

**Records of the
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**WETLAND FAUNAL RESOURCES OF WEST BENGAL. I.
NORTH AND SOUTH 24-PARGANAS DISTRICTS**

**N. C. NANDI, S. R. DAS, S. BHUINYA
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By

N. C. NANDI, S. R. DAS, S. BHUINYA

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1. INTRODUCTION

Wetlands are transitional areas between aquatic and terrestrial ecosystems. According to International Union for Conservation of Nature and Natural Resources (IUCN) wetlands are defined as "areas of submerged or water saturated land, both natural and artificial, permanent and temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water, the depth of which at low tide does not exceed 6 m." It includes a diverse habitat from flood plains and shallow water bodies to shallow freshwater, brackish-water, estuarine and marine coastal areas.

Interests on Indian wetlands has recently been developed and very little, in deed, is known about faunal resources of wetland ecosystem in India (Biswas, 1974 ; Gopal, 1982 ; Trisal and Zutshi, 1985 ; Fernandes, 1987 ; Ghosh, 1989, 1990 ; Balakrishnan Nair, 1989 ; Anonymous, 1989, Ramakishna, 1990). Information, so far, available on wetlands of West Bengal as well as 24-Parganas district (Ghosh, 1987, 1990 ; Ghosh and Sen, 1987 ; 1988 ; De *et al.*, 1989 ; Ghosh and Chattopadhyay, 1990) is too inadequate to understand their ecological significance, socio-economic relation and conservation values. Realising the importance of wetlands in the ecology of any area the study of wetland faunal resources of West Bengal at the district level has been assigned by the department and the present one dealing with wetlands (faunal resource) of North and South 24-Parganas districts is the humble, beginning from the state of West Bengal.

2. PHYSIOGRAPHY OF THE STUDY AREA

The district 24-Parganas was divided into six Sub-Divisions, namely Bongaon, Barasat, Barrackpore, Basirhat, Sadar (Alipore) and Diamond Harbour. Out of total area of 87,853 sq. km. of the State of West Bengal, the share of 24-Parganas is about 13,796 sq. km. i.e. 15.7 per cent. The corresponding population as per 1981 Census were 54.48 millions and 10.72 millions respectively suggesting that about 20 per cent of the total population of the State is borne by this district.

The erstwhile 24-Parganas district has formally been separated on and from 1st March, 1986 into North 24-Parganas district with Barasat

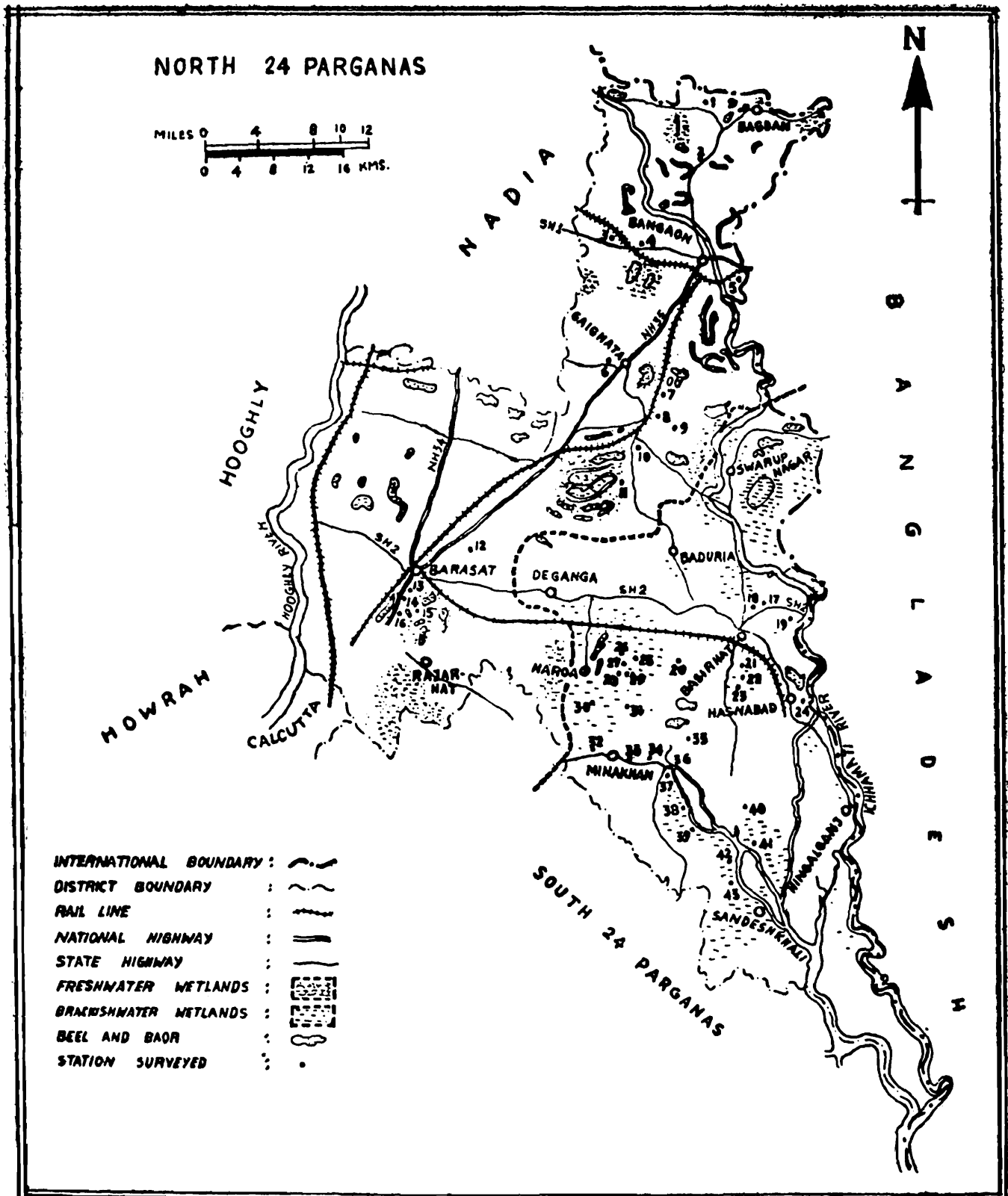


Fig-1

Fig. 1. Map of North 24-Parganas district showing freshwater and brackishwater wetlands and the stations surveyed.

[Stations: 1. Padma beel, 2. Kundipur baor, 3. Akaipur baor 4. Beldanga baor, 5. Dumur baor, 6. Jaleswar baor, 7. Bishnupur beel, 8. Gobardanga pond, 9. Kankan beel, 10. Jamuna jolla, 11. Nagla beel, 12. Phulbagan beel, 13. Makarsa beel, 14. Thakurpukur beel, 15. Badu beel, 16. Itkhola beel, 17. Sangrampur fishery I, 18. Sangrampur fishery II, 19. Dhaltitha beel, 20. Ghona fishery, 21. Bhaba Choumatha fishery, 22. Chaltaberia pond, 23. Noapara pond, 24. Hasnabad fishery, 25. Jangalhati fishery I, 26. Jangalhati fishery II, 27. Jangalhati pond, 28. Gabtala fishery, 29. Majid Khash Balanda pond, 30. Mobarak jalkar, 31. Beel Samity fishery, 32. Ghusighata jalkar, 33. Bamanpukur pond, 34. Minakhan jolla, 35. Malergheri fishery, 36. Kalbari fishery, 37. Mathbari ghery, 38. Dhamakhali ghery 39. Baunia Abad ghery, 40. Jahnabi fishery, 41. Chaker ghery, 42. Dwarik Jangal fishery, 43. Jeলেখali fishery].

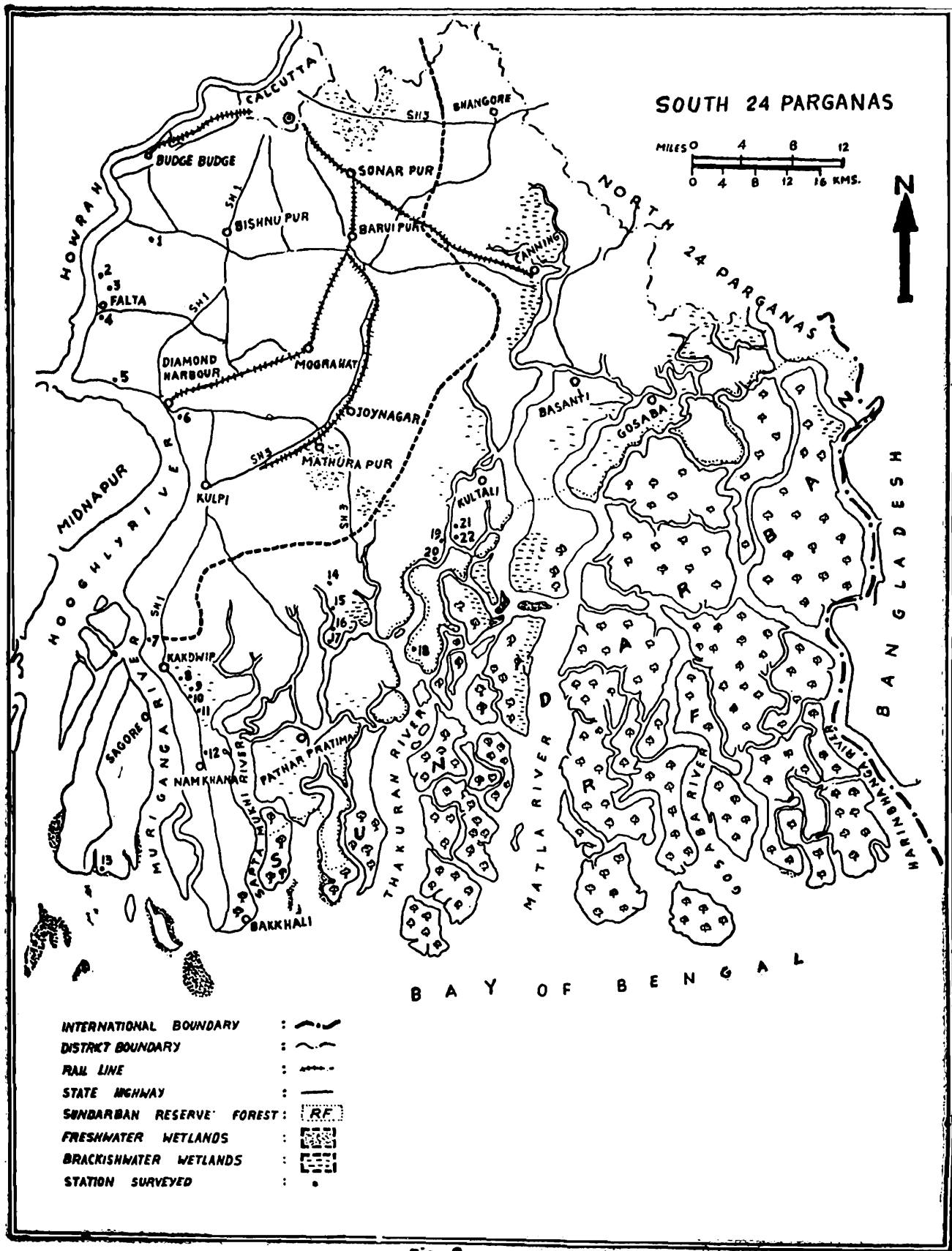


Fig.-2

Fig. 2. Map of South 24-Parganas district showing freshwater and brackishwater wetlands and the stations surveyed.

[Stations : 1. Mamudpur pond, 2. Samsundarpur pond, 3. Apsara jheel, 4. Balsura jheel, 5. Roychnak beel, 6. Kellar jheel, 7. Harwood pond, 8. Kakdwip fishery, 9. Moynapara pond I, 10. Moynapara pond II, 11. Bishalakshmipur pond, 12. Narayanpur pond, 13. Gangasagar beel, 14. Company Thek jolla, 15. Roydighi fishery, 16. Kumarapara fishery, 17. Chhatua fishery, 18. Bhubaneswari fishery, 19. Kholarghery, 20. Sakhi-Abjia jolla, 21. Kundakhali fishery, 22. Moyrerchak fishery].

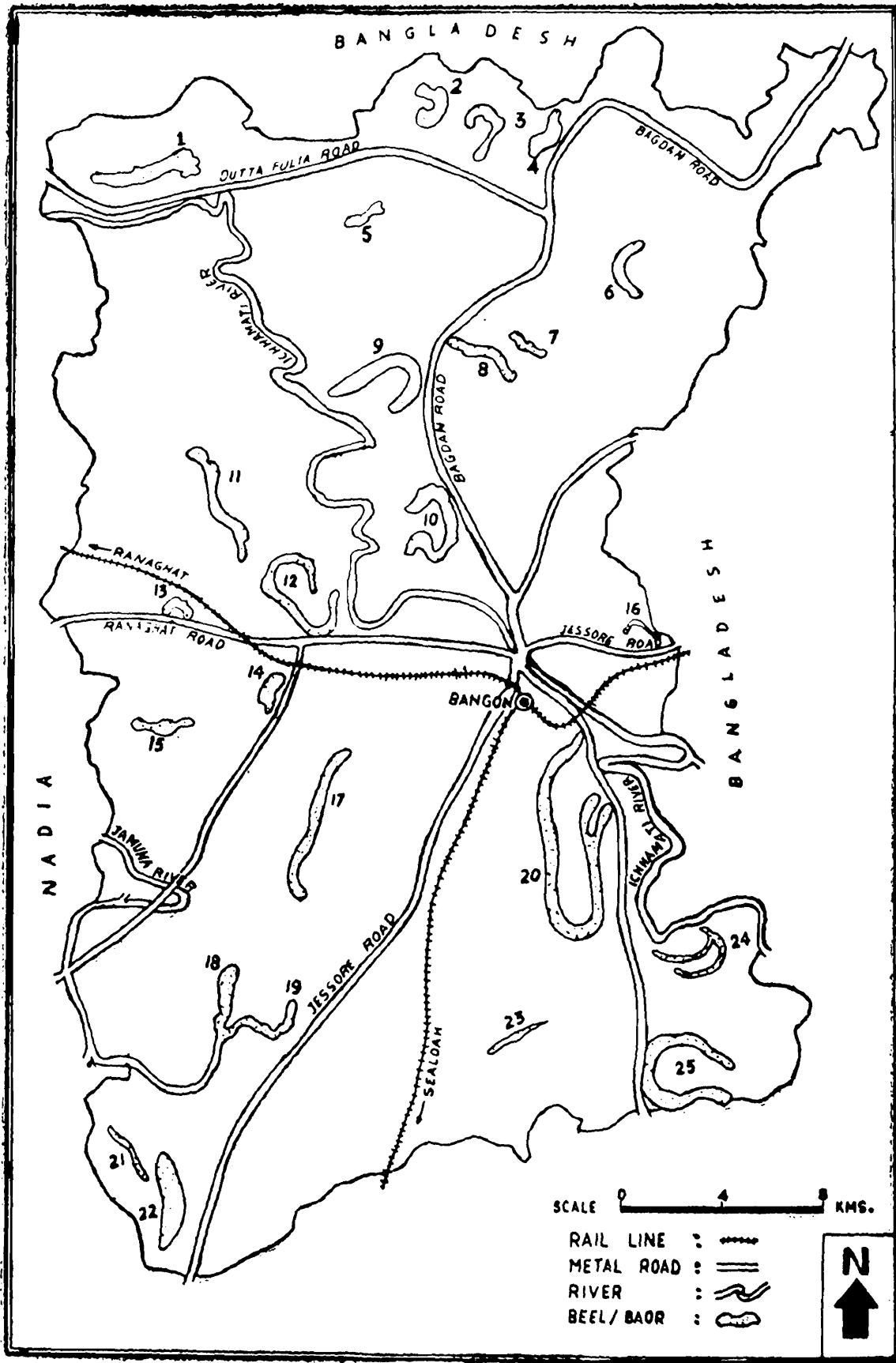


Fig.-3

Fig. 3. Map showing some important beels and baors of Bongaon Subdivision. [Beel/Baor: 1. Ramgarpur baor, 2. Padma beel, 3. Beribari baor, 4. Madhupur baor, 5. Ghatpatila baor, 6. Hamkura baor, 7. Patangi baor, 8. Sundarpur baor, 9. Kundipur baor, 10. Panchita baor, 11. Baliampur baor, 12. Beledanga baor, 13. Akai pur baor, 14. Sanakpur baor, 15. Bhabanipur baor, 16. Petrapole baor, 17. Dharampur baor, 18. Jaleswar baor, 19. Chandigarh baor, 20. Dumur baor, 21. Amankandia baor, 22. Gopalpur baor, 23. Manikhira baor, 24. Tetulbaria baor, 25. Ramnagar baor].

as Headquarter and South 24-Parganas district with Headquarter office located at Alipore (Calcutta) as before. These two districts of West Bengal are located between the latitudes 22° 10' and 23° 15' North and longitudes 88° 15' and 89° 00' East. They are bounded by Hooghly river on the West, Bangladesh in the East, Nadia district in the North and Bay of Bengal in the South (Figs. 1 and 2).

The landmass is formed by alluvial deposits laid down by the river Ganga and its tributaries. The deposition of silt is still continued creating islands and ox-bows which dominate the area under study. The freshwater flood plains, beels and baors (ox-bows), the brackish-water *bheries* (impoundments) and mangrove swamps of these two districts constitute the largest wetland complex in India (Figs. 1-3).

2.1. CLIMATE :

Climatic condition varies seasonally. Monsoon prevails for about four months from mid-June to mid-October with higher humidity. Occasional rains are also encountered throughout the year. July-August are the wettest months with rainfall as high as 390 mm. Humidity annually ranges between 80-90%. Premonsoon period is predominantly dry and warm with occasional thunderstorms while the postmonsoon period is characterised by cold weather with negligible rainfall. The mean maximum temperature is 30°C (June) and the mean minimum temperature is 20°C (December-January).

2.2. SOIL :

Soil of different wetland areas is usually grey to greyish black in colour, silty clay to silty clay loam in texture having high water retentive capacity. In marshy areas silt and clay predominate over sand. In brackishwater *bheries* the *pH* of the surface soil is almost neutral varying between 6.5 and 7.5, while the subsoil is acidic. In general *bheri* soils are poor in nitrogen (14.0-17.8 mg N/100 g) but medium in organic carbon content (0.53-0.69% C) and rich in phosphorus (8.1-12.4 mg P₂ O₅/100 g), while both organic carbon (0.89%) and available nitrogen (19.0 mg N/100 g) were higher in sewage polluted saline *bheries* because of higher organic loads (Saha *et al.*, 1986). In

brackishwater *bheries* salinity of the soil varies with the water salinity which turned into normal during monsoon months.

The brackishwater wetlands are rich in nutrients and favour growth of natural food organisms for crustaceans and fishes.

2.3. VEGETATION :

The aquatic vegetation play a very significant role in retarding eutrophication of any water body and act as sinks for the absorption and release of nutrients and heavy metals. As such the role of any aquatic plant should be adjudged understanding its impact in the ecology of the area concerned. A large number of macrophytes (Fig. 4) have been observed from different wetlands of 24-Parganas district. They are categorised as (i) free floating forms which belong to the genera *Pistia*, *Wolffia*, *Lemna*, *Azolla*, *Ceratopteris*, *Utricularia*, *Salvinia* and *Eichhornia*, and (ii) fixed sedentary forms. This later category includes plants under three groups viz., (a) Emergent hydrophytes such as *Phragmites* and *Typha* (b) Floating leafed hydrophytes, namely, *Nelumbium*, *Nymphaea*, *Nymphoides* and *Ipomoea* and (c) Submerged hydrophytes like *Vallisneria*, *Hydrilla*, *Otella*, *Najas*, *Chara* etc. rooted to bottom. There are some marginal plants (amphibious) capable of growing on moist lands as well as floating on the water surface such as *Jussiaea*, *Ipomoea*, *Enhydra*, *Colocasia*, and *Marsilia quadrifoliata*. Some common marginal rooted hydrophytes are *Nymphoides*, *Potamogeton*, *Aporogeton*, *Trapa*, *Nymphaea*, *Nelumbium*, *Scirpus*, *Eleocharis*, *Chara*, *Nitella*. But there is no clear cut zonation of different groups of aquatic vegetation. In certain area they are seen in abundance and all occurring as intermixed mats. While in some areas *Typha* species occur as continuous patches of monospecific strands. Among these certain species are of economic importance and are widely used in thatching huts etc., while some are edible and are sold in the local markets. Still some others are of considerable importance as fodder for domestic cattles.

In addition to these there are a number of phytoplankters which include unicellular and colonial green algae, diatoms and myxophyceae. The microphytoplanktons are mainly comprised of *Microcystis*, *Chlorella*, *Euglena*, *Anabaena*, *Spirogyra*, *Volvox* etc. in freshwater and brackish-water wetlands.

2.4. WETLANDS PROFILE :

Ecologically, wetlands of 24-Parganas district (North and South) can be categorised as (i) freshwater wetlands and (ii) brackishwater wetlands located near estuary in the coastal region. The freshwater wetlands are rain water reservoirs, flood plains, beels and boars which are characterised with sweet water without any trace of salinity. This type of wetlands are located very close to Calcutta covering Police Stations like Barasat, Barrackpore, Budge Budge, Baruipur, Sonarpur, Habra, Gobardanga, Gaighata, Diamond Harbour, Falta, Bongaon etc., as a whole or in part. The brackishwater wetlands are categorised as saline water bodies viz., bheries, gheries, jalkars, fisheries etc., with salinity varying between 1 ppt and 30 ppt. These brackishwater impoundments are located under P. S. Haroa, Hasnabad, Hingalgunge, Minakhan, Basirhat, Basanti, Canning, Mathurapur, Joynagar, Patharpratima, Sagar, Namkhana, Kakdwip, Kultali, Gosaba, Sandeshkhali etc., and may further be grouped as low saline, medium saline and high saline zones (Saha *et al.*, 1986).

The different hydrological parameters studied and/or reported from these wetland systems (Saha *et al.*, 1986) are summarized in Table 1 as follows :

Table 1. Range of annual values of hydrological parameters from two different types of wetlands.

Hydrological Parameters	Wetland systems	
	Freshwater	Brackishwater
Water depth (m)	0.2-8.5	0.2-1.8
Water temperature (°C)	20.2-32.0	22.3-32.5
pH	6.8-7.8	7.0-8.4
Dissolved oxygen	4.0-6.8	4.1-6.6
Total alkalinity	84-212	90-196
Salinity	0.0-1.0	0.2-15.8

3. LOCATION AND INVENTORY

The location of both freshwater and brackishwater wetlands is shown in Figs 1-3 and Appendix—I & II. The presence or absence of tidal effect in these water bodies and the distance of these wetlands

from the sea or estuaries virtually determine the salinity and lead towards categorization of low, medium and high saline brackishwater wetlands.

During the course of survey an attempt has been made towards inventorisation of the wetlands occurring in these two districts. A perusal of literature reveals the presence of 22,976.96 ha impounded water areas, 14,610.66 ha freshwater beels or baors (Anonymous, 1986) and 1334 brackishwater bheries covering about 32939 ha area (Saha *et al.*, 1986) under North and South 24-Parganas districts. An incomplete list of some these wetlands is given in Appendix—II which may provide some baseline information about the location and ecological categories of the listed wetlands for further specific study. However, almost all the baors (Ox-bows) of Bongaon Sub-Division are shown in Fig. 3.

4. MATERIALS AND METHODS

Field observations and collections have been made from two different types of wetlands of North and South 24-Parganas districts during the years 1988-89 and 1990-91. A total of 65 water bodies comprising of 21 freshwater beels, baors etc., 44 brackishwater bheries, jalkars etc., once in each case (Appendix—I ; Figs, 1 and 2), have been surveyed. A large number of these brackishwater bheries is used for paddy-cum-fish culture (Fig. 5) purposes. Data on some environmental and hydrobiological parameters (Temperature, vegetation, soil, salinity pH etc.) were noted. Collections were made using nets [drag net (Fig. 6), cast net, plankton net (Fig. 7) etc.], and sieves as well as by hand picking. Observations on higher vertebrates viz., mammals, birds, reptiles, and on larger and/or culturable species of amphibians and fishes have been made in the field. Informations on animals, usage of wetlands and common diseases of the people inhabiting close to the wetlands were gathered through observations and local enquires, and filling data sheet as far as possible. The collected specimens were belonged to 9 major groups viz., reptiles, amphibians, fishes, crustaceans, insects, arachnids, molluscs, annelids and planktons. A considerable majority of the specimens were identified by the respective section of this department. However, several other surveys participated by the authors in the recent past were also incorporated in preparing this account.

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- ig. 4. Freshwater wetland of Joynagar infested with a number of macrophytes
ig. 5. Brackishwater wetland of Kultali used for paddy-cum-fish culture.
ig. 6. Collection of wetland fauna (brackishwater) using a drag net.

5. FAUNAL RESOURCE

Wetland fauna are herein considered those animals residing permanently or temporarily in and around water bodies or aquatic ecosystems for food, shelter and/or roosting. Most of them are aquatic and live in water, while some others live on land or trees or both, and depend on the wetlands for fishes and other aquatic organisms as their food. Still, some others are associated with wetlands as marsh dwellers, reed dwellers living/staying on marshes, on ground or vegetation. All these three categories of wetland fauna viz. (i) aquatic, (ii) wetland dependent and (iii) wetland associates are included to have a complete and precise picture of the faunal composition in wetland scenario. But, a large number of still other animals, least depended on wetlands, which may often be found as occasional visitors, ground-dwellers or tree-dwellers, are left out as dryland/terrestrial components. The typical wetland fauna which are habitually found to live or spend a major part of their time as wetland components are incorporated herein as integral part of the ecosystem indicating their status and nature of association with the wetlands (Tables : 2-4 and 7-11). The status is indicated in the tables as follows : A=Abundant ; C=Common ; FC=Fairly Common ; R=Rare.

5.1. VERTEBRATES :

5.1.1. MAMMALS :

Only 3 species of mammals belonging to 3 families viz., the Fishing Cat, *Felis viverrina* Bennett (Family : Felidae), the Bandicoot Rat, *Bandicota indica* (Bechstein) (Family : Muridae) and the Smooth Indian Otter, *Lutra perspicillata* Geoffroy (Family : Mustelidae), all dependents on wetlands for food, have been recorded from freshwater and brackish-water wetlands of North and South 24-Parganas districts. The Fishing Cat is rarely found around brackishwater wetlands of Kakdwip and Kultali areas. The Bandicoot rat is predominant around both freshwater and brackishwater wetlands. They prefer eating both aquatic and land snails. Numerous broken shells of *Pila globosa* were observed around a low saline wetland of Roychak, South 24-Parganas district. They predate also on fishes at night from Raidighi fishery and even seizing snakes from water edges (Nandi, 1984). The Smooth Indian Otter is one of the important species of mammals inhabiting wetlands. They hunt fishes at night and are reported to eat bananas from Barasat (Makarsa beel). Their population is alarmingly reduced from various parts of these two districts, reportedly occurring two-three years ago

from areas like Padma beel (Baneswarpur), Kundakhali (Kultali), Chaltaberia (Basirhat) and Moynapara (Kakdwip). The destruction of suitable habitat appears to be the principal cause for their population decline.

Some other animals like Indian Fox, Small Indian Civet, Small Indian Mongoose and rats which are occasionally associated with wetlands of these two districts, are considered as 'casual' associates. However, the Marsh Mongoose, *Herpestes palustris* Ghose, though described recently as sibling species by Ghose (1965) from Salt Lake areas could not be recognised in the field.

5.1.2. BIRDS :

About 72 species of birds belonging to 16 families have been observed (Table 2). They are comprised of water birds, marsh birds (waders) and some predatory species (wetland dependent), namely, Kites, Kingfishers and owls. The water birds, commonly known as swimmers and divers, mostly belong to five families viz., Podicipitidae, Pelecanidae, Phalacrocoraciidae, Anatidae and Laridae. They primarily prey on fishes and constitute the main waterfowl elements of wetland ecosystems. The marsh birds mainly belong to four families such as Ardeidae, Rallidae, Charadriidae and Ciconidae. They are popularly known as waders and represent greatest diversity in species. The family Charadriidae consists of a wide variety of avifauna which includes lapwing, plover, sandpiper, redshank, greenshank, snipe and stint. However, numerically, winter migrants (Anatidae) always excel all other species put together. During winter, large number of ducks descend on the wetlands every year from September onwards to the mid-March. Big beels and baors as well as brackishwater *bheries* of these two districts have been the favourite wintering resorts for wild anatids over the years.

Water birds viz., cormorants and ducks are gregarious in nature. They occur in thousands and sometimes their population becomes so high that it appears as a thick carpet of birds on the water surface. Such a situation was noticed in a fishery at Jelekhali comprising of species like Lesser Whistling Teal, *Dendrocygna javanica* (Horsfield), Cotton Teal, *Nettapus coromandelianus* (Gmelin), Common Teal, *Anas crecca* Linnaeus, Pintail, *Anas acuta* Linnaeus, Garganey, *Anas querquedula* Linnaeus, Gadwal, *Anas strepera* Linnaeus etc. These migratory birds spend the daytime in the fishery system but fly out in the evening to feed on vegetable and animal matters from the surrounding areas.

It is informed that two guards are employed to drive over 2000 Little Cormorants, *Phalacrocorax niger* (Vieillot) at Jaleshwar fishery during winter. However, in general, water fowl population has declined in recent years.

Some water birds and marsh birds make their nests on trees adjacent to wetlands which attract these birds with an assured food supply and offers suitable and safe nesting sites. The marsh birds like egrets, pond heron, night heron, grey and purple herons, and the Openbill Stork, *Anastomus oscitans* Boddaert wade through the shallow waters or occasionally hunt along dry margins of the water spreads. The population of openbills, an important resident species, is considerable around high saline wetlands.

The birds belonging to the family Laridae is represented by gulls and terns in the North and South 24-Parganas districts. They prey primarily on fishes, prawns, crabs and insects as well as frogs. The avian family Accipitridae is represented by kite, shikra, eagle, osprey and kestrel around wetlands. These birds inhabit in well watered area. They build their nests usually high up on a lofty tree, preferably near water. The Pariah Kite, *Milvus migrans govinda* Sykes is quite common throughout these two districts while the Brahminy Kite *Haliastur indus* (Boddaert) is localised in some freshwater wetlands of Bongaon and Gobardanga. Their population is poorly represented in brackishwater wetlands (Haroa), estuarine and coastal wetlands.

The Kingfishers (Family Alcedinidae) are invariably associated with wetlands. They are represented by four species of which the Whitebreasted Kingfisher *Halcyon smyrnensis fusca* (Boddaert) occurs in abundance around freshwater wetlands. They are mostly resident in the mangrove and feed on fishes, crustaceans and other aquatic organisms using overlying branches of mangroves as observation posts. Unlike accipitrids (kites and eagles) and alcedinids (Kingfishers), the owls (Family Strigidae) are nocturnal birds preying on small mammals, birds, reptiles and even on fishes. These birds also very much depend on wetlands for their food and usually inhabit well watered tracts. It is reported that a species of owl, presumably *Bubo zeylonensis*, is causing much concern to Raidighi Fishery. However, they are well associated with paddy-cum-fishery and the farmers of these districts use to set series of observation posts for owl to allow preying on rats as a rodent control measure.

There are a wide variety of passerine and non-passerine birds living

on ground (Family Phasianidae) or trees (Families Psittacidae, Cuculidae, Apodidae, Coraciidae, Upupidae, Capitonidae, Picidae, Alaudidae, Hirundinidae, Laniidae, Oriolidae, Dicruridae, Artamidae, Sturnidae, Corvidae, Irenidae, Pycnonotidae, Muscicapidae, Motacillidae, Nectarinidae, and Ploceidae) which visit wetland areas, though not exclusively dependent on it.

Birds belonging to the family Muscicapidae abound wetlands not brought under intensive pisciculture. Warblers fill the reeds and bushes around wetlands as associated fauna. However, Wagtails (*Motacilla* spp.) sunbirds (*Nectarina* spp.), Mynas (*Sturnus* spp.), flycatchers (*Muscicapa* spp.) etc., though observed in plenty and assemble around wetlands and marshes in search of insect food, are considered as 'occasional visitors.'

Many of these birds occur during flowering/fruited seasons of the trees associated with wetlands. Some others are found to forage on insects associated with the grasslands adjoining the beels and baors of these two districts especially those wetlands untapped for fishery pursuits.

TABLE 2. List of avifauna recorded in wetlands of North and South 24-Parganas districts, West Bengal (W = waders or marsh birds ; WA = wetland associated birds or reed dwellers ; WB = water birds ; WD = wetland dependent birds for fishes, insects etc ; RB = resident birds ; MB = migratory birds).

Family and Species	Freshwater Wetlands (FW)	Brackishwater Wetlands (BW)	Remarks
Family PODICIPITIDAE			
<i>Podiceps ruficollis capensis</i> Salvadori (Little Grebe)	C	C	RB/WB
Family PELICANIDAE			
<i>Pelecanus philippinus</i> Gmelin (Grey Pelican)	—	C	MB/WB
Family PHALACROCORACIDAE			
<i>Phalacrocorax niger</i> (Vieillot) (Little Cormorant)	A	C	RB/WB
<i>Phalacrocorax fuscicollis</i> Stephens (Indian Shag)	C	FC	RB/WB
<i>Anhinga rufa melanogaster</i> Pennant (Darter, Snake-bird)	C	C	RB/WB
Family Ardeidae			

TABLE 2

(Contd.)

Family and Species	FW	BW	Remarks
<i>Ardea purpurea manilensis</i> Meyen (Eastern Purple Heron)	—	C	RB/W
<i>Ardeola grayii grayii</i> (Sykes) (Indian Pond Heron)	A	C	RB/W
<i>Bubulcus ibis coromandus</i> (Boddaert) (Cattle Egret)	A	C	RB/W
<i>Egretta alba modesta</i> (J. E. Gray) (Eastern Large Egret)	C	C	RB/W
<i>Egretta g. garzetta</i> (Linnaeus) (Little Egret)	A	C	RB/W
<i>Nycticorax n. nycticorax</i> (Linnaeus) (Night Heron)	FC	C	RB/W
<i>Ixobrychus cinnamomeus</i> (Gmelin) (Chestnut Bittern)	C	C	RB/W
<i>Ixobrychus flavicollis</i> (Latham) (Black Bittern)	A	C	RB/W
Family CICONIIDAE			
<i>Anastomus oscitans</i> (Boddaert) (Openbill Stork)	C	C	RB/W
Family ANATIDAE			
<i>Dendrocygna javanica</i> (Horsfield) (Lesser Whistling Teal)	A	A	RB/WB
<i>Tadorna ferruginea</i> (Pallas) (Brahminy Duck)	R	C	MB/WB
<i>Anas acuta</i> (Linnaeus) (Pintail)	FC	A	MB/WB
<i>Anas crecca</i> Linnaeus (Common Teal)	A	C	MB/WB
<i>Anas platyrhynchos</i> Linnaeus (Mallard)	FC	C	MB/WB
<i>Anas querquedula</i> Linnaeus (Garganey)	C	FC	MB/WB
<i>Aythya ferina</i> (Linnaeus) (Common Pochard)	A	FC	MB/WB
<i>Aythya nyroca</i> (Guldenstadt) (White-eyed Pochard)	FC	A	MB/WB

TABLE 2

(Contd.)

Family and Species	FW	BW	Remarks
<i>Aythya fuligula</i> (Linnaeus) (Tufted Duck)	FC	A	MB/WB
<i>Nettapus coromandelianus</i> (Gmelin) (Cotton Teal) Family RALLIDAE	FC	A	RB/WB
<i>Rallus striatus</i> Linnaeus (Banded Rail)	C	A	RB/W
<i>Amaurornis phoenicurus chinensis</i> (Boddaert) (Whitebreasted Waterhen)	A	C	RB/W
<i>Gallicrex cinerea</i> (Gmelin) (Water Cock)	C	C	RB/W
<i>Gallinula chloropus indica</i> Blyth (Indian Moorhen)	C	FC	RB/W
<i>Porphyrio p. poliocephalus</i> (Latham) (Purple Moorhen)	C	C	RB/W
<i>Fulica atra atra</i> Linnaeus (Coot) Family JACANIDAE	C	FC	RB/W
<i>Hydrophasianus chirurgus</i> (Scopoli) (Pheasant-tailed Jacana) Family CHARADRIIDAE	C	FC	RB/WB
<i>Vanellus malabaricus</i> (Boddaert) (Yellow-Wattled Lapwing)	C	FC	RB/W
<i>Pluvialis dominica fulva</i> (Gmelin) (Eastern Golden Plover)	C	C	MB/W
<i>Charadrius dubius</i> Scopoli (Little Ringed Plover)	C	C	MB/W
<i>Numenius arquata orientalis</i> C.L. Brehm (Eastern Curlew)	FC	C	MB/W
<i>Tringa totanus eurhinus</i> (Oberholser) (Redshank)	A	A	MB;W
<i>Tringa nebularia</i> (Gunnerus) (Greenshank)	C	C	MB/W
<i>Tringa stagnatilis</i> (Bechstein) (Marsh Sandpiper)	FC	C	MB/W

TABLE 2

(Contd.)

Family and Species	FW	BW	Remarks
<i>Tringa ochropus</i> Linnaeus (Green Sandpiper)	C	C	MB/W
<i>Tringa glareola</i> Linnaeus (Wood Sandpiper)	A	C	MB/W
<i>Tringa hypoleucos</i> Linnaeus (Common Sandpiper)	FC	FC	MB/W
<i>Gallinago stenura</i> (Bonaparte) (Pintail Snipe)	FC	FC	MB/W
<i>Gallinago gallinago</i> (Linnaeus) (Fantail Snipe)	FC	FC	MB/W
<i>Scolopax rusticola</i> Linnaeus (Woodcock)	FC	—	MB/W
<i>Calidris temminckii</i> (Leisler) (Temminck's Stint)	FC	FC	MB/W
<i>Philomachus pugnax</i> (Linnaeus) (Ruff and Reeve)	C	C	MB/W
<i>Himantopus h. himantopus</i> (Linnaeus) (Blackwinged Stilt)	A	A	MB/W
<i>Rostratula benghalensis</i> (Linnaeus) (Painted Snipe)	C	C	MB/W
Family LARIDAE			
<i>Larus brunnicephalus</i> Jerdon (Brownheaded Gull)	—	C	MB/WB
<i>Chlidonias hybrida indica</i> Stephens (Indian Whiskered Tern)	C	C	RB/WB
<i>Gelochelidon nilotica affinis</i> (Horsfield) (Gullbilled Tern)	FC	FC	RB/WB
<i>Sterna aurantia</i> J.E. Gray (Indian River Tern)	C	C	RB/WB
Family ALCEDINIDAE			
<i>Ceryle rudis leucomelanura</i> (Reichenbach) (Lesser Pied Kingfisher)	C	C	RB/WD
<i>Alcedo atthis bengalensis</i> Gmelin (Common Kingfisher)	C	C	RB/WD
<i>Pelargopsis c. capensis</i> (Storkbilled Kingfisher)	C	C	RB/WD
<i>Halcyon smyrnensis fusca</i> (Boddaert) (Whitebreasted Kingfisher)	A	C	RB/WD
Family ACCIPITRIDAE			

TABLE 2

(Contd.)

Family and Species	FW	BW	Remarks
<i>Haliastur indus</i> (Boddaert) (Brahminy Kite)	A	A	RB/WD
<i>Haliaeetus leucoryphus</i> (Pallas) (Pallas's Fishing Eagle)	C	FC	RB/WD
<i>Ichthyophaga ichthyaetus</i> (Horsfield) (Greyheaded Fishing Eagle)	C	FC	RB/WD
Family FALCONIDAE			
<i>Pandion haliaetus</i> (Linnaeus) (Osprey)	—	R	MB/WD
Family STRIGIDAE			
<i>Bubo zeylonensis leschenaulti</i> (Temminck) (Brown Fish Owl)	C	C	RB/WD
Family MUSCICAPIDAE			
* <i>Cisticola juncidis cursitans</i> (Franklin) (Streaked Fantail Warbler)	FC	C	RB/WA
* <i>Prinia subflava inornata</i> Sykes (Plain Wren-Warbler)	C	C	RB/WA
* <i>Prinia flaviventris flaviventris</i> (Delessert) (Yellowbellied Wren-Warbler)	C	FC	RB/WA
* <i>Locustella certhiola rubescens</i> Blyth (Pallas's Grasshopper Warbler)	—	FC	MB/WA
* <i>Megalurus palustris toklao</i> (Blyth) (Striated Marsh Warbler)	C	FC	MB/WA
* <i>Acrocephalus aedon aedon</i> (Pallas) (Thickbilled Warbler)	FC	FC	MB/WA
* <i>Acrocephalus stentoreus brunnescens</i> (Jerdon) (Indian Great Reed Warbler)	FC	FC	MB/WA
* <i>Acrocephalus orientalis</i> (Temmick & Schlegel) (Eastern Great Reed Warbler)	FC	FC	MB/WA
* <i>Acrocephalus dumetorum</i> Blyth (Blyth's Reed Warbler)	FC	FC	MB/WA
* <i>Acrocephalus agricola agricola</i> Jerdon (Paddyfield Warbler)	FC	FC	MB/WA
Family PLOCEIDAE			
<i>Lonchura punctulata</i> (Linnaeus) (Spotted Munia)	C	C	RB/WA

* Reed dweller

5.1.3. **REPTILES :**

Seven species of reptiles belonging to four families comprising of turtles, lizards and snakes are found to be associated with wetlands (Table 3). Among them *Enhydryis enhydryis* and *Xenochropis piscator* are the commonest aquatic ophidian species occurring in freshwater wetlands. The Checkered Keelback, *X. piscator* was found in abundance particularly in the intensively cultured fishery system of Padma beel, Raidighi fishery etc. The Common Indian Monitor, *Varanus bengalensis*'s (Daudin) (Fig. 8) and the Yellow Monitor, *Varanus flavescens* were occasionally encountered around marshes in search of food at Falta, Barasat, Bongaon, Kakdwip, Kultali and Diamond Harbour areas. A species of poisonous snake, *Naja naja kaouthia* Lacepede is also available around marshes of lower Bengal. Death due to bite of this cobra species is not uncommon.

TABLE 3. List of reptilian fauna recorded from wetlands of North and South 24-Parganas districts.

Family and Species	Freshwater Wetlands	Brackishwater Wetlands	Remarks
Family TRIONYCHIDAE			
<i>Lissemys punctata</i> (Bonaterre)	C	R	Aquatic
Family VARANIDAE			
<i>Varanus bengalensis</i> (Daudin)	C	C	Wetland associate
<i>Varanus flavescens</i> (Gray)	C	C	„
Family COLUBRIDAE			
<i>Enhydryis enhydryis</i> (Schneider) (Smooth Water Snake)	A	A	Aquatic
<i>Xenochropis piscator</i> (Schneider) (Checkered Keelback)	A	A	Aquatic
<i>Cerberus rhynchops</i> (Schneider) (Dog-faced Water Snake)	—	C	Aquatic
Family ELAPIDAE			
<i>Naja naja kaouthia</i> (Lacepede) (Monocellate Cobra)	A	A	Wetland associate

5.1.4. **AMPHIBIANS :**

Six species of toads and frogs, namely, *Bufo melanostictus* Schneider, *Rana tigerina* Daudin, *R. cyanophlyctis* Schneider, *R. hexadactyla* Lesson,

R. limnocharis Wiegmann, *R. crassa* Jerdon, belonging to two families viz., Bufonidae and Ranidae, either aquatic or wetland dependent, abound mostly in and around freshwater wetlands, while the Skipper Frog, *R. cyanophlyctis*, is adapted to brackishwater wetlands as well. The larger species of frogs viz., *R. tigerina* and *R. hexadactyla* were widely caught in early 1980's for the export of frog legs. It was sold at Rs. 1/- to Rs. 2/- per piece in the local markets. But recently steps were taken to stop the wild harvest of frogs as a conservation measure.

5.1.5. FISHES :

Seventy six species of fishes belonging to 28 families have been collected and/or recorded from two different types of wetlands of North and South 24-Parganas districts (Table 4). Of these, about 56 species have been encountered from freshwater wetlands and 73 species from brackishwater wetlands (Table 4) and 53 species of fishes inhabit both the wetland systems indicating their adaptation to varying salinity. *Oreochromis* (= *Tilapia*) species and cyprinid food fishes are cultured in freshwater and brackishwater wetlands.

TABLE 4. List of fish fauna recorded in freshwater and brackishwater wetlands North and South 24-Parganas districts, West Bengal.

Family and Species	Freshwater Wetlands (FW)	Brackishwater Wetlands (BW)
Family ANGUILLIDAE, Freshwater Eels		
<i>Anguilla bengalensis</i> (Gray & Hardwicke)	C	FC
Family OPHICHTHIDAE, Snake Eels		
<i>Pisodonophis boro</i> Hamilton	—	FC
Family NOTOPTERIDAE, Feather back		
<i>Notopterus chitala</i> (Hamilton)	C	—
<i>Notopterus notopterus</i> (Pallas)	FC	—
Family CHANIDAE, Milk fish		
<i>Chanos chanos</i> (Forsk.)	—	R
Family CYPRINIDAE, Carps & Barbs		
<i>Salmostoma bacaila</i> (Hamilton)	F	C
<i>Hypophthalmichthys molitrix</i> (Valenciennes)	A	FC
<i>Esomus danricus</i> (Hamilton)	A	FC
<i>Amblypharyngodon mola</i> (Hamilton)	A	C
<i>Cyprinus carpio</i> Linnaeus	A	C

TABLE 4.

(Contd.)

Family and Species	FW	BW
<i>Puntius sarana</i> (Hamilton)	C	C
<i>Puntius sophore</i> (Hamilton)	A	C
<i>Puntius ticto</i> (Hamilton)	A	C
<i>Puntius gelius</i> (Hamilton)	A	R
<i>Puntius javanicus</i>	C	C
<i>Rasbora daniconius</i> (Hamilton)	C	C
<i>Chela laubuca</i> (Hamilton)	A	C
<i>Labeo bata</i> (Hamilton)	FC	FC
<i>Labeo calbasu</i> (Hamilton)	FC	R
<i>Labeo rohita</i> (Hamilton)	A	FC
<i>Cirrhinus mrigala</i> (Hamilton)	A	FC
<i>Catla catla</i> (Hamilton)	A	FC
<i>Ctenopharyngodon idella</i> (Valenciennes)	FC	C
<i>Lepidocephalus (Lepidocephalichthys) guntea</i>	A	C
Family BAGRIDAE		
<i>Mystus bleekeri</i> (Day)	A	C
<i>Mystus cavasius</i> (Hamilton)	FC	C
<i>Mystus gulio</i> (Hamilton)	R	A
<i>Mystus vittatus</i> (Bloch)	A	C
Family PLOTOSIDAE, Catfish eels		
<i>Plotosus canius</i> Hamilton	—	R
Family SILURIDAE, Sheat fishes		
<i>Ompak bimaculatus</i> (Bloch)	FC	R
<i>Ompak pabda</i> (Hamilton)	FC	R
<i>Wallago attu</i> (Schneider)	FC	R
Family PANGASIIDAE		
<i>Pangasius pangasius</i> (Hamilton)	—	R
Family CLARIIDAE, Air breathing Cat fishes		
<i>Clarias batrachus</i> (Linnaeus)	A	R
Family HETEROPNEUSTIDAE, Stinging Cat fishes		
<i>Heteropneustes fossilis</i> (Bloch)	A	C
Family BELONIDAE, Freshwater Gars		
<i>Strongylura strongylura</i> van Hasselt	—	R
<i>Xenentodon cancila</i> Hamilton	FC	FC
Family CYPRINODONTIDAE, Killi fishes		

TABLE 4.

(Contd.)

Family and Species	FW	BW
<i>Aplocheilus panchax</i> (Hamilton)	A	A
<i>Oryzias melanostigma</i> (Mc Clelland)	A	FC
Family CHANNIDAE, Murrels		
<i>Channa marulius</i> Hamilton	C	R
<i>Channa punctatus</i> (Bloch)	A	FC
<i>Channa striatus</i> (Bloch)	A	C
<i>Channa gachua</i> (Hamilton)	FC	C
Family SYNBRANCHIDAE Swamp eels		
<i>Monopterusuchia</i> (Hamilton)	FC	C
Family THERAPONIDAE, Squeaking perches		
<i>Therapon jarbua</i> (Forsk.)	—	FC
Family POLYNEMIDAE, Thread Fins/Indian Salmon		
<i>Eleutheronema tetradactylum</i> (Shaw)	—	C
Family CENTROPOMIDAE, Giant perches		
<i>Lates calcarifer</i> (Bloch)	—	A
Family CHANDIDAE, Glass fishes		
<i>Chanda nama</i> (Hamilton)	A	A
<i>Chanda ranga</i> (Hamilton)	A	A
Family SCATOPHAGIDAE, Seats or Butter fishes		
<i>Scatophagus argus</i> (Linnaeus)	—	FC
Family MUGILLIDAE, Mulletts		
<i>Mugil cephalus</i> (Linnaeus)	—	C
<i>Rhinomugil corsula</i> (Hamilton)	R	A
<i>Liza macrolepis</i> (Smith)	—	C
<i>Liza parsia</i> (Hamilton)	R	A
<i>Liza tade</i> (Forsk.)	R	A
Family GOBIIDAE, Gobies		
<i>Gobius planiformes</i> (Day)	—	R
<i>Glossogobius giuris</i> (Hamilton)	A	C
<i>Oligolepis acutipinnis</i> (C.V.)	A	C
<i>Boleophthalmus boddarti</i> (Pallas)	—	C
<i>Taenioides cirratus</i> (Blyth)	—	C
<i>Scartelaos histophorus</i> (Val.)	—	C
<i>Odontamblyopus rubicundus</i> (Hamilton)	—	C
<i>Pseudapocryptis lanceolatus</i> (Bloch & Schneider)	—	C
<i>Periophthalmus schlosseri</i> (Pallas)	—	C

TABLE 4.

(Contd.)

Family and Species	FW	BW
<i>Periophthalmus vulgaris</i> (Eggert)	—	C
Family ANABANTIDAE, Climbing perches		
<i>Anabas testudineus</i> (Bloch)	A	C
Family CICHLIDAE		
<i>Etroplus suratensis</i> (Bloch)	—	C
<i>Oreochromis mossambica</i> Peters	A	FC
<i>Oreochromis nilotica</i> Valenciennes	C	C
Family NANDIDAE		
<i>Nandus nandus</i> (Hamilton)	C	C
<i>Badis badis</i> (Hamilton)	A	C
Family BELONTIDAE		
<i>Colisa fasciatus</i> (Schneider)	A	FC
Family MASTACEMBELIDAE, Spiny Eels		
<i>Macrogathus aculeatus</i> (Bloch)	A	C
<i>Mastacembelus armatus</i> (Lacepede)	A	A
<i>Mastacembelus pancalus</i> (Hamilton)	A	C
Family TETRADONTIDAE, Puffer fish		
<i>Tetraodon cutcutia</i> (Hamilton)	C	—

Freshwater fisheries : The freshwater food fishes and their fishery occupy an important position in these two districts. The fishes are mostly belonged to Cypriniformes, Siluriformes, Channiformes, Mastacembelliformes and Osteoglossiformes. The Cypriniformes includes both major and minor carps. The major carps, namely, *Catla catla* (Ham.), *Labeo rohita* (Ham.) and *Cirrhinus mrigala* (Ham.) contribute to more than 80% of the freshwater fish production in these two districts. These species are extensively cultured in freshwater ponds, beels and baors, and the average production in recent years has increased to 150 kg/acre through improved farming practices.

Usually non-predaceous and fast growing fishes are selected for mixed culture, but predaceous murrels (Channiformes) are often raised simultaneously along with other carps including exotic food fishes viz., *Cyprinus carpio* Linnaeus, *Hypothalamichthys molitrix* (Valenciennes), *Ctenopharyngodon idella* (Valenciennes), *Tilapia mossambica* Peters and *Tilapia nyloica* (Valenciennes). Live fishes which include *Clarias batrachus* *Heteropneustes fossilis*, *Anabas testudineus* as well as the murrels occur abundantly in freshwater wetlands, both cultivated and unculti-

vated, and are highly priced in the local markets as well as in Calcutta markets. Two species of Feather Backs viz., *Notopterus chitala* (Ham.) and *N. notopterus* (Pallas) are also common in freshwater system and are well-priced in these markets. The Sheat fishes viz., *Wallago attu* (Schneider), *Ompak bimaculatus* (Bloch) and *Ompak pabda* (Hamilton) are not uncommon in freshwaters. The latter two species are well accepted for fishery purpose, but the former one is not usually wanted by the pisciculturists for their carnivorous habit. However, quite a good number of other species comprising of cat fishes (*Mystus* spp.), eels (*Mastacembelus armatus* (Fig. 9), *M. pancalus* and *Macrognathus aculeatus*); cyprinid fishes (*Puntius* spp. (Fig. 10), *Amblypharyngodon mola* etc. and perches (*Chanda* spp. (Fig. 11), *Nandus nandus*, etc.) are also available in freshwater fisheries. While certain species of small sized fishes (*Esomus danrica* (Fig. 12), *Lepidocephalus guntea*, *Colisa fasciatus* (Fig. 13) *Puntius gelius* (Fig. 14), *Badis badis* (Fig. 15), *Aplochelilus panchax* (Fig. 16), *Salmostoma bacaila* (Fig. 17) are found to breed in confined waters. They are not so important in fishery point of view, but they are more or less abundantly available in uncultivated beels, paddy fields and nallahs. One species of puffer-fish viz., *Tetraodon cutcutia* Ham. (Fig. 18) is also encountered in some baors of Bongaon.

Though a good number of beels and baors out of a total of 14,610.66 ha. of such area under 24-Parganas district (Anonymous, 1986) are brought under intensive culture through fishermen cooperative societies, there are considerable number of such freshwater systems which remain uncultivated or ill-tapped for fishery. Special efforts are needed to take up pisciculture in such water bodies so that the fishermen, fishery entrepreneurs and fish eaters of lower Bengal may be benefited.

Sewage-fed fisheries; In North and South 24-Parganas districts of West Bengal, the Calcutta city sewage is being extensively utilized for fishery purposes. It is led to Bidyadhari River which passes through Bidyadhari spill area where sewage water is let in for profitable pisciculture pursuits.

Because of the abundance of nutrient elements, the sewage-fed fisheries are very rich in planktonic fish food organisms and are, therefore, highly productive. There are about 176 sewage-fed fisheries comprising of 4082.96 ha (Table 5) which produce 12,800 tonnes of fish annually (Anonymous, 1986).

Bidyadhari spill area was earlier used as brackishwater fisheries. The system of feeding sewage was initiated since 1947. The tidal effect in

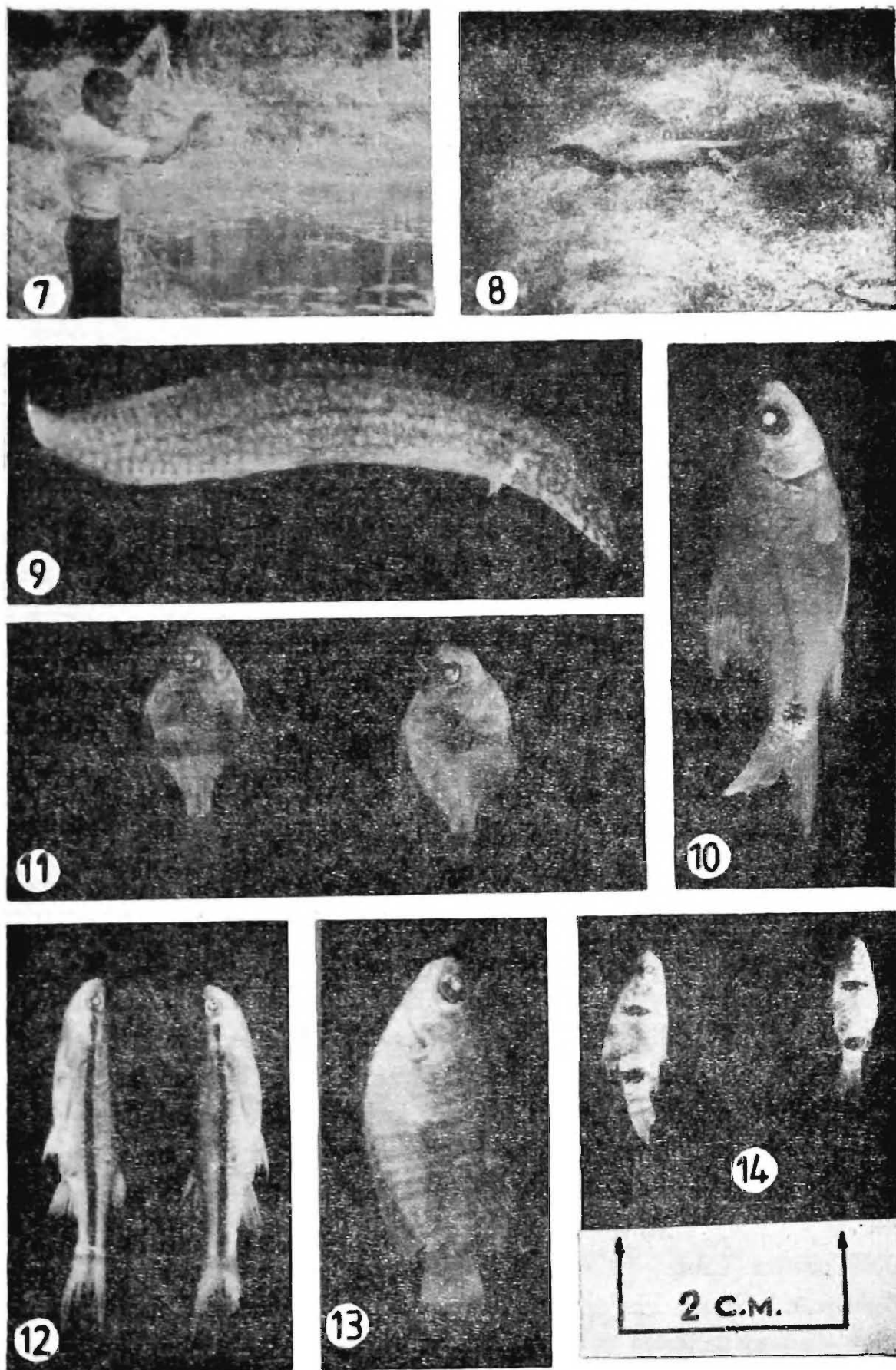


Fig. 7. Collection of plankton specimens using a plankton net from a freshwater wetland at Barasat. Figs. 8-14. Some common wetland fauna (reptile and fishes, of North and South 24-Parganas districts). Fig. 8. *Varanus bengalensis* Fig. 9. *Mastacembelus armatus* Fig. 10. *Puntius sophore* Fig. 11. *Chanda ranga* (left) and *Chanda nama* (right) Fig. 12. *Esomus danricus* Fig. 13. *Colisa fasciatus* Fig. 14. *Puntius gelius*

TABLE 5. Sewage-fed-fisheries of 24-Parganas district, West Bengal.

Name of the Police Station	Area (in heactares)
Tiljala	657.22
Sonarapur	532.47
Salt Lake	1359.58
Bhangar	885.92
Others (Small fisheries)	647.77
Total	4,082.96

Source : The Directorate of Fisheries, Govt. of West Bengal (Anonymous, 1986).

these bheries had been ceased prior to independence due to silting up of the Bidyadhari river and as a result erstwhile brackishwater bheries have been converted into sewage-fed fishery. The fishes, namely, Indian major carps, exotic carps, and tilapias are mainly cultured though several other species available in freshwater are also commonly raised in these fisheries. However, these fisheries are prone to pollution from various sources. About 11,516 number of licensed sources of contaminants are connected to Calcutta sewage system (Anonymous, 1986). Therefore, treatment of sewage water for fishery and evolving technology of optimum production of fish in such fisheries is essential.

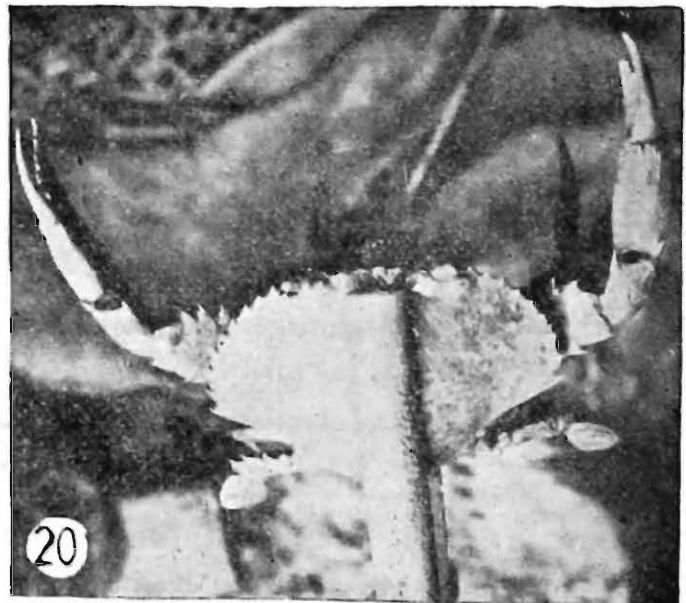
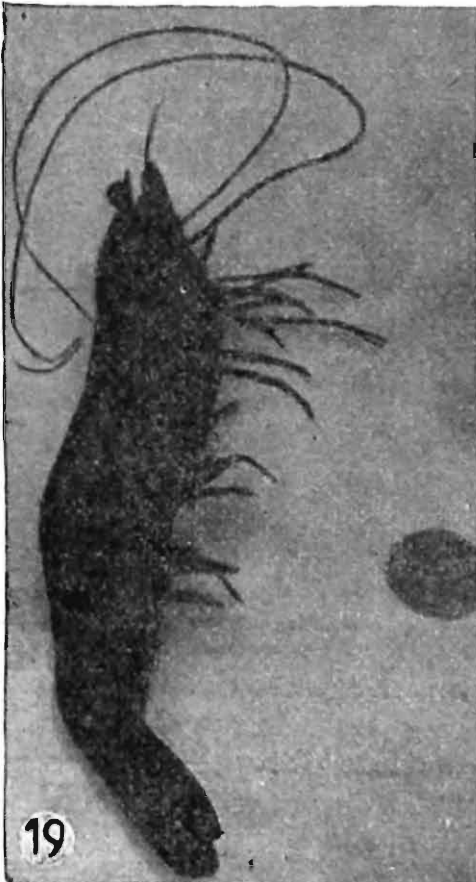
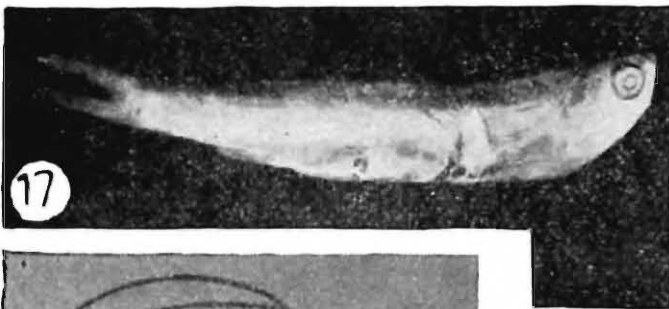
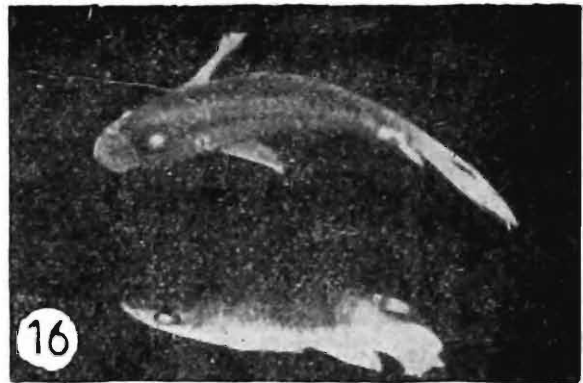
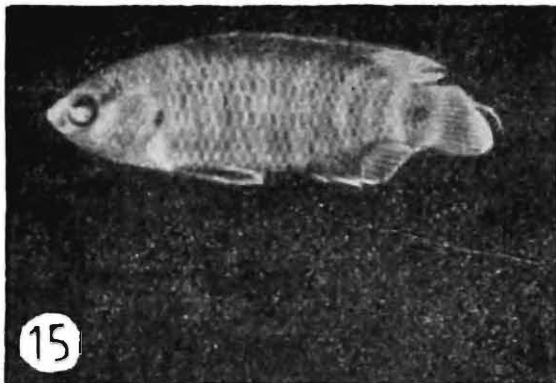
Brackishwater fisheries : These fisheries are located in both the districts. Saha *et al.* (1986) categorised these fisheries into low saline (below 10 ppt), medium saline (10-20 ppt) and high saline (above 20 ppt) water bodies. They vary in salinity depending on their distance from the sea. Low saline fisheries/*bheries* are located in the North 24-Parganas district under Barasat, Swarupnagar, Deyganga, Rajarhat and Baduria police stations. Besides Indian major carps, tilapia fishes are extensively cultured along with Bagda prawn (*Penaeus monodon*, Fig. 19) and parse (*Liza parsia*). Paddy is grown from July to November along with freshwater fishes. In North 24-Parganas district, 23,887.09 ha (Table—6) of such 'paddy-cum-fisheries' are in existence, while in the South 24-Parganas district about 2.10 lakh ha of potential brackishwater fisheries are available with relatively high salinity and greater tidal amplitude (Anonymous, 1986). The average production from low saline brackishwater wetlands was estimated at about 878 kg/ha/yr including 70 kg/ha/yr. of Bagda prawn production. Estimated total annual production of fishes and prawns in this zone is about 8641 t including that of *P. monodon* 690 t (Saha *et al.*, 1986).

Table 6. Paddy-cum-fisheries/brackishwater fisheries of North and South 24-Parganas districts, West Bengal.

Name of the District and Police Stations	Area (in hectares)
NORTH 24-PARGANAS	
1. Haroa	7,384.00
2. Sandeshkhali	3,552.89
3. Basirhat	2,417.88
4. Minakhan	1,961.68
5. Hasnabad	2,112.03
6. Rajarhat	650.61
7. Barasat	2,146.16
8. Deganga	416.96
9. Gaighata	148.99
10. Hingalgunje	205.04
11. Swarupnagar	56.84
12. Baduria	2,834.01
Total	23,887.01
SOUTH 24-PARGANAS	
13. Gosaba	126.95
14. Basanti, Canning, Kultali, Kulpi, Namkhana, Sagar, Patharpratima & Mathurapur	2,429.15
Total	2,556.10
Grand Total	26,443.19

Source : The Directorate of Fisheries, Govt. of West Bengal (Anonymous, 1986).

Medium saline *bheries* (10-20 ppt) are also located in the North 24-Parganas district under Haroa, Minakhan, Hasnabad, Basirhat and Hingalgunge Police Stations. This zone has saline sewage-fed *bheries* at Minakhan P. S. The type of fishes and prawn grown in these wetlands are similar to those in low saline wetlands, though various species of freshwater fishes belonging to Cypriniformes (*Puntius* spp.), Siluriformes (*Mystus*, *Clarias*, *Heteropneustes*), Channiformes (*Channa* spp.) Mastacembeliformes (*Mastacembelus* spp.) and Perciformes (*Badis*, *Colisa*, *Chanda* and *Nandus* etc.) are also quite common in these



FIGS. 15-20. Some common wetland fauna (fishes and crustaceans) of North and South 24-Parganas districts. Fig. 15. *Badis badis* Fig. 16. *Aplocheilus punchax* Fig. 17. *Salmostoma bacaila* Fig. 18. *Tetraodon cutcutia* Fig. 19. *Penaeus monodon* Fig. 20. *Scylla serrata*

fisheries. The average production of fishes and prawns is about 749 kg/ha/yr. which includes a prawn production of about 214 kg/ha/yr. Estimated annual production of this zone about 11692 t of which *P. monodon* contributes about 749 kg/ha/yr. (Saha *et al.*, 1986).

High saline *bheries* are located under Canning, Mathurapur, Joynagar, Patharpratima, Basanti, Kultali, Kakdwip, Kulpi, Namkhana and Sagar Police Stations of South 24-Parganas district and in Sandeshkhali P.S. of North 24-Parganas district. Brackishwater fishes, namely, *Liza parsia*, *L. tade*, *Lates calcarifer*, *Eleutheronema tetradactylum*, *Mystus* spp., *Etioplos suratensis* etc. and prawns viz., *Penaeus monodon*, *Metapenaeus monoceros*, *M. brevicornis* are usually reared. The average production is 964 kg/ha/yr. Estimated total annual production from this zone is about 5185 t of which *P. monodon* accounts for about 625 t (12%) (Saha *et al.*, 1986).

5.2. INVERTEBRATES :

The aquatic invertebrate fauna dominate the wetland habitats in number of species and in individuals. They inhabit various biotopes in large communities. A good number of species are commercially important of which the crustaceans, the prawns and the crabs, determine the economy of this region to a greater extent.

5.2.1. DECAPOD CRUSTACEANS (Figs. 19-22)

Crustaceans abound brackishwater wetlands and comprise commercially important crustaceans along with other non-commercial macrocrustaceans mainly belonging to the order Decapoda under subclass Malacostraca. There are about 9 species of decapod macrurans comprising of the major and minor prawn fishery resources of this region and 6 species representing brachyuran crabs of commercial value (Table—7).

The commercial prawns are usually categorized as penaeid prawn (Family Penaeidae) and non-penaeid species (Families Atyidae, Palaemonidae Sergestidae). The prawn fisheries of brackishwater *bheries* are of paramount importance in respect of production and export. The highly priced Tiger prawn *Penaeus monodon* Fabricius (Fig. 19), extensively cultured in brackishwater *bheries*, is considered as the 'living dollars' of this region. *P. monodon* attains a length of about 20 cm and weighing over 100 gm. While prawns of the genus *Metapenaeus* are slightly smaller in size but often occur in abundance than those of *Penaeus*. *Metapenaeus monoceros* and *M. brevicornis* are

available in appreciable quantities in brackishwater wetlands and are quite suitable for culture in paddy-cum-fisheries. These two species are found in abundance during monsoon months.

Table 7. List of decapod crustaceans recorded in freshwater and brackishwater wetlands of North and South 24-Parganas districts, West Bengal.

Family and Species	Freshwater Wetlands	Brackishwater Wetlands
Order DECAPODA		
Suborder MACRURA		
Family PALAEMONIDAE		
<i>Palaemon styliferus</i> Milne Edwards	—	A
<i>Macrobrachium rosenbergii</i> (de Man)	C	C
<i>Macrobrachium rude</i> (Heller)	C	C
Family PENAEIDAE		
<i>Penaeus monodon</i> Fabricius	—	A
<i>Penaeus indicus</i> Milne Edwards	—	FC
<i>Metapenaeus brevicornis</i> (Milne Edwards)	—	A
<i>Metapenaeus monoceros</i> (Fabricius)	—	A
Family SERGESTIDAE		
<i>Acetes indicus</i> Milne Edwards	—	C
Family ATYIDAE		
<i>Caridina gracilipes</i> (de Man)	A	—
Family GRAPSIDAE		
<i>Sesarma bidens</i> (de Haan)	—	R
<i>Sesarma tetragonum</i> Fabricius	—	C
<i>Varuna litterata</i> (Fabricius)	C	A
Family PORTUNIDAE		
<i>Scylla serrata</i> (Forsk.)	R	A
Family POTAMONIDAE		
<i>Paratelphusa spinigera</i> Wood-Mason	FC	C
<i>Paratelphusa hydrodromus</i> Herbst	C	C

The non-penaeid prawns belonging to families Palaemonidae and Sergestidae are fairly common in these two districts. Majority of them are smaller in size but the freshwater species *Macrobrachium rosenbergii* are large sized and are highly priced in the local markets. This species is also cultured in low saline *bheries* and is used as an item of export. *Palaemon styliferus* is abundantly available in brackishwaters.

The brachyuran crabs abound both fresh and brackishwaters. Among the brachyuran species, *Scylla serrata* (Fig. 20) is extensively used as food and is sold in the local as well as Calcutta markets. A large section of people inhabiting Sundarban is engaged in catching and selling this crab species. The brackishwater crab, *Varuna litterata* (Fig. 21), is also sold in the local markets in large numbers particularly during May-June months. While the freshwater species *Sartoriana* (= *Paratelphusa*) *spinigena* (Fig. 22) is fairly available in the local markets for local consumers mainly during monsoon months (July-September).

5.2.2. INSECTS :

The insects constitute one of the major faunal component of wetland ecosystems. They play a very vital role in the trophic structure of freshwater wetlands in converting plant food into animal protein of insectivorous animals in the ecosystem. They also play a significant role as consumers of organic wastes in the freshwater habitats and even serve as a source of natural food for fishes. But they are known to compete for food with the fingerlings sharing the same habitat and often cause much damage to hatchery. Therefore, they are considered crucial in the ecology and management of wetland ecosystems. Though they are a diversified group comprising about eleven orders which are known to spend at least a part of their life cycle in water, only water bugs and water beetles inhabit the water throughout their lives. Orthopteran insects [Grasshoppers viz., *Oxya fuscovittata* (Marsch) and *Attractomorpha crenulata* (Fabr.)] are associated with weeds at the water edge. However, only four insect orders viz., Hemiptera, Coleoptera, Odonata and Diptera are reported briefly hereunder.

Order Hemiptera (Figs. 23-24) : Twenty one species belonging to 6 different families have been recorded from freshwater and brackish-water wetlands (Table—8). They are commonly known as water bugs (Belostomidae), water scorpions (Nepidae), water back swimmers (Notonectidae), water boatmen (Corixidae) and pond skaters (Gerridae). The belostomid bugs, namely, *Lethocerus indicus* and *Sphaerodema* species (Fig. 23) are large, dorsoventrally subflattened insects with short antennae and short rostrum. They are highly predaceous and feed on a wide variety of aquatic organisms including small fishes and frogs. The nepids belonging to the genera *Laccotrephes* and *Ranatra*, are also predaceous in their habit and devour any aquatic organism that they could capture. The nepid species are distinguished by their chelate forelegs and long, slender, caudal appendages. The members

Table 8. List of Hemiptera fauna recorded in freshwater and brackishwater wetlands of North and South 24-Parganas districts, West Bengal.

Family and Species	Freshwater Wetlands	Brackishwater Wetlands
Family GERRIDAE		
<i>Gerris spinolae</i> Leth. & Serv.	FC	—
<i>Gerris</i> sp.	FC	—
<i>Limongonus fossarum</i> (Fabr.)	FC	C
<i>Limnogonus nitidus</i> (Mayer)	C	—
<i>Limnogonus parvulus</i> (Stal)	C	—
<i>Limongonus</i> sp.	C	—
<i>Rhagadotarsus kraepelini</i> Breddin	C	—
Family CORIXIDAE		
<i>Corixa</i> sp.	C	C
<i>Micronecta</i> sp.	C	C
Family NOTONECTIDAE		
<i>Anisops breddini</i> Krikaldy	C	C
<i>Anisops bouvieri</i> Krikaldy	FC	—
<i>Anisops sardea</i> Herrich-Shaffen	C	—
Family NEPIDAE		
<i>Ranatra filiformis</i> (Fabricius)	C	—
<i>Ranatra sordidula</i> Dohrn	C	C
<i>Laccotrephes griseus</i> (Guerin)	C	C
<i>Laccotrephes</i> sp.	C	—
Family BELOSTOMIDAE		
<i>Sphaerodema annulatum</i> (Fabricius)	FC	R
<i>Sphaerodema molestum</i> Dufour	C	—
<i>Sphaerodema</i> sp.	C	—
<i>Lethocercus indicum</i> (Lepel and Serv.)		
Family MESOVELIIDAE		
<i>Mesovelia vittigere</i> Horvath	—	C

of these two families occur abundantly in fallow freshwater beels than in the brackishwater systems. While the species belonging to Notonectidae, Corixidae and Gerridae predominate the freshwater fishery systems. The pond skater, *Gerris spinolae* (Fig. 24), one of the long, slender species among gerrids, are found in abundance in Padma beel. However, *Anisops* (Notonectidae) species abound both freshwater and low saline wetlands. They are known to damage fish fry and cause much concern in the management of fisheries.

Order Coleoptera : The coleopteran insects or beetle living in aquatic or wetland habitats mainly belong to five families viz., Dytiscidae, Hydrophilidae, Gyrinidae, Chrysomelidae and Curculionidae. They are either predaceous or omnivorous in habit with well developed mouth parts. Their legs are somewhat flattened to suit swimming in water. So far, 27 species of beetles have been recorded from these freshwater and brackishwater wetlands in the present investigation (Table—9). Of these, majority belong to Dytiscidae and Hydrophilidae.

TABLE 9. List of Coleoptera fauna recorded in freshwater and brackishwater wetlands of North and South 24-Parganas districts, West Bengal.

Family and Species	Freshwater Wetlands	Brackishwater Wetlands
Family DYTISCIDAE		
<i>Canthyrus lactabilis</i> (Walker)	FC	C
<i>Canthyrus luctuosus</i> (Aube)	FC	C
<i>Canthyrus morsbachi</i> (Wel.)	C	—
<i>Cybister limbatus</i> (Fabricius)	C	—
<i>Cybister tripunctatus asiaticus</i> Sharp	C	—
<i>Hydrovatus castaneus</i> Motschulsky	C	—
<i>Hydrovatus bonvouloiri</i> Sharp	C	—
<i>Hydrovatus</i> sp.	C	—
<i>Laccophilus anticatus</i> Sharp	C	—
<i>Laccophilus parvulus</i> Aube	C	—
<i>Laccophilus</i> sp.	C	—
<i>Hydrocoptus subvittulus</i> (Mots.)	C	—
<i>Hydrocoptus</i> sp.	—	C

TABLE 9.

(Contd.)

Family and Species	FW	BW
<i>Hypoporus bengalensis</i> Severin	C	—
<i>Hydaticus fabricii</i> Mac Leay	C	—
<i>Eretes sticticus</i> (Linnaeus)	C	—
<i>Guignotus flammulatus</i> (Sharp)	C	—
<i>Guignotus</i> sp.	C	—
Family HYDROPHILIDAE		
<i>Hydrophilus olivaceus</i> (Fabricius)	FC	—
<i>Sternolophus rufipes</i> (Fabricius)	C	—
<i>Berosus indicus</i> Motschulsky	C	—
<i>Regimbertia attenuata</i> Fabricius	C	—
<i>Helochares</i> sp.	—	C
<i>Globaria</i> sp.	—	C
Family GYRINIDAE		
<i>Dineutes indicus</i> Aube	C	—
Family CHRYSOMELIDAE		
<i>Cassida</i> sp.	C	—
Family CURCULIONIDAE		
<i>Bagous</i> sp.	C	—

Dytiscids are predaceous diving beetles which feed on adults and larvae of other aquatic insects, worms, snails, shrimp etc. While the hydrophilids are scavenger beetle eating on aquatic plants and animals both. These beetles are well represented in freshwater habitats than the brackishwater bheries. But the whirligig beetles (Gyrinidae), leaf beetles (Chrysomelidae) and weevils (Curculionidae) are either skim on water surface or associated with aquatic vegetation and are, in general, ill represented in wetlands. The species belonging to the genera *Canthydrus*, *Hydrocoptus*, *Hydrovatus* (Dytiscidae) and *Berosus*, *Regimbertia*, *Sternolophus* (Hydrophilidae) are more or less common in freshwater wetlands.

Order Odonata : Both dragonflies (Suborder Anisoptera) and damselflies (Suborder Zygoptera) lay their eggs in water or in mud along the water edge. Their larval (nymphs or naiads) are entirely dependent on wetlands. The adults of these flies abound wetland

areas, flying from submarginal plants to plants as well as among floating vegetation. The nymphs feed on a variety of aquatic insects, molluscs, crustaceans and algae and in turn serve themselves as food for carnivorous fishes. They are found in abundance in both freshwater beels and brackishwater *bheries*. Dragonfly nymphs are distinguished by their short and stout body, narrower head and small spine-like projections surrounding the anal opening, while the damselfly nymphs are diagnosed by their delicate and slender body, broad head and lack of any spine-like structure surrounding the anus. A large number of these larvae were collected from different wetlands but they could not be specifically identified. They mainly belong to the family Libellulidae (dragonfly) and Coenagrionidae (damselfly). The adult odonates were abundantly encountered around brackishwater wetlands of Bakkhali, Baunia Abad, Frasergunje areas. Seven species were identified as follows: *Ischnura elegans* (Family Coenagrionidae); *Brachythemis contaminata*, *Diplocodes trivialis*, *Pantala flavescens*, *Tramea basilaris burmesteri*, *Trithemis pallidinervis* and *Urothemis signata signata*.

Order Diptera : The larval stages (larvae and nymphs) of dipteran insects are quite common in freshwater, brackishwater and sewage-fed fisheries. It includes mosquitoes (Culicidae), midges (Tendipedidae), houseflies (Muscidae) tabanids (Tabanidae) and Chironomids (Chironomidae). The identification of these larval stages have not been attempted.

5.2.3. ARACHNIDS :

So far 8 species of spiders belonging to 3 families viz., Lycosidae, Tetragnathidae and Salticidae have been recorded. These species were collected from weeds associated with wetlands. The lycosid spiders belonging to the genera *Pardosa* (*P. birmanica*, *P. annandalei*, *P. sp.*), *Hippasa* and *Lycosa* (*L. lambai*) are found abundantly around wetlands. They are wolf spiders which chase and hunt their prey. The tetragnathid spiders, viz., *Tetragnatha andamanensis* and *Tetragnatha sp.* are fairly common spiders near the vicinity of water. They are long, cylindrical spiders with long projecting maxillae and usually with very long and toothed chelicera in male. The jumping spiders *Zygoballus sp.* (Salticidae) is also not uncommon.

5.2.4. ANNELIDS :

Three species of earth-worms [*Perionyx excavatus* (Perrier), *Metaphire posthuma* (Vaillant) and *Lamprito mauritii* Kinber] and five species of

leeches [*Hemiclepsis marginata* Muller, *Halobdella nociva* Harding, *Herpobdelloidea lateroculata* Kaburaki, *Glossiphonia weberi* Blanchard and *Hirudo* sp.] have been recorded from freshwater wetlands. A species of land leech, *Haemadipsa sylvestris* Blanchard is also encountered at Phulbagan beel, Barasat.

5.2.5. MOLLUSCS (Figs. 25-27) :

Molluscs are one of the most conspicuous wetland fauna in West Bengal. The wetlands of these two districts are specially highly productive in this respect. Both the types of wetlands abound molluscs. Majority of them are gastropods, while some are bivalves. The gastropod molluscs are mostly mud dwellers, either crawl on the substratum or live inside their burrows. Bivalves are primarily burrowers and occur in abundance in some freshwater wetlands.

A total of 21 species of molluscs have been collected of which 12 species are found in freshwater wetlands and 13 species in brackish-water bodies and 3 species in both (Table—10). Of the 21 species of molluscs 19 species are gastropods and 2 species are bivalves. The gastropod molluscs are remarkably rich in uncultivated or semi-cultivated freshwater wetlands. The population density of freshwater mussel, *Lamellidens marginalis* is also appreciably high in some freshwater ponds. The flesh of *Lamellidens* species is sold at local markets as well as in Calcutta. Recently this freshwater species has appeared in the newspapers for the presence of pearls in them (Raut and Biswas, 1989). The Directorate of Fisheries, Govt. of West Bengal, has taken much interests in mussel culture now-a-days.

TABLE 10. List of Mollusca fauna recorded in freshwater and brackishwater wetlands of North and South 24-Parganas districts, West Bengal.

Family and Species	Freshwater Wetlands	Brackishwater Wetlands
MOLLUSCA : GASTROPODA		
Family NERITIDAE		
<i>Neritina smithi</i> Wood	—	C
<i>Neritina violacea</i> (Gmelin)	—	C
<i>Septaria caerulea</i> (Sowerby)	—	C
Family ASSIMINEIDAE		
<i>Assiminea francissiae</i> (Gray)	—	C

TABLE 10

(Contd.)

Famimily and Species	FW	BW
Family THIARIDAE		
<i>Thiara tuberculata</i> (Muller)	—	A
<i>Thiara lineata</i> Gray	—	C
<i>Thiara granifera</i> (Lamarck)	—	C
Family VIVIPARIDAE		
<i>Bellamya bengalensis</i> (Lamarck)	A	C
<i>Bellamya dissimilis</i> (Muller)	R	—
Family PILIDAE		
<i>Pila globosa</i> (Swainson)	A	C
Family BITHYNIIDAE		
<i>Gabbia orcula</i> Frauenfeld	R	—
<i>Digoniostoma cerameopoma</i> (Benson)	FC	—
<i>Digoniostoma pulchella</i> (Benson)	R	—
Family ONCHIDAE		
<i>Onchidium typhae</i> Puchamon	—	R
Family PLANORBIDAE		
<i>Indoplanorbis exustus</i> (Deshayes)	A	C
<i>Gyraulus convexiusculus</i> (Hutton)	A	—
Family LYMNAEIDAE		
<i>Lymnaea luteola</i> Lamarck	A	C
<i>Lymnaea acuminata</i> Lamarck	C	—
Family VERONICELLIDAE		
<i>Laevicaulis alte</i> (Ferussac)	C	—
MOLLUSCA : BIVALVIA		
Family UNIONIDAE		
<i>Lamellidens marginallis</i> (Lamarck)	A	—
Family MYTILIDAE		
<i>Modiolus striatulus</i> (Hanley)	—	C

The gastropod molluscs viz., *Indoplanorbis exustus*, *Pila globosa* (Fig. 25) *Gyraulus convexiusculus*, *Thiara* (Fig. 26), *Bellamya* and *Lymnaea*

species are the most common and predominate the freshwater wetlands. The flesh of *Pila* and *Bellamya* species is sold at Calcutta markets. A species of slug, *Onchidium typhae* Puchamon (Fig. 27) was rarely observed at Kellar jheel, Diamond Harbour. Another species of slug, *Laevicaulis alte* (Ferrusac) was common in freshwater wetlands.

5.2.6. PLANKTONS :

A total of 23 species of planktons belonging to 9 families comprising of Cladocera (9 species), Ostracoda (1 species), Copepoda (10 species) and Rotifera (3 species) have been collected (Table—11) with the help of a plankton net of 25 meshes/cm fitted on a circular brass ring of 95 cm diameter. These plankters were collected from 14 freshwater beels/baors and 16 brackishwater bodies usually in shallow open water and among aquatic vegetations close to the shores at different depths for qualitative study. Six out of the 9 species of Cladocera occur in both freshwater and brackishwater wetlands. Two species viz., *Diaphanosoma excisum* and *D. sarsi* are considered to be tropicopolitan and eurytropic species being available in abundance in both freshwater and brackishwater habitats. While *Moinodaphnia macleayii* is recorded in a freshwater beel and *Cypris* sp. (Ostracoda) in a brackishwater bhery.

Table 11. List of species of Planktons recorded in freshwater and brackishwater wetlands of North and South 24-Parganas districts, West Bengal.

Group and Species	Freshwater wetlands	Brackishwater wetlands
CLADOCERA		
<i>Pseudosida bidentata</i> Herrick	++	+
<i>Diaphanosoma excisum</i> Sars	+++	+++
<i>Diaphanosoma sarsi</i> Richard	++	+++
<i>Daphnia lumholtzi</i> Sars	+	++
<i>Ceriodaphnia cornuta</i> Sars	—	++
<i>Moina micrura</i> Kurz	++	+
<i>Moinodaphnia macleayii</i> King	+	—
<i>Alona pulchella</i> King	—	++
<i>Alona</i> sp.	+	++

TABLE 11

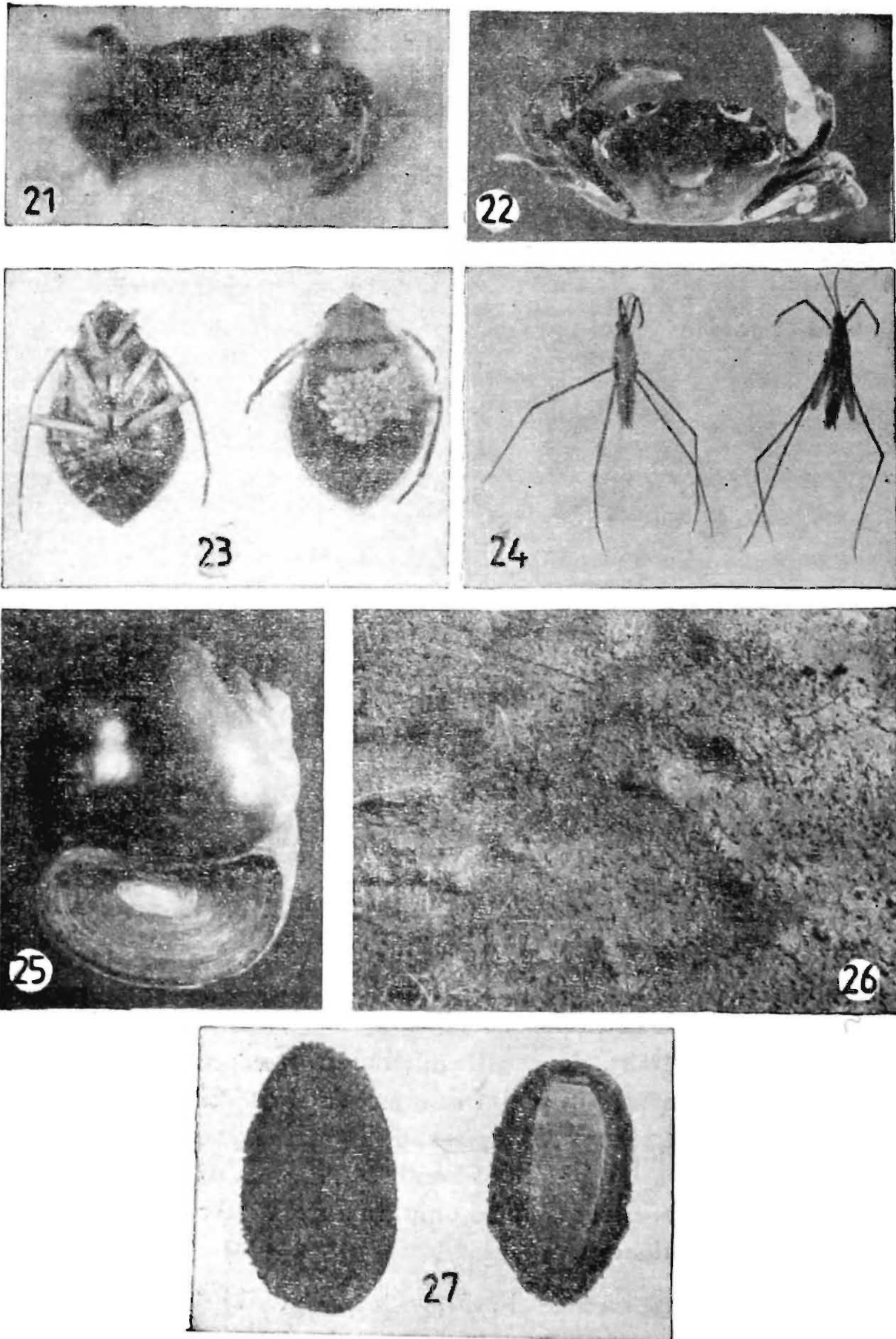
(Contd.)

Group and Species	FW	BW
OSTRACODA		
<i>Cypris</i> sp.	-	++
COPEPODA		
<i>Rhinediaptomus indicus</i> Kiefer	++	+
<i>Diaptomus neonates</i>	-	+
<i>Diaptomus</i> sp.	++	+++
<i>Heliodiaptomus viduus</i> Gurney	+++	++
<i>Spicodiaptomus chelospinus</i> Rajenduan	-	+
<i>Paradiaptomus greeni</i> Gurney	-	+
<i>Phyllodiaptomus anae</i> Apstein	+	-
<i>Mesocyclops hyalinus</i> Rehberg	+++	++
<i>Mesocyclops leuckarti</i> (Claus)	++	+
<i>Mesocyclops</i> sp.	++	+++
ROTIFERA		
<i>Branchionus falcatus</i> Bar	++	+
<i>Branchionus calyciflorus</i> Pallas	+	-
<i>Asplancha</i> sp.	+	+

+++ = Abundant ; ++ = Fairly common ; + common

So far 10 species of Copepoda have been collected and identified from these two districts. Among them all the three species of cyclopoid copepods are represented in both freshwater and brackishwater wetlands. However, *Spicodiaptomus chelospinus* and *Paradiaptomus greeni* are available only in brackishwaters of South 24-Parganas district. Likewise, *Phyllodiaptomus anae* is represented only in a freshwater beel of Falta, South 24-Parganas district.

Rotifera are represented by 3 species only. Their occurrence in brackishwater is very meagre. Besides these, a species of mysid viz. *Mesopodopsis orientalis* Tattersall, an amphipod, *Quadrivisio bengalensis* Stebbing and a brine shrimp, *Artemia salina* L. are also found in brackishwater wetlands. A species of green hydra is also found in a freshwater pond.



Figs. 21-27. Some common wetland fauna (crabs, insects and molluscs) of North and South 24-Parganas districts

Fig. 21. *Varuna litterata* Fig. 22. *Paratelphusa spinigera* Fig. 23. *Sphaerodema annulatum*
 Fig. 24. *Gerris spinolae* Fig. 25. *Pila globosa* Fig. 26. *Thiara* sp. Fig. 27. *Onchidium typhe*

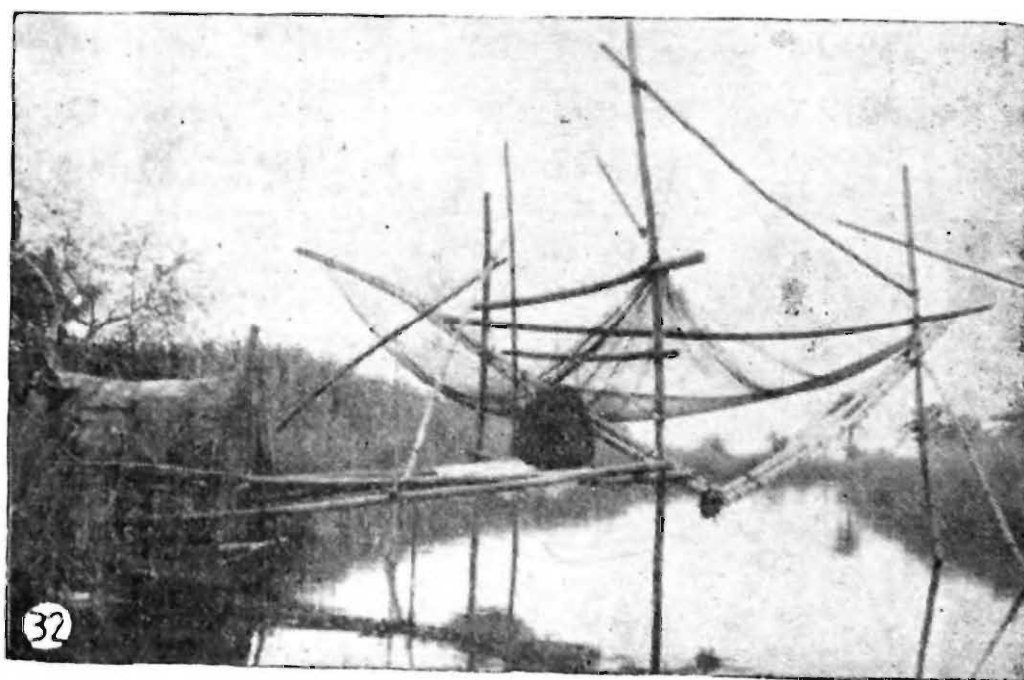
6. SOCIO-ECONOMIC ASPECTS

The usages of the wetlands of 24-Parganas district are manifold (Figs. 28-32). Besides pisciculture (Table 12) or paddy-cum-fish culture, wetlands are widely used for reed gathering, bathing, brick-making, jute-retting (Fig-28) and disposal of factory wastes. It also provides a source of drinking water for domestic animals.

TABLE 12. Economics of fish production from Akaipur baor, North 24-Parganas district.

Year	Liberation of fry and fingerlings		Production of fishes	
	Quantity (Kg.)	Value (Rs.)	Quantity (Kg.)	Value (Rs.)
1980-81	2190	29829	79699	779980
1981-82	1361	20674	14657	164170
1982-83	2523	31500	12415	146355
1983-84	5350	83599	6847	84374
1984-85	2474	34987	23854	328328
1985-86	2374	33573	19421	234820
1986-87	1950	53398	13415	152940
1987-88	1950	21827	31110	453621
1988-89	2165	47127	21776	270124

- Note* :
1. Total area—165 acres, water area—125 acres, water depth—1.5—3.5 m, pH—7.0—7.8.
 2. Introducing periods of fry and fingerlings—thrice a year (April—May, June—July and September—October).
 3. Harvesting season—thrice a year (August—September, October—November and January—February).
 4. Species of fishes grown—*Catla catla*, *Labeo rohita*, *Cirrhinus mrigala*, *Cyprinus carpio*, *Heteropneustes fossilis*, *Clarius batrachus* etc.
 5. Average growth of major carps : In August—September (200—500 gm), October—November (300—750 gm) and January—February (200—400 gm).



Figs. 28-32. Showing some usages of North and South 24-Parganas wetlands viz. jute-retting (Fig. 28), fishing by hand net (Fig. 29), fishing by hook (Fig. 30), cattle (buffalo) bathing (Fig. 31) and fishing by net (Fig. 32).

The brackishwater bheries with an waterspread of about 33,000 ha under these two districts play a very prominent role in the economy of this region. Estimated total production of fish and prawn from *bheries* is about 25518 t per annum with an average annual production of 775 kg/ha from a *bheri*. The production of Tiger prawn *P. monodon* is about 4664 t per annum with an average production of 142 kg/ha (Saha *et al.*, 1986). Economics of *bheri* fishery worked out by Saha *et al.*, 1986 indicates a net profit of Rs. 10,713/- per hectare with a capital turn over of about 174% in the low saline *bheries*. Mention may be made that several thousands fishermen earn their livelihood in culturing fishes and prawns from these wetlands. It also uplifts the socio-economic condition of fishermen community. The economics of fish production from an ox-bow lake (Akaipur baor) is shown in Table 12.

7. DISCUSSION

While wetlands have been conserved, and managed with great care for their economic and aesthetic values in developed countries of the temperate regions their importance has not yet been understood, appreciated or assessed in tropical areas, especially in India (Balakrishnan Nair, 1989). This is true for wetlands existing in North and South 24-Parganas districts.

Biologically wetlands are among the richest and most productive ecosystems. Typically wetlands in these two districts consist of freshwater ponds, beels and baors and brackishwater bheries, gheries, jalkars and paddy-cum-fisheries. These freshwater and brackishwater wetlands are the richest and most fertile floral and faunal zones occurring in this part of lower Bengal. The number of species representing the different group of fauna (Tables : 2-4 and 7-11) exhibits excellence in animal diversity in these two districts. It includes typically 3 species of mammals, 72 species of birds, 7 species of reptiles, 6 species of amphibians, 76 species of fishes, 15 species of decapod crustaceans, 55 species of insects (Hemiptera, Coleoptera and Odonata), 8 species of arachnids (Spiders), 9 species of annelids, 21 species of molluscs, 23 species of planktons and some minor groups (4 species).

Researches on fishery, and hydrobiology etc., have been carried out by Saha *et al.*, (1986) from some brackishwater wetlands. Their researches relate to productivity and pisciculture. Researches on faunal resources of specific wetlands in Calcutta and neighbouring 24-Parganas district are those of De *et al.*, (1989), Ghosh (1990) and Ghosh and

Chattopadhyay (1990). However, multidisciplinary investigations on wetlands and environmental impact assessment studies are needed to understand the biogeoecological values of these wetlands *vis-a-vis* land use and developmental programme.

Wetlands are now considered as important prerequisites for a balanced ecosystem. But being close to Calcutta, the wetlands of these two districts are much affected due to land-filling for human habitation. The progressive siltation of wetlands has increasingly interfered with normal drainage cycle of the area. Population pressure and agricultural activities have overshadowed the conservation considerations and environmental necessities of these wetlands. Since indiscriminate conversion of wetlands for agriculture, human habitation, discharge of factory effluents and sewage disposal have adversely affected various wetlands of North and South 24-Parganas districts, it is felt that a complete understanding of the multidisciplinary problems pertaining to productivity, hydrobiology, ecology, socio-economy, soil fertility, conservation and management needs may create environment for all-round development.

8. SUMMARY

A total of 65 wetlands comprising of 21 freshwater beels, baors, ponds etc., and 44 brackishwater bheries, jalkars, paddy-cum-fisheries etc., have been surveyed, once in each case, from North and South 24-Parganas districts, West Bengal during the year 1988-89 and 1990-91. It has been observed that these two districts are rich in wetlands as well as faunal diversity. Out of 11 major groups comprising of 295 species observed, majority of them are aquatic and wetland dependent for their food, while some are associated with wetlands as marsh dwellers or reed dwellers. These major groups include 3 species of mammals, 72 species of birds, 7 species of reptiles, 6 species of amphibians, 76 species of fishes, 15 species of decapod crustaceans, 55 species of insects, 8 species of arachnids, 9 species of annelids, 21 species of molluscs and 23 species of planktons. Of these 295 species, 242 (82%) species occur in freshwater wetlands, and 231 (78%) species in brackishwater wetlands. Insect fauna are found to predominate in freshwater wetlands (92%) than the brackishwater wetlands (29%). About 60% of the total identified species are found to exist in both fresh and brackishwater wetlands. The fishery resources, usages as well as socio-economic aspects of these wetlands have been discussed. An inventory of wetlands above 50 acres is appended,

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11. APPENDIX—I

List of major and minor wetlands surveyed from North and South 24-Parganas districts

Sl No.	Name of the wetland (Number indicated in Fig. 1 & 2)	Name of the nearest village/ town	Approximate area (acres)	Ecological category
1	2	3	4	5
NORTH 24-PARGANAS DISTRICT (Fig. 1)				
A. Major wetlands (Above 50 acres)				
1.	Padma beel (1)	Kulia	118.37	Freshwater
2.	Kundipur baor (2)	Garapota	350.0	„
3.	Akaipur baor (3)	Akaipur	165.0	„
4.	Beledanga baor (4)	Gopalnagar	175.0	„
5.	Dumur baor (5)	Naradah	359.55	„
6.	Jaleshwar baor (6)	Gaighata	119.36	„
7.	Kankan baor (9)	Gabardanga	210.0	„
8.	Nagla beel (11)	Kumra Kashipur	200.0	„
9.	Ghona fishery (20)	Ghona	206.0	Brackishwater
10.	Gabtala fishery (28)	Haroa	400.0	„
11.	Dwarik Jangal fishery(42)	Dwarik Jangal	148.5	„
12.	Jeleshkhal fishery (43)	Sandeshkhali	231.0	„
B. Medium sized wetlands (1-50 acres)				
13.	Bishnupur beel (7)	Gobardanga	2.54	Freshwater
14.	Jamuna jolla (10)	„	1.15	„
15.	Phulbagan beel (12)	Chhota Jagulia	1.62	„
16.	Makarsa beel (13)	Madhyamgram	19.1	„
17.	Thakurpukur beel (14)	„	7.50	„
18.	Badu beel (15)	Madhyamgram	17.66	„
19.	Itkhola beel (16)	Gangangar	1.35	„
20.	Sangrampur fishery (I) (17)	Basirhat	29.70	Brackishwater
21.	Sangrampur fishery (II) (18)	„	15.0	„
22.	Dhaltitha beel (19)	„	1.5	„
23.	Bhabe Choumatha fishery (21)	„	25.0	„
24.	Chaltaberia pond (22)	„	1.32	„

APPENDIX—I contd.

1	2	3	4	5
25.	Hasnabad fishery (24)	Hasnabad	5.0	Brackishwater
26.	Jangalhati fishery I (25)	Haroa	20.0	„
27.	Jangalhati fishery II (26)	Haroa	17.1	„
28.	Mobarak jalkar (30)	Haroa	2.31	„
29.	Beel Samity fishery (31)	Haroa	3.50	„
30.	Ghusighata jalkar (32)	Ghusighata	2.65	„
31.	Minakhan jolla (34)	Minakhan	5.00	„
32.	Malergheri fishery (35)	Chaitalghat	1.0	„
33.	Kalbari fishery (36)	Malancha	2.5	„
34.	Mathbari ghery (37)	„	3.30	„
35.	Dhamakhali ghery (36)	Dhamakhali	3.76	„
36.	Baunia Abad ghery (39)	Baunia Abad	15.51	„
37.	Jahnabi fishery (40)	Nazat	49.5	„
38.	Chaker ghery (41)	Nazat	42.9	„
C. Minor wetlands (below 1 acre)				
39.	Gobardanga pond (8)	Gobardanga	0.25	„
40.	Noapara pond (23)	Basirhat	0.30	Brackishwater
41.	Jangalhati pond (27)	Haroa	0.66	„
42.	Majid Khash Balanda pond (29)	„	0.50	„
43.	Bamanpukur pond (33)	Minakhan	0.30	„
SOUTH 24-PARGANAS DISTRICT (Fig. 2)				
A. Major wetlands (Above 50 acres)				
44.	Chhatua fishery (17)	Roydighi	60.0	„
45.	Sakhi-Abjia jolla (20)	Jamtala	—	„
B. Medium sized wetlands (1-50 acres)				
46.	Balsura jheel (4)	Falta	18.15	Freshwater
47.	Roychak beel (5)	Roychak	1.25	„
48.	Kellar jheel (6)	Diamond Harbour	24.75	Brackishwater
49.	Company Thek jolla (14)	Roydighi	3.0	„
50.	Roydighi fishery (15)	„	15.0	„
51.	Bhubaneswari fishery (18)	Bhubaneswari	17.0	„
52.	Kundakhali fishery (21)	Kultali	1.50	„
53.	Moyrarchk fishery (22)	„	0.50	„

APPENDIX—I contd.

1	2	3	4	5
C. Minor wetlands (below 1 acre)				
54.	Mamudpur pond (1)	Mallikpur	0.30	Freshwater
55.	Samsundarpur pond (2)	Falta	0.50	Freshwater
56.	Apsara jheel (3)	Falta	0.85	„
57.	Harwood pond (7)	Kakdwip	0.25	Barckishwater
58.	Kakdwip fishery (8)	Kakdwip	0.33	„
59.	Moynapara pond I (9)	Kakdwip	0.40	„
60.	Moynapara pond II (10)	Kakdwip	0.33	„
61.	Bishalakshmipur pond (11)	Budhakhali	0.90	„
62.	Narayanpur pond (12)	Namkhana	0.70	„
63.	Gangasagar beel (13)	Sagar Island	0.50	„
64.	Kumrapara fishery (16)	Roydighi	0.37	„
65.	Kholar ghery (19)	Jamtala	0.45	„

N. B. The geographical coordinates of the wetlands have not been included as these are within the district limit.

APPENDIX—II

Inventory of wetlands above 50 acres of North and South 24-parganas districts.

Sl. No.	Name of the wetland	Name of the nearest village/town	Approximate area (Acres)	Ecological category
NORTH 24-PARGANAS : A. Natural wetlands				
1. BAORS				
1.	Ramgarpur baor	Chak Mandalbhag	175.0	Freshwater
2.	Berbari baor/ Purdah baor	Berbari	135.38	„
3.	Ghatpatila baor	Kumarkho	100.0	„
4.	Hamkura baor	Kola, Bagdaha	72.94	„
5.	Patangi baor	Patsimulia	50.0	„
6.	Sundarpur baor	Sundarpur	150.0	„
7.	Kundipur baor	Garapota	350.0	„
8.	Panchita baor	Panchita, Nakful	294.0	„
9.	Balirampur baor	Ambikapur	330.0	„
10.	Beledanga baor	Gopalnagar	167.0	„

APPENDIX—II contd.

1	2	3	4	5
11.	Akaipur baor	Akaipur	165.0	Freshwater
12.	Angrail baor	Angrail	193.86	,,
13.	Sanakpur baor	Nischintapur	100.0	,,
14.	Bhabanipur baor	Dighari	110.0	,,
15.	Dharampur baor	Dharampur	400.0	,,
16.	Jaleshwar baor	Gaighata	119.36	,,
	(Beel Chandania baor)			
17.	Chandigarh baor	Gaighata	120.0	,,
18.	Dumur baor/	Naradah	359.55	,,
	Dooma-Barnaberia baor			
19.	Ramnagar baor	Panchoota	400.0	,,
20.	Petrapole baor	Petrapole	86.8	,,
21.	Tentulbaria baor	Raghunandanpur	300.0	,,
22.	Manikhira baor	Huda	100.0	,,
23.	Gopalpur baor	Gopalpur	160.0	,,
24.	Amankandia baor	Maraldanga	110.0	,,
25.	Madhupur baor	Bagdaha	120.0	,,
26.	Kankan baor	Media, Gobardanga	210.0	,,
27.	Chamta baor	Bayspur	66.42	,,
28.	Narayanpur Berir baor	Panchpota	408.29	,,
29.	Sarapole baor	Swarupnagar	80.0	,,
30.	Chakkantaleia baor	Jagadishpur	50.0	,,
2. BEELS				
31.	Padma beel	Kulia	118.37	,,
32.	Bithari beel	Hakimpur	115.0	,,
33.	Purba Palta beel	Ghola	90.0	,,
34.	Nalbara beel	Ghola	110.0	,,
35.	Chandipur beel	Swarupnagar	125.0	,,
36.	Sise beel	Habra	150.0	,,
37.	Ghoba beel	Daulatpur	120.0	,,
38.	Kachua beel	Habra	110.0	,,
39.	Bhaluka beel	Majhipara	125.0	,,
40.	Mathura beel	Kampa, Kanchrapara	500.0	,,
41.	Borti beel	Barrackpore	800.0	,,

APPENDIX—II contd.

S1. No.	Name of the wetland	Name of the nearest village/town	Approximate area (Acres)	Ecological category
42.	Nagla beel	Kumra Kashipur	200.0	Freshwater
43.	Baykar beel	Kumra Kashipur	180.0	„
44.	Bejon beel	Begampur	100.0	„
45.	Kuruleia beel	Hatkuruleia	50.0	„
46.	Buranir beel	Baneshwarpur	840.0	„
47.	Baisa beel	Bangon	—	„
48.	Phulsura beel	Phulsura	—	„
49.	Belta Beel	Belta	—	„
50.	Chandpara beel	Chandpara	—	„
51.	Chamardah beel	Gopalnagar	68.0	„
52.	Mendia beel	Srikrishnapur	100.0	„
53.	Panchilbaria beel	Gopalpur	—	Brackishwater
54.	Bali beel	Swarupnagar	—	„
55.	Dhirer beel	Baduria	—	„
56.	Puter beel	Barasat	—	„
B. Natural-cum-man made fisheries				
57.	Goberia Abad bhery	Haroa	500.0	Brackishwater
58.	Tentulia Abad bhery	Tentulia	—	„
59.	Khatra Abad ghery	Gopalpur	—	„
60.	Munshi ghery	Haroa	—	„
61.	Beel Baba Chandi	Matigachha	740.0	„
62.	Samity ghery	Nazat	198.1	„
63.	Pantamari ghery	Pantamari	135.3	„
64.	Kanmari ghery	Kanmari	726.0	„
65.	Sandeshkhali 8 No. ghery	Sandeshkhali	264.0	„
66.	Sandeshkhali 9 No. ghery	Sandeshkhali	297.0	„
67.	Sikari ghery No. I	Nazat	183.0	„
68.	Sikari ghery No. II	Nazat	126.0	„
69.	Sikari ghery No. III	Nazat	66.0	„
70.	Baunia Abad ghery	Nazat	—	„
71.	Khariberia ghery	Khariberia	—	„
72.	Nimtala ghery	Hasnabad	—	„
73.	Sangrampur ghery	Basirhat	—	„
74.	Bhave Choumatha	Bhave Choumatha ghery	—	„
75.	Tushkhali jalkar	Tushkhali	330.0	„

1	2	3	4	5
76.	Jeলেখালি জালকাৰ	Sandeshkhali	231.0	Brackishwater
77.	Nazat jalkar No. II	Nazat	148.5	„
78.	Nazat jalkar No. III	Nazat	151.8	„
79.	Kunikhali jalkar	Sandeshkhali	107.25	„
80.	Mahamaya jalkar	Nazat	82.5	„
81.	Sahebkhali jalkar	Nazat	181.5	„
82.	Sikari jalkar	Nazat	330.0	„
83.	625 Bigha jalkar	Ghona	206.0	„
84.	Bhanga Tushkhali jalkar	Bhanga Tuskhali	165.6	„
85.	Bholakhali jalkar	Sandeshkhali	115.0	„
86.	Krishna Gapal fishery	Dwarik Jangal	148.0	„
87.	Kalimata fishery	Nazat	198.0	„
88.	Durgamata fishery	Nazat	231.0	„
SOUTH 24-PARGANAS : A. Natural wetlands				
89.	Madhabpur beel	Jamtala	400.0	Freshwater
90.	Kalitala beel No. II	Sonarpur	166.0	„
91.	Kalitala beel No. III	Sonarpur	240.0	„
B. Natural-cum-man made fisheries				
92.	Kishorimohanpur fishery	Kishorimohanpur	297.0	Brackishwater
93.	Saki fishery	Kultali	396.0	„
94.	Roydighi fishery	Roydighi	131.67	„
95.	Chatua fisheries	Roydighi	—	„
96.	Moyrerchak fisheries	Kultali	—	„
97.	Moukhali fishery	Canning	—	„
98.	Rupchand ghery	Mathurapur	—	„
99.	Mandal's ghery	Basanti	—	„
100.	Radhaballabhpur ghery	Kultali	—	„
101.	Dariwala ghery	Patharpratima	—	„
102.	Muchipara bhery	Nayabad	70.0	Freshwater
103.	Najirabad bhery	Karimpur	70.0	„
104.	Jagatipota bhery	Jagatipota	—	„
105.	Bagir bhery	Kalikapur	—	„
106.	Heder bhery	Kalikapur	105.0	„
107.	Bhagabanpur bhery	Bhagabanpur	70.0	„
108.	Khodati bhery	Khodati	70.0	„
109.	Kharkir bhery	Kharki	—	„
110.	Diara bhery	Diara	50.0	„