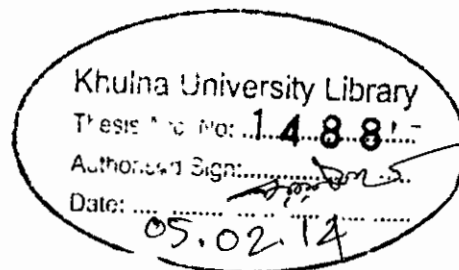


**IMPACTS OF THE COMMUNITY BASED SANCTUARY
MANAGEMENT ON FISH PRODUCTION IN OPEN WATER:
A CASE STUDY ON THE JAGANNATHPUR KOLE**



PROFULLA KUMAR SARKAR



**Fisheries and Marine Resource Technology Discipline
Khulna University, Khulna
Bangladesh**

March 2008

**IMPACTS OF THE COMMUNITY BASED SANCTUARY
MANAGEMENT ON FISH PRODUCTION IN OPEN WATER:
A CASE STUDY ON THE JAGANNATHPUR KOLE**

A Thesis

By

Profulla Kumar Sarkar

Examination Roll No: MS-010615

Session: 2000-2001



The thesis submitted to the Fisheries and Marine Resource Technology Discipline in partial fulfillment of the requirements for the Degree of

Master of Science

In

Fisheries and Marine Resource Technology

March 2008

**IMPACTS OF THE COMMUNITY BASED SANCTUARY
MANAGEMENT ON FISH PRODUCTION IN OPEN WATER:
A CASE STUDY ON THE JAGANNATHPUR KOLE**

Approved as to style and content by



Dr. Khandaker Anisul Huq

Professor and Head

**Fisheries and Marine Resource Technology Discipline
Khulna University, Khulna
Bangladesh.**

March 2008

Declaration

Impacts of The Community Based Sanctuary Management on Fish Production in Open Water: A Case Study on The Jagannathpur Kole

The results submitted in this thesis are entirely of the candidate's own investigation and no part of the results has been accepted for any degree, nor it is being concurrently submitted for any degree.



(Signature of the candidate)

Profulla Kumar Sarkar

Examination Roll No: MS-010615

Session: 2000-2001



(Signature of the supervisor)

Dr. Khandaker Anisul Huq

Professor and Head

Fisheries and Marine Resource Technology Discipline
Khulna University, Khulna, Bangladesh

Dedicated to

The Fisher's Community of the Jagonnathpur Kole, those who sacrificed their valuable time, Physical labor and intelligence cordially to provide me the required data as well as many other supports to complete this study.

Acknowledgement

It is my gratification for being able to complete this study, so first of all my appreciation and gratitude go for the creator of this universe, the almighty God.

There were many people who helped me in various ways to complete this study successfully. I wish to express my thanks and appreciation to them all. I would like to mention the name of Mr. Nazrul Islam, Team Leader, DCHDO, an assisting NGO working over the site and the CBO raised for the management of the kole, those who help a lot in data collection and providing secondary information, especially.



I would like to thank my Supervisor Dr. Khandaker Anisul Huq, Professor and Head Fisheries and Marine Resource Technology Discipline, Khulna University, Khulna for his guidance, advice, support, patience and encouragement. Thanks are extended for giving me a chance to be experienced during extensive field visits and survey.

Special thanks are extended to all teachers of Fisheries and Marine Resource Technology Discipline, Khulna University, Khulna for their constant encouragement and providing of all necessary facilities during the course of the study.

In addition, I would like to convey my thanks to my friends whose inspirations were all along with me during hard times of the present study.

Special thanks to my family, friends for their endless love, support and encouragement to complete this study.

The Author

March, 2008

Abstract

A study on the Impact of the Community Based Sanctuary management in a semi closed water body of the giant river Padma under Kustia district, locally called Jaganathpur Kole was conducted from 2003 to 2004. The study mainly focused on In this study conclusion has been drawn on four years catch data, showing only the increasing or decreasing trend of fish production along with any change of recovery of any endangered fish species and the change of socio-economic condition of the fisher's community of the Kole. Required data were collected in random sampling and PRA (participatory rural appraisal) approach. The result shows that the fish production trend increased after the establishment of the sanctuary in the kole. The total catch has become more than double in 2004 with respect to base line production 2001. In 2001 and 2002, total fish production was 6932 kg. and 64811 kg. respectively. After the establishment of sanctuary in the kole in 2002 the total production was found 94562 kg. and 148920 kg. respectively. The results also shows that production of some species such as Air (*Mystus aor*), Boal (*Wallago attu*), Chital (*Notopterus chitala*), Beley (*Glossogobius giuris*), Piali (*Aspidoparia morar*), Bata (*Cirrhina reba*) etc. were going diminished abruptly before establishment of the sanctuary. The production of those species has been increased remarkably after the establishment of the sanctuary. Catch trend of kajoli (*Ailichthys punctata*) and Pabda (*Ompok pabda*) Bata (*Cirrhina reba*) etc indicate that these were going disappeared before the establishment of the sanctuary and these three species were being reappeared after the sanctuary in the kole. The other three species Rita, kawnia and Keski show zero catch even after the sanctuary establishment, indicating absence of any sign of recovery soon. Although some species like Punti (*Puntius* species), Chingri (*Palaemon spp.*), Chanda (*Chanda spp.*), Bain (*Mastacembalus pancalus*) reduced to some extent after the sanctuary establishment in the kole. It might happen due to increase of predatory species like Air, Boal, and Chital after sanctuary. The management of the sanctuary of the kole was good enough by the community organization developed for this purpose. We can conclude that a strong management support is needed for the success of a sanctuary. For strong management, it needs to involve the local community especially fishers with required sustainable institutional arrangements. However, it can be concluded that fish sanctuary is one of the most effective tool for open water management to boost up its production.

T A B L E O F C O N T E N T S

Title	Page no
Acknowledgement	i
Abstract	ii
Contents	iii-iv
List of Tables	v-vi
List of Figures	vii-viii
List of Diagrams	viii
List of Abbreviations	ix
Chapter-1 Introduction	01-03
1.1 Background of the study	01
1.2 Objectives of the study	03
Chapter-2 Review of Literature	04-09
Chapter-3 Materials and Methods	10-21
3.1 Selection of the study area	10
3.2 Historical Background of the Study area	11
3.3 Description of the Sanctuary	12
3.4 Physical Structure	13
3.5 Factors affecting or influencing the open water yield	13
3.6 Management History of Kole	13
3.7 Study period	16
3.8 Data collection	17
3.9 Secondary Source	19
3.9 Data Analysis	19
Chapter-4 Results and Discussion	22-47
4.1 Checklist of Fish Species of the Sanctuary	22
4.2 Production trend of the sanctuary, Kole	23
4.3 Production of different species of Kole in the study period	24
4.3.1 Production of Chanda (<i>Chanda spp</i>) in Kole	24
4.3.2 Production of Punti (<i>Puntius spp</i>) in Kole	24



4.3.3	Production of Taki (<i>Channa punctatus</i>) in Kole	25
4.3.4	Production of Bain (<i>Mastacembelus pancalus</i>) in Kole	25
4.3.5	Production of Tengra (<i>Mystus tengra</i>) in Kole	26
4.3.6	Production of Beley (<i>Glossogobius giuris</i>) in Kole	27
4.3.7	Production of Aeor (<i>Mystur aor</i>) in Kole	27
4.3.8	Production of Boal (<i>Wallago attu</i>) in Kole	28
4.3.9	Production of Chital (<i>Notopteras chitala</i>) in Kole	29
4.3.10	Production of Chingri (mainly Paelemonid) in Kole	29
4.3.11	Production of Bata (<i>Cirrhina reba</i>) in Kole	30
4.3.12	Production of Chapila (<i>Gudusia chapra</i>) in Kole	31
4.3.13	Production of Piali (<i>Aspidoparia morar</i>) in Kole	32
4.3.14	Production of Pabda (<i>Ompok pabda</i>) in Kole	32
4.3.15	Production of Kajali (<i>Ailichthys punctata</i>) in Kole	33
4.3.16	Production of Rui (<i>Labeo rohita</i>) in Kole	34
4.3.17	Production of Catla (<i>Catla catla</i>) in Kole	35
4.3.18	Production of Mrigel (<i>Cirrhina mrigala</i>) in Kole	35
4.3.19	Production of Shoal (<i>Channa striatus</i>) in Kole	36
4.3.20	Production of other species in Kole	37
4.4	Inter relation between species	38
4.5	Overall discussion about fish production	38
4.6	Socio-Economic Profiles of the Fishermen Community	41
4.6.1	Age Structure	41
4.6.2	Family Size	42
4.6.3	Educational Background	43
4.6.4	Religion	44
4.6.5	Family Pattern	44
4.6.6	Occupation	45
4.6.7	Gross Annual Income	46
Chapter-5	Recommendations	48-49
Chapter-6	Conclusion	50
Chapter-7	References	51-57
	Photo Gallery	58-62

L I S T O F T A B L E S

Sl. No.	Title	Page no
1.	Sanctuary at a glance	12
2.	Physical structure of Kole	13
3.	Physical factors of Jogonnathpur Kole	13
4.	Management Profiles	16
5.	Checklist of Fish Species	20
6.	Year wise production of Kole	22
7.	Production of Chanda in Kole	24
8.	Production of Punti in Kole	24
9.	Production of Taki in Kole	25
10.	Production of Bain in Kole	26
11.	Production of Tengra in Kole	26
12.	Production of Beley in Kole	27
13.	Production of Beley in Kole	27
14.	Production of Boal in Kole	28
15.	Production of Chital in Kole	29
16.	Production of Chingri in Kole	30
17.	Production of Bata in Kole	30
18.	Production of Chapila in Kole	31
19.	Production of Piali in Kole	32
20.	Production of Pabda in Kole	33
21.	Production of Kajali in Kole	33
22.	Production of Rui in Kole	34

23.	Production of Catla in Kole	35
24.	Production of Mrigel in Kole	36
25.	Production of Shoal in Kole	36
26.	Production of other species in Kole	37
27.	Age Structure of Kole Fishermen	41
28.	Family Size of Kole Fishermen	42
29.	Educational Background of Fishermen	43
30.	Religion of Fishermen	44
31.	Family Pattern of Fishermen	45
32.	Occupation of Kole Fishermen	45
33.	Wellbeing status of the fishers (Professional)	47

L I S T O F F I G U R E S

Sl. No.	Title	Page
1	Social map of the Kole	10
2	Social Map of Jagonnath pur of Kole	10
3	Sketch of Kole.	11
4	Sign/bill board of the sanctuary	11
5	Sanctuary of the Kole	12
6	Sanctuary of the Kole	12
7	Production trends of Kole from 1960- 2004	23
8	Year wise production of Chanda in Kole	24
9	Year wise production of Punti	25
10	Year wise production of Taki	25
11	Year wise production of Taki	26
12	Year wise production of Tengra	26
13	Year wise production of Beley	27
14	Year wise production of Aeor	28
15	Year wise production of Boal	28
16	Year wise production of Chital	29
17	Year wise production of Chingri	30
18	Year wise production of Bata	31
19	Year wise production of Chapila	31
20	Year wise production of Piali	32
21	Year wise production of Pabda	33
22	Year wise production of Kajali	34



23	Year wise production of Rui	34
24	Year wise production of Catla	35
25	Year wise production of Mrigel	36
26	Year wise production of Shoal	36
27	Year wise production of other species	37
28	Inter relation within the species	38
29	Age structure of fishermen community.	41
30	Family size of fishermen community	42
31	Educational background of fishermen community	43
32	Religion of fishermen community	44
33	Family pattern of fishermen community	45
34	Occupation of fishermen community	46
35	Gross socio economic status of fishermen community	46

L I S T O F D I A G R A M S

Sl. no.	Title	Page no
01	Schematic Diagram of Methodology of the Study	21

L I S T O F A B B R E V I A T I O N S

BBS	Bangladesh Bureau of Statistics.
CBFM	Community Based Fisheries Management
CBO	Community Based Organization
CAS	Catch Assessment Survey.
MACH	Management of Aquatic Resources through Community Husbandry.
CNRS	Centre For Natural Resource Studies.
DCHDO	Dustha Child and Health Development Organization
DoF	Department of Fisheries.
FMC	Fisheries Management Committee.
FSC	Fisheries Subcommittee.
FFP	Fourth Fisheries Project.
NGO	Non Government Organization
PRA	Participatory Rural Appraisal
UNDP	United Nations Development Program

Some Uncommon Terms & Words:

Kole: Deep water pool zone of a river locally called kole.

Jagannathpur Kole: Local name of a Semi-closed water body originated from the giant river Padma due to change of its main course. In fact, this water body is a dead part of the padma commonly called oxbow lake, locally called Jagannathpur kole where a fish sanctuary has been established in 2002 and operated by the local fishermen community. This water body is located in Kumarkhali and Khoksha upazilla under Kushtia district

Fisheries Management Committee (FMC): Fisheries Management Committee (FMC) refers to the management committee of the Jagannathpur kole. An executive body has been formed with a representative from each fisher's village with a view to undertake planning and management of that water body.

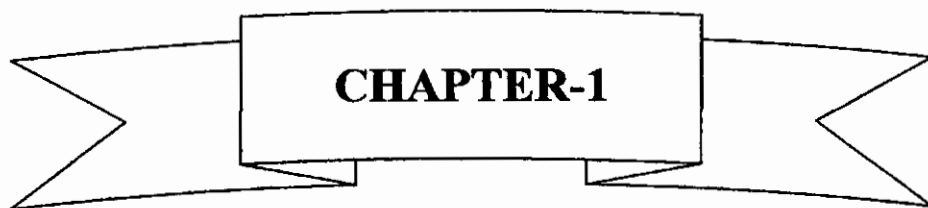
Destitute Child Health and Development Organization (DCHDO):

A working NGO (Non-government Organization) over the sanctuary site recruited by FFP. This NGO took the initiative to aware and organize the fishers. They provided the required assistance to the community in the formation and CBO capacity building.

Catch Assessment Survey (CAS):

Statistical survey, planned, designed and undertaken to estimate the open water catch. Normally sampling method is used to determine the catch. Catch assessment survey includes selection of data collection site, area, date, time, data collectors and data providers or gears. Accuracy of the catch depend on method used to select those factors and how efficiently and effectively planned and performed those jobs. Based on experience Partial and full lottery method can be used in selection.





INTRODUCTION

Chapter-1

INTRODUCTION

1.1. Background of the study

Bangladesh is an agro-based and riverine country where the fisheries resources play a vital role in the socio-economic development of the country. Fisheries sectors provide fulltime employment about 1.2 million and part time employment facilities to about 10.8 million people (DoF, 2003). The fisheries resources contribute 63% of the national animal protein intake, about 5.24% of the total GDP (gross domestic product) and 4.76% of the total foreign earning majority of which, comes from exporting of shrimp.

The fisheries sector in Bangladesh can be broadly divided into four major sub-sectors:

- (1) Inland capture or open-water fisheries, (2) Inland culture or closed-water fisheries, (3) Marine industrial (trawling) fisheries and (4) Marine artisanal fisheries.

The open-water fishery is a self-sustaining system although human interventions have significantly deteriorated its health and productivity in recent years. The culture fishery on the other hand is primarily an economic venture managed by private and individuals and farms. The inland fisheries contribute about 72% of the total catch.

Bangladesh is located in the delta formed by a few of the world's major river systems. The largest river systems flowing through Bangladesh are the Ganges, the Brahmaputra and the Meghna. This river system is enriched with a lot of rivers, along with its huge number of tributaries covering area about 1032 thousand hector and floodplain covering area about 2833 thousand hectares. In aggregate the inland open water covers 4048 thousand hectares. Rivers, canals and interconnecting channels were providing a good habitat, breeding and feeding ground for the fishes. Thence, this vast river system was abounds in a wide variety of indigenous fishes. In the decade of 70 more than 80% of the total fish production of the country were come from the open water. Gradually this contribution was going down. In 1998, the contribution from the open water was 41.5%, while in 2003 it brought down 38.26% of the total fish production. It is clear that this contribution has been bringing down rapidly in the recent years. A lot of causes both natural and man-made are responsible for destruction of this valuable resource. In fact, this resource

has been going down to a level of threatening in the recent past. We have to protect and conserve this vast valuable resource. In the earlier, some natural protection for fish and aquatic organisms already prevailed in our river system. So, fish were available in natural water. That's why nobody felt the need of strict protection and conservation of fish including other aquatic resources. But at present, it is obligatory to protect and conserve the indigenous fishes to increase natural production.

A lot of co-management efforts have been practiced in different floodplains including many dead rivers and semi-closed water bodies of Bangladesh to boost up natural production. A lot of management tools and intervention have been incorporated in this co-management system. Establishment of aquatic sanctuary in the open water system has been considered as one of the most effective tools or intervention to boost up natural fish production. In the past 10 years about 228 no. of sanctuary have been established in 176 water bodies under different development project of the DoF. Fish production has been increased in these water bodies in a wide range of variation along with the reappearance of a good number of fish species. But in almost all the cases, each sanctuary was supported many other tools and interventions. So it is difficult to determine the exclusive role of the sanctuary on fish production and biodiversity conservation. In fact, in our country, a good quality, regular catch data are not available for making conclusion exclusively on sanctuary in open water. Present study has focused on it. This study has been conducted to determine effectiveness of an aquatic sanctuary to boost up fish production in open water. Through this study, if this aquatic sanctuary proved fruitful, then it will increase the confidence of the planner as well as the community involved in planning and management in a water body.

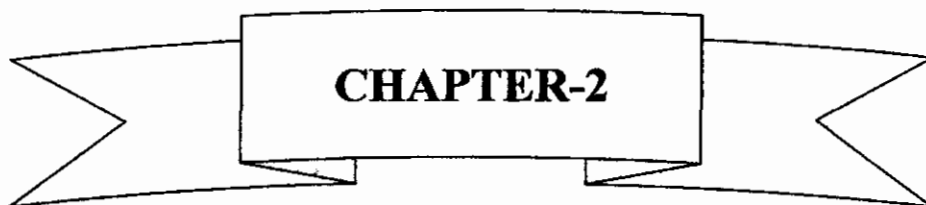
Local people said that once this Jagonnathpur Kole was abound in varieties of local fishes. Due to over fishing and many other causes the stocks were going depletion. Some species were going disappear. Even some species were not found any more. At that moment, the kole was brought under community based management with the initiative of Fourth Fisheries Project. As per provision of the project, a partner NGO named DCHDO organizes the fisher's community for Kole management. In continuation of this management, a sanctuary was established 2002 in the kole. The community takes the responsibility of protection and conservation of this sanctuary. Finally it creates an opportunity to conduct this study. This study was performed with a view to fulfilling the following objectives.

1.2. Objectives of the study

Broad objective: To find out the impacts of the sanctuary on fish production.

Specific objectives: By this study impacts will be evaluated on the basis of trend of fish production or year wise catch, recovery of any endangered fish species and socioeconomic change of fish if any. Hence, the study was conducted with a view to fulfilling the following specific objectives.

1. To find out the increasing or decreasing trend of fish production before and after the sanctuary in the kole (a selected water body).
2. Recovery of endangered fish species if any.
3. To determine the change of socio-economic status of the professional fishers.



REVIEW OF LITERATURE

Chapter-2

REVIEW OF LITERATURE

The four million ha. of open waters in Bangladesh are among the world's richest and most complex fisheries. The rivers, *beels* (permanent and seasonal lakes and wetlands), *baors* (oxbow lakes), *haors* (large deeply-flooded depressions), and floodplains support some 260 fish species (Rahman 1989). About 80% of rural households catch fish for food or to sell, and fish contributes about 60% of animal protein consumed (BBS 1997). However, the many "miscellaneous" small fish caught from the floodplains by poor people have been neglected in official statistics and policies, yet they are the accessible and preferred food of poor people. Some also provide relatively more micronutrients than do the fish favored by fish culture (Flood Action Plan 16 1995; Thilsted *et al.* 1997).

More than 70% of households fish in the floodplains either for income or food (Minkin *et al.*, 1997; Thompson *et al.*, 1999). In Bangladesh poverty is understood to be multidimensional and has many roots. A household is considered welfare-poor if its assets do not allow the generation of adequate income (in money or in kind) to satisfy food needs. On the other hand, a household is investment-poor if its assets fail to generate an adequate flow of money or services to support investments (Bahamondes, 2003).

In Bangladesh, various forms of co-management arrangements have been experienced more than a decade. These are: (1) NGO led strategies; (2) Government led strategies, and (3) Government and NGO partnerships (Ahmed *et al.* 1997).

Community based management of natural resources or common pool resources has become a strategy for improving resource management and empowering local communities in the past two decades based on the concepts such as co-management, using local knowledge, recognizing local institutions and establishing common property regimes (Berkes *et al.* 1989; Ostrom 1990; Pomeroy and Berkes 1997). Although there has been a focus on design principles for community management institutions (Ostrom 1994) and on identifying factors linked with sustainable common property regimes and institutions (Agarwal 2001).

Efforts to improve management of inland fisheries through community participation in Bangladesh have shown that some form of common property regime and facilitated local institution building are essential (Middendorp *et al.* 1999; Thompson *et al.* 1999, 2001).

The methodology developed for consensus building has been named Participatory Action Plan Development (PAPD) and involved holding a series of linked local workshops where different stakeholders in a wetland or fishery participate separately and in plenary to develop a management plan for the common aquatic resources they use (Barr *et al.* 2001).

The original method was developed by a Bangladeshi NGO, the Center for Natural Resource Studies and a team from Newcastle and Durham Universities. It can be characterized as deliberative, inclusive and participatory (Holmes and Scoones 2000).

Fish sanctuaries are types of aquatic protected or no-take fishing areas. Found throughout the world, they are most-often associated with marine habitats (Uychiaoco, Alino & Dantis 2000; Francis, Nilsson & Waruinge 2002; Benedetti-Cechi, Bertocci, Micheli, Maggi, Fosella & Vaselli 2003), although they are also known for freshwater environments (Hoggarth, Dam, Debnath & Halls 1999). Despite their prevalence, little has been documented about how fish sanctuaries that encompass deep-water pools function in tropical rivers, streams and other types of inland wetlands (Poulsen, Ouch, Viravong, Suntornratana & Tung 2002).

Natural deep-water pools are now recognised as important to the ecology of many fishes in the Mekong River Basin (Roberts & Baird 1995; Valbo-Jorgensen & Poulsen 2000; Baird, Hogan, Phylavanh & Moyle 2001a; Baird *et al.* 2001b; Poulsen *et al.* 2002; Baird & Flaherty 2005). Deep-water areas are especially important as dry season refuges (Baird *et al.* 2001b; Poulsen *et al.* 2002; Baird & Flaherty 2005), and some species also rely on them for spawning (Roberts & Baird 1995; Baird *et al.* 2001b; Baird & Flaherty 2005). Deep-water pools occur both within large rivers and in permanent and seasonal water bodies on the floodplains. In this paper, deep-water pools broadly refer to a variety of relatively deep aquatic habitats surrounded and connected to shallower aquatic environments. Therefore, even deep parts of wetland marshes or back swamps that totally dry out by the end of the dry season are considered to be a type of deep-water pool, as such areas are often critical for fish stocks, representing the last refuges for aquatic animals during the dry

season (Tubtim & Hirsch 2005). In Laos, all fish sanctuaries appear to be situated in deep-water pools or depressions.

Many freshwater fisheries management systems in the tropics, including ones in Laos, rely on strategies to protect fish during the spawning-season (Bush 2003), which is generally in the rainy season. However, fishers realize that when water levels are high, fish are much less vulnerable than during the low water dry season, and concentrate their protection efforts in the latter period (Baird *et al.* 2001b; Baird & Flaherty 2005).

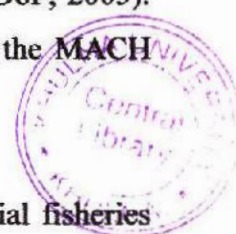
Fish sanctuaries have also been established in the southern province of Xekong. In the mid-1990s, the provincial government established a number of fish sanctuaries along the Xekong River by decree, but with little consultation with local people, and as a result many failed soon afterwards. Similar problems have also identified from parts of Champasak province (Hirsch 2000) and Khammouane province (personal observation). More recently, however, INGOs like CUSO and Oxfam Community Aid Abroad have supported communities and local government to establish co-management fisheries regulations with more success.

In Champasak and Savannakhet provinces, efforts have been made to stock natural ponds, including certain types of fish sanctuaries to improve their productivity. Using both native and non-native species, enhancement efforts have met with mixed success (Bush 2003).

Sometimes fish sanctuaries are established to protect other aquatic animals apart from fish. For example, people from one community in Savannakhet province ban fishing in two large perennial ox-bow lakes near the Xe Bang Fai River to protect a resident population of Siamese crocodiles (*Crocodylus siamensis* Schneider) that have great spiritual value for local people. Strong taboos are attached to these wetlands and fishing is totally banned in one area while being heavily restricted in the other (Shoemaker *et al.* 2001).

Sanctuaries are a potentially important tool for protecting Irrawaddy dolphins (*Orcaella brevirostris* Gray) in the mainstream Mekong River, as dolphins tend to concentrate themselves in parts of the mainstream Mekong River >8 m deep during the dry season (Baird & Mounsouphom 1997; Baird & Beasley 2005).

53 sanctuaries were established under 45 water body (rivers and beals) by the Department of Fisheries through their 4th Fisheries Project from 2001 to 2003 (DoF 2005). Because of establishment of sanctuary, the production of fish increased at the rate of 15% to 200%. Among 27 sanctuaries, number of species increased in 23 sanctuaries (DoF, 2005). In 1998, there were 73 sanctuaries established under 36 water body through the MACH project of Government (DoF, 2005).



The Oxbow Lakes Small Scale Fishermen Project-II (OLP-II) is a social fisheries project in 23 oxbow lakes, locally called *boar*, in south-western Bangladesh along the border with India. The objective of OLP-II is to transfer the culture-based fisheries management of oxbow lakes to the fishers themselves by creating appropriate institutions and a mechanism for guaranteeing security of tenure (Middendorp *et al.*, 1996).

Oxbow lakes are common resources, with both the fish and the water forming part of the common resource. Unmanaged common resources become "open access" and tend to be over-used by the people living near such resources (Ostrom, 1990). Common property regimes are forms of management grounded in a set of accepted rights and rules by a group of resource users for the sustainable and interdependent use of a collective goods (Pomeroy, 1994). The members of the Bahadurpur fishers group not just catch fish but they actually manage the fisheries resource as a common property regime (Apu *et al.*, 1997).

In the day-to-day implementation of the common property regime in oxbow lakes, the Fishing Rules are upheld to ensure participation in fishing maintain equity and enforce LMG democracy by rotation of leadership (Apu *et al.*, 1997).

Governments of many countries in Asia and the Pacific have often underestimated the role and capacities of local communities in the management of fisheries, while at the same time local communities also can not successfully implement fisheries management by themselves alone (Ruddle, 1994).

Hossain *et al.*, (1997) recorded 43 fish species from two floodplains in the south-western region of Bangladesh in 1992-1995. Rahman (1989) reported 260 freshwater species from floodplains, lakes and rivers of Bangladesh. The indigenous fish species reported from oxbow lakes under culture based fisheries management appear not different from a control lake (Haque *et al.*, 1997).

Presently, 20 lakes are under intensive culture-based fisheries management by the fishers groups (LFT) and stocked with carp fingerlings of six different species (Middendorp *et al.*, 1996). A detailed analysis of the financial performance of ten fishers groups in their fifth year of operation is presented (Middendorp *et al.*, 1997). Middendorp and Balarin (1999) reported that culture based fisheries is considered as a kind of farming, as it involves ownership of the fish as well as management control.

Fishing is considered as a low-class profession and fishermen are traditionally poor. They lived from hand to mouth (Hannan, 1994). These fishermen are socially, economically and educationally disadvantaged communities and lack their own financial resources (Rahman, 1994 b). Fishermen and their families in the South and South East Asia often are considered to be among the poorest of the poor (Bailey, 1994).

In Bangladesh, most of the fishermen are illiterate and few have primary level of education (Rahman, 1994a). Coastal fishermen of Bangladesh have a low level of education (Bailey and Doulman, 1994).

Ahmed (1996) found that the full time fishermen in Tangail district area were 84%; 24% had subsidiary occupation, 81% were found fishing throughout the year and 92% were member of some associations, clubs and co-operatives.

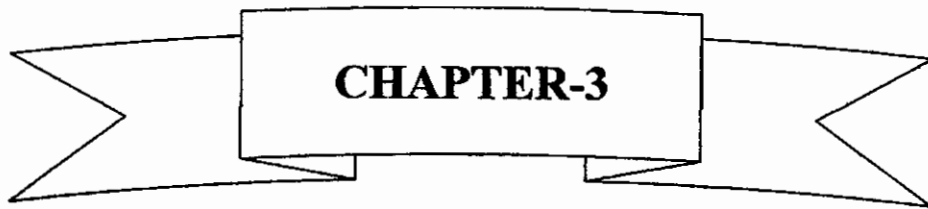
Mahabubullah (1986) studied the polder fishing community of Bangladesh. He reported that among the polder fishing community 64% had no boat and 61 % had no gear. While, 98% reported, fishing as their main source of income and 71% earned 400 taka per month or above. A similar study was conducted by DOF (1993) on fishermen community of the chanda beel and revealed that there were 22% professional and 74% non-professional fishermen. 85% carried out fisheries activities individually, 5% were members of cooperatives, 34% aware of NGO programs. Average household income was 15000 taka per year.

Mannu (1999) obtained data on the sea going fishermen at Kuakata and reported that 72% were full time fishermen, 89% earned an average 25000 taka per year, 2% were owners of a trawler, and 4% carried out fishing during winter and rainy season. Ahmed (1999) studied the socioeconomic conditions of the coastal fishermen and reported that 73.33% earned taka 50 per day.

DOF (1990) further conducted a survey on the socioeconomic conditions of the fishermen in eleven upzillas of the district of Patuakhali and Barguna under Fisheries Extension Development Project and reported that rate of literacy among fishing communities was far less than other areas. Their economic condition was so bad that they often could not afford educational expenses for their children. This study reported that about 70-80% fishermen were laborers (work in other gear and boats); about 70% of fishermen had an average daily income of taka 20-25, and the rest 30% taka 25-40.

A vast majority (90% and 91.66%) fisherman of the Dhaleswari river is engaged in full time fishing. This study also revealed that maximum fishermen caught fish individually, and more than 97% fishermen were members of different associations (Al-Muhit, 2000).

Chantarasri (1994) reported about the Sunderbans Reserve Forest (SRF) fishermen community. Fishing was carried out in-groups. Most fishermen own their fishing gears with which they caught less than 40-kg fish per month. Typically monthly earning was between 2000 and 3000 taka.



MATERIALS AND METHODS

Chapter-3

MATERIALS AND METHODS

3.1. Selection of the study area:

The survey was conducted in a semi closed water body of the giant river Padma, locally called Jagonnath pur Kole, Kumarkhali, Kustia. The kole is bounded by Khaschar, Charbhani pur and char Mohendrapur in the north, Mohendrapur and Char mohendrapur bound Kuncha road in the west, Mohendrapur, Bagchi satpakhia, Gopogram, Amlapara, Goshaidonga, Dhokrakole and Mklurchar village in the south, Amlabaria and Khaschar village in the east.

Once, the kole was connected with the Padma by two canals in the rainy season, one through village Moklurchar, kumar Khali upazilla and another through Khaschar, Khoksha upazilla, under Kushtia district. At present, the upper channel (Mklurchar) has been silted up and has been separated by a big kancha road which completely disconnects the kole from the main channel the padma.

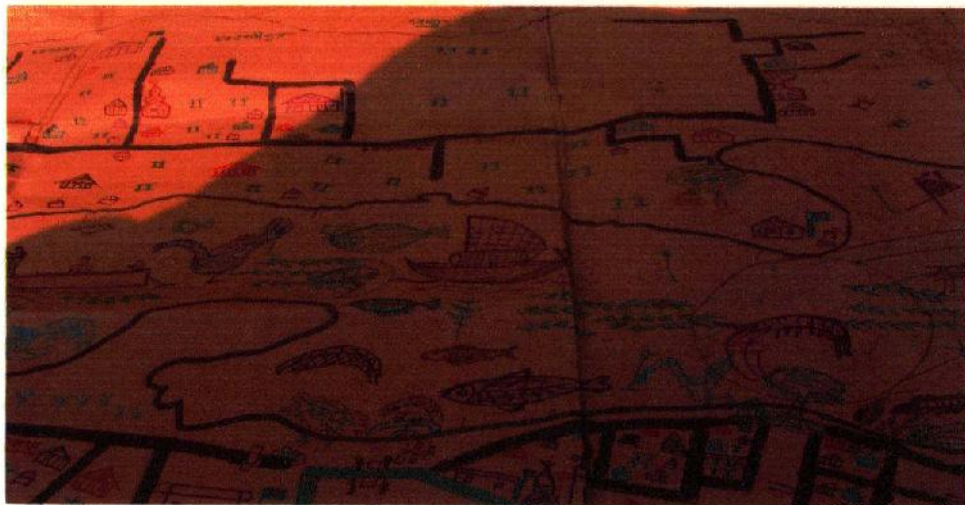


Fig-1: Social map of the study site prepared in impact period (2004).



Fig-2: Social map of the study site prepared in base line period (2001).



Fig-3: Sketch of the Kule indicating location of the sanctuary.



Fig-4: Sign/bill board of the sanctuary established in the Jagonnathpur kole in 2002.

3.2. Historical Background of the Study area:

The Jagonnathpur Kule is a dead part of giant river the Padma. Once it was the main channel. Through PRA study (Historical Calender) it has been known that up to 1958-59 the Padma was flowing inebriate through this channel. In the 1959-60, the major portions of the existing villages engulfed by the Padma due to heavy erosion. But with in 1-2 years, a big sandy island evolved nearly on the mid river miraculously, still then, there was a big flow especially in the rainy season. Gradually, the course the Padma moved towards the Pabna district landmass. In the 1961-63 the kole has taken the present shape. Up to the 1975, there were a lot of connecting channel with the Padma in the rainy season. From the 1975-2000 only two channels were in existence. During the period, there was a flow especially in the flood season while the upper and lower end of the kole was silted up and became disconnected with the main existing Padma channel in the dry season. Then it becomes completely a separate closed water body. In rainy season, it again reconnects with the

mainstream of the Padma. At present, there is a single canal which connects the Padma in the rainy season. In the earlier, the kole was deeper (60-70 feet) and wider (1000-1500 m.). It has been becoming shallow and narrow day by day due to siltation from the inflow of turbid Padma water in the rainy season.

3.3. Description of the Sanctuary:

Sanctuary, established in the 2002 is located at one of the deeper part of the kole which begins with the Amlabari kalighat Bat Tala and ends in Amlabari Malopara ghat. It is about 1km. long and 500 m. breadth in the rainy season. Particulars of the sanctuary are as follows

Table1: Sanctuary at a glance

Parameter	Time period	Unit
Length		1000 m.
Breadth	Rainy season	700 m
	Dry season	500 m.
Depth	Rainy season	7 m
	Dry season	5 m.
Area	Rainy season	70 ha
	Dry season	50 ha.
	Brush filing area	10 ha.
	Fish ban zone on both side of the brush filing	20+20=40 ha.



Fig-5: Dry season view of the Jagonnthpur kole.



Fig-6: Photograph showing the Sanctuary in the Jagonnath pur Kole

3.4 Physical Structure the study site:

At present, it is about 8 km. long and 1000 -1200 m. wide, depth is about 5-7 m. in the rainy season, 5 km. long and 300-500 m. depth 2-4 m. in the dry season. The kole is bounded by 13 fisher's villages.

Table-2: Physical structure of the Kole at glance.

Sl. N	Characters	period	Kole
1	Length	Rainy Season	8 km.
		Dry season	5 km.
2	Breadth	Rainy Season	800-1000 m.
		Dry season	300-700 m.
3	Depth	Rainy Season	5-7 m.
		Dry season	2-4 m.
4	Area (ha)	Rainy Season	1000
		Dry season	500
		Khas land	87.82

3.5 Factors affecting or influencing the open water yield:

Factors affecting or influencing the inland open water yield was considered and there was a provision of keeping records of some these parameters in this study. These were as follows.

Table-3: Physical factors of the Jogannathpur Kole

Parameters		2001-02	2003-04
Area	Rainy season	1000 ha.	1000 ha.
	Dry season	350	340 ha.
Rainfall		Relatively less	Relatively less, slightly higher than baseline.
Flood situation		Late, moderate flood, 5 months	Late, moderate flood, 5.5 months.
Average Depth	Rainy season	12'	14'
	Dry season	6'	7'
Turbidity		Moderately turbid	Moderately turbid
Transparency (Secchi disk)	Rainy season	Turbid	Turbid
	Dry season	Clear (30-34 cm)	Clear (28-36 cm)
Vegetation	Rainy season	-	-
	Dry season	20% covered by Hydrilla	20% covered by Hydrilla

3.6. Management History of Kole:

In fact, in the earlier, there was no planed management in this kole. It was leased out on open auction basis from the DC office kushtia, under MOL. Leased owner collect high rate fishing fees from the fishers. Sometimes, they made the fishing by the fishers through share system. Suffice it to say, they would give a little share to the fishers, offers a little

income which was too insufficient to run their livelihood smoothly. Not only that, in this system, all the fishers have no access in fishing equally, especially, in case of more efficient gears. The fishers who bowed down their head to the land owner, they would get the access in fishing. Mohajan, aratdar, lease owner provided costly gears. At that time there was no any set management plan for boosting up production in the kole. There was no any ban or restriction on any gears, mesh size, fishing efforts or catch, fishing season etc. Even, the fishers did not think about the management. In 1991-95 the Kole were brought under the management of Third Fisheries Project (TFP). About 20 mt. carp fries were released in the kole in the year 1995. Fishers were organized under the project for periodical conserving the stocked fish and harvesting after a certain interval of time. Then, fish ban in the month of October and November in each year, restriction on current jal and size of the stocked fish were observed. At that time, carp production increased considerably as well as annual income of the fishers. But that program did not sustain after the end of the project. Again the kole was brought under the earlier auction management system. Thus, the fishers were lost their fishing right and ownership of the kole.

However, in 2000, the kole was brought under the management of Fourth Fisheries Project. First of all, Carp stocking program were taken. The management approach was participatory. Village Fishers groups were formed and the representative from each village united to form a management committee called FMC. Thus, a CBO came into existence for the community based fisheries management in the kole. In a participatory discussion among the community, the need of establishment of an aquatic sanctuary was brought out. Thus, during the period April to June 2002, an aquatic sanctuary was established in the kole. The CBO took the responsibility of the implementation including the other management.

Fishers from the 13 surrounding villages are used to fish in the kole. For the first time on the basis of consensus of the concerned village fishers, fisheries subcommittee (FSC) was formed in each village. The committee consists of 6-10 members depending on the size of the fisher's village. Normally one member from each FSC was united to form a kole management committee, called Fisheries management committee (FMC). On the basis of the consensus of the committee members three executive post- President, Secretary and Accountant cum Cashier were selected among them. This committee along with a partner NGO named DCHDO conducted household and gear survey in the surrounding fisher's villages. They also formulate a byelaw to constitute a CBO for the kole in the participatory

approach. On the basis of this constitution, a CBO for the kole was being in to existence. The CBO or FMC played managerial and leading role in the kole management. They have been provided training on open water fisheries management. Based on this training they were made a management and an action plan for each year.

In October, 2001, after the formation and taking the full shape of the CBO, a fisheries management plan were prepared for the kole for the first time,. Ban on current jal, restriction on fine mesh net and capturing small size carp fish including at least one month total fish ban just after the stocking were included in that plan. Then the kole was brought under the intervention of carp fry/ fingerling stocking. That stocking was performed in a participatory approach. Community provided 10% in the first year, 40% in the 2nd year and the rest were provided by the FFP. In the 3rd and afterwards community conserve the natural carp fries immigrated from the Padma. First stocking was performed in October 2001. Based on the past experience, community decided to establish a sanctuary in the Kole.

In October 2002, Community declared a total 50 ha deep pool zone of the kole as sanctuary. Out of 50 ha, they protected the mid 10 ha. by brush files with branched bamboo poles. The rest 40 ha on both sides of the brush files were declared as no fish zone and remarketed by bamboo poles with red flags. The FMC made a boat for guarding and protecting the illegal fishing in the kole. The other management options were almost same before and after the establishment of sanctuary.

In 2004, the CBO realized the role of sanctuary in their kole. Then they decided to establish another new sanctuary from the own CBO fund. At present, two sanctuaries and other management are going on in the kole. By this time, Forth Fisheries Project supports including NGO have been with drawn. Yet, the CBO is organized well and the kole management under the leadership of this CBO is running fine. Now they are stronger, more efficient and capable in the kole management than the project period. They are now happy with the present production and income. Details management profiles are given bellow-

Table 4: Management Profiles

	Before 80	81-90	91-2000	2001-2002	2003-2005
Leasing system	Open auction	Handed over to the community	Open auction	Handed over to the community	Handed over to the community
ownership	Influential	Fishers	Influential	Fishers	Fishers
Management authority	Lease holders	Fishers	Lease holders	Fishers/FMC	Fishers/FMC
Management options	Indiscriminant catch	Controlled catch	Indiscriminant catch	Controlled catch	Controlled catch
Intervention	No Intervention	Stocking	No Intervention	Stocking & 1 sanctuary	Stocking & 2 sanctuary
No of fishers	400	350	350	313	313
No of gears	Berjal:20	Berjal:12	Berjal:16	Berjal: 10	Berjal: 5
	Jhaki jal:250	Jhaki jal:150	Jhaki jal:200	Jhaki jal:162	Jhaki jal:150
	Mojjal:150	Mojjal:80	Mojjal:100	Mojjal:66	Mojjal:60
	Fash jal:270	Fash jal:100	Fash jal:160	Fash jal:100	Fash jal:50
	Thela jal:150	Thela jal:100	Thela jal:100	Thela jal:100	Thela jal:50
	Hook/Barshi: 200	Hook/Barshi:1 50	Hook/Barshi:15 0	Hook/Barshi:1 20	Hook/Barshi: 100
No. of Berjal owners	5	10	4	40	40
Fishers share	5-20%	40%	10-20%	40%	50-60%
Fish ban	No planned ban	Two months ban After stocking	No planned ban	6months ban after one month interval	6months ban after one month interval
Area ban	No ban on any area	No ban on any area	No ban on any area	Ban on one sanctuary territory	Ban on two sanctuary territory
Ban on catch quantity	-	-	-	Other than Ber jal catch restrict up to 5kg	Other than Ber jal catch restrict up to 5kg
Size restriction	-	Not to catch carp bellow 9 inches	-	Not to catch carp bellow 9 inches and some other small fishes.	Not to catch small size carps & Aeor, Boal, Chital, shoal etc.

3.7. Study period:

The study was conducted from 2003 to 2004. Details plan and design of the works were set up in a participatory approach with the community. In 2002 sanctuary was established in the kole. Hence, the catch data 2001 to 2002 have been considered as base line production while the catch data from 2003 to 2004 have been considered as impact on fish production.

3.8 Data collection

Actual stock status and its trends assessment and analysis can show the actual impacts of the sanctuary establishment. More effective data collection method can give more representative data and more representative data can demonstrate the actual impact. So, maximum importance has been given on data collection method. Base line data were collected through PRA and impact data were collected by catch assessment survey by random sampling method:

3.8.1. Identification of survey area: In the Jagannathpur Kole, due to introduction community based management fishing were almost controlled. So it was easy to identify the fishing area and fishing gears. Almost all the fishers brought their catch in to the Bat-tala landing centre operated by the CBO after the end of the fishing. Beside this, round over the kole by CBO mechanized boat was easy to identify the selected fishers for interview.

3.8.2. Determination of indicator species: Some species represent the characteristic features of a water body. Some of these species are available in large quantities and are collected commercially. The other species are noncommercial but indicate some other features. Actually selection of indicator species depend on the CAS aims and objectives. For determining the species and gear wise total catch with stock position and trends to assess the impact of management undertaken.. In fact, the aim and objectives of the study (whether the fish production or catch increased or decreased as a result of sanctuary establishment in the kole) was clearly explained to the community and then asked them to set up indicator species. They discussed well among them and finally select the indicator species for this purpose. These were Tengra, Beley, Bata, Piali, Boal, Aeor, Chital. Pabda, Kajali, Bain, Canda, Punti, Rita, Kawnia etc..

Once these species were available and going reduced gradually. Some were going vanishes. More over, these were commercially important, breed locally, prefer shelter etc. On the whole, these indigenous fishes and meaningful for the sanctuary.

3.8.3. Identification fishing gears: It is important to identify the actual number of gears. Frame survey has been conducted for this purpose. The gear position are reviewed and revised before data collection through PRA. CBO and the NGO helped a lot to identify the fishing gears.

3.8.4. Identification of data collection month: For the study, yearly 6 months data were collected to come in conclusion. In the starting period, Partial lottery method has been followed for the selection of data collection months. The name of the 12 months was taken down in 12 pieces of papers. These papers were shaken well in a pot and taken one from it as the starting month of the data collection. Then alternate month was selected for data collection. Later on the fishing were limited to alternate 6 months yearly.

3.8.5. Selection of data collection day: The data collection days were selected by systematic random sampling method. Partial lottery method was practiced in data collection. All the days of a week (1 – 7) were noted down on small pieces of papers. Folded paper pieces were taken into a pot and shaken well. Then a piece of folded paper was taken out from the pot. If it was 6, the first date of data collection will be sixth of this month. The next date will be 12th, 18th and 24th day of the month.

3.8.6. Selection of data Providers/gears: All the gears of each village were brought under registration with a serial/code no. Each gear type was encoded by a separate serial/code number. We select the gears along with its operators by partial random sampling method.

3.8.7. Data collection & entry: We developed a questionnaire and format for data collection in participatory approach with the NGO and community members. Some NGO and CBO workers were trained on catch assessment survey (CAS). They assist me in data collection. We made a plan and collect data as per plan. Collected data were put in to a format for estimation.

3.8.8. Use of Participatory Rural Appraisal (PRA) tools:

To make the change of production trend more comprehensive decade wise annual catches were taken by participatory rural approach (PRA) for a period before the study (2001-2004). Baseline data (2001 – 2002) were also taken by PRA. Different PRA tools especially Focus Group Discussion, Fish Catch History Calendar were used to determine the decade wise annual catch begins with the origin of the kole in the decade of seventy and ends in the last decade of the 20th century. Fish biodiversity in different period and wellbeing status and other social information of the fishers were also collected by applying different PRA tools. These are listed below:

- » Rapport Building
- » Physical & Social Mapping
- » Fish diversity Historical Calendar.
- » Selection of indicator species for the impact study.
- » Small Group Discussion
- » Focus Group Discussion
- » Personal Observation
- » Fish Catch History Calendar
- » Fish/Catch Calendar
- » Fishers Wellbeing study for 2001
- » Fishers Wellbeing study for 2004.

3.9. Secondary Source of information:

Necessary relevant information on Kole history, fish availability and management system were collected from the Kole Fisheries management committee (FMC), NGO, Local DoF office and Fourth Fisheries Project Documents. Sometimes cross check was made on different information with the secondary data.

3.10. Data Analysis

Collected information obtained from the survey were accumulated, grouped and interpreted according to the objective as well as parameters. Some data contained numeric and some contained narrative facts. The data were then presented in graphs and tabular forms. All processing and analysis was done by using MS Excel and MS Word.



Fig7: Relevant information were collected through Participatory Rural Appraisal (PRA)

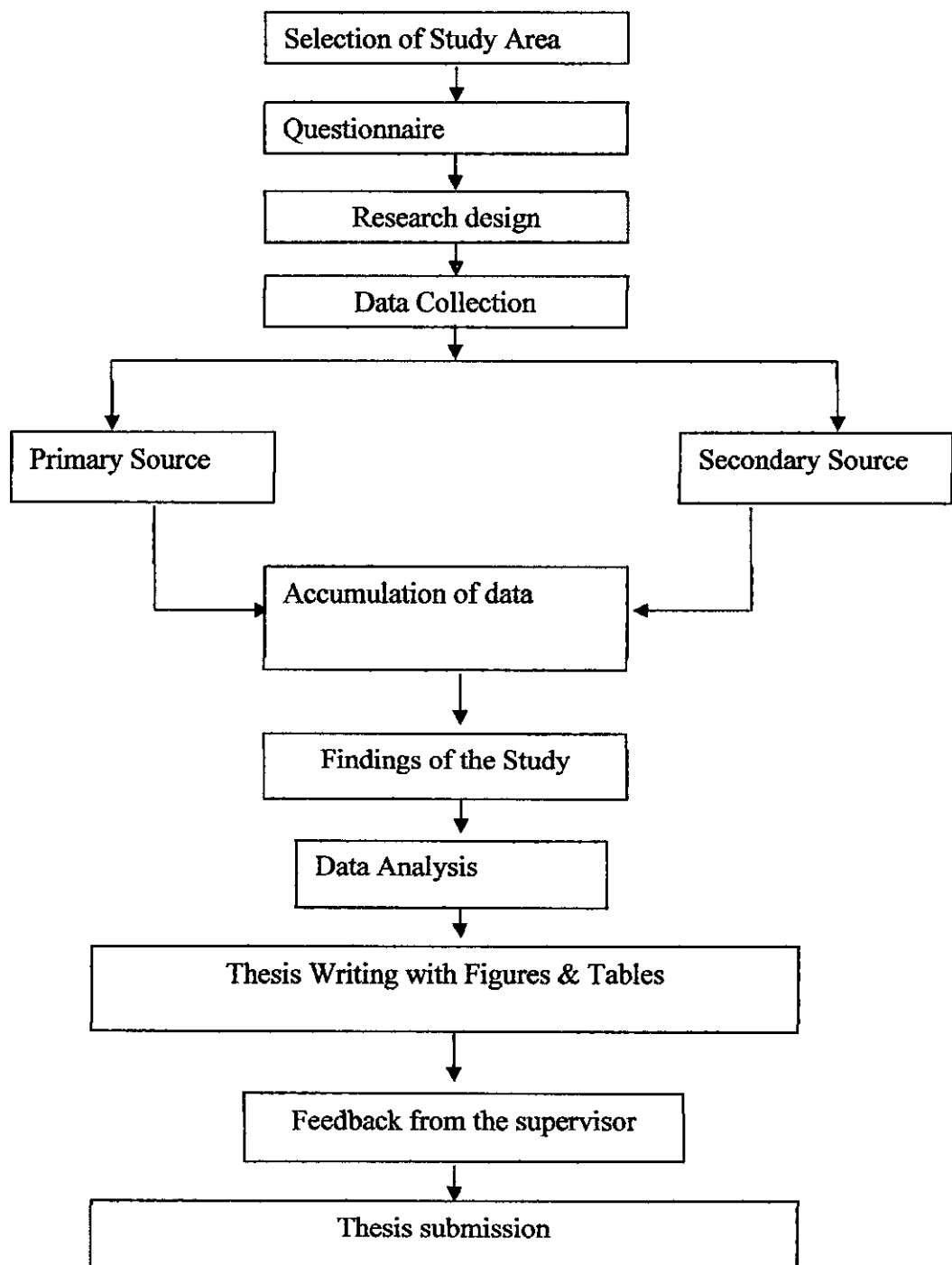


Diagram-1: Schematic Diagram of Methodology of the Study



CHAPTER-4

RESULTS AND DISCUSSION

Chapter-4

RESULT AND DISCUSSION

4.1. Checklist of Fish Species of the Sanctuary

Besides the stocked species more 32 different fish species have been recorded from the studied area. Local name and scientific name of the fish species recorded in the studied area.

Table-5: Checklist of Fish Species

Sl No.	Local Name	Scientific Name
1	Aeor	<i>Mystur aor</i>
2	Bata	<i>Cirrhina reba</i>
3	Bele	<i>Glossogobius giuris</i>
4	TaraBain	<i>Mastacembelus armatus</i>
5	Boal	<i>Wallago attu</i>
6	Catla	<i>Catla catla</i>
7	Rui	<i>Lbeo rohita</i>
8	Mrigel	<i>Cirrhina mrigala</i>
9	Common carp	<i>Cyprinus carpio</i>
10	Chapila	<i>Gudusia chapra</i>
11	Chanda	<i>Chanda spp.</i>
12	Chela	<i>Salmostorma bacaila</i>
13	Chital	<i>Notopterus chitala</i>
14	Foli	<i>Notopterus notopterus</i>
15	Ghutum	<i>Lepidocephalus guntea</i>
16	Kachki	<i>Corica soborna</i>
17	Kaspona/Dankona	<i>Aplocheilus panchax</i>
18	Kazoli	<i>Ailichthys punctata</i>
19	Mrigal	<i>Cirrhina mrigala</i>
20	Mola/Maya	<i>Amblypharyngodon mola</i>
21	Pabda	<i>Ompok pabda</i>
22	Punti	<i>Puntius spp.</i>
23	Piali	<i>Aspidoparia morar</i>
24	Rui	<i>Labeo rohita</i>
25	Shoal	<i>Channa striatus</i>
26	Taki	<i>Channa punctatus</i>
27	Tara bain	<i>Mastacembelus armatus</i>
28	Tengra	<i>Mystus tengra</i>
29	Small chingri	<i>Palaemon spp.</i>
30	Golda chingri	<i>Macrobrachium rosenbergii</i>
31	Lotia chingri	<i>Macrobrachium mirabilie</i>
32.	Gachi Bain	<i>Mastacembalus pancalus.</i>

4.2. Production trend of the sanctuary, Kole:

In regards to total annual catch the normal production trend was decreasing before the establishment of sanctuary. But it was found increasing after the establishment of the sanctuary. Decade wise annual catches and base line production were collected by PRA (up to 2000) while the annual catches during study period were taken by random sampling method (2003- 04). It was found that the average yearly fish production of the Kole in the decade of 70 was 352225 kg. But it began to decrease gradually and in the decades of 80, it was found 148555 kg. An abrupt fall of production found in the decade of ninety, it was 9535 kg. In 2001 and 2002 it was found 69732 kg and 64811 kg. After the establishment of sanctuary in 2002 the production of Kole was found 94562 kg and 148920 kg in the year of 2003 and 2004 respectively. Again the increasing trend was found.

Table-6: Year wise production of Kole

Year	Production (kg)
1960-70	352225
1971-80	342326
1981-90	148555
1991-2000	94535
2001	69732
2002	64811
2003	94562
2004	148920

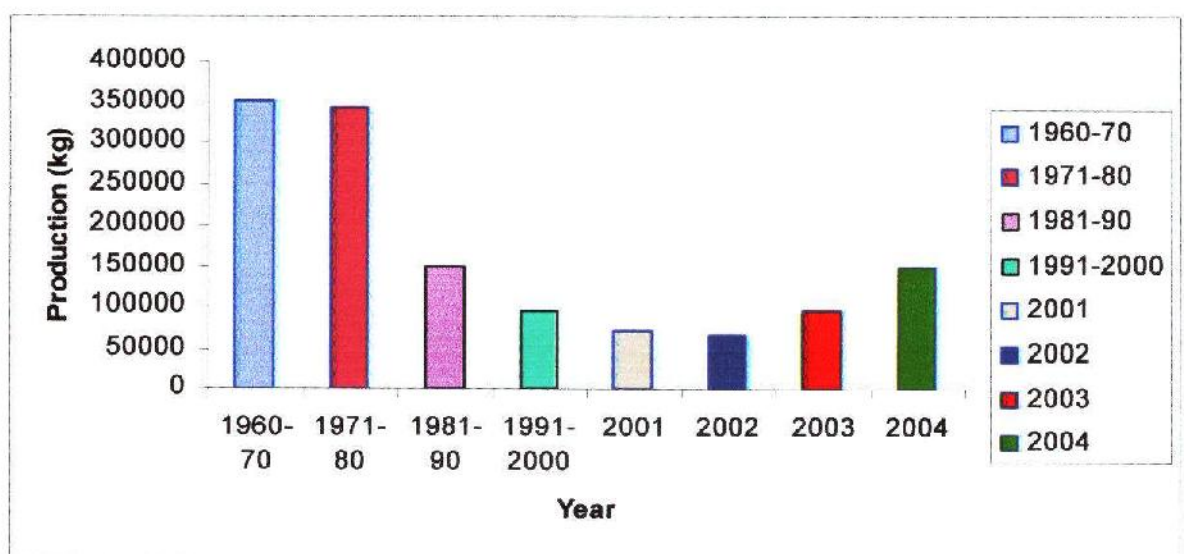


Fig-7: Production trends of Kole from 1960- 2004

4.3. Production of individual species of the Kole in the study period

4.3.1. Production of Chanda (*Chanda spp*) in Kole:

From the Catch data it was found that production of Chanda in the Kole decreased day by day and it was found the highest 13050 kg in 2002 and lowest 7150 kg in 2004. After the establishment of sanctuary, a decreasing trend was found. The production of the same was found 9234 kg in 2003 and 7105 kg in 2004 which indicates the decreasing trend.

Table-7: Production of Chanda in Kole:

Year	Production(kg) of Chanda
2001	12984
2002	13050
2003	9234
2004	7105

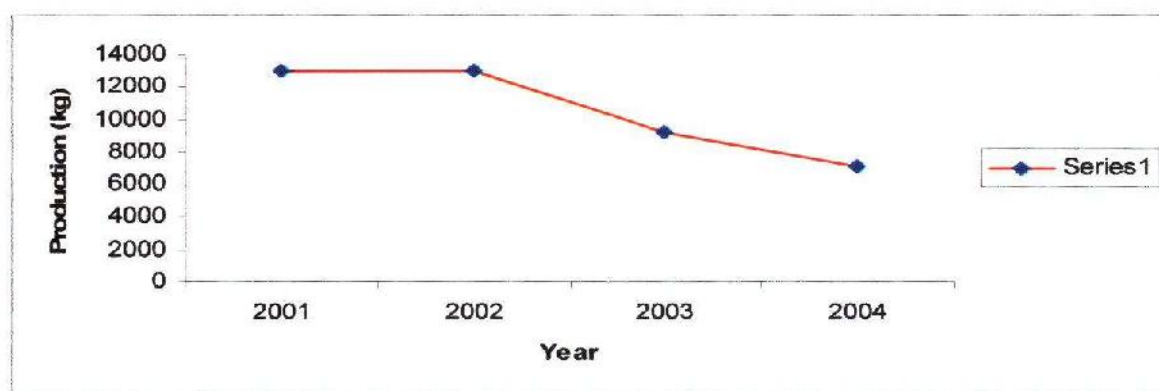


Fig-8: Year wise production of Chanda in Kole

4.3.2. Production of Punti (*Puntius spp*) in Kole:

From the catch data it was found that there was no remarkable variation in production of Puti in Kole and it was found highest 5700kg in 2003 and lowest 5114kg in 2002. After the establishment of sanctuary, there was no amazing change in production. It was found 5700 kg in 2003 and 5138 kg in 2004.

Table-8: Production of Punti (*Puntius sp.*) in Kole:

Year	Production(kg) of Punti
2001	5204
2002	5114
2003	5700
2004	5138

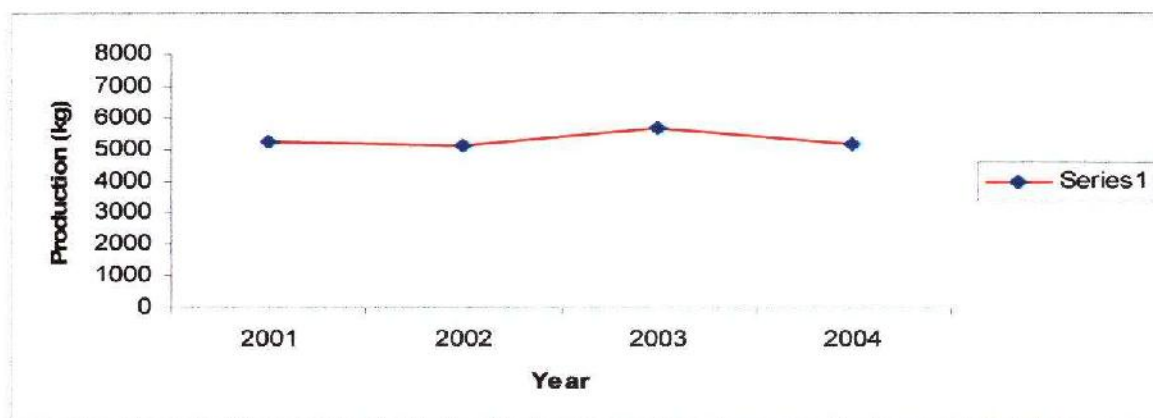


Fig-9: Year wise production of Punti

4.3.3. Production of Taki (*Channa punctatus*) in Kole:

From the catch data it was found that production of taki in kole decreased slightly in the study period and highest production was found 3126 kg in 2001 and lowest production was found 2142 kg in 2002. After sanctuary, a slightly increasing trend was found. It was found 2427 kg in 2003 and 2877 kg in 2004

Table-9: Production of Taki in Kole:

Year	Production(kg) of Taki
2001	3126
2002	2142
2003	2427
2004	2877

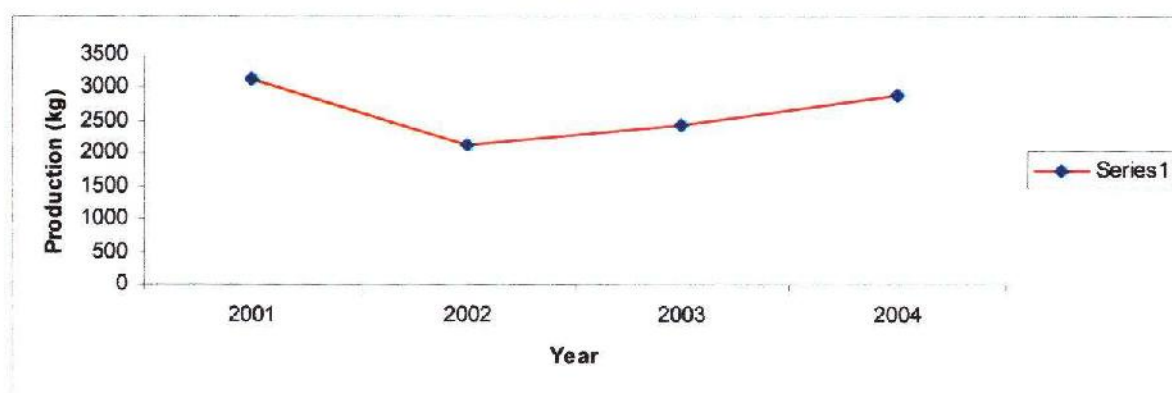


Fig-10: Year wise production of Taki

4.3.4. Production of Bain (*Mastacembelus pancalus*) in Kole:

From the catch data it was found that production of Bain in kole decreased very slowly in the study period and highest production was found 3016 kg in 2001 and lowest production was found 2272 kg in 2002. After the establishment of sanctuary, there was no notable change. The production of it was found 2325 kg in 2003 and 2325 kg in 2004.

Predation on small size tiki by big Boals and many other predatory fishes might be the one of the cause which inhabits increasing trend.

Table-10: Production of Bain in Kole:

Year	Production(kg) of Bain
2001	3016
2002	2272
2003	2325
2004	2325

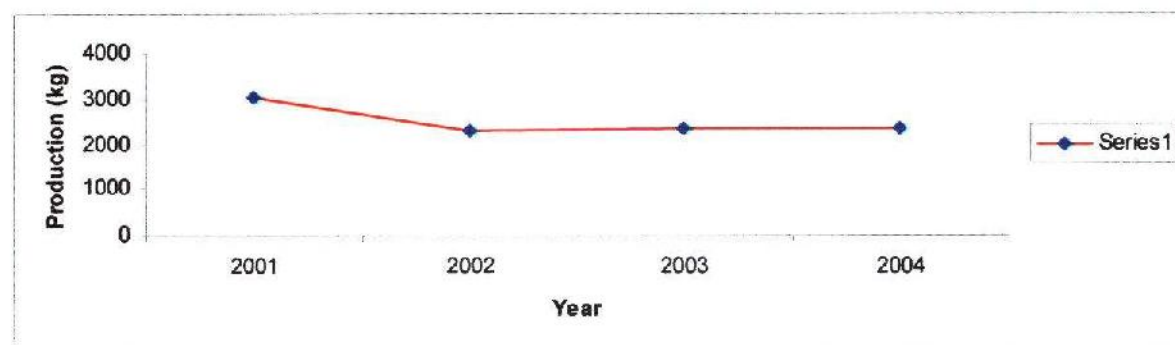


Fig-11: Year wise production of Bain

4.3.5. Production of Tengra (*Mystus tengra*) in Kole:

The production of tengra in Kole was remarkable before the sanctuary and highest production was 3717 kg in 2001 and 3792 kg in 2002. It was found 7024 kg in 2004 and lowest production was 3714 kg in 2003 after the establishment of sanctuary, a remarkable increasing production was found in 2004.

Table-11: Production of Tengra in Kole:

Year	Production(kg) of Tengra
2001	3917
2002	3792
2003	3714
2004	7024

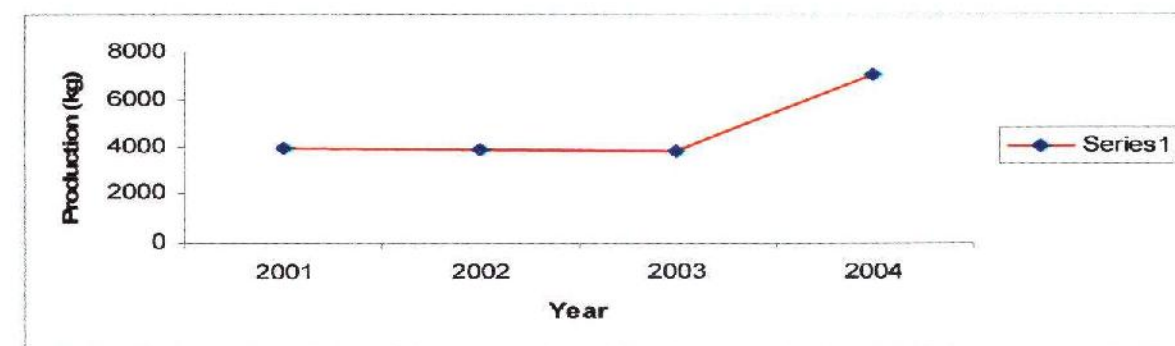


Fig-12: Year wise production of Tengra

4.3.6. Production of Beley (*Glossogobius giuris*) in Kole:

From the data it was found that the production of Beley was decreased mention ably and the highest production was 3376 kg in 2001 and the lowest production was 1198 kg in 2002. After the establishment of sanctuary, a slightly increasing trend was found. The production of the same was found 1715 kg in 2003 and 2470 kg in 2004

Table-12: Production of Beley in Kole:

Year	Production(kg) of Beley
2001	3376
2002	1198
2003	1715
2004	2470

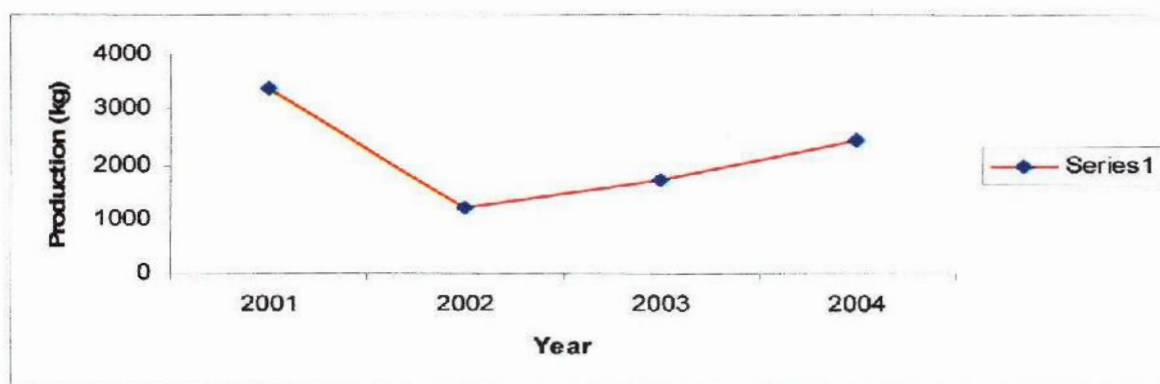


Fig-13: Year wise production of Beley

4.3.7. Production of Aeor (*Mystur aor*) in Kole:

Production of Aeor was decreased mention ably and the highest production was found 1977 kg in 2001 and the lowest 1484 kg in 2002. After the establishment of sanctuary, an amazing increasing trend was found. The production of it was 2371 kg in 2003 and 4347 kg in 2004.

Table-13: Production of Beley in Kole:

Year	Production(kg) of Aeor
2001	1977
2002	1484
2003	2371
2004	4347

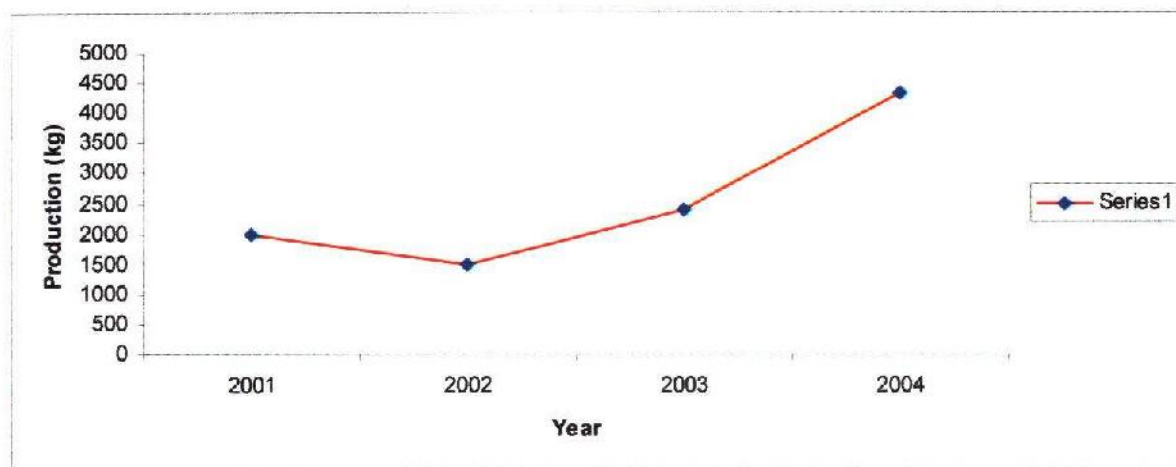


Fig-14: Year wise production of Aeor

4.3.8. Production of Boal (*Wallago attu*) in Kole:

The production of Boal was very low before sanctuary, found 1138 kg in 2001 and 1181 kg in 2002. That decreasing trend increased remarkably after establishment of sanctuary in the kole. The production of the same was found 2282 kg in 2003 and 3747 kg in 2004, a remarkable increasing trend.

Table-14: Production of Boal in Kole

Year	Production(kg) of Boal
2001	1138
2002	1181
2003	2282
2004	3747

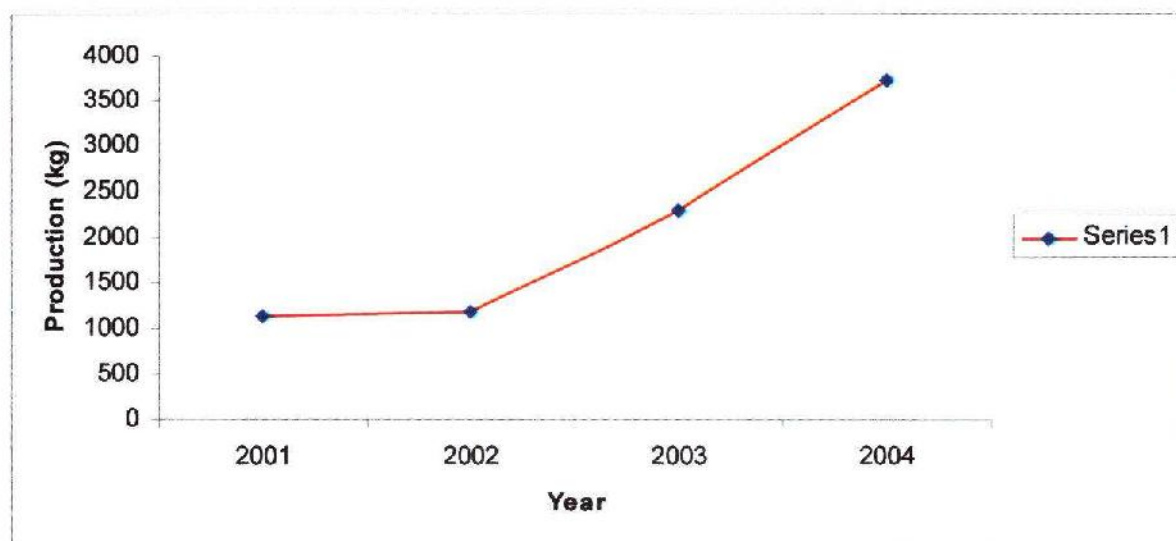


Fig-15: Year wise production of Boal

4.3.9. Production of Chital (*Notopteras chitala*) in Kole:

The Catch data shows that before the establishment of sanctuary, the production of Chital was decreased in a level of endangered and the highest production was found 770 kg in 2001 and the lowest production was found 458 kg in 2002. After the establishment of sanctuary, a note able increasing trend was found. The production of that was found 1534 kg in 2003 and 3122 kg in 2004. This amazing increase can be treated as recovery from the danger level.

Table-15: Production of Chital in Kole:

Year	Production(kg) of Chital
2001	770
2002	458
2003	1534
2004	3122

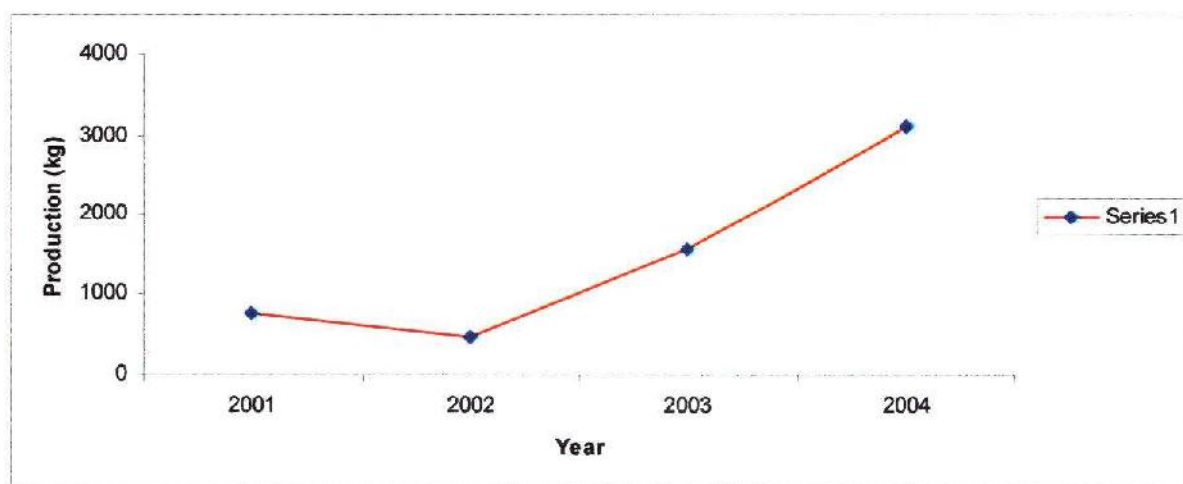


Fig-16: Year wise production of Chital

4.3.10. Production of Chingri (mainly Paelemonid) in Kole:

It was found that before the establishment of sanctuary the production trend of Chingri was decreasing and the highest production was found 11213 kg in 2001 and the lowest production was found 5928 kg in 2002. After the establishment of sanctuary, still the trend was decreasing. The production of the same was found 7292 kg in 2003 and 5928 kg in 2004. Such decreasing trend might occur due to increase of predatory species as a result of the sanctuary establishment in the kole.

Table-16: Production of Chingri in Kole:

Year	Production(kg) of Chingri
2001	11213
2002	9253
2003	7292
2004	5928

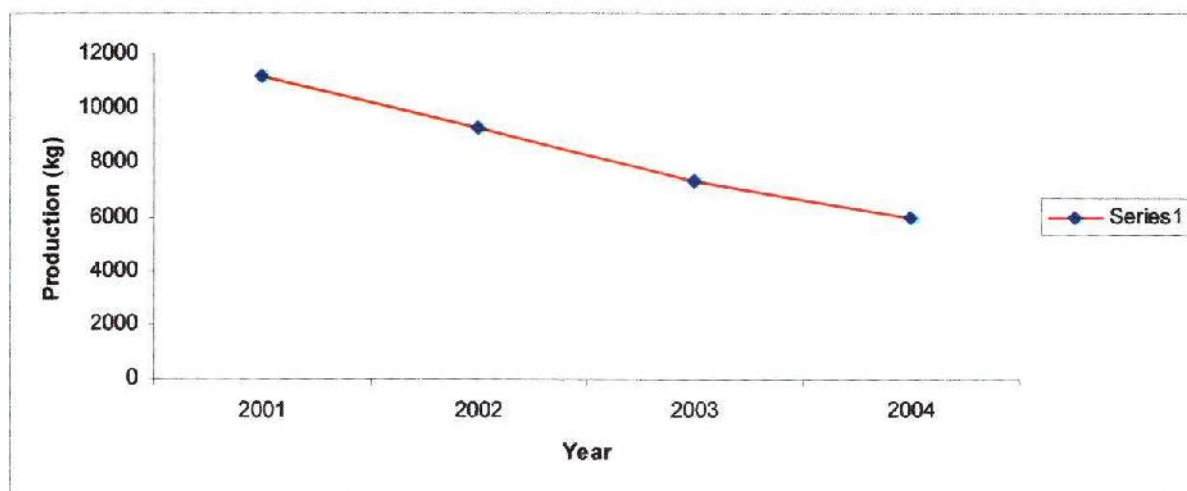


Fig-17: Year wise production of Chingri

4.3.11. Production of Bata (*Cirrhina reba*) in Kole:

The Catch data before the establishment of sanctuary shows that the production of Bata decreased in a threatening level and the highest production was found 517 kg in 2001 and the lowest production was found 372 kg in 2002. After the establishment of sanctuary, an amazing increasing trend was found. The production of it was found 1715 kg in 2003 and 2778 kg in 2004

Table-17: Production of Bata in Kole:

Year	Production(kg) of Bata
2001	517
2002	372
2003	1715
2004	2778

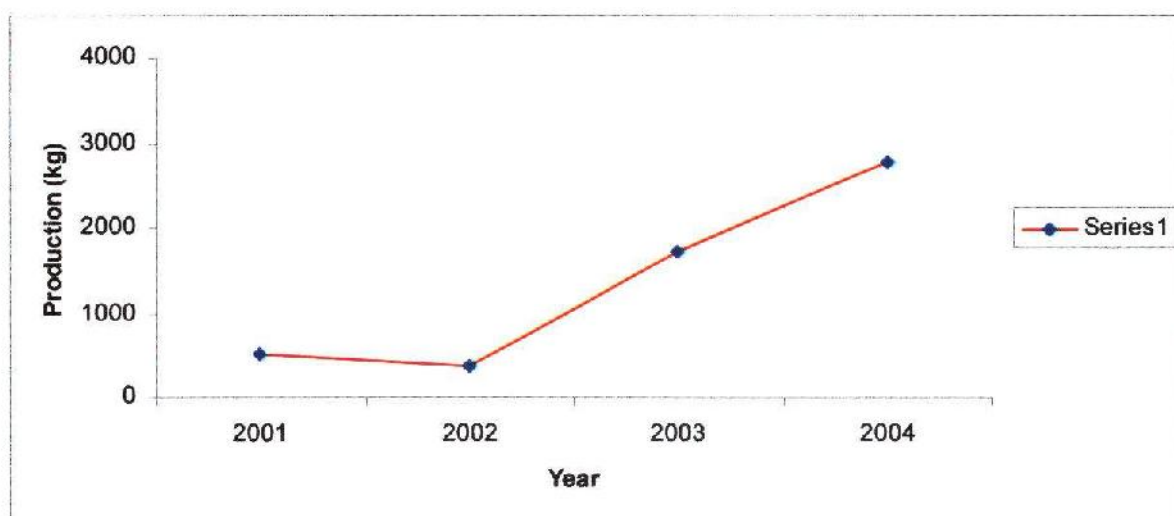


Fig-18: Year wise production of Bata

4.3.12. Production of Chapila (*Gudusia chapra*) in Kole:

The Catch data shows that before the establishment of sanctuary the production of Chapila was not so good and the highest production was found 1964 kg in 2001 and the lowest production was found 1744 kg in 2002. After the establishment of sanctuary, a significant increasing trend was found. The production of the same was found 2381 kg in 2003 and 3254 kg in 2004

Table-18: Production of Chapila in Kole:

Year	Production(kg) of Chapila
2001	1964
2002	1744
2003	2381
2004	3254

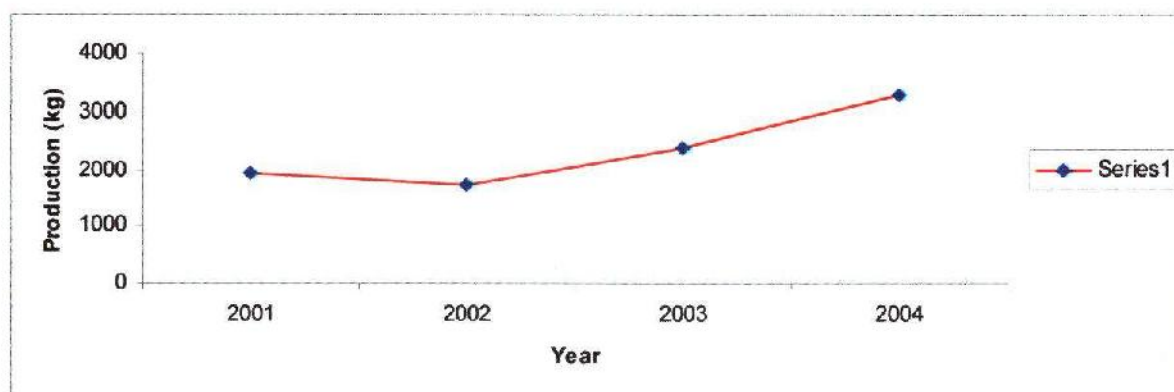


Fig-19: Year wise production of Chapila

4.3.13. Production of Piali (*Aspidoparia morar*) in Kole:

Before the establishment of sanctuary, Catch figure tells that the Piali was going disappear from the site and the production was found 698 kg in 2001 and the 524 kg in 2002. After the establishment of sanctuary, a significant increasing trend was found. It was found 1113 kg in 2003 and 2501 kg in 2004.

Table-19: Production of Piali in Kole:

Year	Production(kg) of Piali
2001	698
2002	524
2003	1113
2004	2501

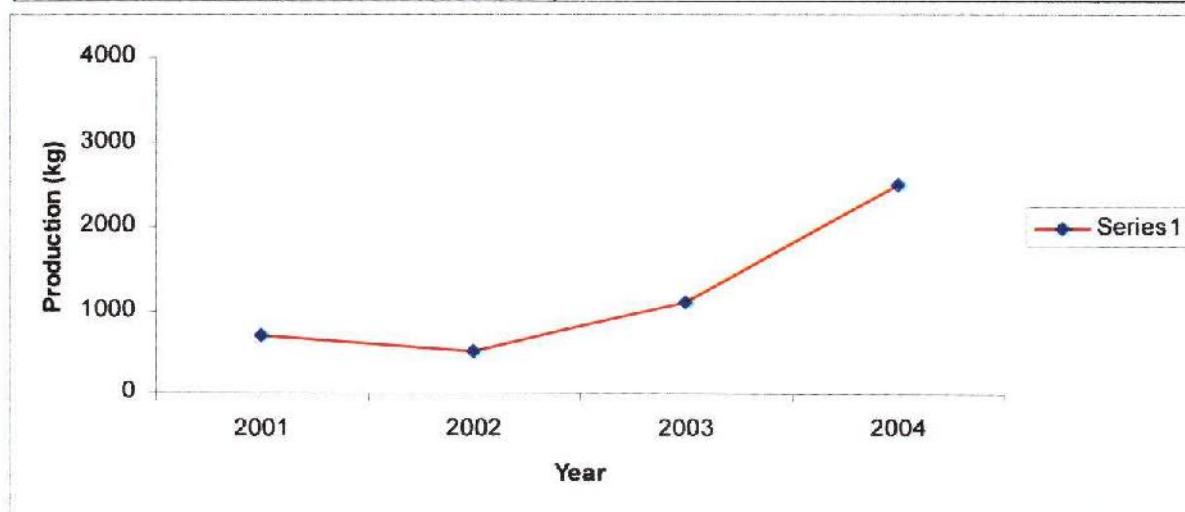


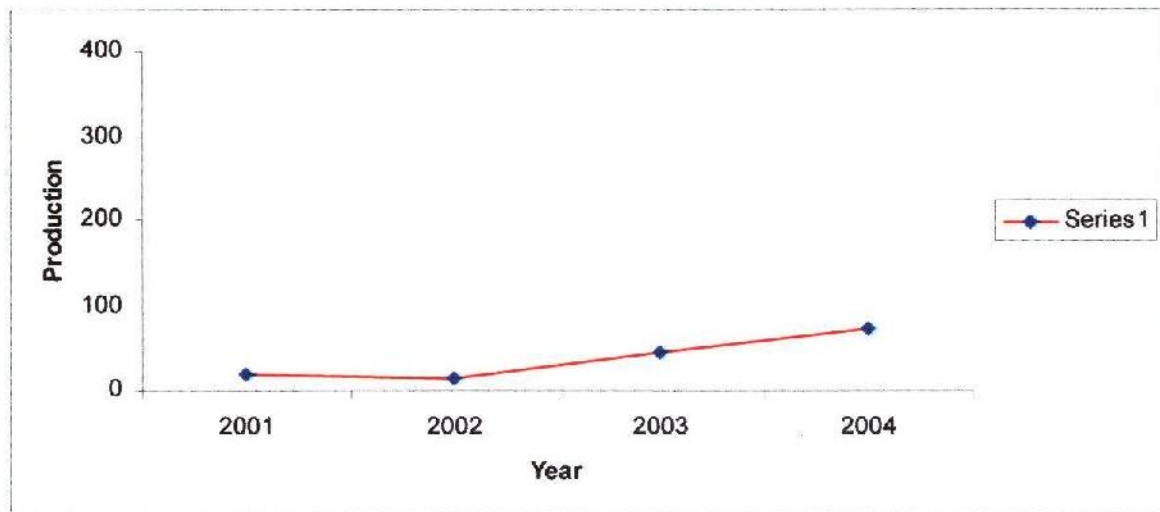
Fig-20: Year wise production of Piali

4.3.14. Production of Pabda (*Ompok pabda*) in Kole:

The Catch data shows that before the establishment of sanctuary the production of Pabda was going to be an extinct species and the highest production was found 18 kg in 2001 and the lowest production was found 13 kg in 2002. After the establishment of sanctuary, it was found in a reappearing trend. The production of the same was found 44 kg in 2003 and 74 kg in 2004

Table-20: Production of Pabda in Kole:

Year	Production(kg) of Pabda
2001	18
2002	13
2003	44
2004	74

**Fig-21: Year wise production of Pabda****4.3.15. Production of Kajali (*Ailichthys punctata*) in Kole:**

Before the establishment of sanctuary, the production of Kajoli indicates that was going down to a vanishing category and the production of it was found 50 kg in 2001 and the 50 kg in 2002. After the establishment of sanctuary, it was found in a reappearing manner. The production of the same was found 114 kg in 2003 and 178 kg in 2004

Table-21: Production of Kajali in Kole:

Year	Production(kg) of Kajali
2001	50
2002	50
2003	114
2004	178

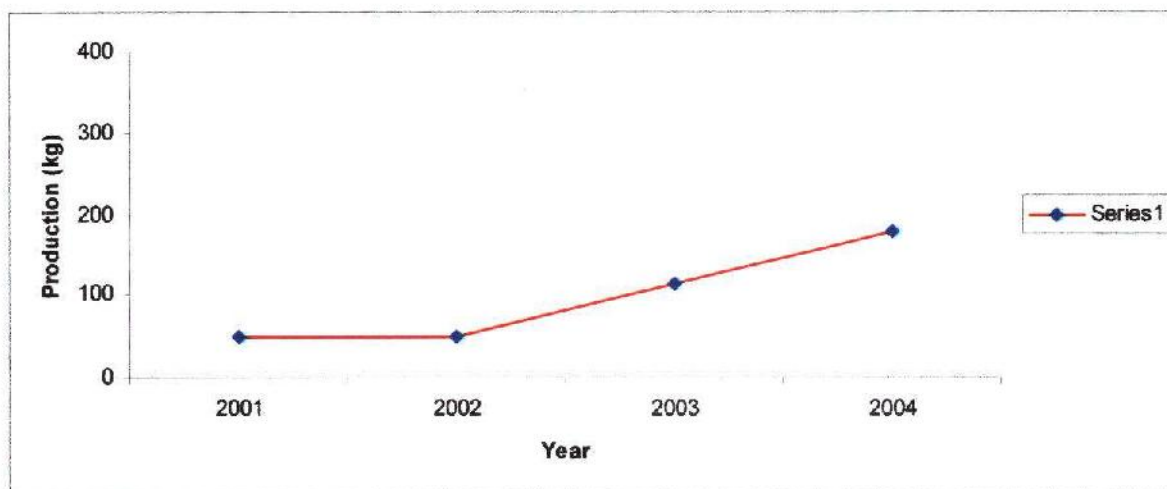


Fig-22: Year wise production of Kajali

4.3.16. Production of Rui (*Labeo rohita*) in Kole:

The catch data shows that before sanctuary establishment the production of rui was not so much better due to lack of any conservation and any other management practice for the kole. It was found that the production was 2393 kg in 2001 and 2140 in 2002. But after sanctuary establishment and fry stocking the production was growing up amazingly. The production was found 17227 kg in 2003 and 16441 kg in 2004. It might occur due to stocking and conservation taken by the community.

Table-22: Production of Rui in Kole:

Year	Production(kg) of Rui
2001	2393
2002	2140
2003	17227
2004	16441

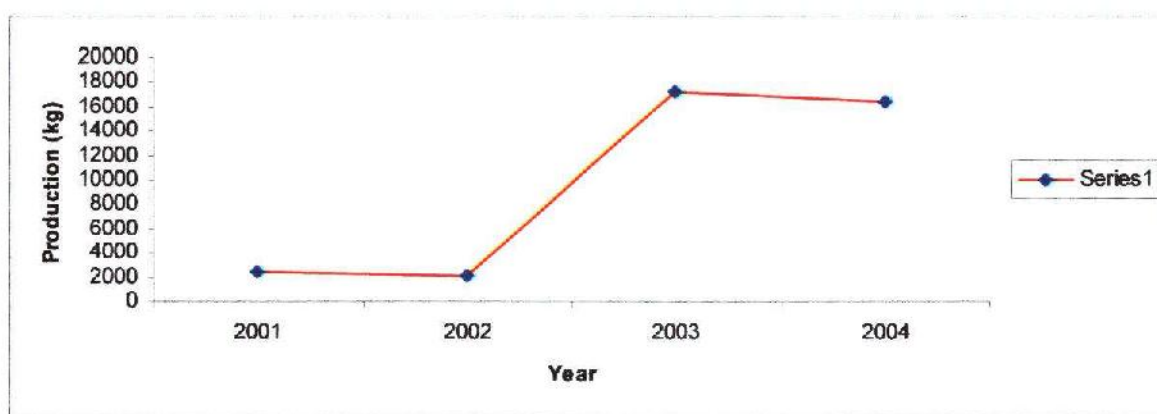


Fig-23: Year wise production of Rui

4.3.17. Production of Catla (*Catla catla*) in Kole:

The catch data before sanctuary establishment shows that the production of Rui was not so much better and it was found that the production was 2843 kg in 2001 and 2813 kg in 2002. But after sanctuary establishment and fry stocking the production was increased highly. This was due to stocking of carp fry-fingerlings and conservation of the carp fries immigrated in to the kole from the padma. The production was found 13726 kg in 2003 and 17315 kg in 2004.

Table-23: Production of Catla in Kole:

Year	Production(kg) of Catla
2001	2843
2002	2813
2003	13726
2004	17315

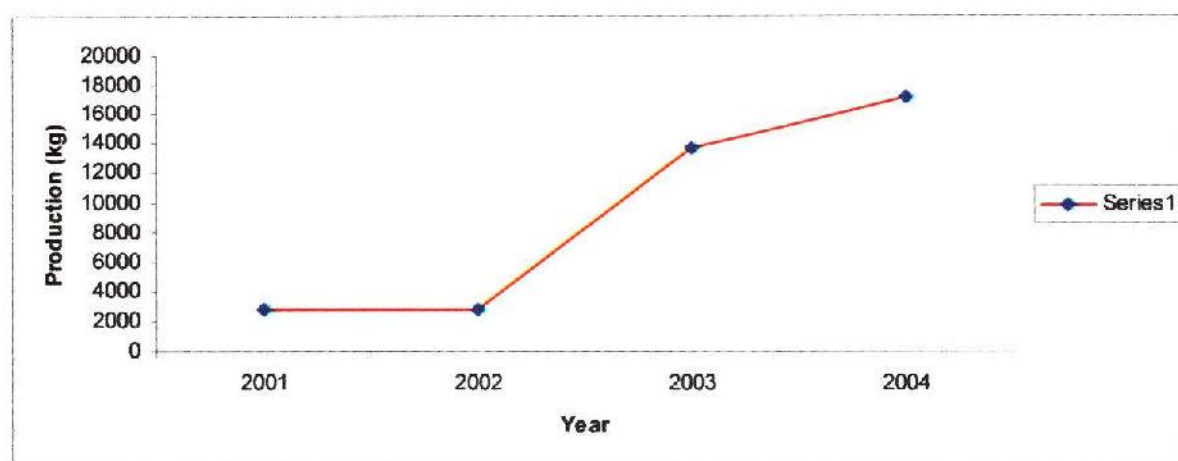


Fig-24: Year wise production of Catla

4.3.18. Production of Mrigel (*Cirrhina mrigala*) in Kole:

The catch data shows that before sanctuary establishment the production of catla was not so much better and it was found that the production was 1928 kg in 2001 and 3666 kg in 2002. But after sanctuary establishment and fry stocking the production was increased highly. This was due to stocking of carp fry-fingerlings and conservation of the carp fries immigrated in to the kole from the padma due to establishment of the sanctuary. The production was found 9671 kg in 2003 and 13283 kg in 2004.

Table-24: Production of Mrigel in Kole:

Year	Production(kg) of Mrigel
2001	1928
2002	3666
2003	9671
2004	13283

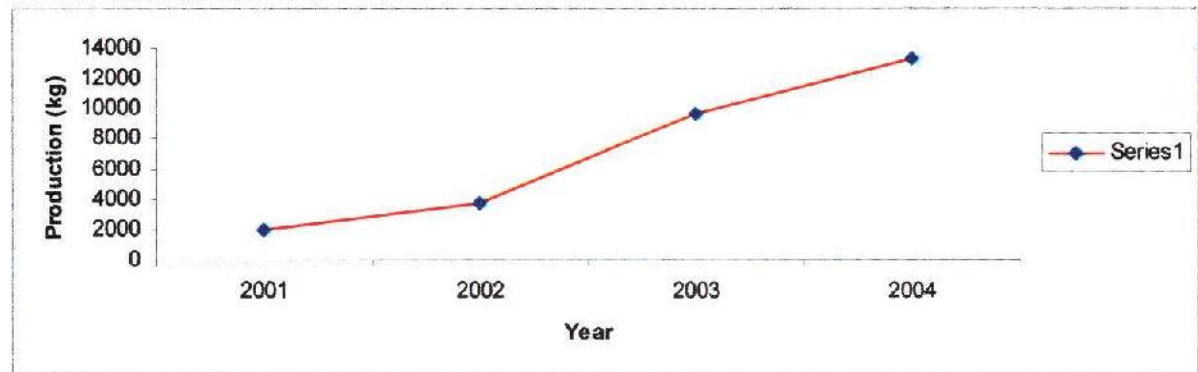


Fig-25: Year wise production of Mrigel

4.3.19. Production of Shoal (*Channa striatus*) in Kole:

The Catch data shows that before the establishment of sanctuary the production of shoal was decreased in a threatening level and the highest production was found 1141kg in 2001 and the lowest production was found 993 kg in 2002. After the establishment of sanctuary, a remarkable increasing trend was found. The production of the same was found 1872 kg in 2003 and 2399 kg in 2004

Table-25: Production of Shoal in Kole:

Year	Production(kg) of Shoal
2001	993
2002	1141
2003	1872
2004	2399

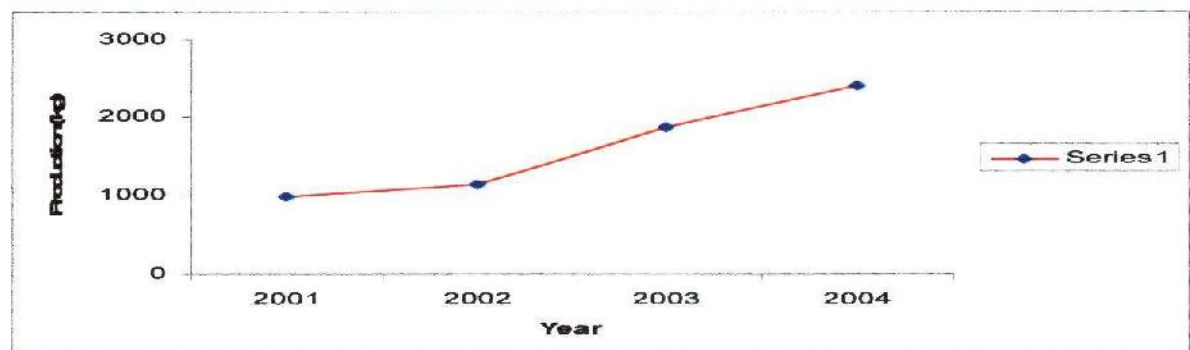


Fig-26: Year wise production of Shoal

4.3.20. Production of other species in Kole:

Other fish include *Xenontodon cancila* (Kakila), *Chella fullo*(ful chela), Teltupri, Kakchi, *Cirrhina reba*(Raich bata), *Rhotee cotio*(Bajar dhela), Meni, *Botio Dario*(Rani), *Amblypharyngodon mola*(mola), Darkina, *Mugil corsula*(Khorsula), *Clupisom gharua*(Ghausa), *Clupisom bacha*(Bacha), *Silondia silondia*(Silanda), *Anabus testudinius* (Koi), *Clarius batrachus*(Magur), *Heteropnustes fossilis*(Shing), *Hilsa illisha*, *Pangasius pangasius*, *Hypophrictis molitrics*, *Arichtrichthys nobilis*(Grass carp), *Xenentodon cancila* Common carp etc. The production of other species increased amazing in 2004 (after the establishment of the sanctuary). It was 8105 kg in 2003 and 46614 kg in 2004 where as in 2001 and 2002 (baseline) it was 11658 kg and 12404 kg. Such notable increase might turn out from the enhancement of stock biomass of different species, included in other group and might occur due to sanctuary.

Table-26: Production of other species in Kole:

Year	Others
2001	11658
2002	12404
2003	8105
2004	46614

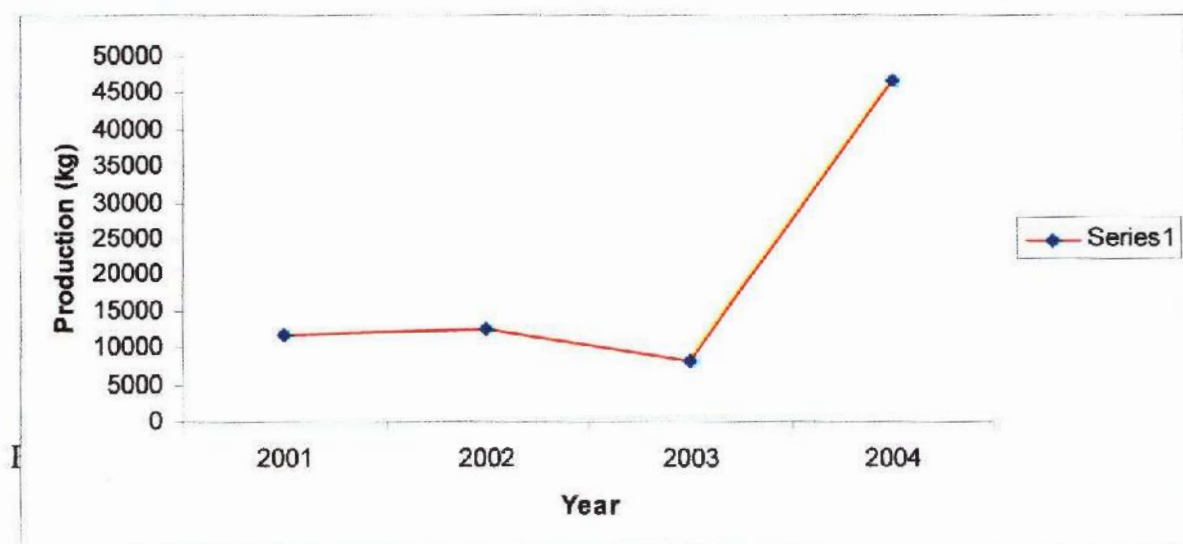


Fig-27: Year wise production of other species

4.4. Inter relation between species

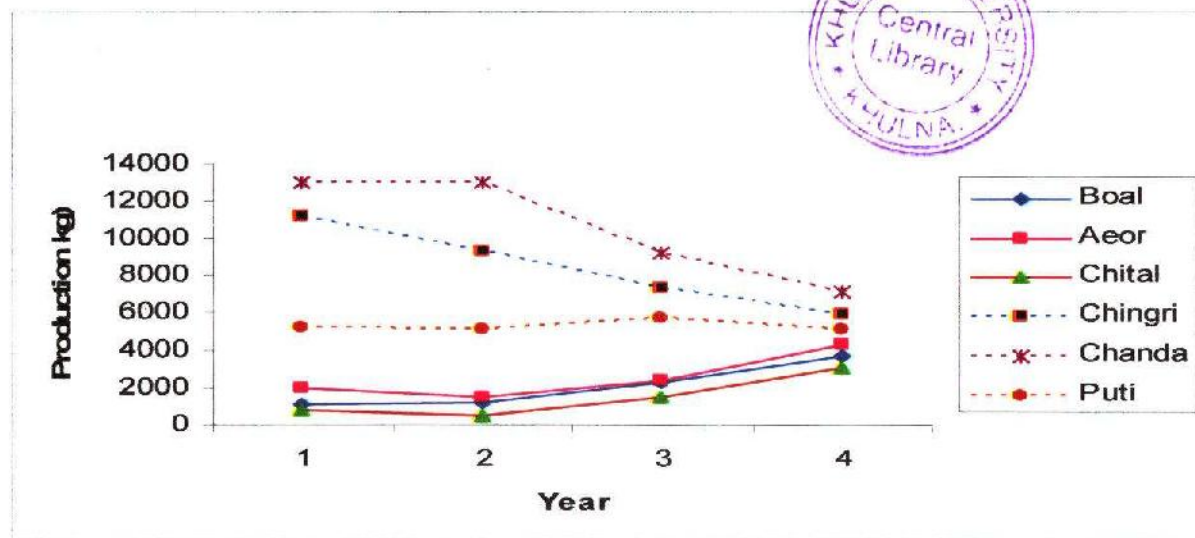


Fig-28: Inter relation within the species

4.5. Overall discussion about fish production

The sanctuary was set up in the kole in 2002. Hence, the total catch of 2001 and 2002 were considered as baseline and consequently, those of 2003 and 2004 as impact production. The earlier fish production trend of the kole was found diminishing including baseline (table-7). The base line production went down 108 kg/ha, consequently, this production came up to 248 kg/ha in 2004 might impacted from the establishment of sanctuary including other management taken in the kole.

The diminishing fish production trend of the kole was found during the period 1980 to 2000. In baseline period, total & individual production also decreased badly. It might occur due to change of the habitat, loss of connectivity with the main channel and lack of proper management and many other causes. In 2001 for the first time organized management practices were began in the kole. Still then, there were a lower productions, might occur due to lack of effective management as because of the fact that the beginning year was the preparatory phase for effective management process. Then the main activities were limited to the community institutional arrangement, preparation of fisheries management plan (FMP) and awareness building. So, the management effects were not reflects properly on the production. Thence, a decreasing trend was found at that period.

In 2002, as per plan developed and approved by the community effective management measures were taken. At the same time, 50 ha area was protected as sanctuary.

For this reason fish production were found increasing 2003 and 2004(table:6). In this period, the baseline production increased more than double of the baseline. That increasing trend can be considered as the outcome of the sanctuary including other managements taken in the kole. One thing should be kept in mind that impacts of a sanctuary depend on the other managements taken in the whole water body. Its success depends on how effectively protect the fish ban area no take zone along with the other restrictions incorporated in the over all water body management.

We can explain this increased production in an alternative way. In this regards, over all, we can consider the hypothesis - (1) Fish production increased due to the other management operated in the kole. (2) Fish production increased as a result of more favorable climatic and other geophysical conditions prevailed in the impact period. (3) Fish production increased due to sanctuary management in the kole. In case of hypothesis -1, table-4 shows that, there were no appreciable changes in other management during base line and impact period. So, this hypothesis has become null. On the other hand, in case of hypothesis 2, Table 2 and 3 shows that the climatic and other geophysical conditions were remaining almost same both in baseline and impact period. So, we can also nullify hypothesis 2. It is evident that if hypothesis 1 and 2 become unacceptable, then hypothesis 3 is logical and acceptable. So, confidently we can say that fish production increased due to establishment of sanctuary in the Kole.

Almost similar increasing production trend was found in other sanctuary sites in Bangladesh. In different water bodies of the country where 228 sanctuaries were established, under CBFM 1&2, New Management Policy and MACH project (DoF -2005). Impacts on fish production and biodiversity conservation were found to increase in varying degrees. The results show that in the study site the fish production increased 111% within two years of sanctuary establishment. Where as in CBFM project fish production increased by 81.42%. On the other hand, in MACH (Management of Aquatic Resource through Community Husbandry, a project operated by Ministry of Fisheries & Livestock.) project fish production increased 110- 163% (DoF 2005). A big success were found in Haile Haor, Srimongal, under Habiganj district where 27 sanctuary were established 1998- 2003. Fish production found increase from 171.08 kg./ha. to 316.0 kg./ha. (CNRS, DoF). In the same period in Turag- Bangshi river of kaliakair, Tangail & Gajipur districts where fish production increased from 59.57 kg/ha to 321.0 kg./ha. While in Kangsho Malighi River,

Sherpur district where 23 sanctuaries were established. The fish production were increased in this river from 150kg/ha to 316 kg/ha with in 3-5 years. In these sites, in some cases the production was higher than the production of the study site. This variation might come from the effective support activities and management taken for those sites. In those sites a lot of connecting channels were made. Beside these, a strong institutional arrangement was provided for effective management of the sanctuary site. Where as in case of study site, there were some laps and gaps such as connectivity with the main channel Padma was not improved.

In this study, the production of Aeor, Boal, Chital, tengra, piali, Bata etc. increased amazingly. Such notable increasing might occur due to impact of sanctuary in the kole. All respondent including fishers said that the species mentioned above were true indicator for that sanctuary. The kole sanctuary provided a safe zone for escaping small, medium and above all parent fish. It also provided a safe environment for breeding, nursing, feeding, escaping and growing of those fishes. That's why increased production obtained.

The base line production of other indicator species Kajali and Pabda and chital were found in such a low level that indicated the vanishing state of those species. After sanctuary, the impacted production of those species was good enough indicating the reappearing trend of those species. It can be compared with the other CBFM (Community based Fisheries Management, a project implemented World Fish and DoF.) sanctuary sites of the country, where the species number increased by 31.24%, In 54 FFP (Fourth Fisheries Project, DoF) sanctuary sites 23 species recovered from the endanger level. In this study site, it was found the recovery trend of at least three species.

The production of other two species Rita and kawnia found '0' both in baseline and impact production. This production indicates vanishing state of those species in that kole. This two species still then did not recovered even after the sanctuary in the Kole.

Study also show that the production of chanda, Puti, Taki, Bain and Chingri reduced gradually. These decreasing continued even in the impact period. This badly decreasing might occur due to amazing increase of predatory species like Beley, Boal, chital, Aeor, shoal etc.

PRA data shows that in Jagannathpur kole, fish production had been decreasing gradually from the decade of 70 to last decade of 20 th century. After the establishment of the sanctuary in the kole the production trend has been increased remarkably. Total production increased more than double, three disappearing species show reappearing trend. Fishers have been organized, their income has been increased and confidence on fish sanctuary along with other management has also been increased as a result of sanctuary establishment.

4.6. Socio-Economic Profiles of the Fishermen Community

4.6.1. Age Structure

Knowledge of age structure of the fishermen is important in estimating potential productive human resources. Planning of education, health and employment generation requires sufficient data on relevant age structures. The age distribution of fishermen has an important influence on labour (Mandima, 1995) and also on their perceptions of the future (Khan and Hashemzadeh, 1985).

In the study area, most fishermen were quite young (21-30 yrs), with an average age estimated in Kole was 45.4% with 16 to 70 yrs. Table-6 and Figure-40 shown age structure range in Kole fish community. According to the interviewee, almost all males over 15 yrs are directly engaged in fishing, while women help in weaving and repairing of nets, making fish traps, and are also engaged in maintaining the house, collecting firewood and livestock rearing to supplement the household income.

Table-27: Age Structure of Kole Fishermen

Age Structure (year's)					Total
Below 20	21-30	31-40	41-50	Above 50	
11.70%	45.40%	18.80%	15.60%	8.50%	100.00%

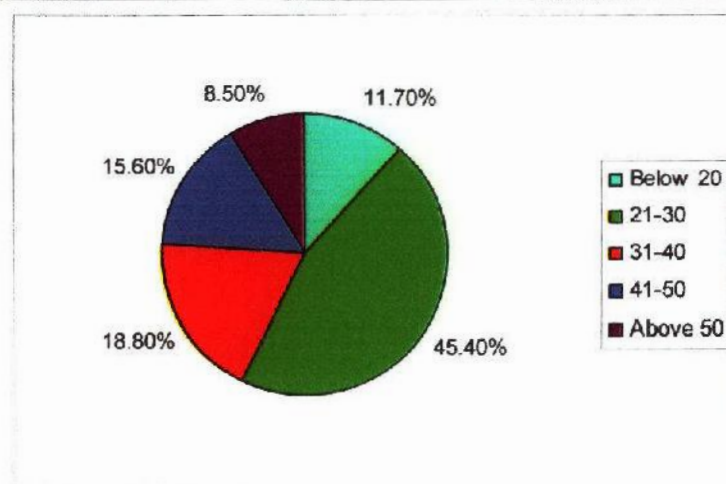


Fig-29: Age structure of fishermen community.

4.6.2. Family Size

This was defined as the number of persons, either working or not, belonging to the same family (Habib et al., 1994). The family size and its composition are related to occupation and income (Islam, 1995), and are likely to have an important influence on fishing practice. As noted by Gill and Motahar (1982), large family sizes may make it difficult for the household to invest in fishing, because of financial constraints and incorporation of family members. Chang (1994) noted that the family size of fishermen in developing countries is high because of the high birth rate and reducing child mortality, and large families, high populations result in high levels of unemployment and other socio economic ills (Ignacy, 1994).

The average family size of fishermen in the selected area was estimated as 6.3 people in a single family, which was higher than national household size as 5.6 (BBS, 2000). Family sizes (%) of the proposed areas are presented in Table-7 and Figure 41

Table-28: Family Size of Kole Fishermen

Family Size			Total
Below 3	6-Apr	Above 6	
23.40%	60.90%	15.60%	100.00%

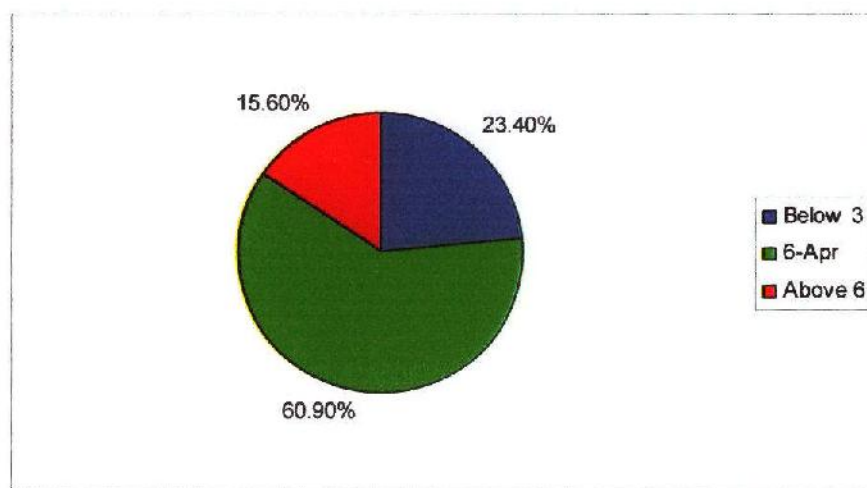


Figure-30: Family size of fishermen community.

4.6.3 Educational Background

There is a strong relationship between society and education (Veerina *et al.*, 1999). Human resource development is largely a function of literacy and educational attainment. Amongst fishermen, literacy and education attainments help develop conceptual skill and also facilitate the acquisition of technical skill, which can have direct bearing on income generation, expenditure and saving activities. Atapattu (1994) stated that fishermen should be properly educated with respect to the importance of management. Education of fishermen was also reported to help improve the efficiency of rural household's in production (Wang *et al.*, 1996).

Four categories were used to define education level: 1) Sign only, 2) Upto primary, 3) Upto secondary, 4) Upto HSC. From the total interviewed, Table-9 and Figure-11 show different educational level of fishermen community. No one was found above secondary level of education. These findings concur with the results of Rahman (1994), who noted that in Bangladesh most of the fishermen were illiterate and few had primary level education. A few respondents stated that they did not appreciate the importance of educating their children. Rather, they try to send them for fishing, or engage in other supplementary activities for additional income. Fishermen educational background represent in Table-8 and Figure-42.

Table-29: Educational Background of Fishermen

Education				Total
Sign only	Up to Primary	Up to secondary	Up to HSC	
52.30%	42.20%	4.20%	1.30%	100.00%

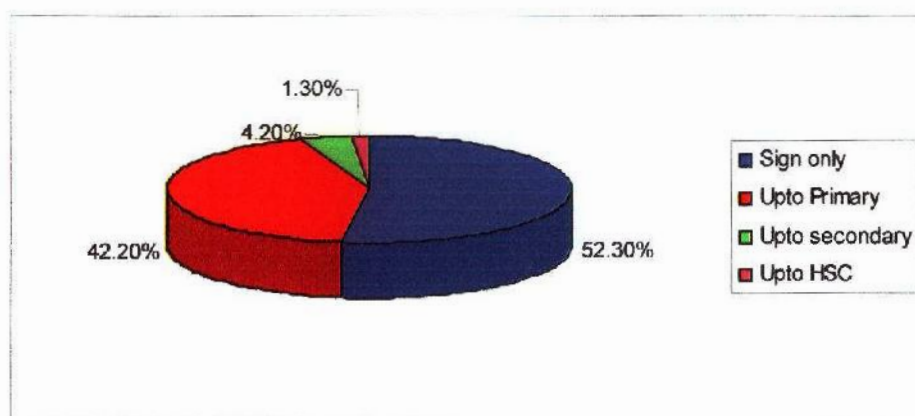


Figure-31: Educational background of fishermen community

4.6.4 Religion

Religion can play a very important role in the socio-cultural environmental life of people of a given area, and can act as a notable constraint or modifies in social change (Cernada and Rob, 1993). Thus, Woolly (2000) noted that amongst other influences, social changes are related not just to economic factors, but also to religious factors. In the study area, an uncommon picture was found that 99% fishermen were Muslims and only 1% were Hindus in Kole (Table-9 and Figure-43), with no Buddhists or Christians. All respondent said that all most all the Hindu fishers immigrated to other places.

Table-30: Religion of Fishermen

Religion		
		Total
Hindu	Islam	
1%	99%	100.00%

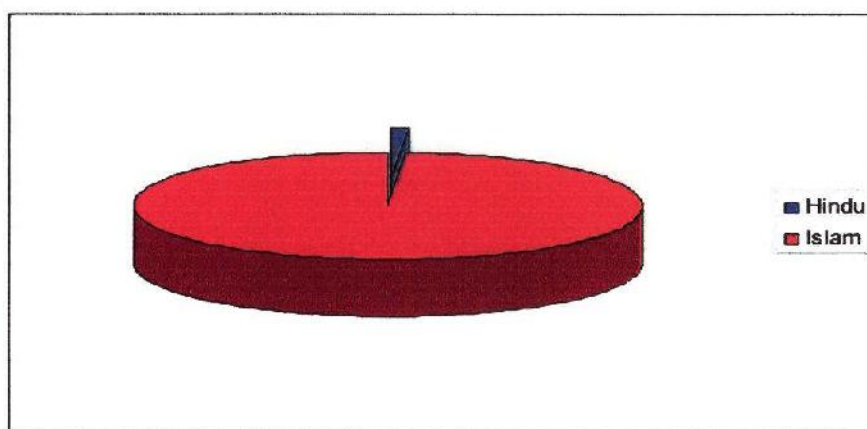


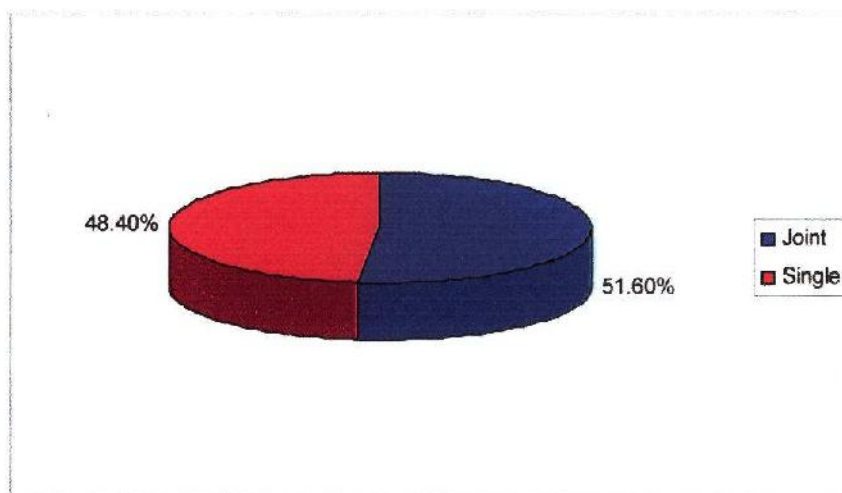
Figure-32: Religion of fishermen community

4.6.5 Family Pattern

In rural Bangladesh, families are classified into two types: 1. Single family (married couple with children) and 2. Joint family (group of people related by blood and/or by law). In the study area, it was found that 48.4% of the people lived with single family and 51.6% lived with joint family in Kole (Table-10 and Figure-44).

Table-31: Family Pattern of Fishermen

Family pattern		
		Total
Joint	Single	
51.60%	48.40%	100.00%

**Figure-33: Family pattern of fishermen community.**

4.6.6. Occupation

Fishing cannot provide full time employment, and the income derived therefore may be insufficient to provide adequate means of livelihood. As such, secondary occupations are involved. Here, 65% professional fishermen, 16% occasional fishermen, 19% subsistence fishermen in Kole. All respondents stated that their secondary occupation was agriculture, day labor, small business etc. (Table-11 & Figure-45).

Table-32: Occupation of Kole Fishermen

Occupation			
			Total
Professional Fisherman	Occasional Fisherman	Subsistence Fisherman	
205	49	59	313
65%	16%	19%	100.00%

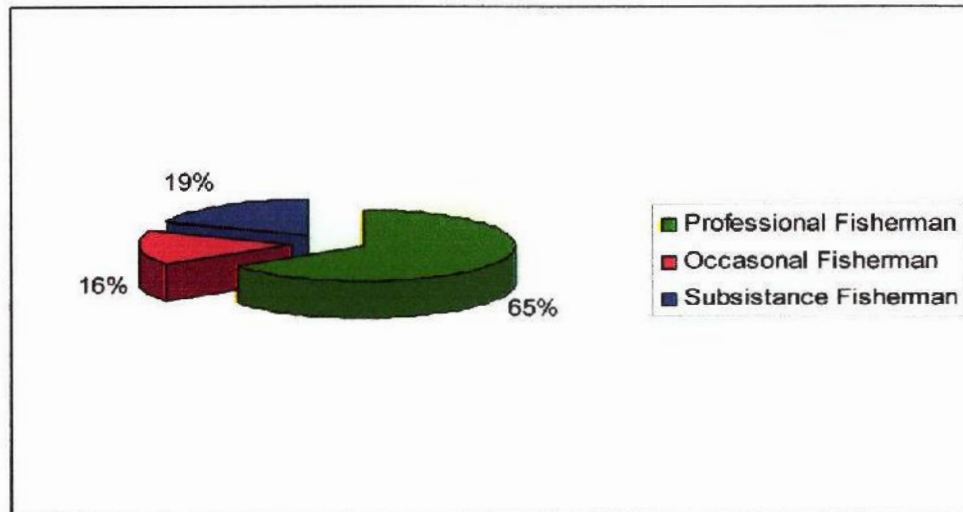


Figure-34: Occupation of fishermen community

4.6.7. Gross Annual Income

Farmer's income is a key measure reflecting economic security, to the extent of adequacy in income to meet basic needs of the household. A household is economically secure when it has the capacity to generate sufficient income to satisfy the basic needs of the family and to maintain or increase the goods necessary for the stability of the household economy.

Increasing population pressures may aggravate the problem of major incomes of fishermen. According to the survey, the average yearly income of a fisherman is calculated in the three category as per consensus made by the fishers. It was above Tk.60 thousands, with in Tk. 40- 60 thousands and below Tk. 40 thousands.

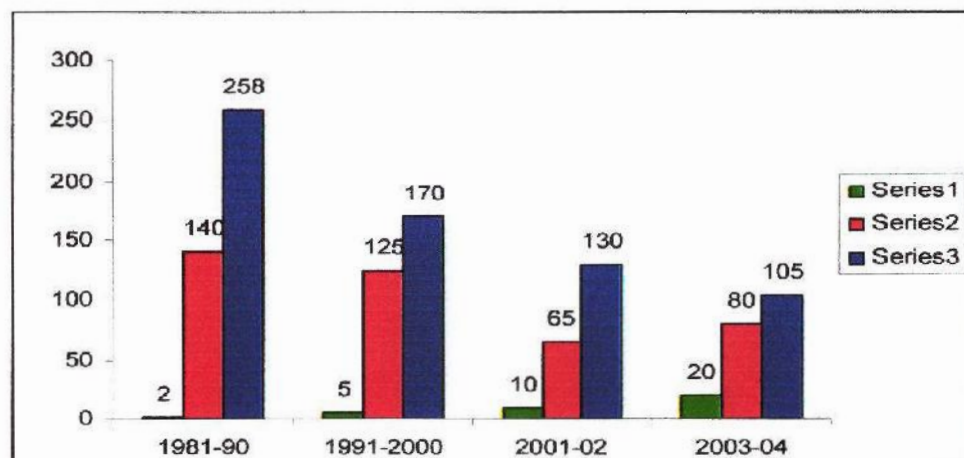
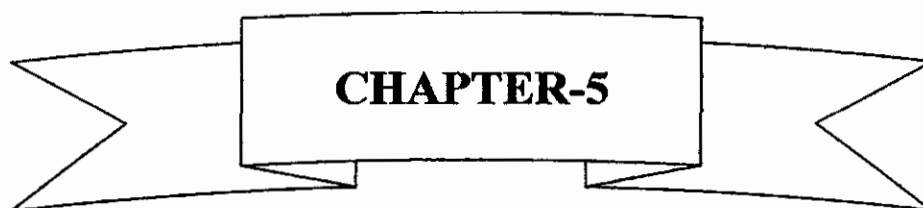


Figure-35: Gross socio economic status of fishermen community.

Table-33: Wellbeing status of the fishers (Professional):

Indicators				
Land/ Agriculture	More than 4 bigha	1-4 bigha	Only Homestead land/No land	
Source of Rice	From own land	Minimum 6 months from own land	Purchase rice round the year	
House status	Semipucca Or good tin shed	Bamboo made tin shed	Single flat tin shed with poor fencing	
Gear ownership	Berjal	Share on Berjal	Berjal operator	
Source of Income	Fishing & others	Fishing & others	Fishing & sell labour	
Other sources of income	Small business, Land, Cow & goat	Land, Cow, goat, poultry	Goat, poultry	
Income level(Tk./Annum)	Above 60,000	40,000-60,000	Below 40,000	
Welbeing status	Rich	Middle class	Poor	Total
1981-90	2	140	258	400
percentage	0.5	35	64.5	100
1991-2000	5	125	170	300
percentage	1.67	41.67	56.66	100
2001-02	10	65	130	205
percentage	4.88	31.71	63.41	100
2003-04	20	80	105	205
percentage	9.76	39.02	51.22	100

It has been found that the wellbeing status of the kole fishers has been changed to some extent. In baseline period the percentage of rich, middle class and poor was 4.88, 31.71 and 63.41 respectively. Where as in 2003-04 (impact period) the percentage of the same category was 9.76 39.02 and 51.22 respectively. Here, the percentage of rich and middle class have been increased considerably where as the poor percentage has been decreased to some extent. The major contribution behind this change might impacted by sanctuary in the kole. But the contribution from other sources might be significant.



RECOMMENDATIONS

Chapter-5

RECOMMENDATIONS

General

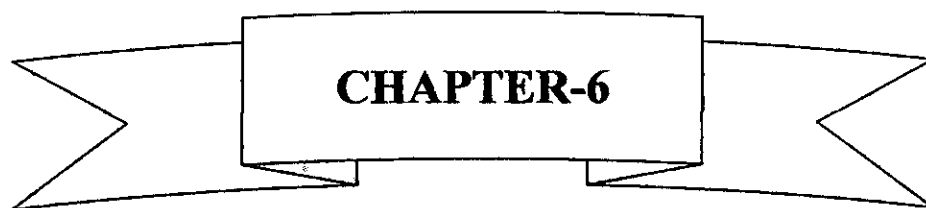
1. Strong management and institutional support is required for successful operation of a sanctuary. So it needs to organize local community before establishment of a sanctuary.
2. Sanctuary type and site selection should be based on Knowledge and experiences of local communities, So, active participation of the community in planning and implementation is truly expected.
3. Need to develop a management plan for controlled fishing and effective implement of the sanctuary in a water body.
4. Massive awareness on positive impact of the sanctuary in the locality is essential for its success.
5. Alternative livelihood program is needed to reduce the negative impact of the sanctuary on local fishers.

Specific to the site

6. Need to connect the kole with the main channel Padma supported by required fish friendly structures.
7. Need to excavate the existing connecting canals of the kole with the Padma to make it more deep and wide.
8. Need to reconnect the kole with the padma through upper Khaschar canals supported by a fish friendly structure on Char Bhabani pur bound road.
9. Fish friendly operation of Gopogram sluice gate is needed to connect the kole with the adjacent flood plains.
10. Need to set up more brush files with branched bamboo poles in the existing sanctuary.
11. Need to stock endangered species in the kole.
12. Need to make liaison with the local farmers to control surface water pump and insecticides used in the adjacent agriculture farms.
13. ALP is needed for the poor fishers to reduce the negative impact of the sanctuary.

Further study is needed on

14. Identification of stock abundance of the kole by length frequency and catch composition.
15. Find out the recruitment patterns of the selected fishes of the kole.
16. Identification of breeding ground of selected fishes in the kole and adjacent river, canals and flood plains.
17. Find out the gear efficiency of the gears used in the kole for future effective management plan.
18. Find out the suitable management options/tools for enhancement of immigration from the Padma in to the kole.
19. Impacts of the shape, Size and duration of the sanctuary to measure the effectiveness of a sanctuary.
20. To identify the effectiveness of different sanctuary materials for successful sanctuary operation.



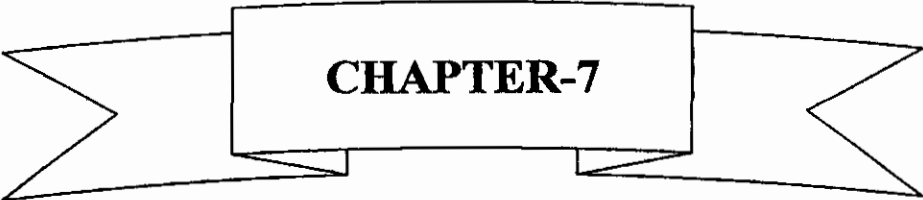
CONCLUSION

Chapter-6

CONCLUSION

In many countries, both home and abroad, Fish Sanctuary has been practicing as one of the effective open water management tool for booting up natural production and biodiversity conservation. In the recent past, a lot sanctuary of different categories has been set up in different water bodies in Bangladesh. But a little has been known about actual impact on fish production and biodiversity conservation. In fact, enough and credible catch data on various aspects of the sanctuary are not available in our country which can assist the development planners, workers and fishers in setting up an effective sanctuary. With a view to fulfill this need, I undertook this study in the semi closed water body of the Padma, named Jagonnathpur Kole Kumar Khali, Kushtia where a sanctuary under community based management were going on. The study has focused mainly on fish production trend – to see the change before and after the sanctuary in the kole. Four years data shows that the over all production of the Kole have been increased significantly. Total production of the study site has been reached to 248 kg/ha. in 2004 in respect to base line production 108 kg/hector in 2001 and 2002. At the same time, the production of some species increased amazing and some species increased slightly. Some disappearing species showed reappearing trend. Although, many other factors may influence this increased production. But superficially we can conclude that this increased production is the outcome of sanctuary management in the Kole. Further studies on many aspects are needed to make a concrete conclusion.

To make a sanctuary successful, a strong management supports are needed. This management shall be supported by a strong community based organization. Avoiding some limitation of the study, it can be concluded that the sanctuary is one of the more easy and effective tool for capture fishery management to boost up its production & biodiversity conservation.



CHAPTER-7

REFERENCES

Chapter-7

REFERENCES



- Agarwal, A. 2001. Common property institutions and sustainable governance of resources. *World Development* 29(10): 1649-72.
- Ahmed, N. U. 1996. Reports on the fishermen's socio-economic survey. *Fisheries survey and monitoring program*. Department of Fisheries. Tangail.
- Ahmed, N. U. 1999. A study on socio-economic aspect of coastal fishermen in Bangladesh, *Department of Fisheries*. Bangladesh Agricultural University, Mymensingh, Bangladesh.
- Ahmed, M., A.D. Capistrano, and M. Hossain. (1997). Experience of partnership models for the co-management of Bangladesh fisheries. *Fisheries Management and Ecology* 4: 233-248.
- Al-Muhit, Abu Saleh Md. 2000. Impact of the Bangobandhu bridge construction on fish production and socio-economic condition of the fishermen communities of Dhaleswari river. *M.Sc. Thesis*. Fisheries and Marine Resource Technology Discipline, Khulna University, Khulna, Bangladesh.
- Apu N.A., Sattar, M.A., Balarin, J.D and Middendorp, A.J. 1997. A system of fisheries co-management in oxbow lakes in southwestern Bangladesh. *Proceedings of ICLARM/Danida National Workshop on Policy for Sustainable Inland Fisheries Management*. Dhaka, Bangladesh, March 1997.
- Atapattu, A.R. 1994. Community-based approaches to fisheries management: the role of marketing development and fisheries co-operatives in improving socio-economic conditions of small-scale fishermen.. In: *Socio-economic Issues in Coastal Fisheries Management*, *Proceedings of the Indo-Pacific Fishery Commission (IPFC) Symposium*. 8: pp. 281-286, RAPA Publication, Bangkok, Thailand.
- Bailey, C. 1994. Employment, labour productivity income in small-scale fisheries of South and South East Asia. In: *Socio-economic issues in coastal fisheries management*. *Proceeding of the IPFC symposium*, Bangkok, Thailand. *FAO Indopacific Fisheries Commission (IPFC)*. 4:24-45.
- Bailey, C. and Doulman D. J. 1994. Employment, labour productivity income in small-scale fisheries of South and South East Asia. In: *Socio-economic issues in coastal fisheries management*. *Proceeding of the IPFC symposium*, Bangkok, Thailand. *FAO Indopacific Fisheries Commission (IPFC)*. 8:24-45.

- Baird I.G. & Beasley I.L. (2005) Irrawaddy dolphin *Orcaella brevirostris* in the Cambodian Mekong River: an initial survey. *Oryx* 39, 301–310.
- Baird I.G. & Flaherty M.S. (2005) Mekong River fish conservation zones in southern Laos: assessing effectiveness using local ecological knowledge. *Environmental Management* 36, 439–454.
- Baird I.G., Hogan Z., Phylavanh B. & Moyle P. (2001a) A communal fishery for the migratory catfish *Pangasius macronema* in the Mekong River. *Asian Fisheries Science* 14, 25–41.
- Baird I.G., Phylavanh B., Vongsencsouk B. & Xaiyamanivong K. (2001b) The Ecology and Conservation of the Smallscale Croaker *Boesemania microlepis* (Bleeker 1858–59) in the mainstream Mekong River, southern Laos. *Natural History Bulletin of the Siam Society* 49, 161–176.
- Baird I.G. & Mounsouphom B. (1997) Distribution, mortality, diet and conservation of Irrawaddy Dolphins (*Orcaella brevirostris* Gray) in Lao PDR. *Asian Marine Biology* 14, 41–48.
- Bahamondes, M.(2003). Poverty-Environment Patterns in a growing Economy: Farming Communities in Arid Central Chile 1991-99. *World Development*, Vol. 31(11), pp. 1947-1957.
- Barr, J.J.F. and P-J. Dixon. 2001. *Methods for consensus building for management of common property resources*. Final Technical Report of R7562. Newcastle, England: University of Newcastle, Centre for Land Use and Water Resources Research.
- Benedetti-Cechi L., Bertocci I., Micheli F., Maggi E., Fosella T. & Vaselli S. (2003) Implications of spatial heterogeneity for management of marine protected areas (MPAs): examples from assemblages of rocky coasts in the northwest Mediterranean. *Marine Environmental Research* 55, 429–458.
- Berkes, F., D. Feeny, B.J. McCay, and J.M. Acheson. 1989. The benefits of the Commons, *Nature* 340: 91-93.
- BBS. 1997. Statistical yearbook of Bangladesh. Bangladesh Bureau of Statistics, Dhaka.
- BBS. 2000. Bangladesh bureau of statistics. Statistics Division, Ministry of Planning, Government of the People's Republic of Bangladesh.

- Bush S. (2003) "Give a man a fish...": Contextualising Living Aquatic Resources Development in the Lower Mekong Basin. Sydney: Australian Mekong Resource Centre, University of Sydney, Working Paper No. 8, 38pp.
- Cernada, G.P. and Rob, A.K.U.1993. Information, education and communication needs in family planning: the case of Pakistan. *International Quarterly of Community Health Education*, 13(2):97-107.
- Chang, K.C. 1994. Labour absorption in fisheries: inevitable trends and prospects in employment creation. In: *Socio-economic Issues in Coastal Fisheries Management, Proceedings of the Indo-Pacific Fishery Commission (IPFC) Symposium*, 8: pp. 49- 63, RAPA Publication, Bangkok, Thailand.
- Chantarasri, S. 1994. Integrated Resources Development of the Sundarbans Reserved Forest. 4th draft reports on Fisheries Resources Management for the Sundarbans Reserved Forest, Khulna, Bangladesh (BGD/84/056) *FAO- UNDP*. Pp 5-171.
- DOF. 1990. Socio-Economic Conditions of fishermen in the eleven upazilla of Patuakhali and Barguna district, *Department of Fisheries*, Government of Bangladesh and Bay of Bengal Program (BOBP/FAO).
- DOF. 2005. Establishment of Fish Sanctuary to Conserve and Enhance Biodiversity, *Department of Fisheries*, Government of Bangladesh and Bay of Bengal Program (BOBP/FAO).
- Flood Action Plan 16. 1995. Potential impacts of flood control on the biological diversity and nutritional value of subsistence fisheries in Bangladesh. Flood Plan Coordination Organization, Ministry of Water Resources (unpublished report prepared by Irrigation Support Project for Asia and the Near East).
- Francis J., Nilsson A. & Waruinge D. (2002) Marine protected areas in the Eastern African Region: how successful are they? *Ambio* 31, 503–511.
- Habib, M.A.B., Rashiduzzaman, M., Molla, A., Hasan, M.R. and Begunt, A. 1994. A survey on socio-economic and technical aspects of pond fish culture in Bangladesh.
- Hannan, M. 1994. Fisherfolk organization in Bangladesh, In: *Socio-economic issues in coastal fisheries management*. Proceeding of the IPFC symposium, Bangkok, Thailand. *FAO Indopacific Fisheries Commission (IPFC)*. 8:216-222.
- Ihaque, A.K.M.A., Middendorp, A.J. and Hasan, M.R. 1997. Abundance and biodiversity of non-stocked indigenous fish in culture based fisheries: a case study of two

- OLP-II lakes. Proceedings of ICLARM/Danida National Workshop on Policy for Sustainable Inland Fisheries Management. Dhaka, Bangladesh, March 1997.
- Hirsch P. (2000) Managing the Mekong commons – local, national and regional issues. In: M. Ahmed & P. Hirsch (eds) Common property in the Mekong: issues of sustainability and subsistence. ICLARM Stud. Rev. 26, 19–26.
- Hoggarth D.D., Dam R.K., Debnath K. & Halls A.S. (1999) Recruitment sources of fish stocks inside a floodplain river impoundment in Bangladesh. Fisheries Management and Ecology 6, 287–310.
- Holmes, T. and I. Scoones. 2000. *Participatory policy processes; Experiences from North and South*. IDS Working Paper 113. Brighton: Institute of Development Studies.
- Hossain, M.S., Ehsan, M.A. and Mazid, M.A. 1997. Fish biodiversity of three floodplains in Bangladesh. Proceedings of ICLARM/Danida National Workshop on Policy for Sustainable Inland Fisheries Management. Dhaka, Bangladesh, March 1997.
- Ignacy, S. 1994. Population, development and employment. International Social Science Journal, 46(3): 343-359.
- Islam, M.S. 1995. Socio-economic status of marine fishermen and their upliftment. In: Proceedings of the Seminar on Sustainable Development of Marine Fisheries.
- Khan, A.S. and N. Hashemzadeh. 1985. The significance of non-price factors to the economic survival of small and medium size farms in North Carolina. Rural Sociological Society (RSS), Radford, VA 24142.
- Mahbubullah, M. 1986. Case study of polder and estuarine fisheries community in Bangladesh. In: *Socio-economic study of Tropical Fishing Community in Bangladesh*. A report for Food and Agricultural Organization (FAO), Rome.
- Mandima, J.J. 1995. Socio-economic factors that influence the adoption of small-scale rural fish farming at household level in Zimbabwe. Naga, Iclarm, 18(2): 25-29.
- Mannu, M. U. 1999. Jeleder Sukh Dukh. *The Daily Janakantha*. 22 August 1999.
- Middendorp, A.J., Hasan, M.R. and Apu, N.A. 1996. Community fisheries management of freshwater lakes in Bangladesh. *Naga, the ICLARM quarterly* 19(2): 4-8.
- Middendorp, A.J., Rahman, M.M. and Sattar, M.A. 1997. Profitability, operating costs and credit needs in culture based fisheries management by lake fishing teams in Oxbow Lakes projects in Bangladesh. Proceedings of ICLARM/Danida National Workshop on Policy for Sustainable Inland Fisheries Management. Dhaka, Bangladesh, March 1997.

- Middendorp, A.J. and J.D. Balarin. 1999. Fisheries enhancement and participatory aquatic resources management: two types of management in the oxbow lakes in Bangladesh. In: H.A.J. Middendorp, P. Thompson and B.S. Pomeroy (editors), Sustainable Inland fisheries Management in Bangladesh, ICLARM Conference Proceedings 58, Manila, pp. 31-34.
- Middendorp, A.J., P.M. Thompson and R.S. Pomeroy (eds.). 1999. Sustainable inland fisheries management in Bangladesh. ICLARM Conference Proceedings 58. Manila: International Centre for Living Aquatic Resources Management.
- Minkin, S.F., Rahman, M.M., Halder, S. (1997). Fish biodiversity, human nutrition and environmental restoration in Bangladesh. In: Tsai, C., Ali, M.Y. (Eds.), Open water Fisheries of Bangladesh, the University Press Limited, Dhaka, pp. 183-198.
- Motahar, S.A. and Gill, G.J. 1982. Social factors affecting prospects for intensified fish farming in Bangladesh. Bangladesh Journal of Agricultural Economics, 5(1-2)24.
- Ostrom, E. 1990. Governing the commons: the evolution of institutions for collective action. Cambridge University Press.
- Ostrom, E. 1990. *Governing the Commons; The evolution of institutions for collective action*. Cambridge, UK and New York: Cambridge University Press.
- Poulsen A.F., Ouch P., Viravong S., Suntornratana U. & Tung N.T. (2002) Deep Pools as Dry Season Fish Habitats in the Mekong Basin. Phnom Penh. Mekong River Commission, MRC Technical Paper No. 4, 22pp.
- Pomeroy, R.S. 1994. Common property regimes. *Naga, the ICLARM quarterly* 17(2): 37-38.
- Pomeroy, R.S. and F. Berkes. 1997. Tow to tango: The role of government in fisheries co-management. *Marine Policy* 21(5): 465-80.
- Rahman, A.K.A. 1989. Freshwater fish of Bangladesh. Dhaka University, Dhaka.
- Rahman, A. K. A. 1994a. The small-scale marine fisheries of Bangladesh. In: *Socio-economic issues in coastal fisheries management*. Proceeding of the IPFC symposium, Bangkok, Thailand. FAO Indopacific Fisheries Commission (IPFC). 8:170-175.
- Rahman, A.K.A. 1994b. Country report on socio-economic issues in coastal fisheries management in Bangladesh. In: *Socio-economic Issues in Coastal Fisheries Management*, Proceedings of the Indo-Pacific Fishery Commission (IPFC) Symposium, 8: pp. 170-175, RAPA Publication, Bangkok, Thailand.

- Rahman, A.K.A. 1989. Freshwater Fishes of Bangladesh. Zoo. Soc. Bangladesh. Dhaka. 352pp.
- Roberts T.R. & Baird I.G. (1995) Traditional fisheries and fish ecology on the Mekong River at Khone Waterfalls in southern Laos. *Natural History Bulletin of the Siam Society* 43, 219–262.
- Ruddle, K. 1994. Changing the focus of coastal fisheries management, p. 63–86. In R, S Promeroy (ed.) *Community management and common property of coastal fisheries in Asia and the Pacific: concepts, methods and experiences*. ICLARM Conf. Proc. 45, 189 p.
- Shoemaker B., Baird I.G. & Baird M. (2001) *The People and their River: A Survey of River-based Livelihoods in the Xe Bang Fai River Basin in Central Lao PDR*. Vientiane: Lao PDR/Canada Fund for Local Initiatives, 79pp.
- Thilsted, S.H., N. Roos and N. Hasan. 1997. The role of small indigenous fish species in food and nutrition security in Bangladesh. *Naga, the ICLARM Q.* 20(3 and 4) 82–84.
- Thompson, P.M., P. Sultana, M.N. Islam, M.M. Kabir, M.M. Hossain, and M.S. Kabir. 1999. An Assessment of co-management arrangements developed by the community based fisheries management project in Bangladesh. Paper presented at the International Workshop on Fisheries Co-management, Penang, Malaysia, August 23–28.
- Thompson, P.M., P. Sultana, M.N. Islam, M.M. Kabir, M.M. Hossain, and A.k. Saha. 2001. Lessons from community based management of floodplain fisheries.
- Tubtim N. & Hirsch P. (2005) Common property as enclosure: a case study of a backswamp in Southern Laos. *Society and Natural Resources* 18, 41–60.
- Uychiaoco A.J., Alino P.M. & Dantis A.L. (2000) Initiatives in Philippines coastal management: an overview. *Coastal Management* 28, 55–63.
- Valbo-Jorgensen J. & Poulsen A. (2000) Using local knowledge as a research tool in the study of river fish biology: Experiences from the Mekong. *Environment, Development and Sustainability* 2, 253–276.
- Veerina, S.S., Nandasha, M.C., De Silva, S.S. and Ahmed, M. 1999. An analysis of production factors in carp farming in Andhra Pradesh, India. *Aquaculture research*, 30(11–12):805–814.

- Woolly, D.P.2000. Relationship between national religion and personal freedom in 127 countries. Southern Sociological Society (SSS), Department of Sociology and Anthropology, North Carolina State University, Raleigh 27.
- Wang, J., Cramer, G. L. and Wailes, E. J. 1996. Production efficiency of Chinese agriculture: evidence from rural household survey data. *Agricultural Economics*, 15 (1): 17-28.



PHOTO GALLERY

PHOTO GALLERY

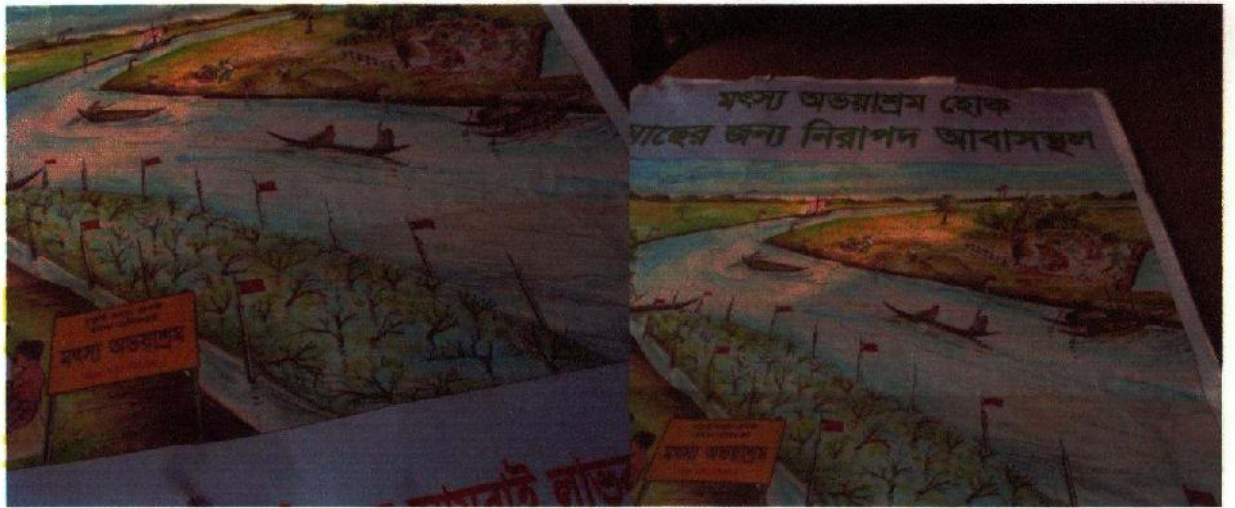


Fig:36 Signboard & Billboard of the study site with sketch of a Fish Sanctuary.

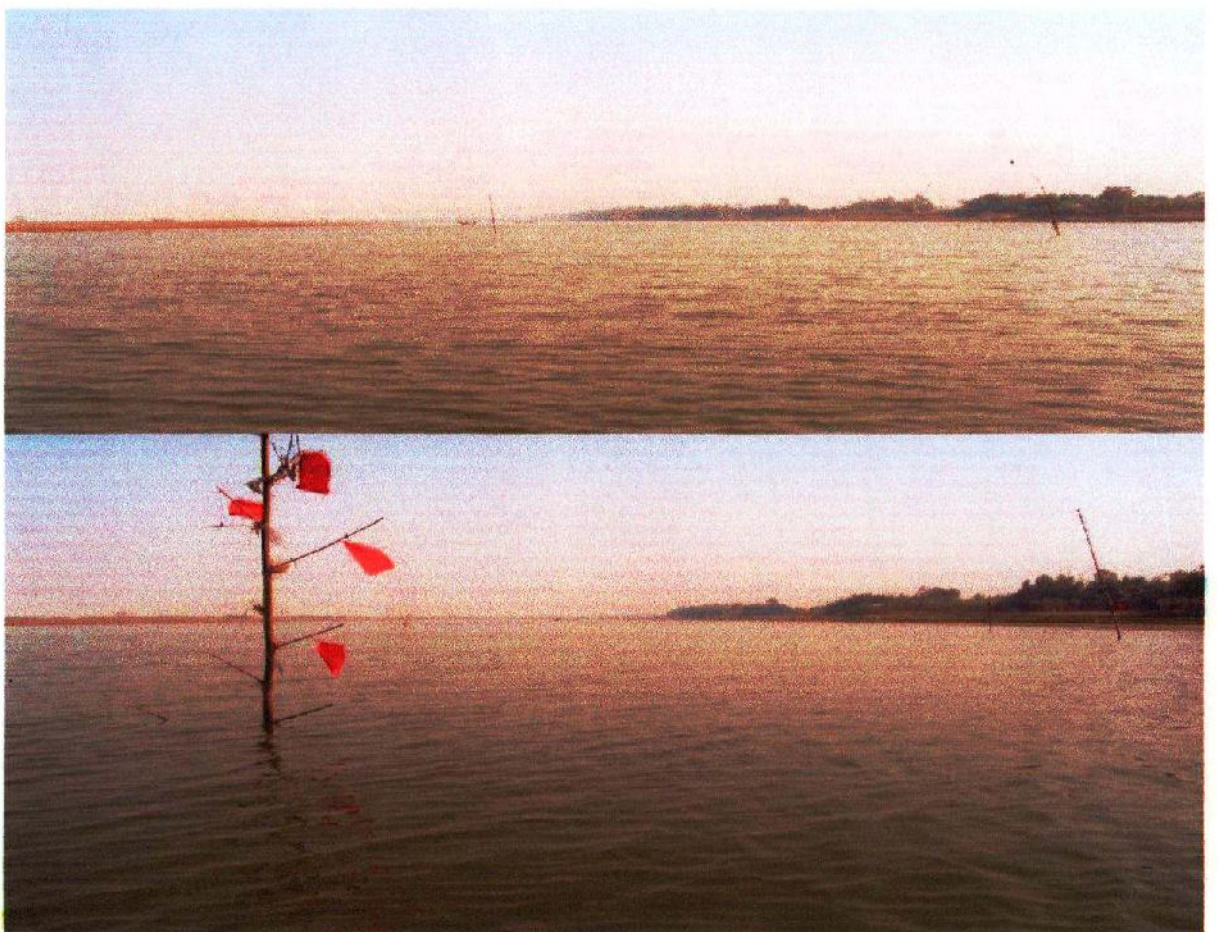


Fig: 37 Study site (Fish Sanctuary in the Kalibarighat area of the Jagannathpur kole, Kumarkhali & Khoksha under Kushtia district).

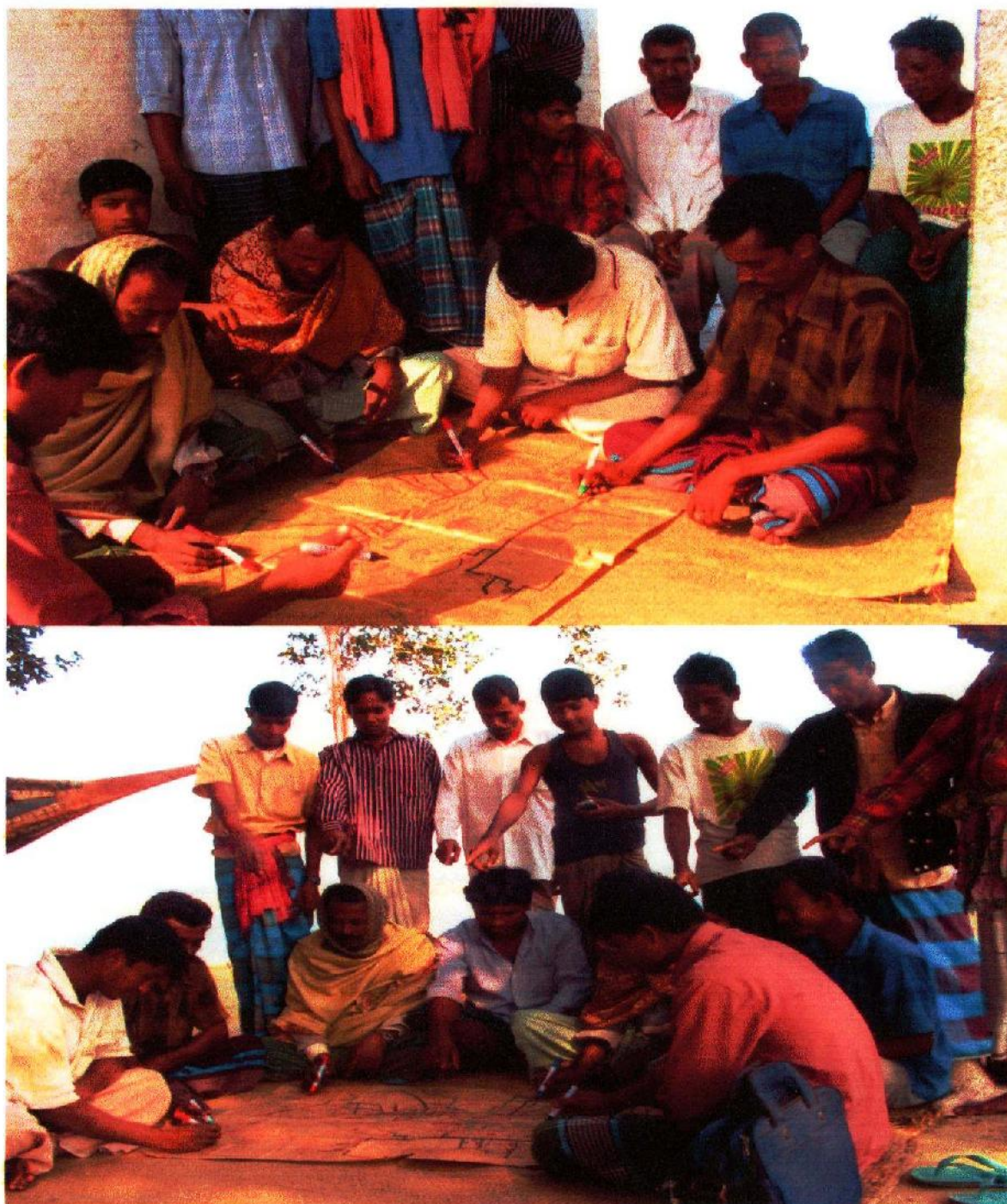


Fig : 38 A wide range of PRA tools have been used to collect required information for this study.

Some of the fish species found in the Jagonnathpur kole are given bellow. Photo taken during the data collection.



Fig : 39. Kajali (*Ailia coila*), Chital (*Notopterus chitala*), Pabda (*Ompok pabda*). These species show reappearing trend in the study.



Fig: 40. Air (*Mystus aeor*), increased after sanctuary

Fig: 41. Boal (*Wallago attu*), increased after sanctuary.



Fig: 41. Rohu (*Labeo rohita*) increased after sanctuary.

Fig: 42. Punti (*Puntius spp*) increased after sanctuary.



Fig: 43 Different types of Bata found in the kole), increased after sanctuary.

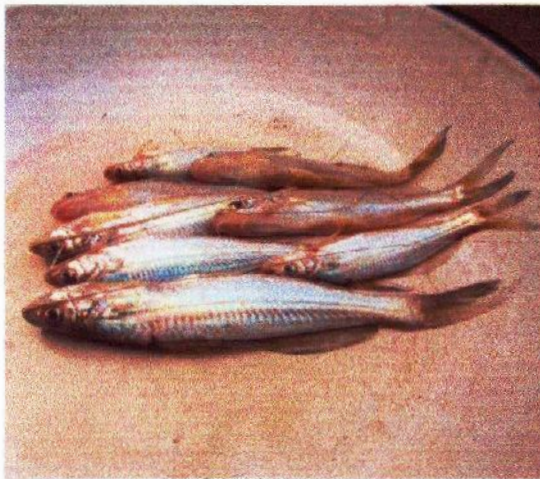


Fig: 44 Tangera (*Mystus tengera*), increased after sanctuary



Fig: 45 Chapila (*Gudusia chapra*), increased after sanctuary



Fig: 46 Beley (*Glossogobias giuris*), increased after sanctuary.



Fig: 47 Chapila (*Gudusia chapra*), increased after sanctuary.



Fig: 48. Kucho Bain. (*Mastacembellus pancalus*).
These species increased after sanctuary in the Kole.

Fig: 49. Shoal (*Chana striatus*).



Fig: 50 Mixed Species. Some of the other fishes found in the Jagannathpur kole, increased after sanctuary.