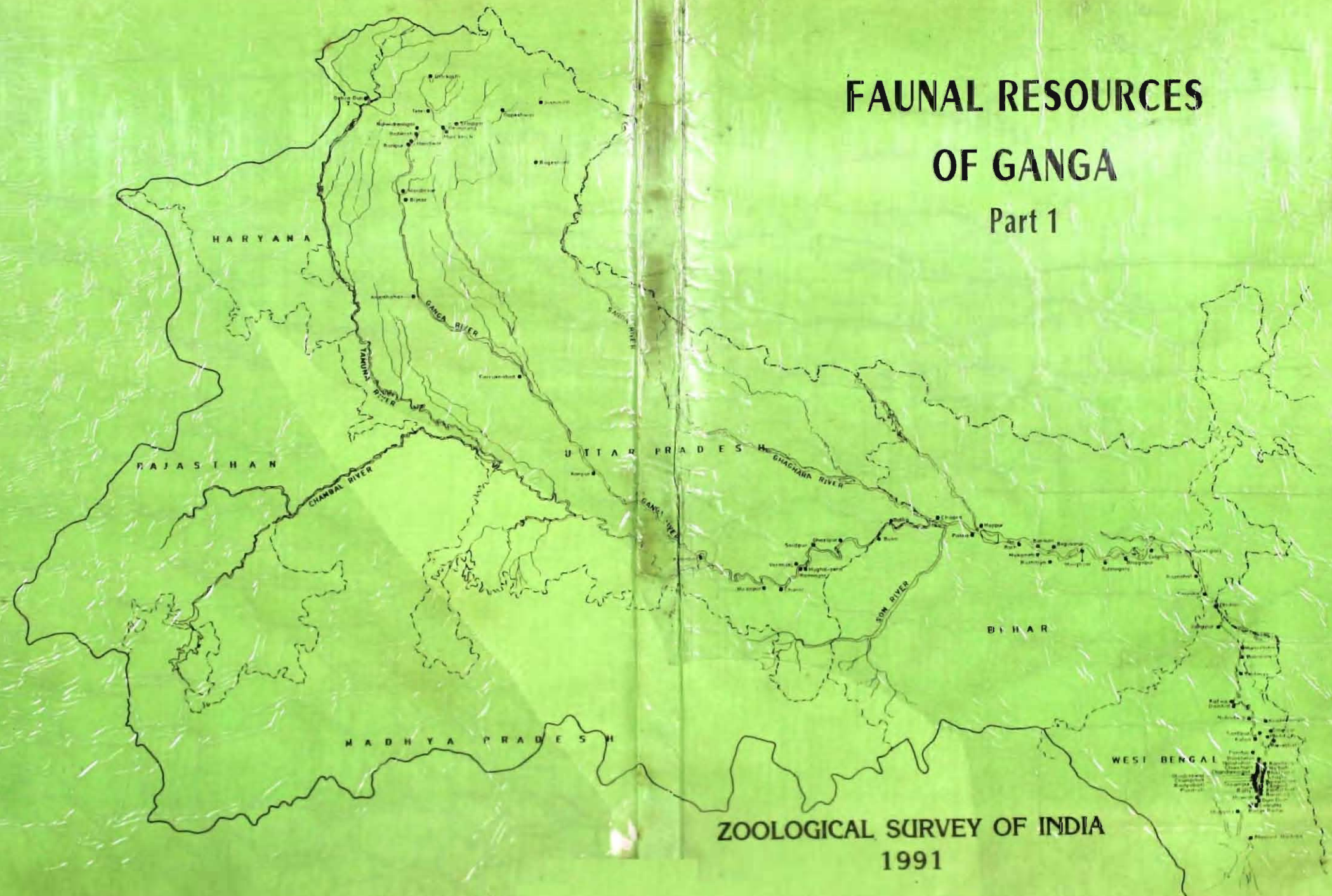


FAUNAL RESOURCES OF GANGA

Part 1



ZOOLOGICAL SURVEY OF INDIA
1991

FAUNAL RESOURCES OF GANGA

Part 1

(General Introduction and Vertebrate Fauna)

Edited by
Director, Zoological Survey of India



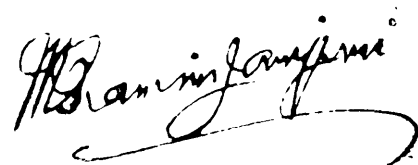
ZOOLOGICAL SURVEY OF INDIA
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FOREWORD

The River Ganga and its tributaries cover more than a quarter of total geographical area of India. It has attracted attention and concern of millions of citizens of this country which includes common man, scientists and philosophers for over centuries of civilisation. In recent times, Ganga has drawn national attention for its rather critical condition with respect to high load of pollutants, bank erosion and other problems. The Government of India has made a plan to clean Ganga as one of the top priority project, under the Ministry of Environment and Forests. The biological diversity inhabiting this longest freshwater system of this country needs to be documented. The present publication provides an overview of the river followed by vertebrate fauna of Ganga – fishes being the single largest component. This document is based on all available records and one has to compare the status of such biological diversity in to-days context. Expectedly, some of the old records may not become evident and many may have become rare. Restoration of biodiversity demands a complete status report on the basis of the past records, its present position and finally a strategy for bio restoration.

The document aims to fulfill the first objective; the second part on invertebrate fauna will follow shortly and finally the third part dealing with present status of fish fauna of Ganga will be published.

I wish to record my sense of appreciation to Dr. A. K. Ghosh, Joint Director, who has helped in scrutinising the papers presented in this publication.



(Mohammad Shamim Jairajpuri)
Director
Zoological Survey of India

30th July, 1991

FAUNAL RESOURCES OF GANGA

Part 1

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THE GANGA : A PROFILE AND BIOLOGICAL RESOURCES

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INTRODUCTION

The Ganga river system along with its tributaries form the single largest river system in India. Rising at Garhwal Himalaya (30°55'N, 79°7'E) as Bhagirathi in the ice cave of Gumukh at the snouts of Gangotri Glacier (c 4100 m, M.S.I.) the river traverses a distance of 2525 km to meet the ocean.

The Ganga basin encompasses an area of more than a million kilometers (1060,000 km²) in Indian and adjoining countries of Nepal, Bangladesh and China. In India alone, it covers more than a quarter (861404 km²) of total geographical area. The annual yield of water had been calculated to be 468,700 million m³ with a flow rate of 442,170 m³/km² and constituting 25.2 per cent of India's total water resource.

THE COURSE OF GANGA

The Bhagirathi, after originating at Gomukh cuts through the rocky himalayan terrain to meet another head stream, the Alaknanda, near Devaprayag and become known as "Ganga" After traversing 250 km through Himalaya to Rishikesh, it turns southwestwards for a distance of 30 km before coming down to the vast Indo-Gangetic plains near Hardwar (c 283 m). The river suddenly changes its profile at this point, widening to an extent of 750 meters.

During its course through the peninsula, the Ganga drains eight states viz., Himachal Pradesh, Uttar Pradesh, Madhya Pradesh, Rajasthan, Delhi, Bihar and West Bengal. The table (Table 1) illustrates the total geographic area of each of these state, per cent of total area under influence of the river, reporting area and per cent of reporting area. Most of the tributaries barring 5 major ones (Jammuna, Ghaghara, Kosi, Son, Gandak) have rather poor flow rate.

TABLE 1
Statewise share of the Ganga basin area

State	Total geographical area (km ²)	Per cent of total geographical area	Reporting area (km ²)	Per cent of total of reporting area
1. Uttar Pradesh	294,413	34.2	294,413	36.1
2. Madhya Pradesh	201,705	23.4	201,705	24.7
3. Bihar	144,401	16.7	138,296	16.9
4. Rajasthan	107,382	12.5	102,883	12.6
5. West Bengal	72,010	8.4	50,717	6.2
6. Haryana	34,200	4.0	21,265	2.6
7. Himachal Pradesh	5,799	0.6	5,799	0.7
8. Delhi	1,485	0.2	1,485	0.2
Ganga basin	681,404	100.0	816,563	100.0

(After Rao, 1975 and CSME/CBPCWP 1984)

The first major tributary received by Ganga is Ramganga at Kunnauj in Uttar Pradesh (contributing 15.26 billion m³ of water). Further down near Allahabad, Jamuna joins Ganga from the right (contributing 7.6 billion m³) and henceforth several major tributaries join the Ganga-Jamuna twins viz. on the right, Tons (contributing 4.9 billion m³), Sons (22.4 billion m³), and on the left - Gomati, Ghaghara, Gandak, Burhi Gandak, Kosi. The other major tributaries contributing to the water source are Damodar, Kiul, Kosi, Haldi, Dwarka, Rupnarayan, Punpun, Ajoy etc. but all of these latter named tributaries join the system after Farakka. Table 2 indicates the catchment area, annual yield of water, mean rate of flow of streams in the Ganga basin (after Rao, 1975, CSME/CBPCWP 1984).

The major contribution to the Ganga system come from Himalayan streams in the north (more than 60%), rest being (40%) contributed by Peninsular streams. However it is to be noted that catchment area of Peninsular stream cover 60 per cent of the entire Ganga basin (CSME/CBPCWP 1984).

The weather in Ganga basin is positively influenced by a southwest monsoon extending from the month of June to September (during which period it receives more than 70 per cent to total annual rainfall); a three month long spell of dry summer extending from the month of March to May and a winter, of almost same duration, extending from

TABLE 2

Catchment area, annual yield of water, and mean rate of flow of streams in the Ganga basin

Stream	Area of basin		Total annual yield		Rate of flow	
	km ²	Per cent	million m ³	Per cent	m ³ /s	m ³ /km ²
1. Jamuna	366,223	42.5	76,000	16.2	2,410	207,524
2. Son	71,259	8.3	22,420	4.8	711	314,627
3. Ghaghara	57,578*	6.7	94,400	20.1	2,993	740,392
4. Ramganga	32,493	3.8	15,258	3.3	484	469,578
5. Gomati	30,437	3.5	7,390	1.6	234	242,797
6. Damodar	25,820	3.0	12,210	2.6	387	472,889
7. Tons	16,860	2.0	4,927	1.0	156	292,230
8. Klu	16,580	1.9	5,900	1.3	187	355,850
9. Kamnasa and adjoining streams	11,709	1.4	5,750	1.2	182	491,075
10. Kosi	11,000*	1.3	61,560	13.1	1,952	708,400
11. Haldi	10,210	1.2	5,300	1.1	168	519,099
12. Burhi Gandak	10,150	1.2	7,100	1.5	225	699,507
13. Dwarka	8,850	1.0	4,678	1.0	149	526,604
14. Rupnarayan	8,530	1.0	4,400	0.9	140	515,826
15. Punpun	8,530	1.0	3,577	0.8	114	419,343
16. Gandak	7,620*	0.9	52,200	11.1	1,655	1139,738
17. Ajay	6,050	0.7	3,207	0.7	102	530,083
18. Other streams	170,035	19.7	31,400	6.7	996	184,668
19. Ganga	861,404*	100.0	468,700	100.0	14,862	442,170

* Area figures relate of the part of basin falling within Indian territory only.

the month of December to February, are the other distinct seasons in the basin area. Obviously, distinct seasonal rainfall pattern directly influence the flow pattern during wet and dry spells. Table 3 clearly illustrates the seasonal variation of stream flow in the Ganga basin (source CSME/CBPCWP 1984, CWC).

Another feature which deserves attention is the effect of ebb and flow tides. After Ganga bifurcates into Padma channel and Bhagirathi near Farakka, the major share of water goes down Padma. The Bhagarathi with significantly lesser water flows southwards towards deltaic plains of West Bengal and halfway through from Farakka, enters tidal zone of Gangetic delta. The hydrological feature of the river changes before it meets Bay of Bengal, near Sagar Island as the river Hugli.

TABLE 3
Seasonal variation of stream flow in the Ganga basin

River Station	Mean seasonal flow (million m ²)				Mean annual rate of flow (m ³ /second)
	Monsoon (Jun-Sep)	Post-monsoon (Oct-nov)	Winter (Dec-Feb)	Summer (Mar-May)	
Ganga :					
Rishikesh (1971-81)	21,631	1,912	1,305	2,150	856
Balawali (1976-81)	13,306	947	167	760	481
Garhmuktesar (1967-81)	18,392	1,756	908	982	699
Fatehgarh (1972-81)	17,300	1,266	264	281	606
Kanpur (1960-81)	30,736	4,139	1,518	910	1,184
Allahabad (1970-81)	112,278	10,703	4,148	2,987	4,216
Mirzapur (1979-81)	97,142	9,362	4,529	3,362	3,627
Varanasi (1960-81)	112,206	11,244	4,213	2,739	4,105
Buxar (1960-81)	113,247	17,741	5,463	3,438	4,436
Patna (1965-81)	192,625	28,488	11,044	8,341	7,626
Azamabad (1960-81)	235,357	54,494	18,055	12,474	10,159
Baharampur (1975-81)	12,817	6,055	8,140	6,277	1,056
Nabadwip (1975-81) (Purbasthali)	18,666	7,763	7,910	7,107	1,314
Jamuna :					
Tajewala	6,800	1,400	900	1,400	333
Delhi Ry. Bridge	6,500	800	200	400	251
Etawah	7,300	1,000	300	200	279
Pratappur	61,600	9,300	3,400	1,700	2,410
Son :					
Chopan (1960-81)	14,867	2,105	1,915	1,534	648
Koelwar (1960-81)	17,699	2,256	1,497	966	711
Tons :					
Meja Rd. (1960-81)	4,159	491	194	83	156

LAND USE IN GANGA BASIN

The land use profile indicate that at least 509,994 km² of land is extensively cultivated; this constitutes 62.45 per cent to total reporting area (816, 653 km²). The non arable land has been estimated at 189,646 km² or 23.2 per cent of total reporting area. A large portion of non-arable land however is used for human habitation. The third category of land use comes under forest; the forest cover in the basin appears highly variable, from 2.43 per cent in Haryana to 59.37 per cent in Himachal Pradesh; the mean value for forest cover comes to about 14.33 per cent to total land in Ganga basin. Table 4 illustrates pattern of land use (statewise) in the Ganga basin, on the basis of total geographical area.

TABLE 4
Land use pattern in Ganga basin
(in per cent of the total geographical area)

State	Non-arable	Forest	Cultivation	Net sown	Habitation	Economic use
	1	2	3	4	5	6
Haryana	18.08	2.43	79.49	59.95	3.58	65.96
Uttar Pradesh	15.33	14.69	69.78	58.94	5.91	79.54
Bihar	28.93	7.55	63.52	49.86	9.70	67.11
West Bengal	15.09	7.56	77.35	65.74	10.75	84.05
Rajasthan	40.82	8.70	49.78	44.93	2.22	55.85
Madhya Pradesh	23.90	23.07	53.03	45.45	1.79	70.31
Himachal Pradesh	25.07	59.37	15.55	14.16	1.54	75.07
Delhi	51.04	0.94	48.01	46.46	43.78	91.18
Ganga basin	23.22	14.33	62.45	52.41	5.35	72.09
India	22.51	20.44	47.87	42.64	3.49	66.57

N.B. Col. 6 = Cols. 2 + 4 + 5

SOIL

The Ganga basin area, show different soil characters at different zone. The high mountain remain prone to soil erosion, the lower peninsula act as a receiver of thick layer of sediment while southern plateau shows a thick mantle of soil of varying thickness. Based on NATMO map (Dasgupta, 1980), at least ten different types of soils could be identified. These are important to understand the physical background as also to assess the ecological condition that can be evidenced in such zones and their consequent correlation with biota. The soil types are shown in Table 5.

CLIMATE

CSME/CBPCWP report (1984) indicate that Ganga basin forms an extensive bowl for warm air, May being recognised as the hottest month in the entire basin, when the temperature rises to 40°C and

above in the plains west of Gaya. In the same area, the daily mean minimum temperature can come down to 10.1°C in the month of January. In the lower gangetic plain, the mean maximum may be little lower (35°C-38°C) on summer but mean minimum also remains higher (11°C-13°C) in winter.

TABLE 5
Soil types in Ganga basin

1. Mountain Soils	Below permanent snowline and in the alpine grassland.
2. Submontane Soils	Below alpine meadows in middle and lesser Himalaya.
3. Alluvial Soils	Vast alluvial plain (52 per cent of total Ganga basin).
4. Red Soils	In Central Indian Plateau (12 per cent of Basin area).
5. Red and Yellow Soils	Good agricultural soil of high fertility in Bihar, West Bengal border.
6. Mixed Red & Black Soils	Eastern Rajasthan, largely used for pasture land.
7. Deep Black & Soils	Alluvial in origin or through weathering of dyke rocks in Madhya Pradesh and Rajasthan (Chambal valley, Panna Satna dist., etc).
8. Medium Black Soils	Widespread (11 percent of Ganga basin), mostly in high plateaus of Madhya Pradesh.
9. Shallow Black Soils	Less-than 30 cm deep; in Rajmahal hills.
10. Latorite & lateritic Soils	High rainfall area of upland belt fringing alluvial plains.

It is interesting to note that diurnal range between daily mean minimum and daily mean maximum temperatures decreases with the advancing monsoon reaching the lowest point at the peak of monsoon usually in the month of August.

The general trend of high temperature prevailing over the basin leads to high rate of evaporation and the total annual evaporation in Ganga basin has been estimated to be higher than the total annual rainfall received except in lower Bengal and Himalayan region. But for the fact that rainfall is not evenly distributed round the year and becomes maximum during three monsoon months, the surplus at that period (which is higher than what is lost through evaporation) help to maintain the surface flow.

It has been estimated that on an average every square kilometer of Ganga basin receives one million cubic meter of rainfall but available water remains at the level of less than half the amount received; this is ascribed to loss by evapotranspiration (30 per cent) and seepage into ground water aquifer (20 per cent). The balance remains at 493.8 billion cubic meter of water.

NATURAL VEGETATION

The vegetation in the catchment area of Bhagirathi is grouped in three major zones based on altitudes viz. (i) Subtropical zone (below 1200 m), (ii) Temperate zone (1200-1800 m), (iii) Sub-Alpine zone (1800-3000). Some typical floristic components are shown in Table 6.

The upper Ganga Plain (73°3'E-82°21' and 25°15'N-30°17'N in U.P.) exhibit few small patches of woodlands and vegetation appear more extensive in the submontane belt. The forests in the region can be grouped under 'tropical moist deciduous', 'tropical wet' and 'sub tropical dry' classes; the tropical moist deciduous forests are largely confined to Tarai region and is predominated by Sal (*Shorea robusta*) besides other species of trees and tall grasses viz. elephant grass, kans, (*Saccharum spontaneum*) *munj* (*S. bengalensis*) etc; the tropical wet forest appear more open and show admixture of

Semal (*Bombax ceiba*) whereas subtropical dry forests have *shishum* (*Dalbergia sisso*), *babul* (*Acacia nilotica*), *khair* (*Acacia catechu*), *Semal* (*Bombax ceiba*) etc. The total forest cover in upper Ganga Plain was estimated to be only 4.5 per cent even in 1971 and it can be easily estimated to be much less after nearly two decades in view of general trend of loss of forest cover. The deforestation of catchment area has already caused national concern and a massive plantation programme was initiated near Hardwar, in recent time (1985-86).

The Middle Ganga Plain (24°30'N-27°50'N and 81°47'E-87°50'E) has been considered as the heart region of India. Covering an area of 144,409 km², in the plains of Bihar, eastern Uttar Pradesh lying on the side of Ganga and Ghaghara within himalayan and peninsular ramparts show little vegetation cover except in northern part of Champaran district of Bihar, pockets of Tarai and some rivers banks. The Champaran forests are classified as (i) Siwalik Sal (ii) Moist high alluvial Sal (iii) Gangetic moist deciduous riverine forest. In general, moderate rainfall and fertile soil offer a natural niche for 'Sal' and other species e.g. *Shisam*, *Jamun* (*Szygium cumini*), *Mahua* (*Madhuca longifolia*), *ber* (*Zizyphus mauritiana*) etc. Savannah with grasses e.g. *bher*, *moonj*, *kans*, *Jhau* are common in Tarai and low lying areas. Besides the forest and grassland vegetation a number of other floristic components viz. *peepal*, banyan, tamarind, *mahua*, *neem*, *babul*, palmyra, date-palm, form a part of natural scenario. Planted fruit orchards of common tropical fruit trees e.g. mango, *jamun*, guava, jack fruit, plams, citrus, lemon are also frequently noted. In general groves, orchards and vegetation of low-lying marshes can be noted more frequently in north-Bihar Plains than in the south. However total forest cover in most of the district is alarmingly low, varying between 0.01-11.0%.

The lower Ganga Plain (21°25'N-26°50'N and 86°30'-89°58'E) encompasses an area of 80,968 km² in the Purnea district of Bihar and whole of state of West Bengal (except mountainous part of Darjiling and Puruliya district). The region exhibit tropical evergreen forest in the north (in Duars region), while deciduous and scrub vegetation covers the greater part; the largest mangrove forest in India (together with mangrove forest of contiguous area of Sundarban in Bangladesh this forms the largest mangrove forest in the world) cover the Sundarban near the confluence of Ganga (here called Hugli) with Bay of Bengal. This mangrove forest show a preponderance of *Avicennia* spp, *Excoecarica agallocha*, *Ceriops decandra*, *Bruguiera* spp, *Kandelia candel*, *Amoora cucutata*, *Phoenix paludossa* etc; a total of 30 tree species, 20 shrub species and 20 herb species have been listed from the region of which 35 species are grouped as true mangrove species, 28 as mangrove associates and 7 other as obligate mangrove (Naskar & Guha Bakshi 1987).

The natural vegetation of Ganga basin area, needless to emphasise, offer diverse ecological niches for the terrestrial fauna to evolve and radiate. The aquatic flora however specially microphytes, which play vital role in the food-chain in aquatic ecosystem, remain little known.

TABLE 6

Some typical components of natural vegetation in the catchment area of Bhagarathi

Sub Alpine Zone :	Silver fir	:	Abies pindow
	Blue pine	:	Pinus excelsa
	Spruce	:	Picea morinda
	Cypress	:	Cupressus torulosa
	Deodar	:	Cedrus deodara
	Birch	:	Betula utilis

TABLE 6 (Cont'd.)

Some typical components of natural vegetation in the catchment area of Bhagarathi

<i>Lower Sub Alpine :</i>	Oaks	:	Quereus dilatata
		:	Quereus himalayensis
		:	Quereus incana
		:	Quercus semicarpifolia
	Rhododendron	:	Rhododendron arboreum
<i>Temperate Zone :</i>	Chir Pine	:	Pinus roxburgii
	Poplar	:	Populus ciliata
<i>Sub-Tropical Zone :</i>	Sal	:	Shorea robusta
	Kaniu	:	Holontilia integrifolia
	Semal	:	Bombax ceiba
	Haldu	:	Adina cordifolia
	Khair	:	Aeacia catechu
	Sisso	:	Dalbergia sisso
	Bamboo	:	Dendrocalamus strictus

FAUNA

The faunal resources of Ganga have distinct characteristic features in three zones viz. (i) the upper flowing through hilly terrains (for about 220 km), (ii) the middle reaches traversing through the alluvial plains of Uttar Pradesh, Bihar and West Bengal and finally (iii) the deltaic tract, where it spreads out into numerous creeks and courses coming under the influence of tidal amplitudes.

While Nelson Annandale, the founder Director of the Zoological Survey of India must be credited for providing the first albeit brief account of fascinating animal life in Ganga (1923), Francis Hamilton Buchanan, an officer of East India Company (serving during the years of 1794-1815), should be given the place of pride for his "Account of Fishes found in the river Ganges and its branches" (1882). Hamilton Buchanan collected the information during his Statistical Survey of Bengal and other official duties but it is his keenness as a naturalist which prompted in the publication of 405 page monographic account of 267 species of fishes.

Recent account of fauna of Ganga is rather scattered and scarce. No systematic survey of the entire Ganga system has ever been made. However, due to direct economic impact of fishery development programme, limited data on fish landings are available with Central Inland Capture Fisheries Research Institute (erstwhile CIFRI). Recent projects like Limnological Survey of the impact of human activities on river Ganga (MAB-India Project, Bhagalpur University), 'Investigation on the Ganga river to determine biological indicators of water quality' (MAB-India Project, BHU), Degradation of Pesticide residue and effect on biota of river Ganga (MAB-India Project, BHU), and at least 30 other project on pollution and biota under Integrated Ecodevelopment Research Scheme on River Ganga and Immediate basin (DOEn, 1985) hardly provide any updated and substantial data on fauna and flora of Ganga system.

In recent years, however due to continued emphasis on mangrove ecosystem conservation and substained research on Sundarbans and adjoining deltaic region, consolidated results of investigations on fauna have been published (Anon : Marine Science Department, Calcutta University, 1985); additional references on the subject are also available in the socio bio-ecological study of Sundarbans published by Mandal and Ghosh (1989). Similar account of flora of delta i.e. region is also available in Naskar and Guha Bakshi (1987).

However, tracing back the course of history, it can be seen that Asoka the great, in his fifth pillar of Edict promulgated the game laws and fishery legislation in 3rd century B.C., and listed among an apparently obscured list of animals, at least two of the animals from Ganga, one that of "String-Ray" and the other that of "Dhongoka Turtle" and it may reasonably be assumed from onomatopoeic point of view that his *gangapaputakas*, refers to well known Gangetic Dolphin.

Europeans, before the time of birth of Christ had traveller's account of India as a land of myth and mystery. Pliny and elder, in 1st Century A.D., called the Gangetic Dolphin by its modern generic name *Platanista* and described almost in an uncanny manner the migration of fishes to and from Ganga, for breeding. Another Greek, Aelian in 2nd Century A.D., provided a fairly accurate description of Gharial. Babar, the first of the great Moghuls, after seventeen centuries of the time of Asoka, described the Gangetic Dolphin and Crocodiles, from his own observations, marvelling at such life form which must have appeared so alien to anyone from Central Asia.

The life in Ganga finds expression in an array of animal species. The most well known being Gangetic Dolphin, *Platanista gangetica* (Lebeck, 1801), known locally as Susu or Susuk; with its fusiform body, long, slender and compressed snout, almost negative eyesight, it has, like other Dolphin, ability to communicate through echo-sounding. A positive proof of migration, according to some expert may be wanting, but its range extends from base of mountains to the tidal water. However, it never enters the Sea. A recent study indicates that Gangetic Dolphins are most abundant from Monghyr to Sahibganj, common up to Farraka Barrage in the east and Varanasi in the west, but nevertheless, is present in Bhagirathi and Hooghly rivers eastwards in West Bengal and towards Allahabad in the West, upto Jamuna. Besides Dolphin, at least 9 other species of aquatic mammals viz. Large Indian porpoise, *Orcaella brevirostris* (Gray), Malaya Dolphin *Stenella malayana* (Leopold) and Smooth coated Indian otter, *Lutra perspicillata* (I. Geoffrey) etc. are known. The Wildlife (Protection) Act, 1972 lists Gangetic Dolphin in Schedule I, offering full protection.

The bird life in Ganga varies in different stretches as it passes through the plains but in the estuaries in Sundarbans, assumes a new dimension, Mangrove forest in Hooghly estuaries of Sundarban is known to harbour as many as 30 species of birds.

The tradition of worshipping "Makara" or Crocodile is an ancient one. In Ganga, all the three species of Crocodiles known from India, occur variably at its different stretch. *Gavialis gangetica* (Gmelin) commonly known as Indian Gharial or Gavial, derives its popular name from the bulbous knoblike protruberance on a breeding male's snout resembling "Ghara" or pitcher. Gharial is considered giant among Indian crocodiles measuring upto 6.25 meter. Once known to swarm Ganga and its tributaries from Chambal in Rajasthan to Mahanadi in Orissa, Gharial's population has dwindled to 200 individuals. The Saltwater or Estuarine Crocodile *Crocodylus porosus* Schneider, is an ocean going species and can also reach 6 meter length, but it has a stout snout with an edge extending between eyes in front of the snout. Once reported to be "flourishing along the shores of Bay of Bengal" Saltwater crocodiles survive through small population in Hooghly estuary, Sundarbans, besides in Orissa and Andaman & Nicobar Island. The Mugger or *Crocodylus palustris* Lesson, is a smaller species without a wedge on its strong snout, is sympatric in distribution with Gharial and can be located in canal, bundhs, lakes and marshes along Ganga system. The Wildlife (Protection) Act, 1972

includes all the three species under Schedule I, offering complete legal protection to these endangered species.

The monitor lizards are regarded, as the biggest and heaviest members of living lizards. India's largest lizard, *Varanus salvator* (Laurenti), reaching a length of 25 m, is a familiar water monitor in Ganga. It is the second largest living lizard in the World, second only to "Komodo Dragon" of Indonesia. Once common in Gangatic course, this good swimmer can be found in estuaries in Sundarban mangrove, besides in Orissa and Andaman & Nicobar Islands.

Besides the fascinating Crocodiles and water Monitor, at least 11 different species of freshwater, mud and estuarine turtle and tortoises inhabit Ganga system. J.E. Gray (1830-1835) in his "Illustrations of Indian Zoology", chiefly based on the collection of Major General Hardwicks, described 6 of these reptiles e.g. the Dongoka Turtle *Kachuga dhongka* (Gray, 1834), Bengal Roofed Turtle *Kachuga kachuga* (Gray, 1831), North Indian Roofed Turtle *Kachuga tecta* (Gray, 1831), North Indian Fresh water Turtle *Geoclemys hamiltoni* (Gray, 1831), Narrow headed soft sheld Turtle *Chitra indica* (Gray, 1831) and Peacock marked soft shelled Turtle *Trionyx hurum* Gray, 1831), the last being closely related to Ganga soft shelled Turtle, *Trionyx gangetica* (Cuvier, 1831) described by noted french Zoologist Cuvier; besides these seven species, four other species, of which three were described by Gray, are also known to occur in Ganga system viz. Batagur River Terrapin *Batagur basaka* (Gray, 1855), Peninsular soft shelled Turtle *Trionyx lethi* (Gray, 1872) and North Indian Flap-shelled Turtle *Lissemys punctata punctata* (Lacepede, 1788) - the last being the oldest of the described species listed above. Of the above 11 species, at least 6 belong to freshwater terrapin group and 5 (except Batagur or River Terrapin) are almost endemic to Ganga-Brahmaputra system; the other five species of flap-shelled or soft shelled turtles have also restrictive distribution. All these facts only indicate how vital the role that is played by Ganga River system in the life of these reptiles, which have been exploited for cheap protein thus bringing them to an endangered or vulnerable status. Besides the freshwater turtles, the Olive Ridley Turtle *Lepidochelys olivacea* Eschscholtz, the smallest of the marine turtle, visits Sundarbans for egg laying.

While amphibian (frogs and toads) play important role in the aquatic ecosystem both as food to the higher vertebrates such as carnivores or meat eating reptiles and as predator of lower animals, no definite data was available on amphibians.

The fishes, as noted by Hamilton-Buchanan, forms the largest group of living natural resource in Ganga. The fishes found in the upper reaches in the hill-stream sector, develop peculiar adaptation to stick to the substratum against the fast-flowing water, similar to the young tadpole stage of frogs and toads in the hill stream. Anandale in 1923 mentioned about two species Mahasheer and Goonch. The Mahasheer, a gangetic migrating barbet, can move against the strong current of the river and reach the base of hills and Goonch, a huge sluggish catfish skulks in the crevices amongst rock and protects itself against water current. The migration of Hilsa from marine ecosystem to freshwater of Ganga and its egg-laying habit in the mixed-water is now well known. Although Hilsa also visits other rivers of India, the Hilsa of Ganga occupies the place of pride. The fish resource of inland water system depend largely on Ganga and the estuarine delta, and southern Bengal continues to play a vital role.

The crabs and the prawns form two other important animal groups inhabiting Ganga system. At least four common estuarine prawn occur in Hooghly estuaries viz. "*Bagda chingri*" (*Penaeus semisculatus* De hunn), "*Chapda chingri*" (*P. indicus* Edw.), *Dhanbone chingri* (*Metapenaeus brevicornis* Edw.) and "*Karaney chingri*" (*M. monaceras* Fab.). Among the freshwater prawns, "*Golda chingri*" (*Macrobrachium carcinus* Fab.), besides other, is most well known. The commonest of edible crab "*Nona kankra*" or Salt Water crab (*Scylla serrata* Fors.), is harvested heavily along with freshwater crab, "*Pati kankra*" (*Peratelpusa spinigera* Wood-Mason) and a species of smaller variety *Varuna littorata* (Fab.). It is interesting to note that besides the most well known edible crabs, at least 55

other species of crabs occur only in estuary region in Sundarbans. Of the crab species, Varuna crab is known to be tolerant to salinity, as it can live both in open sea and freshwater. Every year this little crab species invades Ganga in the neighbourhood of Calcutta for breeding but never has established itself as a permanent denizen of inland water. The same is true for a small jellyfish, a marine animal, *Campanulina ceylonensis* (Browne) which also used to invade the Canal system of Calcutta, which are linked up with Ganga, in an annual cycle.

The shell-fishes of mollusca of gangetic delta is known to be very rich in species diversity, including many land-inhabiting gastropods which become evidenced in large number in the mud flats when exposed in low tide. A recent survey of Hooghly estuary region alone reveal occurrence of at least 70 species of molluscs of which at least 3 species of bivalves are used commercially in limeshell industry and poultry feed. Besides, of the 70 species, at least 20 are only found from Gangetic delta and have not been reported from anywhere else in the world. Nelson Annandale stated as far back as in 1922 that Coelenterates Hydra, Jellyfish, Sea Anemone and others are richly represented in euryhaline fauna (which can survive over a wide range of salinity) of gangetic delta. A gaint variety of sea-anemone has been reported as recently as in 1975 from Sagar Island in Sundarban; another species of sea-anemone, known earlier from Porto Novo has been recorded in estuarine region in 1976.

Examples can be cited from other interesting animal forms, which enrich fauna of gangetic estuarine region. King Crabs or Horse-shoe crabs (Which are not true crabs but relatives) are regarded as living fossils. In sundarban estuarine region, at least two species of horse-shoe crabs *Carcinoscorpius rotundicauda* (Latreille) and *Tachypleus gigas* (Muller) breed in muddy shores or sandy beds.

The recent finding of a new hemichordate (animal placed in between vertebrate and invertebrate) (*Sacoglossus* sp. Singh and Chowdhury, 1984) in deltaic region is stated to represent the sole species known from mangrove environment in the tropics.

All the living forms in Ganga are obviously linked through a web of food chain which derived nutrient from the level of planktons (a gneral term used for tiny organisms in the water). The plankton population in any water body provide the basic food for larger members of animal world and can also indicate the state of environment. Studies on seasonal abundance and biomass of zooplankton with relation to commercial fish landing and other resources reveal a rich zooplankton (specially copepods) fauna of Ganga, specially in the lower reaches. The investigations on fisheries of Ganga River system carried out by Central Inland Fisheries Research Institute during a eitht year period of 1958-1966 yield a host of data on this most poterntial resource base. Classified data on major carps - *Rohu*, *Mrigala*, *Catla* and *Kalbosh*, *Catfish* - *Tangra*, *Clupeids* - *Hilsa* and others were tabulated and it was estimated that annual average catch in the area between Agra and Allahabad in Jamuna and Kanpur to Bhagalpur in Ganga, centres around 800 tonnes (in a total of 8 stations only).

However, the living world in Ganga-system, along with alarming pollution level is facing critical situation for some years in the past. Besides untreated sewage, effluents from sugar mills, pesticides, oil refinery, pulp and paper factories, fly-ash from coal washeries, etc. all contribute to the fast deterioratng environment of this largest riverine system of the country. While specialists from every conceivable field are making efforts for a clean Ganga, [under "Central Ganga Authority"] Integrated Ecodevelopment Research on River Ganga and its immediate basin, funded by the "Man and Biosphere - India" committee is expected to cover some of the biological aspects. Of a total of 29 projects proposals as mentioned earlier, assigned to 8 different universities, at least 8 projects are specifically concerned with biological aspects. However, all these projects are in West Bengal Universities and can cover only a stretch of Ganga system.

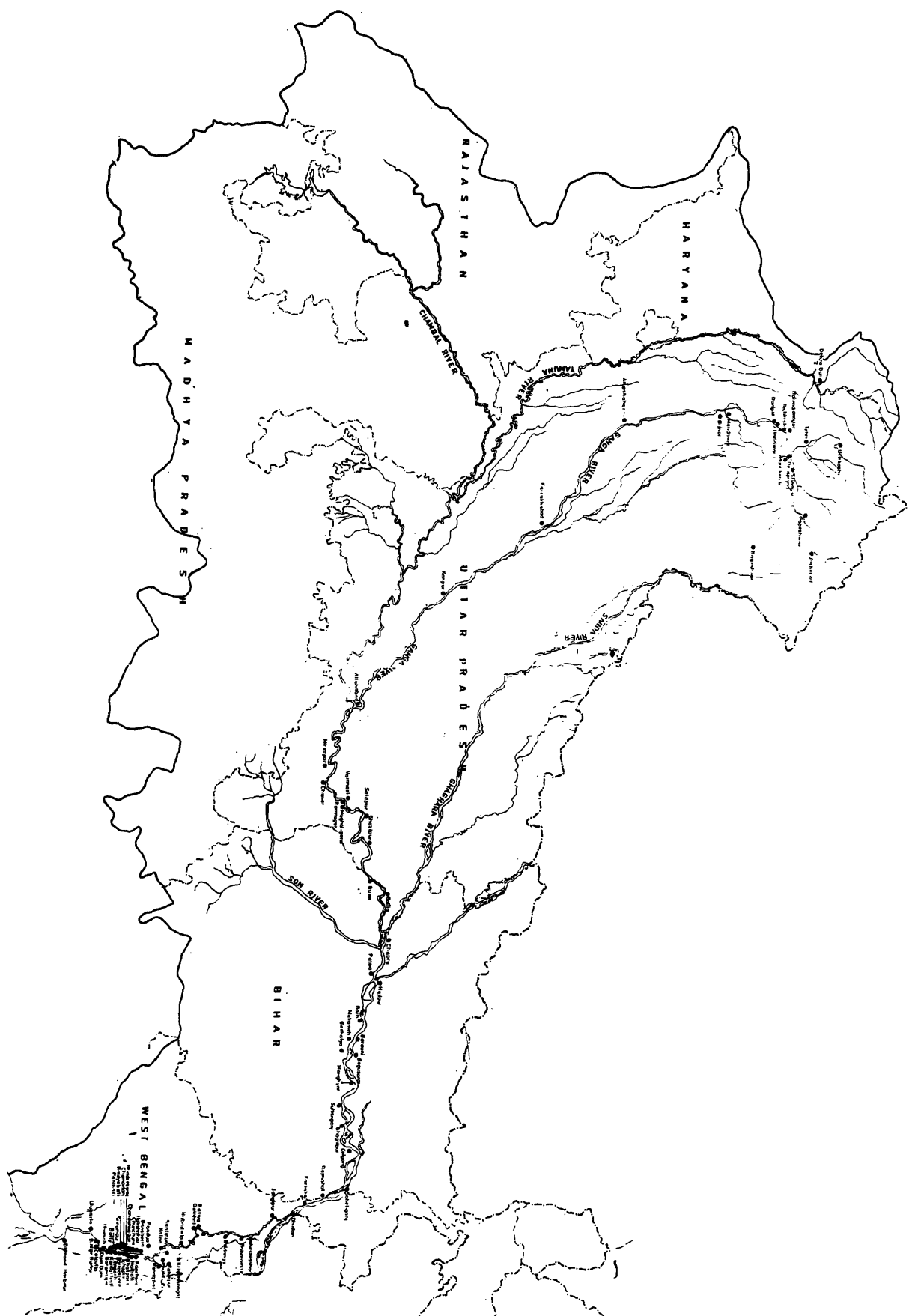
The life in Ganga depend on success story of "Clean Ganga" As some of the animals have already

been listed under schedule I of Indian Wildlife Protection Act, the past impact of human activities can easily be evidenced. An integrated approach should have an uniform component to save the myriad of life forms along with their habitat, the Ganga.

In the following chapters accounts of major fauna of Ganga system have been given by subject specialists of Zoological Survey of India. One has to admit that while these may not be the by far most complete of such accounts, nevertheless, these form the pioneering attempts to project a profile of life in Ganga.

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MAMMALIA

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INTRODUCTION

Making an inventory of the mammalian fauna of the River Ganga is not an easy job, since no such survey was made in the past. Hence, an attempt has been made here to compile a list of mammalian species so far reported from this river (*vide* Atkinson 1974, Blanford 1888-91, Ellerman & Morrison-Scott 1951, Norris 1966, Walker 1968, Khajuria 1975, Honacki et al. 1977, Corbet & Hill 1980, Kasuya and Haque 1972, Jones 1982), together with a brief review of the work done on these species in India and abroad.

Out of the two orders of aquatic mammals occurring within the Indian limits, only one, namely, Cetacea is represented in the river Ganga and that too merely by seven species. Strictly speaking, the Gangetic Dolphin is the only fresh water form which may be ascribed to be a fauna of this river. The rest are only casual visitors which ascend the river upto a certain distance during high tide. In addition to these aquatic forms, there are a few other mammals which live near the banks of the river and are dependant for their food on aquatic organisms. One of these is the otter which lives by the margin of river and goes after its prey, mainly fish, in creeks, tidal streams, estuaries and riverulets, so much so that its body has become adapted for swimming. The other species is the Fishing Cat, *Felis viverrina*, which as its name signifies, also visits the estuaries, river banks, reed beds, etc., for fishing and swoop up the fish with the blow of its paw. The forefeet of this cat have moderately well-developed webs between the toes. Contrary to the habit of otters which swim in the river for long distances, this cat rarely enters the water in pursuit of its prey. These species have also been included here (Table 1, page 19-20).

TAXONOMY

The taxonomic status of most of the dolphins and whales is in array due to paucity of collections. Pilleri (1971), Pilleri and Gehr (1972) and Jones (1982) consider the populations of Gangetic and Indus dolphins as two distinct species, namely, *Platanista gangetica* (Roxburgh) and *Platanista minor* Owen, whereas Anderson (1879) and Kasuya (1972) treat them as two subspecies of a single species. Perrin (1975) and Honacki et al. (1982) placed *Delphinus malayanus* under *Stenella attenuata*, but according to Blanford (1888-91) *malayana* differs from *attenuata* in being uniformly ashy grey throughout as against dark brown above in the latter species. Recently, Corbet and Hill (1980) have synonymized *S. attenuata* with *Stenella dubia*, but without any mention to the status of *malayana*. As regards the taxonomic status of the Little Indian Porpoise, it was first described by Cuvier (1929) as *Delphinus phocaenoides* and was later kept under the genus *Neomeris* Gray, 1864. But *Neomeris* Gray, being a junior homonym (being preoccupied by *Neomeris* Lamoceraux, 1816) was rechristened by Palmer (1899) as *Neophocaena*, and the species as *N. phocaenoides*.

DISTRIBUTION

Most of the work on aquatic mammals in India are limited to reports of their occurrence in territorial waters.

The Gangetic Dolphin, *Platanista gangetica* is a fresh water form. It is fairly common in tidal

waters but never enters the sea. It has been reported from the River Ganga right from its origin up to the mouth, including its tributaries. It is abundant in some localities and rare in others. Large shoals of this dolphin may be seen sporting near most of the large towns on the banks of this river and is most abundant at the junction of tributaries with the main body of the Ganga. Its maximum concentration has been reported at Buxar, Bhagalpur and Farraka, especially between Barari and Sultanganj in Bihar (Gupta 1968).

The Gangetic Dolphin was first reported by Jerdon (1874) to occur in the river Ganga and its large tributaries like Yamuna, Gogra, etc., and also in Brahmaputra. It was subsequently reported from Hardwar, Varanasi, Devkali Trunk, Mahdali Chak, Patna, Chupra, Monghyr, Sultanganj, Bhagalpur, Sahibganj, Raj Mahal, Farakka and Calcutta (Blanford 1888-91, Sclater 1891, Nath 1974, Atkinson 1974, Jones 1982, and Gupta 1986). In addition, it also occurs in the rivers Narayani (Kasuya and Haque 1972), Kosi and Karnali (Upreti and Majupuria 1982) in Nepal and Meghna (Kasuya and Haque 1972) in Bangladesh.

The Irrawadi Dolphin *Orcaella brevirostris*, the Black Finless Porpoise, *Neophocaena phocaenoides* and the Indian Pilot Whale, *Globicephalus indicus* (= *G. macrorhyncha*) are all marine forms which ascend the river Ganga as far as the tide extends. A pair of *G. indicus* was found stranded on the shallows of Salt Water Lake near Calcutta in July 1852 (Jerdon 1874, Blanford 1888-91 and Sclater 1891). Another of this species was killed in the river Hugli near Serampore, West Bengal about the same time of the year (Jerdon 1874). Similarly, *Orcaella brevirostris* has been recorded in the river Hugli from Serampore and Budge Budge, *N. phocaenoides* from tidal waters near Calcutta and *Stenella malayana* from Sunderbans, West Bengal (Sclater 1891 and Blanford 1888-91). There are also records of stranding of the Great Blue Whale, *Balaenoptera indica* (= *B. musculus*) and the Little Piked Whale *Balaenoptera edeni* near Sondip Island and Sidhi Island (Bangladesh) respectively, at the mouth of the Ganga (Sclater 1891, Blanford 1888-91, and Ellerman and Morrison-Scott 1951).

The Fishing Cat has a rather wide but patchy distribution. It is found from about 1550 m altitude in the Himalayas down to the sub-Himalayan region and the Indo-Gangetic Plains. It is fairly common in the Sunderbans, West Bengal, Chilka Lake, Orisssa and the Malabar Coast, Kerala. Three species of otters, namely, *Lutra lutra*, *Lutra perspicillata* and *Aonyx cinerea* occur on the banks of the river Ganga and its tributaries. *Lutra lutra* has been reported from the river Ramganga, Uttar Pradesh (Atkinson 1974) and Calcutta (Solater 1891), *Lutra perspicillata* from Yamuna river and also from Salt Water Lake, Calcutta and Sunderbans in West Bengal, and *Aonyx cinerea* from Sarda river near Karnaprayag (Atkinson 1974) and Salt Water Lake, Calcutta (Jerdon 1874).

STATUS

Practically nothing is known about the population status of aquatic mammals in India. Most of the species have been exploited in the past for their oil, blubber and flesh (Nath 1974, Motwani et al. 1961), so much so that the status of many of them is threatened. Hence, all the species under the Order Cetacea (except *N. phocaenoides* which is included in Schedule IV) have been included in Schedule I of the Wildlife Protection Act, 1972, as amended up to 1980, and in Appendix I & II of CITES, so that the killing or trade in any of these species is prohibited. However, a lot more have to be done for their conservation. The same has been discussed in detail by James (1985).

Apart from the Survey of the Gangetic Dolphin in Narayani river in Nepal and Brahmaputra-Meghna rivers in Bangladesh (Kasuya and Haque 1972), a few piecemeal attempts have been made to survey the Indian portion of the Ganga (Nath 1972 and Gupta 1985). Recently, Jones (1982) has reviewed the present state of this dolphin's distribution and abundance in different sectors of the Ganga-Brahmaputra river system and suggested measures to repopulate it. He has estimated a total population

of 4000-5000 dolphins in the entire river system (500-750 in Ganga and its tributaries, 500 in Brahmaputra, 750 in Meghna and 3000-3500 in estuarine belt). Recently, Singh and Sharma (1986) observed 43-47 dolphins in Chambal.

The status survey of the Fishing Cat was made in Eastern India by the Zoological Survey of India under a collaborative project with the World Wildlife Fund : India, on the "Status Survey of the Lesser Cats in Eastern India (Biswas & Ghose, 1982)." The report states that this species is very rare in northern West Bengal and Sikkim.

HABITS

The behaviour of aquatic mammals is difficult to study as they live under water. Anderson (1879) in his exhaustive work dealt with the taxonomic status, distribution, biology and anatomy of the Gangetic Dolphin, *P. gangetica*. Other works on the behaviour of this species are by Pilleri *et al* (1972), Nath (1974), Gupta (1985), etc. In addition, some useful work on the organ-weight relationship (Kamiya & Yamasuki 1974, Pilleri & Ghir 1972a), cerebral anatomy (Pilleri 1972a), ecology (Geisler and Pilleri 1972), sound production (Anderson & Pilleri 1972, Nishiwaki 1974), and growth and determination of age (Kasuya 1972) in *P. gangetica* have also been done.

Practically nothing is known about other species of mammals occurring in the river Ganga except for the work of Anderson (1979) on the anatomy of *Orcaella brevirostris* and *Balaenoptera edeni*, and of Moses (1940) on *Balaenoptera indica*.

From a review of literature, it is seen that apart from stray reports on the sighting or capture of these animals in the river Ganga, and some work on different aspects of the Gangetic Dolphin, nothing is known about other species. Hence, it is suggested that this river should be thoroughly surveyed and a first hand inventory of the aquatic mammals occurring in this river, prepared. Simultaneously, an estimate of their population and the study of their ecology and behaviour be undertaken to suggest ways and means for their conservation.

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TABLE 1
List of mammals reported from the river Ganga, including its tributaries

Sl. No.	Common name	Scientific name	Current Scientific name	Distribution	Protection status
		Order	CETACEA		
		Family	DELPHINIDAE		
1.	Irrawaddy Dolphin	<i>Phocaena brevirostris</i> Gray, 1866	<i>Orcaella brevirostris</i> (Gray, 1866)	Ganga : Scrampore & Budge budge, West Bengal. Coastal waters & large rivers of SE Asia, N. Australia & Papua N. Guinea.	WL Sch I, CITES App II
2.	Indian Pilot Whale	<i>Globicephalus indicus</i> Blyth, 1852	<i>Globicephalus macrorhynchus</i> Gray, 1846	Ganga : Scrampore & Salt Water Lakes, Calcutta. Tropical & subtropical waters of the world	WL Sch II, CITES App II
3.	Malay Dolphin	<i>Delphinus malayanus</i> Lesson, 1826	<i>Stenella attenuata</i> (Gray, 1846)	Ganga : Sunderbans, W. Bengal. SE Asia.	WL Sch II, CITES App II
		Family	PHOCAENIDAE		
4.	Black Finless Porpoise	<i>Delphinus phocaenoides</i> G. Cuvier, 1829	<i>Neophocaena phocaenoides</i> (G. Cuvier, 1829)	Ganga : Tidal waters near Calcutta. Persian Gulf to Java, China & Japan	WL Sch I, CITES App I
		Family	PLATANISTIDAE		
5.	Gangetic Dolphin	<i>Delphinus gangeticus</i> Lebeck, 1801	<i>Platanista gangetica</i> (Roxburgh, 1801)	Whole of River Ganga & Brahmaputra and their tributaries	WL Sch I, CITES App I
		Family	BALAENOPTERIDAE		
6.	Great Blue Whale	<i>Balaenoptera indica</i> Blyth, 1859	<i>Balaenoptera musculus</i> (Linnaeus, 1758)	Mouth of Ganga : Sondip Island, Bay of Bengal. Worldwide : Subtropical to subarctic.	WL Sch II, CITES App II
7.	Little Piked Whale	<i>Balaenoptera edeni</i> Anderson, 1879	<i>Balaenoptera edeni</i> (Anderson, 1879)	Mouth of Ganga : Sidhi Island, Bay of Bengal Worldwide : Temperate to Tropical	WL Sch II, CITES App II

Table 1. (Contd.)

Sl. No.	Common name	Scientific name	Current Scientific name	Distribution	Protection status
		Order Family	CARNIVORA FELIDAE		
8.	Fishing Cat	<i>Felis viverrinus</i> Bennett, 1833	<i>Felis viverrina</i> , Bennett, 1833	India : West Bengal : Sunderbans Orissa : Chilka Lake Kerala : Malabar Coast Also Nepal, Sri Lanka east to Vietnam & SE to Indonesia.	WL Sch I, CITES App II
		Family	MUSTELIDAE		
9.	Common Otter	<i>Lutra vulgaris</i> Erxleben 1777 <i>Lutra nair</i> Cuvier, 1823 <i>Lutra nudipes</i> Melchior, 1834	<i>Lutra lutra</i> (Linnaeus, 1758)	India : U.P. Ramganga West Bengal : Hugli River Also Nepal, Bangladesh, Eurasia New Africa, India, east to Vietnam and SE to Indonesia.	WL Sch. II, CITES App. I
10.	Smooth-coated Indian Otter	<i>Lutra ellioti</i> Anderson, 1879	<i>Lutra perspicillata</i> I. Geoffroy, 1826	India : West Bengal : Sundarbans. U.P. : Jamuna river. Nepal: Terai. Also Iraq to Vietnam, Malaysia and Indonesia.	WL Sch II, CITES App II
11.	Small-clawed Otter	<i>Aonyx leptonyx</i> Horsfield, 1823	<i>Aonyx cinerea</i> Illiger, 1815	India : U.P. : Kumoon : Sarda River West Bengal : Salt Water Lakes Also in SE Asia.	WL Sch I, CITES App II

AVES

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The Ganga waterbody has been serving as a vital system to the northern plains of India. Biologically, the watercourse offers different ecological theatres for the support of an intricate chain of interdependent biotic elements — from microbes to higher vertebrates. In the complex biopyramid, supported by the waterbody, the avifauna is no less important. Avifauna, as a whole, derives benefit from the Ganga in the form of food, foraging ground, shelter, rest, roosting place and also migration route landmark. Many species are totally dependant on the waterbody while others are partially or casually dependant on it.

Broadly, avifauna of the domain may be divided into three categories, namely, 1. Hill birds of the Kumaon Himalayas, 2. Birds of the plains and 3. Mangrove birds of the Sundarban Delta, corresponding to the Upper, Middle and Lower courses of the Ganga. Again, avifauna may be divided into two other categories like the Resident birds and the Migratory birds. Most of the migratory birds spend the cold winter months coming down from the temperate zones of Eurasia and also from the cooler higher regions of the Himalayas to the lower heights including the plains. In addition to these some stragglers also come into the area especially driven by the inclement weather and storm.

Of the 2060 species and subspecies included in the faunal list of the Indian subcontinent about threefifth of them may be arbitrarily included in the list of birds of the catchment area of the river Ganga. But, here only those species which are some how directly linked with the Ganga water have been mentioned.

1. HILL BIRDS

From the foothills to the elevation of about five thousand metre along the course of the Ganga, different types of vegetation offer different habitats where birds can thrive. Biotic resources in the water body also varies from altitude to altitude. However, the following birds are conspicuous in the area. Large Cormorant, Goosander, Himalayan Greyheaded Fishing Eagle, Osprey and Himalayan Pied Kingfisher may be found fishing in deep waters. On sand banks or on shingle banks, Spurwinged Lapwing and Ibisbill may be found. Along streams and rapids, Dipper, Brown Dipper, Gould's Shortwing, Lesser Shortwing, Plumbeous Redstart, Little Forktail, Blackbacked Forktail, Slatybacked Forktail, Spotted Forktail, Blue Whistling Thrush and Whitecapped Redstart may be found.

During winter, many migratory species may be found in this area on passage. Of them, Lesser Whistling Teal, Spotbilled Duck, Mallard, Pintail, Common Teal and Coot may be found foraging for a day or so in a place.

2. BIRDS OF PLAINS

The course of the Ganga in the northern plains traverses quite a distance but the habitats along it are more or less monotypic and supplimented with human disturbances. Yet, this area is enriched with many species of birds. Of them, Little Cormorant, Brahmini Kite, Pallas's Fishing Eagle, Greyheaded

Fishing Eagle, Indian Skimmer, Lesser Pied Kingfisher, Common Kingfisher, Brownheaded Storkbilled Kingfisher, and Whitebreasted Kingfisher amidst deep waters and in shallow waters near banks, Grey Heron, Purple Heron, Little Green Heron, Pond Heron, Large Egret and Smaller Egret may be found fishing. Nighth Heron, Brown Fish Owl and Tawny Fish Owl are also fishing during night.

On the mud flats or on sand banks, Redwattled Lapwing, Little Ringed Plover, Collared Pratincole, Small Indian Pratincole and Sand Lark, may be found foraging.

When flood water inundates the low lands on either bank, the following species may also be found foraging in shallow waters. They are Grey Heron, Purple Heron, Black Bittern, Painted Stork, Openbilled Stork, Whitenecked Stork, Blacknecked Stork, White Ibis, Black Ibis, Glossy Ibis, Spoonbill and Blackwinged Stilt.

During winter influx of migratory species add varieties and number to the bird population. Grebes ducks and geese, waders and wagtails, in fact, outnumber the resident population of birds.

3. BIRDS OF SUNDARBAN MANGROVE

The characteristic mangrove of Sundarban where the river system anastomosing with numerous creeks and nullahs, the typical vegetation and the wetland offer a unique habitat for the birds. In addition to most of the species found in the plains a few typical mangrove species are also found here. Moreover, many species of coastal birds also are added. Cotton Teal, Large Whistling Teal, Whitebellied Sea Eagle, Great Stone Plover, Gullbilled Tern, Indian River Tern, Blackbellied Tern, Little Tern, Brown Hawk Owl, Brownwinged Storkbill Kingfisher, Blackcapped Kingfisher and White Collared Kingfisher are typical resident birds. In the adjoining mangroves. Swamp Partridge and Mangrove Whistler are note worthy species.

During winter many migratory species, specially the waders, flock in schools of thousands. They include terns, gulls, plovers, sandpipers and curlews.

Occasionally some vagrant species are also found in this area. They include Grey Pelican, Lesser Flamingo and Great Whitebellied Heron.

LIST OF BIRDS

As recorded in upper, middle and lower stretches of Ganga

Order	PELECANIFORMES	
Family	PHALACROCORACIDAE	
<i>Phalacrocorax carbo</i> (Linnaeus)	Large Cormorant	U M L
<i>Phalacrocorax niger</i> (Vieillot)	Little Cormorant	M L
Family	PELECANIDAE	
<i>Pelecanus philippensis</i> Gmelin	Grey Pelican	L
Order	CICONIFORMES	
Order	ARDEIDAE	
<i>Ardea cinerea</i> Linnaeus	Grey Heron	M L
<i>Ardea purpurea</i> Linnaeus	Purple Heron	M L

<i>Ardea alba</i> Linnaeus Large Egret	M L
<i>Butoridea striatua</i> (Linnaeus) Little Green Heron	M L
<i>Ardeola gravii</i> (Sykes) Pond Heron	M L
<i>Egretta intermedia</i> (wagler) Smaller Egret	M L
<i>Egretta carzetta</i> (Linnaeus) Little Egret	M L
<i>Nycticorax nycticorax</i> (Linnaeus) Night Heron	M L
<i>Ixobrychus cinnamomeus</i> (Gmelin) Chestnut Bittern	M L
<i>Ixobrychus sinensis</i> (Gmelin) Yellow Bittern	M L
<i>Dupetor flavicollis</i> (Latham) Black Bittern	M L
Family CICONIDAE	
<i>Mycteria leucocephalus</i> (Pennant) Painted Stork	M
<i>Anastomus oscitans</i> (Boddaert) Openbill Stork	M L
<i>Ciconia episcopus</i> (Boddaert) Whitenecked Stork	M L
<i>Xenorhynchus asiaticus</i> (Latham) Blacknecked Stork	M L
Family THRESKIORNITHIDAE	
<i>Threskiornis aethiopicus</i> (Latham) White Ibis	M
<i>Pseudibis papillosa</i> (Temminck) Black Ibis	M L
<i>Plegadis falcinellus</i> (Linnaeus) Glossy Ibis	M
<i>Platalea leucorodia</i> Linnaeus Sponbill	M
Family PHOENICOPTERIDAE	
<i>Phoeniconaias minor</i> (Geoffroy) Lesser Flamingo	L
Order ANSERIFORMES	
Family ANATIDAE	
<i>Anser indicus</i> (Latham) Barheaded Goose	M
<i>Dendrocygna javanica</i> (Horsefield) Lesser Whistling Teal	M L
<i>Dendrocygna bicolor</i> (Vieillot) Large Whistling Teal	M L
<i>Tadorna ferruginea</i> (Pallas) Brahmini Duck	M
<i>Anas acuta</i> Linnaeus Pintail	U M L
<i>Anas crecca</i> Linnaeus Common Teal	U M L
<i>Anas poecilorhyncha</i> Forster Spotbill Duck	M L
<i>Anas platyrhynchos</i> Linnaeus Mallard	U M L
<i>Anas querquedula</i> Linnaeus Garganey	M L
<i>Anas clypeata</i> Linnaeus Shoveller	M L
<i>Netta rufina</i> (Pallas) Redcrested Pochard	M L
<i>Aythya ferina</i> (Linnaeus) Common Pochard	M L
<i>Aythya baeri</i> (Radde) Baer's Pochard	M L

<i>Aythya fuligula</i> (Linnaeus) Tufted Duck	M
<i>Aythya marila</i> (Linnaeus) Scaup Duck	M L
<i>Nettapus coromandelianus</i> (Gmelin) Cotton Teal	M L
<i>Sarkidiornis melanotos</i> (Pennant) Comb Duck	M L
<i>Merqus merqanser</i> Linnaeus Goosander	U
Order FALCONIFORMES	
Family ACCIPITRIDAE	
<i>Haliastur indus</i> (Boddaert) Brahminy Kite	M L
<i>Haliaeetus leucogaster</i> (Gmelin) Whitebellied Sea Eagle	L
<i>Haliaeetus leucoryphus</i> (Pallas) Pallas's Fishing Eagle	M L
<i>Ichthyophaga ichthyaetus</i> (Horsfield) Greyheaded Fishing Eagle	M
<i>Ichthyophaga nana</i> (Blyth) Himalayan Greyheaded Fishing Eagle	U
<i>Pandion haliaetus</i> (Linnaeus) Osprey	M L
Order GRUIFORMES	
Family RALLIDAE	
<i>Fulica atra</i> Linnaeus Coot	U M
Order CHARADRIIFORMES	
Family CHARDRIIDAE	
<i>Vanellus indicus</i> (Boddaert) Redwattled Lapwing	M L
<i>Vanellus duvaucelii</i> (Lesson) Spurwinged Lapwing	U M
<i>Pluvialis squatarola</i> (Linnaeus) Grey Plover	L
<i>Pluvialis dominica</i> (Muller) Eastern Golden Plover	M L
<i>Charadrius leschenaultii</i> Lesson Large Sand Plover	L
<i>Charadrius dubius</i> Scopoli Little Ringed Plover	M L
<i>Charadrius alexandrinus</i> Linnaeus Kentish Plover	L
<i>Charadrius mongolus</i> Pallas Lesser Sand Plover	L
<i>Numenius phaeopus</i> (Linnaeus) Whimbrel	L
<i>Numenius arquata</i> (Linnaeus) Curlew	L
<i>Tinca erythropus</i> (Pallas) Spotted Redshank	L
<i>Tringa totanus</i> (Linnaeus) Common Redshank	L
<i>Tringa stagnatilis</i> (Bechstein) Nash Sandpiper	L
<i>Tringa nebularia</i> (Gunnerus) Greenshank	L
<i>Tringa ochropus</i> Linnaeus Green Sandpiper	L
<i>Tringa glareola</i> Linnaeus Wood Sandpiper	L
<i>Tringa terek</i> (Latham) Terek Sandpiper	L
<i>Tringa hypoleucos</i> Linnaeus Common Sandpiper	L

<i>Arenaria interpres</i> (Linnaeus) Turnstone	L
<i>Calidris tenuirostris</i> (Horsfield) Eastern Knot	L
<i>Calidris ruficollis</i> (Pallas) Eastern Little Stint	M L
<i>Calidris minutus</i> (Leisler) Little Stint	M L
<i>Calidris temminckii</i> (Leisler) Temminck's Stint	M L
<i>Philomachus pugnax</i> (Linnaeus) Ruff and Reeve	M L
Family RECURVIROSTRIDAE	
<i>Himantopus himantopus</i> (Linnaeus) Blackwinged Stilt	M L
<i>Ibidorhyncha struthersii</i> Vigors Ibisbill	U
Family BURHINIDAE	
<i>Esacus maqnirostris</i> (Vieillot) Great Stone Plover	M L
Family GLAREOLIDAE	
<i>Glareola pratincola</i> (Linnaeus) Collared Pratincole	M L
<i>Glareola lactea</i> Temminck Small Indian Pratincole	M
Family LARIDAE	
<i>Larus ichthyaetus</i> Pallas Great Blackheaded Bull	L
<i>Larus brunnicephalus</i> Jerdon Brownheaded Gull	M L
<i>Larus ridibundus</i> Linnaeus Blackheaded Gull	M L
<i>Chlidonias hybrida</i> (Pallas) Whiskered Tern	M L
<i>Chlidonias leucoptera</i> (Temminck) Whitewinged Black Tern	M L
<i>Gelochlidon nilotica</i> (Gmelin) Gullbilled Tern	L
<i>Sterna aurantia</i> Gray Indian River Tern	M L
<i>Sterna hirundo</i> Linnaeus Common Tern	L
<i>Sterna acuticauda</i> Gray Blackbellied Tern	M L
<i>Sterna albifrons</i> Pallas Little Tern	M L
<i>Sterna bergii</i> Lichlenstein Large Crested Tern	L
<i>Rynchops albicollis</i> Swainson Indian Skimmer	M L
Order STRIGIFORMES	
Family STRIGIDAE	
<i>Bubo coromandus</i> (Latham) Dusky Horned Owl	M
<i>Bubo zeylonensis</i> (Gmelin) Brown Fish Owl	M
<i>Bubo flaviceps</i> (Hodgson) Tawny Fish Owl	U M
<i>Ninox scutulata</i> (Raffles) Brown Hawk Owl	M L
Order CORACIFORMES	
Family ALCEDINIDAE	
<i>Ceryl luqubris</i> (Temminck) Himalayan Pied Kingfisher	U

<i>Ceryl rudis</i> (Linnaeus) Lesser Pied Kingfisher	M L
<i>Alcedo atthis</i> (Linnaeus) Common Kingfisher	U M L
<i>Pelarqopsis amauropotera</i> (Pearson) Brownwinged Kingfisher	L
<i>Pelarqopsis capensis</i> (Linnaeus) Storkbilled Kingfisher	M L
<i>Halcyon smyrnensis</i> (Linnaeus) Whitebreasted Kingfisher	M L
<i>Halcyon pileata</i> (Boddaert) Blackcapped Kingfisher	L
<i>Halcyon chloris</i> (Boddaert) Whitecollared Kingfisher	M L

U = Upper Ganga Course, M = Middle Ganga Course, L = Lower Ganga Course

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REPTILES

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INTRODUCTION

This is evident that reptiles have a great role in the ecological balance and in the conservation of Nature and many of them bear a direct and most beneficial impact on the economy of our country. Studies on the Indian reptiles (including the reptiles of Ganga basin) started in the middle of the last century, and most intensive studies have been taken up recently. The "Handbooks" on Testudines and Lizards, giving a comprehensive taxonomic account of all the species available in India along with their phylogeny, distribution, habits, habitats, biology, ecology, conservation, breeding and actual status during the recent times have already been prepared. A "Handbook" on Snake on the same lines is also under preparation and will be ready for publication by the end of 1990.

At present all over the world naturalist are concerned with the conservation of wild fauna and flora. Already our human civilization has reached a stage, that if proper methods are not employed for the conservation of wildlife, mankind is bound to be deprived of their magnificent association. Due to thoughtless destruction of biotopes by man for his own uses a large number of wildlife species are endangered today in most countries including India. Reptiles are also no exception. Out of 25 species of reptiles including 3 crocodilians, 14 testudines, 3 lizards and 5 snakes available in Ganga water or in its basin showing acute affinity to the aquatic habitat, at least following 19 are now extremely vulnerable or threatened. All the three species of crocodilians, namely Gharial (*Gavialis gangeticus*), Mugger (*Crocodylus palustris*) and the Estuarine Crocodile (*Crocodylus porosus*) are threatened with extinction, chiefly due to ruthless killing by man during last 50 years for their skins. Out of 14 species available in Ganga at least 12 species of turtles, namely Batagur (*Batagur baska*), Brahminy River Turtle (*Hardella thurgi*), Dhongoksa Turtle (*Kachuga dhongoka*), Bengal Roofed Turtle (*Kachuga kachuga*), Brown River Turtle (*Kachugs smithi*), North Indian Roofed Turtle (*Kachuga tecta*), North Indian Freshwater Tortoise (*Geoclemys hamiltoni*), North Indian Flap-shelled Turtle (*Lissemys punctata punctata*), Narrow-headed Soft-shelled Turtle (*Chitra indica*), Ganga Soft-shelled Turtle (*Trionyx gangeticus*), Peninsular Soft-shelled Turtle (*Trionyx leithi*) and the Peacock-Marked Soft-shelled Turtle (*Trionyx hurum*) are endangered on account of large scale killing for eggs and adults, habitat destruction and urbanisation on the nesting sites. All the three available species of Monitor lizards (*Varanus bengalensis*, *Varanus salvator* and *Varanus flavescens*) are also subject to the same plight on account of excessive killing for skins, urbanization and industrialization for man. Larger snakes like the Indian Python (*Python molurus*), available on the banks of Ganga and lead almost a semi aquatic life are being killed in very large numbers for their skins. Most of the mentioned species of reptiles available in Ganga and in its basin are subject to an enormous pressure of commercial exploitation for the purpose of their hides and flesh. The steps for their conservation will be proved most effective if the following suggestions are taken into consideration. (1) Common people must be educated so as to create a general public awareness for the protection and conservation of wildlife. To plan for the conservation of these species, their ecology must be studied in all possible details. (2) There must be a total ban on the killing and export of all the endangered species. (3) The natural habitats of all these species must be protected and no exploitation for man should be allowed. This will prove most fruitful for the Gharial, Mugger, Monitor lizards, Pythons and for almost all the

turtles. (4) Frequent surveys must be conducted for the collections of the eggs of crocodilians and turtles and all the collected eggs must be transplanted at suitable places for artificial hatching. Ultimately, hatchlings should be released in the natural habitats of the species.

SYSTEMATIC ACCOUNT

Order CROCODYLIA

GHARIAL

1. *Gavialis gangeticus* (Gmelin)

A distinctive, large and extremely slender-snouted, fish eating, amphibious crocodilian, adult males reach around 6.5 m. and females about 4.5 m. Body strongly armoured, bearing more than two dozen sharp pointed teeth on each side of each jaw. Adults olive, young lighter, spotted or barred with dark brown. Adult male Gharial bear a tough bulbous excrescence at the tip of the snout. The name Gharial is derived from the resemblance of the knob to an earthen pot, known as a 'ghara' in north India. When the male emerges from water the obstruction of exhaled air caused by the ghara usually results in a hissing sound.

Distribution : Now a days present in Bangladesh, India, Nepal and Pakistan. Mainly restricted to the Himalaya-fed river system in the north of the Indian sub-continent, namely the Sind, Ganga and Brahmaputra Rivers and their tributaries. Further south Gharial is available in the Mahanadi River. Formerly present in the Manas River (a tributary of Brahmaputra) in Bhutan.

Habits and habitat : Gharial prefers to live in deep fast-flowing sinous rivers with relatively clear water, high banks, deep pools and undisturbed sand banks at the river edge or in mid-river for nesting and basking. Gharials bask on sand banks for long periods during the winter, when water levels are low. Dispersal especially of juveniles, often occurs during monsoon flooding when Gharials move out of the mainstream into side creeks. Like other crocodilians, Gharial will float at the water surface with only the eyes and tip of the snout exposed. Gharial feeds mainly on fish. A swimming fish is first seized across the middle, then the long snout is raised out of the water and with two or three snaps of the jaws the entire fish is turned and swallowed head first. Occasionally they supplement their fish diet by birds, dogs and other vertebrates. Sometimes they attack on human beings also. Nesting takes place from last March to mid-April in sand banks on the river-edge, or in mid river. Between 18-40, elliptical eggs (85-90 mm long and 65-70 mm wide) are laid in quiet deep nests. The inside temperature of the nest ranges between 25-37°C and inside humidity also remains relatively constant despite periods of rainfall. Incubation period ranges between 83-94 days. The female guards the nest site and also closely attends the hatchlings for several months. Sometimes the mother Gharial stays for months together in the shallow water with hatchlings on her head and body, and others swimming or basking on the bank immediately beside her. Sexual maturity is attained at between 8-12 years, at a length of about 3 metres.

Status : At present the status of Gharial is critically depleted. Such a serious plight is mainly attributed to habitat modification and disturbance and to killing of animals for skins or in course of fishing operations ii. A secondary factor is collection of eggs for food by some tribals. iii. Both eggs and hatchlings are heavily predated by fish, Jackals, monitor lizards, birds of prey and larger Gharials iv. A significant number of nests are destroyed by flooding.

In the nineteenth and early twentieth centuries the Gharial was in abundance in many areas, but now extinct or extremely depleted throughout its former range. It is almost extinct in Bangladesh and Pakistan, less than 20 individuals may be present in each country. The estimated Indian population was not more than 75 animals in 1970 and the species was almost at the verge of extinction. But

recently implemented conservation measures give some hope for the survival of this crocodile in India. Now the approximate number of Gharials in India is 141 individuals (including the juveniles) distributed in major rivers in the states of Uttar Pradesh, Rajasthan and Madhya Pradesh. In other parts of India it has been estimated that less than 10 occur in Orissa, less than 10 in Bihar and around 10 in Assam. Few isolated Gharials still available in some Indian rivers that formerly supported large populations, such as the Ramganga in Corbett National Park (U.P.), the Ghagra (U.P.), the Gandak (U.P. and Bihar) and the Kosi (Bihar). The regular breeding of Gharial has been known in recent years in only three areas, in the Girwa, Chambal and Mahanadi Rivers. The Government of India initiated a crocodile breeding and management project in 1975, with preliminary survey being undertaken in 1974. This project operates on advice from a U.N. Food and Agriculture Organization (F.A.O.) Chief Technical Advisor, with finance from the U.N. Development Programme (UNDP). Under this scheme, Gharial eggs are collected from the wild and transported to hatcheries where the young are reared for release into the wild at a length of 1.2 m., aged about 18 months. These Gharial hatcheries are located at various places in India as namely Tikarpada, Mahanadi River (Orissa); Kukrail near Lucknow (Uttar Pradesh); Satkoshia Gorge Sanctuary (Orissa); National Chambal River Sanctuary (Uttar Pradesh, Madhya Pradesh and Rajasthan) and Katarniaghat Sanctuary, Girwa River (Uttar Pradesh). Breeding in captivity occurred for the first time at the Nandankanan Biological Park in Orissa, where a female mated with a male and laid 25 eggs in March 1980, from which 24 hatchlings emerged on 7 May 1980.

MUGGER OR MARSH CROCODILE

2. *Crocodylus palustris* (Lesson)

A moderately large 3-5 m. in length short and broad snouted, commonest of all crocodilians and much smaller than the Estuarine Crocodile and the Gharial. Adults dark olive, juveniles pale with black spots, muzzle about $1\frac{1}{2}$ to $1\frac{3}{4}$ times as long as broad at the base. Dermal armour is quite similar to *Crocodylus porosus*. Upper jaws are having 17 or 18 sharp teeth on each side.

Distribution : Its range includes India, Bangladesh, Iran, Nepal, Pakistan and Sri Lanka. Marsh Crocodile is available in scattered populations over most of India, except the state of Jammu and Kashmir, Himachal Pradesh and Punjab in the extreme north-west and the north-west desert regions. The eastern limit of distribution extends beyond the Darrang district into Arunachal Pradesh. In India *C. palustris*, still occurs in small scattered and isolated populations in many states like Kerala, Tamil Nadu, Karnataka, Andhra Pradesh, Madhya Pradesh, Maharashtra, Orissa, Gujarat, Rajasthan, Uttar Pradesh, Bihar, Haryana and West Bengal.

Habits and habitat : This sluggish crocodile occurs in any kind of freshwater habitat and are occasionally reported in brackish waters well within tidal limits. Mugger prefers still waters with a depth of 3-5 m. and may be present in rivers, streams, jungle pools, man-made lakes, village ponds and large irrigation reservoirs. The species avoids fast-flowing rivers during monsoon periods and sometimes Muggers are seen in river side villages at this time of year. Burrows are excavated in the banks of inhabited waters, sometimes to a depth of 8-10 m., these may provide shelter from extremes of temperature since new burrows may be made both in summer and winter. Muggers of all sizes prefer to live in groups in their respective size class, except for males during the breeding season. Like other crocodilians Mugger is also carnivorous. Hatchlings predominantly feed on water insects and fish fingerlings. Adult crocodiles have been reported feeding on frogs, small mammals, birds, squirrels, mongooses, kites, crows, monkeys, paddy birds, cat fish and other vertebrates. Courtship season it from November to February in India. Males exhibit a strong dominance hierarchy and dominant males mate with several females. Mating takes place in the open water. The females start digging trial nest

pits at least a fortnight before actual egg laying. Nests are made inside the burrows and 10-35 eggs (4 to 5 cm by 6 to 8 cm., weighing 80 to 120 gms.) are laid in a nest chamber of 35 to 50 cm. depth. The nest chamber is a wide-mouthed pitcher shaped structure, dug quite away from the water's edge in a high sloping bank. The egg laying takes place between late February to first week of April. Nest temperatures vary from 30° to 34°C and incubation period varies from 50 to 65 days. Hatchlings that are ready to emerge make grunting noises from within the nest, stimulating the mother crocodile to excavate the nest and release the hatchlings to the water. Hatchlings are 25 to 30 cm. in length and weigh about 60 to 100 gm.

Status : In India the main threats to survival of Mugger are; i. Set net fishing (nylon gill nets set across rivers or standing bodies of water, usually set out in the evening and taken in the next morning when trapped crocodiles are clubbed to death. ii. Egg predation for food by humans, mongooses, jackals, monitor lizards and sloth bears. iii. Hatchling predation by birds like herons and storks. iv. Natural calamities like flooding and desiccation. v. Habitat destruction. vi. Medicinal use of crocodile parts and their eggs by human beings.

Population of *C. palustris* has been depleted considerably throughout the range and present population rise is estimated to be around 5,000 in India. The best remaining populations are in Tamil Nadu (400 crocodiles) and Gujarat (200 crocodiles). More than 2,000 eggs a year are collected for captive hatching by different state crocodile projects in India. Collection of wild-laid eggs is carried out by the Government Wildlife conservation agencies for captive hatching and rearing for eventual release in suitable wild *C. palustris* habitat. Many states in India like Tamil Nadu, Gujarat, Orissa, Andhra Pradesh, Kerala, Uttar Pradesh, Maharashtra, Karnataka and Rajasthan are now engaged in such Mugger conservation programmes since 1975.

This species breeds readily in captivity and several zoos have been breeding Mugger since the first success at Jaipur Zoo in 1960. The various Zoos in India engaged in the breeding of this crocodile are Jaipur Zoo (breeding since 1960), Ahmedabad Zoo (breeding since 1967). The Madras Snake Park and Crocodile Bank Trust (breeding since 1975), Delhi Zoo (breeding since 1976), Vizag Zoo (breeding since 1978), Hyderabad Zoo (breeding since 1980) and Baroda Zoo (recently started the breeding).

ESTUARINE CROCODILE

3. *Crocodylus porosus* Schneider

The largest and strongly built of all existing crocodilians (maximum recorded length around 10 m., a few individuals of 7-8 m. still occur in India). Body shielded by an overall armature of closely set, horn-sheathed, bony plates with saw-toothed fringes along the upper border on tail. Adults dark olive and young pale with large black spots, muzzle about twice as long as its breadth at the base and tapers to a point; jaws bear formidable pivoted teeth, less than 20 on each side which remain exposed even when mouth closed; enlarged fourth tooth of the lower jaw fitting into a notch on the side of the upper jaw.

Distribution : *Crocodylus porosus* has a wide range of distribution and is available in Sri Lanka, the east coast of India, the Andaman and Nicobar Islands, Bangladesh, Burma, Thailand, Kampuchea, Vietnam, the Philippines, the western Caroline Islands (Palau Group), Malaysia, Indonesia, Brunei to Papua New Guinea, the Solomon Islands, Vanuatu and northern Australia. Formerly was available near Cochin in India, southern China and Singapore but now it is extinct at these places. Wandering individuals have been noticed at sea and places far outside their range, such as Solomon Islands and Fiji Islands, Cocos-keeling and Ponape in the eastern Caroline Islands.

Habits and habitat : A sluggish and lethargic creature typically associated with brackish waters,

such as coastal mangrove swamp-forests, but also visits freshwater rivers and grass swamps. This crocodile is very well adapted to semiaquatic mode of life; enters the sea to make long oceanic journeys but inhabits estuaries. Appear like a dead log on land lying in wait for the quarry which are generally small domestic animals; in water it is an expert fisher. Although lives in saline water it drinks fresh water. *C. porosus* is an opportunistic feeder, and the nature and size of the prey taken varies with age and habitat. Feeding occurs during the day and night, when food is available, and on both ebb and flood tides in tidal regions. These crocodiles are mainly shallow water or edge feeders. Juveniles and sub-adults eat mainly crustacea, insects and small fish. Adults take an increasing proportion of vertebrate diet like sharks, archer fish, barramundi, pop-eye mullet, mullet, mudskippers, mangrove snakes, cormorants, magpie geese, turtles, cattle, horses, flying foxes, monkeys and humans. Larger crocodiles are cannibalistic and take *porosus* hatchlings and small juveniles. Sexual maturity in males is attained in 16 years (3.2 m. length) and in females in 10 years (2.2 m. length). *Crocodylus porosus* makes a mound like nest in the wet season and lays between 25-120 eggs. The incubation period is between 80-100 days. The female remains near the nest and defends it most carefully. She assists hatchlings to leave the nest and carry them to water and remains near them for a considerable period.

Status : This crocodile is threatened throughout the world on account of extensive hide-hunting and habitat destruction. Lack of osteoderms in the belly skin, small scutes and large size, lead to high demand for hides. The commercial value of its leather the main reason of its over-exploitation and as a result this crocodile has become quite rare in the coastal regions of South India. Remnants are now confined to the estuaries of the Sundarban, Mahanadi and coastal region of West Bengal, Orissa, Andaman and Nicobar Islands. The total Indian population of *porosus* may be between 170-330. Several breeding centres in Andhra Pradesh, Tamil Nadu, Orissa and West Bengal are successfully rearing this species. This crocodile breeds readily in captivity.

Order TESTUDINES BATAGUR RIVER TERRAPIN

4. *Batagur baska* (Gray)

The Batagur is a moderately large, web-footed, aquatic species of terrapin, reaching a length of 61 cm. Adults weigh up to 18 kg. when fully mature. The head is comparatively small with an upturned, pointed and strongly projecting snout. The skin of the posterior portion of head is divided into small shields. The skull is characterised by having a bony temporal arch, quadrato-jugal in contact with the jugal and post-orbital, body choanae on level with the posterior part of the orbits, alveolar surface of jaws very broad with two strong, denticulate ridges placed in the middle of both the upper and lower jaws. Upper jaw is provided with a notch at the middle. The carapace is smooth, shining, sub-truncated anteriorly, rounded posteriorly, heavy and moderately depressed. In the young an interrupted keel is present, which reduces gradually as growth takes place and ultimately disappears in the fully mature adult. The nuchal shield is subquadrangular, quite broader than long in posterior aspect. Vertebral shields are 5 in number, the second the third are subequal, fourth is smaller. Vertebrae are much broader than long in young individuals but in adult they are almost as broad as long and a little narrower than the costal shields in adults. Costal shields are 4 on each side. Marginal shields are generally 25, rarely 26 (including one nuchal and a pair of supracaudal shields). The plastron consists of paired gular, humeral, axillary, pectoral, abdominal, inguinal, femoral and anal shields. The plastron is much smaller than the shell opening, laterally angulated in the young and rounded in the adult, truncated anteriorly and notched posteriorly. The inguinal shield of the plastron is larger than the axillary. The width of the bridge of plastron is more than the length of the hind lobe; the longest median suture is between the abdominal shields and the shortest between the gular shields. Limbs are

with narrow transversely enlarged scales, digits fully webbed and are provided with four claws. Tail is extremely short in comparison with the body. Its shell is uniformly brown, olive brown or greenish; the head and the under surface of the neck are brown. In the breeding season, the male assumes a brilliant colouration, the nostrils becoming pale blue, iris from yellow-cream to white, the head deep black, and the neck and the front limbs deep crimson to black. The hind part of the Batagur remains dull reddish purple and eyes greenish yellow throughout its life.

Distribution : This terrapin is available in Sumatra, West Malaysia, Thailand, Bangladesh, Burma and the Sunderbands of India. Records are also available from Kampuchia, and Vietnam. Prehistoric remains of this turtle indicate that it was widely distributed in the Ganga river system up to twelfth century A.D. Fragments of this species have also been recorded from the Mohanjodaro and Harappa sites.

Habits and habitat : The Batagur is found in fresh, brackish or even salt waters. It occurs in freshwater lakes, canals or other water bodies. But its most favourite habitat is the shallow, muddy, tidal regions at the wide river mouths, lined with mangrove or other vegetation. It has been observed that many individuals at Trengganu (Malaysia) come above most tidal influence. At this place the river is quite shallow with sandy gravel bottom, less than 450 feet wide and banks are sandy with spars or no vegetation. It is an omnivorous terrapin but generally prefers a vegetarian diet consisting of stems, leaves and fruits of river-side plants. It also feeds on molluscs, crustaceans and fish. Mating takes place between September and November. During this period the males assume brilliant breeding colours as stated above. The Batagur prefers to nest in a colony on large sandy banks with slopes and also on river-islands. Large number of females sometimes up to 500 individuals or more, emerge every year on the sandy river banks from January to March for nesting and egg-laying. Nesting females are site-specific and observe a definite period for egg deposition every year and at that time they are extremely sensitive to any disturbance. The female digs a body pit for the nest by employing the four limbs, then a 15-30 cm. deep egg-chamber is excavated within it. About 50-60 oblong eggs (measuring up to 70 mm. in length) are deposited in the egg-chamber in three clutches (generally 10-30 eggs in each clutch). The interval of egg-laying varies from 15 to 20 days. The incubation period under natural conditions ranges between 80 and 100 days. Then the nesting spot and its surrounding area is covered with sand by the mother terrapin and this takes a long time, almost twice as long as digging and egg laying. The process of sand compacting by the female is most interesting and is accomplished by the repeated raising and dropping of its body on the ground. This phenomenon of sand compacting by large number of terrapins on a beach creates a drumming sound, which can be heard from a considerable distance and is called as 'tuntong' (means drumming) in Malaysia. As the females return to the water they throw sand backwards over the nesting sites and sometimes also dig false nest pits to confuse the predators. Adult Batagur is predated upon by man, sharks and the saltwater crocodile *Crocodylus porosus*. Eggs and hatchlings are devoured by otters, dogs, monitor lizards, fishes and crocodiles.

Status : The species is endangered over of its range, on account of large scale exploitation for its eggs and flesh for food. Batagur was over-exploited in Bengal in the mid-nineteenth century and its fat was much used for the manufacture of soap in Calcutta. It is occasionally sold in Bangladesh at Bagerhat and Chalna Bazar, close to the Sunderbans. In Malaysia most adults for sale are caught accidentally by fishermen and are consumed by Chinese and native people. Eggs are considered as delicacy and even cost more than the marine turtle eggs. The habitat destruction is also a most important factor for the decline of this terrapin in Malaysia, Thailand and India. The various factors which are responsible for the habitat destruction of this species are mining, removal of river side sand clearing of riverside vegetation and exposing the banks to erosion, construction of dams and barrages, urbanisation along the banks and increase in the steamer traffic in the rivers.

Conservation : It is generally protected by legislation throughout its range. During the last 35 years many hatcheries have been established in Malaysia to incubate Batagur eggs. The hatchlings are raised and kept in separate concrete pools according to different age groups for one to seven years. Hatchlings and juveniles of different age groups are released in the river from time to time. It is estimated that about 10,000 hatchlings have been released in Perak river since 1969. The success of such hatching programmes cannot be fully confirmed until artificially reared females are themselves shown to nest successfully. The species has been listed in Appendix I of the CITES. Further protection by law for the species and its habitat in all aspects must be provided to all the existing populations throughout the range. Conservation and proper management will help in providing a valuable protein-rich food for numerous people within the range of this terrapin.

Captive breeding : Forty-eight Batagurs have been raised from eggs hatched in 1968 at Batu Gajah, Perak, but significant results on breeding are not available as yet.

BRAHMINY RIVER TURTLE

5. *Hardella thurgi* (Gray)

This is a most interesting completely aquatic river tortoise showing extraordinary sexual dimorphism. Its females reach to a length of 65 cm. while males attain a maximum length up to 20 cm. The head is moderately large with a pointed and extremely projecting snout. The skin of the posterior portion of head is divided into a large number of small scales arranged in transverse rows. The skull is with a bony temporal arch. The quadratojugal is in contact with the jugal and post-orbital; carotid canal lies between pterygoid and prootic; the chamber for paracapsular sac completely opens posteriorly; alveolar surface of jaws is very broad and provided with a strong ridge in the middle; margins of jaws strongly denticulated and upper jaw is bicuspid. The carapace is moderately depressed, the unicarinate, and the posterior portion of each vertebral shield has a knob-like structure. Vertebrae are elongate, somewhat hexagonal with a short anterior margin. The posterior margin of the carapace is slightly serrated. Nuchal shield is not very large and is broadest posteriorly. The first vertebral is generally longer than broad and its anterior margin is shorter than the posterior. Second to fourth vertebrae are generally broader than long in young individuals but are as broad as long and much narrower than the costals in the adult specimens. The plastron consists of paired gular, humeral, axillary, pectoral, abdominal, inguinal, femoral and anal shields. It is almost as long as the carapace, angulate laterally in juveniles, truncate anteriorly; its hind lobe is much narrower than the opening of the shell, considerably shorter than the width of the bridge, notched posteriorly, the longest median suture is between the abdominal shields; the shorter between the gular, axillary and inguinal shields large. Plastron is intimately united to carapace by a suture. The axillary and inguinal buttresses are very prominent and extend almost to the vertebrae. the axillary is connected with the first rib. Ectoplastron is situated anterior to the humero-pectoral suture. Limbs are with fully and broadly webbed digits and have narrow transversely enlarged scales. Fore limbs are provided with five claws. Tail remains quite short throughout life and exhibits no difference in juveniles and adults. General dorsal colouration is dark brown-black with a yellow margin in juveniles and adults. This yellow margin fades out in very large and aged individuals. The keel and the inner margins of the first three costals are blackish to dark black. Ventrals are pale yellow with two large black spots on each side on the plastral bridge. Anterior mid portion of the plastron is with a blackish tinge. Abdominal scutes are with large black spots. Other parts of the plastron are also spotted with black. Head is dark-brown to black; curved orange yellow bands are present on the top of the snout, below the nostrils up to eyes, behind the eyes emerging on the neck above the tympanum and along the rami of the lower jaws. Limbs are brownish, margined with yellow behind.

Distribution : Available in the Ganga, Brahmaputra, and Sind River systems, ranging from Sind

(Pakistan) to Sylhet (Bangladesh), in the east.

Habits and habitat : It is entirely aquatic inhabiting stagnant ponds, canals and backwaters and hardly emerges for basking. The Brahminy river turtle generally avoids fast flowing water. The species is entirely herbivorous and devours fruits and vegetables. The species is most docile and never bites even on rough handling. Eggs are oval and look exactly like the hen's eggs.

Status : The species is extremely vulnerable. The main threat to the species is through over-exploitation of adults and their egg by animal predators and man for food and habitat destruction. Its flesh is consumed on a very large scale throughout its range and is said to be excellent. Large numbers of Brahminy turtles are still brought into markets in Bengal and their flesh is sold for food.

Conservation : Generally protected by legislation throughout its range but the conservation measures are not effective in many areas. Conservation and management of the species has the potential to provide a valuable protein-rich food source for the people of India and Pakistan, if suitable programmes of sustained utilization are followed.

DHONGOKA TURTLE

6. *Kachuga dhongoka* (Gray)

This is a moderately large turtle, whose females are larger and reach a maximum length of 40 cm. Males never exceed 20 cm. in length. The head is moderately long with a pointed snout which projects beyond the lower jaw and is shorter than the orbit. Skin of the posterior portion of head is divided into shields. Skull is with a bony temporal arch. The quadrato-jugal being in contact with the jugal and the post-orbital. Alveolar surfaces of jaws very broad, that of the upper jaw with a strong median ridge which is nearer to the inner than to the outer margin; bony choanae on a level with the middle part of the orbits. Upper jaw is feebly bicuspid. The carapace is smooth, depressed, unicarinate, the keel interrupted, most prominent upon the second and third vertebral shields, where it terminates in a pointed knob in the young and becomes less marked with advancing age; posterior margin feebly crenulated. Nuchal shield is not very large and broadest at the posterior aspect. First vertebral is longer than broad, more or less constricted in the middle; second broader than long in the young, longer than broad in the adult, narrowing posteriorly, its posterior margin is produced and fitting into an emargination of the third shield, which is shorter than the second or fourth; third vertebral shield forming a broad suture with the fourth, which overlies parts of four or five neural bones; neural plates much longer than broad. The plastron consists of paired gular, humeral, axillary, pectoral, abdominal, inguinal, femoral and anal shields. It is long and narrower than the opening of the shell, angulate laterally in the young, truncate anteriorly, notched posteriorly; the width of the bridge considerably exceeds the length of the posterior lobe. The longest median suture is between the abdominal shields, the shortest between the gular; humero-pectoral suture straight; inguinal shield large, axillary smaller. Limbs are with fully and broadly webbed digits and have transversely enlarged scales. Fore limbs are provided with five claws. Tail remains quite short throughout the life and exhibits no difference between juveniles and adult. General dorsal colouration is olivaceous or brownish with black vertebral stripe. In young individuals two black lateral stripes are present. Ventrals are yellowish. All the shields of plastron are generally having a large reddish-brown patch in the juveniles. Soft parts are olivaceous or yellowish, a yellow stripe runs along the side of the head starting from the nostrils and passing above the eye and the tympanum.

Distribution : Eastern Ganga River system as far west as Allahabad and north to Nepal. The species has also been recorded from the Brahmaputra. Fossils have been found in the Siwalik hills.

Habits and habitat : The species is entirely aquatic and lives on vegetable matter. About 30 to 35 elongate eggs measuring 55 x 3 mm. are deposited on the sandy banks in a single clutch.

Status : The species is extremely vulnerable. The main threats of the species are over-exploitation of adults and their eggs by animal predators and man for food and habitat destruction. The flesh of the species is much esteemed as food.

Conservation : Generally protected by legislation throughout its range but the conservation measures are not effective.

BENGAL ROOFED TURTLE

7. *Kachuga kachuga* (Gray)

This is a moderately large turtle in which also females are larger than males and reach a maximum length up to 39 cm. The head is moderately long, snout is pointed, slightly upturned, shorter than the orbit and projecting much beyond the lower jaw. Skin of the posterior portion of head is divided into shields. Skull is with a bony temporal arch. The quadrato-jugal is in contact with the jugal and the post-orbital. Alveolar surfaces of jaws very broad, that of the upper jaw with a strong and prominent median ridge which is medially situated between the inner and the outer margins. Bony choanae on a level with the posterior portion of the orbits. Upper jaw is feebly bicuspid in the adult individuals. The carapace is depressed, unicarinate, the keel is interrupted and remains most prominent upon the second and third vertebral shields, where it terminates in a pointed knob-like structure in the juveniles but disappears gradually in the adult individuals. Posterior margin of the carapace is crenulated in the young. Nuchal shield is not very large, broadest at the posterior aspect. First vertebral shield as long as broad; second vertebral shield broader than long in the young, about as broad as long in the adult, longer than the third vertebral, with which it forms a straight transverse suture; fourth vertebral is longest and forms a broad sutural margin with the third vertebral. The plastron consists of paired gular, humeral, axillary, pectoral, abdominal, inguinal, femoral and anal shields. It is long and narrow, considerably narrower than the opening of the shell, angulate laterally in the young truncate anteriorly, openly emarginate or notched posteriorly; the width of the plastral bridge exceeds the length of the hind lobe of plastron. The longest median plastral suture is between the abdominal shields, the shortest between the gular; humeropectoral suture curved or forming an obtuse angle; inguinal shield large, axillary smallest. Limbs are with fully and broadly webbed digits and have narrow, transversely enlarged scales. Forelimbs are provided with five claws. Tail remains quite short throughout life and exhibits no difference between juveniles and adults. General dorsal colouration is olivaceous or brownish. Ventrals are yellowish. Neck is light brown, with seven reddish longitudinal stripes. Lateral aspects of head bluish; throat with a pair of oblong red or yellow markings. Top of head in male has a brilliant red colour during the breeding season.

Distribution : The species is available in the Ganga River system of Bengal, Bihar and Uttar Pradesh in India. Bangladesh and Nepal. Occurrence of the species in Godavari and Krishna River systems has not been established so far.

Habits and habitat : The species is entirely aquatic and inhabits freshwater bodies with plenty of aquatic vegetation. It is mainly herbivorous. Eggs are laid on the sandy banks of Ganga during March.

Status : The species is extremely vulnerable. The population is towards decline in recent years on account of large scale exploitation for food and on account of habitat destruction and abrupt changes in ecology caused by the construction of various dams and reservoirs in the area. These turtles used to be common 20 years ago but on account of excessive killing by man in the recent past, the numbers now have been reduced considerably. Though exact figures are not known, illegal trade exists all over its range. Nesting areas on the banks of the Ganga and other rivers are destroyed by the removal of earth for commercial purposes. This causes a sudden loss of aquatic and other vegetation on the banks, thus creating scarcity of food for turtles, and gradually their population declines on account of starvation.

On account of various Hydroelectric and other projects like dams, many portions of the river systems in the range of species remain dry for a considerable period in the year and cause a sudden and radical change in the ecology of these water loving creatures and ultimately force them to die.

Conservation : Generally protected by legislation throughout its range but the conservation measures are not adequate.

BROWN RIVER TURTLE

8. *Kachuga smithi* (Gray)

This is a small turtle and reaches maximum length of 23 cm. The head is moderately small, snout is pointed, shorter than the orbit and projecting much beyond the lower jaw. Skin of the posterior portion of head is divided into shields. Skull is with a bony temporal arch. The quadrato-jugal is in contact with the jugal and the post-orbital. Alveolar surface of jaws is very broad, that of the upper jaw with a prominent median ridge, which is nearer to the inner than the outer margin. Upper jaw is not notched at the middle. The carapace is depressed, with obtuse, interrupted, vertebral keel; its posterior margin may be regular or in certain cases feebly serrated. Nuchal shield is not very large, broadest at the posterior aspect. First vertebral shield is longer than broad in the adult; second shortest, broader than long and almost with a straight posterior aspect; third longer than broad, pentagonal in the young but subquadrangular in the adult, its posterior border is almost straight; fourth vertebral longest, with a narrow, pointed anterior margin forming a narrow sutural articulation with the third vertebral; fifth vertebral distinctly broader than long and much broader than other vertebral shields. The plastron consists of paired gular, humeral, axillary, pectoral, abdominal, inguinal, femoral and anal shields. It is almost equal in length to the carapace, strongly angulate laterally in juveniles, truncate anteriorly; hind lobe of the plastron narrower than the shell-opening, notched posteriorly, shorter than the width of the plastral bridge. The longest median suture is between the abdominal shields, the shortest between the gular; inguinal shields large, axillary shield is smallest. Limbs are with fully and broadly webbed digits and have transversely enlarged scales. Fore limbs are provided with five claws. Tail remains quite short throughout life and exhibits no difference between juveniles and adults. General dorsal colouration is pale olive. Vertebral keel is blackish. Ventrums are yellow and such plastral shield is provided with a dark brown tinge. In many individuals the shields of plastron are completely black with narrow white borders. Top of the head is black. Prominent reddish or pink spots are present behind the eyes. Neck has got light brown longitudinal stripes.

Distribution : The species is available in the Ganga and Sind river systems. Records are also available from Bangladesh.

Habits and habitat : The species is entirely aquatic and is a rapid swimmer. It is omnivorous and devours flesh readily. Lays five to eight eggs on the sandy banks of rivers in a single clutch; eggs measure 33 mm. in length and 24 mm. in width.

Status : The species is vulnerable. Population is considerably reduced in recent years owing to mass exploitation for food and habitat destruction.

NORTH INDIAN ROOFED TURTLE

9. *Kachuga tecta* (Gray)

This is a small species and the females never reach more than 23 cm. in length, males are still smaller. The head is moderately small, pointed, shorter than the orbit. Skin of the posterior part of head is divided into large shields. Skull is with a bony temporal arch. The quadratojugal is in contact with the jugal and the post-orbital. Alveolar surfaces of jaws quite broad, that of upper jaw with a prominent median ridge which is nearer to the inner than the outer margin. Upper jaw is not notched.

The carapace is elevated and rounded in adult individuals. Vertebral keel is prominent, abruptly transforms into a strong spinous process at the posterior margin of the third shield. Posterior margin of the carapace is generally not much serrated. Nuchal shield is usually broadest at the posterior margin; first vertebral shield is variable in shape, with straight lateral margins in juveniles, the anterior portion of this shield becomes narrower in the adults; second vertebral shield is generally longer than the third and obtusely pointed, posteriorly; third vertebral is pointed behind and touches the pointed extremity of the fourth vertebral; fourth vertebral shield is much longer than the other vertebral shields; fifth vertebral shield is broader than long and is much broader than other vertebrals. The plastron consists of paired gular, humeral, axillary, pectoral, abdominal, inguinal, femoral and anal shields. Plastron is almost as long as the carapace; angulate laterally, truncate anteriorly; hind plastral lobe is smaller than the shell opening, notched posteriorly; its length is slightly less or almost equal to the width of the plastral bridge; the longest median suture is between the abdominal shields, the shortest between the gular or the anal; axillary and inguinal shields are almost equal. Limbs are with fully and broadly webbed digits and have transversely enlarged scales. Tail remains quite short throughout life and exhibits no difference between juveniles and adults. General dorsal colouration is olivaceous with minute black spots and orange or reddish vertebral stripe. The vertebral stripe is most distinct on the anterior dorsum extending up to first three shields. In the adults colouration becomes dark olive-brown and the spots become inconspicuous. The rim of the shell remains pinkish-yellow throughout the life. Ventrums are reddish, yellowish or reddish-yellow with large dark brown or almost black spots. Head is blackish, temporal region orange or yellow, neck is blackish with thin yellow longitudinal lines, limbs dark olive with yellow spots, back of thighs with dark transverse streaks.

Distribution : The species is available in the Ganga, Brahmaputra and Sind River systems of India and Pakistan. Fossils have been recorded from the Pleistocene deposits of the Siwalik Hills.

Habits and habitat : The species is fully aquatic and inhabits freshwater bodies with plenty of aquatic vegetation. It is a less active species and comparatively a poor swimmer. It feeds chiefly on vegetable matter. Not much is known about its breeding habits. Eggs are round or oval in the same clutch.

Status : This most familiar species has become extremely vulnerable and its population has been reduced enormously due to over exploitation (eggs as well as adults) for food. Habitat destruction is also a most important threat. The nesting areas of the species are destroyed by removing the sand for commercial purpose and as such aquatic vegetation is lost. These factors create the scarcity of food for these turtles and the populations decline automatically. The construction of various Hydroelectric projects also has a bearing on the habitat destruction of these turtles.

Conservation : Normally protected by legislation. The detailed ecological investigation of this species will help in ascertaining the approximate numbers, distribution pattern and ecological preference with a view to design suitable conservation and management plans.

NORTH INDIAN FRESHWATER TORTOISE

OR

BLACK-SPOTTED POND TURTLE

10. *Geoclemys hamiltoni* (Gray)

This is a fairly large species reaching up to 31 cm. in length. The head is large, broad, snout rounded, as long as the orbit and slightly projecting beyond the lower jaw. Skin of the posterior portion of head is divided into large shields. Skull with a bony temporal arch, the quadrato-jugal being separated from the post-orbital by the jugal. Alveolar surfaces of jaws very broad, without median ridge; body choanae on a level with the hinder part of the orbits; the upper jaw broadly emarginate in

the middle. The carapace is tricarinate, strongly convex with three interrupted keels in addition to the vertebral and costal keels; posterior margin serrated. The nuchal shield is not very large, broadest at the posterior aspect. First vertebral shield longer than broad; second and third vertebrals broader than long in juveniles, about as broad as long in the adult individuals but these are narrower than the costals. The plastron consists of paired gular, humeral, axillary, pectoral, abdominal, inguinal, femoral and anal shields. Plastron intimately attached to the carapace by suture, axillary and inguinal buttresses are strong but short and extend only up to the outer ends of the costal shields. Entoplastron is situated quite anterior to the humero-pectoral suture. Plastron is almost equal to the carapace in length, angulate laterally, truncate anteriorly, posterior plastral lobe is much narrower than the opening of the shell and as long as the width of the plastral bridge, deeply notched posteriorly, the longest median suture is between the abdominal shields and shortest between the anal or the humeral, axillary and inguinal shields large. Limbs are with fully webbed digits and have transversely enlarged scales. Tail quite short in comparison to body, covered below with small granular scales. General dorsal colouration is dark brown to black and richly spotted and streaked with deep yellow. Soft parts dark brown to black with numerous round yellow spots which are largest on the head and neck.

Distribution : The species is mainly restricted to the Ganga and Sind river systems. Records are available from Sind (Pakistan) to West Bengal. Fossils have been recorded from the Siwalik hills.

Habits and habitat : The species is absolutely aquatic and prefers to live in quite shallow and clear water with plenty of aquatic vegetation. This is a carnivorous turtle and its diet mainly consists of snails. In captivity it relishes raw meat and fish but rejects any vegetable matter. Nothing is known about its breeding habits.

Status : The species is extremely vulnerable. This turtle was fairly abundant in the early 20th century from Sind to Bengal but in recent years the species has been depleted drastically all over its range, owing to the over exploitation of eggs and adult individuals for food. Habitat destruction constitutes the second most significant threat to the survival of the species. Nesting areas are lost for commercial removal of sand on the one hand, and cleaning of riverside aquatic vegetation on the other. This causes scarcity of food sources and expose the banks to soil erosion. The construction of recent hydro-electric dams and barrages has checked the movement of the species to its nesting sites during breeding seasons.

Conservation : Nominally protected by legislation throughout its range.

THREE KEELED TORTOISE

11. *Melanochelys tricarinata* (Blyth)

This is a moderately small species reaching a length of 17 cm. The head is moderately small, snout shorter than the orbit, truncate, upper jaw feebly notched at the middle. Skin of the posterior portion of head is divided into large shields. Skull is with a slender, thin and incomplete bony temporal arch; alveolar surfaces of jaws are narrow, without median ridge; choanae on a level with the anterior portion of the orbits; squamosal bone is present. The carapace is much elongated, arched and with steep sides in fully grown up males; with three obtuse keels; posterior border smooth or feebly serrated. Second neural plate is generally octagonal, other succeeding neural plates are narrow on the posterior border. Nuchal shield is not very large; first vertebral shield is broadest on the anterior margin; second, third, and fourth vertebrals broader than long, narrower than the costal shields. Plastron is intimately attached to the carapace by a suture, with short axillary and inguinal buttresses which reach to the outer margins of the costal plates. Entoplastron intersected by the humero-pectoral suture. Plastron usually as long as the carapace, feebly angulated laterally in the juveniles, truncate anteriorly; hind plastral lobe is narrower than the shell opening, longer than the width of the bridge, notched posteriorly; the

longest median suture is between the abdominal or the pectoral shields, the shortest between the humeral or the femoral, axillary shield usually present, inguinal shield is usually missing. Limbs are with long claws, fingers half webbed, toes with rudimentary webs only. Front part of arms with enlarged, squarish somewhat pointed scales; hind limbs flattened and quite large in the grown up males, the anterior margins and keels with enlarged horny scales. Tail is short. Dorsum is dark-plum coloured with light brown keels having dark brown outlines. Ventrals yellowish-brown. Head and limbs dark plum or blackish above; a broad red stripe on each side of the head, starting from the nostril and passing above the eye and the tympanum; a similar band below the angle of the mouth, along the inferior margin of the lower jaw. Limbs with or without yellow spots.

Distribution : The species is available from Chotanagpur (Bihar), Jalpaiguri district (West Bengal), and the Dafla Hills and Bisnath Plain in northern Assam.

Habits and habitat : The species inhabits the hilly terrestrial areas. It is mainly herbivorous and generally 3 to 6 oval eggs are laid in a single clutch. Egg laying takes place throughout the year.

Status : Indeterminate, probably vulnerable. The main threats to the species include large scale exploitation of eggs and adults for food by the local tribals. The habitat destruction is the another major threat to the survival of this species.

Conservation : As a protective measure the Director, Zoological Survey of India has already proposed for the inclusion of this species in Appendix I of the Indian Wildlife Act, 1972.

BIHAR FRESH WATER TURTLE

12. *Melanochelys trijuga indopeninsularis* (Annandale)

A moderately large turtle in which the shell reaches up to a length of 34 cm. The head is moderately small, snout shorter than the orbit, slightly projecting beyond the lower jaw; upper jaw notched at the middle. Skin of the posterior portion of head smooth but divided into large shields. Skull is with a bony temporal arch, which is sometimes incomplete posteriorly; alveolar surfaces of jaws are narrow, without median ridge; choanae on a level with the anterior portion of the orbits; squamosal bone is present. The carapace is moderately depressed, tricarinate, the lateral margins slightly reverted, the posterior margin feebly serrated in the juveniles. Nuchal is moderately small; vertebral shields are quite variable both in shape and proportions, as long as broad or longer than broad in the adults, slightly narrower than the costals. Plastron is intimately attached to the carapace by a suture, with short axillary and inguinal buttresses which reach to the outer margins of the costal plates. Entoplastron intersected by the humero-pectoral suture. Plastron is almost as long as the carapace, truncate and openly emerginating anteriorly; hind plastral lobe is narrower than the shell opening, generally shorter than the width of the plastral bridge, deeply notched posteriorly; the longest median suture is between the abdominal shields or the pectoral shields; the shortest median suture is between the humeral shields. Axillary and inguinal shields are present. Limbs are flattened and with completely webbed digits; front of arm and hinder part of leg with enlarged horny scales. Tail very short in comparison to the body. Dorsum dark brown in the juveniles but deep black in the adults. Vertebral keels and plastral margins are yellow. Head grey or brownish, young with yellow reticulations but adults are devoid of such markings.

Distribution : Chotanagpur (Bihar) and Jalpaiguri District (West Bengal).

Habits and habitat : Mainly aquatic but at ease on the land also. It is herbivorous and food comprises the grass, vegetables and fruits. Nothing is known about the breeding habits of this subspecies.

Status : Indeterminate, possibly has become vulnerable on account of habitat destruction and large

scale exploitation of eggs and adults individuals for food by the local tribals.

Conservation : Suitable conservation measures have not yet been followed. This subspecies must be included in Appendix I of the Indian Wildlife Act.

NORTH INDIAN FLAP-SHELLED TURTLE

13. *Lissemys punctata punctata* (Lacepede)

This is a small, flat turtle whose length hardly exceeds more than 24 cm. The head is moderately large, the snout is short and broad, its length is less than the length of the eye opening. The carapace and plastron covered by a continuous sheet of soft skin and their callosities are finely granulated. Skin of dorsal disc of juveniles longitudinally plaited. The lateral and the hinder portions of the carapace are most flexible. Neural bones are two in number and rest between the first pair of costal plates. First marginal bone in the adult is very large, much longer than the other marginal bones. Plastron is with soft, semicircular flaps, which accommodate the retracted hind feet to be totally concealed; front portion of the plastron is quite flexible and permits the closure of the anterior shell opening quite effectively. Plastron is with seven callosities in the adult, namely paired hyo-hypo., xiphi., and epiplastral, and a single entoplastral (quite small in adults). Limbs are fully webbed, with only three claws on each foot. Tail is very short. Olive-brown above. Carapace is grey-green, with numerous black-bordered yellow spots, irregularly arranged and with a light yellow marginal rim.

Distribution : Bangladesh, Burma (Akyab), India Andaman Islands, and the Ganga and Sind river systems. Sikkim and Kutch, Nepal, Pakistan and Sri Lanka.

Habits and habitat : The species prefers to live in shallow, muddy ditches, lakes and marshes. It is a carnivorous turtle and feeds mainly on frogs, fishes, shrimps and snails. Nothing is known about its breeding habits except that it lays 12 eggs in a single clutch.

Status : Suspected to be threatened on account of ruthless killing and overexploitation of adults and their eggs for protein-rich food. Habitat destruction is the another principal factor of threat to the species. The nests of these turtles are frequently raided by predators like man, otters, mongooses, jackals and dogs. The construction of hydro-electric dams and barrages has greatly checked the movements of the turtles to its breeding grounds.

Conservation : Nominally protected by legislation and export of adults and their products is prohibited. This subspecies is already in the Appendix I of IUCN. Exact data on the population are not available but it has been drastically reduced. A detailed study on the status and ecology will lead as to formulate suitable management plans to conserve this endangered subspecies.

NARROW-HEADED SOFT-SHELLED TURTLE

14. *Chitra indica* (Gray)

This is a gigantic, flat soft-shelled species reaching to a length of 90 cm. or more. The head is quite small in comparison to the body, somewhat elongated; snout is rounded; proboscis about as long as the eye-opening. Skull is very long and narrow, flat above, the orbits are close to its anterior extremity; post-orbital arch twice as broad as the diameter of the orbit; posterior margin of the pterygoid is free and devoid of any ascending process. The alveolar surfaces of jaws are slightly expanded, and the edges of jaws are extremely sharp. The eyes are displaced much forward. Carapace is remarkably pitted and vermiculated; a single neural plate rests between the first pair of costals; outer extremity of nuchal plate overlapping the second dorsal rib; eight neural plates form a continuous series; eight pairs of costal plates are present, the last pair is in contact with the mid-line. Hyoplastron

is distinct from hypoplastron; anterior limbs of epiplastra are long and slender, widely separated from one another; four well developed hyo-hypo and xiphi plastral callosities are present in the adults. Dorsal colouration is olivaceous-yellow, with dark vermiculations or black dots in juveniles. In adults the black punctate markings are replaced by large angular markings of light yellow colour. Head and neck with light, black-edged longitudinal streaks and a shaped mark in the mid-line commencing just in front of the disc. In fully grown up and aged adults these markings become less distinct.

Distribution : India (Uttar Pradesh, Bihar and West Bengal), Nepal, Pakistan, Malaysia and Thailand.

Habits and habitat : This species is most agile and prefers to live in shallow rivers with sandy bottom and banks. This is most dangerous carnivorous freshwater turtle and its food comprises mainly fish, gastropod molluscs and other small animals. On handling it suddenly shoot outs its long neck and bites most savegely. It is capable of inflicting most severe wounds. It lays 8-10 spherical eggs in a single clutch; eggs measuring 36-42 mm. in diameter.

Status : Indeterminate, suspected to be threatened on account of excessive killing of adults and overexploitation of eggs for food. Other factors of threat are same as given in the case of other Trionychids.

Conservation : Nominally protected by legislation. Exact population estimates are not available but it has been considerably depleted in the recent past. A detailed study on the status and ecology will lead as to formulate suitable management plans to conserve this endangered species.

INDIAN SOFT-SHELLED TURTLE

OR

GANGA SOFT-SHELLED TURTLE

15. *Trionyx gangeticus* Cuvier

This is a very large, soft-shelled turtle with an oval shell and reaches up to 45 cm. in length. The head is comparatively large and broad with dorso-laterally situated eyes and quite thick and somewhat elongated proboscis. The snout is equal to the diameter of the orbit. In the skull, postorbital arch is one-half to one-third the diameter of the orbit; alveolar surfaces of upper jaw is flat, with a well defined medial axillary groove between them; mandibles with raised inner edges, which meet at the symphysis to form a short, median projection; length of symphysis is less than the diameter of the orbit in the adult. Two neural plates rest between the first pair of well developed costal plates; last pair of costal plates is generally in contact in the mid-line; all the plates of the carapace are coarsely pitted and vermiculated; Nuchal shield is not present; anterior limbs of epiplastra long and slender, in contact with or narrowly separated from one another; four plastral callosities, hyo-hypoplastral and xiphiplastral are well developed in the fully grown adults, in aged turtles a fifth callosity is also present upon the entoplastron. Limbs are with three claws. Tail is short in both sexes. Dorsal colouration is olive-green; carapace is dull olive or greenish with irregular dark reticulations; plastron is ivory white; head is greenish, with a black longitudinal streak from between the eyes on the nape and three oblique black streaks on either side diverging from it; another streak starting from behind the eye. Juveniles are greenish with a reticulated pattern of four irregular ocelli in the carapace; sometimes with black longitudinal line on the top of the head.

Distribution : The species inhabits the Ganga, Sind and Mahanadi river system. It is common in N.W. Pakistan, Bangladesh and the Nepal foothills.

Habits and habitat : The species is highly aquatic inhabiting the deep turbid rivers but it is frequently seen basking on sandy banks or resting in shallow water with its head stricking out of

water. It is an omnivorous species and the diet comprises a wide range of aquatic vegetation and animal food like fish, molluscs, frogs and crustaceans. It is a very prominent scavenger also. Breeding takes place in late September to October. The spherical and hard shelled eggs with a diameter of 3 cm. are laid on the sandy river banks.

Status : The species has become endangered on account of excessive killing of the adults for flesh, and overexploitation of eggs for food. The flesh of this turtle is highly liked as an important food item at various places in Bengal and Orissa. Habitat destruction is also a principal factor of threat to this species.

Conservation : Nominally protected by legislation but adequate measures are not followed strictly. Exact data on the population are not available but the number has reduced drastically. A detailed study on the status and ecology will lead as to formulate suitable management plans to conserve this endangered species. This turtle species has already been included in the Appendix I of INCN.

PENINSULAR SOFT-SHELLED TURTLE

16. *Trionyx leithi* Gray

This very large, soft-shelled turtle reach slightly above 50 cm. in length. This species is quite similar to *Trionyx gangeticus* in the taxonomic characters of the carapace and plastron but differs from it in having a bony snout longer than the diameter of the orbit; post-orbital arch one-half to one-third the diameter of the orbit; alveolar surface of upper jaw is flat and with a fairly well defined median maxillary groove between them; inner edge of mandible not raised; the mandibular symphysis is flat, its length is equal to or greater than the diameter of the orbit in the adult. Dorsal colouration is olive-green with lighter vermiculations. Ventrums are whitish. Head is greenish with black longitudinal lines from between the eyes and two or three oblique black streaks emerge on either side and one streak is starting behind the eye. The carapace in the juveniles is with four distinct ocelli (concentric circles).

Distribution : Ganga river systems and all the rivers of Peninsular India as far south as Madras.

Habits and habitat : The species is perfectly aquatic and like *Trionyx gangeticus* frequently seen basking on sandy banks or resting in shallow water with its head sticking out of water. The species inhabit deep turbid rivers as well as canals, marshes, ponds and lakes. The species is completely omnivorous like *Trionyx gangeticus* and is also a scavenger. Eggs are slightly oval.

Status : This species is also endangered on account of excessive killing of the adults for flesh, and over-exploitation of eggs for food. Habitat destruction and urbanisation is the another factor responsible for its decline.

PEACOCK-MARKED SOFT-SHELLED TURTLE

17. *Trionyx hurum* Gray

This is a gigantic soft-shelled species in which length reach up to 60 cm. and above. The head is comparatively large and its snout is prominently projecting down turned and is longer than the diameter of the orbit; postorbital arch one-half to one-third the diameter of the orbit; alveolar surfaces of upper jaw sloping gradually to meet the median maxillary groove; mandibular symphysis has a median groove which is longer than the orbital diameter. Other taxonomic characters of carapace and plastron are as available in *Trionyx gangeticus*. Dorsum is olive-green, reticulated with black and generally with four striking ocelli (like the peacock eye) with a narrow yellow rim and large number of broken longitudinal markings. Head is dark green with several yellow spots. Carapace, ocelli and yellow head spots become less distinct by the advancement of age. A pale yellow spot across the snout is always present. Plastron is ivory-white.

Distribution : The species is available in the lower reaches of the Ganga and Brahmaputra rivers.

Habits and habitat : The species is markedly aquatic and omnivorous.

Status : The species has become endangered on account of habitat loss and by the predation of man and animals for food.

Conservation : Nominally protected by legislation but adequate measures are not followed strictly.

Order SQUAMATA

Suborder SAURIA

INDIAN MONITOR

18. *Varanus bengalensis* (Linnaeus)

The common Indian Monitor is a medium-sized, dark brown monitor. It is popularly known as ghorpad. It measures from 72 to 75 cm. in the head and body length. The young possesses pale rign-spots and blackish cross-bars. The blackish cross-bars sometimes also persist in the adult. The tail is very strong, long and compressed, and measures about 100 cm. in length. Characteristically, the scales on the crown are larger than those on the neck region and those of the anterior part are rounded and keeled posteriorly. The snout is convex terminally. The nostrils are oblique slits lying midway between the eye and the end of the muzzle. The teeth are acute, long, sharp and recurved. The tongue is very long, forked and protrusible.

Distribution : The Common Indian Monitor occurs throughout the Indian subcontinent.

Habits and habitat : The monitor is mostly diurnal. It is found in variable habitats, such as, forest, desert, river bank, by the side of nullah, marshy land, tidal creek and the sea coast. It occupies burrows, dense clump of vegetation, hollows of trees, cracks, and crevices. This monitor is graceful in its movement and is a good climber and swimmer. It is a formidable reptile, bites hard, lashing with the tail and scratching vigorously with its powerful claws, when approached or caught in the wild condition. Its main food items are small terrestrial vertebrates, preferring ground-brds and their eggs; also takes arthropods and fishes. It breeds from July to September. The eggs, 19 to 30 in a clutch, are deposited in holes and are covered with leaves, rubbish and sand.

Status : The population of the Common Indian Monitor has alarmingly dwindled throughout the country, due to excessive exploitation of the adults for their commercially valuable skins.

INDIAN YELLOW MONITOR

19. *Varanus flavescens* (Gray)

The yellow Monitor is of dark brown colour with a reddish tinge on the body. It measures about 36 cm. in the head and body length. The tail is strongly compressed and is about 46 cm. in length. The snout is short and convex, and the nostrils are oblique slits. The scales on the crown are smaller than the nuchal ones, and the dorsal scales are strongly keeled. The digits are very short.

Distribution : It is known from northern India from Punjab to West Bengal.

Habits and habitat : It is a very good swimmer and prefers to make burrows on muddy bunds around ponds, lakes and canals. The freshwater crabs and small fishes are its main food items. The breeding season is from July to August. It lays about 20 eggs in a clutch. The eggs are deposited in holes on the banks of ponds, lakes and canals.

Status : The population of the yellow Monitor has greatly run down, as it has been exploited commercially for its beautiful skin.

INDIAN WATER MONITOR

20. *Varanus salvator* (Laurenti)

The water monitor is the second largest of all the monitors of the world, attaining a length of about 3 m., including the tail. Like other monitors, it has a tapering head and long, slender neck. Its ear-openings are distinct. The eyes are provided with lids and have round pupils. The nostrils are round or oval and are situated at the anterior end of the head. Its teeth are long, sharp recurved, and laterally flattened and are frequently replaced. The tongue is very long, forked anteriorly and protrusible. Its tail is long strongly compressed and powerful. The body is covered with small overlapping granular scales. A fully grown lizard is dark olive, indistinctly spotted with yellow; the young is blackish, with small yellow and large rounded spots arranged in transverse rows.

Distribution : The species is distributed throughout the Indian subcontinent, including the Andaman and Nicobar groups of Islands. Elsewhere it is found in Sri Lanka, Bangladesh, northern Burma, southeast Asia and northern Australia.

Habits and habitat : The water monitor inhabits wet, marshy, humid forests, banks of rivers, estuarine forests, etc. It is more aquatic than other species of monitors. It can swim far off in the sea in search of food. It is omnivorous in diet but has special liking for birds eggs and fishes. It breeds from June to August. 15-30 eggs are laid in holes on the river-banks or on trees beside water.

Status : This species is severely depleted in number and is at risk almost throughout its range of occurrence. The skin of this monitor makes excellent leather. From 1930 till recently, about 20,000,000 skins of the Indian Water Monitor have been shipped from Calcutta alone. Its skin is in heavy demand in Europe. However, this lizard is protected under Schedule 1 of the Indian wildlife (Protection) Act, 1972.

Suborder SERPENTES INDIAN ROCK PYTHON OR AZGAR

21. *Python molurus molurus* (Linnaeus)

The Indian Rock Python or Azgar is an impressively large and heftiest snake and is the second largest of the Indian snakes. Its length ranges from 2.5 to 6 m.; the maximum recorded length is 7 m. and weight 85 kg. The head is quite distinct from the neck and has symmetrical shields; the rostral, the anterior supralabials and the anterior and posterior infralabials are pitted. These sensory pits on the rostral and first two labials constitute one of the main characters differentiating this Python from other Indian snakes. The other taxonomic characters are, costals are smooth and arranged in 60-75 rows; ventrals 245-270; caudals in 60-72 pairs. Eyes are small and with vertical pupils, iris flecked with gold; nostrils are large, directed upwards and situated high on the snout; chin is with a mental groove. Tail is short and prehensile, tapering to a point; vestiges of pelvis and hind limbs terminate in a claw like spur on either side of anus, which are more prominent in males than the females. The colour of the body varies from pale grey to yellow above, and is yellow below; the flanks are paler. A dorsal series of large walnut-coloured crown saddles alternate with pinkish laterals.

Distribution : This subspecies is distributed in India, Pakistan and Sri Lanka.

Habits and habitat : The Azgar inhabits marshes, moist forests and wet rocky ledges near streams and pools in almost all the parts of Ganga basin. It occupies burrows, dense clumps of vegetation, large rotten logs, caves, crevices and ruins. It is an excellent climber and at certain occasions suspends it-self from the branch of a tree, waiting motionless for a prey to come within its reach. It is extremely fond of water, an expert swimmer and spends considerable time in the water and can remain submerged for at least half an hour, when needed. Pythons have been seen swimming in Ganga wholly submerged except for the tip of the snout. Python is most active at night but lethargic and slow moving during the day. It crawls in an almost straight line, leaving a distinctive track. It hibernates in winter in to hollows of trees, underneath rocks or in rock shelves. In Ganga basin its courtship and mating takes place during hibernation (between late December to middle of February). On provocation the Python produce loud hissing sound and strike effectively, inflicting deep wounds on the body of the intruders. Pythons can be tamed and behave like good natured docile pets. The food comprises mainly the reptiles, birds and mammals. The prey is killed by constriction and swallowed by the side of head. It is oviparous and female exhibits parental care by coiling herself round the eggs. The single clutch of eggs, generally comprises from 60 to 100 white, soft eggs (12x6 cm.). The incubation period is from 50 to 60 days and hatchlings at the time of birth measure from 65 to 75 cm. in length. A healthy Python in nature survives for more than 30 years and its survival record in captivity is over 22 years.

Status : The Python used to be common in the major part of the Ganga basin but during the recent years its population has considerably declined and the species has become vulnerable on account of over-exploitation during the last sixty years. The main cause of the decline in number of the subspecies to this alarming level is due to the existing illegal trade in its skin. Large number of pythons are killed every year in North India for their skins, which are in high demand all over the world for the fancy leather goods. Now a days this Python has been protected under Schedule I of the Indian Wildlife (Protection) Act, 1972, and under Appendix I of CITES.

CHECKERED KEELBACK

22. *Xenochrophis piscator* (Schneider)

The checkered Keelback is the commonest freshwater, fairly robust snake whose length hardly exceeds a metre; the maximum recorded length is 1.48 m. The head is oval and distinct from neck, slightly flattened, with a bluntly pointed snout. The other main characters are as follows : Rostral wider than high; nostrils are between nasals; only one large loreal; eyes are moderately large, with round pupil; preocular one or two (rarely); postoculars three, rarely four; anterior temporals are long and narrow, usually two in number; posterior temporals are 2 to 4 in number; eight to ten upper labial (fourth and fifth touching the eye); nine to ten lower labials; body cylindrical; costals are 19 at the middle of body, lateral rows are smooth, median rows are feebly keeled; ventrals are 122-158; subcaudals 60-97; anal is divided. Hemipenis and sulci spermaticus are forked. The colour of the body is much variable, may be yellowish, olive, light green, grey, brown with a reddish tinge, with five rows of small light black spots, bars which are generally narrow than interspaces separating them, quincuncially arranged; head olive brown above, with two oblique black streaks, one below, the other behind the eye. The dorsal black markings are arranged in five transverse series (a ventral, 2 dorsolateral and 2 lateral) and form a chess-board like pattern; belly is creamy white, usually with small black spots on the lateral margins of ventrals.

Distribution : Whole of Indian (including the Himalayas and Andamans). It is widely distributed in the complete Ganga basin. Distributed in the complete Malayan region, southern China, Taiwan, Bangladesh, Borneo, Burma, Sri Lanka, Pakistan and Indo-chinese subregion.

Habits and habitat : The checkered keelback is a diurnal vicious, agile, most common freshwater

snake inhabiting marshy areas, pools of water, ditches, canals and shallow edges of rivers with plenty of aquatic vegetation. The hibernation takes place from December to January. Its main food comprises small fishes and frogs. Courtship and mating takes place in late September to October; numerous gravid females are seen in November to the end of May. Clutch size varies from 8 to 91 (16x28 mm.) eggs and the incubation period ranges from 35 to 55 days.

DARK-BELLIED MARSH SNAKE

23. *Xenochrophis cerasogaster* (Cantor)

This most handsome, docile, good-tempered, shy, most agile and diurnal snake is much similar to the checkered keelback in shape but body is comparatively more slender. Total recorded length in males ranges from 550 to 670 mm. and in females from 730 to 975 mm. The head is long, narrow, distinct from neck, flattened and with a bluntly pointed snout. Rostral square shaped, nostril is in nasal; preocular one, postoculars three or four; anterior temporals and elongated, two in number; posterior temporals are three; upper labials are 8 or 9, fourth touching the eye; lower labials are 9 to 11; anterior chin shields are shorter than the posterior ones; costals in 20 or 21 : 19 : 17; all dorsal scales are keeled except 2 or 3 lateral rows; ventrals are 140-160; sub-caudals are 63-78; anal is divided. Dorsal colour is dark brown, greenish or olivaceous, with light yellow stripe on fifth and sixth scale rows; many individuals are with dark or olive-brown spots on the body; ventrum is with a reddish tinge, with brown, light black and white spots which are more prominent on the anterior part of the body; a yellow line along the outer aspects of the ventrals, margined with chocolate on the upper side and with red on the lower side; lips are yellow and chocolate; chin and throat is white, with red dots; under side of the tail is black.

Distribution : It is available from lower Sind (Pakistan) to Bengal and Assam in India through the complete Ganga basin. Also recorded from central Nepal.

Habits and habitat : The species is absolutely aquatic and inhabits the side streams, pools, marshes and ditches where plenty of aquatic vegetation is available. The main food of this snake comprises the small fishes, shrimp and frogs. Egg laying takes place from April to June and each clutch contains from 15 to 20 eggs.

Status : Available in abundance throughout its range.

COMMON INDIAN RIVER SNAKE

24. *Enhydryis enhydryis* (Schneider)

This gentle, stout, short-tailed snake ranges from 750 to 960 mm. in length. Its main characters are as follows : Teeth are well developed, last two or three maxillary teeth are grooved and enlarged. Nostrils are situated on the upper surface of the snout. Eyes are small and directed upwards. Snout is broad and rounded; only one internasal which is two times broader than long and always remains in contact with the subquadrangular loreal; frontal broader than the supraocular; rostral is not deeply excavated; upperlabials are 8 in number, fourth touching the eye and last one is very small; posterior pair of genials is larger than the anterior pair which is in contact with the four lower labials; costals are in 21 or 23 rows at the middle of body; ventral are 140 to 175; subcaudals are 46 to 70. The hemipenis is short and forked for about half its length. The dorsal colour is brown, olivaceous, with a dorsoventral stripe (occupying from 4-8 scale rows), which are bounded on either side by a pale stripe; outer three scale rows are whitish, buff or red; ventrals are yellow or white with brown lateral margins and with a median series of brown spots. Head is brown, with light variegations with a light stripe on each side of the eye.

Distribution : Complete middle and eastern part of the Ganga basin including the Uttar Pradesh,

Bihar and Bengal. In north range extends up to Himalayan foot hills and Assam. It has also been recorded from Orissa. Outside India the species is available in Burma, Malaysia, Thailand, southern China and south Vietnam.

Habits and habitat : The snake is perfectly aquatic (equally at home both in freshwater and saltwater) and is an expert swimmer. It can go on land also but not much away from the water. On land the locomotion is quick and is effected by the simultaneous jerks. Its main food is fish but occasionally the diet is supplimented by frogs, toads and other small vertebrates available by the side of rivers. It is viviparous and give birth from 6-18 young ones.

Status : Available in abundance throughout its range.

WHITE BROWN-SPOTTED RIVER SNAKE

25. *Enhydris sieboldi* (Schlegel)

It is stout, diurnal river snake not exceeding in length more than 900 mm., females are comparatively longer and more stout than males. Teeth are well developed, last three maxillary teeth are grooved and enlarged. Nostrils are located on the upper surface of the snout. Eyes are small and directed upwards. Snout is blunt and somewhat squarish. Internasals are longitudinally divided, generally touching the loreal which is almost as high as long; frontal broader than the supraocular; supralabials are 7 or 8, fourth touching the eye, last one or two are horizontally divided; preoculars are generally two in number, the lower of the two and postocular generally extend up to the lower surface of the eye; anterior pair of genials longer than the posterior pair and is in contact with 4 or 5 labials; costal scales are in 29 to 31 rows at the middle of body; ventrals are 147 to 158; subcaudals are 48 to 56. The hemipenis is almost like that of *Enhydris enhydris*. The dorsal colouration is whitish or buff with dark-brown black-edged rhomboidal spots, arranged in transverse series on the complete dorsum; head with three dark-brown longitudinal stripes meeting between the eyes; a series of round spots on sides alternating with the dorsal spots; ventrum is whitish and is profusely spotted with black.

Distribution : Recorded in the Ganga basin from the Uttar Pradesh, Bihar and Bengal. Within Indian limits this snake is also found in Kerala, Maharastra, Madhya Pradesh and Assam. Outside India the species has been recorded from Burma.

Habits and habitat : The species is entirely aquatic and most secretive. During winter season these snakes hibernate by hiding in mud. These snakes are most active swimmers, their movements are considerably fast on the land also and the progression is followed by quick jerks. These are most docile snakes and even on the serious provocation, never make any attempt to bite. The food mainly comprises fishes, shrimps, frogs and tadpoles.

Status : Available in abundance in most of its range.

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·AMPHIBIA

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INTRODUCTION

Amphibian fauna of India have been studied by a number of workers from mid-nineteenth Century. A few of the important works to mention are Cope(1865), Boulenger(1882-1920), Annandale(1907-1919), Rao(1915-1937), Smith(1917-1927), Hora(1922-1928), Bhaduri(1929-1980), Daniel(1962-1975), Kripalani(1953-1961), Abdulali(1954-1985), Satyamurthy(1967), Yazdani & Chanda(1971), Pillai & Chanda(1973-1981), Pillai(1978-1981), Mahanti-Hajmadi(1974), Sarkar(1981), Inger & Datta(1986), Chanda(1986).

It is evidenced from the literature that a detailed study has not been carried out on the amphibian fauna of Ganga river basin from West Bengal, Bihar and Uttar Pradesh. However, few stray papers have been published on the amphibian fauna of river ganga basin are Annandale & Rao(1918) on the amphibian fauna from Nainital and Mirzapur, Uttar Pradesh. Bhaduri(1938-1947) from West Bengal, Venkateswarlu & Murthy(1972) from Bihar. Chopra(1972) recorded seven species from "Ram Ganga" which flows through the Corbett National Park, Uttar Pradesh.

As a result, a total of 12 species of amphibians under four families and six genera as given below ~~so far been~~ recorded from river ecosystem which appears to be very negligible in comparison to the amphibian fauna of Indian region. It is presumed that river ganga bisin may yeild further novelty to science with regard to amphibian fauna if these areas can be throughly explored.

SYSTEMATIC ACCOUNT

LIST OF AMPHIBIA

Class AMPHIBIA

Order ANURA

Family BUFONIDAE

Genus *Bufo* Laurenti

1. *Bufo melanostictus* Schneider

2. *Bufo stomaticus* Lutken

Family MICROHYLIDAE

Genus *Microhyla* Tschudi

3. *Microhyla ornata* Dum & Bibron

Genus *Uperodon*

4. *Uperodon globulesum* Gunther

Genus *Kaloula* Grey

5. *Kaloula pulchra* Grey

Family RANIDAE

Genus *Tomopterna* Dum & Bibron6. *Tomopterna breviceps* SchneiderGenus *Rana* Linnaeus7. *Rana cyanophlyctis* Schneider8. *Rana erythraea* Schlegel9. *Rana hexadactyla* Lesson10. *Rana limnocharis* Boissduval11. *Rana tigerina* Daudin

Family RHACOPHORIDAE

Genus *Ploypedates* Tschudi, 183812. *Ploypedates leucomystax* (Gravenhorst, 1829)1. *Bufo melanostictus* Schneider

This is usually called 'Common Indian toad' and is the largest of the Indian toads reaching a maximum length of 160 mm from tip of snout to vent. Head with prominent bony cranial ridges; two large and distinct parotoid glands present; tympanum distinct, circular. First finger equal to or longer than second. Toes half or less than half webbed; tibiotarsal articulation reaches tympanum or upto eyes. Skin heavily tuberculated and has many black spine-tipped warts. Colour uniform grey of various shades, brown or reddish with darker markings. Ventral surface uniform white or speckled with black on the chin and throat.

Distribution : Throughout Indian region; Sri Lanka; Burma; Southern China; Malay Peninsula and Archipelago.

Remarks : This is the commonest species among the Indian anurans and is found to occur in almost all the biotopes. In the Himalayas it has been recorded up to an altitude of 3048 m. It is abundantly found in the damp places, and the banks of the streams. The hill specimen is as a rule much larger in size than on the plains. This species usually remain hiding in holes during the day and come out in the evening hunting for insects in and around human dwellings. This species lay eggs in stagnant and often muddy water in which the tadpole undergoes development.

This species remain silent during the greater part of the year but may be heard throughout the year where there is plenty of rainfall. The monsoon is the breeding season, when the males burst into continuous croaking. During this season the throat tinged with brick-red or orange yellow, which is only distinctly visible when the gular sac is inflated. Generally the male is smaller than the female and far exceed the female in number and consequently there is a keen competition among the males for the possession of the females and there is often considerable fighting. Although breeding season is usually restricted to the begining of the rainy season, yet it can breed throughout the year under favourable conditions. Though it is nocturnal in habit, during the breeding season it can be seen both during day and night. This species is mainly insectivorous. On provocation its parotoid glands secrete a milky fluid which causes irritation to human skin.

2. *Bufo stomaticus* Lutken

A medium sized toad. Maximum length 76 mm from tip of snout to vent. Head without cranial ridges; parotoid glands present; tympanum distinct, two-third diameter of eyes. Toes two-third webbed. Tibiotarsal articulation reaching between shoulder and eyes. Dorsal skin slightly tuberculate. Ventral skin granular and that of throat is smooth. Dorsally greyish in colour. Ventral surface white.

Distribution : INDIA : West Bengal, Bihar, Andhra Pradesh, Rajasthan, Uttar Pradesh, Maharashtra; Nepal; Burma; Sri Lanka; Pakistan; Arabia.

Remarks : This species is rarely seen owing to its strict nocturnal habits. It can burrow in moist or loose sandy soil (Paranjape & Mulherkar, 1979). The call of the male is distinctive and can easily be distinguished from that of the common toad. Eggs are laid in translucent strings, pale yellowish green in colour. The metamorphosed young measures less than 10 mm in snout to vent length.

3. *Microhyla ornata* (Dumeril & Bibron).

It is a slender frog rarely exceeding 26 mm from tip of snout to vent. Head small, pointed. Fingers and toes rather slender with their tips dilated into very small discs. Fingers free; first finger shorter than second. Toes with rudimentary web. Subarticular tubercles distinct. Hind limbs moderately long; tibiotarsal articulation reaching between shoulder and eyes. Skin smooth. Dorsally greyish brown with a large black marking on the back, extending backwardly between the eyes and widening posteriorly. Limbs with conspicuously dark cross bars.

Distribution : INDIA: West Bengal, Assam, Meghalaya, Arunachal Pradesh, Mizoram, Nagaland, Manipur, Tripura; Sri Lanka; Burma; South China; South-east Asia; Taiwan.

Remarks : It is the commonest of the family microhylidae and is nocturnal in habit. Although it is nocturnal but may be found during the day, hidden under leaves and stones. It has adapted itself to life in different biotopes from heavy rainfall areas to desert. It has been recorded upto an altitude of 1542 m from plains. This species is mainly insectivorous and feeds on specially small coleoptera and ants. Breeding season generally on June and July. Eggs are laid in flat, transparent masses. It is abundantly found to occur in heavy rainfall areas.

4. *Uperodon globulosum* (Gunther)

Large microhylid from attaining a length of 75 mm from tip of snout to vent. Head small with rounded snout and beady eyes. Interorbital space very wide about two and half to three times the breadth of upper eyelid. Hind limbs short with two large shovel-shaped metatarsal tubercles. Toes with rudimentary webs. Dorsal skin smooth or slightly tuberculated. Anal region granular. Ventral surface smooth or wrinkled. Colour uniform brown or grey above, ventrally white with tinges of yellow during breeding season.

Distribution : INDIA: West Bengal, Orissa, Madhya Pradesh, Gujarat, Maharashtra, Karnataka, Assam.

Remarks : Only two species of the genus *Uperodon* so far been recorded from India and both of them are endemic to Indian region. It is a fossorial and rare species and generally found inside the soil except during breeding season. In loose soil, using their powerful shovel-shaped metatarsal tubercles this species can quickly burrow and disappear inside the soil. On land it can simply hop or slowly walk, while in water they simply float and are the most feeble swimmers. It is mainly found on termite nests and it would appear that this sedentary species restricts its movement to finding and burrowing into the nests of their main food, termites and perhaps the ground dwelling ants.

5. *Kaloula pulchra* Grey

Medium sized from attaining a length of 75 mm from tip of snout to vent. Head short, round; interorbital space broader than upper eyelid. Fingers rather slender, free; tips of fingers bears well developed triangular discs. Toes nearly one-third webbed. Two strong compressed metatarsal tubercles present. Tibiotarsal articulation reaching shoulder or slightly beyond shoulder.

Distribution : INDIA: West Bengal, Madhya Pradesh, Karnataka, Tamil Nadu; Sri Lanka.

Remarks : This is a rare and nocturnal species. During the monsoon period this species occasionally found to climb on moist boundary walls of the houses. It can inhale air and swells like a balloon keeping the head a little downwards and secretes a milky fluid through the epidermal pores of the skin. During the dry season this species is seldom seen or can be heard but become active soon after the rain and croak noisily. Males may be found floating in large numbers on the surface of every pool and their bodies being inflated until they resemble rather 'flattened tennis balls' in shape. At a distance of about half a kilometre the sound resembles a gurgling waterfall.

6. *Tomopterna breviceps* (Schneider)

A medium sized frog, attaining a length of 50 mm from tip of snout to vent. Head broader than long; tympanum short; fingers short, blunt and free. Hind limbs comparatively short and thick. Tibiotarsal articulation reaching in front to tympanum; toes fully webbed. A very large, strongly compressed, shovel shaped sharp-edged inner metatarsal tubercle present. Both dorsal and ventral skin may be smooth or granular. Dorsally light to dark brown. Ventral surface yellowish white.

Distribution : INDIA: West Bengal, Uttar Pradesh, Andhra Pradesh, Gujarat, Himachal Pradesh, Kerala, Madhya Pradesh, Maharashtra, Karnataka, Rajasthan, Tamil Nadu; Sri Lanka; Nepal; Upper Burma.

Remarks : It is a rare and burrowing species of frog and can be seen during early monsoon months. Its strong shovel-shaped metatarsal tubercle is used for digging and sometimes found to dig soil in search of food and shelter mostly during the day. Sometimes this species burrow into the soft ground to a depth of about one metre or even more. According to Rao (1915) this species is thoroughly terrestrial and the burrowing habits have resulted in an appearance very similar to the Microhylid frog *Uperodon systoma*. It leads a solitary life and congregates only during the breeding season. Its call is characteristic and resembles to the short syllables "Rut-Rut-Rut", uttered in quick successions. The young of this species are able to withstand captivity much better than adult one.

7. *Rana cyanophlyctis* Schneider

A medium sized frog, attaining a length of 70 mm from tip of snout to vent. Head slightly broader than long; snout round; tympanum distinct. Fingers free, pointed; first and second fingers equal. Hind limbs moderate; tibiotarsal articulation reaching between eyes and nostrils; tips of toes dilated into small discs; toes fully webbed. A digitiform inner metatarsal tubercle present, outer metatarsal tubercle absent. Dorsal skin warty. A strong glandular fold extending posteriorly behind the eyes to the shoulder. Dorsally grey, olive, brown or blackish with darker spots or marblings. Ventral surface almost white.

Distribution : Throughout the Indian region; Iran; South Arabia; Sri Lanka; Nepal; Thailand,

Remarks : It is the commonest and most easily available of the Indian frogs, inhabiting all biotopes of the country. It is almost entirely aquatic and is active both during day and night. It has the peculiar habit of skipping over the surface of water, this accounts for its popular name "Skipper frog". It may be frequently found on the banks of streams or ponds and prefers still water. This species is an extremely active creature and appears to undertake long overland journeys during the night. The call of

this frog is characteristic and resembles a somewhat low-pitched rattle, produced by its ovoid vocal sac which is inflated and deflated alternately. This frog is a voracious feeder, its food consisting of insects, little frogs, tadpoles and insect larvae.

8. *Rana erythraea* (Schlegel)

Medium sized frog, attaining a length of 48 mm from snout to vent. Head pointed, longer than broad; tympanum distinct, two-third of eyes. Fingers free; tips of fingers dilated into small discs, bearing grooves, separating the upper surface from the lower one. Third finger longest. Hind limbs moderately long; tibiotarsal articulation reaching tip of snout; toes two-third webbed; tips of toes dilated into small discs with prominent grooves, separating the upper surface from the lower one.

Distribution : India : West Bengal, Assam, Meghalaya, Mizoram; Burma; Pakistan; Sri Lanka.

Remarks : This is a rare species of frog and was originally recorded from Java. Boulenger(1920) recorded the species for the first time in Indian region. It is generally found to occur in thick floating marshy vegetation and in the bushes grown at the edges of streams.

9. *Rana hexadactyla* Lesson

Large sized frog. Maximum length 130 mm from tip of snout to vent. Head slightly broader than long; tympanum distinct, two-third diameter of eyes. Fingers free; first finger slightly longer than second. Tibiotarsal articulation reaching eyes. Toes fully webbed. Prominent inner metatarsal tubercle present; outer metatarsal tubercle absent. Skin smooth above, warty on flanks, anal region and throat. A glandular fold extending from posterior region of eyes to shoulder. Dorsally bright grass green or olive green with or without a pale yellow vertebral line from snout to vent.

Distribution : INDIA: West Bengal, Andhra Pradesh, Gujarat, Karnataka, Kerala, Maharashtra, Orissa, Punjab; Goa; Sri Lanka.

Remarks : This is a common species of South India and fairly common in West Bengal. This species is generally found floating in the ponds on green aquatic vegetation in which it can hide properly to protect themselves from the predators. It is also found on land specially at night, when probably it come in search of food. The population of this species has declined on account of exporting their legs.

10. *Rana limnocharis* Boisduval

It is a medium sized frog, attaining a length of 55 mm from tip of snout to vent. Head broader than long; tympanum distinct, half the diameter of eyes. Fingers free. Tibiotarsal articulation reaching tip of snout; toes pointed, half-webbed. Both inner and outer metatarsal tubercles present. Dorsally warty with longitudinal glandular folds. Colour dorsally grey or brown with darker markings. Limbs and lips often with dark bands. A mid-dorsal yellowish band of varying width often present. Ventral surface white.

Distribution : It is the commonest and most widely distributed of the Indian frogs. It is found abundantly in the vicinity to tanks and streams, and also found at the edges of ponds and marshes. Normally this species do not float on the surface of water like *Rana cyanophlyctis*, but only rest on the surface, with the legs hanging down below the surface of water. During dry season these frogs either found under stones, logs in damp places during the day, and come out at dusk or aestivate. During the monsoon, they wander far and wide in the grass and may be found both during day and night. This species apparently does not have any fixed breeding season but can breed throughout the year if the conditions suitable for breeding is continuously available.

11. *Rana tigerina* Daudin

Large sized frog, attaining a length of 90 mm or even more from tip of snout to vent. Head as long as broad, projecting beyond lower jaw. Tympanum very distinct, two-third diameter of eyes. Fingers free with rounded tips. Hind limbs very long; tibiotarsal articulation reaching beyond tip of snout; toes with prominent rounded tips, fully webbed. Dorsal skin smooth, sometimes granulate with distinct longitudinal glandular folds. Ventral skin smooth. Dorsally olive green or brown with darker markings. A light vertebral streak from snout to vent often present. Limbs barred or spotted with black.

Remarks : It is the commonest and most widely distributed of the Indian frogs next to *Rana cyanophlyctis* and *Rana limnocharis*. It is abundantly found in the vicinity of tanks and streams as well as at the edges of ponds and marshes. Sometimes it is also found in large water bodies that are or either parmanent or semi-permanent nature. This species has a tendency to move on the edges of water, hidden either in the hollows or in the grass or other vegetation. It has a high commercial importance.

12. *Polypedates leucomystax* (Gravenhorst)

Medium sized frog attaining a length of 60 mm from tip of snout to vent. Head broader than long; tympanum distinct. Fingers long with rudiment of webs, with well developed discs and with cutaneous circum-marginal grooves. Tibiotarsal articulation reaching anterior corner of eyes; toes two-third webbed; tips of toes dilated into well developed discs with cutaneous circum-marginal grooves. Dorsal skin finely granulated; belly and thigh granulate and the rest of the ventral surface of the body smooth. Dorsally yellowish to grey; ventral surface almost white.

Distribution : India : West Bengal, Maghalaya, Assam, Arunachal Pradesh, Nagaland, Manipur, Sikkim, Kerala; Sri Lanka.

Remarks : This is a nocturnal and rare species of the genus. During the monsoon period this species occasionally found inside the room specially at night. It prefers moist and dark atmosphere of lavatory and may be found to rest inside thick leaves of plants like pine and roofs of thatched village huts.

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PISCES

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INTRODUCTION

The most striking feature of the Ganga River is that it harbours the richest freshwater fish fauna of India, ranging from mahseers and the torrential fishes of hills to the culturable Gangetic carps, the hilsa yielding bumper catches and a wide array of other fishes. Hamilton-Buchanan's (1822)* account entitled "An Account of the Fishes found in the River Ganges and its branches", indicated the richness and diversity of this drainage region. The fishery resources of the Ganga river system are of tremendous economic and nutritional sustenance to the people of the riparian states. The Ganga river system alone contributed as much as 89.5% to the country's total carp seed production for 'seeding' the water under fish culture. This contribution is now reduced to 30% on account of destruction of breeding grounds of major carps due to various modification of the river (dam construction, embankments, etc) and advances in induced breeding techniques. Jhingran and Ghosh (1978), and Jhingran, A.G. (1980) have stressed the unique position this water-course occupies in the socio-economic pattern existing in the country, and have discussed the fisheries in the context of Indian aquaculture. The Ganga has the largest river basin of 90,000 sq. km covering 26 percent of India's land mass and carrying 25 percent of the country's water wealth.

The Ganga river system still lacks a reliable ichthyofaunal synthesis, the *Checklist* of Venkateswarlu and Menon (1979) leaving much to be desired, and, further, the scientific nomenclature provided in Jayaram's (1981) *Handbook* needs tremendous revision in the light of current knowledge. The exact number of species is still unknown. The present compendium goes a long way towards correcting this situation by presenting state-of-the-art ichthyological information of this great river system, so as to provide adequate background data which is essential for scientifically sound management decisions.

FISH AND FISHERIES

The Ganga R. which has its origin in the Himalaya, unfolds, from beginning to end, a succession of fish life. Our knowledge of the fish fauna and its distribution is very patchy, simply because of the distances involved and difficulties in travelling. Some regions are well sampled, but in others there are long stretches of unsampled river. The headwaters of the Ganga in the high altitudes of the Himalaya are most unexplored. The water of the upper reaches are characterised by high transparency, high dissolved oxygen and sparse biota. Most of the fishes are small-sized and have developed special organs of attachment to enable them to live in fast turbulent mountainous streams. The common and relatively more abundant endemic cold-water fishes inhabiting rivers, streams and brooks are the mahseers, minor carps, lesser barils, snow-trouts, loaches, etc. As might be expected the 1600 km stretch of the river Ganga from Hardwar (Uttar Pradesh) to Lalgolaghat (West Bengal) is turbid and beset with deep pools in the silt covered sandy bed. There is adequate oxygen near the surface but nearer the bottom the oxygen is meagre. This region is inhabited by carps, catfishes, etc capable of

* 1823 according to Roberts (1980; 1982a, 1982b; 1983)

withstanding poorly aerated water. The fauna is thus essentially Ostariophysan, dominated by the modern cypriniform and siluriform genera. In most places, the species of the small-sized cyprinoids are the principal forage-fishes, on which the larger predatory species feed. They swarm in great abundance in the lowland Ganga system. The delta brackish-water comprise freshwater, euryhaline and marine forms, and contribute to important fisheries. Most are diadromous and some, particularly threadfins and catfishes, seasonally ascend the river, spawning in the the gradient or freshwater zone of the estuary. Dominant groups include the herrings (Clupeidae and Engraulidae), drums or croakers (Sciaenidae), ribbonfishes (Trichiuridae), threadfins (Polynemidae), catfishes (Ariidae) and flatfishes (Cynoglossidae). In terms of total fish harvests, this is one of the more productive zones of the Ganga basin. A summary of the Ganga River fish and an indication of species distribution and systematics is given. Three hundred and seventy-five species have been documented; the 290 new species discovered in earlier years from the Ganga, along with their current taxonomic status is summarised in Table I. The text is organised along systematic classification lines, following the scheme proposed by Nelson (1984) but with slight modifications based on recent studies.

- Class CHONDRICHTHYES
1. Order ORECTOLOBIFORMES
1. Family HEMISCYLLIDAE
[Bamboo sharks]

Sharks of this family are sluggish, bottom-dwelling and inhabit shallow waters of tropical regions. *Chiloscyllium griseum* Muller & Henle is fairly common in the catches in the Hooghly estuary. The 10 to 12 dark crossbars on the body (fading with growth) distinguishes this shark from other sharks of the Hooghly estuary.

2. Family STEGOSTOMATIDAE
[Zebra sharks]

This group of sharks is referable to the monotypic genus *Stegostoma* Muller & Henle which is characteristic in having a subterminal mouth and the caudal-fin about as long as rest of the body. *Stegostoma fasciatum* (Hermann) is a tropical shark, the young of which are often observed in the Hooghly. These young ones are dark brown above, yellowish below, with vertical yellow stripes and spots breaking the dorsal colouration into dark saddles. Although this shark is apparently not dangerous and has only very small teeth, its jaws are strong and could deliver a painful bite to an unwary human tormentor.

2. Order CARCHARHINIFORMES
3. Family CARCHARHINIDAE

The requiem sharks form the largest family among the elasmobranch fishes. Although species in other families may enter river mouths and ascend rivers for a short distance, a few members of this family, particularly the Bull-shark (*Carcharhinus leucas*) but possibly also the little-known Ganga-shark (*Glyphis gangeticus*), apparently are the only living sharks that can live in freshwater for extended periods. Both these sharks occur in the Ganga. *Carcharhinus hemiodon* (Valenciennes) and *C. melanopterus* (Quoy & Gaimard) have been reported from the Hooghly River. *Carcharhinus limbatus* (Valenciennes) occurs off the river mouth, but does not penetrate far into the estuary. *Carcharhinus leucas* (Valenciennes) has only recently (Campagno, 1984) been reported from the Hooghly River based on 650 mm term fetus or newborn male (Zoological Survey of India regd. no. 10250) collected in 1867. Datta and Roy (1977 : 76) list *Carcharhinus bleekeri* (Dumeril) from the Sundarbans, a

species now considered conspecific with *Carcharhinus sorrah* (Valenciennes). The occurrence of this species, however, in the Hooghly is most doubtful.

Glyphis gangeticus (Muller & Henle), the Ganga-shark, is a poorly known freshwater riverine and estuarine shark. The elusive Ganga-shark has been famed and fabled for its occurrence in freshwater as well as for its bloody reputation as a man-eater. The Zoological Survey of India houses one of the two extant specimens of *G. gangeticus* in museum collections. This specimen (61 cm newborn female; ZSI regd.no. 8067) was collected by Dr. J. Anderson from the Hooghly on 4th April 1867. The hideous reputation of the true Ganga-shark grew on the assumption that there was only one species of shark in freshwater of the Hooghly-Ganga system, which was responsible for the numerous attacks on people reported by Day (1878) and other writers. Although sharks are currently caught in the Ganga system, it is not known how common the true Ganga-shark is relative to Ganga River System (Compagno, 1984). The presence of newborn individuals in the Hooghly suggests that at least the young may be born in freshwater. The minute eyes of the Ganga shark suggests that it may be adapted to turbid water with poor visibility, as in large tropical rivers and muddy estuaries (Compagno, 1984).

Rhizoprionodon acutus (Ruppell) has been reported at the mouth of the Ganga and often in the Hooghly estuary, whereas *Scoliodon laticaudus* Muller & Henle is fairly common in the lower reaches of the Hooghly and it is uncertain if the species can live in perfectly freshwater for extended periods. *Lamiopsis temmincki* (Muller & Henle) is a small, rather stocky shark which is apparently rare in the Hooghly.

4. Family SPHYRNIDAE

[Hammerhead-sharks]

The hammer or mallet-shaped lateral expansions of the head of these sharks is unique. The hammerheads are a small but common family of wide-ranging, warm-temperate and tropical sharks. Misra (1962) refers to the occurrence of *Eusphyra blochii* (Cuvier) in the Hooghly at Calcutta. This is a small shark of remarkable appearance, found in shallow water on the continental and insular shelves.

3. Order RAJIFORMES

5. Family PRISTIDAE

[Sawfishes]

Sawfishes are characterised in having the snout produced in a long, flat firm blade with teeth on each side (teeth are of equal size and embedded in sockets); body somewhat sharklike although the head is depressed; two dorsal fins; and a caudal fin. The sawfish is a ray, as is shown by the position of the gills on the underside of the pectoral fins. These rays, which abound in the Bay of Bengal and migrate some of the larger rivers, are very destructive to edible fish. Their livers yield a valuable oil. *Anoxypristis cuspidatus* (Latham) is a euryhaline species which Annandale (1909) observed to be common at the mouth of the Ganga. *Pristis microdon* Latham is a very common species in the estuary of the Ganga which it ascends for at least 300 km, often captured in freshwater (Annandale, 1909 : 6). *Pristis pectinata* Latham is also fairly common in the Hooghly estuary, and is largest of the sawfishes. It attains a length of 7.5 m and the flesh is good eating.

6. Family RHINOBATIDAE

[Guitarfishes]

The elongated body is flattened along the sides of the head and trunk, with the pectorals extended as small raylike wings; gills are on the underside of the pectorals. The body is intermediate between

sharklike and skatelike; tail stout, but not definitely marked off from the body. The guitarfishes are shallow-water bottom feeders, often being found in bays and estuaries. *Rhina ancylostoma* Schneider, *Rhinobatos granulatus* Cuvier and *R. obtusus* Muller & Henle occur only off the mouth of the Ganga, while *Rhinobatos annandalei* Norman, *R. lionotus* Norman and *R. typus* Bennett have often been observed in the Hooghly estuary. The giant Indo-Pacific *Rhynchobatus djiddensis* (Forsskal) has been listed from the Sundarbans by Datta and Roy (1977) but this needs confirmation. This species has the caudal-fin notched in the centre whereas other guitarfishes have a more symmetrical tail.

7. Family DASYATIDAE

[Stingrays]

Only two families of rays have poisonous spines. Usually a single flattened and tapered spine is attached to the dorsal surface of the tail; many sharp, small teeth along the sides of the spine give the stingray its fearful reputation. These rays have the disc less 1.3 times as broad as long, the outer anterior margin of pectorals continuous along side of head, no distinct dorsal-fin and no caudal-fin. Stingrays are marine and estuarine, but a few species penetrate brackish and fresh waters. Stingrays of three genera inhabit the Ganga.

1. Genus *Dasyatis* Rafinesque

The disc is oval or rhomboidal; teeth relatively small and thin-crowned; tail whip-like, with cutaneous folds either above or below, or on both dorsal and ventral sides. *Dasyatis zugei* (Muller & Henle) is primarily marine, but is common in the Hooghly estuary. The marine dasyatid, *D. bennetti* (Muller & Henle) has been reported from freshwater in South-east Asia (Compagno and Roberts, 1982) and probably inhabits the Hooghly estuary also.

2. Genus *Himantura* Muller & Henle

Himantura differs from all other dasyatids in having a long, slender tail without tail-folds. As presently understood, *Himantura* is morphologically diverse and may well be polyphyletic. *Himantura fluviatilis* (Hamilton-Buchanan), the rare and poorly known stingray, has been reported in the Ganga as high up as Kanpur. *Himantura marginata* (Blyth), the marine and estuarine dasyatid is common in the Hooghly at Calcutta. The common marine and estuarine *H. imbricata* (Schneider), perhaps the smallest *Himantura*, attains a maximum size of only about 22 cm. *Himantura bleekeri* (Blyth) and *H. uarnak* (Forsskal) have also been listed from the Hooghly estuary.

3. Genus *Hypolophus* Muller & Henle

This monotypic genus represented by its type species, *Hypolophus sephen* (Forsskal) is the stingray most commonly reported from freshwater in South-east Asia. It occurs in marine and estuarine habitats, and has been erroneously reported from freshwater in the Ganga. *H. sephen* is distinguished by a diamond-shaped disc, greatly enlarged hexagonal teeth with thick high crowns, thick tail with enormous ventral tail-fold, sting positioned very far posteriorly, and uniformly black colouration on dorsal surface of disc. All reports of *sephen* from our freshwaters actually pertain to *Himantura fluviatilis*.

8. Family MYLIOBATIDAE

[Eagle-rays]

A large fleshy pad extending around the front end of the head, giving the appearance of a flabby

upper lip, is the diagnostic mark of the eagle-ray. *Aetomylaeus nichofii* (Schneider) has been reported from the Ganga river mouth (Misra, 1962), but probably does not enter the estuary.

- Class OSTEICHTHYES
4. Order OSTEOGLOSSIFORMES
9. Family NOTOPTERIDAE

Featherbacks are easily identified by the very long anal-fin which is inserted just behind the head and extends along the undersurface of the body to the tip of tail. The caudal-fin, as such, is not evident. In the centre of the back is a small, slender dorsal-fin, from which the fish derives the name "featherback". The family is represented in the Ganga by *Notopterus notopterus* (Pallas) and *N. chitala* (Hamilton-Buchanan) which inhabits the quite, weedy reaches and also the flood plains and in stagnant backwaters. The males are found to guard the eggs with great care during the incubation period of 5 or 6 days. Although they have small bones, they are considered choice food fishes.

5. Order ELOPIFORMES

Although primarily marine, these fishes are known from brackish and even freshwaters. The most diagnostic character of this group is the presence of a fairly large long gular plate between the two mandibles.

10. Family ELOPIDAE

Elops machnata (Forsskal) is reported to ascend freshwater rivers and probably occurs in the Hooghly also. It has large pseudobranchiae in the gill area, and grooves in which both dorsal and anal fins can be depressed.

11. Family MEGALOPIDAE

[Tarpons]

The tarpons lack the pseudobranchiae and the grooves for the dorsal and anal fins, and are much heavier-bodied than *Elops*. Further, the last ray of the dorsal-fin is extended as a long filament. *Megalops cyprinoides* (Broussonet) is common at the mouth of Ganga, and also ascends the river.

6. Order ANGUILLIFORMES

[Eels]

With the exception of one family of freshwater eels, all members of this Order are marine in habitat. These fishes are snake-like, lack the pelvic-fins, and the dorsal and anal fins are usually continuous with the caudal-fin. Most of them have a strange, transparent, ribbon-like larval form known as leptocephalus.

12. Family ANGUILLIDAE

[Freshwater Eels]

The anguillids differ from the other eel families of our region in the possession of scales, which in this case are the embedded cycloid type that are visible only on careful inspection. *Anguilla bengalensis* (Gray & Hardwicke) is fairly common in the Ganga upto Patna (Bihar), and is one example of a freshwater to marine migration.

13. Family MORINGUIDAE

[Worm eels]

Jayaram (1981 : 28) refers to *Moringua raitaborua* (Hamilton-Buchanan) only from the Gangetic estuary. Castle (1968) demonstrated that two species have been confused by several authors under the name *M. raitaborua*. One is a short, stubby moringuid with a relatively long head and fewer vertebrae (*M. raitaborua*), and the other is more slender with a shorter head and more vertebrae, viz. *M. arundinacea* (McClelland). The latter eel was originally discovered from the Ganga. The worm-eels have an extremely elongate, threadlike body; devoid of scales; eyes small; gill-openings are low on body; and the vertical fins are reduced to low folds, posteriorly, and confluent with caudal-fin. All of them have small pectoral-fins and are thought to be head burrowers rather than tail burrowers like some of the eels in other families.

14. Family MURAENIDAE

[Moray eels]

The muraenids are identified by a combination of characteristics, important ones being the absence of pectoral fins, the dentition, the colour pattern and the profile of the nostrils. *Lycodontis tile* (Hamilton-Buchanan) and *L. sathete* (Hamilton-Buchanan), originally discovered from the Hooghly estuary near Calcutta, are fairly common in the Hooghly.

15. Family MURAENESOCIDAE

[Pike eels]

The pike eels are characteristic in having well-developed pectoral fins and large eyes covered by skin. The family is represented by four species, belonging to two genera, in the estuary of the Ganga : *Congresox talabon* (Cuvier) and *C. talabonoides* (Bleeker) are occasionally obtained in the Hooghly estuary, while *Muraenesox bagio* (Hamilton-Buchanan) and *M. cinereus* (Forsskal) are not uncommon in the fish catches in the Hooghly. The latter two eels may be readily recognised by their large size, raptorial teeth and aggressiveness.

16. Family OPHICHTHIDAE

[Snake-eels]

Most snake-eels are small and very slender. Typically, the dorsal-fin is inserted just behind the head and extends for the full length of the body; anal-fin is much shorter and the caudal-fin is absent (strong, spikelike tail). *Pisodonophis boro* (Hamilton-Buchanan) originally discovered from the Hooghly estuary, is common in the Ganga and its tributaries.

7. Order CLUPEIFORMES

17. Family CLUPEIDAE

[Herrings, Shads, Sardines]

Economically, the herrings, sardines, etc form one of the world's most important groups of food-fishes. All the clupeids are noted for their oily flesh. The body is deeply compressed laterally and covered with deciduous scales, which form a knife-like ridge along the centre line of the undersurface of head. The dorsal-fin is short and placed near the centre of body, and the caudal-fin is deeply forked. The large mouth (with small or minute teeth) works like a siphon to suck in small planktonic organisms, which are caught on the gillrakers in the throat. Majority of clupeids are primarily marine, many move

easily into brackish and fresh waters. There are several genera with all or some members that live in fresh or brackish water.

(a) Subfamily CLUPEINAE

The Clupeinae are mainly coastal schooling fishes, but none of the Indian genera enter the freshwater. The juveniles of *Escualosa thoracata* (Valenciennes) have, however, been reported from the lower parts of the Hooghly river. The large and rectangular 2nd supra-maxilla in this species is an excellent field character separating this from juveniles of *Hilsa ilisha*. The upper jaw is slightly notched as in the Alosinae, but the low pelvic finray count of 7 distinguishes this species from *Hilsa*.

(b) Subfamily ALOSINAE

The Alosinae are characteristic in having a distinct notch in upper jaw in which the symphysis of the lower jaw fits; pelvic scute with ascending arms; and the last dorsal finray is normal. *Gudusia chapra* (Hamilton-Buchanan) contributes to riverine artisanal fishery in the Ganga basin. These fishes have small scales, the rows somewhat irregular in the upper part of the body. The Indian Shad, *Hilsa (Tenulosa) ilisha* (Hamilton-Buchanan) contributes a very important fishery in the Ganga, highly prized as food fish, and is concentrated in the middle and lower stretches. The fish is characteristic in having large scales which are evenly arranged. This is an anadromous fish ascending rivers for breeding. Two spawning runs of hilsa have been recorded in the Ganga, the post-monsoon and the winter runs, the former being of a higher magnitude. Hilsa stocks of the Ganga system have been considered endemic in nature with limited migration within the system. The hilsa fishery has disappeared in the upper Ganga with the commissioning of Farakka Barrage posing as an obstruction in its upward migration.

(c) Subfamily PELLONULINAE

Corica soborna Hamilton-Buchanan, the Ganga River Sprat, is fairly common in the lower reaches of the Ganga. *Corica biharensis* Kamal & Ahsan, 1979, described from the Gangetic system, is clearly conspecific with this species (Talwar and Jhingran, Ms). This is a small herring-like fish characteristic in having the pelvic scute normal, a terminal mouth, anterior supra-maxilla absent, a short anal-fin, and pelvic finrays 8.

(d) Subfamily DOROSOMATINAE

The Gizzard shads derive their name from the peculiar muscular stomach which all of the species in this subfamily possess. They are deep-bodied, with a sharp ridge along the abdomen, and with the last ray of the dorsal-fin of several species extended as a long filament. The mouth is inferior or subterminal, the upper jaw is not evenly rounded in front but with a distinct median notch into which the symphysis of the lower jaw fits. The genus *Anodontostoma* Bleeker is marine and represented in the Hooghly estuary by *A. chacunda* (Hamilton-Buchanan) and *A. thailandiae* Wongratana, both of which contribute to a minor fishery. The genus *Gonialosa* Regan are small freshwater gizzard-shads, represented by *G. manmina* (Hamilton-Buchanan) in the Ganga which contributes to a small fishery. The genus *Nematalosa* Regan which is distinctive in having the last dorsal finray prolonged as a filament, is a medium-sized marine and riverine gizzard shad which is represented by only one species, *N. nasus* (Bloch) in the Hooghly estuary where it contributes a minor fishery.

18. Family PRISTIGASTERIDAE

[Ilishas, Pellonas]

These fishes are marine coastal, but some species enter estuaries while a few are restricted to

freshwater. *Ilisha megalopectera* (Swainson) is common in the Ganga at Allahabad, and *I. melastoma* (Schneider) occurs only in the estuarine part of the Ganga. *Opisthopecterus tardoore* (Cuvier) enters artisanal fisheries in the Hooghly estuary. *Pellona ditchela* Valenciennes also contributes to the artisanal catches. *Raonda russeliana* Gray is caught at the mouth of the Ganga, but juveniles are fairly common in the Sundarbans.

19. Family ENGRAULIDIDAE

[Anchovies]

The projecting snout and under-slung lower jaw make the anchovies easy to recognise, inspite of the great variations in body form. Their greatest abundance is in tropical marine waters; brackish water does not bother them. The genus *Coilia* Gray retains the chinless appearance of the anchovy, but add to it a long, tapering, ratlike tail with a minute caudal-fin at the tip. *Coilia dussumieri* Valenciennes, *C. ramcarati* (Hamilton-Buchanan), *C. reynaldi* Valenciennes and *C. neglecta* Whitehead are fairly common in the commercial catches in the Hooghly estuary. The genus *Setipinna* Swainson is recognisable at first sight by the elongate uppermost ray of the pectoral-fin. *Setipinna phasa* (Hamilton-Buchanan) contributes a sizeable fishery in the upper Ganga especially at Allahabad. *Setipinna brevifilis* (Valenciennes) and *S. taty* (Valenciennes) are also common in the Ganga upto Allahabad, while *S. tenuifilis* Valenciennes is restricted to the Hooghly estuary. *Setipinna phasa* is also available in the estuary generally from November to March-April (Jones and Menon, 1952); *S. taty* appears in larger quantities than *S. phasa* in the catches of the estuary (David, 1954). Fishes of the genus *Stolephorus* Lacépède are small translucent marine fishes, some are euryhaline. Whitehead (1973 :225) reports *S. tri* (Bleeker) from the Ganga, but this is evidently rare. The fishes of the genus *Thryssa* Cuvier are coastal species, four species being reported from the Hooghly estuary, viz. *T. dussumieri* (Valenciennes), *T. hamiltonii* (Gray) *T. purava* (Hamilton-Buchanan) and *T. stenosoma* Wongratana.

8. Order GONORHYNCHIFORMES

20. Family CHANIDAE

[Milkfish]

The milkfish, *Chanos chanos* (Forsskal) is a valuable food-fish in the country. It is a large, silvery fish reaching a length of 150 cm. The milkfish spawns in shallow, brackish water. The larvae of the milkfish have been observed in the Bakkhali region of Lower Sunderbans (Basu and Pakrasi, 1976).

9. Order CYPRINIFORMES

This very large group of freshwater fishes consists of minnow-like fishes and their relatives. The cypriniform fishes have in general become the dominant freshwater group in any landmass to which they have access. Wherever they occur naturally in any considerable number they have differentiated into many more species than in other group.

21. Family CYPRINIDAE

[Carps and Minnows]

Most of the cyprinids are the embodiment of the conventional body fish shape. The body is usually only moderately compressed, and the upper and lower profiles are usually equally convex. This important family of freshwater fishes have soft rays without true spines; however, in some of the carps and barbs the last unbranched ray of the dorsal-fin is hardened into a stiff spinelike structure, and sometimes the last simple ray of the anal-fin is also hardened. They have toothless jaws, but

compensate for this by having strong pharyngeal (throat) teeth which are very important in classification. Head is naked but the body, with few exceptions, are evenly scaled. About 75 species are known from the Ganga and its tributaries, some of which are very valuable economically.

(a) Subfamily CYPRININAE

This is the largest subfamily of the Cyprinidae, which is widely distributed in the freshwaters of Asia, Africa and Europe. The diagnostic features of this subfamily are the paired fins are laterally inserted; body is usually compressed; and the pharyngeal teeth are in one to three rows. This subfamily is represented by nine genera in the Ganga.

1. Genus *Catla* Valenciennes

This monotypic genus is Oriental and is characteristic in having a conspicuously large head which exceeds half the body length; mouth wide and terminal, the upper lip is absent; gillrakers fine and long; dorsal fin inserted slightly in advance of pelvic-fins, with 14 to 16 branched rays; and the scales are large-sized. *Catla*, *Catla catla* (Hamilton-Buchanan) is the natural inhabitant of the freshwater sections of the rivers of northern India and is one of the renowned major carps of the country. Its favourite habitat is the deep pools of the rivers of north India. It is one of the largest fishes of India, and reported as one of the fastest growing fishes of the world. At Allahabad and Kanpur, average annual landings of catla are 16.86 and 4.98 t., respectively, but at all other centres of the Ganga its average annual landings range between 1.63 t. and 4.99 t. (Jhingran, V.G. 1982). Being a commercially important fish, it has been introduced into almost all parts of India and is reared in tanks and rivers. Rainboth (in press) has resurrected the genus *Gibelion* for this species. This will result in some nomenclatural modifications which are not exactly in agreement with the principle of stability of nomenclature (Talwar, under preparation).

2. Genus *Cirrhinus* (Oken) Cuvier

This genus is endemic to the Oriental region and forms a fairly distinct group which apparently resembles *Labeo*. The lower jaw is rather sharp, generally devoid of a horny covering but with a small symphyseal knob; lower lip is closely adnate to the lower jaw. Further, the dorsal-fin is inserted anterior to pelvic-fins, and the last unbranched dorsal finray is nonosseous. It is represented by two species in the Ganga, viz. *C. mrigala* (Hamilton-Buchanan) and *C. reba* (Hamilton-Buchanan). *Cirrhinus mrigala* is one of the major carps of India and is known to attain a length of 99 cm and a weight of 12.7 kg from two of the most important rivers of its occurrence in India, Ganga and Yamuna. It is the most dominant species in the upper stretches of the Ganga from Kanpur down to Allahabad. Its annual average landings are about 36.0 t. at Allahabad and 16.5 t. at Kanpur; at Varanasi, Buxar and Ballia, its annual landings dwindle to 1.09, 1.01 and 2.32 t., respectively. Further lower down, mrigal becomes a little more abundant showing average annual landings of 9.65 t. and 5.3 t. at Patna and Bhagalpur, respectively. Commercial riverine catches are constituted by 9 age-groups (Jhingran, V.G., 1959). It breeds in shallow marginal areas. *Cirrhina reba* breeds in flooded marginal shallows from June to September. It grows to 24 cm in West Bengal (Jhingran and Ghosh, 1984).

3. Genus *Chagunius* Smith

This genus endemic to the Oriental region, was erected by Smith (1938) for a species which, at that time, was included in the heterogeneous generic assemblage *Barbus* in the sense of Gunther (1868) and Day (1877). The type-species, from the Ganga-Brahmaputra, was originally called *Cyprinus chagunio* by Hamilton-Buchanan (1822). *Barbus chagunio* was elevated to generic level because of its

peculiar physiognomy relative to other southeast Asian barbins. *Chagunius chagunio* (Hamilton-Buchanan) inhabits the Brahmaputra and Ganga along the Himalayan foothills (Rainboth, 1986). It has pronounced sexual dimorphism in tuberculation and anal-fin shape. The seasonal development of secondary sexual characters in males occur prior to and during winter breeding season. *Chagunius chagunio* is not known to be a long range migrant (unlike *Tor* spp) and according to Hora and Mukerji (1936) its movements are fairly restricted. It reaches a maximum length of about a half-metre. It offers a good sport on a small hook.

4. Genus *Labeo* Cuvier

The genus is distributed in Asia and Africa (Reid, 1985) and is extremely well represented in the Ganga where some of the species reach a length of 1.5 m. The genus is distinguished from other cyprinids in having the lower jaw with a cornified edge but invariably covered by a thick labial fold; mouth subterminal or inferior; lips generally thick, covering both jaws and continuous at the corners of mouth; and the lower lip partly or entirely separated from the isthmus by a distinct postlabial fold or joined to it by a bridge. This genus is represented by 11 species in the Ganga : *Labeo angra* (Hamilton-Buchanan), *L. bata* (Hamilton-Buchanan), *L. boga* (Hamilton-Buchanan), *L. boggut* (Sykes), *L. calbasu* (Hamilton-Buchanan), *L. dero* (Hamilton-Buchanan), *L. dyocheilus* (McClelland), *L. fimbriatus* (Bloch), *L. goni* (Hamilton-Buchanan), *L. nandina* (Hamilton-Buchanan), *L. pangusia* (Hamilton-Buchanan) and *L. rohita* (Hamilton-Buchanan). The Rohu (*Labeo rohita*) fishery of the Ganga river system is more like that of Mrigal, being more dominant in the upper and lower stretches of the Ganga but less important in the middle. *Calbasu* (*Labeo calbasu*) fishery in the Ganga is almost negligible except for some sizable landings in the upper stretch; at Allahabad the average annual landings are 9.57 t. (Jhingran, V.G., 1982). *Labeo bata* is cultured in the estuarine waters of the Sundarbans (West Bengal). *Labeo dero*, another minor carp, prefers rapids and pools and has been observed to occur in association with *Tor putitora*. *Labeo sindensis* (Day) has been listed from Hardwar (Uttar Pradesh) by Jayaram (1981) but its occurrence in the Ganga R. needs confirmation.

5. Genus *Neolissochilus* Rainboth

These are medium to large barbels which may show slight dimorphism in body-shape and tuberculation. Often migratory, moving upstream to clear, rocky, headwater reaches, staying in deep, slowing pools during wet season. *Neolissochilus* is closely related to the genus *Tor* Gray and occurs over much of the same range. *Neolissochilus hexastichus* (McClelland) is common in the Himalayan foothills. Rainboth (1985 : 28) makes a reference to two syntypes of *Neolissochilus spinulosus* (McClelland, 1845) from the "Ganga" in the Senckenberg Museum, Frankfurt and has doubted the type designation of these specimens since McClelland (1845) based his original description on one specimen only from Sikkim. *Neolissochilus hexagonolepis* (McClelland), the Assamese Katli, occurs in the Gangetic drainage in the Eastern Himalaya only upto 1067 m, where it forms the main food-fish (Jhingran and Ghosh, 1978) and offers considerable sport to anglers in the Himalayan streams.

6. Genus *Oreochthys* Smith

This monotypic genus is Oriental and the most remarkable feature appears to be the presence of numerous fine, parallel sensory folds on the sides of head; lateral-line is, as a rule, confined to the anterior 4 or 5 scales. *Oreochthys cosuatis* (Hamilton-Buchanan) has been recorded from West Bengal of the Gangetic Provinces. Tilak and Sati (1984) have recently discussed the taxonomy of this species.

7. Genus *Osteobrama* Heckel

This genus is also Oriental and is represented by one species in the Ganga plain and the adjoining

hilly areas. *Osteobrama cotio cotio* (Hamilton-Buchanan) is a variable species and its salient diagnostic features are a very long anal-fin, absence of barbels, and its abdominal edge trenchant only between pelvic-fin base and vent. The body is trapezoid and considerably compressed, and the scales are somewhat deciduous and irregularly arranged (Hora and Misra, 1940). The species is fairly common in the ponds and ditches of West Bengal, and grows to a length of 15 cm. *Osteobrama belangeri* (Valenciennes) was originally described from freshwaters of Bengal, but according to Hora and Misra (1940 : 163) there appears to have been some inaccuracy about the locality label. This species has not since been found in Bengal waters, but is to be looked for. This species can be readily distinguished from its congeners by the fact that its whole abdominal edge is trenchant and sharp, whereas in other species its sharp only between the bases of pelvic-fins and anal-fin.

8. Genus *Puntius* Hamilton-Buchanan

The puntiid fishes are commonly called barb and are widely distributed in South Asia. This great group is a speciose group of cyprinid fishes. Intraspecific variability of colour pattern coupled, on occasion, with similar interspecific morphometric and meristic characters, have made it very difficult to distinguish between species. This genus is characteristic in having the lower lip closely adnate to the jaw and without any horny covering. Most of these fishes do not grow to large sizes, but compensate this with their numerical abundance and are thus economically abundant. This genus is represented by 12 species in the Ganga : *P. chola* (Hamilton-Buchanan), *P. chrysopterus* (McClelland), *P. conchoni* (Hamilton-Buchanan), *P. gelius* (Hamilton-Buchanan), *P. guganio* (Hamilton-Buchanan), *P. phutunio* (Hamilton-Buchanan), *P. puntio* (Hamilton-Buchanan), *P. sarana* (Hamilton-Buchanan), *P. spilurus* (Gunther), *P. sophore* (Hamilton-Buchanan), *P. terio* (Hamilton-Buchanan) and *P. ticto* (Hamilton-Buchanan). *Puntius sarana* is often found in the tidal reaches and also in shallow ponds, reservoirs and streams of the Ganga system; it attains a length of about 30 cm. *Puntius conchoni*, the Rosy barb, is perhaps the best known and most popular of the genus as far as aquarists are concerned. *Puntius gelius* is an ideal aquarium fish and is characterised by three features : its diminutive size, its slim shape and oddly sprinkled black spots. *Barbus barbouri* Fowler, 1924, reported as probably from the Himalaya, is perhaps identical with *Puntius guganio* (Hamilton-Buchanan, 1822), a species common in the Gangetic provinces. *Puntius ticto*, the two-spot barb, is a popular barb of the aquaria.

9. Genus *Tor* Gray

These large-scaled barbels (or mahseers) are among the most important cyprinid fishes of south and southeast Asia. In India they constitute the most important along with *Neolissochilus*, of game fishes. Some of the mahseers have a fantastic development of very fleshy lips which may be present in some individuals and absent in others of the same species collected in the same area. The genus *Tor* is closely related to *Neolissochilus* and occurs over much of the same range. The development of the lower lip into a fleshy lobe below the mandibular symphysis in *Tor* seems to be the most useful character throughout its full geographic range, from the Indus river basin to Borneo (Rainboth, 1985). The median lobe of *Tor* can always be seen even though there may be no hypertrophy of the lip. In the Ganga River and its tributaries, the number of gillrakers on the lower arm of the first arch distinguishes all *Neolissochilus* which have 6 to 9 gillrakers, from all *Tor* except *T. progeneius* (McClelland), which have 10 to 16 in the five remaining species; *Tor progeneius* has 8 to 10 rakers on the lower arm of the first arch and appears to be intermediate between *Tor* and *Neolissochilus* in other ways (Rainboth, 1985). *Tor progeneius* is the only Gangetic *Tor* with cheek tubercles and the only *Tor* anywhere which may occasionally lack completely a median lobe on the lower lip. *Tor mosal* (Hamilton-Buchanan), *T. puiitora* (Hamilton-Buchanan) and *T. tor* (Hamilton-Buchanan) are common in the upper reaches of the Ganga along the foothills of the Himalayan range. *T. puiitora*, the Golden

mahseer, is the most common and largest mahseer of the Himalaya and grows to 2.7 m; the commercial fishery in the Ganga consists largely of individuals either ascending streams for breeding or the spent ones returning to perennial ponds in the plains (Jhingran and Sehgal, 1978); it breeds three times in a year. Since this mahseer has only 26 scales along the lateral-line, a fish of this size has individual scales almost large enough to cover the entire palm of the hand. *Tor tor* is more stoutly built than the putitora-mahseer and is the typical mahseer of anglers in north India, attaining about 1.5 m in length (Tilak and Sharma, 1982). *Tor chalinoides* (McClelland) is restricted to the Himalayan foothills and is distinctive in possessing a high lateral-line scale count (32-37 vs. 22-28). Sen and Jayaram (1982 : 15) were uncertain of the generic relationship of this species and did not consider it even a *Tor*. This species clearly occurs in Pakistan (as *T. zhobensis*).

(b) Subfamily CULTRINAE

The members of this subfamily are small fishes with lots of intermuscular bones and hence not preferred as food fishes. They may be easily distinguished by the greatly compressed body with a soft ventral keel which in some species, extends the whole length of the abdomen. A reappraisal and taxonomic relationship of the various taxa is given in Howes (1979) who pointed out that of all the cyprinid subfamily assemblages recognised at present, there is probably none so ill-defined as Cultrinae. This group is represented in the Ganga by 3 genera.

10. Genus *Chela* Hamilton-Buchanan

This genus is widely distributed in the Oriental region as far as Thailand. It has a rather deep body, no symphyseal process on lower jaw and the predorsal scales commence far behind the eyes. It is represented by two species in the Ganga system : *Chela cachius* (Hamilton-Buchanan) and *C. laubuca* (Hamilton-Buchanan) which may be separated from each other in the number of lateral-line scales (51-66 vs. 31-37) and also in the number of predorsal scales (23-29 vs. 15-20). Both these species grow to 6 cm and because of their small size and beautiful colouration, they are used for ornamental purposes in the aquaria. In many places these species are used as a bait for mahseer, *Channa* and other larger carnivorous fishes. Both these white-minnows are shoaling fishes which inhabit the upper water-layers. The shape of the mouth and the deep body are adaptations associated with a trend towards specialised surface or aerial feeding habits (Howes, 1979 : 186). These fishes when alive are more or less transparent but, when placed in formaline, exhibit certain definite and characteristic colour patterns (Silas, 1958). Although not comparable to the cyprinodonts, these two species are useful substitutes and are of fair quality for larvivorous work (Silas, 1958 : 97).

11. Genus *Salmostoma* Swainson

This genus also is widely distributed in South Asia and close to *Chela*, different from it in its more elongated body, gently curved lateral-line and more posteriorly placed pelvic-fins. It is represented by four species in the Ganga drainage : *Salmostoma acinaces* (Valenciennes), *S. bacaila* (Hamilton-Buchanan), *S. phulo* (Hamilton-Buchanan), and *S. sardinella* (Valenciennes). *Salmostoma sardinella poonpuni* Tilak, 1978, described from Bihar in the Ganga river system, is clearly a synonym of *S. sardinella* (Valenciennes). The Hooghly river population of *S. acinaces* through its high number of anal finrays, gillrakers and scales, may represent a distinct subspecies (Banarescu, 1968). Howes (1979 : 190) considers this large-scaled species as probably polyspecific. The long-jawed species, *S. bacaila* is a surface feeder and is regarded as a useful larvivorous fish.

12. Genus *Securicula* Gunther

This monotypic genus, endemic to the South-Asian subregion of the Oriental region, is

characteristic in having an elongate body; lower jaw with a well-developed symphysial knob; abdominal keel hardened and supported by a rigid expansion of the pectoral girdle; predorsal scales extend to between eyes; and the pectoral axial scale is thickened along its lower border. *Securicula gora* (Hamilton-Buchanan) which attains a length of 23 cm, contributes a minor fishery in the Ganga (Misra, 1962).

(c) Subfamily RASBORINAE

This subfamily is rather numerously represented by both genera and species in the Ganga system. All genera are Oriental. These fishes have an elongated and compressed body, the abdomen not compressed but more or less rounded; symphysial notch and process on dentary usually present; and the lateral-line running along the middle of caudal peduncle. Most of these fishes are too small and bony to have a direct economic value to man; they are, however, sold as aquarium fishes. The 13 genera represented in the Ganga are discussed below.

13. Genus *Amblypharyngodon* Bleeker

This genus is represented by two species in the Ganga plains and the adjoining hills : *Amblypharyngodon microlepis* (Bleeker) and *A. mola* (Hamilton-Buchanan). *Leuciscus pellucidus* McClelland, 1839, described from the Ganga R., is probably a senior synonym of the former species. Fowler (1924) reported the Burmese *Amblypharyngodon atkinsonii* (Blyth) from northern India, probably the Ganga river system. *A. microlepis* is an active but peaceful species in the aquaria (Sterba, 1967). *A. mola* is of fishery value (Misra, 1962) and attains a length of 7.5 cm.

14. Genus *Aspidoparia* Heckel

This genus is Oriental but is represented in West Asia also. The genus is characteristic in having the lower jaw with a sharp crescentic edge, with no lower lip (Howes, 1979). Two species recognised (Kottelat, 1984) and both from the Gangetic system : *Aspidoparia jaya* (Hamilton-Buchanan) and *A. morar* (Hamilton-Buchanan); the former species has 7 branched anal finrays and may be separated from *A. morar* which has a higher number (8 to 10). *Aspidoparia jaya* is a tasty fish but rare in the catches, while *A. morar* is of considerable fishery value in the Ganga attaining a length of 17.5 cm.

15. Genus *Barilius* Hamilton-Buchanan

Although several authors recently paid attention to the systematic position of the genus *Barilius* (last and best treatment is of Howes, 1980), their systematics at the species level is still poorly understood. The genus is restricted to the South Asian subregion of the Oriental region and is represented by six species in the Ganga system : *Barilius barila* (Hamilton-Buchanan), *B. barna* (Hamilton-Buchanan), *B. bendelisis* (Hamilton-Buchanan), *B. shacra* (Hamilton-Buchanan), *B. tileo* (Hamilton-Buchanan) and *B. vagra* (Hamilton-Buchanan). The barilins are for the most part fishes of hill-streams although some species inhabit lowland waters. *Barilus barna* has a fairly deep body and lack barbels (often rudimentary), whereas in the other four Gangetic species the body is shallow and possess two pairs of barbels. *Barilius barila* was stated to lack barbels in the original description, but in fact has two pairs (Howes, 1980 : 190) which are liable to be overlooked owing to their being hidden underneath folds of skin. *Barilius bendelisis* displays marked sexual dimorphism (Tilak and Jaffer, 1982), and *B. vagra* is a fish of small size and very attractive which displays a beautiful combination of different shades of colour. *Barilius menoni* Sen, 1976, described from north Bihar is clearly a variant of *B. tileo*.

16. Genus *Bengala* Gray

This monotypic genus is represented in the Ganga system by its type-species, *B. elanga* (Hamilton-Buchanan). The genus is closely allied to *Rasbora* but may be distinguished in the absence of body and fin markings, and also in the presence of a pair of short rostral barbels. A good osteological description and its relationship with other allied genera, is given in Howes (1980).

17. Genus *Brachydanio* Weber & de Beaufort

This Oriental genus is very characteristic not only with regard to several morphological characters, but also in the colouration. The colour markings of the various species appear to be specific. This genus is represented by *Brachydanio rerio* (Hamilton-Buchanan) in the Ganga system, which occurs in the submontane regions of Bengal and Bihar. Apart from other considerations, this species can be distinguished most readily by its prominent and well-marked colour bands. It is popularly called the Zebra danio and is one of the most popular aquarium fishes, being active and graceful. It is strikingly beautifully coloured, easy to feed and resistant to disease.

18. Genus *Danio* Hamilton-Buchanan

The name of the genus is derived from the word "Dhani" (belonging to dhan = paddy), by which name all the allied species are collectively called by the Bengalese, probably referring to their smallness of their size or to their being found in grassy jungles on the edges of rivers and lakes. These small gorgeously coloured active fishes do not constitute any fishery, but their chief value lies in the fact that they form food for the predatory fishes of the Ganga system. Several are of aquarium importance, both inland and overseas. This genus is represented by three species in the Ganga system : *Danio aequipinnatus* (McClelland), *D. dangila* (Hamilton-Buchanan) and *D. devario* (Hamilton-Buchanan). *Danio dangila* has the longest pairs of barbels which enables it to be easily distinguished. *Danio devario* is a pretty species and is a fairly popular aquarium fish.

19. Genus *Esomus* Swainson

These are small fishes which are easily recognised by a pair of very long, slender maxillary barbels. The genus is represented in the Ganga system by *Esomus danricus* (Hamilton-Buchanan). *Esomus lineatus* Ahl, 1924, described from the Gangetic delta, it probably conspecific with it. It is an excellent aquarium fish, easily adapted to confinement in small vessels. It is also a good larvivorous fish.

20. Genus *Parluciosoma* Howes

This genus is also Oriental and is closely allied to *Rasbora*, but has a distinctive colour pattern comprising a black lateral band and dark edges to caudal-fin. *Parluciosoma daniconius* (Hamilton-Buchanan) is common in the Ganga and is listed by Misra (1962) as one of the commercial fishes of the country. It attains a length of 10 cm. It is not very popular with aquarists since it does not have particularly outstanding colour.

21. Genus *Raiamas* Jordan

This genus is widely distributed in Asia and Africa (Howes, 1980). It is primarily Oriental but has spread into West Asia and Africa from South-East Asia. The genus is closely allied to *Barilius* but may be separated in having the lower jaw longer than the combined length of snout and eye, and the elongate pectoral axillary scale which is without a fleshy border. *Raiamas bola* (Hamilton-Buchanan) which is confined to the hilly areas of the north-western region of the country, is an important game fish in the Ganga and takes the fly well (Tilak and Sharma, 1982). It is popularly called Indian trout

and grows to 30 cm and attains a weight of 2 kg. It is a fine flavoured delicate fish. *Barilius corbetti* Tilak & Husain, 1980, described from Uttar Pradesh is undoubtedly a juvenile of *Raiamas bola*. In the male the scales on the sides of the body, particularly in the posterior half, become rough during spawning season and the fishes attain a bright colour.

22. Genus *Rasbora* Bleeker

This genus is widely distributed in the Oriental region and is characteristic in having the dorsal-fin inserted behind the vertical from anal-fin origin, no barbels, and with no distinctive colour pattern. It is represented by *Rasbora rasbora* (Hamilton-Buchanan) in the Ganga basin and is fairly common in the Gangetic provinces. It attains a length of 10 cm. In females the ventral profile is more strongly convex, the males are slimmer. Because of its beauty and hardiness, it has proved popular in small aquaria.

(d) Subfamily SCHIZOTHORACINAE

[Snow trouts]

This subfamily includes the famous snowtrouts or mountain barbels of the High Asian subregion of the Oriental region. They are confined to cold regions as a rule, or at least to localities possessing snow-fed rivers. They are specialised for the hill-stream life and show wonderful adaptations. A tile-like row of scales, enclosing the vent and anal-fin base, is the diagnostic feature of this group of fishes. Of the eight genera known from the Indian region, two occur in the Ganga system.

23. Genus *Schizothoraichthys* Misra

This genus is distributed along the Himalayas (Tilak, 1987) and is distinctive in having the body complete with scales and in the absence of a hard papillated structure (sucker) on the chin. *Schizothoraichthys progastus* (McClelland) is a prominent inhabitant of headwaters of the Ganga. It breeds during the end of March to May end in clear streams with comparatively slower current of water. It attains a length of about 0.5 m. It comes on paste and on being hooked it fights to the last (Tilak and Sharma, 1982). This is an important food-fish of the hilly regions.

24. Genus *Schizothorax* Heckel

The fishes of this genus are prominent inhabitants of the rivers and lakes of Himalayan and Sub-Himalayan regions of the country, usually above an altitude of 670 m. The labial fold is modified into a well developed papillated sucker. *Schizothorax richardsonii* (Grey) occurs in the upper reaches of the Ganga, in the snowfed streams (not found in plains). It breeds during April-May and before the monsoons flood the rivers and streams. It grows to a length of 0.6 m. It comes on paste and also on fly (Tilak and Sharma, 1982). *Schizothorax kumaoensis* Menon which inhabits the Kumaon hills in the Ganga drainage, is a very rare species.

(c) Subfamily GARRINAE

The outstanding diagnostic character of this group of fishes is the absence of a groove between the upper lip and the snout, the upper lip being coalescent with the skin of the rostrum. *Crossocheilus latius latius* (Hamilton-Buchanan) occurs in the Gangetic watershed of the Himalayas (Menon, 1957; Banareseu, 1988). *Garra gotyla* (Grey) occurs all along the Himalayas, while *Garra lamta* (Hamilton-Buchanan) is restricted to the Kumaon Himalayas of the Ganga System (Menon, 1964). The fishes of the genus *Garra* Hamilton-Buchanan are aided in maintaining their positions in mountain streams by means of a small sucking disc on the lower lip that enable them to adhere to stones.

22. Family PSILORHYNCHIDAE

Fishes of this monotypic family are known to occur primarily in the Gangetic drainage of southern Asia (Rainboth, 1983). From the arrangement of the pharyngeal teeth and presence of a number of simple (unbranched) rays in the paired fins, this group may be separated from the family Cyprinidae. *Psilorhynchus sucatio* (Hamilton-Buchanan) has been reported from the Ganga R. in Uttar Pradesh and Bihar (Chandra, 1976), and *Psilorhynchus balitora* (Hamilton-Buchanan) from the Ganga R. at Dighwara (Bihar) (Karamchandani, 1962). *P. gracilis* Rainboth, 1983, probably also occurs in the Gangetic lowlands.

23. Family BALITORIDAE

The fishes of this family are small freshwater fishes which occupy torrential and swift streams from low to high altitudes (Kottelat, 1988).

Subfamily NEMACHEILINAE

This family comprises the loaches which are mainly found in the montane and submontane regions but rarely in the plains (Menon, 1987). They inhabit shallow, clear and swift streams among the pebbles and stones at the bottom. The species reported from the Ganga system are :

Nemacheilus beavani Gunther

Nemacheilus botia (Hamilton-Buchanan)

Nemacheilus corica (Hamilton-Buchanan)

Nemacheilus doonensis Tilak & Husain

Nemacheilus gangeticus Menon

Nemacheilus rupecola (McClelland)

Nemacheilus savona (Hamilton-Buchanan)

24. Family COBITIDAE

This group of fishes are bottom dwellers, mostly of small size and are primarily found in streams, rivers and lakes of hilly areas.

(a) Subfamily COBITINAE

This subfamily is diagnostic in having an erectile spine (concealed in a groove) near the eye and only a single pair of rostral barbels. *Lepidocephalus guntea* (Hamilton-Buchanan) occurs both in the Himalaya and Gangetic plains (Jayaram, 1974) and has been reported in the Ganga R. at Banaras (Banarescu and Nalbant, 1968). *L. caudofurcatus* Tilak & Husain has been reported from the Doon Valley.

(a) Subfamily BOTIINAE

These loaches are characteristic in having an erectile spine (concealed in a groove) near the eye, and two pairs of rostral barbels. The fishes of the genus *Botia* Gray occur in the upland areas of the Gangetic plains (Taki, 1972). *Botia dario* (Hamilton-Buchanan) and *B. lohachata* Chaudhuri are fairly common while *B. almorhae* Gray, *B. dayi* Hora, *B. histrionica* Blyth and *B. rostrata* Gunther are rare in the Ganga system. *Botia lohachata* is a fairly common aquarium fish, and is said to be sociable as well as less timid and pugnacious than other *Botia* spp (Sterba, 1967).

Order SILURIFORMES

Catfishes are usually easy to identify because the majority have barbels (or feelers) extending from each side of the upper jaw some also have them on the lower jaw. Spines are often present at the front of the dorsal and pectoral fins; these spines may be saw-toothed and often carry venom glands.

25. Family BAGRIDAE

The bagrids are widely distributed in Asia and are diagnostic in having a dorsal-fin preceded by a spine; adipose fin present, often large; nostrils wide apart; and the gill-membranes confluent with each other, but free from the isthmus. This family is represented in the Ganga system by four genera :

1. Genus *Aorichthys* Wu

This genus is endemic to the Oriental region. *Aorichthys aor* (Hamilton-Buchanan) and *A. seenghala* (Sykes) contribute an important fishery in the Ganga, the maximum landings of "Daryai tengra" are at Allahabad. Saigal (1960) who worked out the biology of *A. aor* in the Ganga river system, concluded that the breeding is from March to August, and it lays its eggs in breeding pits formed in relatively deeper areas of rivers. It attains a size of 1.8 m, although specimens of a metre in length are commonly seen in fish markets. *A. seenghala*, however, breeds in shallow marginal areas of the river by constructing saucer-shaped breeding pits. Both species come on dead bait and provide a good sport (Tilak and Sharma, 1982).

2. Genus *Mystus* Scopoli

This genus is widely distributed in the Oriental region but is also represented in West Asia. The genus is closely allied to *Aorichthys* but lacks the interneural shield. In the Ganga there are six species : *Mystus bleekeri* (Day), *M. cavasius* (Hamilton-Buchanan), *M. gulio* (Hamilton-Buchanan), *M. menoda* (Hamilton-Buchanan), *M. tengara* (Hamilton-Buchanan) and *M. vittatus* (Bloch). *Mystus gulio* is partly marine while the other five species inhabit the Gangetic plains and the adjoining hilly areas. *Mystus vittatus* is a striking 7-inch (= 17.5 cm) fish found throughout the plains of the Ganga. The stripes begin just behind the head and extend horizontally to the caudal-fin; there are usually four light stripes alternating with four dark ones.

3. Genus *Rama* Bleeker

This monotypic genus is characteristic in having conspicuously large eyes visible from the underside of head, pelvic finrays 6, and pores on ventral surface and sides of head. *Rama chandramara* (Hamilton-Buchanan) is rather rare in the Ganga drainage. Jayaram (1972) established the genus *Chandramara* for this species which is clearly a subjective synonym of the genus *Rama*. Tilak (1984) discussed the natural distribution of this bagrid.

4. Genus *Rita* Bleeker

This genus is endemic to the Oriental region. This genus may be separated from other bagrid genera in having pelvic finrays 7 or 8; a short anal-fin, with 8 to 13 rays; eyes dorsal-lateral in position; and three pairs of barbels. *Rita rita* (Hamilton-Buchanan) is common in the Ganga in Uttar Pradesh and Bihar, and of considerable fishery value. It grows to a length of 1.3 m. The "Khagga" is a meaty and stout fish which is esteemed as food. It comes on the dead bait. It surprises the angler with its protesting squawks and grunts after it is landed (Tilak and Sharma, 1982). It attains maturity at 38 cm and breeds during May-September with peak during July-August (Saxena, 1972).

26. Family SILURIDAE

The silurids have a very short dorsal-fin, not preceded by a spine; adipose fin absent; and pelvic fins small, often absent. The very long anal-fin is usually the silurids most important means of locomotion.

1 Genus *Ompok* Lacepede

This genus is diagnostic in having a strongly oblique mouth, the gape not extending to anterior border of eye and the eyes are distinctly visible from underside of head. *Ompok bimaculatus* (Bloch) is fished in good quantities in the Ganga and is considered a very tasty fish. *Ompok pabdo* (Hamilton-Buchanan) and *O. pabo* (Hamilton-Buchanan) are also caught in fairly large numbers, particularly in West Bengal, in the Ganga system. Both these species are prized as food and are also of medicinal value.

2. Genus *Pinnwallago* Gupta, Jayaram and Hajela

This monotypic genus represented by its type-species, *P. kanpurensis* Gupta, Jayaram & Hajela, is restricted to the Ganga River System, inhabiting ponds at Kanpur (Uttar Pradesh). It is unique in having two rayed dorsal-fins. In Indian siluroids the second dorsal-fin, whenever present, is smooth and adipose except in the families Chacidae and Plotosidae where the second dorsal-fin is rayed but in both these groups it is confluent with the caudal-fin.

3. Genus *Wallago* Bleeker

This genus is widely distributed in the Oriental region. The gape of the mouth is wide and very long, extending posteriorly well beyond the eyes; eyes small, not visible from the underside of head (Roberts, 1982). *Wallagu attu* (Schneider) is a large and powerful fish, inhabiting the freshwater and tidal waters of the Ganga. This catfish is a good sport and can be easily taken on hook with dead bait. It grows to 2 m and weighs more than 45 kg. Due to its rich oil-content it is liked by many. The species is abundant in the upper stretch of the Ganga at Kanpur.

27. Family SCHILBEIDAE

These catfishes constitute in India a striking and well-marked group, and occur in both large and small rivers. The salient features of these catfishes are : dorsal-fin few-rayed, with a pungent spine; adipose dorsal-fin small, vestigial or absent; anal-fin long, with 28 to 90 rays; nasal barbels usually present; and the caudal-fin is forked. The family is represented in the Ganga by five genera :

1. Genus *Ailia* Gray

This genus is endemic to the South Asian subregion of the Oriental region and is represented by the two recognised species in the Ganga. The genus is characteristic in the absence of the rayed dorsal-fin. *Ailia coila* (Hamilton-Buchanan) is much esteemed as food; *Ailia punctata* (Day) is rather rare and has erroneously been listed as identical with *A. coila* by Menon (1974).

2. Genus *Clupisoma* Swainson

Clupisoma is widely distributed in the Oriental region and may be distinguished from allied genera in its moderate mouth, the gape not extending to eye; barbels four pairs; teeth villiform on jaws; vomero-palatine tooth-band transverse or semilunar, not interrupted in the middle; and the airbladder greatly reduced. *Clupisoma garua* (Hamilton-Buchanan) is common in the freshwater rivers of the Gangetic plains and grows to a metre in length. It is considered a good fish throughout its range. As it

is an animal feeder near the bottom of water, it takes a worm put on a light tackle well below the surface of the water.

3. Genus *Eutropiichthys* Bleeker

This group is also distributed in the Oriental region upto Burma and may be separated from allied genera in having a large mouth, the cleft extending to anterior border of eye or even beyond; barbels four pairs; teeth on jaws villiform; and the airbladder greatly reduced and tubular. *Eutropiichthys murius* (Hamilton-Buchanan) is common in the lower reaches of the Ganga while *E. vacha* (Hamilton-Buchanan) is caught in large numbers along the entire Ganga. The best fishing season is from March to November. The latter species is an elegant catfish and an excellent table fish. It rises readily to the fly and affords a good sport.

4. Genus *Pseudeutropius* Bleeker

This genus, widely distributed in the Oriental region, is allied to *Clupisoma* but may be separated in having the vomero-palatine tooth-band in two distinct patches. *Pseudeutropius atherinoides* (Bloch) has attracted the attention of aquarists for its bright colour and small-size.

5. Genus *Silonia* Swainson

This genus is also widely distributed in the Oriental region and is characteristic in having caniniform teeth on jaws and two pairs of barbels. *Silonia silondia* (Hamilton-Buchanan) is very common in the Indo-Gangetic basin and Gangetic estuaries, and an important food-fish of West Bengal where its flesh is prized. It attains a length of 100 cm and occasionally to twice that size. This is a gregarious catfish moving in shoals and breeding in the monsoon months. During the monsoons the adults ascend from the estuaries to nearly the source of the stream for breeding (Hora, 1938). This catfish provides considerable sport to anglers and is regarded as a game-fish of no mean value.

28. Family PANGASIIDAE

These fishes are among the largest freshwater fishes of India. The nasal barbels are absent, but possess only a single pair of chin barbels; adipose dorsal-fin is small. *Pangasius pangasius* (Hamilton-Buchanan) inhabits the lower reaches of the Ganga and its estuaries. A good fishery exists in the Gangetic estuaries during July-August. It strays into the estuaries where during the rains it breeds. Since it attains a good size (1.5 m), it affords a good sport to anglers. In general appearance this fish resembles *Silonia silondia* of the family Schilbeidae, but may be readily distinguished by the absence of the caniniform teeth on the jaws and by the presence of two pairs of fairly well-developed barbels. It is a food-fish but its flesh is not graded among those of good variety of fishes. It is rarely found in pure freshwater.

29. Family AMBLYCIPITIDAE

[Torrent catfishes]

These are small fishes inhabiting swift streams of Southern Asia. These fishes are characteristic in having a short dorsal-fin, the dorsal and pectoral spines weak; gill-membranes united to each other, but free from the isthmus; palate edentulous; and the nostrils are close together, separated by a barbel. *Amblyceps mangois* (Hamilton-Buchanan) occurs along the foothills of the Himalaya. This species has a special acquisition for respiration in the fast currents characteristic of its natural haunt. There is a

prominent fold of skin in front of the pectoral-fin in which the gill-membrane rests when the gill-opening is closed. Further, it has a well developed thoracic adhesive appendage enabling it to cling to stones in swift currents. It attains a length of 12.5 cm but is of no interest to fisheries.

30. Family SISORIDAE

[Sisorid catfishes]

This family is widely distributed in the Oriental and West Asian region, and are mostly small forms occurring in mountain rapids. These fishes are characteristic in having four pairs of barbels; short dorsal-fin; adipose dorsal-fin usually large; anal-fin short; and nostrils generally close together, separated by the nasal barbels. It is represented in the Ganga by eight species belonging to five genera.

1. Genus *Bagarius* Blecker

This genus is endemic to the Oriental region and differs from other sisorids, and perhaps from all other catfishes, in the following two characters : (i) premaxillary bone on each side evidently composed of two ossifications instead of a single ossification, and (ii) dentition of lower jaw markedly heterodont (Roberts, 1983). *Bagarius bagarius* (Hamilton-Buchanan) is common in the Ganga and is mainly an inhabitant of rapids and rocky pools. Specimens are caught by line fishing. Being sluggish in habit, it offers no game. According to Roberts (1983) most references to *B. bagarius* including those of Hora (1939), are wholly or at least partly based on *B. yarrellii* Sykes. *Bagarius yarrellii* is the giant species of *Bagarius* and the largest Asian catfish. It grows to a size of 2 m or more and attains a weight of over 135 kg. The flesh is not much realised being very stiff and fibrous. The breeding season is prior to the commencement of the monsoon rains. It takes spoon and spinning bait, and also live-bait; the fish is usually speared. The true *B. bagarius* is relatively small, not exceeding 20 cm standard length.

2. Genus *Conta* Hora

This monotypic genus has a well-developed adhesive thoracic pad in the form of longitudinal folds of skin, gill-openings separated by a broad isthmus and the pectoral spine is strongly serrated along both its edges. *Conta conta* (Hamilton-Buchanan) is a slender fish which has been reported at the base of the Himalaya in the Ganga river system. In its general facies, habits and habitat, it seems much alike the other loach-like catfishes of the genera *Amblyceps* and *Olyra* (Hora, 1950 : 197).

3. Genus *Gagata* Blecker

This genus is endemic to the Oriental region. The body is smooth, without any bony plates; gill-membranes confluent with the isthmus; maxillary barbels with osseous bases; mandibular barbels inverted on a transverse line at the same level; dorsal-fin with a strong spine; and the adipose fin short and prominent. This genus is represented by three species in the Ganga river system : *Gagata cenia* (Hamilton-Buchanan), *G. gagata* (Hamilton-Buchanan) and *G. sexualis* Tilak.

4. Genus *Glyptothorax* Blyth

The fishes of this genus are usually of a small size. They are primarily hillstream forms, but some are also found in sluggish streams not very far from the base of the hills. They prefer to live at the bottom. The adhesive thoracic pad is in the form of longitudinal folds of skin, adipose dorsal-fin is short and high, gill-openings separated by a narrow isthmus, and the cubito-humeral and scapular processes are inconspicuous. Seven species have been recorded from the Doon Valley of the Ganga

river system : *Glyptothorax brevipinnis* Hora, *G. alaknandi* Tilak, *G. cavia* (Hamilton-Buchanan), *G. dakpathari* Tilak & Husain, *G. garhwali* Tilak, *G. horai* Shaw & Shebbeare, and *G. pectinopterus* (McClelland) (Tilak, 1969; Tilak and Husain, 1973). Further, *G. telchitta* (Hamilton-Buchanan) has been reported from the Ganga river system in Bihar and West Bengal. A new replacement name is being proposed for *Glyptothorax horai* Shaw & Shebbeare as it is occupied by Fowler (1934). Recently Li (1986) divided the genus *Glyptothorax* into several subgenera based on the nature of the sucking apparatus and serrations on the dorsal spine.

5. Genus *Hara* Blyth

This genus is also endemic to South Asia. The body is smooth, without any bony plates; gill-membranes free from each other, but united broadly with the isthmus; four pairs of barbels, all annulated; dorsal-fin short, with a well developed spine; and the caudal-fin is emarginate. This genus is represented by *Hara hara* (Hamilton-Buchanan), *H. jerdoni* (Day) and probably also *H. horai* Misra in the Ganga river system. These hillstream fishes are small-sized and the formidable pectoral spines are the most prominent feature of these fishes.

6. Genus *Nangra* Day

This genus is also endemic to South Asia. It was merged with the genus *Gagata* by Hora and Law (1941), but Tilak (1963) concluded that the two genera are osteologically distinct. In this genus the gill-membranes are free from the isthmus or only slightly adherent to it and the bases of the mandibular barbels are arranged at different levels. *Nangra nangra* (Hamilton-Buchanan) and *N. viridescens* (Hamilton-Buchanan) are known from the Ganga river system. These catfishes are of no interest to fisheries.

7. Genus *Pseudecheneis* Blyth

This monotypic genus has a distinct and well developed adhesive apparatus in the thoracic region, in the form of prominent transverse folds of skin. *Pseudecheneis sulcatus* (McClelland) inhabits fast-flowing hill-streams and has been reported (Tilak and Husain, 1973) from the Doon Valley (Uttar Pradesh) in the Ganga river system.

8. Genus *Sisor* Hamilton-Buchanan

This monotypic genus is endemic to South Asia. It has a rudimentary adipose dorsal-fin consisting of a small spine, no teeth on jaws or palate and the uppermost ray of the caudal-fin is considerably elongated. *Sisor rhabdophorus* (Hamilton-Buchanan) is confined to Ganga and Jumna of northern India.

31. Family CLARIIDAE

[Airbreathing catfishes]

Clariids differ from other catfishes in having an auxiliary breathing apparatus contained in a pocket that extends back and upward from the gill-cavity, the tree-like breathing organs in this special pocket are attached to the second and fourth gillarches and are undoubtedly responsible for the ability of the clariids to live out of water much longer than other catfishes. Around the mouth are four pairs of barbels rather than the two or three pairs usually found in other catfishes. *Clarias batrachus* (Linnaeus) is a rather hardy fish which is extensively fished in the Ganga system. It attains a length of 45 cm and is highly esteemed for its nourishing properties and for quick recovery from prolonged illness. It is sold in live condition in Calcutta and elsewhere where it fetches a relatively high price. The airbladder yields a course isinglass.

32. Family HETEROPNEUSTIDAE

[Airsac catfishes]

This family is represented by a single genus only and may be distinguished by the following characters : body elongate and compressed; head greatly depressed; four pairs of barbels; dorsal-fin short, without a spine; and a long air-sac, serving as a lung, extends posteriorly from the gill-chamber. *Heteropneustes fossilis* (Bloch) is sometimes found in muddy rivers, being primarily a fish of ponds, ditches, etc. A fish of high economic importance, which attains a length of a foot (= 30 cm) or more. The other species of this genus, *H. microps* (Gunther) has recently (Datta Munshi & Srivastava, 1988) been reported from the Ganga system.

33. Family CHACIDAE

[Angler catfishes]

This family is endemic to South Asia and was recently revised by Brown and Ferraris (1988). The head is extremely long, broad and depressed, and the body is compressed posteriorly. *Chaca chaca* (Hamilton-Buchanan) is a very sluggish nocturnal fish of the Ganga which, even when touched, does not abandon its cryptic behaviour and so often passes for a piece of moving wood. According to Sterba (1967) the great mouth appears to serve as a weir-basket-like trap. This fish is robust and ugly looking.

34. Family ARIIDAE

[Sea Catfishes]

The ariid catfishes are a tropical and subtropical group, world-wide in distribution. Unlike many of the freshwater catfishes, they do not spend their time resting on bottom but are always on the move, often in schooling formation. They have four to six barbels around the mouth, and the usual complement of predorsal and pectoral spines; they also have an adipose-fin. However, they differ from other catfishes in that the anterior and posterior nostrils are close together, the latter covered by a valve.

1. Genus *Arius* Valenciennes

This genus is characteristic in having three pairs of barbels, and the teeth of the palate are arranged in one to three patches of a varying size and shape on each side (Jayaram, 1982). *Arius arius* (Hamilton-Buchanan) and *A. gogora* (Hamilton-Buchanan) are estuarine catfishes and are fairly common in the artisanal catches of catfishes in the Hooghly estuary. *Arius sagor* (Hamilton-Buchanan), *A. sona* (Hamilton-Buchanan) and *A. caelatus* Valenciennes are primarily marine but are common in the catches in the Hooghly estuary. *Arius platystomus* Day is reported to be common in the Hooghly River at its mouth.

2. Genus *Batrachocephalus* Bleeker

This monotypic genus is characteristic in having only a pair of very small mandibular barbels, with indications of inner (mental) ones. *Batrachocephalus mino* (Hamilton-Buchanan) originally described from the Ganga estuary, is a curious fish, not common and held in no esteem as a food-fish.

3. Genus *Hemipimelodus* Bleeker

This genus is characteristic in having an edentulous palate, jaw teeth villiform, and three pairs of barbels. *Hemipimelodus jaius* (Hamilton-Buchanan) is reported to be a common species of the

Hooghly estuary, ascending far above tidal reach (Jayaram, 1982). I have, however, not been able to observe or collect even a single specimen in the Hooghly.

4. Genus *Osteogeneiosus* Bleeker

This monotypic genus is characteristic in having only a single pair of barbels (maxillary) which are stiff and semiosseous. *Osteogeneiosus militaris* (Linnaeus) often enters the Hooghly estuary and is found in its lower reaches. It attains a length of 25 cm SL.

35. Family PLOTOSIDAE

[Eeltail catfishes]

These fishes occur in marine, brackish and freshwaters of tropical and warm temperate regions. The body is eel-like, and the anal-fin is long and confluent with the caudal-fin which is rounded and extends on the dorsal surface of body. *Plotosus canius* Hamilton-Buchanan inhabits the Gangetic estuary and often ascends up the river in nearly freshwater. The colourful marine catfishes, *Plotosus lineatus* (Thunberg) also occurs in the Hooghly estuary. Both these species contribute to artisanal fisheries in the Hooghly estuary.

Order AULOPIFORMES

36. Family HARPADONTIDAE

[Bombay-ducks]

These fishes are characteristic in having the lateral-line extending onto the pointed median lobe of caudal-fin. They are secondarily pelagic and have a naked head and body except for scales along the lateral-line and on part of the posterior half of the body. *Harpadon nehereus* (Hamilton-Buchanan) is caught in tremendous numbers in the Gangetic estuary and is eaten fresh as well as in the dried state. It accounts for the maximum percentage of catches from the Hooghly-Matlah estuarine system (Gopalakrishnan, 1979). *Harpadon nehereus* is an interesting fish; it looks like a blunt-nosed lizardfish with extremely long pectoral and ventral fins. Although it grows as long as 45 cm, most of those caught commercially are much smaller. In Indian waters the distribution of Bombay-duck is to a certain extent correlated with salinity, for it occurs commonly in river mouths and estuaries. There are marked fluctuations in its abundance in the Ganga which seems to be effected by fresh-water runoff.

Order BATRACHOIDIFORMES

37. Family BATRACHOIDIDAE

[Toadfishes]

Toadfishes are slow-moving, bottom-dwelling fishes with large mouths well equipped with many sharp teeth. The heavy, broad head is depressed anteriorly and tapers to a long, slender tail; small spinous first dorsal-fin; pelvic fins are placed under the throat ahead of the fanlike pectoral fins; and only three pairs of gills are present. Two species of toadfishes inhabit Indian waters (Hutchins, 1981) which are easily distinguished by the presence or absence of a prominent foramen in the upper portion of the pectoral axil. One of these, *Batrachthys grunniens* (Linnaeus) is an ugly fish and is fairly common in the Hooghly estuary. It attains a length of 30 cm, but has no value as a food-fish. The spine may inflict wounds to people handling these fishes.

Order CYPRINODONTIFORMES
 Suborder EXOCOETOIDEI
 38. Family HEMIRAMPHIDAE
 [Halfbeaks]

The halfbeaks are marine but some inhabit brackish and freshwaters. These fishes have a small mouth-opening with an elongate lower jaw. They live on the surface and are protectively coloured for this mode of life by being green or blue on the back, and silvery-white on the flanks and ventrally. *Dermogenys brachynotopterus* (Bleeker) has never been collected since its original discovery in the Hooghly estuary in 1853; Jayaram (1981) erroneously treated it under the genus *Zenarchopterus* Gill. *Hyporhamphus limbatus* (Valenciennes) is frequently observed in the Hooghly estuary and even the fresh waters of the Ganga. Three species of the genus *Zenarchopterus* Gill inhabit the Hooghly estuary : *Z. buffonis* (Valenciennes), *Z. ectuntio* (Hamilton-Buchanan) and *Z. striga* (Blyth). All are viviparous and have secondary sexual characters in the dorsal and anal fins, and also in the shape of the anal-fin. *Rhynchorhamphus georgii* (Valenciennes) occurs probably only at mouth of the Ganga.

39. Family BELONIDAE
 [Garfishes]

This family comprise fishes which are mainly coastal and the open sea, and only a few species ascend rivers or even live permanently in brackish water. *Xenentodon cancila* (Hamilton-Buchanan) is one such species which inhabits the Ganga plains. This is an elegant surface-living fish and is an accomplished leaper which can jump almost vertically. *Strongylura strongylura* (van Hasselt) and *S. leiura* (Bleeker) also frequent the Hooghly estuary. Both are ferocious fish capable of wreaking havoc among schools of smaller fishes.

Suborder ADRIANICHTHYOIDEI
 40. Family ORYZIIDAE
 [Ricefishes]

Oryzias melastigma (McClelland), the estuarine top-minnow, is common in lower Bengal. This is a delicate little killifish and its utility for mosquito control established. The fish is easily distinguished by the strongly compressed diaphanous body, small fixed upper jaw, and its truncate or rounded caudal fin (Rosen, 1964).

Suborder CYPRINODONTOIDEI
 41. Family APLOCHEILIDAE
 [Rivulines]

Aplocheilus panchax (Hamilton-Buchanan) inhabits the brackish-water of the Ganga. This is an oviparous cyprinodont and a larvivorous fish. A prolific perennial breeder with a spawning maximum in the monsoon months of June, July and August. This is one of those species with which it is practically impossible for the aquarist to go astray in the matter of identification.

Order SYNGNATHIFORMES
 42. Family SYNGNATHIDAE
 [Pipefishes]

The members of this group are noted not only for their bizarre appearance but also for their strange

anatomical and biological characteristics which clearly set them apart from all other living fishes. All have a tube-like snout. The monotypic genus *Ichthyocampus* Kaup represented by its type-species, *I. carce* (Hamilton-Buchanan) is euryhaline and is fairly common in the Hooghly estuary and probably enters freshwaters (Dawson, 1977). *Hippichthys specifer* (Ruppell) is another syngnathine pipefish which is known from the estuarine region of the Ganga (Dawson, 1978). Two species of gastrophorine pipefishes have been reported from the Ganga (Dawson, 1984) : *Microphis cuncalus* (Hamilton-Buchanan) inhabits the low salinity habitats of the Ganga whereas *M. deocata* (Hamilton-Buchanan) inhabits the middle reaches.

Order SYNBRANCHIFORMES

Eel-shaped fishes of small to moderate-size, which lack pelvic fins or girdle and the caudal-fin is reduced or absent. These fishes commonly display a burrowing or covericolous habit (Travers, 1984a, b).

Order SYNBRANCHIOIDEI

43. Family SYNBRANCHIDAE

[Swamp eels]

Although called "eels" because of their appearance, the synbranchids are not true eels; they are air-breathing fishes the exact affinities of which are still in dispute. They lack the paired fins, and the dorsal and anal fins are reduced to a ridge. Rosen and Greenwood (1976) whose major revision forms the basis of the material here, have given an excellent account of the osteology of this group of fishes. Synbranchids occur in a variety of habitats, both freshwater and estuarine. *Ophisternon bengalense* McClelland, described originally from the Hooghly river, is very common in West Bengal and grows to about a metre in length. It inhabits estuaries and freshwaters within the influence of tides. It may be easily recognised in having the gill-opening a simple crescentic transverse fold free from the isthmus (Rosen and Greenwood, 1976). *Monopterus albus* (Hamilton-Buchanan) is also fairly common in the lower reaches of the Ganga and may be distinguished in having a triangular gill-opening which is internally attached to the isthmus. Both species are of food value.

Order SCORPAENIFORMES

44. Family SYNANCEIIDAE

Fishes of this family are tropical marine, rarely brackish and freshwater. *Minous coccineus* (Alcock) has been reported from the mouth of the Hooghly R., Sandheads (Eschmeyer *et. al.*, 1979). This is a small, scaleless fish and has the lowermost ray of the pectoral-fin separated from the rest of the fin.

45. Family PLATYCEPHALIDAE

[Flatheads]

These are benthic fishes and are primarily marine. The young ones of *Platycephalus indicus* (L.) have occasionally been observed in the Hooghly estuary during pre-monsoon months. The strongly depressed head with smooth bony ridges is a good field character for distinguishing this species. *Grammoplites scaber* (L.) contributes a minor fishery in the Hooghly estuary.

Order PERCIFORMES
 Suborder PERCOIDEI
 46. Family CENTROPOMIDAE
 [Barramundis]

Lates calcarifer (Bloch), commonly called Bhukti, ascends the Ganga in pursuit of food and shelter, but always returns to estuarine and marine environments for spawning. Juveniles are known to frequent the lower estuarine areas in the Hooghly-Matlah river system and they enter the impoundment along with the tidal water which acts as the main source of seed for brackishwater fish culture in impoundments, popularly known as "Bhasabandha" fisheries in West Bengal. This species is considered a fairly good game-fish and esteemed as a food-fish. It attains a length of 150 cm. The gasbladder of this fish is exported as isinglass.

47. Family AMBASSIDAE
 [Glassfishes]

The transparent, glass-clear body is usually relatively deep and strongly compressed. The vertebral column and swimbladder are easily visible in the living fish. The majority of the species live in the sea or in brackishwater and only a few small forms inhabit freshwaters. *Chanda nama* Hamilton-Buchanan is common in the fresh and brackish waters of the Ganga; *Pseudambasis ranga* (Hamilton-Buchanan), *P. lala* (Hamilton-Buchanan) and *P. baculis* (Hamilton-Buchanan) are also fairly common in the Ganga plains, but *Ambassis nalua* (Hamilton-Buchanan) is common only in the lower reaches and mangrove-lined tidal creeks.

48. Family SERRANIDAE

The serranids have a typical seabass or grouper appearance which is not difficult to recognise. Most species are marine, but a few go into brackish water. Hamilton-Buchanan (1822) described *Bola coioides* from the estuary of the Ganga which is now considered conspecific with *Epinephelus malabaricus* (Schneider).

49. Family TERAPONIDAE

This family of perciform fishes is found in brackish and marine waters of India. The family is characterised by an oblong-ovate body with a deeply notched dorsal-fin and a fairly short anal-fin. The mouth is quite large and protrusible. The presence of parallel transverse stripes on the caudal-fin lobes further distinguish the group. All the three known species, namely *Terapon jarbua* (Forsskal), *T. theraps* (Cuvier) and *T. puta* (Cuvier) are fairly common at the mouth of the Ganga. While the young fishes school and are very peaceful, the larger ones are typical predators.

50. Family SILLAGINIDAE

A family of fishes of sandy shores and estuarine waters. *Sillaginopsis panijus* (Hamilton-Buchanan), popularly referred to as the Gangetic Whiting, is a commercially important fish captured by nets and longlines in the Hooghly estuary; it attains a length of 44 cm and probably spawns in the Hooghly twice a year, the juveniles migrate towards the upper reaches during March-April and during December where they remain for two to three months (Krishnayya, 1964). *Sillago sihama* (Forsskal) is a nearshore species that frequently penetrates the Hooghly estuary for considerable distances.

51. Family CARANGIDAE

This group of fishes are primarily marine, rarely brackish. The body is generally compressed and the lateral line is modified into spiny scutes. Juveniles of *Caranx carangus* (Bloch) have often been observed in the Hooghly estuary and there are stray reports of adults in the Hooghly also.

52. Family LEIOGNATHIDAE

[Pony-fishes]

These are small Indo-Pacific fishes, chiefly marine in habitat but sometimes living in brackish and freshwater. They have deep, laterally compressed bodies and extremely protrusible mouth which form tubes when extended. *Leiognathus equulus* (Forsskal) is common in the catches in the Hooghly; *Secutor ruconius* (Hamilton-Buchanan) is also fairly common though it does not contribute to any fishery in the Hooghly estuary. Young ones of *Gazza minuta* (Bloch), *Leiognathus blochii* (Valenciennes) and *L. equulus* have often been observed in the Hooghly estuary.

53. Family LUTJANIDAE

The snappers are shallow-water inshore species. Hamilton-Buchanan (1822) described *Coius catus* from the estuaries of the Ganga, a species now considered identical with *Lutjanus johni* (Bloch).

54. Family LOBOTIDAE

This is a family of few species whose representatives live predominantly in brackishwaters at the mouths of larger rivers of south-east Asia and penetrate into freshwater. *Datnioides quadrifasciatus* (Sevastianov) is found at the mouth of the Ganga. It is not esteemed as a food-fish. The brown triple-tail, *Lobotes surinamensis* (Bloch) probably also inhabits the mouth of the Ganga.

55. Family GERREIDAE

The small, silvery, shallow-water mojarras are similar in many respects to the ponyfishes. They have the protrusible mouth, but have a different sheathing along the base of the dorsal and anal fins. *Gerreomorpha setifer* (Hamilton-Buchanan) ascends tidal rivers and is common in the Hooghly estuary. It attains a length of 10 cm.

56. Family HAEMULIDAE

Externally the grunts look very much like the snappers, but they differ from them primarily in their dentition, having very feeble teeth and very potent pharyngeal teeth. They are mostly tropical marine species. *Pomadasys argenteus* (Forsskal) occurs only at the mouth of the Ganga.

57. Family SPARIDAE

These are deep-bodied fishes, usually equipped with powerful canine or incisor teeth in the jaws, and also strong molar or grinding teeth. *Acanthopagrus latus* (Houttuyn) is not uncommon in the catches of the Hooghly estuary.

58. Family SCIAENIDAE

These fishes are shallow-water, usually carnivorous, inshore denizens of tropical and temperate seas. Some species move readily into brackish and freshwater. The croakers have two separate dorsal fins, usually barely connected at the base. The majority are considered marketable food-fishes. *Pama pama* (Hamilton-Buchanan) is known to inhabit the coastal regions and perform both genetic and tropic

migrations into the Hooghly-Matlah estuarine system (Pantulu, 1966). The period of abundant catches are the monsoon and winter seasons. *Daysciaena albida* (Cuvier) and *Macrospinosa cuja* (Hamilton-Buchanan) are estuarine species which are fairly abundant in the Hooghly estuary during winter months. *Johnieops sina* (Cuvier), *Panna microdon* (Bleeker), *Johnius carutta* (Bloch), *J. belangerii* (Cuvier) and *J. coitor* (Hamilton-Buchanan) are fairly common in the Hooghly estuary, whereas *J. gangeticus* Talwar contributes a minor fishery in the Ganga at Allahabad. *Protonibea diacanthus* (Lacepede) has been often listed from the Hooghly. *Pterolithus maculatus* (Kuhl & van Hasselt) and *Otolithoides biauritus* (Cantor) are not uncommon in the Hooghly estuary, while *Bahaba chaptis* (Hamilton-Buchanan) is a rare species. *Panna heterolepis* Trewavas, 1977, was described on a postlarval specimen from Calcutta.

59. Family TOXOTIDAE

Archers adapt readily to fresh, brackish, or salt water. These fishes exhibit one of nature's most remarkable feeding adaptations—they are capable of forcefully ejecting squirts of water from their mouths and drowning insects (Allen, 1978). *Toxotes chatareus* (Hamilton-Buchanan), originally described from the mouth of Ganga R., is capable of penetrating well inland. *Toxotes jaculator* (Pallas) is known to inhabit mangrove estuaries and the lowermost reaches of freshwater streams.

60. Family KYPHOSIDAE

The rudderfishes have some incisiform teeth and the maxilla exposed. *Kyphosus cinerascens* (Forsskal) is a common species but apparently not abundant in the Hooghly.

61. Family SCATOPHAGIDAE

These are coastal fishes primarily but move into shallow brackish water. They have four anal spines, an exceptional condition which is quite helpful in identification. Young ones of *Scatophagus argus* (Bloch) which are usually dark in colour, are common at the mouth of the Ganga and its estuary.

62. Family NANDIDAE

This family comprises a fascinating group of small fishes. At rest, most look deceptively like drifting leaves. *Badis badis* (Hamilton-Buchanan) is a colourful fish which can change its colour rapidly. It grows to about 8 cm in length and is common in the Gangetic provinces. *Nandus nandus* (Hamilton-Buchanan) is also common in the ponds of the Gangetic provinces.

Suborder MUGILOIDEI

63. Family MUGILIDAE

[Mulletts]

This family is widely distributed in warm and temperate seas. Some species ascend the rivers whereas a few are confined to freshwaters; most species are typically coastal-estuarine and adaptable to great changes in salinity. The mullets are remarkably uniform in external anatomy. *Mugil cephalus* Linnaeus is known to ascend the Ganga, but is rare in Bengal waters. *Rhinomugil corsula* (Hamilton-Buchanan) which was originally discovered in the Ganga R., is fished in small quantities. *Liza melinoptera* (Valenciennes), *L. parsia* (Hamilton-Buchanan), *L. subviridis* (Valenciennes) and *L. tade* (Forsskal) contribute minor fisheries in the Hooghly estuary. *Sicamugil cascasia* (Hamilton-Buchanan) is a purely freshwater species and the lowermost point on the Ganga R. system where this has been observed is Patna. *Valamugil cunnesius* (Valenciennes) and *V. speigleri* (Bleeker) are known to ascend the Ganga R. far beyond the tidal influence and contribute to minor fisheries in the Hooghly estuary.

Suborder POLYNEMOIDEI
64. Family POLYNEMIDAE

Typical of the threadfins, sometimes called tassel-fishes, is an anchovy-type head with rounded snout and recessed lower jaw; the mouth, which is on the underside of the head, is not obvious unless it is opened. *Eleutheronema tetradactylum* (Shaw) is also highly esteemed as a food-fish in the Hooghly estuary. *Polydactylus sextarius* (Bloch) is fairly common in the trawl nets operated at 60 m in the Hooghly estuary. *Polynemus paradiseus* Linnaeus which is common on the West Bengal coast, is known to enter the Hooghly river up to about 100 km for breeding from April to June. *P. longipectoralis* Weber & de Beaufort has been recorded only recently (Talwar & Mukherjee, in press) from the Hooghly estuary.

Suborder CALLIONYMOIDEI
65. Family CALLIONYMIDAE

A sharp preopercular spine and a very small gill-opening on the upper part of the head are two of the identifying marks of the dragonets, a group of small fishes with slender, anteriorly flattened bodies. These fishes live at the bottom and are primarily marine. *Callionymus fluviatilis* Day is a euryhaline species (Fricke, 1983) and was originally discovered from the Hooghly R. at Calcutta. *Callionymus sagitta* (Pallas) and *C. recurvispinis* (Li) have been reported at the mouth of the Hooghly only.

Suborder GOBIOIDEI
66. Family GOBIIDAE

Bottom fishes, with a world-wide distribution, whose chief characteristic is the usually complete, less often partial, union of the pelvic fins. Through this fusion a basin-shaped sucker is produced which enables the gobies to attach themselves to any firm support. Many ascend the rivers, but only a few are bound to freshwater. *Glossogobius giuris* (Hamilton-Buchanan) is the only relished food-fish amongst the gobioids in the Hooghly. *Apocryptes bato* (Hamilton-Buchanan) and *Pseudapocryptes lanceolatus* (Bloch and Schneider) occur in large numbers in the Hooghly estuary and though not very much relished, form a major part of the yield. *Glossogobius giuris* and *Stigmatogobius sadanundio* (Hamilton-Buchanan) are virtually limnic and widely distributed in the Ganga plains. In the Ganga, there are two species of the genus *Boleophthalmus* Valenciennes and one species of *Periophthalmus* which are known to ascend the river for a considerable distance, viz. *Boleophthalmus boddarti* (Pallas), *B. dussumieri* Valenciennes and *Periophthalmus koelreuteri* (Pallas). The other gobiids known from the Hooghly estuary are :

- Acentrogobius globiceps* (Hora)
- Acentrogobius viridipunctatus* (Valenciennes)
- Apocryptodon madurensis* (Bleeker)
- Awaouichthys menoni* Chatterjee
- Awaous gutum* (Hamilton-Buchanan)
- Bathygobius fuscus* (Ruppell)
- Brachygobius nunus* (Hamilton-Buchanan)
- Cryptocentrus gymnocephalus* (Bleeker)
- Glossogobius biocellatus* (Valenciennes)
- Gobiopsis macrostoma* Steindachner
- Gobiopterus chuno* (Hamilton-Buchanan)

Oligolepis acutipennis (Valenciennes)
Oxuderces dentatus Eydoux & Souleyet
Parachaeturichthys polynema (Bleeker)
Parapocryptes rictuosus (Valenciennes)
Periophthalmodon schlosseri (Pallas)
Periophthalmodon tredecemradiatus (Hamilton-Buchanan)
Periophthalmus pearsei Eggert
Periophthalmus weberi Eggert
Scartelaos histophorus (Valenciennes)
Stigmatogobius hoevenii (Bleeker)

67. Family ELEOTRIDIDAE

The largest of the gobioid fishes are the eleotrids which lack the sucking disc. All species have the pelvic fins separated either completely to the base or almost to it. They are called sleepers because of the habit most of them have of lying on the bottom, rarely moving except when disturbed. They are worldwide in their distribution, but especially numerous in the brackish-water zones of tropical seas. *Butis butis* (Hamilton-Buchanan), *B. melanostigma* (Bleeker) and *Eleotris fusca* (Schneider) are fairly common in the Hooghly estuary, while *Ophiocara porocephala* (Valenciennes) and *Odonteleotris macrodon* (Bleeker) are not so common. *Eleotris lutea* Day, *E. melanosoma* Bleeker and *Ophieleotris aporos* (Bleeker) are rare in the Hooghly estuary.

68. Family GOBIOIDIDAE

[Eellike gobies]

These eellike gobies are marine, brackish and freshwater. The body is eellike and the eyes are very small. The following species have been reported from Hooghly (Koumans, 1941; Chatterjee, 1978) :

Brachyamblyopus urolepis (Bleeker)
Odontamblyopus rubicundus (Hamilton-Buchanan)
Pseudotrypauchen multiradiatus Hardenberg
Taenioides anguillaris (Linnaeus)
Taenioides buchanani (Day)
Taenioides cirratus (Blyth)

Odontamblyopus rubicundus occurs in large numbers in the Hooghly and though not relished very much, forms a major part of the yield of the gobioids. *Pseudotrypauchen multiradiatus* occurs only at the mouth of the Hooghly.

69. Family TRYPAUCHENIDAE

[Burrowing gobies]

Like the true gobies, they usually have a sucking disc under the body. In life they are pink or blue in colour. The spiny-rayed and soft rayed portions of the extremely long dorsal-fin are continuous rather than separate as in the gobies. The following species have been reported from the Hooghly (Koumans, 1941; Chatterjee, 1978) :

Amblyotrypauchen arctocephalus (Alcock)

Ctenotrypauchen microcephalus (Bleeker)

Trypauchen vagina (Bloch & Schneider)

Trypauchenichthys sumatrensis Hardenberg

Suborder SCOMBROIDEI

70. Family TRICHIURIDAE

This is a family of primarily marine fishes with narrow, laterally compressed bodies and barracuda-like heads armed with fantastic dentition. The body tapers gradually to a point. *Lepturacanthus pantului* (Gupta) and *Trichiurus gangeticus* Gupta contribute an important fishery in the Hooghly estuary in the lower zone during winter months (Gopalakrishnan, 1973).

Suborder ANABANTOIDEI

71. Family ANABANTIDAE

This is a group of small, tropical freshwater fishes found in South-east Asia and Africa. Because of the special labyrinthine breathing apparatus located in a cavity above each gill-chamber and connected to it, the members of this family are called labyrinth fishes. Each cavity is filled with a series of bony plates covered with a rosette-like vascular membrane containing many fine blood vessels which extract oxygen from the atmospheric air as it passes over them. This accessory breathing apparatus enables the anabantids to live in oxygen-deficient water that would otherwise be lethal. *Anabas testudineus* (Bloch) is an economic species which flourishes in ponds and swamps of the Gangetic system. *Anabas cobojius* (Hamilton-Buchanan) also inhabits the Gangetic system, a species earlier not recognised as distinct but clearly a senior synonym of *Anabas oligolepis* Bleeker.

72. Family BELONTIIDAE

This group of fishes also has a suprabranchial organ, but the dorsal-fin base is usually slightly over one-third as long as anal-fin base (*versus* considerably longer). *Colisa fasciatus* (Schneider), *C. lalia* (Hamilton-Buchanan) and *C. sota* (Hamilton-Buchanan) are common in the Gangetic system and are one of the loveliest aquarium favourites, but unfortunately rather susceptible to disease. They are commonly referred to as gourami. The pelvic fins are long and pointed serving as organs of touch which provide independent information about the environment.

Suborder CHANNOIDEI

73. Family CHANNIDAE

[Snakehead fishes]

The snakeheads are fairly round in cross-section and have long dorsal and anal fins without spiny rays, and six-rayed pelvic fins. These fishes are carnivorous and have the typical bulldog lower jaw which protrudes beyond the upper jaw; the anterior nostril usually has a pronounced tube. A suprabranchial organ for air-breathing is present. They are widely distributed in the Oriental region. The colour patterns are usually in shades of gray, brown and black, often with distinctive markings. *Channa amphibi* (McClelland), *C. barca* (Hamilton-Buchanan), *C. marulius* (Hamilton-Buchanan), *C. orientalis* Bloch & Schneider, *C. punctatus* (Bloch), *C. stewartii* (Playfair) and *C. striatus* (Bloch) have been reported from the Ganga system. *Channa marulius* is of great food value. Because of their amphibious mode of respiration, they can be kept alive for long periods in the market for sale. They fetch a better price when sold alive.

Suborder MASTACEMBELOIDEI

74. Family MASTACEMBELIDAE

The spiny eels form a strange group of eel-like freshwater fishes ranging throughout Africa and Asia. The snout is very sensitive and is supported by a special cartilage; at the end of the snout are the tubular anterior nostrils, which together with the snout form a trilobed appendage, the posterior nostrils are located farther back on the head near the eyes. The name "spiny" comes from a series of detached, depressible spines preceding the soft dorsal-fin. They are excellent food-fish, and are also occasionally kept as an aquarium fish. *Macrogathus aral* (Bloch) is common in brackish waters within the tidal influence of the Ganga, whereas *M. pancalus* Hamilton-Buchanan is abundant in both the fresh and brackish waters of the Ganga river system. *Mastacembelus armatus* (Lacepede) is the largest spiny-eel and is common in the Ganga system, both salt and fresh waters. Earlier workers (Hamilton-Buchanan, 1822; Day, 1876, 1889; Jayaram, 1981) reported *Macrogathus aculeatus* (Bloch) from the Ganga system, a species now shown as not occurring in India (Roberts, 1980).

Order PLEURONECTIFORMES

The flatfishes are chiefly marine and a very distinctive group. Adults are not bilaterally symmetrical. Flatfishes are benthic and carnivorous.

75. Family BOTHIDAE

Bothid flounders are of moderate size and primarily marine. *Pseudorhombus arsius* (Hamilton-Buchanan) is fairly common in the Hooghly estuary while *P. javanicus* (Bleeker) is rather uncommon.

76. Family CYNOGLOSSIDAE

Eyes on the left side of the head, a pointed tail, and the absence of ribs are characteristics that readily identify the tongue-sole fishes. The tongue-soles are small, teardrop-shaped, usually less than 30 cm in length. *Cynoglossus lingua* Hamilton-Buchanan, *C. cynoglossus* Hamilton-Buchanan and *C. puncticeps* (Richardson) are fished in small quantities in the Hooghly estuary. *Cynoglossus macrostomus* Norman has not been rediscovered in the Hooghly since its original discovery in 1928.

77. Family SOLEIDAE

In the true soles both eyes are on the right side of the head and the preopercular margin of the gill-cover is never free but hidden by the skin and scales of the head. *Euryglossa pan* (Hamilton-Buchanan) inhabits estuaries and tidal rivers, and is taken commercially in small quantities in the Hooghly estuary.

Order TETRAODONTIFORMES

These fishes can produce sounds by grinding the jaw teeth or the pharyngeal teeth or by vibrating the swimbladder. The stomach of some tetraodontiforms is highly modified to allow inflation to an enormous size. All of them have small openings from the gill-cavities and small mouths with strong teeth.

78. Family TETRAODONTIDAE

[Puffers]

The stomach of these fishes is highly modified to allow inflation to an enormous size. Fish with this ability are popularly called puffers. Inflation is caused by gulping down water into a ventral

diverticulum of the stomach when the fish is frightened or annoyed. Deflation occurs by expelling the water. If the fish is removed from the water, inflation can occur with air. These fishes are characteristic in having four fused teeth on jaws (teeth in each jaw fused but separated by a median suture); and the body naked or with only small scattered prickles. *Arothron stellatus* (Bloch & Schneider) is a marine fish which is rare in the Hooghly. *Chelonodon fluvialis* (Hamilton-Buchanan) is a very poisonous fish and fairly common in the Ganga. *Chelonodon patoca* (Hamilton-Buchanan) is common only in the lower stretch of the Ganga. *Lagocephalus lunaris* (Bloch & Schneider) and *Takifugu oblongus* (Bloch) are marine species which enter the Hooghly. *Tetraodon cutcutia* Hamilton-Buchanan is a freshwater species and fairly common in the Ganga including its estuary. This fish is diagnostic in having a short and rounded nostril with a terminal opening, the border of which is at the most slightly lobed (Dekkers, 1975).

SUMMARY

The Ganga River harbours the richest freshwater fish fauna of India. 375 species have been documented; 280 species discovered in earlier years from the Ganga R., along with their current status, is tabulated. Further, a comprehensive bibliography of the ichthyofauna along with synoptic list of the fishes known from this water-course, is given.

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TABLE I
Fishes Discovered From the Ganga R. with their Current Status

Original Name	Current Name
Family CARCHARHINIDAE	
<i>Carcharias (Prionodon) gangeticus</i> Muller & Henle, 1841	<i>Glyphis gangeticus</i> (Muller & Henle)
<i>Carcharias (Physodon) muelleri</i> Valenciennes, 1839	<i>Scoliodon laticaudus</i> Muller & Henle
Family RHINOBATIDAE	
<i>Rhinobatus annandalei</i> Norman, 1926	<i>Rhinobatos annandalei</i> Norman
<i>Rhinobatus lionotus</i> Norman, 1926	<i>Rhinobatos lionotus</i> Norman
Family DASYATIDAE	
<i>Raja fluvialis</i> Hamilton-Buchanan, 1822	<i>Ilmantura fluvialis</i> (Hamilton-Buchanan)

Original Name	Current Name
<i>Raja sancur</i> Hamilton-Buchanan, 1822	<i>Hypolophus sephen</i> (Forsskal)
<i>Trygon bleekeri</i> Blyth, 1861	<i>Himantura bleekeri</i> (Blyth)
<i>Trygon crozieri</i> Blyth, 1861	<i>Dasyatis zugei</i> (Muller & Henle)
<i>Trygon ellioti</i> Blyth, 1861	? <i>Himantura uarnak</i> (Forsskal)
<i>Trygon marginatus</i> Blyth, 1861	<i>Himantura marginata</i> (Blyth)
Family NOTOPTERIDAE	
<i>Mystus chitala</i> Hamilton-Buchanan, 1822	<i>Notopterus chitala</i> (Hamilton-Buchanan)
<i>Notopterus buchanani</i> Valenciennes, 1848	<i>Notopterus chitala</i> (Hamilton-Buchanan)
Family MEGALOPIDAE	
<i>Cyprinodon cundinga</i> Hamilton-Buchanan, 1822	<i>Megalops cyprinoides</i> (Broussonet)
Family ANGUILLIDAE	
<i>Muraena bengalensis</i> Gray, 1831	<i>Anguilla bengalensis</i> (Gray)
<i>Anguilla brevirostris</i> McClelland, 1845	<i>Anguilla bengalensis</i> (Gray)
<i>Anguilla nebulosa</i> McClelland, 1845	<i>Anguilla bengalensis</i> (Gray)
Family MORINGUIDAE	
<i>Aphthalmichthys gangeticus</i> Fowler, 1912	Status uncertain; probably an ophichthid (vide Castle, 1968)
<i>Moringua linearis</i> Gray, 1831	<i>Moringua raitaborua</i> (Hamilton-Buchanan)
<i>Moringua lumbriciformis</i> Kaup, 1856	? <i>Moringua raitaborua</i> (Hamilton-Buchanan)
<i>Muraena raitaborua</i> Hamilton-Buchanan, 1822	<i>Moringua raitaborua</i> (Hamilton-Buchanan)
<i>Muraena vamos</i> Hamilton-Buchanan, 1822	? <i>Moringua raitaborua</i> (Hamilton-Buchanan)
<i>Ptyobranhus arundinaceus</i> McClelland, 1844	<i>Moringua arundinacea</i> (McClelland)
<i>Ptyobranhus brevis</i> McClelland, 1844	<i>Moringua raitaborua</i> (Hamilton-Buchanan)
<i>Ptyobranhus erythreus</i> McClelland, 1844	<i>Moringua raitaborua</i> (Hamilton-Buchanan)
<i>Ptyobranhus gracilis</i> McClelland, 1844	<i>Moringua raitaborua</i> (Hamilton-Buchanan)
<i>Ptyobranhus gunthrianus</i> McClelland, 1844	<i>Moringua raitaborua</i> (Hamilton-Buchanan)
<i>Ptyobranhus medius</i> McClelland, 1844	<i>Nomen nudum</i> (vide Castle, 1968)
<i>Ptyobranhus multidentatus</i> McClelland, 1844	<i>Moringua raitaborua</i> (Hamilton-Buchanan)
<i>Ptyobranhus parvidentatus</i> McClelland, 1844	<i>Moringua raitaborua</i> (Hamilton-Buchanan)
? <i>Rataboura hamiltoni</i> Gray, 1831	<i>Moringua raitaborua</i> (Hamilton-Buchanan)
? <i>Rataboura hardwickii</i> Gray, 1831	<i>Moringua raitaboura</i> (Hamilton-Buchanan)
Family MURAENIDAE	
<i>Lycodontis longicaudata</i> McClelland, 1844	<i>Lycodontis sathete</i> (Hamilton-Buchanan)
<i>Muraenophis sathete</i> Hamilton-Buchanan, 1822	<i>Lycodontis sathete</i> (Hamilton-Buchanan)
<i>Muraenophis tile</i> Hamilton-Buchanan, 1822	<i>Lycodontis tile</i> (Hamilton-Buchanan)
<i>Strophidon literata</i> McClelland, 1844	<i>Lycodontis tile</i> (Hamilton-Buchanan)
<i>Strophidon maculata</i> McClelland, 1844	<i>Lycodontis tile</i> (Hamilton-Buchanan)

Original Name	Current Name
<i>Strophidon punctata</i> McClelland, 1844	<i>Lycodontis tile</i> (Hamilton-Buchanan)
Family MURAENESOCIDAE	
<i>Muraena bagio</i> Hamilton-Buchanan, 1822	<i>Muraenesox bagio</i> (Hamilton-Buchanan)
<i>Muraenesox bengalensis</i> McClelland, 1844	<i>Muraenesox cinereus</i> (Forsskal)
<i>Muraenesox hamiltoniae</i> McClelland, 1844	<i>Muraenesox cinereus</i> (Forsskal)
<i>Muraenesox tricuspidata</i> McClelland, 1844	<i>Muraenesox cinereus</i> (Forsskal)
Family OPHICHTHYIDAE	
<i>Ophisurus boro</i> Hamilton-Buchanan, 1822	<i>Pisodonophis boro</i> (Hamilton-Buchanan)
<i>Ophisurus caudatus</i> McClelland, 1844	<i>Pisodonophis boro</i> (Hamilton-Buchanan)
<i>Ophisurus harancha</i> Hamilton-Buchanan, 1822	<i>Pisodonophis boro</i> (Hamilton-Buchanan)
<i>Ophisurus hijala</i> Hamilton-Buchanan, 1822	<i>Pisodonophis boro</i> (Hamilton-Buchanan)
<i>Ophisurus minimus</i> McClelland, 1844	<i>Pisodonophis boro</i> (Hamilton-Buchanan)
<i>Ophisurus rostratus</i> McClelland, 1844	<i>Pisodonophis boro</i> (Hamilton-Buchanan)
<i>Ophisurus vermiformis</i> McClelland, 1844	<i>Pisodonophis boro</i> (Hamilton-Buchanan)
Family CLUPEIDAE	
<i>Alausa microlepis</i> Valenciennes, 1847	<i>Gudusia chapra</i> (Hamilton-Buchanan)
<i>Clupanodon cagius</i> Hamilton-Buchanan, 1822	<i>Anodontostoma chacunda</i> (Hamilton-Buchanan)
<i>Clupanodon chacunda</i> Hamilton-Buchanan, 1822	<i>Anodontostoma chacunda</i> (Hamilton-Buchanan)
<i>Clupanodon chanpole</i> Hamilton-Buchanan, 1822	<i>Anodontostoma chacunda</i> (Hamilton-Buchanan)
<i>Clupanodon chapra</i> Hamilton-Buchanan, 1822	<i>Gudusia chapra</i> (Hamilton-Buchanan)
<i>Clupanodon ilisha</i> Hamilton-Buchanan, 1822	<i>Hilsa (Tenuylosa) ilisha</i> (Hamilton-Buchanan)
<i>Clupanodon manmina</i> Hamilton-Buchanan, 1822	<i>Gonialosa manmina</i> (Hamilton-Buchanan)
<i>Corica biharensis</i> Kamal & Ahsan, 1979	<i>Corica soborna</i> Hamilton-Buchanan
<i>Corica soborna</i> Hamilton-Buchanan, 1822	—
Family ENGRAULIDIDAE	
<i>Clupea phasa</i> Hamilton-Buchanan, 1822	<i>Setipinna phasa</i> (Hamilton-Buchanan)
<i>Clupea purava</i> Hamilton-Buchanan, 1822	<i>Thryssa purava</i> (Hamilton-Buchanan)
<i>Clupea telara</i> Hamilton-Buchanan, 1822	<i>Setipinna phasa</i> (Hamilton-Buchanan)
<i>Coilia cantoris</i> Bleeker, 1853	<i>Coilia ramcarati</i> (Hamilton-Buchanan)
<i>Coilia quadregesimalis</i> Valenciennes, 1848	<i>Coilia ramcarati</i> (Hamilton-Buchanan)
<i>Coilia whiteheadi</i> Rao & Jayaswal, MS	<i>Coilia reynaldi</i> Valenciennes
<i>Engraulis brevifilis</i> Valenciennes, 1848	<i>Setipinna brevifilis</i> (Valenciennes)
<i>Mystus ramcarati</i> Hamilton-Buchanan, 1822	<i>Coilia ramcarati</i> (Hamilton-Buchanan)

Original Name	Current Name
Family CYPRINIDAE Subfamily CYPRININAE	
<i>Abramis gangeticus</i> Swainson, 1839	<i>Osteobrama cotio cotio</i> (Hamilton-Buchanan)
? <i>Barbus barbouri</i> Fowler, 1924	Status uncertain
<i>Barbus carletoni</i> Fowler, 1924	<i>Puntius sophore</i> (Hamilton-Buchanan)
? <i>Barbus gardonidus</i> Valenciennes, 1842	<i>Puntius sarana</i> (Hamilton-Buchanan)
<i>Barbus garmani</i> Fowler, 1924	Status uncertain
<i>Barbus hexastichus</i> McClelland, 1839	<i>Neolissochilus hexastichus</i> (McClelland)
<i>Barbus sophoroides</i> Gunther, 1868	<i>Puntius chola</i> (Hamilton-Buchanan)
<i>Chondrostoma gangeticum</i> Valenciennes, 1842	<i>Cirrhinus reba</i> (Hamilton-Buchanan)
<i>Cirrhina bengalensis</i> Bleeker, 1853	<i>Cirrhinus reba</i> (Hamilton-Buchanan)
<i>Cirrhina rubripinnis</i> Valenciennes, 1842	<i>Cirrhinus reba</i> (Hamilton-Buchanan)
<i>Cyprinus (Bangana) bata</i> Hamilton-Buchanan, 1822	<i>Labeo bata</i> (Hamilton-Buchanan)
<i>Cyprinus (Bangana) cura</i> Hamilton-Buchanan, 1822	<i>Labeo bata</i> (Hamilton-Buchanan)
<i>Cyprinus (Bangana) mrigala</i> Hamilton-Buchanan, 1822	<i>Cirrhinus mrigala</i> (Hamilton-Buchanan)
<i>Cyprinus (Bangana)reba</i> Hamilton-Buchanan, 1822	<i>Cirrhinus reba</i> (Hamilton-Buchanan)
<i>Cyprinus (Cabdio) cotio</i> Hamilton-Buchanan, 1822	<i>Osteobrama cotio cotio</i> (Hamilton-Buchanan)
<i>Cyprinus (Cabdio) guganio</i> Hamilton-Buchanan, 1822	<i>Puntius guganio</i> (Hamilton-Buchanan)
<i>Cyprinus (Cyprinus) catla</i> Hamilton-Buchanan, 1822	<i>Catla catla</i> (Hamilton-Buchanan)
<i>Cyprinus (Cyprinus) calbasu</i> Hamilton-Buchanan, 1822	<i>Labeo calbasu</i> (Hamilton-Buchanan)
<i>Cyprinus (Cyprinus) chagunio</i> Hamilton-Buchanan, 1822	<i>Chagunius chagunio</i> (Hamilton-Buchanan)
<i>Cyprinus (Cyprinus) curchius</i> Hamilton-Buchanan, 1822	<i>Labeo gonius</i> (Hamilton-Buchanan)
<i>Cyprinus (Cyprinus) cursa</i> Hamilton-Buchanan, 1822	<i>Labeo gonius</i> (Hamilton-Buchanan)
<i>Cyprinus (Cyprinus) gonius</i> Hamilton-Buchanan, 1822	<i>Labeo gonius</i> (Hamilton-Buchanan)
<i>Cyprinus (Cyprinus) rohita</i> Hamilton-Buchanan, 1822	<i>Labeo rohita</i> (Hamilton-Buchanan)
<i>Cyprinus (Cyprinus) sarana</i> Hamilton-Buchanan, 1822	<i>Puntius sarana</i> (Hamilton-Buchanan)
<i>Cyprinus (Cyprinus) sophore</i> Hamilton-Buchanan, 1822	<i>Puntius sopnore</i> (Hamilton-Buchanan)

Original Name	Current Name
<i>Cyprinus (Morulius) morala</i> Hamilton-Buchanan, 1822	<i>Labeo angra</i> (Hamilton-Buchanan)
<i>Cyprinus (Morulius) musiha</i> Hamilton-Buchanan, 1822	<i>Labeo angra</i> (Hamilton-Buchanan)
<i>Cyprinus (Puntius) puntio</i> Hamilton-Buchanan, 1822	<i>Puntius puntio</i> (Hamilton-Buchanan)
<i>Cyprinus (Puntius) ticto</i> Hamilton-Buchanan, 1822	<i>Puntius ticto</i> (Hamilton-Buchanan)
<i>Cyprinus (Puntius) titius</i> Hamilton-Buchanan, 1822	? <i>Puntius chola</i> (Hamilton-Buchanan)
? <i>Leuciscus belangeri</i> Valenciennes, 1844	<i>Osteobrama belangeri</i> (Valenciennes)
<i>Leuciscus duvaucelli</i> Valenciennes, 1844	<i>Puntius sophore</i> (Hamilton-Buchanan)
<i>Mrigala buchanani</i> Bleeker, 1859	<i>Cirrhitina mrigala</i> (Hamilton-Buchanan)
<i>Rohita belangeri</i> Valenciennes, 1842	<i>Labeo calbasu</i> (Hamilton-Buchanan)
<i>Rohita buchanani</i> Valenciennes, 1842	<i>Labeo rohita</i> (Hamilton-Buchanan)
<i>Systemus chrysostomus</i> McClelland, 1839	<i>Puntius sarana</i> (Hamilton-Buchanan)
Subfamily CULTRINAE	
<i>Cyprinus (Cabdio) dancena</i> Hamilton-Buchanan, 1822	<i>Chela laubuca</i> (Hamilton-Buchanan)
<i>Cyprinus (Chela) bacaila</i> Hamilton-Buchanan, 1822	<i>Salmostoma bacaila</i> (Hamilton-Buchanan)
<i>Cyprinus (Chela) cachijs</i> Hamilton-Buchanan, 1822	<i>Chela cachijs</i> (Hamilton-Buchanan)
<i>Salmostoma sardinella poonpuni</i> Tilak, 1979	<i>Salmostoma sardinella</i> (Valenciennes)
Subfamily RASBORINAE	
<i>Cyprinus (Bangana) elanga</i> Hamilton-Buchanan, 1822	<i>Bengala elanga</i> (Hamilton-Buchanan)
<i>Cyprinus (Barilius) vagra</i> Hamilton-Buchanan, 1822	<i>Barilius vagra</i> (Hamilton-Buchanan)
<i>Cyprinus (Cabdio) borelio</i> Hamilton-Buchanan, 1822	? <i>Barilius bendelisis</i> (Hamilton-Buchanan)
<i>Cyprinus (Cabdio) devario</i> Hamilton-Buchanan, 1822	<i>Danio devario</i> (Hamilton-Buchanan)
<i>Cyprinus (Cabdio) jaya</i> Hamilton-Buchanan, 1822	<i>Aspidoparia jaya</i> (Hamilton-Buchanan)
<i>Cyprinus (Cabdio) mola</i> Hamilton-Buchanan, 1822	<i>Amblypharyngodon mola</i> (Hamilton-Buchanan)
<i>Cyprinus (Danio) chapalio</i> Hamilton-Buchanan, 1822	<i>Brachydanio rerio</i> (Hamilton-Buchanan)
<i>Cyprinus (Danio) daniconius</i> Hamilton-Buchanan, 1822	<i>Parluciosoma daniconius</i> (Hamilton-Buchanan)
<i>Cyprinus (Danio) danrica</i> Hamilton-Buchanan, 1822	<i>Esomus danricus</i> (Hamilton-Buchanan)
<i>Cyprinus (Danio) rasbora</i> Hamilton-Buchanan, 1822	<i>Rasbora rasbora</i> (Hamilton-Buchanan)
<i>Esomus lineatus</i> Ahl, 1924	? <i>Esomus danricus</i> (Hamilton-Buchanan)
<i>Leuciscus dystomus</i> McClelland, 1839	<i>Bengala elanga</i> (Hamilton-Buchanan)
<i>Leuciscus microlepis</i> Bleeker, 1853	<i>Amblypharyngodon microlepis</i> (Bleeker)
<i>Leuciscus pellucidus</i> McClelland, 1839	? <i>Amblypharyngodon microlepis</i> (Bleeker)
<i>Mola buchanani</i> Blyth, 1861	<i>Amblypharyngodon mola</i> (Hamilton-Buchanan)

Original Name	Current Name
<i>Perilampus recurvirostris</i> McClelland, 1839	<i>Esomus danricus</i> (Hamilton-Buchanan)
Subfamily GARRINAE	
<i>Cyprinus (Garra) gohama</i> Hamilton-Buchanan, 1822	<i>Crossocheilus latius latius</i> (Hamilton-Buchanan)
Family BALITORIDAE	
<i>Acanthocobitis longipinnis</i> Peters, 1861	<i>Nemacheilus botia</i> (Hamilton-Buchanan)
<i>Noemacheilus gangeticus</i> Menon, 1987	<i>Nemacheilus gangeticus</i> Menon
Family COBITIDAE	
Subfamily COBITINAE	
<i>Cobitis guntea</i> Hamilton-Buchanan, 1822	<i>Lepidocephalus guntea</i> (Hamilton-Buchanan)
Subfamily BOTIINAE	
<i>Botia rostrata</i> Gunther, 1868	—
<i>Cobitis geto</i> Hamilton-Buchanan, 1822	<i>Botia dario</i> (Hamilton-Buchanan)
Family BAGRIDAE	
<i>Arius ritoides</i> Valenciennes, 1840	<i>Rita rita</i> (Hamilton-Buchanan)
<i>Bagrus aorellus</i> Blyth, 1859	<i>Aorichthys seenghala</i> (Sykes)
<i>Bagrus keletius</i> Bleeker, 1846	<i>Mystus bleekeri</i> (Day)
<i>Bagrus trachacanthus</i> Valenciennes, 1839	<i>Mystus menoda</i> (Hamilton-Buchanan)
<i>Macrones bleekeri</i> Day, 1877	<i>Mystus bleekeri</i> (Day)
<i>Pimelodus aor</i> Hamilton-Buchanan, 1822	<i>Aorichthys aor</i> (Hamilton-Buchanan)
<i>Pimelodus cavasius</i> Hamilton-Buchanan, 1822	<i>Mystus cavasius</i> (Hamilton-Buchanan)
<i>Pimelodus gulio</i> Hamilton-Buchanan, 1822	<i>Mystus gulio</i> (Hamilton-Buchanan)
<i>Pimelodus rita</i> Hamilton-Buchanan, 1822	<i>Rita rita</i> (Hamilton-Buchanan)
<i>Pimelodus tengara</i> Hamilton-Buchanan, 1822	<i>Mystus tengara</i> (Hamilton-Buchanan)
<i>Rita bucharani</i> Bleeker, 1853	<i>Rita rita</i> (Hamilton-Buchanan)
? <i>Rita crucigera</i> Gunther, 1864	<i>Rita rita</i> (Hamilton-Buchanan)
Family SILURIDAE	
<i>Pterocryptis gangetica</i> Peters, 1861	<i>Silurus cochinchinensis</i> (Valenciennes)
<i>Silurus anostomus</i> Valenciennes, 1839	<i>Ompok pabda</i> (Hamilton-Buchanan)
<i>Silurus (Callichrous) boalis</i> Hamilton-Buchanan, 1822	<i>Wallago attu</i> (Schneider)
<i>Silurus microcephalus</i> Valenciennes, 1839	<i>Ompok bimaculatus</i> (Bloch)
<i>Silurus (Callichrous) pabda</i> Hamilton-Buchanan, 1822	<i>Ompok pabda</i> (Hamilton-Buchanan)
<i>Silurus wallago</i> Valenciennes, 1839	<i>Wallago attu</i> (Schneider)
<i>Wallago russellii</i> Bleeker, 1853	<i>Wallago attu</i> (Schneider)

Original Name	Current Name
Family SCHILBEIDAE	
<i>Malapterurus coila</i> Hamilton-Buchanan, 1822	<i>Ailia coila</i> (Hamilton-Buchanan)
? <i>Malapterurus (Ailia) bengalensis</i> Gray & Hardwicke, 1831	<i>Ailia coila</i> (Hamilton-Buchanan)
<i>Pimelodus anguis</i> Hamilton-Buchanan, 1822	<i>Pseudeutropius atherinoides</i> (Bloch)
<i>Pimelodus silondia</i> Hamilton-Buchanan, 1822	<i>Silonia silondia</i> (Hamilton-Buchanan)
<i>Pimelodus vacha</i> Hamilton-Buchanan, 1822	<i>Eutropiichthys vacha</i> (Hamilton-Buchanan)
<i>Silundia gangetica</i> Cuvier, 1840	<i>Silonia silondia</i> (Hamilton-Buchanan)
<i>Silurus (Callichrous) garua</i> Hamilton-Buchanan, 1822	<i>Clupisoma garua</i> (Hamilton-Buchanan)
Family PANGASIIDAE	
<i>Pangasius buchanani</i> Valenciennes, 1840	<i>Pangasius pangasius</i> (Hamilton-Buchanan)
<i>Pimelodus pangasius</i> Hamilton-Buchanan, 1822	<i>Pangasius pangasius</i> (Hamilton-Buchanan)
Family SISORIDAE	
<i>Bagarius buchanani</i> Bleeker, 1853 (Replacement name for <i>B. bagarius</i>)	<i>Bagarius bagarius</i> (Hamilton-Buchanan)
<i>Nangra buchanani</i> Day, 1877	<i>Nangra nangra</i> (Hamilton-Buchanan)
<i>Pimelodus bagarius</i> Hamilton-Buchanan, 1822	<i>Bagarius bagarius</i> (Hamilton-Buchanan)
<i>Pimelodus gagata</i> Hamilton-Buchanan, 1822	<i>Gagata gagata</i> (Hamilton-Buchanan)
<i>Pimelodus telchitta</i> Hamilton-Buchanan, 1822	<i>Glyptothorax telchitta</i> (Hamilton-Buchanan)
Family CLARIIDAE	
<i>Macropteronotus jagur</i> Hamilton-Buchanan, 1822	<i>Clarias batrachus</i> (Linnaeus)
<i>Macropteronotus magur</i> Hamilton-Buchanan, 1822	<i>Clarias batrachus</i> (Linnaeus)
Family HETEROPNEUSTIDAE	
<i>Silurus singio</i> Hamilton-Buchanan, 1822	<i>Heteropneustes fossilis</i> (Bloch)
Family CHACIDAE	
<i>Chaca buchanani</i> Gunther, 1864 (Replacement name for <i>Platystacus chaca</i> Hamilton-Buchanan)	<i>Chaca chaca</i> (Hamilton-Buchanan)
<i>Chaca hamiltonii</i> Gray, 1831 (Replacement name for <i>Platystacus chaca</i>)	<i>Chaca chaca</i> (Hamilton-Buchanan)
<i>Chaca lophioides</i> Valenciennes, 1834 (Replacement name for <i>Platystacus chaca</i>)	<i>Chaca chaca</i> (Hamilton-Buchanan)
<i>Platystacus chaca</i> Hamilton-Buchanan, 1822	<i>Chaca chaca</i> (Hamilton-Buchanan)
Family ARIIDAE	
<i>Ageneiosus mino</i> Hamilton-Buchanan, 1822	<i>Batrachocephalus mino</i> (Hamilton-Buchanan)
<i>Arius acquirbarbis</i> Valenciennes, 1840	<i>Arius caelatus</i> Valenciennes
<i>Arius aroides</i> Gunther, 1864	<i>Arius caelatus</i> Valenciennes

Original Name	Current Name
<i>Arius buehanani</i> Day, 1877	<i>Arius arius</i> (Hamilton-Buchanan)
<i>Bagrus gadorides</i> Valenciennes, 1839	<i>Arius sona</i> (Hamilton-Buchanan)
<i>Osteogeniosus cantoris</i> Bleeker, 1853	<i>Osteogeneiosus militaris</i> (Linnaeus)
<i>Pimelodus arius</i> Hamilton-Buchanan, 1822	<i>Arius arius</i> (Hamilton-Buchanan)
<i>Pimelodus gadora</i> Hamilton-Buchanan, 1822	<i>Arius gadora</i> (Hamilton-Buchanan)
<i>Pimelodus jatus</i> Hamilton-Buchanan, 1822	<i>Hemipimelodus jatus</i> (Hamilton-Buchanan)
<i>Pimelodus nenga</i> Hamilton-Buchanan, 1822	? <i>Arius caelatus</i> Valenciennes
<i>Pimelodus sagor</i> Hamilton-Buchanan, 1822	<i>Arius sagor</i> (Hamilton-Buchanan)
<i>Pimelodus sona</i> Hamilton-Buchanan, 1822	<i>Arius sona</i> (Hamilton-Buchanan)
Family PLOTOSIDAE	
<i>Plotosus canius</i> Hamilton-Buchanan, 1822	
Family HARPADONTIDAE	
<i>Osmerus nehereus</i> Hamilton-Buchanan, 1822	<i>Harpadon nehereus</i> (Hamilton-Buchanan)
Family BATRACHOIDIDAE	
<i>Batrachoides gangene</i> Hamilton-Buchanan, 1822	<i>Batrachthys grunniens</i> (Linnaeus)
Family HEMIRAMPHIDAE	
<i>Esox ectuntio</i> Hamilton-Buchanan, 1822	<i>Zenarchopterus ectuntio</i> (Hamilton-Buchanan)
<i>Hemirhamphus brachynotopterus</i> Bleeker, 1853	<i>Dermogenys brachynotopterus</i> (Bleeker)
<i>Hemirhamphus neglectus</i> Day, 1869	<i>Zenarchopterus cxtuntio</i> (Hamilton-Buchanan)
<i>Hemirhamphus plumatus</i> Blyth, 1859	? <i>Rhynchorhamphus georgii</i> (Valenciennes)
<i>Hemirhamphus striga</i> Blyth, 1859	<i>Zenarchopterus striga</i> (Blyth)
Family BELONIDAE	
<i>Belone tenuirostris</i> Blyth, 1859	<i>Strongylura leiura</i> (Bleeker)
<i>Esox cancila</i> Hamilton-Buchanan, 1822	<i>Xenentodon cancila</i> (Hamilton-Buchanan)
Family APLOCHEILIDAE	
<i>Esox panchax</i> Hamilton-Buchanan, 1822	<i>Aplocheilus panchax</i> (Hamilton-Buchanan)
Family SYNGNATHIDAE	
<i>Syngnathus carce</i> Hamilton-Buchanan, 1822	<i>Ichthyocampus carce</i> (Hamilton-Buchanan)
<i>Syngnathus cuncalus</i> Hamilton-Buchanan, 1822	<i>Microphis cuncalus</i> (Hamilton-Buchanan)
<i>Syngnathus deocata</i> Hamilton-Buchanan, 1822	<i>Microphis deocata</i> (Hamilton-Buchanan)
Family SYNBRANCHIDAE	
<i>Ophisternon bengalensis</i> McClelland, 1844	<i>Ophisternon bengalense</i> McClelland
<i>Ophisternon hepaticus</i> McClelland, 1844	<i>Ophisternon bengalense</i> McClelland

Original Name	Current Name
<i>Unibranchapertura cuchia</i> Hamilton-Buchanan, 1822	<i>Monopterus (Amphipnous) cuchia</i> (Hamilton-Buchanan)
Family PLATYCEPHALIDAE	
<i>Calliomorus chaca</i> Hamilton-Buchanan, 1822	<i>Platycephalus indicus</i> (Linnaeus)
Family CENTROPOMIDAE	
<i>Coius vacti</i> Hamilton-Buchanan, 1822	<i>Lates calcarifer</i> (Bloch)
Family AMBASSIDAE	
<i>Chanda nalua</i> Hamilton-Buchanan, 1822	<i>Ambassis nalua</i> (Hamilton-Buchanan)
<i>Chanda ranga</i> Hamilton-Buchanan, 1822	<i>Pseudambassis ranga</i> (Hamilton-Buchanan)
<i>Chanda lala</i> Hamilton-Buchanan, 1822	<i>Pseudambassis lala</i> (Hamilton-Buchanan)
<i>Chanda nama</i> Hamilton-Buchanan, 1822	—
Family SERRANIDAE	
<i>Bola coioides</i> Hamilton-Buchanan, 1822	<i>Epineplus malabaricus</i> (Schneider)
Family TERAPONIDAE	
<i>Coius trivittatus</i> Hamilton-Buchanan, 1822	<i>Terapon puta</i> (Cuvier)
Family SILLAGINIDAE	
<i>Cheilodipterus panijus</i> Hamilton-Buchanan, 1822	<i>Sillaginopsis panijus</i> (Hamilton-Buchanan)
Family LEIOGNATHIDAE	
<i>Chanda ruconius</i> Hamilton-Buchanan, 1822	<i>Secutor ruconius</i> (Hamilton-Buchanan)
Family LUTJANIDAE	
<i>Coius catus</i> Hamilton-Buchanan, 1822	<i>Lutjanus johnii</i> (Bloch)
Family LOBOTIDAE	
<i>Coius binotatus</i> Gray & Hardwicke, 1831	<i>Datnioides quadrifasciatus</i> (Sevastianov)
<i>Coius polota</i> Hamilton-Buchanan, 1822	<i>Datnioides quadrifasciatus</i> (Sevastianov)
Family GERREIDAE	
<i>Chanda setifer</i> Hamilton-Buchanan, 1822	<i>Gerrmorpha setifer</i> (Hamilton-Buchanan)
<i>Gerres altispinis</i> Gunther, 1862	<i>Gerreomorpha setifer</i> (Hamilton-Buchanan)
Family HAEMULIDAE	
<i>Coius gudgutia</i> Hamilton-Buchanan, 1822	<i>Pomadasys argenteus</i> (Forsskal)
<i>Polotus nitidus</i> Blyth, 1859	<i>Pomadasys argenteus</i> (Forsskal)
Family SPARIDAE	
<i>Coius catnia</i> Hamilton-Buchanan, 1822	<i>Acanthopagrus latus</i> (Houttuyn)

Original Name	Current Name
Family SCIAENIDAE	
<i>Bola chaptis</i> Hamilton-Buchanan, 1822	<i>Bahaba chaptis</i> (Hamilton-Buchanan)
<i>Bola coibor</i> Hamilton-Buchanan, 1822	<i>Status uncertain</i> (vide Trewavas, 1977)
<i>Bola coitor</i> Hamilton-Buchanan, 1822	<i>Johnius coitor</i> (Hamilton-Buchanan)
<i>Bola cuja</i> Hamilton-Buchanan, 1822	<i>Macrospinosa cuja</i> (Hamilton-Buchanan)
<i>Bola pama</i> Hamilton-Buchanan, 1822	<i>Pama pama</i> (Hamilton-Buchanan)
<i>Dendrophysa hoogliensis</i> Sinha & Rao, 1969	<i>Daysciaena albida</i> (Cuvier)
<i>Johnius gangeticus</i> Talwar, 1990	—
<i>Otolithus submaculatus</i> Blyth, 1861	<i>Pterotolithus maculatus</i> (Kuhl & van Hasselt)
<i>Panna heterolepis</i> Trewavas, 1977	—
<i>Sciaenoides hardwickei</i> Blyth, 1861	<i>Pama pama</i> (Hamilton-Buchanan)
<i>Sciaenoides asper</i> Blyth, 1861	? <i>Macrospinosa cuja</i> (Hamilton-Buchanan)
<i>Wak menoni</i> Talwar & Joglekar, 1970	<i>Johnieops sina</i> (Cuvier)
Family TOXOTIDAE	
<i>Coius chatareus</i> Hamilton-Buchanan, 1822	<i>Toxotes chatareus</i> (Hamilton-Buchanan)
Family SCATOPHAGIDAE	
<i>Chaetodon pairatalis</i> Hamilton-Buchanan, 1822	<i>Scatophagus argus</i> (Linnaeus)
Family NANDIDAE	
<i>Coius nandus</i> Hamilton-Buchanan, 1822	<i>Nandus nandus</i> (Hamilton-Buchanan)
<i>Labrus badis</i> Hamilton-Buchanan, 1822	<i>Badis badis</i> (Hamilton-Buchanan)
Family MUGILIDAE	
<i>Mugil buchanani</i> Bleeker, 1853	<i>Valamugil buchanani</i> (Bleeker)
<i>Mugil corsula</i> Hamilton-Buchanan, 1822	<i>Rhinomugil corsula</i> (Hamilton-Buchanan)
<i>Mugil parsia</i> Hamilton-Buchanan, 1822	<i>Liza parsia</i> (Hamilton-Buchanan)
<i>Mugil planiceps</i> Valenciennes, 1836	<i>Liza tade</i> (Forsskal)
<i>Mugil subviridis</i> Valenciennes, 1836	<i>Liza subviridis</i> (Valenciennes)
Family POLYNEMIDAE	
<i>Polynemus aureus</i> Hamilton-Buchanan, 1822	<i>Polynemus paradiseus</i> Linnaeus
<i>Polynemus risua</i> Hamilton-Buchanan, 1822	<i>Polynemus paradiseus</i> Linnaeus
<i>Polynemus sele</i> Hamilton-Buchanan, 1822	<i>Polydactylus indicus</i> (Shaw)
<i>Polynemus teria</i> Hamilton-Buchanan, 1822	<i>Eleutheronema tetradactylum</i> (Shaw)
<i>Polynemus toposui</i> Hamilton-Buchanan, 1822	<i>Polynemus paradiseus</i> Linnaeus
Family CALLIONYMIDAE	
<i>Callionymus fluviatilis</i> Day, 1875	—

Original Name	Current Name
Family GOBIIDAE	
<i>Awaouchthys menoni</i> Chatterjee, 1978	—
<i>Boleophthalmus histophorus</i> Valenciennes, 1837	<i>Scartelaos histophorus</i> (Valenciennes)
<i>Gobius alcockii</i> Annandale, 1906	<i>Brachygobius nunus</i> (Hamilton-Buchanan)
<i>Gobius bato</i> Hamilton-Buchanan, 1822	<i>Apocryptes bato</i> (Hamilton-Buchanan)
<i>Gobius changua</i> Hamilton-Buchanan, 1822	<i>Pseudapocryptes lanceolatus</i> (Bloch & Schneider)
<i>Gobius chuno</i> Hamilton-Buchanan, 1822	<i>Gobiopterus chuno</i> (Hamilton-Buchanan)
<i>Gobius giurus</i> Hamilton-Buchanan, 1822	<i>Glossogobius giurus</i> (Hamilton-Buchanan)
<i>Gobius gutum</i> Hamilton-Buchanan, 1822	<i>Awaous gutum</i> (Hamilton-Buchanan)
<i>Gobius novemradiatus</i> Hamilton-Buchanan, 1822	<i>Status uncertain</i> (vide Koumans, 1941)
<i>Gobius nunus</i> Hamilton-Buchanan, 1822	<i>Brachygobius nunus</i> (Hamilton-Buchanan)
<i>Gobius plinianus</i> Hamilton-Buchanan, 1822	<i>Boleophthalmus boddarti</i> (Pallas)
<i>Gobius sadanundio</i> Hamilton-Buchanan, 1822	<i>Stigmatogobius sadanundio</i> (Hamilton-Buchanan)
<i>Gobius septemradiatus</i> Hamilton-Buchanan, 1822	<i>Periophthalmodon schlosseri</i> (Pallas)
<i>Gobius tredecemradiatus</i> Hamilton-Buchanan, 1822	<i>Periophthalmodon tredecemradiatus</i> (Hamilton-Buchanan)
<i>Gobius viridus</i> Hamilton-Buchanan, 1822	<i>Scartelaos histophorus</i> (Valenciennes)
<i>Periophthalmus pearsei</i> Eggert, 1935	—
Family ELEOTRIDIDAE	
<i>Cheilodipterus butis</i> Hamilton-Buchanan, 1822	<i>Butis butis</i> (Hamilton-Buchanan)
<i>Cheilodipterus culius</i> Hamilton-Buchanan, 1822	<i>Eleotris fusca</i> (Bloch & Schneider)
<i>Eleotris buccata</i> Blyth, 1861	<i>Status uncertain</i> (vide Koumans, 1941)
<i>Eleotris humeralis</i> Valenciennes, 1837	<i>Butis butis</i> (Hamilton-Buchanan)
<i>Eleotris incerta</i> Blyth, 1861	<i>Eleotris fusca</i> (Bloch & Schneider)
<i>Eleotris macrodon</i> Bleeker, 1853	<i>Odonteleotris macrodon</i> (Bleeker)
Family GOBIOIDIDAE	
<i>Amblyopus buchanani</i> Day, 1873	<i>Taenioides buchanani</i> (Day)
? <i>Amblyopus cirratus</i> Blyth, 1861	<i>Taenioides cirratus</i> (Blyth)
<i>Amblyopus hermannianus</i> Valenciennes, 1837	<i>Odontamblyopus rubicundus</i> (Hamilton-Buchanan)
Family TRYPAUCHENIDAE	
<i>Amblyotrypauchen fraseri</i> Hora, 1924	<i>Amblyotrypauchen arctocephalus</i> (Alcock)
<i>Gobioides ruber</i> Hamilton-Buchanan, 1822	<i>Trypauchen vagina</i> (Bloch & Schneider)

Original Name	Current Name
Family TRICHIURIDAE	
<i>Trichiurus gangeticus</i> Gupta, 1966	—
<i>Trichiurus pantului</i> Gupta, 1966	<i>Lepturacanthus pantului</i> (Gupta)
Family ANABANTIDAE	
<i>Coius cobojus</i> Hamilton-Buchanan, 1822	<i>Anabas cobojus</i> (Hamilton-Buchanan)
Family BELONTIIDAE	
<i>Trichopodus bejeus</i> Hamilton-Buchanan, 1822	<i>Colisa fasciatus</i> (Schneider)
<i>Trichopodus chuna</i> Hamilton-Buchanan, 1822	<i>Colisa sota</i> (Hamilton-Buchanan)
<i>Trichopodus colisa</i> Hamilton-Buchanan, 1822	<i>Colisa fasciatus</i> (Schneider)
<i>Trichopodus cotra</i> Hamilton-Buchanan, 1822	<i>Colisa fasciatus</i> (Schneider)
<i>Trichopodus lalius</i> Hamilton-Buchanan, 1822	<i>Colisa lalia</i> (Hamilton-Buchanan)
<i>Trichopodus sota</i> Hamilton-Buchanan, 1822	<i>Colisa sota</i> (Hamilton-Buchanan)
Family CHANNIDAE	
<i>Ophiocephalus gachua</i> Hamilton-Buchanan, 1822	<i>Channa orientalis</i> Bloch & Schneider
<i>Ophiocephalus lata</i> Hamilton-Buchanan, 1822	<i>Channa punctatus</i> (Bloch)
<i>Ophiocephalus marulius</i> Hamilton-Buchanan, 1822,	<i>Channa marulius</i> (Hamilton-Buchanan)
Family MASTACEMBELIDAE	
<i>Macrognathus pancalus</i> Hamilton-Buchanan, 1822	—
Family BOTHIDAE	
<i>Pleuronectes arius</i> Hamilton-Buchanan, 1822	<i>Pseudorhombus arius</i> (Hamilton-Buchanan)
<i>Pleuronectes nauphala</i> Hamilton-Buchanan, 1822	<i>Pseudorhombus javanicus</i> (Bleeker)
Family CYNOGLOSSIDAE	
<i>Achirus cynoglossus</i> Hamilton-Buchanan, 1822	<i>Cynoglossus cynoglossus</i> (Hamilton-Buchanan)
<i>Cynoglossus buechanani</i> Day, 1869	<i>Cynoglossus cynoglossus</i> (Hamilton-Buchanan)
<i>Cynoglossus brevis</i> Gunther, 1862	<i>Cynoglossus puncticeps</i> (Richardson)
<i>Cynoglossus hamiltonii</i> Gunther, 1862	<i>Cynoglossus cynoglossus</i> (Hamilton-Buchanan)
<i>Cynoglossus lingua</i> Hamilton-Buchanan, 1822	—
<i>Cynoglossus macrostomus</i> Norman, 1928	—
<i>Plagusia bengalensis</i> Bleeker, 1853	<i>Cynoglossus cynoglossus</i> (Hamilton-Buchanan)

Original Name	Current Status
Family SOLEIDAE	
<i>Pleuronectes pan</i> Hamilton-Buchanan, 1822	<i>Euryglossa pan</i> (Hamilton-Buchanan)
Family TETRAODONTIDAE	
<i>Arothron dorsovittatus</i> Blyth, 1861	<i>Chelonodon fluviatilis</i> (Hamilton-Buchanan)
<i>Gastrophysus microphthlmus</i> Blyth, 1861	<i>Takifugu oblongus</i> (Bloch)
<i>Kanduka michiei</i> Hora, 1924	<i>Arothron stellatus</i> (Bloch & Schneider)
<i>Tetrodon cutcutia</i> Hamilton-Buchanan, 1822	<i>Tetraodon cutcutia</i> Hamilton-Buchanan
<i>Tetrodon fluviatilis</i> Hamilton-Buchanan, 1822	<i>Chelonodon fluviatilis</i> (Hamilton-Buchanan)
<i>Tetrodon patoca</i> Hamilton-Buchanan, 1822	<i>Chelonodon patoca</i> (Hamilton-Buchanan)
<i>Tetrodon tepa</i> Hamilton-Buchanan, 1822	<i>Lagocephalus lunaris</i> (Bloch & Schneider)

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APPENDIX

SYNOPTIC LIST OF FISHES FROM GANGA

Superclass PISCES
 Class CHONDRICHTHYES
 Order ORECTOLOBIFORMES
 Family HEMISCYLLIDAE
 (Bamboo sharks)

Chiloscyllium griseum Muller & Henle

Family STEGOSTOMATIDAE
 (Zebra sharks)

Stegostoma fasciatum (Hermann)

Order CARCHARHINIFORMES
 Family CARCHARHINIDAE
 (Requiem sharks)

Carcharhinus hemiodon (Valenciennes)

Carcharhinus limbatus (Valenciennes)

Carcharhinus leucas (Valenciennes)

Carcharhinus melanopterus (Quoy & Gaimard)

? *Carcharhinus sorrah* (Valenciennes)

Glyphis gangeticus (Muller & Henle)

Lamiopsis temmincki (Muller & Henle)

Rhizoprionodon acutus (Ruppell)

Scoliodon laticaudus Muller & Henle

Family SPHYRNIDAE
 (Hammerhead sharks)

Eusphyra blochii (Cuvier)

Order RAJIFORMES
 Family PRISTIDAE
 (Sawfishes)

Anoxypristis cuspidatus (Latham)

Pristis microdon Latham

Pristis pectinata Latham

Family RHINOBATIDAE
(Guitarfishes)

Rhina ancylostoma Schneider

Rhinobatos annandalei Norman

Rhinobatos granulatus Cuvier

Rhinobatos lionotus Norman

Rhinobatos obtusus Muller & Henle

Rhinobatos typus Bennett

? *Rhynchobatus djiddensis* (Forsskal)

Family DASYATIDAE
(Stingrays)

? *Dasyatis bennetti* (Muller & Henle)

Dasyatis zugei (Muller & Henle)

Himantura bleekeri (Blyth)

Himantura fluviatilis (Hamilton-Buchanan)

Himantura imbricata (Schneider)

Himantura marginata (Blyth)

Himantura uarnak (Forsskal)

Hypolophus sephen (Forsskal)

Family MYLIOBATIDIDAE
(Eagle-rays)

? *Aetomylaeus nichofii* (Schneider)

Class OSTEICHTHYES
Order OSTEOGLOSSIFORMES
Family NOTOPTERIDAE
(Featherbacks)

Notopterus chitala (Hamilton-Buchanan)

Notopterus notopterus (Pallas)

Order ELOPIFORMES

Family ELOPIDAE

? *Elops machnata* (Forsskal)

Family MEGALOPIDAE

(Tarpons)

Megalops cyprinoides (Broussonet)

Order ANGUILLIFORMES

Family ANGUILLIDAE

(Freshwater eels)

Anguilla bengalensis (Gray & Hardwicke)

Family MORINGUIDAE

(Worm-eels)

Moringua arundinacea (McClelland)

Moringua raitaborua (Hamilton-Buchanan)

Family MURAENIDAE

(Moray eels)

Lycodontis sathete (Hamilton-Buchanan)

Lycodontis tile (Hamilton-Buchanan)

Family MURAENESOCIDAE

(Pike eels)

Congresox talabon (Cuvier)

Congresox talabonoides (Bleeker)

Muraenesox bagio (Hamilton-Buchanan)

Muraenesox cinereus (Forsskal)

Family OPHICHTHIDAE

(Snake eels)

Pisodonophis boro (Hamilton-Buchanan)

Order CLUPEIFORMES

Family CLUPEIDAE

(Shads and Herrings)

Subfamily CLUPEINAE

Escualosa thoracata (Valenciennes)

Subfamily ALOSINAE

Gudusia chapra (Hamilton-Buchanan)

Hilsa (Tenuulosa) ilisha (Hamilton-Buchanan)

Subfamily PELLONULINAE

Corica soborna Hamilton-Buchanan

Subfamily DOROSOMATINAE

(Gizzard shads)

Anodontostoma chacunda (Hamilton-Buchanan)

Anodontostoma thailandiae Wongratana

Gonialosa manmina (Hamilton-Buchanan)

Nematalosa nasus (Bloch)

Family PRISTIGASTERIDAE

(Ilishas, Pellonas)

Ilisha megaloptera (Swainson)

Ilisha melastoma (Schneider)

Opisthopterus tardoore (Cuvier)

Pellona ditchela Valenciennes

Raconda russeliana Gray

Family ENGRAULIDIDAE

(Anchovies)

Coilia dussumieri Valenciennes

Coilia neglecta Whitehead

Coilia ramcarati (Hamilton-Buchanan)

Coilia reynaldi Valenciennes

Setipinna brevifilis (Valenciennes)
Setipinna phasa (Hamilton-Buchanan)
Setipinna taty (Valenciennes)
Setipinna tenuifilis Valenciennes
Thryssa dussumieri (Valenciennes)
Thryssa hamiltonii (Gray)
Thryssa purava (Hamilton-Buchanan)
Thryssa stenostoma Wongratana

Order GONORHYNCHIFORMES
 Family CHANIDAE

Chanos chanos (Forsskal)

Order CYPRINIFORMES
 Family CYPRINIDAE
 (Carps and Minnows)
 Subfamily CYPRININAE

Catla catla (Hamilton-Buchanan)
Cirrhinus mrigala (Hamilton-Buchanan)
Cirrhinus reba (Hamilton-Buchanan)
Chagunius chagunio (Hamilton-Buchanan)
Labeo angra (Hamilton-Buchanan)
Labeo bata (Hamilton-Buchanan)
Labeo boga (Hamilton-Buchanan)
Labeo boggut (Sykes)
Labeo calbasu (Hamilton-Buchanan)
Labeo dero (Hamilton-Buchanan)
Labeo dyocheilus (McClelland)
Labeo fimbriatus (Bloch)
Labeo gonius (Hamilton-Buchanan)
Labeo nandina (Hamilton-Buchanan)
Labeo pangusia (Hamilton-Buchanan)
Labeo rohita (Hamilton-Buchanan)
 ? *Labeo sindensis* (Day)
Neolissochilus hexagonolepis (McClelland)

Neolissochilus hexastichus (McClelland)
Oreichthys cosuatis (Hamilton-Buchanan)
 ? *Osteobrama belangeri* (Valenciennes)
Osteobrama cotio cotio (Hamilton-Buchanan)
Puntius chola (Hamilton-Buchanan)
Puntius chrysopterus (McClelland)
Puntius conchoni (Hamilton-Buchanan)
Puntius gelius (Hamilton-Buchanan)
Puntius guganio (Hamilton-Buchanan)
Puntius phutunio (Hamilton-Buchanan)
Puntius puntio (Hamilton-Buchanan)
Puntius sarana (Hamilton-Buchanan)
Puntius spilurus (Gunther)
Puntius sophore (Hamilton-Buchanan)
Puntius terio (Hamilton-Buchanan)
Puntius ticto (Hamilton-Buchanan)
Tor chilinoides (McClelland)
Tor mosal (Hamilton-Buchanan)
Tor progeneius (McClelland)
Tor puitora (Hamilton-Buchanan)
Tor tor (Hamilton-Buchanan)

Subfamily CULTRINAE

Chela cachius (Hamilton-Buchanan)
Chela laubuca (Hamilton-Buchanan)
Salmostoma acinaces (Valenciennes)
Salmostoma bacaila (Hamilton-Buchanan)
Salmostoma phulo (Hamilton-Buchanan)
Salmostoma sardinella (Valenciennes)
Securicula gora (Hamilton-Buchanan)

Subfamily RASBORINAE

? *Amblypharyngodon atkinsonii* (Blyth)
Amblypharyngodon microlepis (Bleeker)
Amblypharyngodon mola (Hamilton-Buchanan)

Aspidoparia jaya (Hamilton-Buchanan)
Aspidoparia morar (Hamilton-Buchanan)
Barilius barila (Hamilton-Buchanan)
Barilius barna (Hamilton-Buchanan)
Barilius bendelisis (Hamilton-Buchanan)
Barilius shacra (Hamilton-Buchanan)
Barilius tileo (Hamilton-Buchanan)
Barilius vagra (Hamilton-Buchanan)
Bengala elanga (Hamilton-Buchanan)
Brachydanio rerio (Hamilton-Buchanan)
Danio aequipinnatus (McClelland)
Danio dangila (Hamilton-Buchanan)
Danio devario (Hamilton-Buchanan)
Esomus danricus (Hamilton-Buchanan)
? *Esomus lineatus* Ahl
Parluciosoma daniconius (Hamilton-Buchanan)
Raiamas bola (Hamilton-Buchanan)
Rasbora rasbora (Hamilton-Buchanan)

Subfamily SCHIZOTHORACINAE
(Snow trouts)

Schizothoraichthys progastus (McClelland)
Schizothorax kumaonensis (Menon)
Schizothorax richardsonii (Gray)

Subfamily GARRINAE

Crossocheilus latius latius (Hamilton-Buchanan)
Garra gotyla (Gray)
Garra lamta (Hamilton-Buchanan)

Family PSILORHYNCHIDAE

Psilorhynchus balitora (Hamilton-Buchanan)
? *Psilorhynchus gracilis* Rainboth
Psilorhynchus sucatio (Hamilton-Buchanan)

Family BALITORIDAE

(Loaches)

Subfamily NEMACHEILINAE

Nemacheilus beavani Gunther*Nemacheilus botia* (Hamilton-Buchanan)*Nemacheilus corica* (Hamilton-Buchanan)*Nemacheilus doonensis* Tilak & Husain*Nemacheilus gangeticus* Menon*Nemacheilus rupecola* (McClelland)*Nemacheilus savona* (Hamilton-Buchanan)

Family COBITIDAE

Subfamily COBITINAE

Lepidocephalus caudofurcatus Tilak & Husain*Lepidocephalus guntea* (Hamilton-Buchanan)

Subfamily BOTIINAE

Botia almorhae Gray*Botia dario* (Hamilton-Buchanan)*Botia dayi* Hora*Botia histrionica* Blyth*Botia lohachata* Chaudhuri*Botia rostrata* Gunther

Order SILURIFORMES

Family BAGRIDAE

(Bagrid catfishes)

Aorichthys aor (Hamilton-Buchanan)*Aorichthys seenghala* (Sykes)*Mystus bleekeri* (Day)*Mystus cavasius* (Hamilton-Buchanan)*Mystus gulio* (Hamilton-Buchanan)*Mystus menoda* (Hamilton-Buchanan)*Mystus tengara* (Hamilton-Buchanan)*Mystus vittatus* (Bloch)

Rama chandramara (Hamilton-Buchanan)

Rita rita (Hamilton-Buchanan)

Family SILURIDAE
(Sheatfishes)

Ompok bimaculatus (Bloch)

Ompok pabda (Hamilton-Buchanan)

Ompok pabo (Hamilton-Buchanan)

Pinniwallago kanpurensis Gupta, Jayaram & Hajela

Wallago attu (Schneider)

Family SCHILBEIDAE
(Schilbid catfishes)

Ailia coila (Hamilton-Buchanan)

Ailia punctata (Day)

Clupisoma garua (Hamilton-Buchanan)

Eutropiichthys murius (Hamilton-Buchanan)

Eutropiichthys vacha (Hamilton-Buchanan)

Pseudeutropius atherinoides (Bloch)

Silonia silondia (Hamilton-Buchanan)

Family PANGASIIDAE

Pangasius pangasius (Hamilton-Buchanan)

Family AMBLYCIPITIDAE
(Torrent catfishes)

Amblyceps mangois (Hamilton-Buchanan)

Family SISORIDAE
(Sisorid catfishes)

Bagarius bagarius (Hamilton-Buchanan)

Bagarius yarrellii Sykes

Conta conta (Hamilton-Buchanan)

Gagata cenia (Hamilton-Buchanan)

Gagata gagata (Hamilton-Buchanan)
Gagata sexualis Tilak
Glyptothorax alaknandi Tilak
Glyptothorax brevipinnis Hora
Glyptothorax cavia (Hamilton-Buchanan)
Glyptothorax dakpathari Tilak & Husain
Glyptothorax garhwali Tilak
Glyptothorax horai Shaw & Shebbeare
Glyptothorax pectinopterus (McClelland)
Glyptothorax telchitta (Hamilton-Buchanan)
Hara hara (Hamilton-Buchanan)
? Hara horai Misra
Hara jerdoni (Day)
Nangra nangra (Hamilton-Buchanan)
Nangra viridescens (Hamilton-Buchanan)
Pseudecheneis sulcatus (McClelland)
Sisor rhabdophorus (Hamilton-Buchanan)

Family CLARIIDAE
 (Airbreathing catfishes)

Clarias batrachus (Linnaeus)

Family HETEROPNEUSTIDAE
 (Airsac catfishes)

Heteropneustes fossilis (Bloch)
Heteropneustes microps (Gunther)

Family CHACIDAE
 (Angler catfishes)

Chaca chaca (Hamilton-Buchanan)

Family ARIIDAE
 (Sea catfishes)

Arius arius (Hamilton-Buchanan)
Arius caelatus Valenciennes

Arius gagora (Hamilton-Buchanan)

Arius platystomus Day

Arius sagor (Hamilton-Buchanan)

Arius sona (Hamilton-Buchanan)

Batrachocephalus mino (Hamilton-Buchanan)

Ilemipimelodus jalius (Hamilton-Buchanan)

Osteogeneiosus militaris (Linnaeus)

Family PLOTOSIDAE

(Eeltail catfishes)

Plotosus canius Hamilton-Buchanan

Plotosus lineatus (Thunberg)

Order AULOPIFORMES

Family HARPADONTIDAE

(Bombay-duck)

Harpadon nehereus (Hamilton-Buchanan)

Order BATRACHOIDIFORMES

Family BATRACHOIDIDAE

(Toadfishes)

Batrachthys grunniens (Linnaeus)

Order CYPRINODONTIFORMES

Family HEMIRAMPHIDAE

(Halfbeaks)

Dermogenys brachynotopterus (Bleeker)

Hyporhamphus limbatus (Valenciennes)

? *Rhynchorhamphus georgii* (Valenciennes)

Zenarchopterus buffonis (Valenciennes)

Zenarchopterus ectuntio (Hamilton-Buchanan)

Zenarchopterus striga (Blyth)

Family BELONIDAE

(Garfishes)

Strongylura leiura (Bleeker)

Strongylura strongylura (van Hasselt)

Xenentodon cancila (Hamilton-Buchanan)

Family ORYZIIDAE

(Ricefishes)

Oryzias melastigma (McClelland)

Family APLOCHEILIDAE

(Rivulines)

Aplocheilus panchax (Hamilton-Buchanan)

Order SYNGNATHIFORMES

Family SYNGNATHIDAE

(Pipefishes)

Hippichthys specifer (Ruppell)

Ichthyocampus earce (Hamilton-Buchanan)

Microphis cuncalus (Hamilton-Buchanan)

Microphis deocata (Hamilton-Buchanan)-

Order SYNBRANCHIFORMES

Family SYNBRANCHIDAE

(Swamps-eels)

Monopterusuchia (Hamilton-Buchanan)

Ophisternon bengalense McClelland

Order SCORPAENIFORMES

Family SYNANCEIIDAE

Minous coccineus (Alcock)

Family PLATYCEPHALIDAE

(Flatheads)

Grammoplites scaber (Linnaeus)

Platycephalus indicus (Linnaeus)

Order PERCIFORMES

Family CENTROPOMIDAE

(Sea-perches)

Lates calcarifer (Bloch)

Family AMBASSIDAE
(Glassfishes)

*Ambassis nalu*a (Hamilton-Buchanan)
Chanda nama Hamilton-Buchanan
Pseudambassis baculis (Hamilton-Buchanan)
Pseudambassis lala (Hamilton-Buchanan)
Pseudambassis ranga (Hamilton-Buchanan)

Family SERRANIDAE

Epinephelus malabaricus (Schneider)

Family TERAPONIDAE
(Tiger-perches)

Terapon jarbua (Forsskal)
Terapon theraps (Cuvier)
Terapon puta (Cuvier)

Family SILLAGINIDAE
(Whitings)

Sillaginopsis panijus (Hamilton-Buchanan)
Sillago sihama (Forsskal)

Family CARANGIDAE
(Kingfishes)

Caranx carangus (Bloch)

Family LEIOGNATHIDAE
(Ponyfishes)

Gazza minuta (Bloch)
Leiognathus blochii (Valenciennes)
Leiognathus equulus (Forsskal)
Secutor ruconius (Hamilton-Buchanan)

Family LUTJANIDAE
(Snappers)

Lutjanus johni (Bloch)

Family LOBOTIDAE
(Tripletails)

Datnioides quadrifasciatus (Sevastianov)

? *Lobotes surinamensis* (Bloch)

Family GERREIDAE
(Mojarras)

Gerreomorpha setifer (Hamilton-Buchanan)

Family HAEMULIDAE
(Grunts)

Pomadasys argenteus (Forsskal)

Family SPARIDAE
(Porgies)

Acanthopagrus latus (Houttuyn)

Family SCIAENIDAE
(Croakers)

Bahaba chaptis (Hamilton-Buchanan)

Daysciaena albida (Cuvier)

Johnieops sina (Cuvier)

Johnius belangerii (Cuvier)

Johnius carutta Bloch

Johnius coitor (Hamilton-Buchanan)

Johnius gangeticus Talwar

Macrospinosa cuja (Hamilton-Buchanan)

Otolithoides biauritus (Cantor)

Pama pama (Hamilton-Buchanan)

Panna heterolepis Trewavas

Panna microdon (Bleeker)

Protonibea diacanthus (Lacepede)

Pterotolithus maculatus (Kuhl & van Hasselt)

Family TOXOTIDAE
(Archers)

Toxotes chatareus (Hamilton-Buchanan)

? *Toxotes jaculator* (Pallas)

Family KYPHOSIDAE

Kyphosus cinerascens (Forsskal)

Family SCATOPHAGIDAE
(Scats)

Scatophagus argus (Bloch)

Family NANDIDAE
(Leaf-fishes)

Badis badis (Hamilton-Buchanan)

Nandus nandus (Hamilton-Buchanan)

Family MUGILIDAE
(Mulletts)

Liza melinoptera (Valenciennes)

Liza parsia (Hamilton-Buchanan)

Liza subviridis (Valenciennes)

Liza tade (Forsskal)

Mugil cephalus Linnaeus

Rhinomugil corsula (Hamilton-Buchanan)

Sicamugil cascasia (Hamilton-Buchanan)

Valamugil buchanani (Bleeker)

Valamugil cunnesius (Valenciennes)

Valamugil speigleri (Bleeker)

Family POLYNEMIDAE
(Threadfins)

Eleutheronema tetradactylum (Shaw)
Polydactylus indicus (Shaw)
Polydactylus sextarius (Bloch)
Polynemus longipectoralis Weber & de Beaufort
Polynemus paradiseus Linnaeus

Family CALLIONYMIDAE
(Dragonets)

Callionymus fluviatilis Day
Callionymus recurvispinis (Li)
Callionymus sagitta (Pallas)

Family GOBIIDAE

Acentrogobius globiceps (Hora)
Acentrogobius viridipunctatus (Valenciennes)
Apocryptes bato (Hamilton-Buchanan)
Apocryptodon madurensis (Bleeker)
Awaouichthys menoni Chatterjee
Awaous gutum (Hamilton-Buchanan)
Bathygobius fuscus (Ruppell)
Boleophthalmus boddarti (Pallas)
Boleophthalmus dussumieri Valenciennes
Brachygobius nunus (Hamilton-Buchanan)
Cryptocentrus gymnocephalus (Bleeker)
Glossogobius biocellatus (Valenciennes)
Glossogobius giuris (Hamilton-Buchanan)
Gobiopsis macrostoma Steindachner
Gobiopterus chuno (Hamilton-Buchanan)
Oligolepis acutipennis (Valenciennes)
Oxudercus dentatus Eydoux & Souleyet
Parachaeturichthys polynema (Bleeker)
Parapocryptes rictuosus (Valenciennes)
Periophthalmodon schlosseri (Pallas)

Periophthalmodon tredecemradiatus (Hamilton-Buchanan)

Periophthalmus koelreuteri (Pallas)

Periophthalmus pearsei Eggert

Periophthalmus weberi Eggert

Pseudapocryptes lanceolatus (Bloch & Schneider)

Scartelaos histophorus (Valenciennes)

Stigmatogobius hoevenii (Bleeker)

Stigmatogobius sadanundio (Hamilton-Buchanan)

Family ELEOTRIDIDAE
(Sleepers)

Butis butis (Hamilton-Buchanan)

Butis melanostigma (Bleeker)

Eleotris fusca (Schneider)

Eleotris lutea Day

Eleotris melanosoma Bleeker

Odonteleotris macrodon (Bleeker)

Ophieleotris aporos (Bleeker)

Ophiocara porocephala (Valenciennes)

Family GOBIOIDIDAE
(Eellike gobies)

Brachyamblyopus urolepis (Bleeker)

Odontamblyopus rubicundus (Hamilton-Buchanan)

Pseudotrypauchen multiradiatus Hardenberg

Taenioides anguillaris (Linnaeus)

Taenioides buchanani (Day)

Taenioides cirratus (Blyth)

Family TRYPAUCHENIDAE
(Burrowing gobies)

Amblyotrypauchen arctocephalus (Alcock)

Ctenotrypauchen microcephalus (Bleeker)

Trypauchen vagina (Bloch & Schneider)

Trypauchenichthys sumatrensis Hardenberg

Family TRICHIURIDAE
(Ribbonfishes)

Lepturacanthus pantului (Gupta)

Trichiurus gangeticus Gupta

Family ANABANTIDAE
(Climbing gouramies)

Anabas cobojius (Hamilton-Buchanan)

Anabas testudineus (Bloch)

Family BELONTIIDAE
(Gouramies)

Colisa fasciatus (Schneider)

Colisa lalia (Hamilton-Buchanan)

Colisa sota (Hamilton-Buchanan)

Family CHANNIDAE
(Snakeheads)

Channa amphibi (McClelland)

Channa barca (Hamilton-Buchanan)

Channa marulius (Hamilton-Buchanan)

Channa orientalis Bloch & Schneider

Channa punctatus (Bloch)

Channa stewartii (Playfair)

Channa striatus (Bloch)

Family MASTACEMBELIDAE
(Spiny-eels)

Macrognathus aral (Bloch)

Macrognathus pancalus Hamilton-Buchanan

Mastacembelus armatus (Lacepede)

Order PLEURONECTIFORMES
Family BOTHIDAE

(Left-eyed flounders)

Pseudorhombus arsius (Hamilton-Buchanan)

Pseudorhombus javanicus (Bleeker)

Family CYNOGLOSSIDAE

(Tongue-Soles)

Cynoglossus cynoglossus Hamilton-Buchanan

Cynoglossus lingua Hamilton-Buchanan

Cynoglossus macrostomus Norman

Cynoglossus puncticeps (Richardson)

Family SOLEIDAE

(Solés)

Euryglossa pan (Hamilton-Buchanan)

Order TETRAODONTIFORMES

Family TETRAODONTIDAE

(Puffers)

Arothron stellatus (Bloch & Schneider)

Chelonodon fluviatilis (Hamilton-Buchanan)

? *Chelonodon nigriviridis* (Proce)

Chelonodon patoca (Hamilton-Buchanan)

Lagocephalus lunaris (Bloch & Schneider)

Takifugu oblongus (Bloch)

Tetraodon cutcutia (Hamilton-Buchanan)