CHAPTER 2

REVIEW OF LITERATURE:

Several worker studies on wetlands from different perspectives. It is well established that North East India comprising 8 (eight) state furnish a large water bodies covering various wetlands (table 2). It is a serious concerned that there is a rapid shrinkage of the wetland of this region owing to the interference of both anthropogenic as well as natural hazards. Goswami U.C. (2007) explained various such hazards which have affected the wetland system of the entire country.

Table 2 Fishery Resources in North-Eastern Region

<table>
<thead>
<tr>
<th>State</th>
<th>Rivers/streams (km)</th>
<th>Beels/lakes (ha)</th>
<th>Tanks/ponds (ha)</th>
<th>Paddy/fields (ha)</th>
<th>Other suitable water (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arunachal Pradesh</td>
<td>2000</td>
<td>2500+110 Cold water</td>
<td>1000</td>
<td>2800</td>
<td>700</td>
</tr>
<tr>
<td>Assam</td>
<td>4820</td>
<td>100000</td>
<td>20000</td>
<td>20000</td>
<td>1517</td>
</tr>
<tr>
<td>Manipur</td>
<td>2000</td>
<td>40000</td>
<td>5000</td>
<td>40000</td>
<td>10000</td>
</tr>
<tr>
<td>Megalaya</td>
<td>5600</td>
<td>394</td>
<td>1944</td>
<td>5000</td>
<td>3000</td>
</tr>
<tr>
<td>Mizoram</td>
<td>1748</td>
<td>32</td>
<td>1800</td>
<td>1560</td>
<td>-</td>
</tr>
<tr>
<td>Nagaland</td>
<td>1600</td>
<td>215</td>
<td>2000</td>
<td>10000</td>
<td>-</td>
</tr>
<tr>
<td>Sikkim</td>
<td>900</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Tripura</td>
<td>1200</td>
<td>240</td>
<td>11033</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>19868</td>
<td>143381+112</td>
<td>42777</td>
<td>79360</td>
<td>15217</td>
</tr>
</tbody>
</table>

Source: North Eastern Council Ten year Perspective Plan

Several workers have been working in India and abroad on the limnological and fishery aspects of lentic water bodies since the latter part of the nineteenth century. In India, particularly, prominent references can be traced back since early 1940 and resurgence of the studies took place from 1960 onwards.
Various workers, namely Forel (1892), Whipple (1927), Yoshimura (1936), Hutchinson (1957) and Welch (1952) have tried to classify wetlands differentially. Forel (1982) was the first to propose a generally accepted classification of wetlands of the world into polar, temperate and tropical lakes based on their thermal characteristics. This classification was later modified by Whipple (1927), who subdivides lakes of each type into three orders depending on the temperatures of the surface and bottom waters in different seasons of the year and the annual circulation pattern. Recent limnological investigations have shown that the characteristics of Forel's tropical type of lakes is far too broad, resulting in the clumping together of divergent lakes. Forel's classification has also a geographical connotation which is unsatisfactory. Yoshimura (1936) improved upon Forel's classification and recognized lakes of five types, namely tropical, subtropical, temperate sub polar and polar lakes. Later, this classification was also modified.

Recently, the world wide accepted classification of wetlands has been forwarded by the Rameswar Convention Bureau (1997). Rameswar Convention Bureau (1997) has classified wetlands in terms of "Permanent fresh water lakes' (over 8 ha) and includes 'large ox-bow lakes, seasonal/intermittent freshwater lakes' (over 8 ha), permanent freshwater 'marshes'/pools, ponds (below 8 ha), marshes and swamps. The Ramsar Convention (1971) is an international treaty which provides the framework for international cooperation for the conservation of wetland habitats. Wetlands, in the Ramsar Convention, are defined as "Areas of marsh, fen, peatland or wetland, whether natural or artificial, permanent or temporary, with water which is static or flowing, fresh, brackish or salt including areas of marine water, the depth of which at low tide does not exceed six metres."

The Convention also continues: "The convention's mission is the conservation and wise use of all wetlands through local regional and national actions and international cooperation as a contribution towards achieving sustainable development throughout the world." ( Ramsár, 2002).

Several workers have the studied the physico-chemical and hydro biological characteristics of the wetlands in India. Important works on physico-chemical characteristics of different lakes include those by Sreenivasan (1964a) in three upland lakes of Madras, Gonapati (1940) in the Errakuppum reservoir of Madras, Zafar (1964, 1967) in different ponds of Hyderabad and Mathew (1975) in Gobingarh Lake.
of Madhya Pradesh. The Central Inland Fisheries Research Institute, Barrack pore (CIFRI) in West Bengal, (1947) has conducted physico-chemical studies on wetland ecosystem in different states of India. Other works have been carried out by Ganapati (1940), Das and Srivastava (1959), Zafar (1964), Jana (1973) and Unni (1984). Khuslan (1974) has studied the relationship among water quality, plankton and fish production in the Big Cypress swamps of America.

Similar studies on physico-chemical condition of several natural lakes(e.g. Nainital, Bhimtal, Kurpatal, Sattal and Naukuchital) of District Kumaun in the Tal area of Uttar Pradesh include those of Singh et al. (1980), Joshi et al. (1981), Rao et al. (1982), Sharma et al. (1982), Pant and Sharma (1983) and Pant et al. (1983a, 1983b, 1985a, 1985b, 1986c, 1985d).

Pant and Sharma (1981 and 1983) have studied the plankton of Lake Nainital. Gupta and Pant (1983) have observed the physico-chemical and hydro biological condition of the same Lake.

The seasonal fluctuations of various groups of phytoplankton and zooplankton have been studied by Saha et al. (1971) in the fish ponds at Cuttack (Orissa). Das and Srivastava (1956b and c, and 1959) have reported a bimodal pattern of plankton production in freshwater ponds of Uttar Pradesh. Bhomick (1968) has reported a bimodal pattern of plankton production in Kalyani fish farm (West Bengal), observing peaks in monsoon and winter. The monsoon peak was dominated by zooplankton, particularly rotifers. The diurnal migration of plankton has been reported by Philipose (1959a), George Michael (1964), Verma (1967), Khan and Siddiqui (1970), Saha et al (1971). Algae such as Oscillatoria, Raphidiopsis and Arthrospira have been reported to show maximum density on the surface layers at 3 p.m. and minimum at 3.00 a.m.

Similar studies on plankton include the work of David et al. (1969) in the Tungabhadra reservoir. The plankton of the Tungabhadra reservoir consists of
Myxophyceae (18.6%), Diatomaceae (11.6), Chorophyceae (24.4%), Dinophyceae (14.0%), rotifera (12.3%), Cladocera (3.4%), and Copepoda (15.1). The peaks of phytoplankton occurred in December, February, April and August, showing dominance of Chorophyceae (71.2%, the dominant species being Hormidium, Pediastrum, Mougeotia, Oedogonium, Spirogyra, Bumillera, etc.) in December; of Myxophyceae (34%, the dominant species being Microcystis, Anabaena, Oscillatoria, etc.) in February; of Dinophyceae (25.9%, the dominant species being Ceratium) in April; and of Diatomaceae (57.1% the dominant species being Fragilaria, Navicula and Synedra). Gonapati and Pathak (1969) have studied plankton and gross productivity of the Sayaji Sarover reservoir in Boroda. They found that the gross oxygen production is between 0.42 and 7.46 g/m²/day in 1963 and between 0.45 and 1.57 g/m²/day in 1964, the annual averages for years being 3.36 and 0.84, respectively. Net oxygen production ranged from 0 – 2.06 g0₂/m²/day in 1963 and ranged from 0.01 – 0.44 g 0₂/m²/day in 1964. The annual average photosynthetic efficiency was 0.63 – 1.18% in 1963 and 1964, respectively.

Gonapati (1970), Natarajan and Pathak (1983, 1985) have studied the flow of energy in different aquatic ecosystems. Pathak et al. (1985) has showed the importance of detritus food chain in beel ecosystems. Gonapati and Sreenivasan (1969) have found the photosynthetic efficiency of Amaravathy reservoir to vary between 0.27 and 0.67. Sreenivasan (1969) found the photosynthetic efficiency of the Amaravathy reservoir to vary between 0.27 and 0.67% and of the Stanley reservoir from 0.37 and 0.59%. Sreenivasan (1969) has studied primary productivity of Stanley, Bhavansagar, Sathnnur, Krishnagiri, Amaravathy and Sandynull reservoirs. Concerning the work on primary productivity, a series of studies has been carried out in the wetlands from different parts of the country (Sreenivasan, 1964; Sita Mariah, 1964; Vijayaghavan, 1971; Kan and Siddique, 1971; Sumitra, 1971, Nagar and Dutta munshi, 1975; Hanifa and Pandian, 19780).

The primary productivity and its co-relation with physiochemical parameters, biotic components and fisheries has been studies in details (Dey and Goswami, 1980; Lahon, 1983; Kar, 1984; Goswami, 1985, Kumar, 1985; Pathak
etal, 1985; Yadav et al., 1987; Agarwal, 1996; Acharjee, 1997; Singha et al., 1998; Goswami, 2003). Although intensive studies on the fish and fisheries of riverine, estuarine as well as from marine system have been carried out, yet there is still meagre information from the wetlands, Lakes reservoirs of North Eastern Part of the country. Some of the specific contribution made by De, 1910; Hora, 1921a, b; 1922; Hora and Mukherjee, 1935; Dey, 1964, 1965, 1973, 1975, 1976, a, b, c; 1978, 1982; Dey and Sen., 1982 a, Sen. 1982 are important information.

Fish production in Indian reservoirs varies from water to water depending upon the fishery development. It is estimated to be 6.2 kg and 39.0 kg per ha in Tungabhadra and Mettur, respectively, the approximate estimate of the average fish production from Indian reservoirs being only 6-7 kg/ha (Jhingran and Tripathy, 1990).


The morphometry of the wetlands has been studied by Assam Remote Sensing Application Centre (ARSAC) in collaboration with the Space Application Centre (SAC) where a map of wetlands of Assam (1997) has been prepared.
The production of the fish depends to a large extent on the gears and devices employed for catching (Langler, 1978). Bhagawati and Kalita (1987) have studied the traditional methods of fishing in some beels of Kamrup district. Yadava et al. (1981) and Yadava and Choudhury (1986) have accounted for the special devices used in the floodplain lakes of Brahmaputra river. Dewei and Lahan (1987) have studied the impact of embankments, slice gates and similar structure in the fisheries of Nagaon and Kamrup districts.

Information on Ichthyodiversity and species composition in the north eastern region of India has been reported by Hora (1921a,b; 1930, 1936, 1937, 1938, 1939, 1940, 1941, 1943, 1951a,b,c; 1953), Dey (1973), Jhingran (1988), Jayaram (1999), Biswas et al. (2001), Viswanath (2005) and Goswami (2005). Ghosh and Lipton (1982) have reported 172 species of fishes with reference to their economic importance; Sen. (1985) has reported 187 species of fishes from Assam and its environs; Sinha (1994) has compiled a list of 230 species of fishes from northeastern India; Nath & Dey (1997, 2000) have recorded 131 species of fishes from the drainages in Arunachal Pradesh alone; and Sen (1982, 1995, 1999a, b; 2000) has compiled a comprehensive list of 267 species of fishes from northeastern India. Further, Sen. (2000) has prepared a list of 267 species belonging to 114 genera under 38 families and 10 orders in Northeast India. Goswami U.C. et al. (2007) reported 288 species under 37 families and 115 genera of fishes available in North East India.

Works related to the socio-economic condition of fishermen are restricted to the works of Goswami et al. (1994), Kar and Dey (1996), Deka (1999) and Dutta (2000).

Several workers have studied the biology and occurrence of Cladocerans, Rotifers and other planktons from the wetlands (Michael, 1962; Bhattacharjee, 1980; Reddish, 1964; Fernando, 1966; Lindbergs, 1947; Govind, 1969, Lindberg, 1947 and Govind, 1963).

As wetlands are infested with varieties of macrophytes, there are several studies on the aquatic macrophytes from different wetlands from different regions. In this connection the following references may be cited: Ganapati, 1941; Sen and Chatterjee, 1960; Srivastava, 1976; Misra, 146; Puri and Mhajan; Jha, 1965. 1978, Unni,

The distribution of aquatic macrophytes is known from the diverse literature contributed by Goswami (1987), Goswami and Goswami (2001) Dey and Kar (1989b) and Acharjee et al. (1997). The wetlands of Assam are infested with heavy aquatic weeds; hence the deposits of the decaying weeds at the bottom contribute to richness of the bottom soil in beels. Decaying aquatic macrophytes contribute to the organic detritus pool that is very important in aquatic food webs (Odum and Smalley, 1959). But it also creates the problem of eutrophication in the wetlands of North Eastern Region.

Wetlands are under increasing stress due to the rapidly growing population, technological development and urbanization. Additional pressures on wetlands from natural threats like floods, drought, erosion etc., and anthropogenic threats, result from over exploitation, encroachment, reclamation of vast wetland areas for agriculture, commercial and residential development. Floods are a very common natural calamity in both the Brahmaputra and Bark river systems including the wetlands. The flooding and heavy fast discharge of water carrying much silt and debris into the wetlands. Therefore, wetlands are faced with serious threats such as siltation and ultimately the closure of outlets or the connection of the wetland from the main river system. Several wetlands are being converted into closed typed of wetlands, and this affects the reproductive strategies of several species of riverine fishes. As a result, the fish fauna of northeast India is faced with serious threats and hazards from either environmental, natural or from anthropogenic pressures (Goswami U.C, 2000, 2005).