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Coastal zone of Khulna district in Bangladesh: Fisheries land use and its potentials

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Abstract

Khulna district was established in 1882. It is situated between 22°12' and 23°59' north latitudes and between 89°14' and 89°45' east longitudes. The district is bounded on the north by Jessore and Narail districts, on the east by Bagerhat district, on the south by the Bay of Bengal and on the west by Satkhira district. In respect of area, it ranks 1st among the 10 districts in Khulna division and 4th among the 64 districts of the country.

Land use in coastal Bangladesh is diverse, competitive and conflicting. Agriculture, shrimp farming, salt production, forestry, ship-breaking yards, ports, industry, settlements and wetlands are some of the uses. Land uses have gone through major changes. Land use in the 1950s had been mainly for paddy cultivation, but salinity intrusion and tidal flooding prevented further intensification.

The detailed fisheries study has been carried out up to union level to collect all kinds of relevant data, maps, reports and information from field survey using proper tools and techniques. The relevant secondary data on fisheries land uses, satellite image classification and information pertinent to present status of fisheries had also been collected from Department of Fisheries (DoF), BBS and SPARSO suitability and assign it to one or a few specific uses for which the land will technically most suitable and economically viable. To determine present fisheries land use situation detailed experiment study has been conducted through PRA tools like Key Informant Interview (KII) with the related fish farmer, local people and little coordination of Government officials.

Satellite images were used to identify water bodies of the Khulna District. Upazila wise fisheries land use maps have been prepared interpreting the satellite image. This Upazila wise map was validated and Khulna district fisheries land use map was finalized by ground truthing and discussion at experiment work.

Keywords: Land use, aquaculture, shrimp farming, Land Zoning

Introduction

The fisheries of Khulna district consist of inland open water fisheries and fresh water aquaculture. Like other parts fisheries sector of the country, particularly fisheries of Khulna district is a major source of nutrition, income, employment and livelihood support of the local people.

In Bangladesh, fish provides 60 percent of the national animal protein and this sub-sector contributes about 5 percent to the GDP and approximately 9 percent to the total foreign exchange earnings. Nearly, 1.2 million people directly employed in this sub-sector and another 11 million are indirectly engaged in activities related to this sector (Fisheries Statistical Report of Bangladesh (July 2014 - June 2015)).

To address these issues of wetland destruction, over and unplanned uses of natural wetlands, improper methods of environmental and natural resources management including land resources allocation for different users, due focus was given to the national inventory and assessment of fisheries resources for developing their sustainable management system. An essential feature for any national level inventory of wetland; and its proper management is a classification and zoning of wetland according to its criteria which permit identification of priorities for their conservation and management. The classification or zoning of land should reflect the geographical and ecological characteristics, soil and water suitability and other relevant features pertinent to their proper planning and management.

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The continuing decline in capture fish stocks and production resulting from the factors such as over-fishing, siltation of beels and other water bodies, and the impacts of Flood Control and Drainage (FCD) Projects and other infrastructural activities are very alarming for fish resources. The survival (including sustainable management, where appropriate) of ecologically sensitive wetlands and forest areas is also a burning issue which needs due importance for maintaining our rich ecosystem of the country. Land uses in coastal Bangladesh (Fig. 1.1) have gone through major changes over the last half century. The land is intensively used for agriculture, settlements, forests, shrimp ponds (known locally as *ghers*), water bodies and fisheries, salt production, industrial and infrastructure developments, tourism and preservation and management of environmentally important and special areas. With the continually increasing population, the following features emerge.

Government of the Peoples Republic of Bangladesh, Ministry of Land, field survey 2006-2012 and BBS 2012-2013, SPARRSO 2012-2013, Table 1.2). The study area was selected on the basis of the following criteria: (i) the area should have extensive shrimp and fish culture; (ii) the change in the physical environment should be homogeneous and representative of the situation in the coastal areas; (iii) Fish and shrimp should be the main crop and provide the major share of income of the farmers of the area and (iv) Present

status of agriculture and urban land.

The detailed fisheries study has been carried out up to union level to collect all kinds of relevant data, maps, reports and information from field survey using proper tools and techniques. The relevant secondary data on fisheries land uses, satellite image classification and information pertinent to present status of fisheries had also been collected from Department of Fisheries (DoF-2013) [14] and SPARRSO (2012-2013) respectively to develop a data bank for classifying land and water bodies on the basis of fisheries land suitability and assign it to one or a few specific uses for which the land will technically most suitable and economically viable. To determine present fisheries land use situation detailed study has been conducted through PRA tools like Key Informant Interview (KII) with the related fish farmer, local people and government officials.

Information was collected from upazila different government office and respondents belonging to five landowner categories using land-use survey and questionnaire survey techniques. Field observation based on the perception of local people was carried out and recorded documents of relevant studies were examined. Information relating to the landscape ecology in the past was collected with Retrospective Inquiry System (RIS) techniques and ground truthing was performed with the help of aerial photography and satellite images.

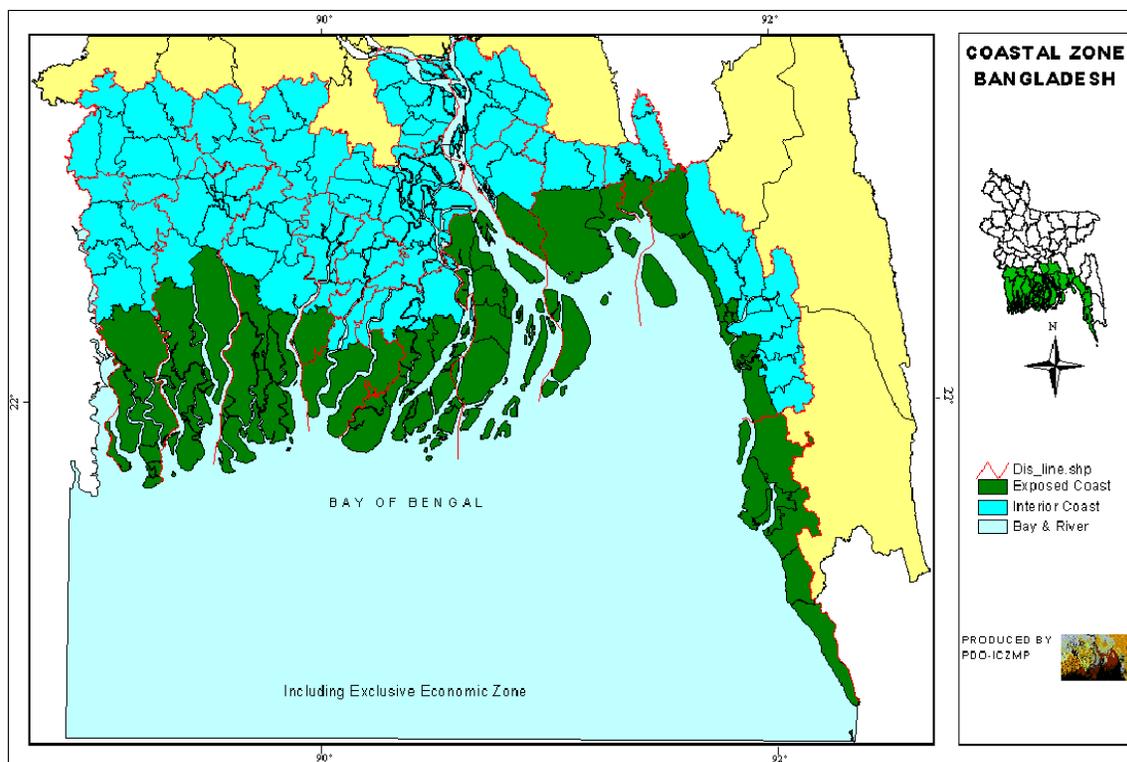


Fig 1.1: The coastal zone of Bangladesh. Source: Islam et al., 2006

Approach and Methodology

The study was conducted in 9 selected upazila Batiaghata, Dacope, Dighalia, Dumuria, Koyra, Paikgachha, Phultala, Rupsa and Terokhada of Khulna District. Khulna District covers 432300 hectare (Table 1.2) of land and is located in the centre of the western region of the coastal zone. It is situated on the Mongla River and is well connected to the Passur River. The area of dacopeupazila of Khulna district close to the Sundarbans mangrove forest and covers 724.16 hectare

land (source-Study of Detailed Coastal Land Zoning with Two Pilot Districts of Plain Land Project under Government of the Peoples Republic of Bangladesh, Ministry of Land, field survey 2006-2012 and BBS 2012-2013, SPARRSO 2012-2013,Table 1.2). The study area was selected on the basis of the following criteria: (1) the area should have extensive shrimp and fish culture; (ii) the change in the physical environment should be homogeneous and representative of the situation in the coastal areas; (iii) Fish and

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Objectives of the Study

The main objectives of the study are:

- to develop and assessment of capture and culture fisheries area and their current status;
- to demarcate the suitable areas for both capture and culture fisheries;
- to identify protective measures for our wetland habitats and its sustainable development;

Expected Outputs of the Study

- An inventory of capture and culture fisheries and their current status.
- A statistics of present wetland area used by fresh water capture and culture fisheries.
- Land zoning implications on fisheries.
- Fisheries land use map of Khulna District.

History of fisheries land use in Khulna district

The Bangladesh coastal zone (Fig. 1.1) is a significant maritime habitat of ecologically rich and economically important natural resources. The area is situated along the largest river system running below the Himalayan Mountains. In this zone, the rivers discharge an enormous quantity of fresh water and maintain a level of salinity both on land and in sea that favours the rapid growth of a wide variety of vegetation and aquatic life. The coastal region, especially the southwestern portion Khulna district is one of the most promising areas for shrimp cultivation for two major reasons (MOFL, 1997; Karim and Shah, 2001) [6, 5]: First, its fresh- and saltwater resources are abundant in almost all seasons; second, the world's largest continuous mangrove forest, the Sundarbans, provides a food source and nursery for the offshore fishery.

It is estimated that about 250,000 ha of land has good potential for coastal aquaculture (Ahmed, 1995) [7]. About 180,000 ha is suitable for shrimp culture (Khan and Hossain,

1996). Coastal aquaculture increased from 20,000 ha in 1994/1995 to 135,000 ha in 1996/1997, and production from 4000 to 35,000 metric tons in the same period (MOFL, 1997) [6]. The rapid expansion of shrimp farm development during the last decade, along with the adoption of extensive and improved extensive culture techniques, has caused growing concern as to its adverse effect on the coastal environment and damage to the traditional agricultural systems. The socio-economic scenarios have changed rapidly.

This chapter aims to assess the effects of the past and current situation as regards shrimp cultivation methods in relation to the coastal environment. In particular, the research aims to identify the inherent potentials and problems, as well as the emerging trends in the causes and extent of land-use changes over a period of time, with a view to understanding the implications for land-use planning and the development of more environmentally acceptable shrimp cultivation methods. How mangrove forests work as sinks of high potential for aquaculture that were not recognized in the resource-assessment process. Exclusion of these lands from an aquaculture zone could prevent appropriate development, subject it to inappropriate regulation or restrict access of poor people to opportunities for aquaculture development. Furthermore, zoning may actually be undesirable for encouraging a concentration of aquaculture because of the associated environmental and social impacts.

Environmental capacity measures the resilience of the natural environment in the face of impact from human activities. Some assessment of environmental capacity is desirable and is of particular relevance to the problem of cumulative effects. It has been argued (GESAMP, 2001) [9] that environmental capacity must be assessed, even if only at the most elementary level, if sustainable development is to have any practical meaning. Environmental capacity (otherwise referred to as assimilative capacity) is 'a property of the environment and its ability to accommodate a particular activity or rate of an activity without unacceptable impact' and must be measured against some established standard of environmental quality.

A set of planning interventions in the form of incentives and constraints (planning regulations) will be required to implement the strategy and ensure that objectives are met, standards are not breached and environmental capacity is not exceeded. These might apply to location of aquaculture development, waste emissions and the quantity or quality of inputs used (e.g. food, chemicals).

Land use of Khulna District

Land use in Bangladesh is generally determined by physiography, climate and land height in relation to water level (Brammer, 2002) [10]. These together make a highly complex environment characterized by five main land types related to depth of seasonal flooding: 30 or more agro-ecological zones encompassing differences in soils, climate and hydrology; and areas with varying degrees of risk of disastrous floods, drought and cyclones. About 60% of the lands are inundated to a depth of 30 cm or more. The Bangladesh Bureau of Statistics publishes land-use statistics regularly. Emphasis is mainly on agriculture. Land uses are classified as net cropped area, current fallow, current waste, forest and area not available for cultivation. Along this line, SRDI (Soil Resources Development Institute) produces agricultural land-use maps for the country identifying many different types of agricultural land use.

Land is the basic natural resource that provides habitat and sustenance for living organisms, as well as being a major focus of economic and livelihood activities. Bangladesh has a population of 123 million living on a land area of 147,000 km² (PDOICZMP, 2004b) [11]. The population is increasing and the land is being converted from directly productive purposes, such as crop cultivation, to other uses such as housing, roads and urban development, and this trend is expected to continue.

In the coastal zone also, the population is expected to increase from 36.8 million in 2001 to 43.9 in 2015, and to 60.8 million by 2050 (PDO-ICZMP, 2005a). Present per capita agricultural land of 0.056 ha will decrease to 0.025 ha by 2050. On top of this, about 54% of the people of coastal Bangladesh are functionally landless and more than 30% are absolutely landless. Among the landholders, 80% are small farmers, 18% are medium farmers and only 2% are large farmers (PDO-

ICZMP, 2004b) [11]. These have decisive impacts on major economic and livelihood activities, on land use and subsequently on the quality of land.

In 2010- 2011, an estimate was made (Table 1.2) capturing a broader perception of land use and recognizing seasonal variations (Source: SPARRSO 2012-2013, Field survey 2006-2012). Two complications were identified: areas under river and water bodies increased greatly in the wet season and estuarine/riverine wetlands (known locally as *chars*) cultivated during the dry season went under water in the wet season. In Khulna District, agriculture, shrimp farming, salt production, forestry, ship-breaking yards, ports, industry, human habitation and wetlands are some of the uses in an area of only 432300 hectare inhabited by 36.8 million people. Land use in the coastal zone is diverse, competitive and conflicting.

Table 1.2: Upazila Wise Land Distribution of Khulna District (Area in hectare)

Upazila Name	Upazila Area (ha)	Agriculture	Fish Culture	Shrimp/Galda	Settlement	Urban	Sundarban
Batiaghata	24800	11839.52	4034.96	2599.04	3159.52	3159.52	0
Dighalia	7700	3952.41	766.92	613.69	1182.72	1182.72	0
Dumuria	45400	19739.92	6165.32	9070.92	5202.84	5202.84	0
Koyra	177500	76413.75	29447.25	35216	18193.75	18193.75	0
Dacope	99200	58230.4	14949.44	4612.8	10326.72	10326.72	724.16
Paikgachha	41100	15675.54	4825.14	12194.37	4196.31	4196.31	0
Phultala	5700	2240.67	119.13	800.85	1268.82	1268.82	0
Rupsa	12000	5614.8	534	1375.2	2236.8	2236.8	0
Terokhada	18900	5762.61	5000.94	4980.15	1576.26	1576.26	0
Total	432300	199469.62	65843.1	71463.02	47343.74	47343.74	724.16

Source: SPARRSO (2012- 2013), BBS (2012-2013), Field Survey (2006-2012)

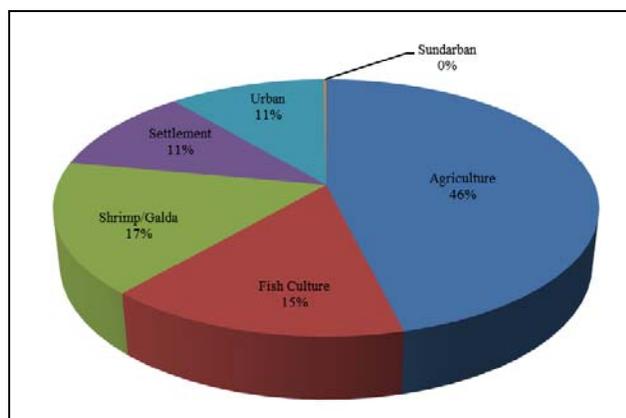


Fig 1.4: Land Distribution of Khulna District

Present Fisheries Status of Khulna District

Fisheries of Khulna district have immense prospects and scope of development to strengthen the rural economy. The basic mechanism of capture fisheries at Khulna has been allocation of fishing rights through periodic leasing and affordable modern aquaculture techniques has been practiced. Fisheries resources of Khulna considering rivers, estuaries, flood plains, beels, lakes and ponds which are the most

important sources of livelihood and food supply for the rural poor.

Wetlands are the most important sources of livelihood and food supply for the rural poor. Wetlands are being threatened by man-made problems and natural calamities. Fisheries sector contributes 4.39% to the national GDP and 22.76% to the total agricultural GDP (Bangladesh Economic Review 2012). About 2.5% the total of country export earning comes from the fisheries sector (2011-2012) and it ranks 3rd among the export oriented industries. Fish supplements to about 60% of our daily animal protein intake and about 11% of the population depends directly and indirectly on the fisheries for their livelihood (DoF, 2013) [14]. Total fish production was gradually grown up during the last 10 years. The production in 2002- 2003 was 21.21 lakh MT, where as it increased up to 34.10 lakh MT in 2011-12 (Fisheries Statistical Year Book of Bangladesh 2012-2013).

The average fish production of Khulna district capture fisheries are 350 kg/ha and culture fisheries (pond aquaculture) are 2100 kg/ ha in 2012-13. Total areas of capture (Shrimp/Galda) and culture fisheries are 71463.02 hectare and 65843.10 ha respectively (Source: GIS data from SPARRSO (2012-2013), Field Survey (2006-2012)).

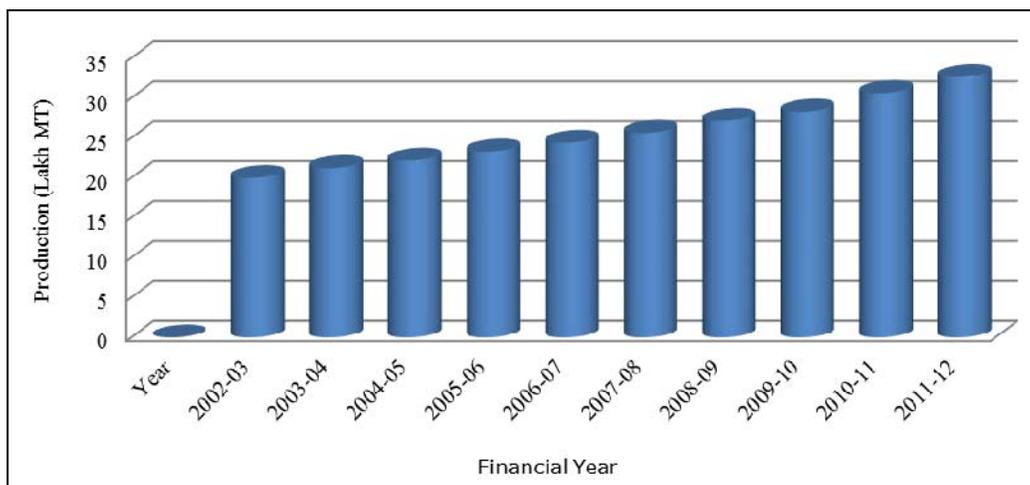


Fig 1.2. Fisheries Production of last 10 years in Bangladesh

Impact of Land use and land zoning Over Fisheries in Khulna District

Zoning is a tool, which defines the demarcation of geographic areas with specific combinations of properties or features. The kind of features, which are chosen and the interpretation of their different combinations depend on the purpose of the zoning exercise. Zoning is most often used for properly maintenance of bio-diversity in the area for research and planning purposes.

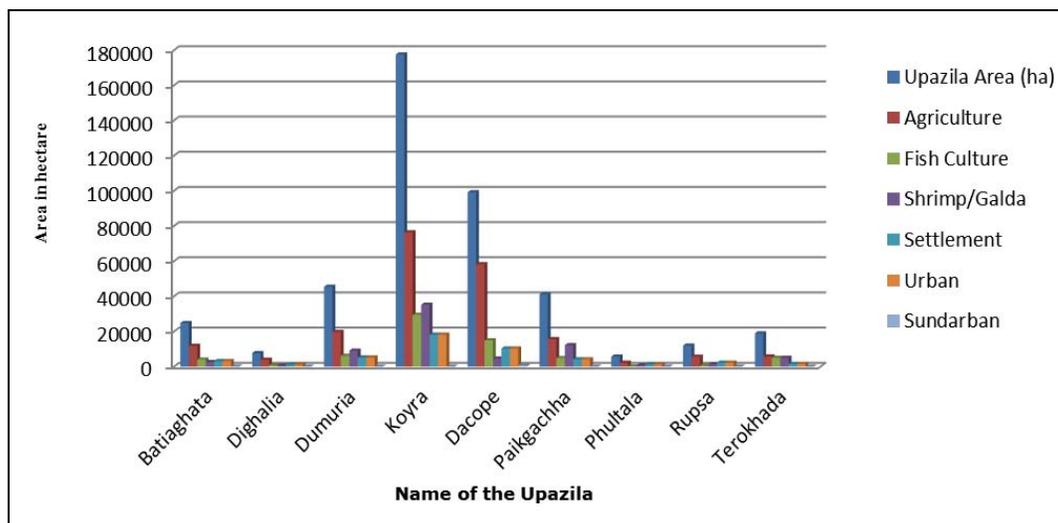
Regarding fisheries in Khulna District, land zoning can help for protection of fish habitat, nursery areas, and as well as habitat restoration of the fisheries ecosystem. It does not usually address fisheries operations such as controls on harvesting (e.g., sizes, seasons, gear type etc).Land zoning can also support fisheries management, overfishing problems and multiple resources use conflicts in this upazila.

The emerging concept is to formulate land zoning, with administrative boundaries as the unit, in accordance with the (dominant) land use and economic activities, as well as their potentials and vulnerabilities. Hence, this zoning has to be more than just a description of the current situation and must account for major underlying ecological and socio-economic factors and processes that have led to the current situation and

that may be important for future trends and hazards. The approach should therefore take into account important ecological and socioeconomic factor (Table 1.2 and figure 1.3).

Zoning as a tool for area development is, of course, an ambitious goal that can only be attained in stages. Mutsaers and Miah (2004) have outlined the following conceptual basis for the first stage in the process to delineate an indicative coastal land zoning:

- Use of an administrative boundary² as the unit for zoning, such as the upazila as the unit for indicative land zoning. Further detailed versions using union and later field blocks will be developed; use of only existing data. Field information to be collected for the purpose of validating the zoning (ground-truthing);
- proactive interaction with relevant agencies at different stages of the elaboration process; and
- Support and backing of a structured technical support group involving government and non-government agencies. The Ministry of Land will be involved as an implementing agency of the Land-Use Policy.



(Source: Table 1.2, SPARSO 2013-2014, Field survey 2006-2011)

Fig 1.3: Upazila Wise Land Distribution of Khulna District

Fisheries Land Use Distribution of Khulna District

Khulna District has a total wetland area of 137306.12 hectare of which 65843.10 hectare is under fish culture and 71463.02 hectare is Shrimp/Galda culture. Upazila wise Land distribution including wetland and others land has been shown

below (Table 1). Terokhada, Paikgachha, Koyra and Dumuria upazila shows good potential for fisheries production of Khulna District which covers 52.81%, 41.41%, 36.42% and 33.46% of total wetland respectively.

Table 1: Wetland Distribution of Khulna District (Hectare)

Upazila Name	Upazila Area (ha)	Fish Culture	Shrimp/Galda	Total Wetland
Batiaghata	24800	4034.96	2599.04	6634 (26.75%)
Dighalia	7700	766.92	613.69	1380.61 (17.93%)
Dumuria	45400	6165.32	9070.92	15236.24 (33.56%)
Koyra	177500	29447.25	35216	64663.25 (36.42%)
Upazila Name	Upazila Area (ha)	Fish Culture	Shrimp/Galda	Total Wetland
Dacope	99200	14949.44	4612.8	19562.24 (19.72%)
Paikgachha	41100	4825.14	12194.37	17019.51 (41.41%)
Phultala	5700	119.13	800.85	919.98 (16.14%)
Rupsa	12000	534	1375.2	1909.2 (15.91%)
Terokhada	18900	5000.94	4980.15	9981.09 (52.81%)
Total	432300	65843.10	71463.02	137306.12 (31.76%)

Source: BBS (2012-13), Field Survey (2006-2012) and SPARRSO (2012-2013)

Out of total area of 432300 hectare only 31.76% represents wetland which covers 48% culture and 52% capture (shrimp/Galda) fisheries respectively (Figure 1). Generally it varies in dry and wet season. When dry season, situation of

water level is alarming and progressive river siltation occur as a result reduce water holding capacity. On the other hand, these water bodies are also dried up quickly in the dry season.

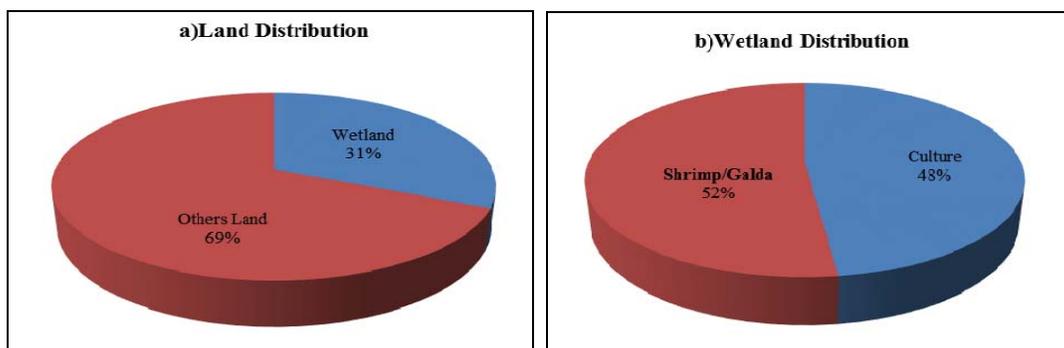


Fig 1: a) Distribution of Land b) Distribution of Capture and Culture Fisheries in Wetland of Khulna District

Open Water Capture Fisheries of Khulna District

Khulna District has potential of inland open water fisheries resources that consist of the seasonal water bodies, rivers, baors, natural depressions or beels and reservoir. There are about 25,000 fisheries beneficiaries involve in fisheries activities of the Khulna District. Present field survey shows that annual flooding in the rainy season inundates up to 10-25% of the total land surface. Despite the existence of huge resources the inland capture fisheries have been replaced as top fish producing sources over the years by aquaculture due to decline and degradation of resources. But, over a few years, aquatic biodiversity especially fish species and other aquatic organism in inland open water have been declined due to

natural and anthropological causes. The priority is given to improved biological management that will restrict the degradation of resources and production. Major native capture species are: aor (*Sperata aor*), taki (*Channa punctatus*), kholisha (*Colisa sp.*), Shrimp (*Peneaus monodon*), Galda (*Macrobrachium rosenbergi*), shoal (*Chana striatus*), chanda (*Chanda ranga*), koi (*Anabas testudineus*), magur (*Clarias batrachus*), tengra (*Mystus tengra*), foli (*Notpterus notpterus*), baim (*Mastacembalus spp.*), raina (*Nandus nandus*), chapila (*Gudusia chapra*), mola (*Amblyphayngodon mola*), puti (*Puntius puntio*), boal (*W. atto*), rui (*Labeo rohita*), catla (*Gibelion catla*) etc.



Harvested Shrimp for Marketing Harvested Prawn (Galda)

Closed Water Culture Fisheries in Khulna District

Fresh water aquaculture is an important component of Khulna District fisheries. The culture fisheries of Khulna District include ponds, nursery, etc and rice fields, canals and small beels (natural depression) are also gradually coming under culture-based capture fisheries practice. The seasonal water bodies, aquaculture pond and the beels offering tremendous scope and potential for augmenting fish production by adopting aquaculture based enhancement techniques in Khulna District. It is expected that with the introduction of scientific method of fish culture, the present production will

be increased substantially. Currently aquaculture has been practicing in a total area of about 670.62 ha which cover about 65.28% of total inland water of Khulna District (Table 1, Figure 1). Culture fisheries comprises of baor and pond aquaculture, fish culture in homestead pond and paddy field etc.

Major native culture species are: bata (*Labeo bata*), mirigal (*Cirrhina mrigala*), tilapia (*Oreochromis nilotica*), grass carp (*Ctenopharyngodon idella*), silver carp (*Hypophthalmichthys nobilis*), pungus (*Pungassius suchi*), rui (*Labeo rohita*), catla (*Catla catla*), Thai koi (*Anabas testudineus*) etc.



Fish Harvest in Aquaculture Pond



Prawn Harvested From Gher



Fish Harvested from Gher



Fish Harvested from Beel

Problems of Capture and Culture Fisheries in Khulna District

- Indiscriminate use of destructive fishing gears like current jal (mono filament twin net).
- The fish species diversity and stocks were under threats of depletion due to indiscriminate and uncontrolled harvesting.
- Indiscriminate harvesting of brood/mother fish during breeding season.
- Municipal waste are creating serious water pollution and hampering the growth of the aquatic flora and fauna etc.
- The demand for agricultural production, particularly cereals, encourage attempts to dry out the wetland with a reduction in the capture area particularly beel and its fisheries resources.
- Erratic rainfall, prolong flooding, six month dry season and sandy soil is a major problems for full time aquaculture practices.
- Blockade of rivers and canals by flood protection embankments has seriously affected natural abundance of fish in open water by disrupting breeding migration.
- Inappropriate pond design and indecision on aquatic

resource use from multiple owners.

- Poor quality fish seeds due to inbreeding depression in the private hatcheries results in poor growth of fish.
- Lack of knowledge about stock enhancement, seed production and improve culture technology and pond management system.
- Perennial water bodies are reducing due to falling of existing ground water level and land conversion.

Suggested Measures for Development of Capture and Culture Fisheries in Khulna District

- Use of destructive gears must be prohibited.
- Current net must be stopped by creating a public awareness.
- Formulation of land zoning for fisheries areas and its implementation is an immediate necessity.
- Provision for fish passes should be kept at vital points during construction of roads, sluice- gate, cross- dam and embankments etc.
- Harvesting of brood/mother fish should be strictly prohibited during breeding season and provide alternative livelihood.

- Transfer of wetland for other purposes/uses is to be strictly prohibited.
- Before construction of embankment, road, culverts etc. its impacts on fisheries and other aquatic fauna and flora should be assessed properly.
- Established fish sanctuary and beel nursery.
- Intensive stocking of fingerlings with free of cost in open water bodies (river, canal, beel etc.) should be initiated by Department of Fisheries.
- Credit facilities should be extended to small traders with minimum/marginal interest.
- Demonstration of aquaculture technologies in the farmer's field at the District and upazila level through government level.
- Introduction of certification methodology by the authority to the hatchery owners that they are maintaining a standard protocol for spawning by using the proper sized broods.
- The fisheries extension activities should be practiced like model village programme, fry traders programme, trial programme, school programme. Rice-fish programme should also be practiced in this region.
- Leasing government ponds, lakes and other water bodies

to targeted poor or unemployed youth.

- Involved poor fishermen in community based culture fisheries development in beel, ghear and other potential water body

Indicative Land Zones and Fisheries Land use map in Khulna District

An indicative land zoning has emerged (Fig.2.2, PDO-ICZMP, 2005b), identifying the following eight zones:

- shrimp (brackish-water) zone,
- shrimp (sweet-water) zone,
- salt-shrimp zone,
- forest zone,
- mangrove (including Sundarban) zone,
- urban and commercial zone (industrial, port, export-processing zones and ship-breaking yards),
- tourism zone, and
- Agricultural zone.

Results of the indicative land zones have been presented to field-level stakeholders at regional workshops and to policy planners at national workshops. There is now a national consensus on indicative land zoning.

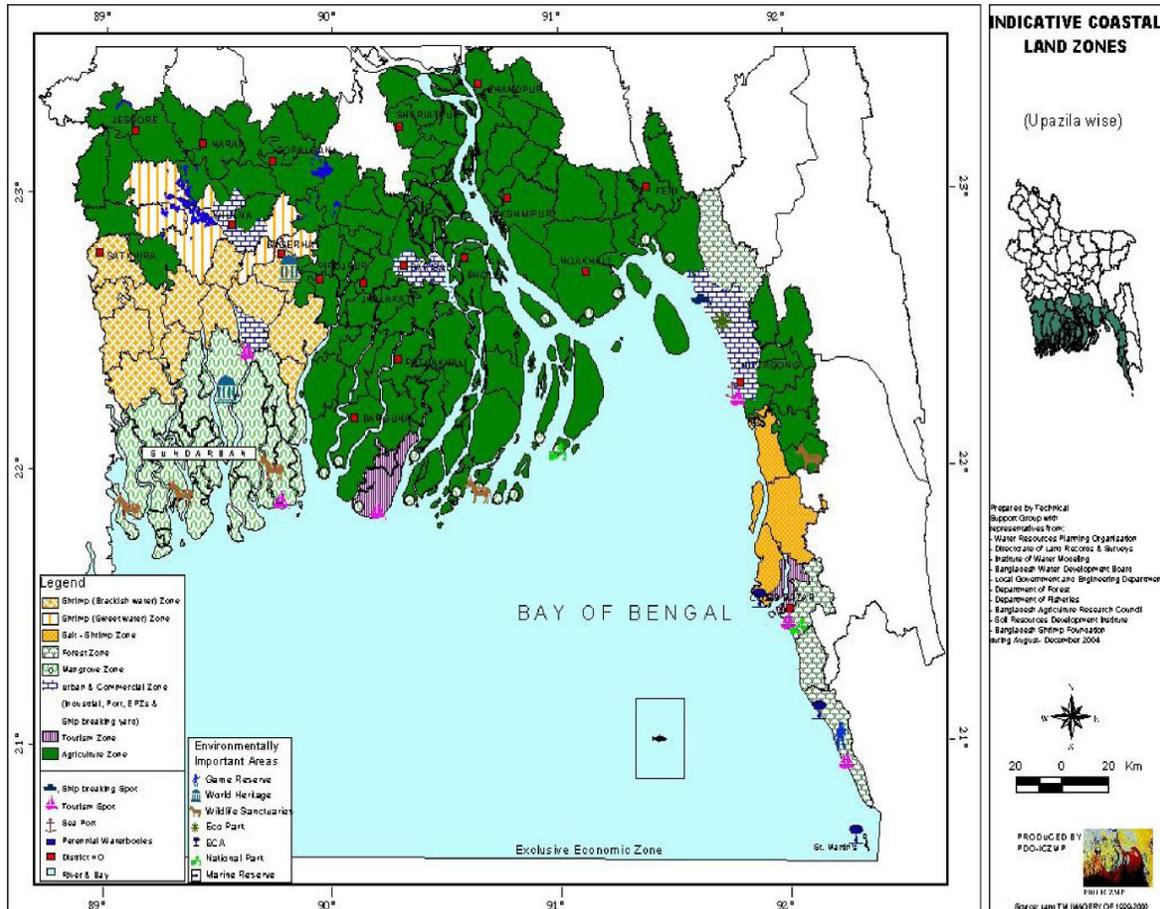
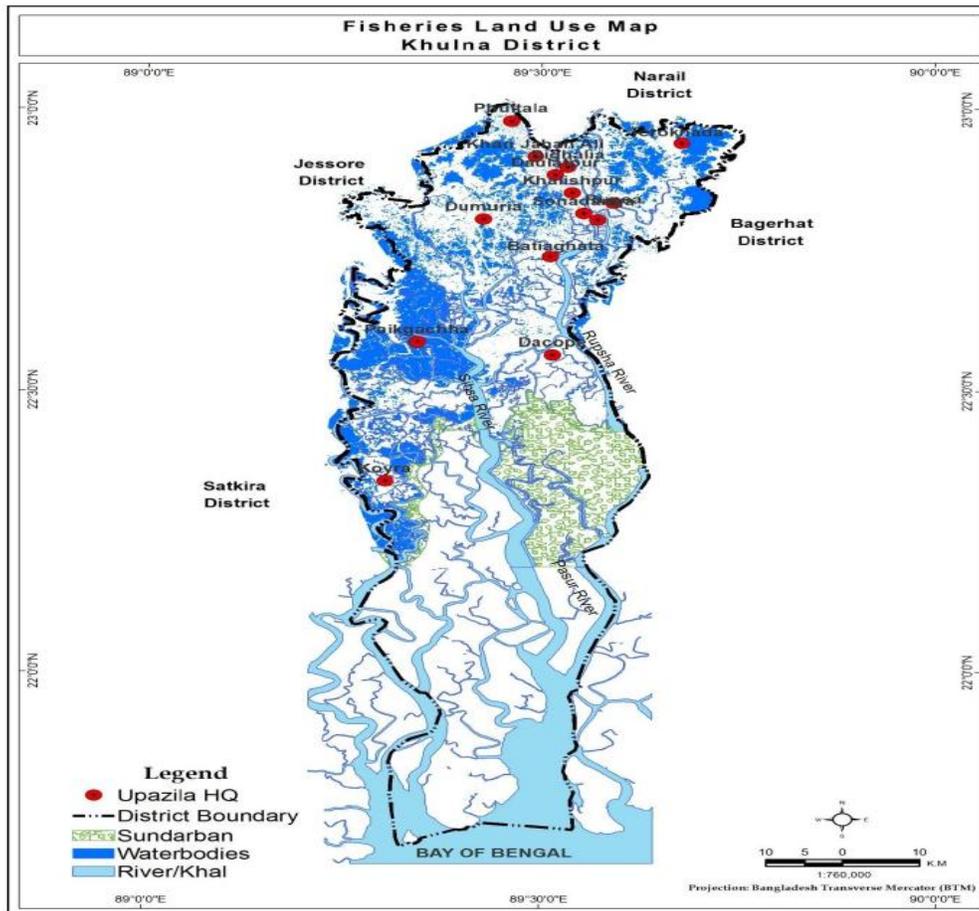


Fig 2.2: Indicative coastal land zones of Bangladesh. Source: Islam et al., 2006



Conclusion

Khulna district is endowed with rich and vast fisheries resources. Due to favorable natural conditions and geographical location these fisheries resources have high potential of increasing fisheries production in this upazila. The coastal and estuarine areas of Bangladesh are covered by extensive mud flats, saline water, brackish water and protected bays. These places support huge numbers of important living resources, which are suitable for marine ranching. Local people indiscriminately utilize these natural resources and some are now completely destroyed, for example, the Sunderban mangrove forest in Khulna District. Most of the resources are being over-utilized (e.g. fish stock and shrimp fry) while some remain untouched or under-utilized (mollusks, seaweeds, crabs and offshore fishes). Therefore, sustainable practices, management and conservation of the estuarine and coastal resources and their related ecosystems are needed. Fisheries Sector of Khulna district can contribute to improve the socio-economic condition of the rural people. Fisheries land use of Khulna was analyzed using field survey, focus group discussion (FGD), government data and statistics and satellite image interpretation. The water bodies of the upazila are habitats of valuable fish and other aquatic organisms. This study has identified potential causes for this decline including habitat degradation due to siltation and conversion of wetland to agriculture, increasing fishing pressure, destructive fishing practices and an acute shortage of dry-season wetland habitats. Continued research on land use will support optimum, sustainable and environmentally friendly land use and the subsequent modern management of land use through land zoning. Setting the appropriate legislative framework is

fundamental to effective implementation of the land use and zoning policy. A number of laws are in operation since long ago using surveillance and patrolling of the coastal and marine waters for the preservation of the natural environment and sustainable use of coastal resources.

This version of land zoning is expected to be used as a basis for detailed land zoning, as elaborated in the Land- Use Policy (MoL, 2001). The challenge is to give a legal status to this broad zoning. However, the strength of this exercise is that it has brought relevant agencies together on an institutional platform. A consensus has been reached to aim for further detailed land use and zoning, but taking one step at a time. Land zoning, complemented by policy and investment support, can be instrumental in managing diverse land uses in the coastal zone.

Apart from this, there is a need for strong protection and conservation policies, which have to be incorporated into a management plan. Some of the plans should include: i) Major identification of coastal fisheries land use, ii) Monitoring activities, which contribute to the understanding of changes in coastal land use, iii) Improved management of existing land to correspond with their multipurpose usefulness, iv) Creation of public awareness and promotion of local participation in managing to proper land use, v) Strengthening and providing the required expertise on coastal zone management for existing coastal land resources, vi) Participation by public bodies (non-government or trade organizations) in the planning of conservation strategies and land management viii) Research on natural and human-induced threats to coastal resources and implementation of national coastal land use management programmes and its potential.

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