of this river stretch. Except Burhanpur town which is situated on the river bank, all other small villages where fish is brought on weekly market days are situated 5 to 15 km away from the fishing villages. During the fishery survey of this stretch, one regular market at Burhanpur and two representative villages viz. Raitalai and Tedtalai amongst the 20 small villages which receive fish supply on market days were sampled.

06-1

Burhanpur : A taluka headquarters of Khandwa district, it is one of the important fishing centres situated on the river bank. The fish catches are regularly landed at Burhanpur fish market for local consumption. Comparatively larger quantities of fish are assembled on Sundays, which is a weekly market day. Owing to a considerable demand for fish on the market day, fishing pressure in the vicinity of Burhanpur is generally high on the previous day. The local fishermen, who undertake fishing every day to meet the daily market requirement, generally restrict their movements to 15 - 25 km in the vicinity of Burhanpur. During certain periods, mostly from January to June, when transportation of fish catches becomes feasible, the fish catches are also brought from remote fishing villages situated several kilometres up stream of Burhanpur. Besides the fish supply from fishing villages of Madhya Pradesh, Burhanpur fish market is also fed by about 12 fishing villages located across the border in Maharashtra State. On an average, a monthly catch of about 800 kg of fish is landed in the local market during winter months. In this season, the most dominating species in the commercial catches was Tor tor (60.7%) and was followed by Mystus seenghala and Mystus aor (19.0%), Channa spp. (7.6%), Mastocembelus armatus (5.1%), Labeo fimbriatus (3.8%) and Puntius sarana (3.8%).

06-2

Raitalai : It is located at a distance of about 5 km from the river bank and is one of the many small villages where fish is brought for sale on the weekly market day (Saturday). It is fed by 10 fishing villages situated in a 19 km stretch of the river. During winter months, an average monthly catch of about 115 kg of fish is brought on 4 to 5 weekly market days. One one weekly market day in winter, Labeo boggut made the bulk (21.4%). The next dominant fisheries were of Tor tor (13.8%), Clupisoma garua (12.8%), Labeo calbasu (9.6%) and Puntius sarana (8.5%).

06-3

Tedtalai : It is a small village like Raitalai and lies at a distance of 8 km from the river bank. The catches are brought for sale in local fish market on every Sunday, which is a weekly market day at this place. This market is fed by the same fishing villages which supply fish to Raitalai. Additional supply of fish is also received from nearby tributaries on market days. The total catches brought to this market

are comparatively more than that of Raitalai. During winter season, an average monthly catch of about 215 kg of fish is landed on weekly market days. The catches mostly comprised Tor tor (40.5%), Mystus seenghala and Mystus aor (14.2%), Labeo boggut (14.0%), Labeo fimbriatus (8.8%), Wallago attu (4.2%) and Cirrhinus reba (3.5%).

(b) River stretch in Maharashtra State (North bank: 275 km ; South bank: 338 km) : In the course of this river stretch, there are about 32 villages where fish catches are landed from the river on weekly market days and one regular fish market at Bhusawal where fish is brought daily. About 196 fishing villages situated in this stretch feed these markets. None of the villages situated on the river bank consumes fish on a large scale. The nearest regular fish market in this area is at Bhusawal. The other villages where fish is assembled for sale on market days are situated at distances varying from 6 to 19 km. At the time of fishery survey of this stretch, one regular fish market at Bhusawal and one weekly market at Adelaabad was visited.

Bhusawal : It is a taluka headquarters in the Jalgaon district and is situated at a distance of about 3 km from the river. Most of the local population here is accustomed to consume marine fish which is regularly imported from Bombay. Owing to a limited demand for freshwater fish, relatively meagre catches are landed at Bhusawal fish market from the Tapti river. The fish catches from the river are brought to this place on all week days, of which Sunday is the market day. About 5 fishing villages situated on both the banks of the river in the vicinity of Bhusawal feed this market regularly. The fish is also sold from door to door by the retailers. The total consumption of freshwater fish from the Tapti river in winter season is about 250 kg per month. Tor tor (44.5%), Mystus seenghala and Mystus aor (44.5%) and Labeo fimbriatus (11.0%) constitute the important fisheries near Bhusawal.

06-5

Adelabad : It is situated at a distance of about 16 km from the river bank and is one of the many small villages in Maharashtra State where fish catches are brought from the Tapti river on weekly market days (Sundays). This market is fed by 10 fishing villages of the Tapti river and also by a few fishing units of the Purna which is one of the important tributaries of the Tapti. About 175 kg of fish, brought from the Tapti river, is disposed of at this village every month in the winter season. The contribution of Purna to the fish catches sold at this village is about 50 kg per month. The fish catches mostly comprised Tor tor (57.0%), Labeo boggut (8.4%), Mystus seenghala and Mystus aor (7.5%) and Cirrhinus mrigala (6.7%), and the rest were Labeo fimbriatus, Puntius sarana, Labeo bata, Cirrhinus reba, Labeo calbasu, Ompok bimaculatus, Clupisoma garua and Channa spp. (20.4%).

(c) River stretch in Gujarat State (North bank and South bank : 155 km each) : In this river stretch, the demand for fish is comparatively meagre as the fish is largely consumed by minority communities residing in the surrounding areas. On account of this, there are just a few small fish markets on the river bank and the fish catches are not taken to distant villages on weekly market days, as is the conventional practice in the other stretches of the river in Madhya Pradesh and Maharashtra State. The fishery in this section of the Tapti river is exploited mostly by Adivasis on a small scale for their own consumption. Besides Surat, which lies within tidal limits and mostly receives a supply of brackish-water fish, Mandvi and Kathor are the only two places in this river section where fish is landed regularly during summer and winter months. During monsoons, the fish catches in this stretch dwindle considerably as the prevailing gear becomes ineffective in high floods. The fishery in this season is, however, substantiated by Hilsa which is caught with gill nets in the vicinity of Surat and downstream of it up to the river mouth and Jhamra jal (triangular scoop net) upstream of Surat up to Piparia.

066

Mandvi : It is a taluka headquarters in the Surat district and is situated on the river bank. Fishing is done in a 15 km river stretch in the vicinity of Mandvi by one

fishermen family of 8-10 members who bring their catches daily to the local market. Fishing in this area is conducted all the year round excepting the monsoon months when cast net and long line fishing is suspended due to the swift current and flooded condition of the river. However, during Hilsa season which coincides with the monsoon season, the fishermen of the surrounding locality catch Hilsa with Jhamra jal by drifting downstream with the current. About 250 kg of fish are landed every month during summer months. Tor tor was the most dominant species (34.6%) in the catches. The next important fisheries were of Labeo fimbriatus, Labeo calbasu, Wallago attu and Puntius sarana.

01-7.
Kathor : It is one of the important villages of Kamrej taluka in Surat district and is situated on river bank. It is quite near to Surat (about 25 km) and is connected with it by an all-weather road. This village is largely inhabited by the Muslim community and fish consumption is, therefore, relatively high. There are not many fishermen in this village, but due to a high demand for fish the local fish market is fed by Kamrej fishing village which is very close to Kathor. Fishing is done all the year round in the vicinity of Kathor and Kamrej. During the monsoon season, Hilsa constitutes a very important fishery in this area and surplus catches are exported to Surat where they fetch a good price. During summer months, the average monthly fish landings amount to 800 kg. Tor tor and Labeo fimbriatus formed dominant fisheries (59.7% and 27.8% respectively). The other species in the catches were Wallago attu (4.3%), Labeo calbasu (2.8%), Cirrhinus mrigala (2.0%), Mystus aor (2.0%), Clupisoma garua (0.7%) and Channa spp. (0.7%).

VI. FISHING ACTIVITIES, FISHING SEASONS AND DISPOSAL OF CATCHES

The fish catches in varying quantities are landed along the entire stretch of the Tapti river. Normally, the professional fishermen exploit fishable waters, comprising mostly deep pools, in the vicinity of their own villages moving 5 to 8 kilometres upstream and downstream. However, the fishermen of certain fishing villages located between Deodongri and Mohta fishing villages (Madhya Pradesh) cover 25-30 kilometres upstream and down stream of their villages. The fishermen of Janabad fishing village in Khandwa district (Madhya Pradesh) are of itinerant type and undertake fishing in vast stretch of the river, about 60-75 kilometres upstream and downstream of their villages, from January through June. Similarly the fishermen belonging to Jalgaon and Dhulia districts (Maharashtra State) cover vast areas of the river, continuously moving from place to place after January-February.

Besides the professional fishermen, the Adivasi community also fish but for their own consumption in certain stretches of the Tapti river, mostly using fishing contrivances of primitive origin. In summer, fishing by using poisons is also resorted to by the Adivasi community in isolated pools located in the upper stretches of the river in Betul district, where this community forms a sizable population. The fish poisons are prepared from the bark of poisonous trees and herbs, locally called tinsa, guradi and gulati, by crushing and boiling them. The poisonous decoctions thus prepared are sprayed in the isolated pools and the fishes come to surface within 10-15 minutes after the application of poisons. The water treated with poisonous decoctions turns black or deep red, depending on the type of bark used. However, waters, so treated, are reported to be harmless to animal and human life.

Fishing is free throughout the river stretch, except in certain stretches in Madhya Pradesh where a licence system has been imposed since 1958. The river stretches from Ratnapur to Najankheda in Burhanpur tahsil of Khandwa district (Madhya Pradesh) are annually auctioned by Gram Panchayats.

The auction is done mostly for pools which get isolated during summer but are connected by narrow trickling stream. The important stretches which are annually auctioned are located near Ramkheda, Dendha, Dagat, Dhar, Gondhri, Dasghat, Dabali, Rajghat (Janabad) fishing villages (Madhya Pradesh). A stretch of the Sapna (a tributary of the Tapti river) in Melghat taluka of Amravati district (Maharashtra State) is also annually auctioned.

Fishing season in the Tapti river commences from September-October, i.e., soon after the floods subside in the river, and continues till the onset of the monsoon season. Fishing operations are extensively conducted after January-February by which time the transporting facilities improve. During the winter and summer months, the operation of cast nets, gill nets and long lines, among other gears, is the most common in the river and the fishes mostly captured are Tor tor, Labeo fimbriatus, Mystus seenghala, Mystus aor, Wallago attu, Labeo calbasu, Labeo bata and Labeo boggut. Mahajal is operated only in certain stretches in Khandwa, Jalgaon, Dhulia and Surat districts during the summer months and all types of fishes are captured with this gear. During the winter season, particularly from November to January, chheer fishing* employing a scare line (local name : dor) and a composite net made of two cast nets is more prevalent. The catches from this type of fishing comprise the fingerlings of commercially important species like Tor tor, Labeo fimbriatus, Wallago attu, Mystus seenghala and Mystus aor and small sized fishes like Labeo bata and Labeo boggut.

The monsoon months generally mark the slack season for fishing in the Tapti river (except in the lower stretch), as fishing with prevailing gear is not feasible due to tremendous flow in the river. However, fishermen of certain fishing villages undertake fishing in nearby nalahs for local consumption. In the upper stretch of the river in Madhya Pradesh, the fishing activities practically come to a standstill during monsoons because the fish catches do not reach in good condition even to the nearest market on account of inadequate transporting facilities.

* The details of chheer fishing have been given by Karamchandani and Pandit (in press) from Narbada river.

In the lower reaches of the Tapti river in Gujarat State, Hilsa constitutes a comparatively lucrative fishery during the monsoon season, particularly in the vicinity of Surat and downstream of it where gill nets are operated and upstream of Surat up to Piperia where jhamra jal (triangular scoop net) is operated. Hilsa caught all along the river stretch from Surat to Piperia is locally consumed, but about 90% of Hilsa caught near Surat and downstream of it is packed in ice and exported to Baroda, Broach and Bombay, where it has a ready market and fetches a high price.

Towards the end of summer, the river becomes extremely shallow (knee-deep water in some places) in the extreme upper reaches, particularly in Betul district, when forage fishes are caught from small isolated pools with small drag nets or by application of fish poisons.

The fish catches are generally disposed of by fishing parties in nearby regular or weekly markets and sometimes the catches are purchased by fish merchants and retailers through their agents who move with the itinerant fishing parties from place to place.

VII. INVENTORY OF FISHING VILLAGES

With the limited scope of the present fishery survey (1959-60), the observations on the fisheries of the Tapti river are to be of a restricted nature. In order to be able to visualise the fishing potentiality of the river, it is imperative to gather the fundamental data on the fisherman population, actively engaged fishermen, fishing craft and gear. With this aim in view, the inventory survey was undertaken in the 728 km stretch of the river from Deodongri (Madhya Pradesh) in the east to Magdala (Gujarat State) in the west, and altogether 515 villages situated along the two banks of the river were surveyed in 24 talukas (tehsils) of 7 districts of Madhya Pradesh, Maharashtra and Gujarat States. The data collected during this survey are given in Table I.

TABLE I

States	Madhya Pradesh		Maharashtra		Gujarat	
	North Bank (298 km)	South Bank (235 km)	North Bank (275 km)	South Bank (338 km)	North Bank (155 km)	South Bank (155 km)
No. of villages surveyed	79	63	128	137	52	56
No. of fishing villages	72	53	98	112	49	52
Fishermen population	12,959	10,628	16,057	15,794	17,001	37,103
Actively engaged fishermen	909	732	969	1,057	995	2,580
Total No. of Boats	9	11	71	26	106	152
No. of fishing boats	4	4	Nil	Nil	68	119
<u>Fishing Gear</u>						
Cast net	126	150	632	594	743	1,019
Long line	136	134	497	583	572	193
Scoop net	136	356	761	683	503	455
Gill net	27	10	29	118	5,092	6,714
Drag net	3	5	22	17	13	27
Fishing rod	2,464	1,285	190	820	1,340	1,025
Fishing trap	362	346	1,068	997	598	657

Fishing villages : Of the 515 villages that were surveyed along the entire stretch of the Tapti river, 436 (84.7%) villages had a certain percentage of active fishermen, 6 (1.1%) were non-fishing villages with fishermen population which had no fishing gear and were engaged in other occupations, while the remaining 73 (14.2%) villages had no fisherman population at all.

Fishermen population : A total population of 1,09,542 fishermen, comprising 18,694 (17.1%) men, 21,907 (20.0%) women and 68,941 (62.9%) children, inhabited the 436 fishing villages and 6 non-fishing villages located along the banks of the Tapti river. Of this fisherman population, 60,717 (55.4%) belonged to the Adivasi community who employ primitive contrivances for fishing and 236 (0.2%) residing in 6 non-fishing villages were fishermen by caste but had switched over to other profitable occupations. Of the remaining population of 48,825 fishermen who resided in the 436 fishing villages, only 7,242 (6.6% of the total fishermen population) were actively engaged in fishing throughout the year while the rest of them either did fishing occasionally during their leisure time or were solely engaged in cultivation, manual labour or other occupations.

Of the total fishermen population on the two banks of the Tapti river, 23,587 resided in Betul and Khandwa districts of Madhya Pradesh, 31,851 in Amravati, Jalgaon and Dhulia districts of Maharashtra State and 54,104 in Broach and Surat districts of Gujarat State.

As compared to the north bank, the south bank was more densely populated with fishermen. A total of 63,525 fishermen (58.0% of the total population and 87 fishermen/km river stretch) resided on the south bank as against the inhabitation of 46,017 fishermen (42.0% of total population and 63 fishermen/km river stretch) on the north bank.

On the north bank, the fishermen population was densely concentrated in Surat and Dhulia districts. The former district had a population of 15,771 fishermen in the 141 km

river stretch (112 fishermen/km) while the latter district 14,572 fishermen in the 133 km river stretch (110 fishermen/km). Each of these two districts accounted for one-third of the fisherman population of this bank. The remaining one-third comprising 15,674 fishermen resided in Betul, Khandwa, Jalgaon and Broach districts. Broach and Khandwa districts were moderately populated, having 1,230 fishermen in the 14 km river stretch (88 fishermen/km) and 8,280 fishermen in the 130 km river stretch (64 fishermen/km) respectively. Betul and Jalgaon districts were thinly populated, having 4,679 fishermen in the 168 km river stretch (28 fishermen/km) and 1,485 fishermen in the 112 km river stretch (10 fishermen/km) respectively.

More than half of the total fishermen population of the south bank was concentrated in the Surat district alone, which had 37,103 fishermen in a 155 km river stretch (239 fishermen/km). The remaining 26,422 fishermen resided in Betul, Khandwa, Amravati, Jalgaon and Dhulia districts. Of these 5 districts, the next thickly populated ones were Dhulia and Khandwa, having 8,741 fishermen in the 128 km river stretch (68 fishermen/km) and 5,357 fishermen in the 94 km river stretch (57 fishermen/km) respectively. Betul, Amravati and Jalgaon were the most thinly populated districts, with 5,271 fishermen in 141 km river stretch (37 fishermen/km), 2,035 fishermen in 59 km river stretch (34 fishermen/km) and 5,018 fishermen in 150 km river stretch (33 fishermen/km) respectively.

Fishing gear and craft : The statistics of the fishing gear and craft possessed by fishermen in the 436 fishing villages are presented in Table I and the prevalence of main fishing gear in various districts bordering the Tapti river is enumerated below :

i) Cast net (Total No: 3,264) : 1,730 cast nets (53.0%) were encountered in the Surat district alone. The next higher prevalence of these nets was recorded in Dhulia district, 798 (24.4%), Jalgaon district, 426 (13.1%) and Khandwa district, 244 (7.5%). The occurrence of cast nets was scarce in Betul and Broach districts with each having 32 (1.0%) only and negligible in Amravati district.

ii) Long line (Total No: 2,115) : The highest number of long lines was recorded in the districts of Surat, 746 (35.3%) and Dhulia, 728 (34.4%). The other districts where the long lines were moderately prevalent were Jalgaon, 352 (16.6%) and Khandwa, 270 (12.8%). The occurrence of long lines was the lowest in Broach district, 19(0.9%). The long lines were totally absent in Betul and Amravati districts.

iii) Gill net (Total No: 11,990 pieces) : The maximum number of gill nets was recorded in the Surat district, 11,806 (98.5%). The occurrence of gill nets was scarce in Jalgaon district, 83 (0.7%), Dhulia district, 64 (0.5%) and Khandwa district, 32 (0.3%). These nets were in a negligible number in Betul district and totally absent in Amravati and Broach districts.

iv) Scoop net (Total No: 2,894) : 1,040 scoop nets (35.9%) were recorded in Dhulia district and the next higher numbers of nets were encountered in Surat district, 897 (31.0%), Khandwa district, 462 (16.0%) and Jalgaon district, 404 (14.0%). Gill nets were relatively scarce in Betul district, 30 (1.0%) and Broach district, 61 (2.1%), and were totally absent in the Amravati district.

VIII. CARP SEED RESOURCES IN A PORTION OF THE TAPTI RIVER DRAINING GUJARAT STATE

With a view to locating suitable and productive carp seed collection centres on the Tapti river, exploratory investigations were undertaken during the 1961 and 1962 monsoon seasons to ascertain the concentration and the quality of carp seed in a portion of the river draining Gujarat State.

During these investigations, standard spawn collection nets made of mosquito netting cloth were operated in shallow areas of the river every day for six hours, three hours in the morning and three hours in the afternoon. Generally three trial nets were operated during the periods when the carp seed was available in fair abundance. During slack periods, only one net was operated to determine the time when the carp seed again appeared in abundance and also to ensure that large quantities of seed were not missed.

The collections were periodically removed from the tail-piece (gamchha) of the spawn-collection nets, the frequency of the collections from the nets depending up on the concentration of spawn in the tail-piece. During peak collections, the contents of the tail-piece were scooped after every 2-3 minutes, otherwise the collections were removed after an interval of 25-30 minutes. The scooping was so regulated that there was no mortality at the collection stage due to crowding of spawn in the tail-piece. The spawn was segregated from its large-sized associates like weed fishes, young ones of predatory fishes, prawns, aquatic insects, weeds, debris etc. by straining the collections through sieves.

For the selection of a collection centre, the contours of river bed and the course of the main current in the river were taken into account. The nets were operated in the vicinity of the main current where the water flow was moderate and the filtration of water through nets was reasonably good.

The location of spawn collection centres in a portion of Tapti river in Gujarat State (see Map) and the periods of investigations are presented in Table II.

TABLE II

Monsoon Season	Collection Centre	District	Period of observation
1961	Bodhan	Surat	16.7.61 to 15.9.61
1962	i) Bodhan	Surat	1.7.62 to 28.8.62
	ii) Kathor	Surat	1.7.62 to 5.9.62

1961 Monsoon Season

Bodhan Centre : About 8.35 lakh of spawn were collected by operating mostly 3 trial nets for 244 hours on 45 days, and the average spawn yield per net per hour was 1,150 during the entire season. The carp seed was available in abundance on July 23 and August 28, 1961 when 4,05,000 and 1,05,000 spawn were collected by operating 3 nets for 6 hours each day, the catch per net per hour being 22,500 and 19,833 respectively. The nets could not be operated from September 7 to 15, 1961 due to high floods in the river.

The examination of nursery-reared carp fry showed that one of the two samples of carp seed comprised 9.9% major carps (Labeo calbasu, 8.0%; Catla catla, 1.1% and Labeo rohita, 0.8%) while the other sample contained no major carps. Minor carps mostly comprised Labeo bata (84.4 and 80.5 %) and Cirrhinus reba (5.7 and 19.5 %).

The river bed at the collection site, located about 1 km downstream of Bodhan, is shallow, sandy and gradually sloping. During normal floods, over 15 nets can be operated simultaneously. But, during high floods, the collection ground is rendered unsuitable due to the precipitous bank. However, the duration of high floods in the river is generally short as the water level after high floods recedes very quickly.

Bodhan is conveniently connected with Surat by road throughout the year.

1962 Monsoon Season

Bodhan Centre : Over 18 lakhs of carp spawn were collected by operating mostly 3 trial nets for 267 hours on 47 days and the average spawn yield per net per hour during the entire season was 4,000. The maximum spawn yield from 3 nets in 6 hours, on one single day (July 17, 1962) was about 6 lakhs, the spawn yield per net per hour being 38,000.

The reared samples of carp seed contained 0.4% major carps (Labeo dyocheilus), the minor carps mostly comprising Labeo bata (97.9%).

Kathor Centre : About 25 lakhs of carp spawn were collected by operating mostly 3 trial nets for 355 hours on 61 days, the yield per net per hour being 3,770 during the entire season. The maximum spawn yield per day was about 4 lakhs on July 9, 1962 which was collected by operating 2 trial nets for 4 hours, the average catch per net per hour being 52,500.

The carp seed samples reared in local nursery tanks contained no major carps. Minor carps mostly comprised Oxygaster spp. (53.8%), Cirrhinus reba (26.9%) and Labeo bata (10.7%).

The carp seed collection ground, situated about 2.5 km downstream of Kathor near Amboli village, is shallow, sandy and gradually sloping. At this site, about 20 nets can be operated simultaneously in a 0.25 km river stretch. The nets could be operated conveniently throughout the season, even during considerably high floods. At another site near Kathor, 3 to 4 nets could be operated during the periods when water level was very low.

Kathor is conveniently connected with Surat all the year round by road.

IX. OBSERVATIONS ON THE OCCURRENCE AND THE BREEDING OF Catla catla (Ham.) AND Labeo rohita (Ham.) IN THE TAPTI RIVER

Observations were made on the occurrence and the breeding of Catla catla (Ham.) and Labeo rohita (Ham.) in the Tapti river during the course of exploratory investigations on the fish seed resources in the river in 1961 monsoon season.

With a view to ascertaining the quality of the Tapti fish seed, several samples of fish seed collected from a section of the river near Bodhan (Gujarat State) from July 16 to September 15, 1961 were reared in two local seasonal tanks. The examination of reared samples from one of these tanks after three weeks' rearing revealed the presence of 26 fingerlings of Catla catla (50-75 mm) and 19 of Labeo rohita (25-40 mm) which together made up 1.9% in the samples. As this seasonal tank was stocked exclusively with the Tapti fish seed, these observations showed that the latter comprised a certain percentage of C. catla and L. rohita and that these two major carps have not only established themselves in certain stretches of the Tapti river but also successfully breed upstream of Bodhan during monsoon floods. These observations are of particular significance in view of the earlier belief regarding the non-availability of these major carps in the Tapti river. The evidences on hand show that the transplantation of C. catla and L. rohita in the Tapti river is accidental.

X. LOCATION OF SPAWNING GROUNDS OF THE INDIAN SHAD, Hilsa ilisha (Ham.) IN THE TAPTI RIVER IN GUJARAT STATE

Observations on the location of spawning grounds of Hilsa were commenced for the first time in the Tapti river at Bodhan (Gujarat State) in the 1961 monsoon season and were continued at Bodhan and Kathor (Gujarat State) in the 1962 monsoon season. About 22,000 and 8,000 Hilsa eggs, belonging to the same age group, were collected at Bodhan in the two monsoon seasons. This indicated that the eggs had drifted from one and the same spawning ground, located above Bodhan between Piperia (8 km upstream of Bodhan) and Mandvi (27 km upstream of Bodhan). During the 1962 monsoon season, about 9,000 Hilsa eggs collected at Kathor belonged to two age groups and had drifted from two spawning grounds, one located above Bodhan and the other between Bodhan and Kathor. As a result of the collection of fertilised Hilsa eggs at Bodhan and Kathor, the spawning grounds of Hilsa have been located for the first time in the Tapti river.

While collecting Hilsa eggs from the spawn-collection nets at Bodhan during the monsoon seasons of 1961 and 1962, some periodicity was observed in the occurrence of Hilsa eggs in the collections. In order to determine the significance of this phenomenon, systematic observations on the occurrence of Hilsa eggs were made by enumerating the eggs collected after every 15 minutes, during the period of their availability. From the data thus collected, it was observed that the peak period of occurrence of Hilsa eggs shifted clockwise by an hour or so every day. It was also observed that the eggs collected during the period of these observations belonged to the same age group, indicating that all the eggs had drifted down from the same spawning ground every day, and the late collection of eggs every day was due to late spawning activities. As the spawning time is closely associated with the migration of Hilsa to the spawning grounds, it is conclusively inferred that the migration of Hilsa was delayed every day by about an hour or so and this periodicity was observed to be in agreement with that of Hilsa fishing in the Tapti river at Bodhan. As similar time pattern is also exhibited by high tides, it is reasonable to conclude that the large shoals of Hilsa enter the mouth of the Tapti estuary along with high tides which fully explains the periodicity in the migration of Hilsa to the spawning grounds, spawning activities and occurrence of Hilsa eggs in the river.

XI. REMARKS

The fishery of the Tapti river can neither be considered rich in variety nor in abundance. The faunistic collections of the river, mostly made from its lower reaches, were represented by about 52 species of fishes. Of these, hardly 12 to 14 species are of real economic value to the fishery. Among the economically important species, Hilsa ilisha, Tor tor, Labeo fimbriatus, Labeo dyocheilus, Mystus seenghala, Mystus aor, Wallago attu, Channa spp. and Labeo calbasu contribute substantially to the fishery of the entire river stretch, though the pattern of species distribution and abundance may vary considerably in different sections of the river.

Of the gangetic major carps, the occurrence of only Cirrhinus mrigala was reported from the entire river stretch by the fishermen during fishery survey of 1959-60 but this major carp was actually recorded only at Kathor (Gujarat State). The other two major carps namely Catla catla and Labeo rohita were neither recorded in the landings of the river nor their occurrence was reported by the local fishermen. According to Setna and Kulkarni (1946), Catla catla is not known to occur in the westerly flowing rivers of Peninsular India but subsequently Rajan and Kaushik (1958) have recorded it from the Narbada river. Likewise, Labeo rohita does not seem to occur naturally in these rivers, though recently one of us (SJK) has recorded its occurrence in the middle and lower reaches of the Narbada river. However, while exploring new fish seed resources in the Tapti river during the 1961 monsoon season, the samples of fish seed collected near Bodhan (Gujarat State), on rearing in local nursery tanks, were found to contain the fingerlings of Catla catla and Labeo rohita. The evidences have shown that these two major carps were accidentally transplanted in the Tapti river and that they have not only established themselves in the lower reaches of the river but also started successfully breeding there. These observations only indicate their potentiality as future carp seed resources but their importance will depend on the quantity of the seed that can be collected in future, since the observations made during the following monsoon season (1962) have shown that the major carps are poorly represented in the fish seed collections made from the same river stretch.

The opportunities for proper exploitation of the fisheries on a commercial basis in the entire stretch of the Tapti river are extremely limited due to unfavourable topography of the river course and its surrounding areas. The river originates on the elevated Satpura plateau and flows over it for about 240 km, at places coursing through deep gorges, in Madhya Pradesh. Its course in this stretch is also beset with three falls, their height ranging from 6 to 10 metres. In certain regions of Maharashtra and Gujarat States the river courses through dense forests and rocky tracts, rendering such stretches inaccessible. Because the river descends almost abruptly from the elevated Satpura plateau to the plains in Gujarat State, it flows swiftly forming pools and rapids at several places along its torrential course. Being a monsoon-fed

and swift-flowing river, the fluctuations in water level between the commencement of the monsoons and the end of the summer season are marked. These factors are largely responsible for limiting large scale fishing activities to more easily accessible stretches of the river and also to a few months in winter and early part of the summer season.

During the monsoon season, fishing with prevailing gear viz. cast net, gill net and long line is not feasible due to the flooded condition of the river and tremendous flow in it. Inadequate transporting facilities and inaccessibility of fishing grounds are the other factors which discourage fishing during monsoon months. However, in this season, fishing is occasionally done in the nalahs and other tributaries of the river by professional fishermen as well as by the Adivasi community for their own consumption. It is only in the lower reaches of the river in Gujarat State where fishing activity is conducted during the monsoon season, when Hilsa is caught on a large scale.

Extensive fishing in the Tapti river is undertaken during winter and early part of the summer season, commencing in the month of September or October, as soon as the floods subside, but large scale fishing activity starts only after January or February, by which time the transporting facilities also improve. During the latter part of the summer season, the river becomes extremely shallow particularly in the upper reaches and fishing is mostly done in the isolated pools in which due to intensive fishing the fish stocks get almost completely exhausted by the end of summer season. However, during the following monsoon season, these pools get naturally replenished by the fishes undertaking short range migration from the lower reaches for breeding purposes.

Unsatisfactory marketing facilities, non-proximity of the regular fish markets and meagre demand for fish in nearby markets, besides the factors stated above, have contributed to poor exploitation of the fisheries of the river. Excluding the Surat fish market, where mostly brackishwater fish is landed, there are only four regular fish markets which are located in the immediate vicinity of the Tapti river in its entire stretch. The demand for fish in small villages situated near the river is very limited, except on market days. Due to

the absence of good roads and inadequate transporting facilities, fish catches cannot be marketed in good condition in big towns located far away from the river. Under the prevailing conditions, the catches are at best transported to the nearest markets on bicycles and on head-loads, and with this mode of transportation, it is hardly possible to feed distantly placed markets. The disposal of fish catches in small quantities is effected on weekly market days in about 50 small villages located in the vicinity of the Tapti river.

XII. SUGGESTIONS FOR THE DEVELOPMENT OF FISHERIES AND FUTURE WORK ON THE TAPTI RIVER

(i) Estimation of total fish production :

As in the case of the Narbada, the fishery of the Tapti river is also of a diffused nature. The fishermen from a particular section of the Tapti assemble their catches in nearby regular fish markets every day and also at six or seven small villages in a week on weekly market days (Monday through Sunday). Due to various limitations it was not feasible for this unit to continue, beyond a few months, the work of estimation of total fish production from the Narbada river in Madhya Pradesh, by sampling all the regular fish markets and important weekly markets in the area. For similar reason, the work of estimation of total fish production from the Tapti river was not taken up by this unit. Since the fishery staff of the State Governments are posted in almost every district, the work of estimation of total fish production from the Tapti river in Madhya Pradesh, Maharashtra and Gujarat States may be taken up by the concerned State Fishery Departments. The data may be collected by them, from regular and weekly fish markets, on species-composition of catches with total weights of each fishery and size composition of important species of fishes in the commercial catches. The data collected on these lines may be utilised for determining (a) total fish production, (b) monthly and seasonal fluctuations in the catches of various fisheries, and (c) size composition of each important fishery entering the commercial landings. In addition to the estimation of total fish production, the information on catch-per-unit-effort for important gears may also be collected at selected places along the river where facilities for such observations are available. The above information collected over a number of years will help the State Fishery Departments in the planning of development, exploitation and conservation of fisheries of the Tapti river.

(ii) Stocking of major carp fingerlings :

The observations on the fish catches landed at regular fish markets and some of the important weekly markets and the information gathered during the inventory survey of fishing villages of the Tapti river in Madhya Pradesh, Maharashtra and Gujarat States have revealed that the percentage of Cirrhinus mrigala is extremely poor whereas the other two major carps viz. Catla catla and Labeo rohita are absent in the commercial catches of the entire river stretch. However, the samples of fish seed collected from the lower reaches of the Tapti river in Gujarat during the 1961 monsoon season, on rearing in a nursery tank, were found to contain the fingerlings of C. catla and L. rohita (1.9% of nursery sample). The evidences on hand have shown that although catla and rohu were accidentally transplanted in the Tapti river, they have started breeding there. This shows that these two major carps can be established in the Tapti river by stocking them in suitable stretches of the river. Since, due either to the absence of major carps or their rare occurrence in the Tapti river, the quality of fish seed in the lower stretches of the river in Gujarat is extremely poor and probably similar is the case in the river stretches in Maharashtra and Madhya Pradesh, the stocking of major carps in the river may be done by the respective State Fishery Departments, with a view to augment the fisheries and enrich the quality of carp seed in this river.

ACKNOWLEDGEMENTS

The authors are indebted to Dr. B.S. Bhimachar, former Director and Dr. V.G. Jhingran, present Director of the Central Inland Fisheries Research Institute, for their valuable guidance and keen interest in the work. Their grateful thanks are due to the Director, Zoological Survey of India, for checking the identification of fishes. Thanks are also due to Shri R.C. Singh of this Institute for his assistance in the field during the 1961 and 1962 spawn prospecting investigations in the Tapti river.

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APPENDIX

Classified list of fishes from the Tapti river *

Class TELEOSTOMI

Subclass ACTINOPTERYGII

Order CLUPEIFORMES

Suborder CLUPEOIDEI

Family CLUPEIDAE

Subfamily CLUPEINAE

1. Hilsa ilisha (Hamilton)

Suborder NOTOPTEROIDEI

Family NOTOPTERIDAE

2. Notopterus notopterus (Pallas)

Order CYPRINIFORMES

Division Cyprini

Suborder CYPRINOIDEI

Family CYPRINIDAE

Subfamily ABRAMIDINAE

3. Chela laubuca (Hamilton)

4. Oxygaster clupeioides (Bloch)

5. Oxygaster phulo (Hamilton)

* The classification adopted here is mainly after L.S. Berg ("Classification of fishes, both recent and fossil". Trav. Inst. zool. Acad. Sci., U.S.S.R., 5(2), 1940).

Subfamily RASBORINAE

6. Barilius barila (Hamilton)
7. Barilius bendelisis var. chedra (Hamilton)
8. Barilius evezardi Day
9. Danio aequipinnatus (McClelland)
10. Danio (Brachydanio) rerio (Hamilton)
11. Esomus danrica (Hamilton)
12. Rasbora daniconius (Hamilton)

Subfamily CYPRININAE

13. Amblypharyngodon mola (Hamilton)
14. Tor tor (Hamilton)
15. Puntius sarana (Hamilton)
16. Puntius sophore (Hamilton)
17. Puntius ticto ticto (Hamilton)
18. Catla catla (Hamilton)
19. Cirrhinus mrigala (Hamilton)
20. Cirrhinus reba (Hamilton)
21. Garra mullya (Sykes)
22. Labeo bata (Hamilton)
23. Labeo boggut (Sykes)
24. Labeo calbasu (Hamilton)
25. Labeo dyocheilus (McClelland)
26. Labeo fimbriatus (Bloch)

(iii)

- 27. Labeo gonis (Hamilton)
- 28. Labeo rohita (Hamilton)
- 29. Osteobrama cotio (Hamilton)

Subfamily GARRINAE

- 30. Crossocheilus latius latius (Hamilton)

Family COBITIDAE

- 31. Noemacheilus botia (Hamilton)
- 32. Noemacheilus dayi Hora
- 33. Noemacheilus evezardi Day
- 34. Lepidocephalichthys guntea (Hamilton)

Division Siluri

Suborder SILUROIDEI

Family SILURIDAE

- 35. Ompok bimaculatus (Bloch)
- 36. Wallago attu (Schneider)

Family BAGRIDAE

- 37. Mystus bleekeri (Day)
- 38. Mystus cavasius (Hamilton)
- 39. Mystus aor (Hamilton)
- 40. Mystus seenghala (Sykes)

Family SISORIDAE

- 41. Gagata itchkeea (Sykes)

Family SCHILBEIDAE

- 42. Clupisoma garua (Hamilton)

Order BELONIFORMES

Suborder SCOMBERESOCOIDEI

Family BELONIDAE

43. Xenentodon cancila (Hamilton)

Order SYNGNATHIFORMES

Suborder SYNGNATHOIDEI

Family SYNGNATHIDAE

44. Dorichthys cuneolus (Hamilton)

Order OPHIOCEPHALIFORMES

Family CHANNIDAE

45. Channa gachua (Hamilton)
46. Channa marulius (Hamilton)
47. Channa punctatus (Bloch)

Order PERCIFORMES

Suborder PERCOIDEI

Family CENTROPOMIDAE

48. Ambassis nama (Hamilton)
49. Ambassis ranga (Hamilton)

Suborder GOBIOIDEI

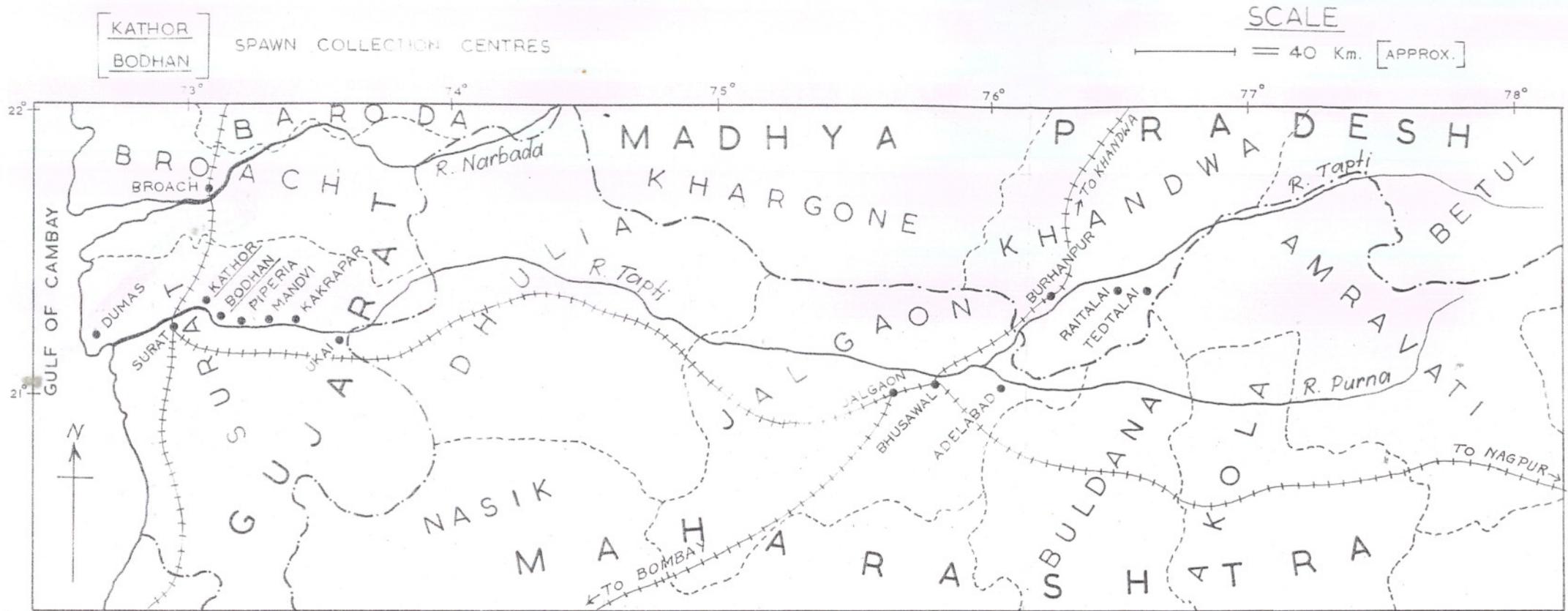
Family GOBIIDAE

50. Glossogobius giuris (Hamilton)

Order MASTOCEMBELIFORMES

Family MASTOCEMBELIDAE

51. Mastocembelus armatus (Lacepede)
52. Mastocembelus pancalis (Hamilton)



MAP OF THE TAPI RIVER SHOWING SPAWN COLLECTION CENTRES AND REGULAR AND WEEKLY FISH MARKETS.