SOME ASPECTS OF FISHERIES OF COMMERCIAL MARINE FISHES FROM THE SOUTH-WESTERN REGION OF BANGLADESH

Fisheries and Marine Resource Technology Discipline
Khulna University

April, 2002

SOME ASPECTS OF FISHERIES OF COMMERCIAL MARINE FISHES FROM THE SOUTH-WESTERN REGION OF BANGLADESH

A Thesis

By

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Roll No.: 970609
Session: 1996-97

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

April, 2002

SOME ASPECTS OF FISHERIES OF COMMERCIAL MARINE FISHES FROM THE SOUTH-WESTERN REGION OF BANGLADESH

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DECLARATION

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

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Dedicated to my Mother

ABSTRACT

The Sundarban Reserve Forest represent a transitional zone between fresh (supplied by river and streams)and marine water (from tidal creeks and the open sea). As such, it provides a habitat not only for fresh water and marine fishes,but also for diadromous species that migrate from one zone to another in order to complete their life cycle e.g. *Lates calcarifer*, *Tenualosa ilisha* etc. The actual number of species inhabiting the Sundarban reserve forest is not known. Most of the fishes are landed in landing center. The actual volume of species landed in landing center is not known. This could be due to the lack of adequate studies on landing data. The Sundarban Reserve Forest along represent 1 to 5% of the total fish harvest of Bangladesh. Length-weight relation plays an important role in predicting for population size and stock of fishes. Length-weight relationship and condition factor of *Lattés clarifier*, *Pampus argenteus*, *Lisa Persia* and *Metapenaeus monoceros* were studied by using 1268 specimens .The estimated equation on length-weight relationship for the four commercially important species of the fishes were found to be *Lates calcanifer* (vetki): Log BW =0.80+1.457Log TL, *Pampus argenteus* (Rupchanda): Log BW=-1.043+2.75Log TL, *Liza parsia* (parsia): Log BW= -2.339+3.585LogTL and *Metapeneaus monoceros* (Harina chingi): Log BW =-1.607+2.90LogTL. In fish landing center fish and shrimp are transported through waterway. During fishing season, fishing is conducted by craft and gear. So craft and gear plays an important role for development fisheries sectors. Round the year, about 260 number of fishing craft in four fish landing center are examined depends on various factors (length, depth, capacity, width, fishermen etc).

ACKNOWLEDGEMENTS

All praises go to Almighty Allah without whose blessing it was well might impossible on my part to accomplish this arduous task.

It is my pleasure to acknowledge the contribution of my respected supervisor, Mr. Dipak Kamal, Associate Professor, Fisheries and Marine Resource Technology Discipline, Khulna University to complete the work within the stipulated period.

I am keenly indebted to Dr. Khairul Azam, Head of Fisheries and Marine Resource Technology Discipline. Without his help, I can't submit my work in time.

I also express my sincere thanks to the people working in different fish landing center for their behavior and help in data collection.

I recall with warm appreciation and great indebtedness for the support, guidance and suggestion extended to me by all of my respected teachers in Fisheries and Marine Resource Technology Discipline, Khulna University.

I am also thankful to Md. Saiful Islam, Md. Nurul Amin and Bakul for their efforts in computer composing the task.

My last gratitude goes in favor of my classmates and friends who have helped me in various times.

Finally, I would like extend my indebtedness to my parents for their inspiration without which, successful completion of this task would have been difficult.

-The Author

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CHAPTER-1
INTRODUCTION

1. INTRODUCTION

Bangladesh is a small country of 143998 Sq. Km. It is located at between lat.20^0 34' N to 26^0 38' N and longitude $88^0$01' E to 92^0 41'. It is bounded by India on the west, North and North East, by Myanmar (Burma) on the East and South East and by the Bay of Bengal on the South.

Bangladesh has the unique advantage of possessing the largest river delta, the Ganges Delta (Rahman 1997) that offers vast and varied fishers potentials in its fresh, brackish and marine waters. The country is also blessed which a network of innumerable river tributaries, canals. creeks, tallers, oxbow taller,(baors) natural depression (haors & beels) and huge flood plain during the monsoon. Several greatest river systems such as the Ganges, the Padmas, the Meghna, the Jamuna and the Brahmaputra are situated in this country. The total inland water body of Bangladesh is 43.37 lakh ha of which 40.47 lakh ha is open water covering flood plain and 2.90 lakh ha is closed water body covering coastal shrimp farms (Ali, 1997). Besides, there are excellent marine fisheries resources in its territorial, offshore and exclusive Economic Zone (EEZ) waters along 710 km long coastline and (Rahman, 1997). The inland water of Bangladesh is inhabited by 260 indigenous and 11 exotic species of fishes (Rahman, 1989) and 25 spececies of prawns (Ali, 1992). The marine water of the Bay of Bengal are blessed with about 475 fishes and 38 shrimp species.

Fisheries sectors assumes an unique status in Bangladesh. It plays a significant role in animal food supply to the peoples, foreign exchange earning through export of fish and fishery products, employment generation and helping the creation as well as expansion of its allied industries. It contributes 60% to the Nation's animal protein intake, nearly 5% to the GDP and about 7.75% to the total export earning. About 12 millions people (nearly 10% of the country population) are directly or indirectly engaged in activities related to fisheries (Ali, 1997).

The vast network of tidal waterways, varying widely from a few meters to several kilometers,the fishery resources of the Sunderbans consists of finfish and shell fish.

Extensive small scale or subsistence capture fisheries exits throughout the Sundasbans and provide employment to a large number of people.

The sundarbans water supports 27 families and 53 species of pelagic fish, 49 families and 124 species of demersal fish, 5 families and 24 species of shrimp, 3 families and 7 species of crabs, 2 species of gastropods, 6 species of pelecypods, 8 species of locust lobster and 1 family and 3 species of turtle. Of the 17 species of snake found in the sunbarbans, 10 species are sea snakes (sarker, 1989).

Based on species composition and salinity of the Sundarban ecosystem has been classified into three zones: Freshwater, moderately salt water and salt water zones. The zonation of the sundarbans is defined by the distribution of the three species Sundri, Gewa and Goran (Chantarasri,1994)

Fresh water zone:. Some fresh water species are commonly found in this zone: *Pangasius pangasius*, *Tenualosa ilisha*, *Lates calcarifer*, *Macrobrachium rosenbergii*.

Moderate saltwater zone: The fish species commonly found in this zone are: *Lates calcarifer*, *Tenualosa ilisha*, *pomadasys hasta*, *Polynemus spp*, *Penaeus monodon*, *Metapenaeus monoceros* etc.

Saltwater zone: Fish species commonly found in this zone: *Harpodon nehereus Trichiurus haumela*, *Pampus argenteus*, *Setipinna taty*, *Penaeus indicus*, *Metapenaeus monoceros*, *Aceles spp* etc.

In the eastern part of the sundarbans salinity level one low. Some diadromous species such are commonly found in low salinity zone are *Tenualosa ilisha*, *Lates calarifer* and *Macrobrachium rosenbergii* . Marine species found in highly saline zone are *Harpodon nehereus*, *Trichiurus haumela*, *Pampus asgenteus*, *penaeus monodon*, *penaeus indicus*, *Metapenaeus monoceros* as well as scates and rays (IUCN,1994).

There are two basic types of fisheries in the Sundarbans, inshore and offshore fishery. Inshore fishery in carried out by small boats in relatively shallow water. About 14 types of

gears are used by artisinal and commercial fisherman in the Sunderbans. Different types of fishing gears used by the fishing community, the most common one are behundi jal (fash jal), hook and line, long line. The present study deals with some aspect of fishery of the Sunderbans. The main object of the studies is as follows.

- To identify major fish landing center.
- To estimate total catch and species wise catch.
- To study seasonal venation in catch
- To estimate of length-weight relationship and condition factor of major commercial species.
- To estimate the relationship among various parameters of fishing craft.

CHAPTER-2

REVIEW OF LITERATURE

2. REVIEW OF LITERATURE

There is no specific work on landing center in South Western region of Bangladesh. Few researchers have completed their study on the population dynamics of marine fish found in the Bay of Bengal of Bangladesh portion. However, the limited numbers of works are mentioned here along with other related works.

Sujansinghani (1957) studied the growth increments of Hilsa in the Hoogly estuary and estimated a growth of 15-20 mm/month in the first 2-3 months after hatching, thereafter decreasing to about 10 mm/month. Yearly differences in mean length and length-weight relationship of annual samples were also discussed.

Shafi and Quddus (1974) established the length-weight relationship of *Cirrhinus mrigala* collected from rivers and ponds. The length-weight relationships obtained were Log W= -1.77538+2.84657 Log TL for the river and Log W = -2.0964 –3.04312 Log TL for the pond mrigal. The extent of fluctuations in relative condition was much higher in fishes taken from the rivers than those from the ponds.

Population dynamics of *Penaeus indicus* from the Manila Bay, Philippines and Southeast India was studied by Agasen and Mundo (1988). According to their report the value of K differ between sexes,1.0 for female and 1.2 for males (1.0-1.1 for the samples of males and females), but were identical for performance of the stocks are very similar and range from 2.64 to 2.71 with of $\phi' = 2.69$.

Population dynamics of *Selar boops* from Davao Gulf, Philippines was studied by Ali (1988). The estimated growth parameters were as: $L\infty = 28.96$ cm and K = 1.9 per year. Analysis of the length-converted catch curve gave very high estimate of Z, F and consequently the exploitation rate (E) was estimated to be high.

Humayun *et al.*, (1988) studied the population dynamics of the Butter fish, *Arrioma indica* from the Bay of Bengal and The Von Bartalanffy parameters of growth are estimated as K = 1.12 per year; $L\infty$ =22 cm. The value of Z, F and M were 5.53, 3.43 and 2.1 respectively.

Mustafa and Khan (1988) studied on some aspects of the population dynamics of Lizardfish *S. tumbil* (Blotch) from the Bay of Bengal. The correlation co-efficient for the regression was 0.98, E was 0.347 and selection pattern was 18.02 cm. The species recruited in the fishery during July to September.

BCAS (1989) observed the population dynamics of *Hilsa ilisha* from the Narisha-Padma fishery. The length-weight relationship for the species was $W = 0.388L^{2.04}$ and The Von Bartalanffy parameters of growth are estimated as K = 0.256/yr, E = 0.71 and $L\infty$ =56.01 cm. Total, fishing and natural mortality were 2.12, 1.50 and 0.62 respectively.

Khan and Mustafa (1989) studied the length-frequency based population analysis of the threadfin bream *N. japonicus* from the coast of Bangladesh and reported that the asymptotic length $L\infty$ and the growth co-efficient K were found to be 24.16 cm and 1.06 per year respectively. The values of Z, F and M were 3.75, 1.078 and 1.97 respectively. The rate of exploitation (E) was estimated as 0.47.

Mahmood *et al.*, (1989) observed the length-weight relationship of *Alpheus lobidens* (De Haan) from the coast of Bangladesh and noticed that the relationship between total length and weight was curvilinear in all cases and with values of 'n' being3.18 and 2.62 respectively. The values of the correlation co-efficient were 0.8895 and 0.5083 respectively. The average values of condition factor 'K' for the calculated weight were 0.40769 and 0.53135.

Chowdhury *et al.*, (1990) analyzed the length-weight relationship of *H. ilisha*, which is expressed in logarithmic form as: log W = -5.1633 + 3.06299 log L. The peak fishing period of hilsa indicated by the report was March-June. From the report it was observed that the fishery was in decreasing trend.

Begum and Mahmood (1991) estimated the age and growth parameters of *Metapenaeus monoceros* (Fabricius) in two different habitats the Matamuhuri estuary and a pond in the vicinity and reported that the average monthly physical growth rates of the species in the first four and half months of their age are almost same in the estuary and the pond 14.66

mm and 15.1 mm respectively. Average of the first nine months growth in the estuary was 8.66 mm. Two spawning periods in the estuary, one in January and the other in September.

Kumar and Gulati (1992) studied on the population dynamics and stock assessment of *Otolithoides biauritus* along the north-west coast of India. The Von Bartalanffy parameters of growth estimated from length-frequency analysis were as: K = 0.2633/yr, $L\infty$ =1572 mm and t_o = 0.0289 year.

Azadi *et al.*, (1994) analyzed the population dynamics of chital, *Notopterus chitala* (HAM) from the Kaptai reservoir and reported that the growth parameters $L\infty$, K and to were estimated as 138.08 cm, 0.347 per year and 0.04058 respectively. Natural mortality (M) was found to be 0.5738 per year. The length-weight relationship of this species had been studied which can be given as $W = 0.00000763\ L^{2.99}$.

Chakrabarty (1994) studied the length-frequency based growth and mortality of *Johnieops sina* from Bombay water, India during the period of 1987 to 1990. The Von Bartalanffy growth parameters were as: $L\infty$ = 239 mm, K = 0.777/yr. and to = 0.03814. This species attained 132 and 192 mm at the end of 1st and 2nd year respectively. The instantaneous rates of total, natural and fishing moralities were 4.35, 1.76 and 2.59 respectively.

Shafi and Quddus (1994c) preesented the results of an analysis on the total length-weight, length-girth and relative condition of *H. ilisha* from the river Padma and Meghna. The length-weight relationship observed was expressed as log W = -1.6182 +2.76829 log TL. The first peak in the relative condition factor was possibly attributed to the recovery from freshwater after migration from salt water and 2nd peak was probably due to spawning and recovery after spawning respectively.

Mustafa and Azadi (1995) studied on the population dynamics of white grunter *Pomadysus hasta* from the Bay of Bengal. According to their report the value of $L\infty$ and K were found to be 56.9 cm and 0.38 per year respectively. The annual rate of natural

mortality (M), fishing mortality (F) and total mortality (Z) were found to be 0.793, 0.815 and 1.608 respectively. The rate of exploitation (E) was estimated as 0.507. This species was recruited in the fishery during March-April. E_{max} was found to be 1.0.

Mustafa (1996) made a study of the population dynamics and management of the brown shrimp *Metapenaeus monoceros* (Fabricius) from the Bay of Bengal and reported that the Wetherall plot provided an estimate of $L\infty$ = 14.81 cm for male and 18.24 cm for female. An additional estimate of Z/K was 2.09 for male and 2.53 for female. Yield-per-recruit analysis suggested that the investigated stocks were not overexploited. Yield-per-recruit isopleths suggested maximum yield could be attained by decreasing the length at first capture t_o 10.5 cm.

Miah *et al.*, (1997) studied population parameters of *T. ilisha* in the Meghna river. According to their report the values of asymptotic length, $L\infty$ =57 cm; growth coefficient, K= 0.66/year; length at first capture, L_c= 3.65 cm; age at first capture, T_c = 0.60yr; age at first recruitment, T_r = 0.58yr; total mortality, Z = 2.03/yr; annual natural mortality, M = 0.89/yr; fishing mortality, F = 1.44/yr and exploitation rate, E = 0.56/yr.

Rahman *et al.*, (1998) conducted a length frequency based analysis of *T. ilisha* by using FiSAT programme from the coastal area of Bangladesh. The values of the population parameters obtained were $L\infty$ = 30 cm, K= 0.743/yr, M = 1.18/yr, F = 1.43/yr, Z = 2.61/yr and L_c = 30 cm. The recruitment pattern showed one seasonal pulse during April, May and June with peak in May. It was also suggested that the maximum yield of fish could be obtained by increasing Lc simultaneously. The length-weight relationship of the fish was recorded as $W = 0.03\ TL^{2.75}$. The population parameters of T. ilisha from Barisal coastal region were obtained by Rahman *et al.*, in 1999 which were as to be: $L\infty$ = 60.92 cm, K = 0.66/yr, M = 1.12/yr, F = 2.16/yr, E = 0.658/yr and E_{max} = 0.429/yr. The investigation clearly indicated over fishing (E>0.50) on *T. ilisha* fisheries in the Barisal coastal region. The estimated length-weight relationship for the combined sex was recorded to be $W = 0.01603TL^{2.911}$. The recruitment pattern was continuous with one peak per year. Whereas, the population parameters viz. $L\infty$, K, M, F, E and E_{max} of *T. ilisha* in Bangladesh water were recorded in 2000 by Rahman *et al.*, which were 61.50

cm, 0.83/yr, 1.28/yr, 2.01/yr, 0.61/yr and 0.697/yr respectively. The recruitment pattern was continuous with one peak per year. They observed over fishing on the fishery of *T. ilisha* in Bangladesh water. The length-weight relationship obtained for the species combinedly was found to be $W = 0.01351TL^{2.974}$.

Mustafa (1999) studied the population dynamics of some demersal finfishes (*P. hasta, P. argenteus, P. chinensis, Parastromateus niger, Megalapsis cordyla, R, kanagurta and I. filigera*) from trawl fishery in the Bay of Bengal. The $L\infty$, K, M, F and Z values for these species were found to be 58.8, 108.0 29.8, 38.1, 41.0, 38.5, 27.4 and 35.0 (L value); 0.52, 0.75, 0.53, 0.67, 0.59, .0.54, 0.90 and 0.75 (K value); 0.97, 1.04, 1.18, 1.29, 1.16, 1.11, 1.71 and 1.42 (M value); 0.72, 1.54, 0.79, 0.83, 1.26, 1.17, 3.21 and 1.95 (F value) and 1.69, 2.58, 1.97, 2.12, 2.42, 2.28, 4.92 and 3.37 (Z value) respectively.

Rashid (2000) studied the population dynamics of eight commercially important marine species viz., *Congresox talaboniodes, Ilisha filigera, Arius thalassinus, Johnius argentatus, Johnieops vogleri, Scomberomorus guttatus, Pampus argenteus and parastromateus niger* from the Bay of Bengal. The $L\infty$ and K values of these species were as 220 and 0.60; 48.90 and 0.80; 82.40 and 0.56; 46.50 and 0.59; 33.50 and 0.85; 73.50 and 0.60; 46.00 and 0.80 and 57.70 and 0.71 respectively. The values of the exponent 'b' were 3.021, 2.5796, 3.0951, 2.5723, 2.3482, 2.8622, 2.7729, 2.8164 respectively.

CHAPTER-3

MATERIALS & METHODS

3.MATERIALS & METHODS

The present study was conducted in 4 major fish landing centers during the period of January to December 2000.

3.1. Study areas:

On the basis major fishing activities, Khulna, Bagerhat and Pirojpur districts were selected for this study.

There are two fish landing centers in Khulna district. . One is Bangladesh Fisheries Development Corporation (BFDC) and located at 5 no.ghat on the west bank of the Rupsha river.It was eslablished in 1970. It has16 depots.The second fish landing center is located at Rupsha Ferri ghat on the west bank of rupsha river. It was established in 1980 and about 60 depots.

There is only one fish landing center in Bagerhat district, which is known as KB Motshu Depot. It is located at the west bank of Daratana river. It was established in 1950. There were 10-12 depots.

One fish landing center is found in Pirojpur district. The name of this landing center is parerhat Motshu Arot. . It is located at the west bank of Baleshor river. It was established in 1950. It has 10-12 depots.

3.2. Collection of data:

Data on catch were collected at monthly interval from January to December; 2000.Craft and gears data were collected through a prescribed questioner set survey (see appendix-II toV and X to XIII). The length-weight data were collected from the 4 landing centers between August to October 2000(see Appendix-VI to IX). The sampling was done between 7.00 Am to 9.00 Am in Khulna and 6.30 Am to 8.30 Am in Bagerhat & Pirojpur which were the main trading/landing of that Arats, length weight data was taken randomly among the Arats with out any bias.

3.3. Choice of Species:

Four major economically important marine fishes were selected for length-weight and condition factor studies. There are: Sea bass (*Lates calcarifer*), Golden spot mullet (*Liza parsis*), Pomfret (*Pampus argenteus*), Brown shrimp (*Metapenaeus monoceros*).

3.4. Collection of Fish:

A total of 1268 specimen comprising of 317 sea bass (Vetki, *Lates calcarifer*), 317 Golden spot mullet (*Liza parsia*), 317 Rupchanda (*Pampus argenteus)* and 317 Brown shrimp (*Metapenaeus monoceros*) were studied during August to October 2000.Some samples were preserved in 10% formalin and some were preserved in deep freeze for laboratory analysis. After bring to the laboratory, samples were thoroughly washed with clean water and excessive water was dried with blotting paper.

In length-weight relationship, standard length was considered. The lengths of the individual fish were measured in nearest centimeter. The length was measured from the most anteriorly projecting part of the head to the distal tip of the caudal fin with the caudal rays squeezed together. In case of Brown shrimp (*Metapenaeus monoceros*), the length was taken between the base of the eyestalk to the base of uropod. The weight of the individual fish was measured to nearest 0.001g with a precision single pan balance.

To determine the length-weight relationship and condition factor, fish samples were collected randomly at a week (7 days) interval.

3.5.Length weight relationship and condition factor:

The relationship between length and weight and condition factor were determined without any consideration to sex.

3.5.1. Length- Weight relationship:

For the study on population dynamics of any species the knowledge of length-weight relationship is important. LeCren (1951) stated that the study of the length-weight relationship is useful for the determination of fitness, general well being of body weight and

gonadal development. These are the important things in fisheries management as discussed by Medawar (1945) and Rao (1957).

For the study of length-weight relationship the total length of the individuals, from the snout to the end of the tail were measured to the nearest mm on a meter scale. Weight were taken to the nearest to 0.1 gm by a sensitive balance.

The relationship between length and weight of fish were determined by using the logarithmic transformation of the well known formula as follows (LeCren, 1957;Rounsfell and Everhart, 1953):

$$W = a.\ L^{b} \quad \text{----------(9)}$$

Where 'a' is a constant, 'b' is an exponent, W is the weight and L is the corresponding length of body weight. The calculated body weight for the corresponding observed mid values of total length (TL) was obtained by using the equation.

The exponential form of the above mentioned formula can be expressed in the logarithmic form as follows:

$$\text{Log } W = \text{Log } a + b \text{ Log } L \quad \text{----------(10)}$$

The co-efficient of the correlation (r) was calculated with the help of the following formula (Pauly, 1983; Spiegel, 1992).

$$r = \frac{\sum xy - \frac{\sum x \sum y}{n}}{\sqrt{\left\{\sum x2 - \frac{(\sum x)2}{n}\right\}\left\{\sum y2 - \frac{(\sum y)2}{n}\right\}}} \quad \text{--------(11)}$$

The significance of `r` was done with the help of the following formula :

$$t = \frac{r.\sqrt{n-2}}{\sqrt{1-r\ 2}} \text{ ----------(12)}$$

Where, r = correlation co-efficient

n = number of observation (groups)

The following standard formulae were used for analysis (Pauly, 1983)

Linear regression equation

y = a + bx ----------(13)

Where a is the value of intercept and b is the value of slope or regression co-efficient.

Regression co-efficient:

$$b = \frac{\sum xy - \frac{\sum x \sum y}{n}}{\sum x2 - \frac{(\sum x)2}{n}} \text{ ----------(14)}$$

Where, b = regression co-efficient

x,y = variables

n = number of observation (groups)

The intercept :

a =y –bx ----------(15)

3.5.2. Condition Factor

Relative condition factor (Kn), are generally done by using the following formula:

$$Kn = \frac{W}{L^3} \text{ ----------(16)}$$

where, K= condition factor

W = observed mean body weight

L = observed length of fish.

But the fishes could not maintain constant form and specific gravity throughout the life and condition is subject to wide variation (Ledger,1956). Therefore, LeCren`s (1951) modified the equation for the calculation of the relative condition factor (Kn). The equation is:

$$Kn = \frac{W}{aL^b} \quad \text{----------(17)}$$

where, a is the value of intercept and b is the value of slope or regression co-efficient and aL^b denotes the calculated weight of the fish, which is denoted as W`.

So, $W` = aL^b$ ----------(18)

Therefore, the relative condition factor becomes:

$$Kn = \frac{W}{W'} \quad \text{----------(19)}$$

where, Kn is the relative condition factor.

W = Observed mean body weight

W`= Calculated body weight.

CHAPTER-4

RESULTS & DISCUSSION

4. RESULT & DISCUSSION

4.1. Fish landing centers:

A Total of 4 fish landing centers were identified in the South West region of Bangladesh. Their locality and geographical location are given in table 01 and fig. 01.

Khulna: There are two fish landing centers in this district. . One is Bangladesh Fisheries Development Corporation (BFDC) and located at 5 no.ghat on the west bank of the Rupsha River. It was established in 1970. It has16 depots. The second fish landing center is located at Rupsha Ferri ghat on the west bank of Rupsha River. It was established in 1980 and about 60 depots.

Bagerhat: There is only one fish landing center, which is known as KB Matshu Depot. It is located at the west bank of Daratana river. It was established in 1950. There were 10-12 depots.

Pirojpur: One fish landing center is found in this district. The name of this landing center is Parerhat Matshu Arat. . It is located at the west bank of Baleshor River. It was established in 1950. It has 10-12 depots.

Table-1 Location, year of establishment and number of depots of four landing center in the South-Western region of Bangladesh.

SL No.	Name of landing center	District	Thana	River side	Established year	Number of depot	Communication
01	PMA	Pirojpur	Projpur sadar	Baleshor	1962	34	Read and water way
02	BFDC	Khulna	Khulna city	Rush	1970	16	"
03	KB	Bagerhat	Bagerhat sadar	Daratana	1950	10-12	"
04	RSMA	Khulna	Khulna city corporation	Rupsha	1998	60	"

On the basis of fish landing, the largest and the smallest fish landing center are PMA (Parerhat Matsu Arat) and K.B Matsu Arat respectively. Distance from district head quarter for each fish landing center are different. Distance of BFDC and RAMA Matsu Arat from the Khulna district are 2 km And 1 km respectively. Distance of K.B. Matsu Arat from Bagerhat district is 03 km and distance of PMA Matsu Arat from Pirajpur district is 05 km. Ownership of PMA, K.B and RSMA Matsu Arat are private limited. But in case of BFDC fish landing center, though the Aratdar local people but they are controlled by Govt. that is Bangladesh fisheries Development Corporation. In four fish landing centers, most of the depots have own or hired fishing trawler. Amount of fish landing in each depot depends on dadon system (loan of money to the poor fisher men).

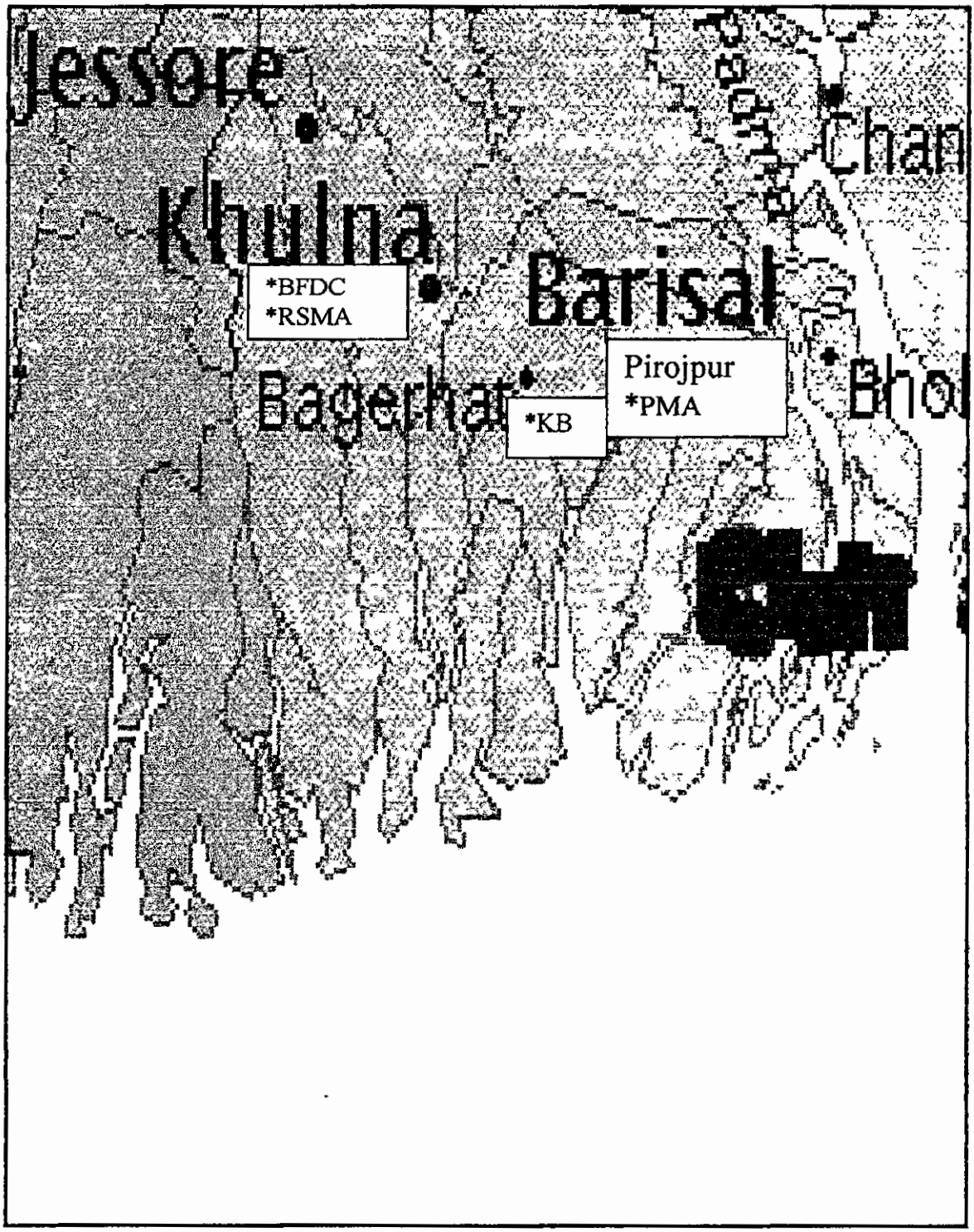


Fig.01 Geographical location of four fish landing center

4.2. Fishing crafts and gear used in Sundarbans region:

4.2.1. Description, Mode of Operation of Gears:

Most of the fishes in the present study were collected from the catches of shore net , shore seine net, hilsha gill net and set bag nets operated in different areas of marine and coastal water. The general description, mode of operation of these gears are given below:

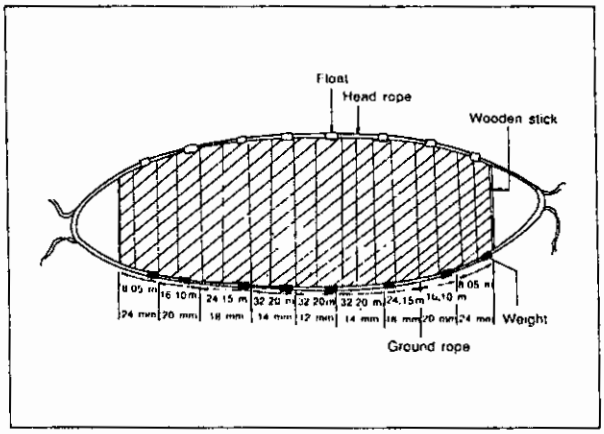


Fig. 01Shore net

a)Shore net:

Shore net require 03 fishermen to insert the foot end of net in the muddy bank along the river or canal, another end is vertically hanged on the bamboo pole before high tide start, fish caught mainly are kept by net when the fishermen harvest in the ebb tide. Length and width of shore net are ranging from 100 to 350 meters and 2.5 to 3.5 meters respectively and net mesh size range from 1.5 to 2.5 cm.

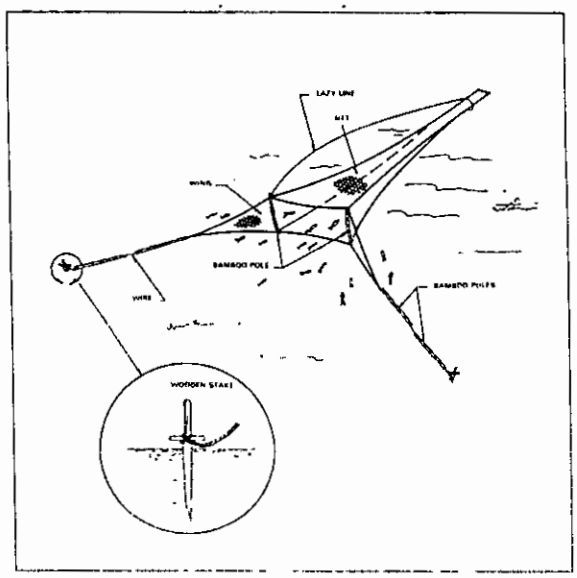


Fig. 04 Set bag net

d)Set bag net:

The set bag net is a fixed net set in the tidal current by attaching it to long bamboo poles and rope. The set bag net catches marine species, which drift with the current or do not swim fast enough to swim away from the current. The net itself consist of six section of which two section are made of four panels. While the remaining four sections consist of one panel each. The upper and the side panels are extended into small wing herding the fish into the mouth opening. The tapering of the net from mouth to cod end is achieved by gradually reducing the size and number of meshes. To keep the mouth of the net open, two vertical bamboo poles are fastened to the forward cover of the upper and lower panel, which are reinforced by gussets of netting. The nets are hand-braided and made mainly of nylon multi-filament and tyro cord(TC)for netting and other synthetic material for framing line.

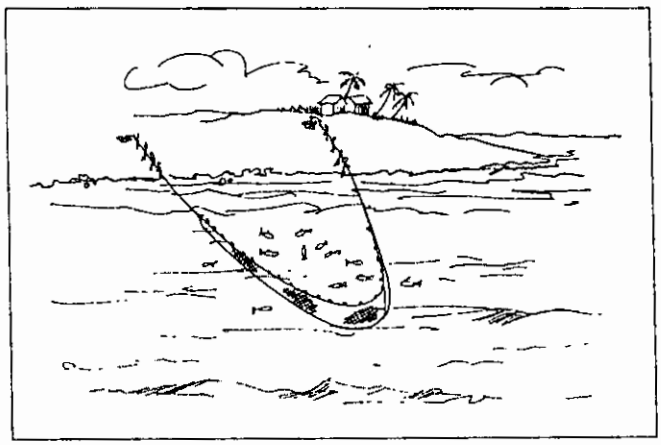


Fig. 02 Shore seine net

b)Shore seine net:

Shore seine net requires 4-6 fishermen. Length and width of the gear are 150 to300meters and 1.8to4.5meters respectively with mesh size ranging from 1.2to 2.5 cm, are lowed from the water with 1to 1.3meter depth.

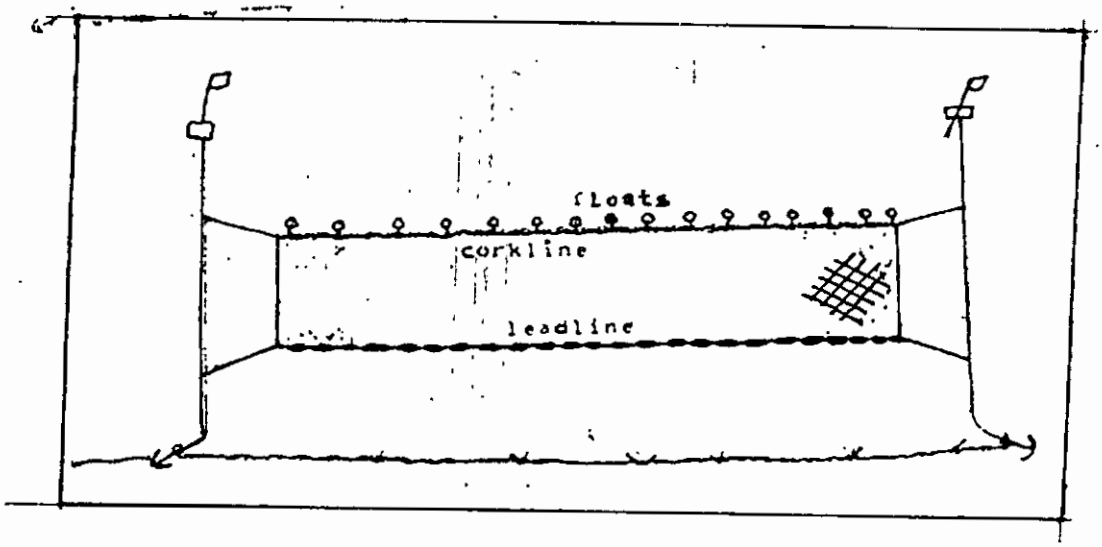


Fig.03Hilsha gill net

c)Hilsha gill net:

Non-mechanized boats use A3.5to 8.5 meters long of nets with mesh ranging 9.5-11.5 cm. 1000 to 3000 meters long of nets with mesh 10.5 to 11.5 cm are operated in the deep sea area by mechanized boat.

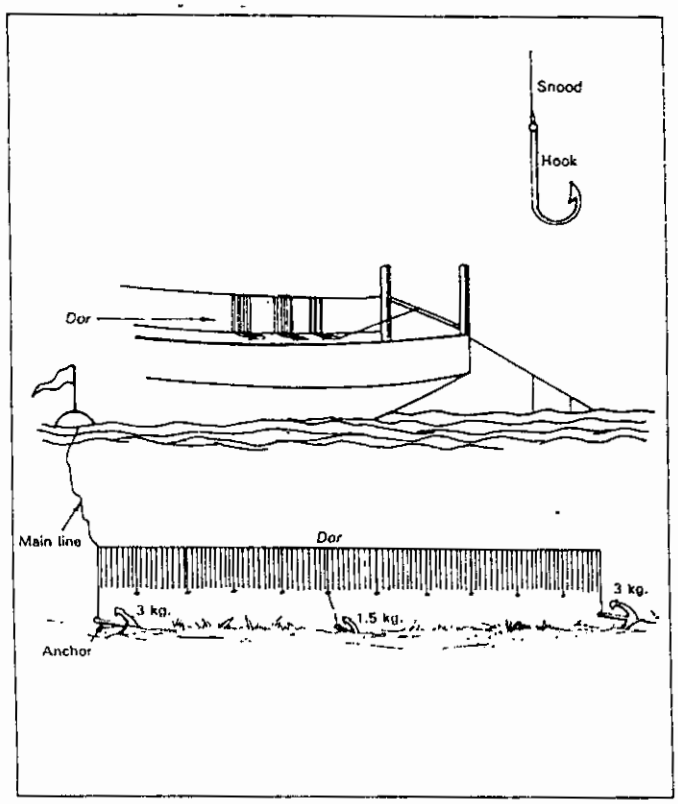


Fig. 05 Hook and Line

e)Hook and Line:

Fleet using this type of gear ranges 5-6 meters with ranging 400-800 hooks in number. Mostly, size of hook used ranges 2-2.5 cm in height or number12. Hook and Lines are operated in daytime, during spring tide throughout the year.

4.2.2.Fishing Craft:

For inshore and offshore fishing in Sundarban area, two type of fishing boats are used .i.e mechanized boat and non-mechanized boat. Each mechanized boat contains 8-14 number fishermen depends on size of boat. Non-mechanized contains 4-8 number fishermen also depends on size of boat. The type, size and kinds of boat are shown as follows:

Boat type	Size category	Length (meter)	Width (meter)	Operating region
Non-mechanized	Minimum	5-6	1	Sundarban and its adjacent canals and river.
	Maximum	10-15	1.5-2	
Mechanized	Minimum	8-9	1.5-2	Sundarban and deep sea fishing to landing center.
	Medium	10-12	2-2.5	
	Maximum	12-15	2.5-3	

4.2.2 .Description and Mathematical Relationships among various craft parameters:

4.2.2.1.Parerhat Matsu Arat, Pirojpur

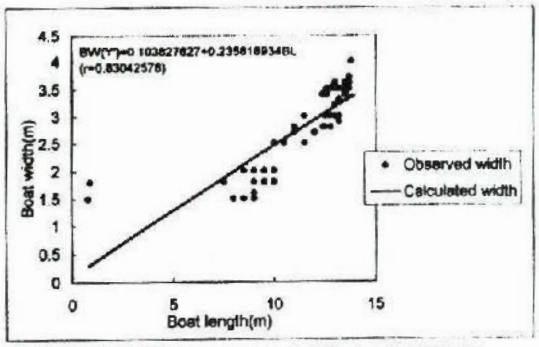


Fig 01 Relationship between Boat Length & Boat width of Parerhat fish landing centre

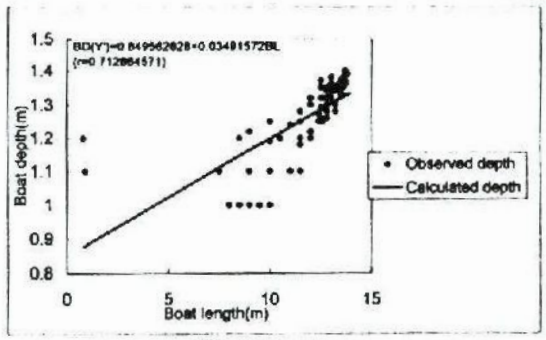


Fig 02 Relationship between Boat Length & Boat depth of Parerhat fish landing centre

The relationship between boat length and boat with has been shown in fig. 01. It is evident from the fig. 01. that boat width is strongly related to its length (r=0.830) from Pirojpur region. The relation was found to be non-significant at 5% (t=1.772) level of significance. It can be concluded that in Pirojpur region, the boat length is positively correlated with boat width.

The relationship between boat length and boat depth has been shown in Fig. 02. It is evident from the fig. 02. that boat depth is strongly related to its length (r=0.713) from Pirojpur region. The relation was found to be significant of 5% (t= 9.549) level of significance. It can be concluded that in Pirojpur region, the boat length is positively correlated with boat depth

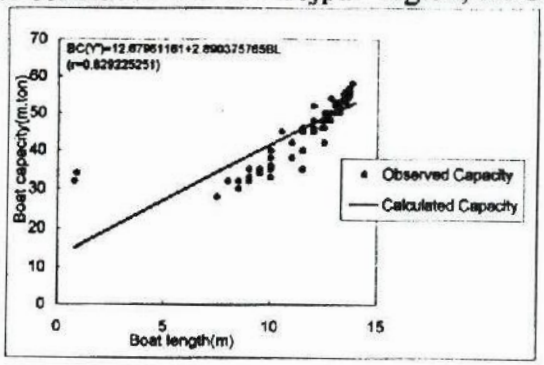


Fig 03 Relationship between Boat Length & Boat capacity of Parerhat fish landing centre

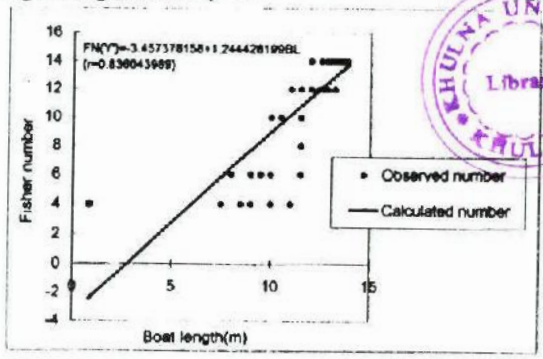


Fig 04 Relationship between Boat Length & fisher number of Parerhat fish landing centre

The relationship between boat length and boat capacity has been shown in fig.03. It is evident from the fig. 03 that boat capacity is strongly related to its length(r=0.829) from Pirojpur region. The relation was found to be non-significant at 5% (t= 1.091)level of significance. It can be concluded that in Pirojpur region. the boat length is positively correlated with boat capacity

The relationship between boat length and fisher number has been shown in fig 04. It is evident from the fig. 04 that fisher number is strongly related to its boat length(r=0.836) from Pirojpur region. The relation was found to be non-significant at 5% (t= 0.209)level of significance. It can be concluded that in Pirojpur region, the boat length is positively correlated with fisher number .

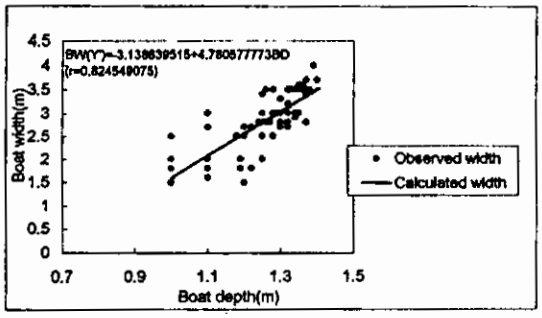


Fig 05 Relationship between Boat depth & Boat width of Pareihat fish landing centre

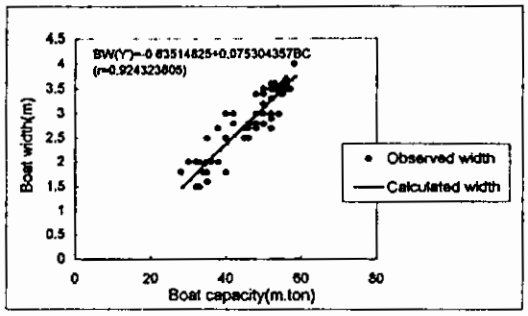


Fig 06 Relationship between Boat capacity & Boat width of Pareihat fish landing centre

The relationship between boat depth and boat width has been shown in fig.05. It is evident from the fig. 05 that boat width is strongly related to its depth (r=0.825) from Pirojpur region. The relation was found to be significant at 5% (t=6.361)level of significance. It can be concluded that in Pirojpur region, the boat depth is positively correlated with boat width.

The relationship between boat capacity and boat width has been shown in fig.06. It is evident from the fig. 06 that boat width is strongly related to its capacity(r=0.925) from Pirojpur region. The relation was found to be significant at 5% (t= 9.801)level of significance. It can be concluded that in Pirojpur region, the boat capacity is positively correlated with boat width.

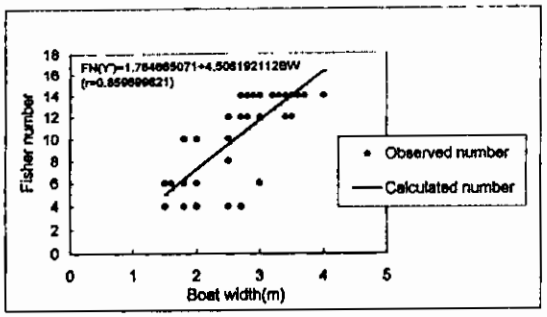


Fig 07 Relationship between Boat width & fisher number of Pareihat fish landing centre

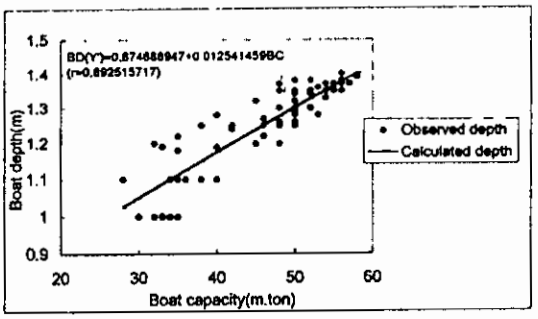


Fig 08 Relationship between Boat capacity & Boat width of Pareihat fish landing centre

The relationship between boat width and boat fisher number has been shown in fig. 07. It is evident from the fig. 07 that boat width is strongly related to its fisher number(r=0.787) from Pirojpur region. The relation was found to be significant at 5% (t= 2.678)level of significance. It can be concluded that in Pirojpur region, the boat width is positively correlated with fisher number.

The relationship between boat capacity and boat depth has been shown in fig.08. It is evident from the fig. 08 that boat depth is strongly related to its capacity(r=0.893) from Pirojpur region. The relation was found to be non-significant at 5% (t= 1.094)level of significance. It can be concluded that in Pirojpur region, the boat capacity is positively correlated with boat depth.

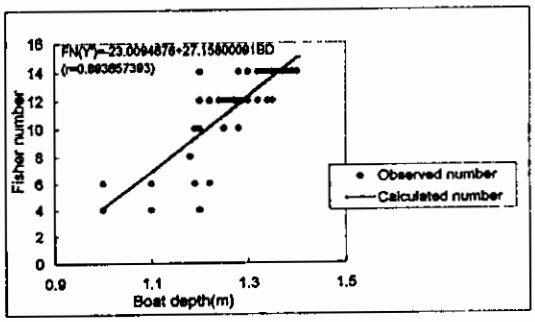


Fig 09 Relationship between Boat depth & fisher number of Pareirhat fish landing centre

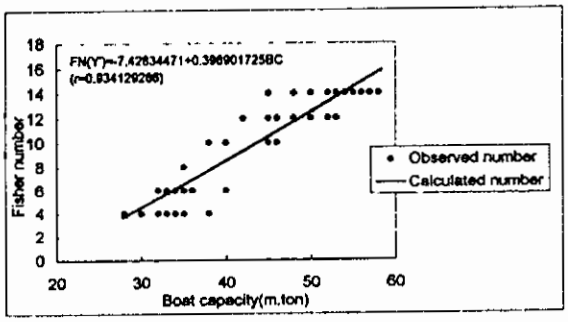


Fig 10 Relationship between Boat capacity & fisher number of Pareirhat fish landing centre

The relationship between boat depth and fisher number has been shown in fig. 09. It is evident from the fig. 09 that fisher number is strongly related to its depth(r=0.894) from Pirojpur region. The relation was found to be non-significant at 5% (t= 1.499)level of significance. It can be concluded that in Pirojpur region, the boat depth is positively correlated with fisher number.

The relationship between boat capacity and fisher number has been shown in fig10. It is evident from the fig. 10 that fisher number is strongly related to its boat capacity(r=0.934) from Pirojpur region. The relation was found to be non-significant at 5% (t= 1.597)level of significance. It can be concluded that in Pirojpur region, the boat capacity is positively correlated with fisher number.

Table 02: Regression parameters among various boat parameters from PMA of the South-western region of Bangladesh.

Relationship between	*a*	b	*r*	*T (d.f=90)*
boat length and boat width	0.103827627	0.235818934	0.830	1.772
boat length and boat depth	0.489562828	0.03491572	0.713	9.549
boat length and boat capacity	12.67961161	2.890375765	0.829	1.091
boat length and fisher number	-3.457378158	1.244428199	0.836	0.209
boat width and boat depth	-3.138639515	4.780577773	0.825	6.361
boat width and boat capacity	-0.63514825	0.075304357	0.924	9.80
fisher number and boat width	-1.761665071	4.506192112	0.860	2.678
boat depth and boat capacity	0.674688947	0.012541459	0.893	1.094
boat depth and fisher number	-23.0094676	27.15800091	0.894	1.499
boat capacity and fisher number	-7.42834471	0.398901725	0.934	1.597

Form the above table, about 90no. of craft are studied in PMA fish landing center. The relationship between various parameters in craft are shown. However, 10 relations are strongly co-related out of 10.

4.2.2.2.Bangladesh Fisheries Development Corporation (BFDC), Khulna

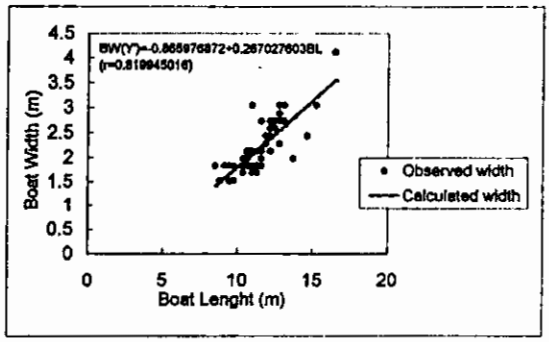


Fig 01 Relationship between Boat Length & Boat width of BFDC fish landing centre

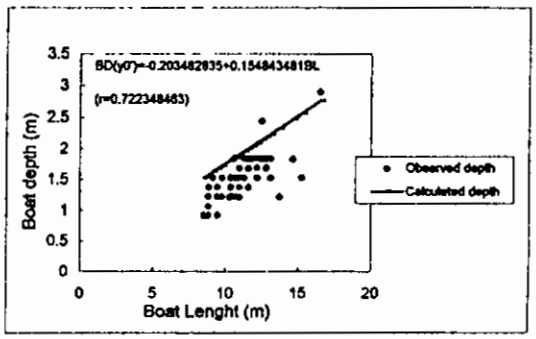


Fig 02 Relationship between Boat Length & Boat depth of BFDC fish landing centre

The relationship between boat length and boat with has been shown in fig. 01. It is evident from the fig. 01. that boat width is strongly related to its length (r=0.820) from Khulna region. The relation was found to be non-significant at5% (t=1.870) level of significance. It can be concluded that in Khulna region, the boat length is positively correlated with boat width.

The relationship between boat length and boat depth has been shown in fig. 02. It is evident from the fig. 02. that boat depth is strongly related to its length (r=0.722) from Khulna region. The relation was found to be significant of 5% (t= 3.282) level of significance. It can be concluded that in Khulna region, the boat length is positively correlated with boat depth.

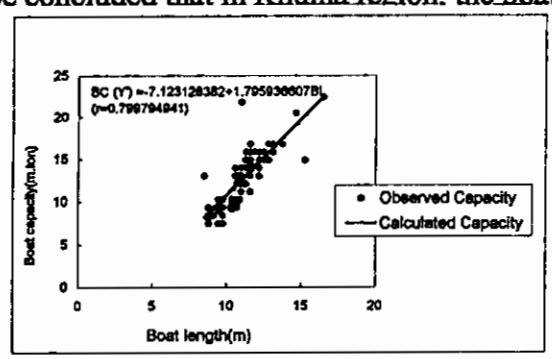


Fig 03 Relationship between Boat Length & Boat capacity of BFDC fish landing centre

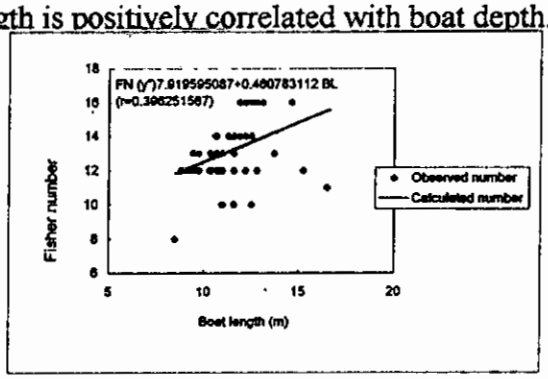


Fig 04 Relationship between Boat Length & fisher number of BFDC fish landing centre

The relationship between boat length and boat capacity has been shown in fig.03. It is evident from the fig. 03 that boat capacity is strongly related to its length(r=0.80) from Khulna region. The relation was found to be significant at 5% (t= 5.761) level of significance. It can be concluded that in Khulna region, the boat length is positively correlated with boat capacity.

The relationship between boat length and fisher number has been shown in fig 04. It is evident from the fig. 04 that fisher number is poorly related to its boat length(r=0.396) from Khulna region. The relation was found to be significant at 5% (t= 4.148) level of significance. It can be concluded that in Khulna region, the boat length is positively correlated with fisher number.

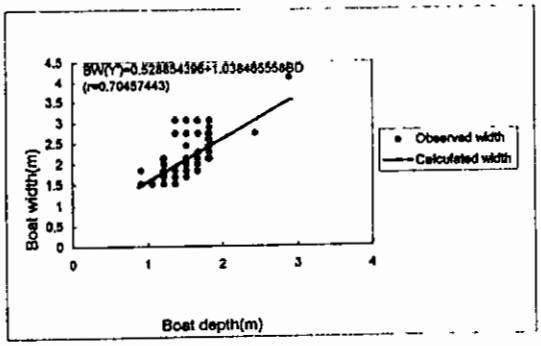


Fig 05 Relationship between Boat depth & Boat width of BFDC fish landing centre

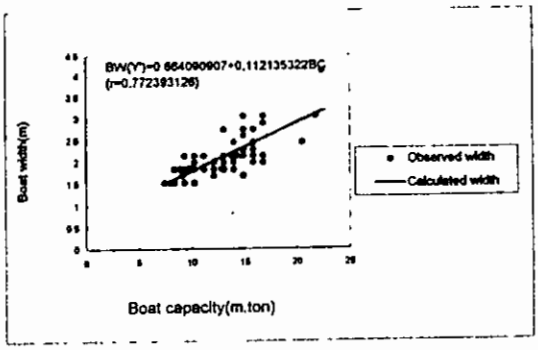


Fig 06 Relationship between Boat capacituy & Boat width of BFDC fish landing centre

The relationship between boat depth and boat width has been shown in fig.05. It is evident from the fig. 05 that boat width is strongly related to its depth (r=0.705) from khulna region. The relation was found to be significant at 5% (t=4.635) level of significance. It can be concluded that in Khulna region, the boat depth is positively correlated with boat width.

The relationship between boat capacity and boat width has been shown in fig.06. It is evident from the fig. 06 that boat width is strongly related to its capacity(r=0.772) from Khulna region. The relation was found to be significant at 5% (t= 3.097) level of significance. It can be concluded that in Khulna region, the boat capacity is positively correlated with boat width.

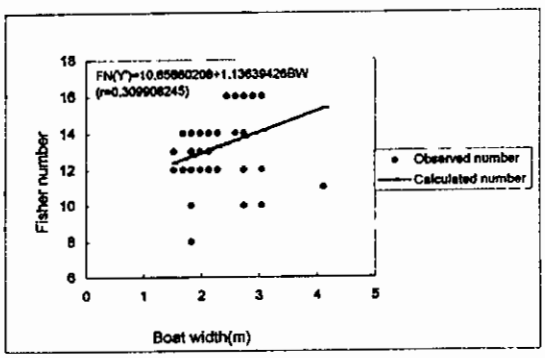


Fig 07 Relationship between Boat width & fisher number of BFDC fish landing centre

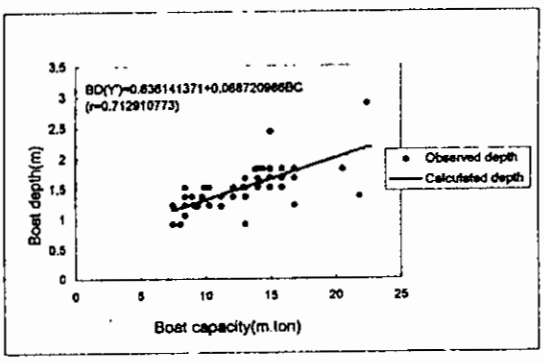


Fig 08 Relationship between Boat capacity & Boat depth of BFDC fish landing centre

The relationship between boat width and fisher number has been shown in fig. 07. It is evident from the fig. 07 that boat width is poorly related to its fisher number(r=0.310) from Khulna region. The relation was found to be non-significant at 5% (t= 5.528) level of significance. It can be concluded that in Khulna region, the boat width is positively correlated with fisher number.

The relationship between boat capacity and boat depth has been shown in fig.08. It is evident from the fig. 08 that boat depth is strongly related to its capacity(r=0.713) from Khulna region. The relation was found to be significant at 5% (t= 2.2502) level of significance. It can be concluded that in Khulna region, the boat capacity is positively correlated with boat depth.

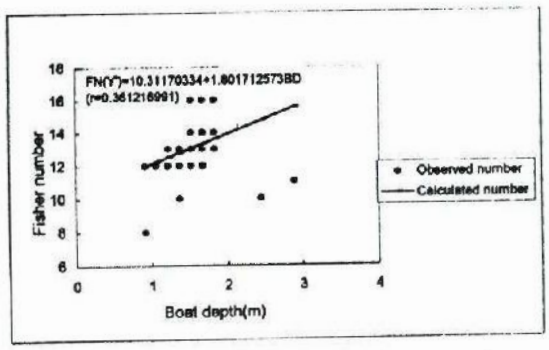


Fig 09 Relationship between Boat depth & fisher number of BFDC fish landing centre

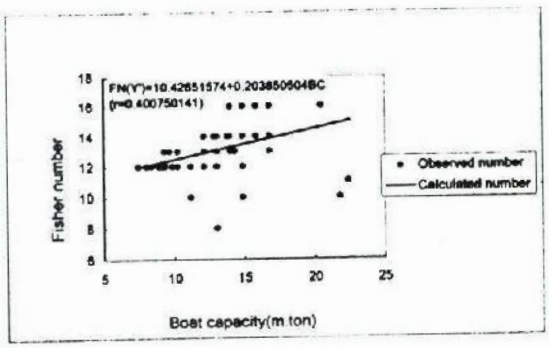


Fig 10 Relationship between Boat capacity & fisher number of BFDC fish landing centre

The relationship between boat depth and fisher number has been shown in fig. 09. It is evident from the fig. 09 that fisher number is poorly related to its depth(r=0.361) from Khulna region. The relation was found to be non-significant at 5% (t= 1.998) level of significance. It can be concluded that in Khulna region, the boat depth is positively correlated with fisher number.

The relationship between boat capacity and fisher number has been shown in fig10. It is evident from the fig. 10 that fisher number is poorly related to its boat capacity(r=0.401) from Khulna region. The relation was found to be non-significant at 5% (t= 0.693) level of significance. It can be concluded that in Khulna region, the boat capacity is positively correlated with fisher number.

Table 03: Regression parameters among various boat parameters from BFDC of the South-western region of Bangladesh.

Relationship between	*a*	b	*r*	*t(d.f=75)*
boat length and boat width	-0.865976872	0.267027603	0.820	1.870
boat length and boat depth	-0.203482835	0.154883481	0.722	3.282
boat length and boat capacity	-7.123128382	1.795936607	0.800	5.761
boat length and fisher number	7.199595087	0.460783112	0.396	4.148
boat width and boat depth	0.528852396	1.038465558	0.705	4.635
boat width and boat capacity	0.664090907	0.112135322	0.772	3.097
fisher number and boat width	10.65660208	1.13639426	0.310	5.528
boat depth and boat capacity	0.636141371	0.068720986	0.713	2.502
boat depth and fisher number	10.31170334	1.801712573	0.361	1.998
boat capacity and fisher number	10.42651574	0.203850504	0.401	0.693

Form the above table, about 75no. of craft are studied in BFDC fish landing center. The relationship between various parameters in craft are shown. However, 6 relations are strongly co-related out of 10.

4.2.2.3. K.B Matsu Arat, Bagerhat.

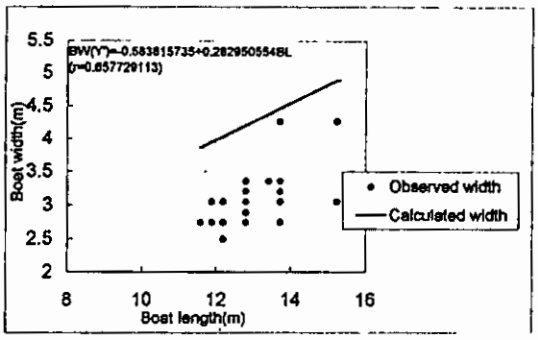


Fig 01 Relationship between Boat Length & Boat width of KB fish landing centre

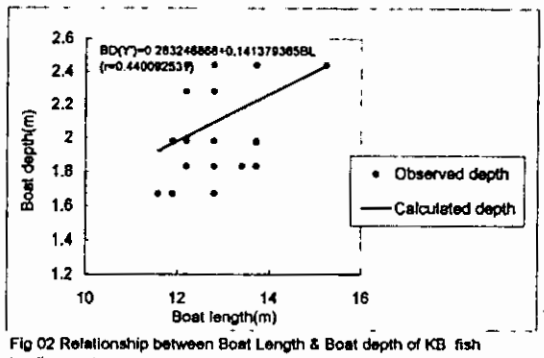


Fig 02 Relationship between Boat Length & Boat depth of KB fish landing centre

The relationship between boat length and boat with has been shown in fig. 01. It is evident from the fig. 01. that boat width is moderately related to its length (r=0.658) from Bagerhat region. The relation was found to be non-significant at 5% (t=1.20) level of significance. It can be concluded that in Bagerhat region, the boat length is positively correlated with boat width.

The relationship between boat length and boat depth has been shown in fig. 02. It is evident from the fig. 02. that boat depth is poorly related to its length (r=0.0.440713) from Bagerhat region. The relation was found to be significant of 5% (t= 3.935) level of significance. It can be concluded that in Bagerhat region, the boat length is positively correlated with boat depth.

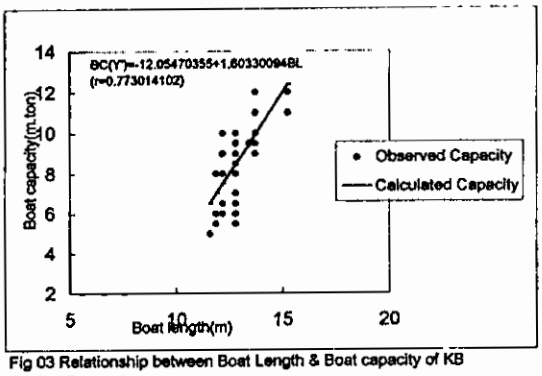


Fig 03 Relationship between Boat Length & Boat capacity of KB fish landing centre

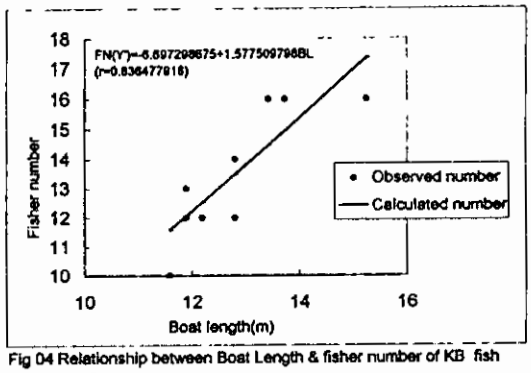


Fig 04 Relationship between Boat Length & fisher number of KB fish landing centre

The relationship between boat length and boat capacity has been shown in fig.03. It is evident from the fig. 03 that boat capacity is strongly related to its length(r=0.773) from Bagerhat region. The relation was found to be non-significant at 5% (t= 3.019)level of significance. It can be concluded that in Bagerhat region, the boat length is positively correlated with boat capacity.

The relationship between boat length and fisher number has been shown in fig 04. It is evident from the fig. 04 that fisher number is strongly related to its boat length(r=0.836) from Pirojpur region. The relation was found to be non-significant at 5% (t= 0.004)level of significance. It can be concluded that in Bagerhat region, the boat length is positively correlated with fisher number .

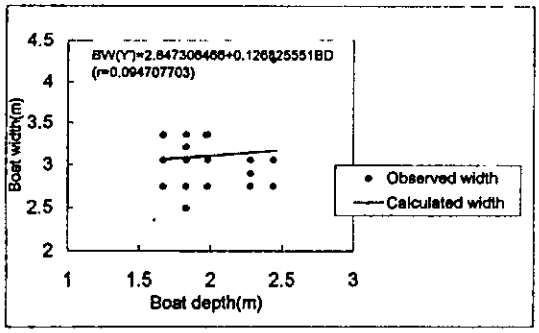


Fig 05 Relationship between Boat depth & Boat width of KB fish landing centre

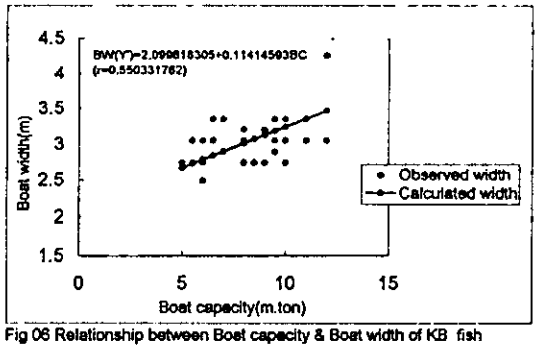


Fig 06 Relationship between Boat capacity & Boat width of KB fish landing centre

The relationship between boat depth and boat width has been shown in fig.05. It is evident from the fig. 05 that boat width is very poorly related to its depth (r=0.095) from Bagerhat region. The relation was found to be significant at 5% (t=8.636)level of significance. It can be concluded that in Bagerhat region, the boat depth is positively correlated with boat width.

The relationship between boat capacity and boat width has been shown in fig.06. It is evident from the fig. 06 that boat width is moderately related to its capacity(r=0.550) from Bagerhat region. The relation was found to be significant at 5% (t= 8.867)level of significance. It can be concluded that in Bagerhat region, the boat capacity is positively correlated with boat width.

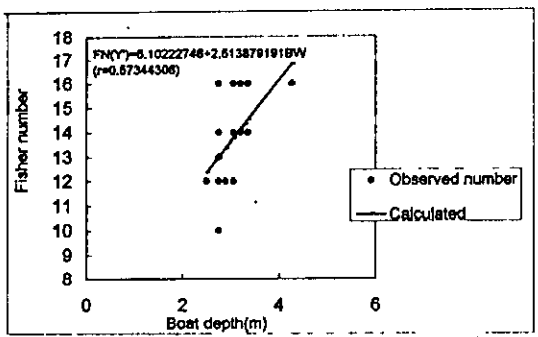


Fig 07 Relationship between Boat depth & fisher number of KB fish landing centre

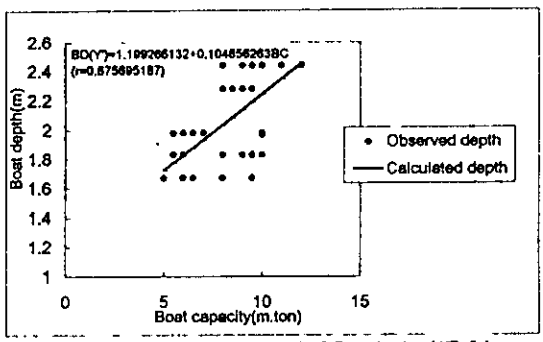


Fig 08 Relationship between Boat capacity & Boat depth of KB fish landing centre

The relationship between boat width and fisher number has been shown in fig. 07. It is evident from the fig. 07 that boat width is moderately related to its fisher number(r=0.573) from Bagerhat region. The relation was found to be significant at 5% (t= 9.255)level of significance. It can be concluded that in Bagerhat region, the boat width is positively correlated with fisher number.

The relationship between boat capacity and boat depth has been shown in fig.08. It is evident from the fig. 08 that boat depth is moderately related to its capacity(r=0.676) from Bagerhat region. The relation was found to be non-significant at 5% (t= 1.538)level of significance. It can be concluded that in Bagerhat region, the boat capacity is positively correlated with boat depth.

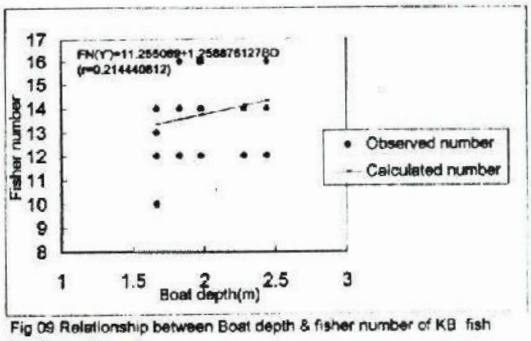


Fig 09 Relationship between Boat depth & fisher number of KB fish landing centre

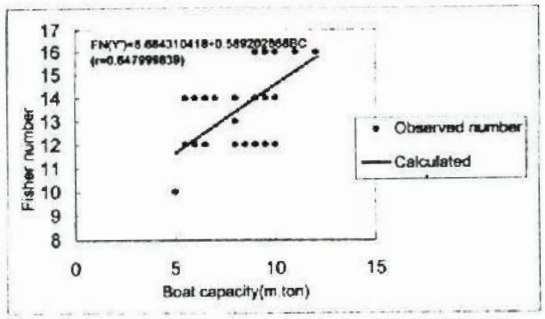


Fig 10 Relationship between Boat capacity & fisher number of KB fish landing centre

The relationship between boat depth and fisher number has been shown in fig. 09. It is evident from the fig. 09 that fisher number is poorly related to its depth(r=0.214) from Bagerhat region. The relation was found to be non-significant at 5% (t= 8.364)level of significance. It can be concluded that in Bagerhat region, the boat depth is positively correlated with fisher number.

The relationship between boat capacity and fisher number has been shown in fig10. It is evident from the fig. 10 that fisher number is moderately related to its boat capacity(r=0.648) from Bagerhat region. The relation was found to be non-significant at 5% (t= 1.087)level of significance. It can be concluded that in Bagerhat region, the boat capacity is positively correlated with fisher number.

4.2.2.4.RSMA Matsu Arat, Khulna

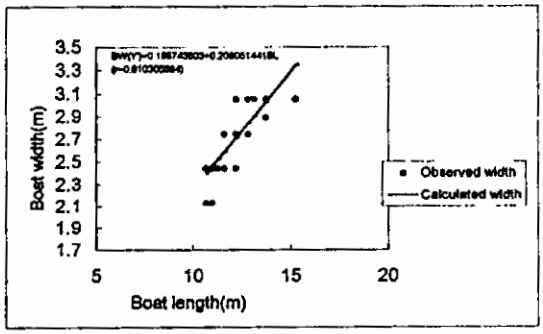


Fig 01 Relationship between Boat Length & Boat width of Rupsha fish landing centre

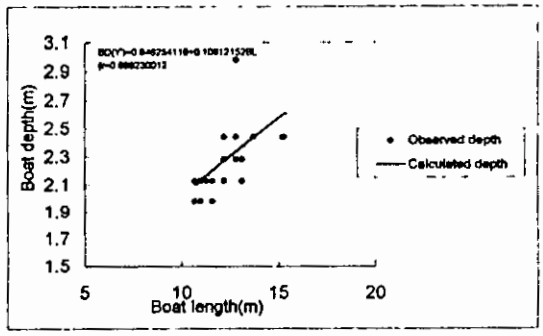


Fig 02 Relationship between Boat Length & Boat depth of Rupsha fish landing centre

The relationship between boat length and boat with has been shown in fig. 01. It is evedent5 from the fig. 01. that boat width is strongly related to its length (r=0.810) from Khulna region. The relation was found to be significant at5% (t=2.374) level of significance. It can be concluded that in Khulna region, the boat length is positively correlated with boat width.

The relationship between boat length and boat depth has been shown in fig. 02. It is evident from the fig. 02. that boat depth is moderately related to its length (r=0.669) from Khulna region. The relation was found to be significant of 5% (t= 5.957) level of significance it can be concluded that in Khulna region. The boat length is positively correlated with boat depth

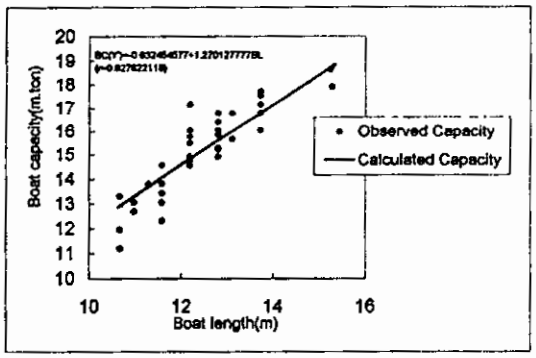


Fig 03 Relationship between Boat Length & Boat capacity of Rupsha fish landing centre

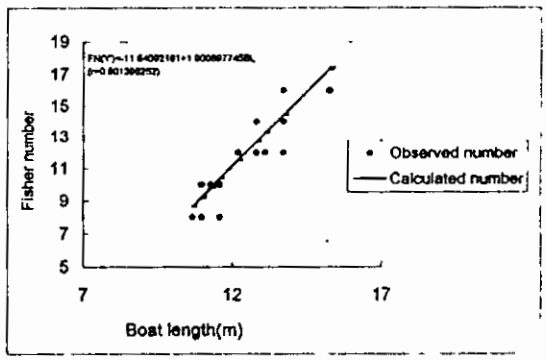


Fig 04 Relationship between Boat Length & fisher number of Rupsha fish landing centre

The relationship between boat length and boat capacity has been shown in fig.03. It is evident from the fig. 03 that boat capacity is strongly related to its length(r=0.828) from Khulna region. The relation was found to be significant at 5% (t= 2.561) level of significance. It can be concluded that in Khulna region. The boat length is positively correlated with boat capacity

The relationship between boat length and fisher number has been shown in fig 04. It is evident from the fig. 04 that fisher number is strongly related to its boat length(r=0.901) from Khulna region. The relation was found to be non-significant at 5% (t= 0.404) level of significance. It can be concluded that in Khulna region. The boat length is positively correlated with fisher number.

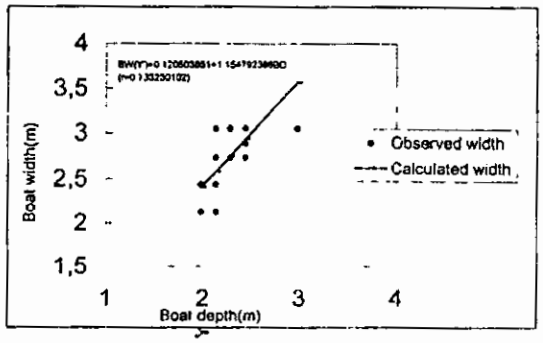


Fig 05 Relationship between Boat depth & Boat width of Rupsha fish landing centre

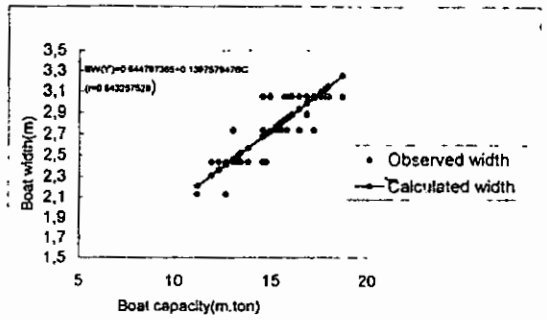


Fig 06 Relationship between Boat capacity & Boat width of Rupsha fish landing centre

The relationship between boat depth and boat width has been shown in fig.05. It is evident from the fig. 05 that boat width is strongly related to its depth (r=0.733) from khulna region. The relation was found to be significant at 5% (t=3.919) level of significance. It can be concluded that in Khulna region. The boat depth is positively correlated with boat width.

The relationship between boat capacity and boat width has been shown in fig.06. It is evident from the fig. 06 that boat width is strongly related to its capacity(r=0.843) from Khulna region. The relation was found to be non-significant at 5% (t= 1.723) level of significance. It can be concluded that in Khulna region. The boat capacity is positively correlated with boat width.

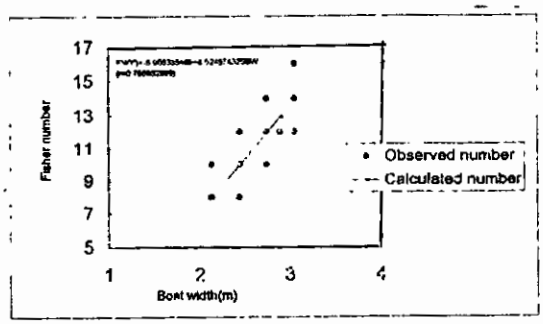


Fig 07 Relationship between Boat width & fisher number of Rupsha fish landing centre

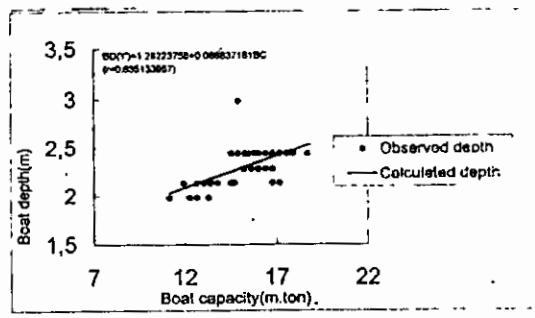


Fig 08 Relationship between Boat capacity & Boat depth of Rupsha fish landing centre

The relationship between boat width and boat fisher number has been shown in fig. 07. It is evident from the fig. 07 that boat width is strongly related to its fisher number(r=0.787) from khulna region. The relation was found to be non-significant at 5% (t= 1.121) level of significance. It can be concluded that in Khulna region. The boat width is positively correlated with fisher number.

The relationship between boat capacity and boat depth has been shown in fig.08. It is evident from the fig. 08 that boat depth is moderately related to its capacity(r=0.635) from khulna region. The relation was found to be significant at 5% (t= 9.617) level of significance. It can be concluded that in Khulna region. The boat capacity is positively correlated with boat depth.

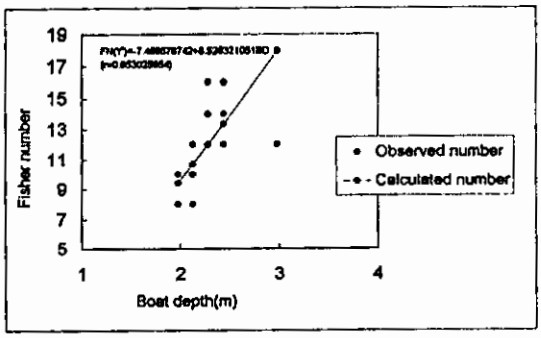


Fig 09 Relationship between Boat depth & fisher number of Rupsha fish landing centre

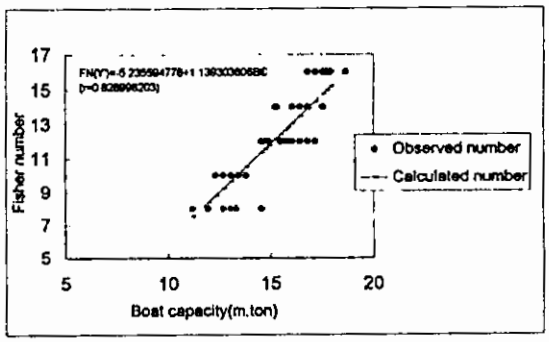


Fig 10 Relationship between Boat capacity & fisher number of Rupsha fish landing centre

The relationship between boat depth and fisher number has been shown in fig. 09. It is evident from the fig. 09 that fisher number is moderately related to its depth(r=0.653) from Khulna region. The relation was found to be non-significant at 5% (t= 1.164) level of significance. It can be concluded that in Khulna region. The boat depth is positively correlated with fisher number.

The relationship between boat capacity and fisher number has been shown in fig10. It is evident from the fig. 10 that fisher number is strongly related to its boat capacity(r=0.829) from Khulna region. The relation was found to be significant at 5% (t= 4.073) level of significance. It can be concluded that in Khulna region. The boat capacity is positively correlated with fisher number.

Table 05: Regression parameters among various boat parameters from RSMA of the South-western region of Bangladesh.

Relationship between	*a*	b	*r*	*t(d.f=45)*
boat length and boat width	0.198743803	0.206051441	0.810	2.374
boat length and boat depth	0.946254119	0.108612152	0.669	5.57
boat length and boat capacity	-0.632454577	1.270127777	0.828	2.561
boat length and fisher number	-11.64092161	1.900697745	0.901	0.404
boat width and boat depth	0.120503851	1.154792386	0.733	3.919
boat width and boat capacity	0.644797365	0.139757947	0.843	1.724
fisher number and boat width	-5.966338469	6.524574325	0.787	1.121
boat depth and boat capacity	1.282223758	0.066837161	0.635	9.617
boat depth and fisher number	-7.469578742	8.528321051	0.653	1.164
boat capacity and fisher number	-5.235594778	1.139303806	0.829	4.073

Form the above table, about 45no. of craft are studied in RSMA fish landing center. The relationship between various parameters in craft are shown. However, 7 relations are strongly co-related out of 10.

4.3.Landing Statistics:

4.3.1. Diversity of landed Fish species:

About 30 commercial important fish/shrimp were identified (Appendix-I). It is shown that most of the species are found in above four fish landing center except the following 12 species. *Lates calcarifer* (Seabass), *Polynemus paradiscus* (Thread fin). *Liza parsia* (mullet), *Arius* spp are not found in BFDC fish landing center. *Eleutheronema tetradactylum* (thread fin), *Eleutheronema* spp, *Lopholatilus chamaeleonlipeps*, *Cephalopholis* (Sea bass), *Argyrosomus* spp are not found in K.B Matsu Arat. *Metapenaeus monoceros* (Brown shrimp), *Penaeus indicus*, *Penaeus japonicus* (red tiger) and *Macrobrachium rude* (Motka chingri) are not found in BFDC and KB Matsu Arat. *Ilisha* spp (River shed) was not found both in Parerhat Matsu Arat (PMA) and K.B Matsu Arat. *Argyrosomus* spp are not found in Rush soda Matsu Arat (RSMA).

From the species wise catch composition data it has been shown that generally total amount of fish (m ton) are gradually decrease from January to June and the amount of fishes (m ton) are gradually increase from July to December see table no (02-05). It is clear that amount of fishes(MT) depends on season. In winter season, the amount of catches increase decease the are and its surrounded water bodies are clam. But in summer and rainy seasons the sea become cruel and change the ecology and coastal fisheries habitat specially Sundarban fisheries.

Table-06 Number of fish species landed in four fish landing center landed:

Landing center	Species Number	Landed volume (MT)
1. PMA	29	14,473.64
2. BFDC	23	2,986.62
3. KB	20	594.06
4. RSMA	29	212.557
Total	30	32666.877

The maximum number of fish main (29) were landed in PMA & RSMA landing center. While, the minimum number of fish/shrimp species was landed: KB landing center.

The maximum (28,873.64 MT) and the minimum (212.557 MT) volume of fish/shrimp landed during 1999-2000 in PMA and RSMA respectively.

The monthly volume of major fish and shrimp species are landed in four landing center are given below:

4.3.2.Parerhat Matshu Arat (PMA):

Among 29 fish species landed in PMA landing center, the river shed *Tanualosa ilisha* species was found to be the highest (9822 MT) in volume. While *Penaeus indicus* was found to be landed minimum (138 ton).

The *Arius* spp, *Trichiurus haumela* and *Arius* species were found to be landed more that 1000 tones/year.

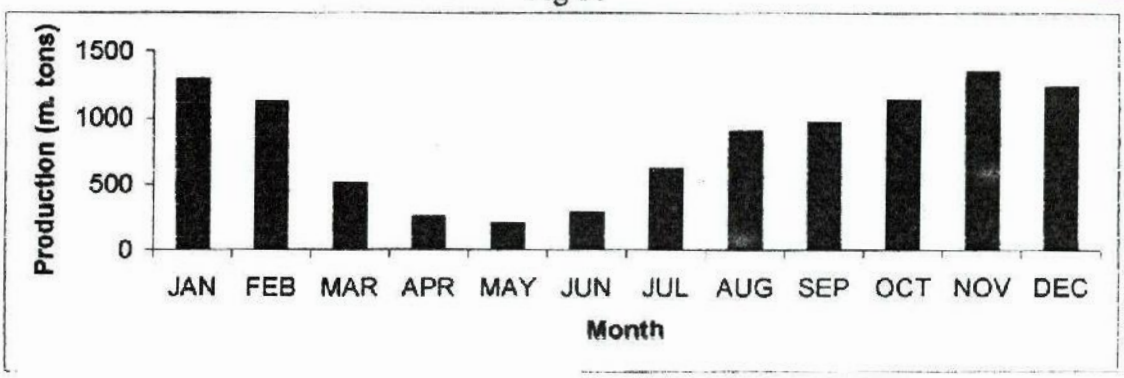
On average, 1789 tons of fish/shrimp was found to be landed in PMA landing center. The SD analysis showed that the average landing would vary from 4518.9 MT to 940.9 MT.

The details of landing statistics are presented below for major species

a) ***Tenualosa ilisha :***

Fig 01 indicates that *T. ilisha* was found throughout the year.

Fig 01



The peak fishing season was found to be from July to February. When the landing volume varied from 616 MT to 1119.5 MT.

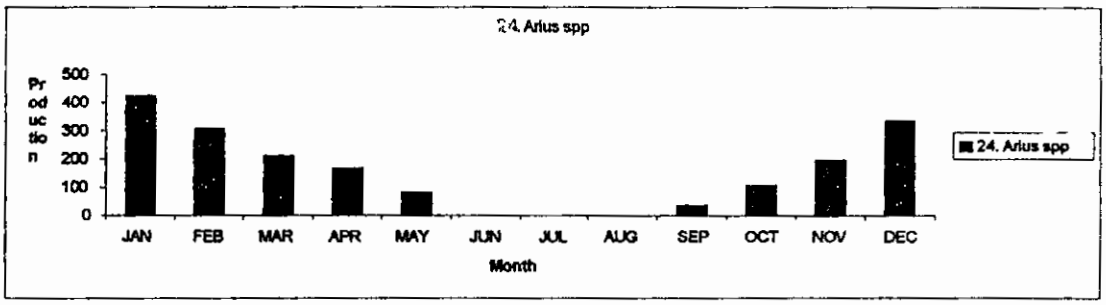
The moderate fishing/harvesting of *T.ilisha* was recorded during March and July with a landing variation from 504 MT to 280 MT.

The lean fishing season was observed during April through June. When the harvesting volume is 196 MT.

b) *Arius* spp:

Fig. 02 indicates that the fish was harvested seasonally. No fishing activities was found from June to July.

Fig. 02



The peak fishing season was found to be from December to February. When the landing volume varied from 338 MT to 304.5 MT.

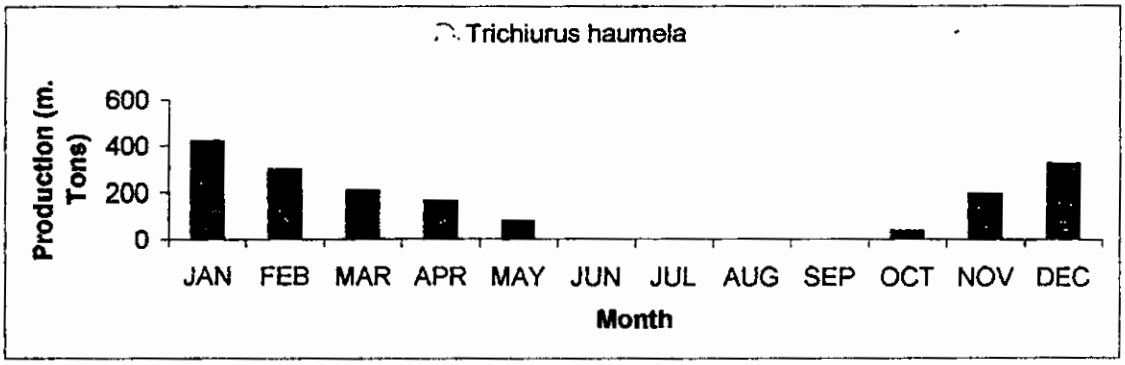
The moderate fishing/harvesting of *Arius* spp was recorded during March, April, October and November with a landing variation from 208 MT to 196 MT.

The lean fishing season was observed during May to September. When the harvesting volume varied from 81 MT to 33.6 MT.

c) *Trichiurus haumela*:

Fig. 03 indicates that the fish was harvested seasonally. No fishing activities was found from June to September.

Fig. 03



The peak fishing season was found to be from December to March. When the landing volume varied from 332.5 MT to 211 MT.

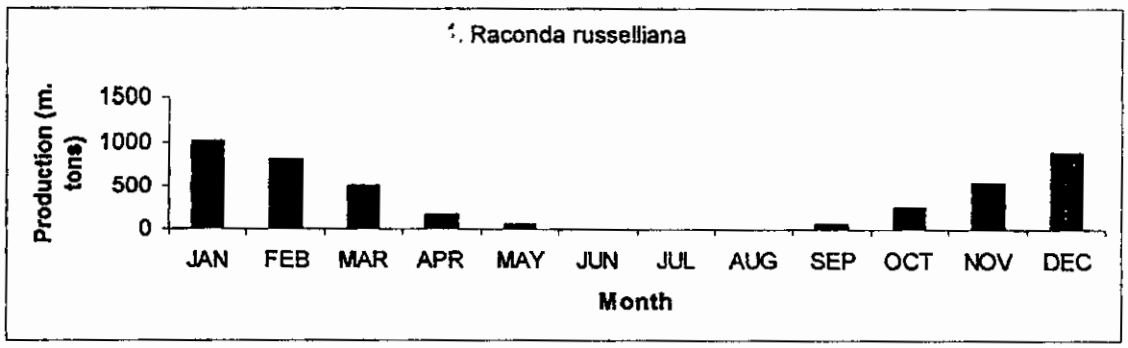
The moderate fishing/harvesting of *Trichiurus haumela* was recorded during April and November with a landing variation from 168MT to 196 MT.

The lean fishing season was observed during May and October. When the harvesting volume varied from 78 MT to 37.6MT.

d) *Raconda russelliana*:

Fig. 04 indicates that the fish was harvested seasonally. No fishing activities were found from June to August.

Fig. 04



The peak fishing season was found to be from November to February. When the landing volume varied from 532 MT to 1012 MT.

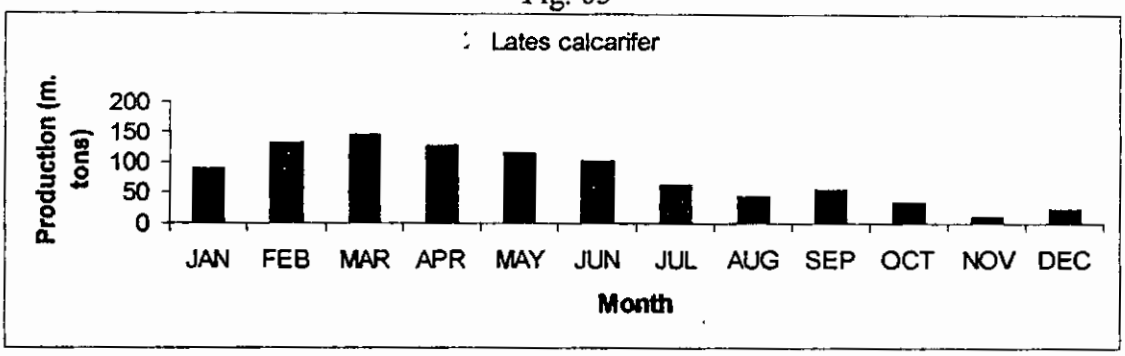
The moderate fishing/harvesting of *Ramona russelliana* was recorded during March, April and October with a landing variation from 168 MT to 252 MT.

The lean fishing season was observed during May through September. When the harvesting volume is varied from 58 MT to 60 MT.

e) *Lates calcarifer*:

Fig. 05 indicates that the fish was harvested throughout the year.

Fig. 05



The peak fishing season was found to be from January to June. When the landing volume varied from 87 MT to 101 MT.

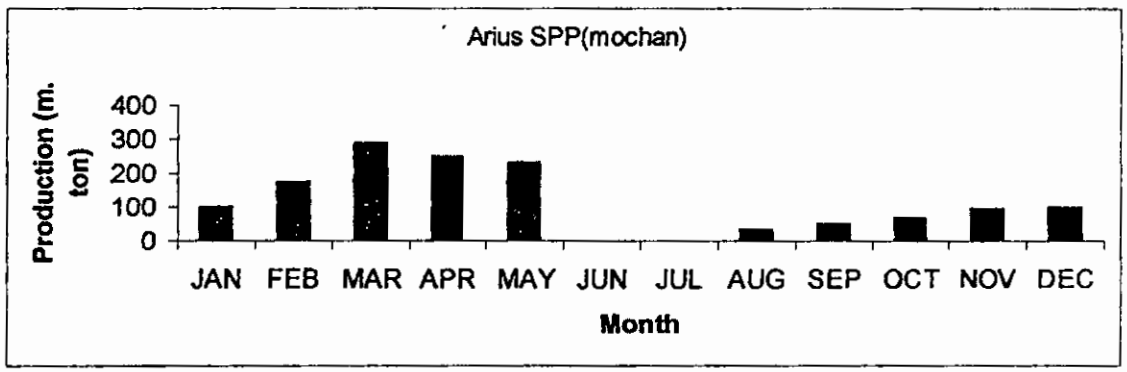
The moderate fishing/harvesting of *Lates calcarifer* was recorded during July to October with a landing variation from 63.5 MT to 35 MT.

The lean fishing season was observed during November through December. When the harvesting volume is varied from 11.5 MT to23 MT.

f) *Arius* spp (mochon mach):

Fig. 06 indicates that the fish was harvested seasonally. No fishing activities were found from June to July.

Fig. 06



The peak fishing season was found to be from February to May. When the landing volume varied from 175 MT to 231 MT.

The moderate fishing/harvesting of *Arius* spp was recorded during October to January with a landing variation from 66.5 MT to 98 MT.

The lean fishing season was observed during April through June. When the harvesting volume varied from 35 MT to 52 MT.

g) Shrimp:

December to March is the peck season for harvesting *Metapenaeus monoceros*, *Penaeus indicus*. While the major fishing season for *P. japonicus* & *M. rude* was found to be October to March.

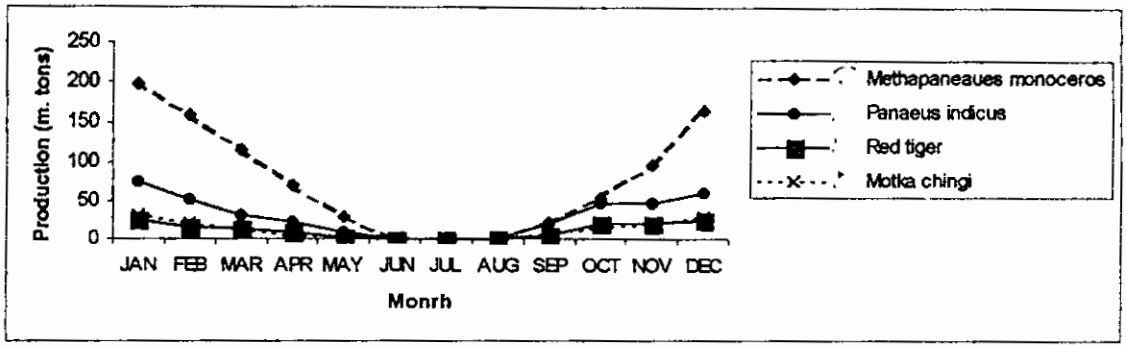


Table-07 Production of *T. ilisha* by landing center:

Landing center	Annual production (MT)	Major fishing season
PMA	9822	October-February
BFDC	2647	August-March
KB	371.5	June-February
RSMA	14.3	July-January

Among the 4 landing center the maximum (9822m.tons) amount of *T. ilisha* was found to be landed in PMA landing center. While the minimum landing was found (14.3 MT) in RSMA landing center.

4.3.3. Bangladesh Fisheries Development Corporation (BFDC):

Among 23 species landed in BFDC landing center, the river shed *T. ilisha* species was found to be the highest (2647 MT) in volume. While *Eleutheronema tetradactylum* species found to be landed minimum (3.5 MT)

The *Elagatis* spp, *Reconda Resselliana, Restrelliger* spp *Pampus argeneus, Ilisha* spp and *Lopholatilus chamaeleonlipeps* were found to be landed more than 18 m. tons.

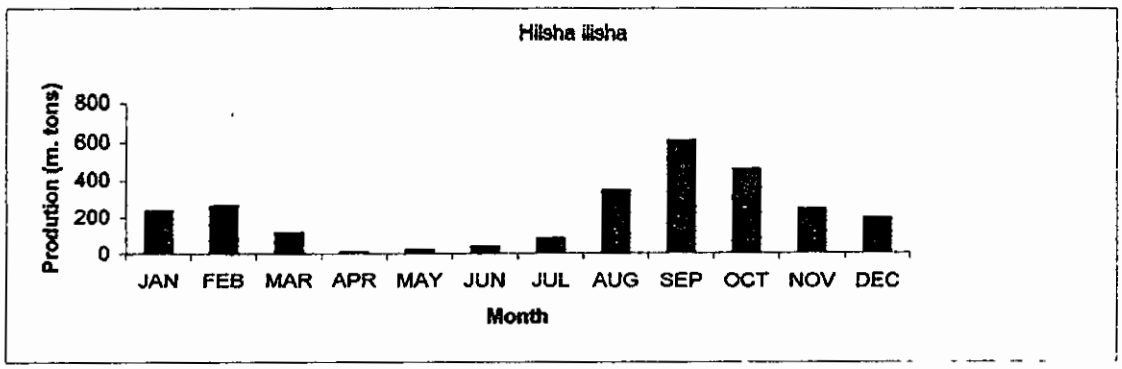
On average, 399.21 MT of fish was found landed in BFDC landing center. The SD analysis showed that the average landing would vary from MT to MT.

The details of landing statistics presented below for major species:

a) *T. ilisha:*

Fig. 01 indicates that the fish was harvested throughout the year.

Fig. 01



The peak fishing season was found to be from August to November. When the landing volume varied from 347 MT to 252 MT.

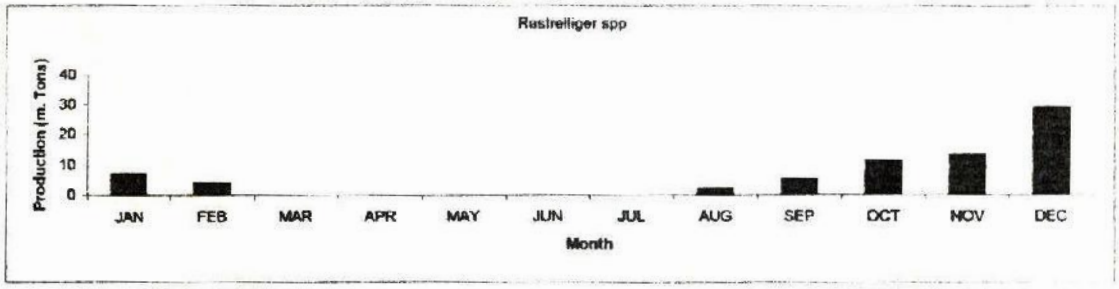
The moderate fishing/harvesting of *T. ilisha* was recorded during December to February with a landing variation from 202 MT to 261 MT.

The lean fishing season was observed during March to July. When the harvesting volume is varied from 11 MT to 87 MT.

b)*Rastrelliger Spp:*

Fig. 02 indicates that the fish was harvested seasonally. No fishing activities were found from March to July.

Fig. 02



The peak fishing season was found to be from October to December. When the landing volume varied from 11.5 MT to 29 MT.

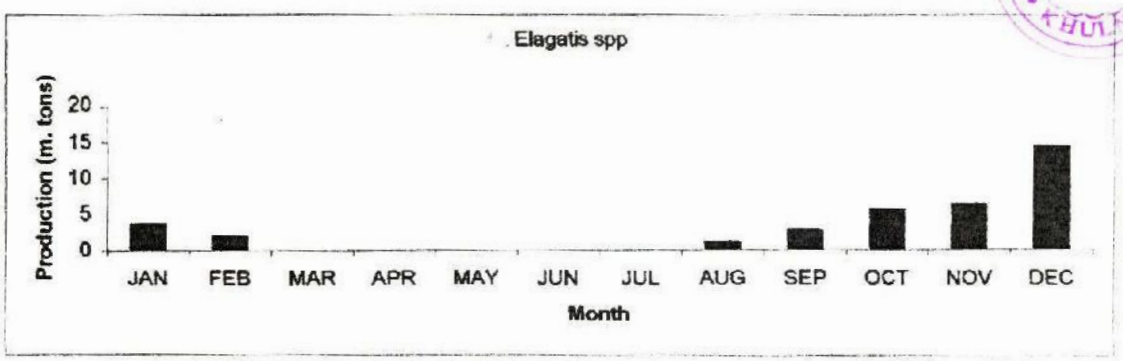
The moderate fishing/harvesting of *Rastrelliger spp* was recorded during January to February with a landing variation from 7 MT to 4 MT.

The lean fishing season was observed during August through September. When the harvesting volume is varied from 2.3MT to 5.6 MT.

c) *Elagatis* spp:

Fig. 03 indicates that the fish was harvested seasonally. No fishing activities were found from March to July.

Fig. 03



The peak fishing season was found to be from October to December. When the landing volume varied from 5.8 MT to 14.4MT.

The moderate fishing/harvesting of *Elagatis* spp was recorded during January to February with a landing variation from 3.5 MT to 2 MT.

The peak fishing season was found to be from October to December. When the landing volume varied from 3 MT to 7.2 MT.

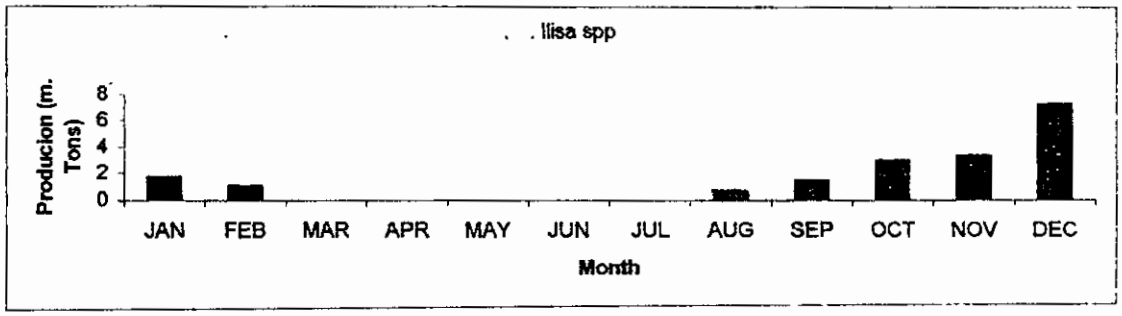
The moderate fishing/harvesting of *Pampus argenteus* was recorded during January to February with a landing variation from 1.7 MT to 1MT.

The lean fishing season was observed during August through September. When the harvesting volume is varied from 0.6MT to 1.4MT.

f) *Ilisha* spp:

Fig. 06 indicates that the fish was harvested seasonally. No fishing activities were found from March to July.

Fig. 06



The peak fishing season was found to be from September, October to December. When the landing volume varied from 1.4 MT to 7.2MT.

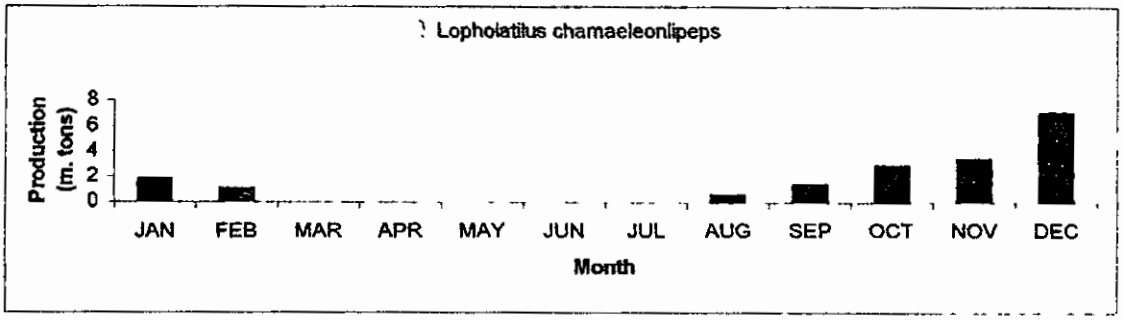
The moderate fishing/harvesting of *Ilisha spp* was recorded during January to February with a landing variation from 1.7 MT to 1MT.

The lean fishing season was observed during August. When the harvesting volume is varied from 0.6MT.

g) ***Lopholatilus chamaeleonlipeps:***

Fig. 07 indicates that the fish was harvested seasonally. No fishing activities were found from March to July.

Fig. 07



The peak fishing season was found to be from October to December. When the landing volume varied from 2.87 MT to 7 MT.

The moderate fishing/harvesting of *Lopholatilus chamaeleonlipeps* was recorded during January to February with a landing variation from 1.75 MT to 1MT.

The lean fishing season was observed during August through September. When the harvesting volume is varied from 0.6 MT to 1.4 MT.

4.3.4. K.B Matshu Arat (KB):

Among 20 species landed in KB landing center, the river shed *T.ilisha* species was found to be the highest (371.5 MT) in volume. While *Pampus* spp (black pomfret) found to be landed minimum (2.25 MT)

The *Arius* spp (gagra tegra), *Liza parsia*, *Rastrelliger* spp were found to be landed more than 20 MT.

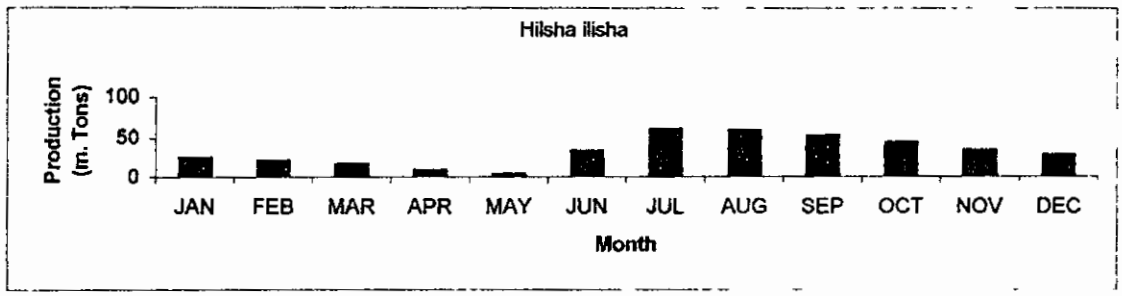
On average, 175.24 MT of fish per species was found landed in K.B landing center.The SD analysis showed that the average landing would vary from 226.19MT to 124.37 MT.

The details of landing statistics are presented below for major species:

a) T. ilisha:

Fig. 01 indicates that the fish was harvested throughout the year.

Fig. 01



The peak fishing season was found to be from July to October. When the landing volume varied from 60 MT to 42 MT.

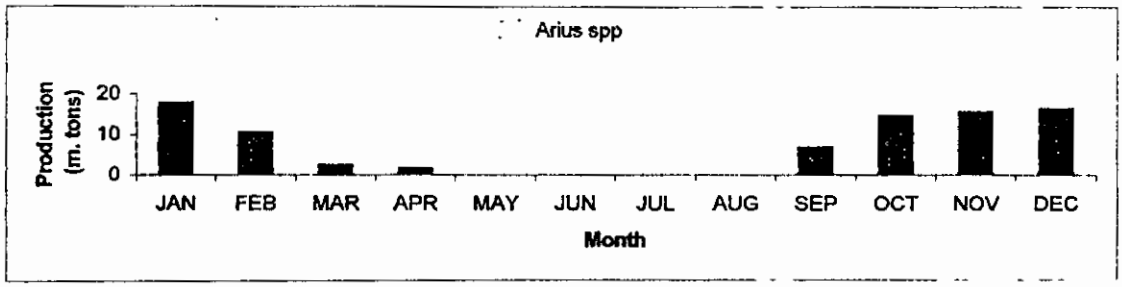
The moderate fishing/harvesting of *T. ilisha* was recorded during November to February with a landing variation from 32 MT to 20.5 MT.

The lean fishing season was observed during April to May. When the harvesting volume is varied from 15 MT to 3 MT.

b)*Arius* spp (Gagra tengra):

Fig.02 indicates that the fish is harvested seasonally. No fishing activities are found during May to August

Fig.02



The peak fishing season was found to be from October to January. When the landing volume varied from 14.5 MT to 17.8 MT.

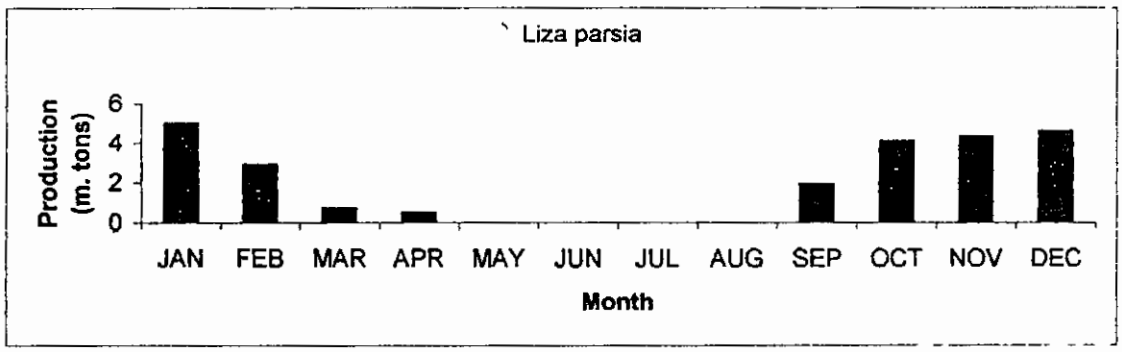
The moderate fishing/harvesting of *Arius* spp was recorded during September with a landing volume is 6.9 MT.

The lean fishing season was observed during September to March. When the harvesting volume is varied from 2.6 MT to 1.6 MT.

c) *Liza parsia*:

Fig.03 indicates that the fish is harvested seasonally. No fishing activities are found during May to August

Fig.03



The peak fishing season was found to be from October to January. When the landing volume varied from 4.1 MT to 5 MT.

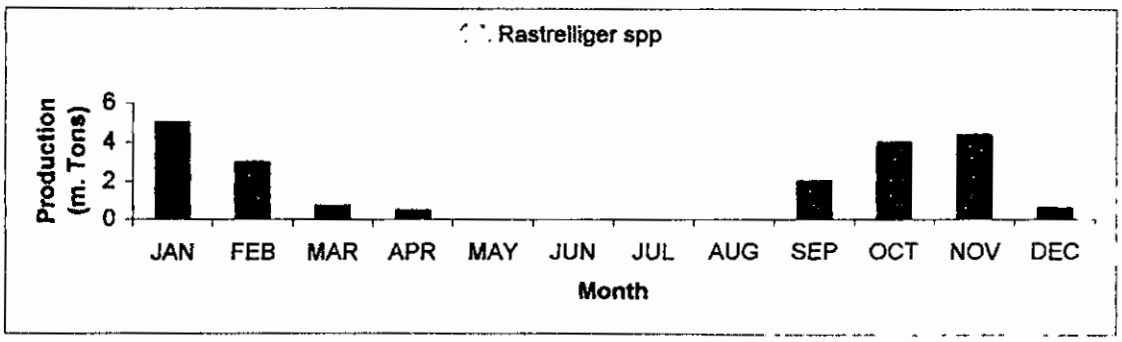
The moderate fishing/harvesting of *Liza parsia* was recorded during February to March with a landing variation from 2.9 MT to 0.45 MT.

The lean fishing season was observed during September. When the harvesting volume is 1.9 MT.

d) *Rastrelliger* spp:

Fig.04 indicates that the fish is harvested seasonally. No fishing activities are found during May to August

Fig.04



The peak fishing season was found to be from November to February. When the landing volume varied from 4.4 MT to 3 MT.

The moderate fishing/harvesting of *Rastrelliger* spp was recorded during September to October with a landing variation from 0.4 MT to 0.8 MT.

The lean fishing season was observed during March to April. When the harvesting volume is varied from 0.16 MT to 0.07 MT.

4.3.5. Rupsha sada Matshu Arat (RSMA):

Among the 29 species landed in RSMA landing center, the *Arius* spp (Gagra tengra) was found to be the highest (29,41 MT) in volume. While *Eleutheronema* spp was found to be landed minimum (1.377 MT).

The *Tenulosa ilisha, Lates calcarifer, Arius* spp (Mochan), *Pampus argenteus, Liza parsia* and *Penaeus japoricus* (red tiger) were found to be landed more than10 MT.

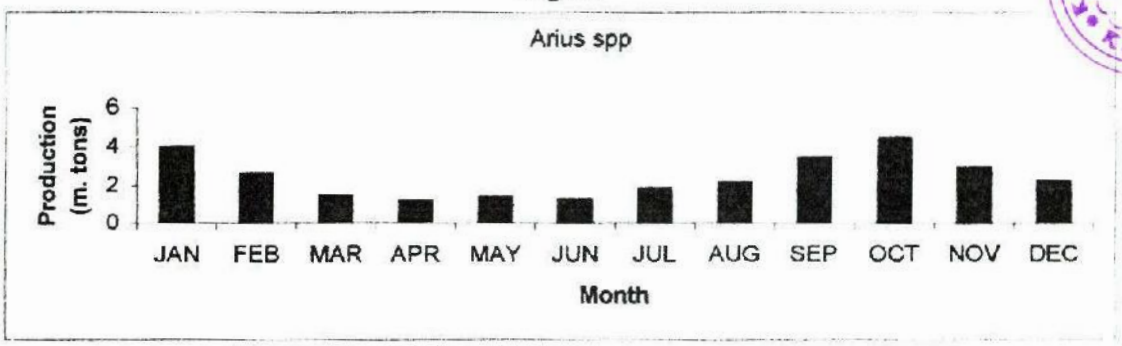
On average, 7.3296 MT of fish/shrimp was found to be landed in RSMA landing center. The SD analysis showed that the average landing would vary 13.22 MT to 1.43 MT.

The details of landing statistics are presented below for major species:

***a) Arius* spp (Gogra tengra):**

Fig. 01 indicates that the fish was harvested throughout the year.

Fig. 01



The peak fishing season was found to be from September to January. When the landing volume varied from 3.5 MT to 4 MT.

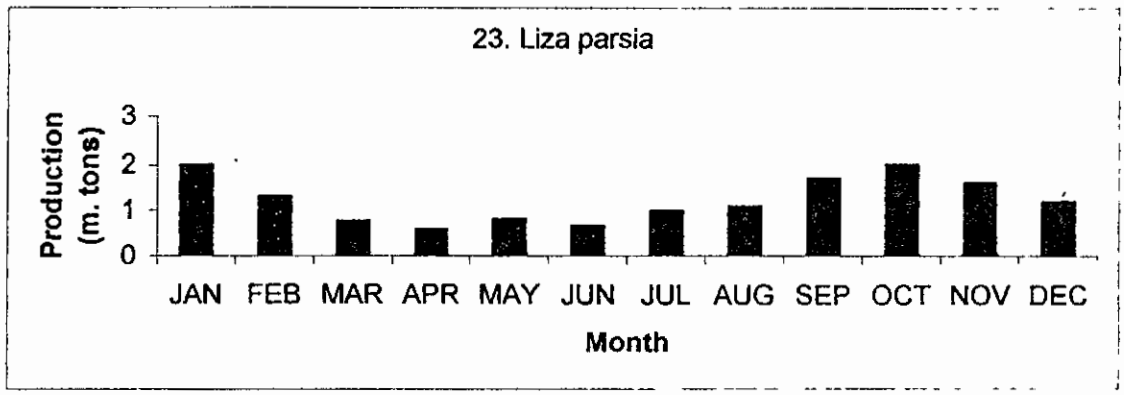
The moderate fishing/harvesting of *Arius spp* was recorded during February, March, July and August with a landing variation from 2 MT to 1.58 MT.

The lean fishing season was observed during April, May and June. When the harvesting volume is 1.3 MT.

b)Liza parsia:

Fig. 02 indicates that the fish was harvested throughout the year.

Fig. 02



The peak fishing season was found to be from September to January . When the landing volume varied from 1.7 MT to 2 MT.

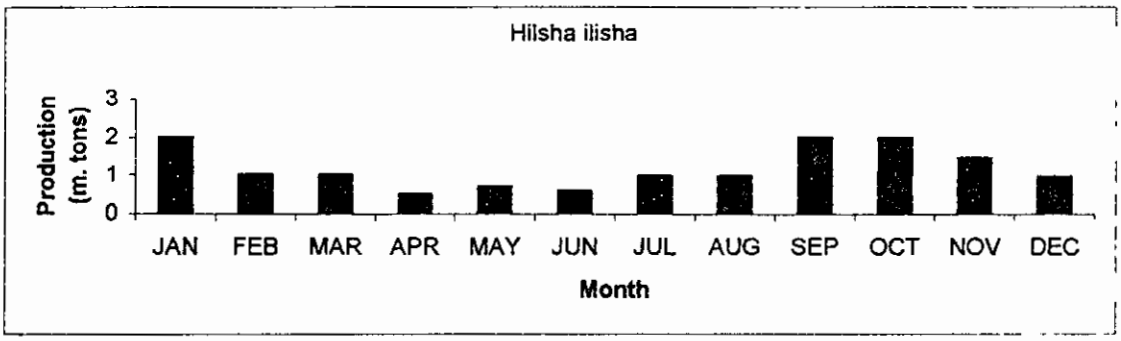
The moderate fishing/harvesting of *Liza parsia* was recorded during February, July to August with a landing variation from 1.3 MT to 2 MT.

The lean fishing season was observed during March to June . When the harvesting volume is varied from 0.78 MT to 0.67 MT.

***c)Tenualosa ilisha*:**

Fig. 03 indicates that the fish was harvested throughout the year.

Fig. 03



The peak fishing season was found to be from September to January. When the landing volume varied from 2 MT to 3 MT.

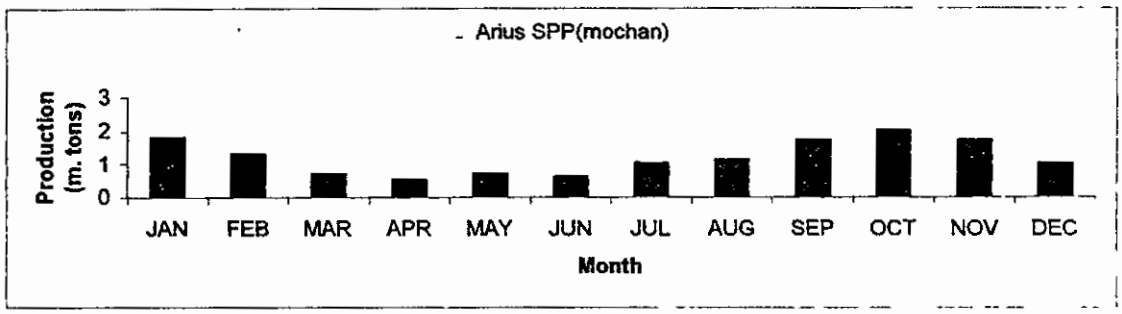
The moderate fishing/harvesting of *Tenualosa ilisha* was recorded during February March , July and August with a landing variation from 1.MT to 1.5 MT.

The lean fishing season was observed during April to June . When the harvesting volume is varied from .5 MT to .6 MT.

d)*Arius spp* (mochan)

Fig. 04 indicates that the fish was harvested throughout the year.

Fig. 04



The peak fishing season was found to be from September to February. When the landing volume varied from 1.7 MT to1.3 MT.

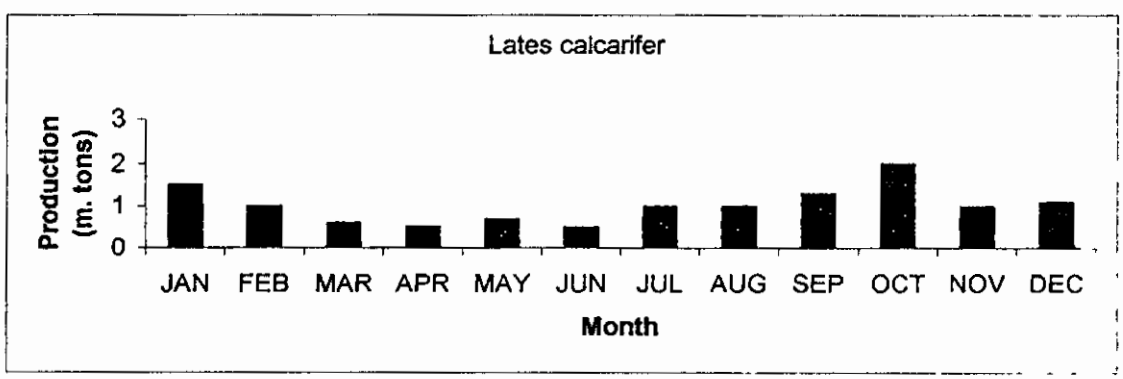
The moderate fishing/harvesting of *Arius spp* was recorded during July to August with a landing variation from 1 MT to1.1 MT.

The lean fishing season was observed during March to June . When the harvesting volume is varied from 0.7 MT to 0.6 MT.

e) *Lates calcarifer*:

Fig. 05 indicates that the fish was harvested throughout the year.

Fig. 05



The peak fishing season was found to be from September to January. When the landing volume varied from 1.3 MT to 1.5 MT.

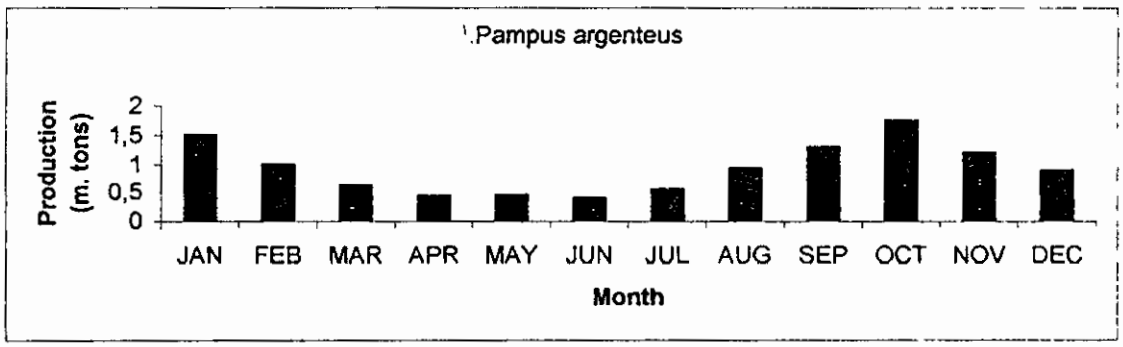
The moderate fishing/harvesting of *Lates calcarifer* was recorded during July, August and February with a landing variation from 1 MT to 1 MT.

The lean fishing season was observed during March to June . When the harvesting volume is varied from 1 MT to 0.6 MT.

f)*Pampus argenteus*:

Fig. 06 indicates that the fish was harvested throughout the year.

Fig. 06



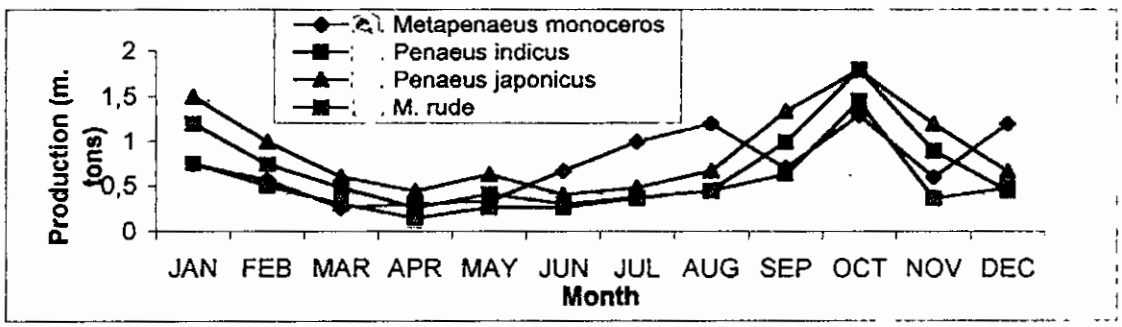
The peak fishing season was found to be from September to January. When the landing volume varied from 1.3 MT to 1.5 MT.

The moderate fishing/harvesting of *Pampus argenteus* was recorded during February, July to August with a landing variation from 0.7 MT to 1 MT.

The lean fishing season was observed during March to June. When the harvesting volume is varied from 0.63 MT to 0.4 MT.

g) Shrimp :

August to January is the peak season for harvesting *M. monoceros*, *P. indicus*. while the major fishing season for *P. japonicus* and *M. rude* was found to be September to February.



4.3.6. Annual production and fishing season of major fish species in four fish landing centers:

1) Production of *Arius* spp (gagra tengra) by landing center:

Landing center	Annual Production (MT)	Major fishing Season (month)
P.M.A	1854.1	October-March
B.F.D.C	-	-
K.B	85.5	October-June
RSMA	29.41	September-June

Among the 0 fish landing center the maximum amount of *Arius* spp (Tengra) was found to be landed (1854.1 MT) is PMA landing center ,while the minimum landed was found (29.41MT)in RSMA landing center

2) Production of *Trichiurus haumela* by landing center :

Landing center	Annual production (MT)	Major fishing season (month)
PMA	1742.1	November-April
BFDC	7.17	October-December
KB	4.74	October-January
RSMA	6.12	September-February

Among the 04 fishing landing center the maximum amount of *Trichiurus haumela* was found to be landed (1742.1 MT) in PMA landing center 4.74 MT) in KB landing center .

3) Production of *Raconda russelliana* by landing center:

Landing center	Annual production (MT)	Major fishing season (month)
PMA	1302	October-February
BFDC	34.5	October-December
KB	6.8	October-January
RSMA	5.94	October-December

Among the 04 landing center, the maximum amount of *Raconda russelliana* was found to be landed (4302 MT) in PMA landing center, while the minimum landed was found (5.94 MT) in RSMA landing center.

4) Production of *Lates calcarifer* by landing center :

Landing center	Annual production (MT)	Major fishing season (month)
PMA	940.5	February-June
BFDC	-	-
KB	12	October-January
RSMA	12.2	September-December

Among the 03 fish landing center, the maximum amount of *Lates calcarifer* was found to be landed (940.5 MT) in PMA landing center, while the minimum landed was found (12 MT)in K.B. landing center.

5) Production of *Arius* Spp (mochon)by landing center:

Landing center	Annual production (MT)	Major fishing season (month)
PMA	1392.5	February-May
BFDC	16.4	September-December
KB	7.1	October-January
RSMA	14.1	September-November

Among the 04 fish landing center, the maximum amount of *Arius* spp was found to be landed (1392.5 MT) in PMA landing center, while the minimum landed was found (7.1 MT) in K.B landing center.

6) Production of *Rastrelliger* spp by landing center:

Landing center	Annual production (MT)	Major fishing season (month)
PMA	863.3	November-February
BFDC	72.9	October-December
KB	20.15	October-February
RSMA	3.086	October-January

Among the 04 fish landing center, the maximum amount of *Rastrelliger* spp was found to be landed (863.3 MT) in PMA landing center, while the minimum landed was found (3.086 MT) in K.B landing center.

7) Production of *Elagatis* spp by landing center:

Landing center	Annual production (MT)	Major fishing season (month)
PMA	280.7	October-February
BFDC	36.1	October-June
KB	9.65	October-February
RSMA	2.766	September-February

Among the 04 fish landing center, the maximum amount of *Elagatis* spp was found to be landed (280.7MT) in PMA landing center, while the minimum landed was found (2.766 MT) in RSMA landing center.

8) Production of *Pampus argenteus* by landing center:

Landing center	Annual production (MT)	Major fishing season (month)
PMA	225.35	October-February
BFDC	18.25	October-December
KB	4.83	October-January
RSMA	11.06	April-February

Among the 04 fish landing center, the maximum amount of *Pampus argenteus* was found to be landed (225.35MT) in PMA landing center, while the minimum landed was found (4.83 MT) in KB landing center.

9) Production of *Ilisha* spp by landing center:

Landing center	Annual production (MT)	Major fishing season (month)
PMA	-	-
BFDC	18.1	October-January
KB	-	-
RSMA	6.06	September-February

Between the 02 fish landing center, the maximum amount of *Ilisha* spp was found to be landed (18.1MT) in BFDC landing center, while the minimum landed was found (6.06 MT) in RSMA landing center.

10) Production of *Lopholatilus chamaeleonlipeps* by landing center:

Landing center	Annual production (MT)	Major fishing season (month)
PMA	139.65	November-March
BFDC	18.02	October-January
KB	-	-
RSMA	6.26	October-February

Among the 03 fish landing center, the maximum amount of *Lopholatilus chamaeleonlipeps* was found to be landed (139.65MT) in PMA landing center, while the minimum landed was found (6.26 MT) in RSMA landing center.

11) Production of *Liza parsia* by landing center:

Landing center	Annual production (MT)	Major fishing season (month)
PMA	140.6.7	October- January
BFDC	-	-
KB	23.95	October-January
RSMA	14.76	September-November

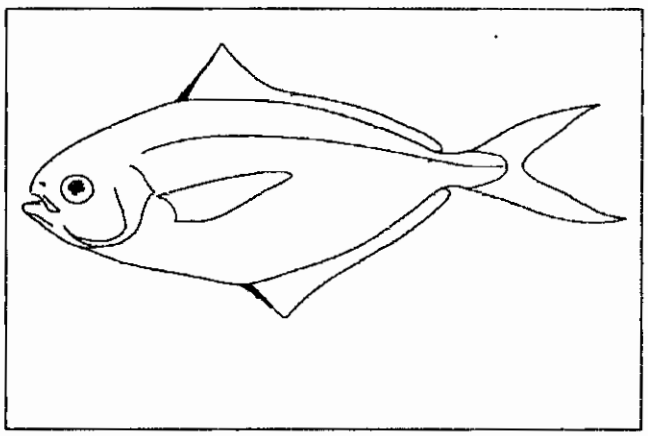
Among the 03 fish landing center, the maximum amount of *Liza parsia* was found to be landed (140.7MT) in PMA landing center, while the minimum landed was found (14.76 MT) in RSMA landing center.

4.4. Fisheries Biology:

4.4.1. Pampus argenteus

Author: (Euphrasen 1788)
Fishbase Name: Silver pomfret

Class: Actinopterygii (ray-finned fishes)
Order: Perciformes (perch-likes)
Family: Stromateidae



Characters: Coastal. Distribution: North and south America, western Africa, and Indo-Pacific. Usually very deep-bodied. Adults without pelvic fins but pelvic girdle present. Continuous dorsal fin. Usually 2-6 spines in anal fin; soft rays 30-50.

Synonyms: Pampus argenteus ((Euphrasen 1788)):new combination

Common Name: Silver pomfret (FAO/English); Aileron argenté (FAO/French); Palometón platero (FAO/Spanish); Silver pomfret (English); Bawal puteh (Malay/Indonesian); White pomfret (English); Silver pomfret (English); Zubedi (Arabic); Bawal cermin (Malay/Indonesian); Bawal putih (Malay/Indonesian); Dueh bujang (Malay/Indonesian); Dueh putih (Malay/Indonesian); Kilat (Malay/Indonesian); Nga-yuzana (Burmese)

Comments: Inshore species, usually in schools over muddy bottoms, associated with fish species like @Nemipterus@ and @Leiognathus@. Feeds on ctenophores, salps, medusae, and other zooplankton groups. Western populations spawn from late winter through the summer with peaks from April to June. Sold fresh in local markets or shipped frozen to urban centers.

2

Size frequency Distribution:

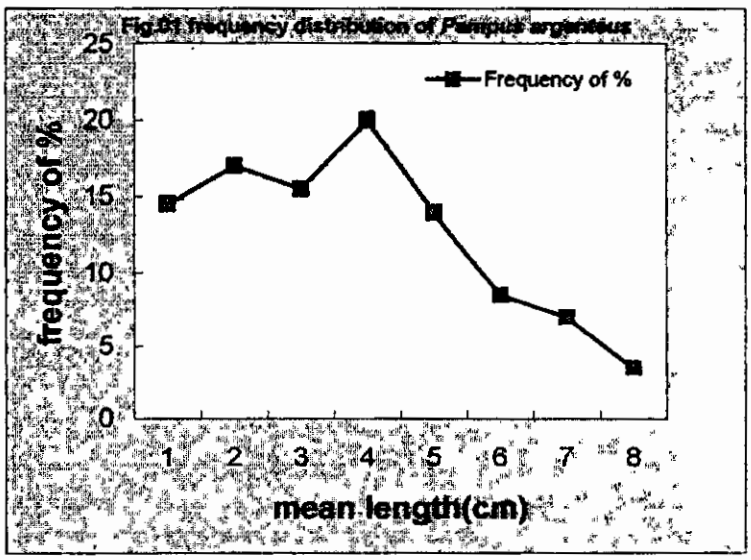


Fig.01 indicates that the maximum mean length of *Pampus argenteus* was 25cm. and the minimum length was 11 cm. 3.5% of 25 cm mean length, 14.5% of 11cm mean length, 20% of 17 cm mean length. 20% formed the most abundant mean length group.

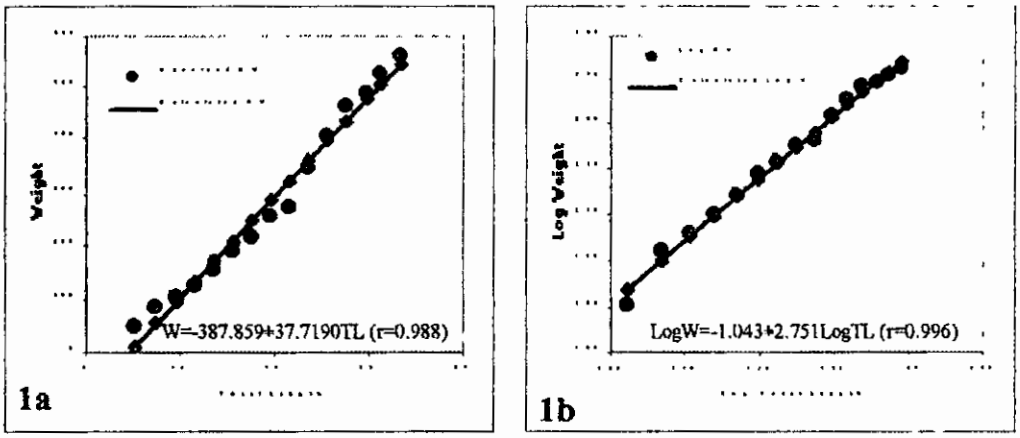
Length-weight relationship:

A total of 317 specimens of *P. argenteus* were classified into 17 size classes from 10 cm to 25 cm with a class size of 1.0cm. When the total and standard length groups of the fish were plotted against the mean values observed and calculated weights (Table 2) on both the logarithmic and arithmetic scale (Fig: 1, 2) a straight line appeared. On the basis of the figures regression equations were calculated for both in logarithmic and arithmetic by the method of least squares. The regression equations found is given on Table 1.

Table 1. Regression equations of length-weight relationships.

Relationships	*Scale*	*Regression Equation*	*r*	*t*	*d.f.*
TL-W	Arithmetic	W=-387.859+37.7190TL	0.988	6.13	14
	Logarithmic	LogW=-1.043+2.751LogTL	0.996	21.31	

TL= Total Length; SL=Standard Length; r=regression coefficient; t=Value of t-test; d.f. = Degree of freedom.



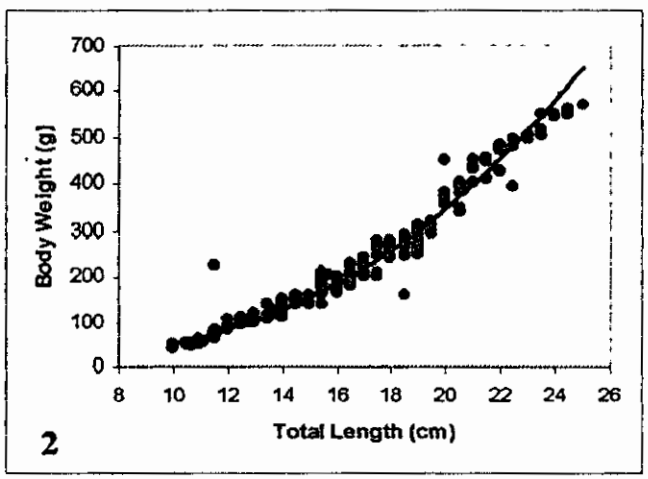


Fig 1. The total length and weight relationship in (a) arithmetic (b) logarithmic scale of *P. argenteus*

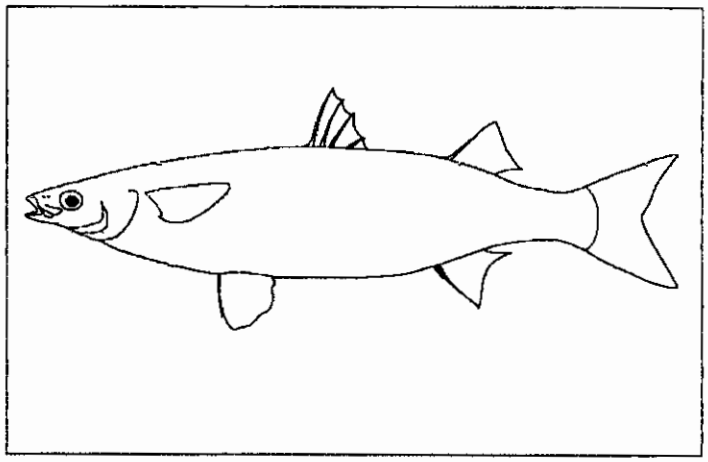
Fig 2. The length and weight relationship of *P. argenteus* in arithmetic scale from pooled data.

http://ibs.uel.ac.uk/fish-bin/fishgen.pl?speccode=4668

4.4.2.Liza parsia

Author: (Hamilton 1822)
Fishbase Name: Gold-spot mullet

Class: Actinopterygii (ray-finned fishes)
Order: Perciformes (perch-likes)
Family: Mugilidae
Family: Mugilidae



Characters: Chiefly marine (coastal) and brackish water. Some in freshwater. Distribution: all tropical and temperate seas. Spinous and soft dorsal fins widely separate, the former with 4 spines. Pelvic fins subabdominal. One spine in pelvic fin; soft rays 5. Lateral line hardly visible when present. Mouth of moderate size. Toothless or teeth small. Long gill rakers. Muscular stomach; extremely long intestine. Vertebrae 24-26. About 0.9 m maximum length.

Synonyms:
Liza parsia ((Hamilton 1822)):new combination
Mugil parsia (Hamilton 1822):original combination

Common Name:
Gold-spot mullet (FAO/English)
Mulet joue d'or (FAO/French)
Lisa mejilla dorada (FAO/Spanish)

Comments: Found in shallow coastal waters, estuaries, lagoons, and sometimes entering tidal rivers. Feeds on small algae, diatoms, and other organic matter. Spawns at sea. Sold fresh in markets; the roe is highly valued.

· Size frequency distribution:

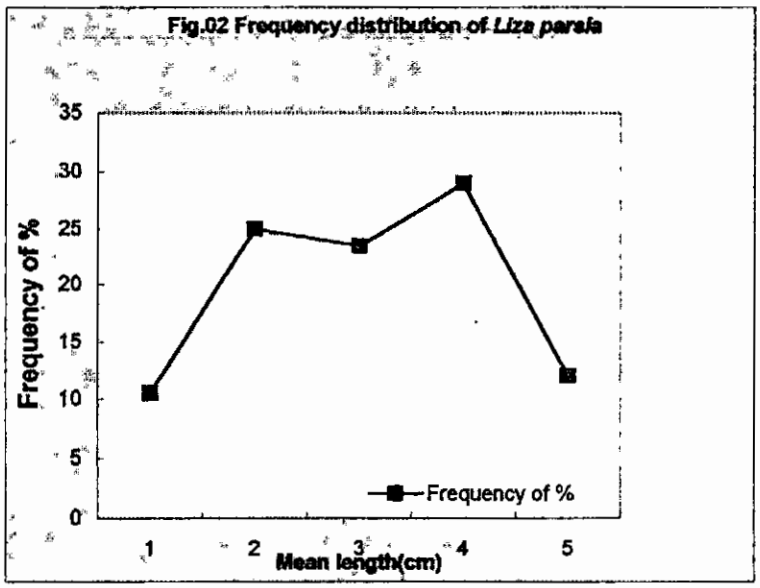


Fig.02 shows that the maximum mean length of *Liza parsia* was 15cm. and the minimum length was 7 cm. 10.5% of 7cm mean length, 25% of 9cm mean length, 29% of 13 cm mean length. 29% formed the most abundant mean length group.

Length-weight relationship:

A total of 317 specimens of *Liza parsia* were classified into 10 size classes from 6 cm to 16 cm with a class size of 1.0cm. When the total and standard length groups of the fish were plotted against the mean values observed and calculated weights (Table 2) on both the logarithmic and arithmetic scale (Fig: 1, 2) a straight line appeared. On the basis of the figures regression equations were calculated for both in logarithmic and arithmetic by the method of least squares. The regression equations found is given here below:

Table 1. Regression equations of length-weight relationships.

Relationships	*Scale*	*Regression Equation*	*r*	*t*	*d.f.*
TL-W	Arithmetic	W=-73.381+9.827TL	0.949	2.68	9
	Logarithmic	LogW=-2.339+3.585LogTL	0.961	2.88	

TL= Total Length; SL=Standard Length; r=regression coefficient; t=Value of t-test; d.f. = Degree of freedom.

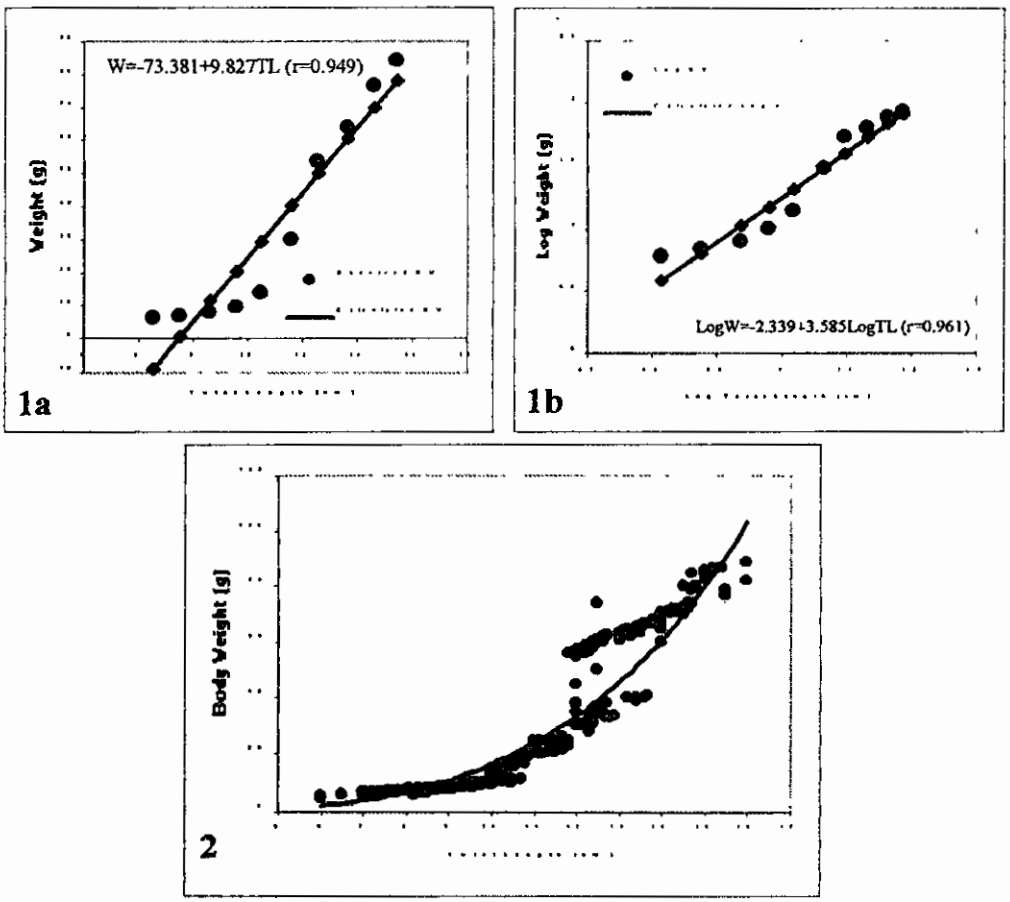


Fig 1. The total length and weight relationship in (a) arithmetic (b) logarithmic scale of *L. parsia*

Fig 2. The length and weight relationship of *L. parsia* in arithetic scale from pooled data .

Table 2. TL-W relationships, condition factor and relative condition factor of *L. parsia*.

Class Limit	*Freq.*	*Mean TL (cm)*	*Observed W (g)*	*Calc. W*	*LogTL*	*Log W*	*Calc. Log W*	*Observed Condition Factor*	*Relative Condition Factor*
6-7	14	6.536	5.964	-9.149	0.815	0.776	0.583	0.021	10.224
7-8	19	7.505	6.905	0.379	0.875	0.839	0.799	0.016	8.645
8-9	35	8.637	7.691	11.503	0.936	0.886	1.017	0.012	7.559
9-10	45	9.567	9.709	20.638	0.981	0.987	1.177	0.011	8.251
10-11	29	10.466	13.931	29.472	1.020	1.144	1.316	0.012	10.582
11-12	45	11.607	30.067	40.687	1.065	1.478	1.478	0.019	20.348
12-13	44	12.532	53.489	49.779	1.098	1.728	1.597	0.027	33.492
13-14	46	13.633	63.717	60.598	1.135	1.804	1.728	0.025	36.870
14-15	30	14.602	76.517	70.122	1.164	1.884	1.835	0.025	41.696
15-16	10	15.440	84.400	78.361	1.189	1.926	1.922	0.023	43.912

Freq.=Frequency; TL=Total length; W=Weight; Calc.=Calculated;
Significance at 5% level ($p<0.01$) with 9 d.f.

Condition factor:

Condition factor (K) was determined for by plotting the 'K' values against mean values of total length. Condition factor varied in *L. parsia* from 0.021 in 6-7 size class to 0.023 in 15-16 size class with a mean value of 0.019 and SD± (0.006). The peak condition factor (K) values were found in 12-13 size class.

Relative condition factor:

Relative condition factor (K_n) was determined by plotting it against mean values of total length. It varied from 10.224 in 6-7 size class to 43.912 in 15-16 size class with a mean value of 22.158 and SD± (15.161). The peak relative condition factor (K_n) values was found in 15-16 size class. The values of K_n were not stable to certain length class; it varies gradually.

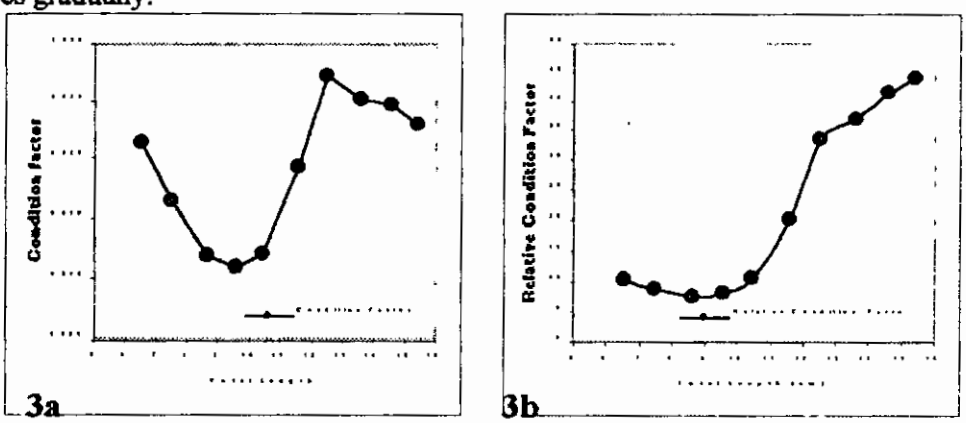
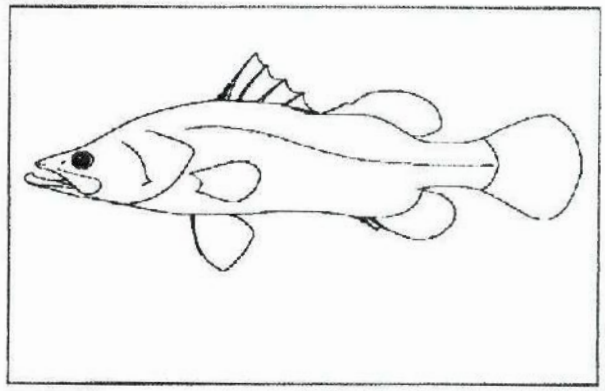


Fig 3. Relationship between total length and (a) observed condition factor and (b) relative condition factor in *L. Parsia* .

4.4.3. Lates calcarifer (Bloch 1790)

Class: Actinopterygii (ray-finned fishes)
Order: Perciformes (perch-likes)
Family: Centropomidae



Characters: Marine. Often brackish. Some in freshwater. Distribution: Atlantic, Indian, and Pacific Oceans. Lateral line extends onto caudal peduncle, reaching posterior margin of fin (except in one species of Centropominae and Latinae). Pelvic axis usually with scaly process. Dorsal fin bipartite (either deeply notched or with a distinct gap). With 7-9 spines on the first part; one spine and 8-15 soft rays on the second. Three anal fin spines; soft rays 6-17 (6-9 in subfamilies Centropominae and Latinae). One spine on pelvic fin; soft rays 5. Caudal fin rounded, truncate or forked. Branchiostegal rays 7. Vertebrae 24 or 25. Attains about 2 m maximum length.

Fishbase Name: Barramundi

Synonyms: *Holocentrus calcarifer* (Bloch 1790):original combination; *Lates calcarifer* (Bloch 1790):new combination; *Lates darwiniensis* (Macleay 1878):junior synonym; *Pseudolates cavifrons* (Alleyne & Macleay 1877):junior synonym

Common Name: Barramundi (FAO/English); Perche barramundi (FAO/French); Perca gigante (FAO/Spanish); Apahap (Bikol); Bulgan (Bikol); Giant sea perch (English); Barramundi (English); Akame (Japanese); Siakap (Malay/Indonesian); Matakating (Maranao/Samal/Tao Sug); Katuyot (Tagalog); Matang pusa (Tagalog); Cá vƯrot (Vietnamese); Giant sea perch (English); Barramundi (English); Lates (Polish); Bukai-bukai (Malay/Indonesian); Gelungsung (Malay/Indonesian); Kakap (Malay/Indonesian); Kakap putih (Malay/Indonesian); Selungsung (Malay/Indonesian); Siakap putih (Malay/Indonesian); Ka-kadit (Burmese); Murrabal (Tokelauan); Kakap (Malay/Indonesian); Barramundi perch (AFS/English); Giant perch (English); Palmer (English); Silver barramundi (English); Asian seabass (English)

Comments: Found in coastal waters, estuaries and lagoons, in clear to turbid water (Ref. 5259). A diadromous fish, inhabiting rivers before returning to the estuaries to spawn. Adults also live in coastal waters (Ref. 9987). Occurs at a temperature range of 26-29°C (Ref. 4959). Feeds on fishes and crustaceans. Reaches 1500-3000 g in one year in ponds under optimum conditions (Ref. 11046). Sold fresh and frozen; consumed steamed, pan-fried, broiled and baked (Ref. 9987).

Size frequency distribution:

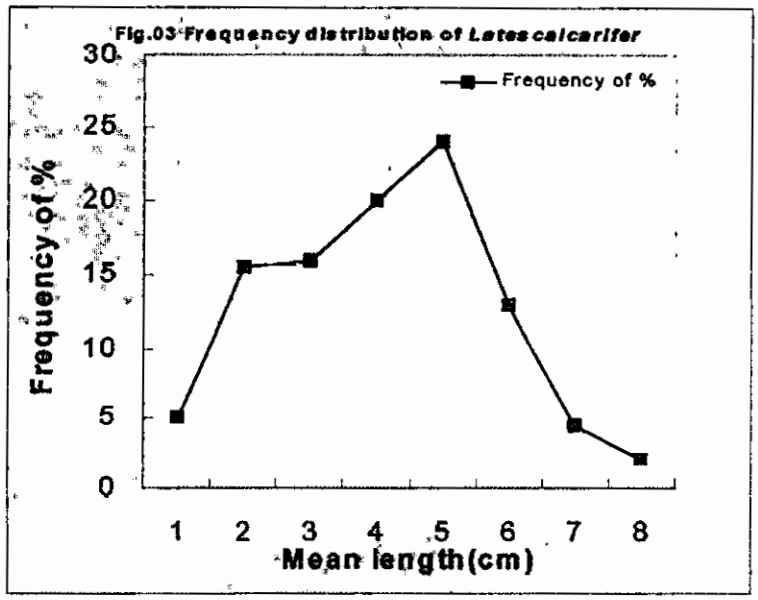


Fig.03 indicates that the maximum mean length of *Lates calcarifer* was 52.5cm. and the minimum length was 17.5 cm. 2% of 52.5cm mean length, 16% of 27.5cm mean length, 24% of 37.5 cm mean length. 24% formed the most abundant mean length group.

Table 2. TL-W relationships, condition factor and relative condition factor of *L. calcarifer*

Class Limit	*Freq.*	*Mean TL (cm)*	*Observed W (g)*	*Calc. W*	*LogTL*	*Log W*	*Calc. Log W*	*Observed Condition Factor*	*Relative Condition Factor*
15-20	17	18.471	500.000	349.992	1.266	2.699	2.647	0.079	188.921
20-25	50	22.964	611.590	574.079	1.361	2.786	2.784	0.051	219.643
25-30	52	27.798	710.029	815.154	1.444	2.851	2.905	0.033	244.380
30-35	64	33.350	930.875	1092.029	1.523	2.969	3.021	0.025	308.163
35-40	76	37.717	1161.750	1309.816	1.577	3.065	3.099	0.022	374.924
40-45	39	43.051	1706.718	1575.832	1.634	3.232	3.182	0.021	536.302
45-50	15	47.667	1886.000	1806.001	1.678	3.276	3.247	0.017	580.869
50-55	4	52.125	2042.500	2028.338	1.717	3.310	3.303	0.014	618.289

Freq.=Frequency; TL=Total length; W=Weight; Calc.=Calculated;
Significance at 5% level ($p<0.01$) with 7 d.f.

Condition factor:

Condition factor (K) was determined for by plotting the 'K' values against mean values of total length. Condition factor varied in *L. calcarifer* from 0.079 in 15-20 size class to 0.014 in 50-55 size class with a mean value of 0.033 and SD± (0.022). The peak condition factor (K) values were found in 15-20 size class.

Relative condition factor:

Relative condition factor (K_n) was determined by plotting it against mean values of total length. It varied from 188.921 in 15-20 size class to 618.289 in 50-55 size class with a mean value of 383.936 and SD± (172.064). The peak relative condition factor (K_n) values was found in 50-55 size class. The values of K_n were not stable to certain length class; it varies gradually.

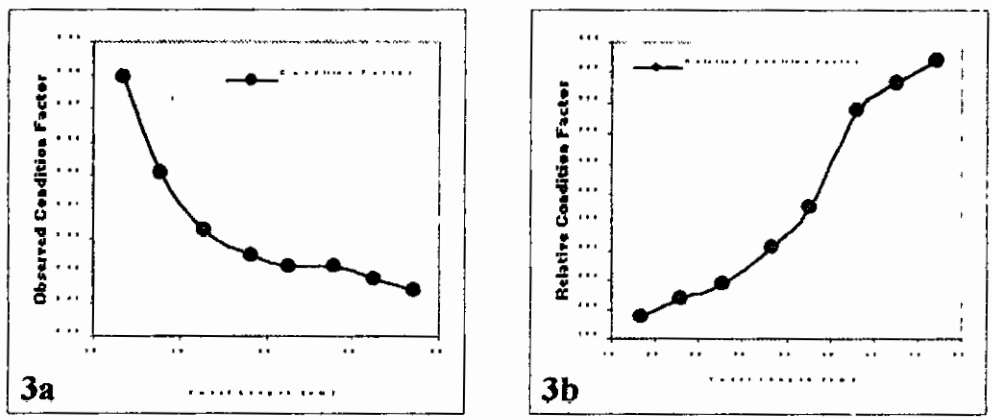


Fig 3. Relationship between total length and (a) observed condition factor and (b) relative condition factor in *L. calcarifer* from the Sundarban ecosystem Bangladesh.

http://www.indian-ocean.org/bioinformatics/prawns/GIF/taxonomy/Tax7.htm

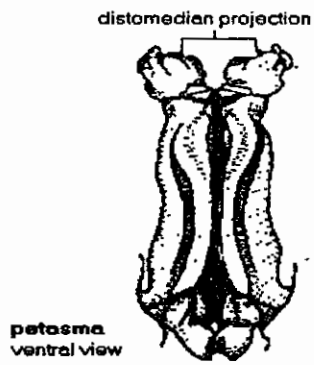
4.4.4. Metapenaeus monoceros

SYSTEMATICS OF *Metapenaeus monoceros (Fabricius, 1798)*

Phylum :	Arthropoda
Class :	Crustacea
Series :	Eumalacostraca
Superorder :	Eucarida
Order :	Decapoda
Suborder :	Natantia
Infraorder :	Penaeidea
Superfamily :	Penaeoidea
Family :	Penaeidae
Genus :	*Metapenaeus*
Species :	*monoceros*
Athority :	Fabricius, 1798

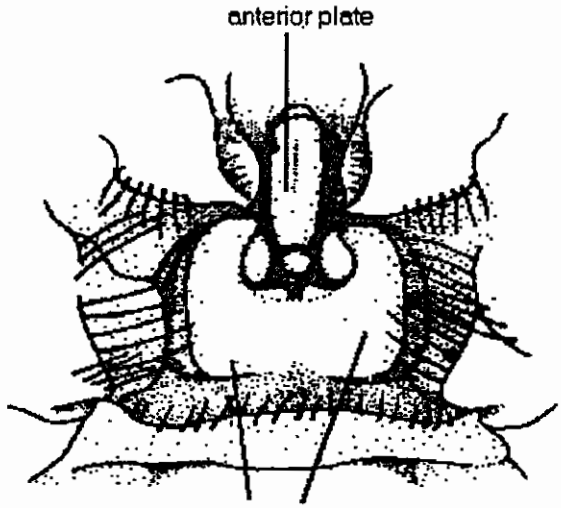
Branchiocardiac sulcus distinctin atleast posterior 1/3 of carapce
Distomedian petasmal projection flap like
Ischial spine on 1st pereopod distinct, rostrum straight

Distomedian projection of petasma convoluted, greatly swollen, bulbiform directed anterolaterally and concealing distolateral projections in ventral view



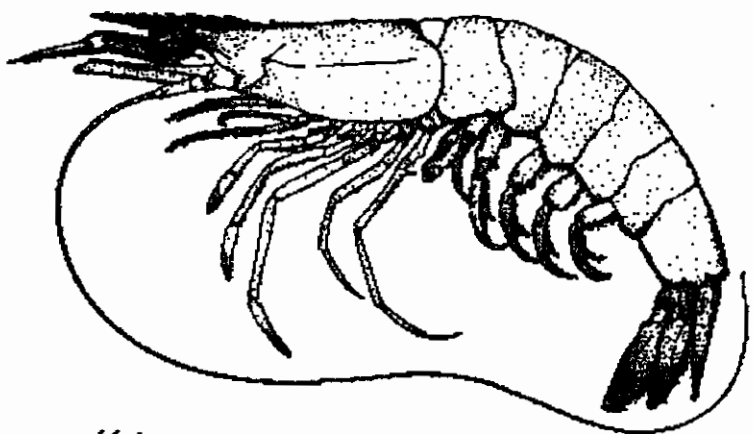
The anterior plate of thelycum long and deeply grooved

Lateral plate with strongly raised lateral margins forming 2 longitudinal crests



thelycum

Species : *Metapenaeus monoceros*



Metapenaeus monoceros

Branchiocardiac sulcus distinctin atleast posterior 1/3 of carapce

- Distomedian petasmal projection flap like
- Ischial spine on 1st pereopod distinct
- Rostrum straight
- Distomedian projection of petasma convoluted, greatly swollen, bulbiform directed anterolaterally and concealing distolateral projections in ventral view
- The anterior plate of thelycum long and deeply grooved
- Lateral plate with strongly raised lateral margins forming 2 longitudinal crests

Size frequency distribution:

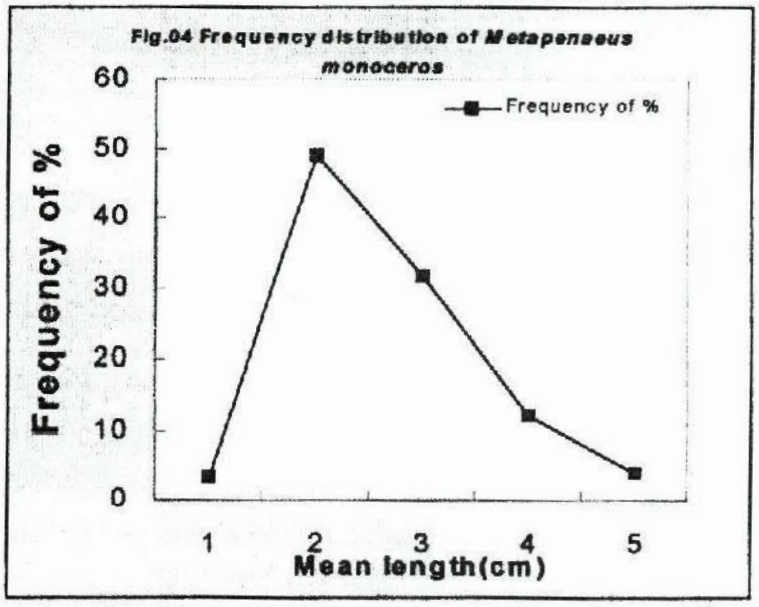


Fig.04 shows that the maximum mean length of *Metapenaeus monocers* was 7.5cm. and the minimum length was 3.5 cm. 3.5% of 3.5 cm mean length, 49% of 4.5cm mean length, 12% of 6.5 cm mean length. 49% formed the most abundant mean length group.

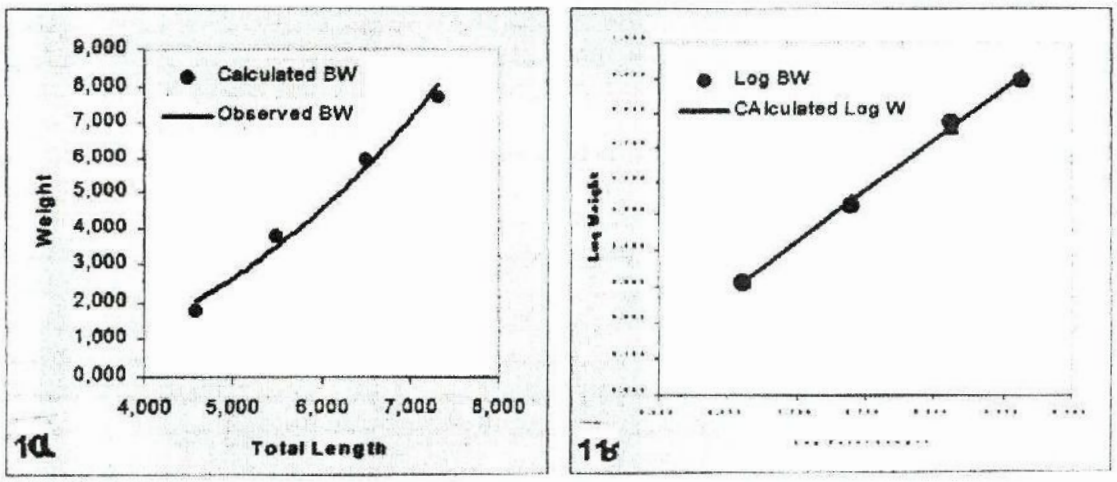
Length-weight relationship:

A total of 317 specimens of *M. monoceros* were classified into 04 size classes from 4cm to 8cm with a class size of 1.0 cm. When the total and standard length groups of shrimp were plotted against the mean values observed and calculated weights (Table-2) on both the logarithmic and arithmetic scale (Fig: 1, 2) a straight line appeared. On the basis of the figure regression equations were calculated for both in logarithmic and arithmetic by the method of least squares. The regression equations found is given on Table 1.

Table 1. Regression equations of length-weight relationships.

Relationships	Scale	Regrssion equation	r	t	d.f.
TL-W	Arithmetic	W=-8.079+2.157TL	0.993	0.197	3
	Logarithmic	LogW=-1607+2.90LogTL	0.998	0.194	

TL=Total Length;SL= Standard Length;r= regression coefficient; t= value of t-test; d.f.=Degree of freedom



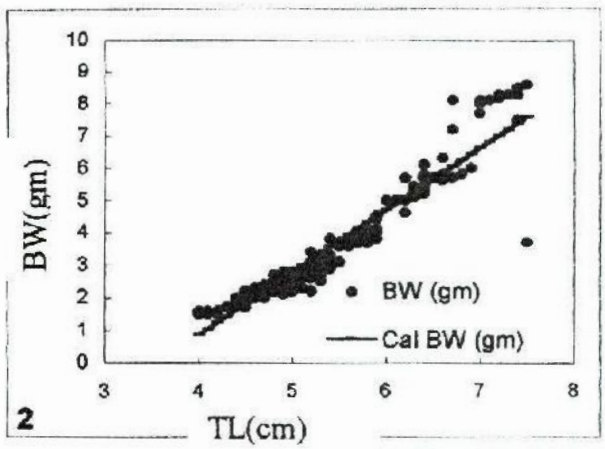


Fig 1. The total length and weight relationship in (a) arithmetic (b) logarithmic scale of *M. monoceros*
Fig 2. The length and weight relationship of M. monoceros in arithmetic scale from pooled data.

Table 2. TL_W relationship, condition factor and relative condition factor of *M. monoceros*

Class limits	Frequency	Mean TL	Observed BW	Cal. BW	Log TL	Log Bw	Cal. log.BW	Condition factor	Relative con. factor
4-5	165	4.576	2.064	1.769	0.661	0.315	0.312	0.022	6.623
5-6	101	5.493	3.389	3.774	0.740	0.530	0.542	0.02	6.252
6-7	49	6.500	5.905	5.947	0.813	0.771	0.754	0.022	7.828
7-8	12	7.317	7.867	7.709	0.864	0.896	0.904	0.02	8.705

Condition factor:

Condition factoe(K) was determined for by plotting the 'K' value aganist mean values of total length. Condition factor varied in M. monoceros from 0.022 in 4-5 size class to 0.02 in 7-8 size class with a mean value of 0.021 and SD (0.001). The peak condition fqactor (K) values were found in 6-7 size class.

Relative condition factor:

Relative condition factors (Kn) was determined for by plotting it against mean values of total length. It varied from 6.623 in 4-5 size class to 8.705 in 7-8 size class with a mean value of 7.352 nad SD (1.125). The peak relative condition factor (Kn) values was found in 7-8 size class. The values of Kn were not stable to certain length class; it varies gradually.

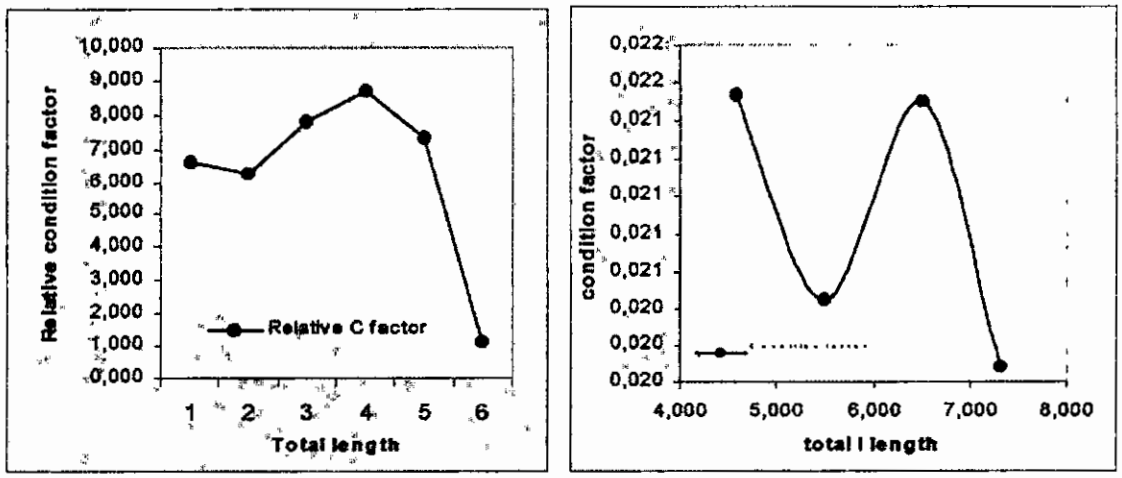


Fig 3. Relationship between total length and (a) observed condition factor and (b) relative condition factor in M. monoceros.

CHAPTER-5

CONCLUSION

5. CONCLUSION

There are four fish landing center are found in South West region of Bangladesh i.e. PMA, BFDC, KB, and RSMA landing center that are located at the bank of river. All the landing center, communication facilities occur both in water and road way. There distances the district head quarter are varied from1 to 5 km.

Among the fishing landing center, about 30 species of marine fishes are identified. PMA is the largest fish-landing center that has 34 depots and landed 14,473.64 MT of fish. The smallest one is KB landing center that has 10-12 depots. All depot owners run their business through dadon system (loan of money to poor fisher men). The landing volume of fish is 594.06 MT. The peak fishing season of four landing center is from October to January and the lean fishing season is from April to July.

For catches of fish, all fish landing center have own/ hired Craft (boat) and gear. The length, width and capacity of the boat are 13m, 3m and 8 to 12 MT. A positive correlation was found in different parameters of boats. Different types of gears are used i.e. shore net, Hilsha gill net, set bag net, hook and line.

From the frequency of % distribution, 17 cm mean length of *Pampus argenteus*, 13 cm mean length of *Liza parsia*, 37.5 cm mean length of *Lates calcarifer* and 4.5 cm mean length of *Metapenaeus monoceros* are the most abundant mean length groups.

A positive length-weight relation is found in four commercial important fish and shrimp species i.e. *Pampus argenteus*, *Liza parsia*, *Lates calcarifer* and *Metapenaeus monoceros*. The peak condition factor (K) value of *Pampus argenteus* is found 11-12 size classes. The peak condition factor (K) values of *Liza parsia*, *Lates calcarifer* and *Metapenaeus monoceros* are found 12-13,15-20 and 6-7 size class respectively.

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Appendix-I

List of marine fish species available in four landing center in the South-western region:

Scientific name	English name	Local name
Tenualosa ilisha	Hilsa shed	Elish
Lates calcarifer	Sea perch	Vetki
Arius spp	Cat fish	Mochan
Raconda russelliana	Smooth head herring	Fesha
Cybium guttatum	Spanish mackerel	Gang chatal
Elaglis spp	-	Konkon
Rastrelliger kanagurta	Indian mackerel	Bombatia
Trichiurus haumela	Ribbon fish	Suri
Chirocentrus spp	Wolf herring	Chela
Harpodon nehereus	Bombay duck	Lotia
Pampus argenteus	Silver pomfret	Foli chanda
Pampus chinensis	Chinese pomfret	Pankha
Pampus spp	Black pomfret	Kalo chanda
Lethrinus spp	Emperor	Datina
Argyrosomus amoyensis	Croaker	Poma vol
Amphotistius zugei	Ray	Shapla pata
Rastrelliger spp	Mackerel	KawaS
Eleutheronema tetradactylum	Thread fin	Lokkha
Eleutheronema spp	Four finger thread fin	Tarial
Lopholatistus chamleonlipeps	-	Java vol
Cephalophlis spp	Sea bass	Koi vol
Polynemus paradiseus	Paradise thread fin	Toposi
Liza parsia	Gold spot mullet	Passha
Ilisha spp	River shed	Khaira
Arius spp	Cat fish	Tengra
Metapenaeus monoceros	Brown shrimp	Horina
Penaeus indicus	-	Chaka
Penaeus japonicus	-	Tiger
Macrobrachium rude	-	Motka
Argyrosomus spp	Croaker	Morma/ Lalpoa

Source: Field survey,2000

Appendix-II

Table-01: Monthly production (MT) of 30 marine fish spices from PMA landing center in 2000.

Species	Month												Total
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
1.Tenualosa ilisha	1287	1119,5	504	252	196	280	616	895,5	965	1133	1343	1231	**9822**
2. Lates calcarifer	87	132	144,5	126	115	101	63,5	46	56	35	11,5	23	**940,5**
3. Arius SPP(mochan)	98	175	289	252	231	-	-	35	52	66,5	95	99	**1392,5**
4. Raconda russelliana	1012	820	506	168	58	-	-	-	58	252	532	896	**4302**
5. Cybium guttatum	66,5	49,6	30,6	15,5	5,5	-	-	-	8,4	20	36,4	58	**290,5**
6. Elagatis spp	56,6	30	26	22	8,7	-	-	-	14	32	36,4	55	**280,7**
7. Rastrelliger kanagurta	44	25	26	15	5,8	-	-	-	11,1	34,7	50,3	61,3	**273,2**
8. Trichiurus haumela	419	300	211	168	78	-	-	-	-	37,6	196	332,5	**1742,1**
9. Chirocentrus spp	78	57,4	31,8	22,4	11,5	-	-	-	-	11,2	58,7	81	**352**
10. Harpodon nehereus	92;5	76	52	29,1	7,8	-	-	-	-	34,7	51,5	72,3	**415,9**
11.Pampus argenteus	47,5	39	20,2	8,95	3,5	-	-	-	-	35	32,5	38,7	**225,35**
12. Pampus chinensis	32	22	9,8	5,6	2,89	-	-	-	5,78	12,7	18	26	**134,77**
13. Pampus SPP (Black pomfret)	66,5	52,2	37,5	22	8,7	-	-	-	17	37,7	47,5	60,7	**349,8**
14. Lethrinus spp	72,2	53	34,5	26	11,5	-	-	-	22,4	43	45	60	**367,6**
15. Argyrosomus amoyensis	48,5	34	30	24	8,7	-	-	-	14	32	36	47	**274,2**
16. Amphotistius zugei	194	164,5	120	77	35	-	-	-	17	46	86,7	150	**890,2**
17. Rastrelliger spp	199,5	133	95,4	67	29	-	-	-	14	49	100	176,4	**863,3**
18. Eleutheronema tetradactylum	205,3	156,7	118,5	84	37,6	-	-	-	18	56	100,7	167,7	**944,5**
19. Eleutheronema spp	66,5	50	36,5	17	6,5	-	-	-	12,6	23	37,8	65,12	**315,02**
20. Lopholatilus chamaeleonlipeps	25,45	22	19	14	5,7	-	-	-	5,6	12,7	15	20,2	**139,65**
21. Cephalopholis spp	52	39	26	14,5	3,5	-	-	-	11,5	26,3	30,78	40,48	**244,06**
22. Polynemus paradiseus	9,8	5,2	2,3	2,79	2,2	-	-	-	2	5,8	8,4	11	**49,49**
23. Liza parsia	26	13	8,7	5,6	2,9	-	-	-	6,7	19,6	26,3	31,8	**140,6**
24. Arius spp	424	304,5	208	165	81	-	-	-	33,6	104	196	338	**1854,1**
25. Ilisa spp	-	-	-	-	-	-	-	-	-	-	-	-	-
26. Metapenaeus monoceros	198	158	115,6	70	29	-	-	-	22,4	55	98	165	**911**
27.Penaeus indicus	75	52	31,8	22,4	8,7	-	-	-	21,4	47,5	48,7	60,7	**368,2**
28.Penaeus japonicus	25	17	14,5	8,4	2,9	-	-	-	5,6	20	19,5	26	**138,9**
29.M. rude	31,8	21	14,4	3,5	3	-	-	-	6,7	15,6	19,6	29	**144,6**
30. Argyrosomus spp	188	138	61	33,6	11,5	-	-	-	22,4	53,7	77,2	121,5	**706,9**
Total	**5227,65**	**4258,6**	**2824,6**	**1741,34**	**1011,09**	**381**	**679,5**	**976,5**	**1423,18**	**2351,3**	**3454,48**	**4544,4**	**28873,6**

Appendix-III

Table-02: Monthly production (MT) of 30 marine fish spices from BFDC landing centre in 2000.

Species	Month												Total
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
1.Tenualosa ilisha	231	261	116	11	23	39	87	347	615	463	252	202	**2647**
2. Lates calcarifer	-	-	-	-	-	-	-	-	-	-	-	-	**0**
3. Arius SPP(mochan)	0,2	1	-	-	-	-	-	0,6	1,3	3	3,3	7	**16,4**
4. Raconda russelliana	3,4	2	-	-	-	-	-	1,1	2,8	4	6,7	14,5	**34,5**
5. Cybium guttatum	0,7	0,4	-	-	-	-	-	0,2	0,5	1,1	1,3	3	**7,2**
6. Elagatis spp	3,5	2	-	-	-	-	-	1,1	2,8	5,8	6,5	14,4	**36,1**
7. Rastrelliger kanagurta	1	0,6	-	-	-	-	-	0,38	0,83	1,73	2	4,3	**10,84**
8. Trichiurus haumela	0,69	0,41	-	-	-	-	-	0,22	0,56	1,1	1,3	2,89	**7,17**
9. Chirocentrus spp	0,3	0,2	-	-	-	-	-	0,1	0,3	0,56	0,67	1,45	**3,58**
10. Harpodon nehereus	0,7	0,41	-	-	-	-	-	0,23	0,52	1,15	1,34	2,79	**7,14**
11.Pampus argenteus	1,7	1	-	-	-	-	-	0,6	1,4	3	3,35	7,2	**18,25**
12. Pampus chinensis	0,7	0,4	-	-	-	-	-	0,2	0,55	1,12	1,34	2,89	**7,2**
13. Pampus SPP (Black pomfret)	1,9	0,84	-	-	-	-	-	0,5	1,1	2,3	2,7	5,78	**15,12**
14. Lethrinus spp	0,7	0,4	-	-	-	-	-	0,23	0,56	1,2	1,3	3	**7,39**
15. Argyrosomus amoyensis	1,7	1	-	-	-	-	-	0,57	1,4	2,8	3,2	7	**17,67**
16. Amphotistius zugei	1,7	1	-	-	-	-	-	0,56	1,4	2,9	3	7,2	**17,76**
17. Rastrelliger spp	7	4	-	-	-	-	-	2,3	5,6	11,5	13,5	29	**72,9**
18. Eleutheronema tetradactylum	0,3	0,2	-	-	-	-	-	0,11	0,26	0,56	0,65	1,42	**3,5**
19. Eleutheronema spp	0,35	0,18	-	-	-	-	-	0,12	0,28	0,56	0,67	1,45	**3,61**
20. Lopholatilus chamaeleonlipeps	1,75	1	-	-	-	-	-	0,6	1,4	2,87	3,4	7	**18,02**
21. Cephalopholis spp	0,69	0,43	-	-	-	-	-	0,22	0,52	0,57	1,34	2,6	**6,37**
22. Polynemus paradiseus	-	-	-	-	-	-	-	-	-	-	-	-	**0**
23. Liza parsia	-	-	-	-	-	-	-	-	-	-	-	-	**0**
24. Arius spp	-	-	-	-	-	-	-	-	-	-	-	-	**0**
25. Ilisa spp	1,7	1	-	-	-	-	-	0,6	1,4	2,9	3,3	7,2	**18,1**
26. Metapenaeus monoceros			-	-	-	-	-	-	-	-	-	-	**0**
27.Penaeus indicus	-	-	-	-	-	-	-	-	-	-	-	-	**0**
28.Penaeus japonicus	-	-	-	-	-	-	-	-	-	-	-	-	**0**
29.M. rude	-	-	-	-	-	-	-	-	-	-	-	-	**0**
30. Argyrosomus spp	1	0,63	-	-	-	-	-	0,35	0,82	1,7	2	4,3	**10,8**
Total	**262,68**	**280,1**	**116**	**11**	**23**	**39**	**87**	**357,89**	**641,3**	**515,42**	**314,86**	**338,37**	**2986,62**

Appendix-IV

Table-03: Monthly production (MT) of 30 marine fish spices from KB landing centre in 2000.

Species	Month												Total
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
1.Tenualosa ilisha	24	20,5	15	8	3	32	60	58	51	42	32	26	**371,5**
2. Lates calcarifer	2,5	1,5	0,3	0,2	-	-	-	-	1	2	2,2	2,3	**12**
3. Arius SPP(mochan)	1,5	0,8	0,2	0,1	-	-	-	-	0,6	1,2	1,3	1,4	**7,1**
4. Raconda russelliana	1,4	0,9	0,2	0,1	-	-	-	-	0,5	1,1	1,3	1,3	**6,8**
5. Cybium guttatum	1	0,6	0,14	0,09	-	-	-	-	0,4	0,8	0,89	0,9	**4,82**
6. Elagatis spp	2	1,1	0,3	0,2	-	-	-	-	0,78	1,7	1,75	1,82	**9,65**
7. Rastrelliger kanagurta	2	1,1	0,29	0,16	-	-	-	-	0,74	1,6	1,7	1,86	**9,45**
8. Trichiurus haumela	1	0,57	0,15	0,09	-	-	-	-	0,39	0,78	0,87	0,89	**4,74**
9. Chirocentrus spp	1	0,58	0,15	0,09	-	-	-	-	0,4	0,8	0,86	0,9	**4,78**
10. Harpodon nehereus	0,75	0,45	0,11	0,07	-	-	-	-	0,3	0,61	0,65	0,67	**3,61**
11.Pampus argenteus	1	0,56	0,15	0,09	-	-	-	-	0,41	0,82	0,87	0,93	**4,83**
12. Pampus chinensis	1	0,56	0,15	0,07	-	-	-	-	0,4	0,76	0,88	0,91	**4,73**
13. Pampus SPP (Black pomfret)	0,5	0,3	0,07	0,03	-	-	-	-		0,4	0,45	0,5	**2,25**
14. Lethrinus spp	1	0,55	0,13	0,07	-	-	-	-	0,4	0,8	0,86	0,9	**4,71**
15. Argyrosomus amoyensis	1	0,5	0,15	0,09	-	-	-	-	0,37	0,82	0,84	0,9	**4,67**
16. Amphotistius zugei	1	0,5	0,16	0,07	-	-	-	-	0,4	0,8	0,85	0,9	**4,68**
17. Rastrelliger spp	5	3	0,7	0,45	-	-	-	-	2	4	4,4	0,6	**20,15**
18. Eleutheronema tetradactylum	-	-	-	-	-	-	-	-	-	-	-	-	**0**
19. Eleutheronema spp	-	-	-	-	-	-	-	-	-	-	-	-	**0**
20. Lopholatilus chamaeleonlipeps	-	-	-	-	-	-	-	-	-	-	-	-	**0**
21. Cephalopholis spp	-	-	-	-	-	-	-	-	-	-	-	-	**0**
22. Polynemus paradiseus	0,4	0,56	0,15	0,07	-	-	-	-	0,41	0,8	0,84	0,91	**4,14**
23. Liza parsia	5	2,9	0,7	0,45	-	-	-	-	1,9	4,1	4,3	4,6	**23,95**
24. Arius spp	17,8	10,3	2,6	1,6	-	-	-	-	6,9	14,5	15,5	16,3	**85,5**
25. Ilisa spp	-	-	-	-	-	-	-	-	-	-	-	-	**0**
26. Metapenaeus monoceros	-	-	-	-	-	-	-	-	-	-	-	-	**0**
27.Penaeus indicus	-	-	-	-	-	-	-	-	-	-	-	-	**0**
28.Penaeus japonicus	-	-	-	-	-	-	-	-	-	-	-	-	**0**
29.M. rude	-	-	-	-	-	-	-	-	-	-	-	-	**0**
30. Argyrosomus spp	-	-	-	-	-	-	-	-	-	-	-	-	**0**
Total	**70,85**	**47,83**	**21,8**	**12,09**	**3**	**32**	**60**	**58**	**69,3**	**80,39**	**73,31**	**65,49**	**594,06**

Appendix-V

Table-04: Monthly production (MT) of 30 marine fish spices from RSMA landing centre in 2000.

Species	Month												Total
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
1.Tenualosa ilisha	2	1	1	0,5	0,7	0,6	1	1	2	2	1,5	1	**14,3**
2. Lates calcarifer	1,5	1	0,6	0,5	0,7	0,5	1	1	1,3	2	1	1,1	**12,2**
3. Arius SPP(mochan)	1,8	1,3	0,7	0,5	0,7	0,6	1	1,1	1,7	2	1,7	1	**14,1**
4. Raconda russelliana	0,7	0,5	0,3	0,25	0,3	0,26	0,33	0,4	0,6	1,3	0,6	0,4	**5,94**
5. Cybium guttatum	0,4	0,3	0,15	0,11	0,15	0,13	0,18	0,3	0,3	0,4	0,3	0,26	**2,98**
6. Elagatis spp	0,37	0,26	0,18	0,07	0,11	0,15	0,186	0,22	0,3	0,44	0,26	0,22	**2,766**
7. Rastrelliger kanagurta	0,37	0,26	0,11	0,15	0,18	0,1	0,19	0,22	0,4	0,48	0,3	0,22	**2,98**
8. Trichiurus haumela	0,74	0,52	0,3	0,22	0,29	0,26	0,37	0,41	0,67	1,3	0,63	0,41	**6,12**
9. Chirocentrus spp	0,4	0,26	0,14	0,1	0,11	0,13	0,15	0,26	0,33	0,48	0,3	0,26	**2,92**
10. Harpodon nehereus	0,373	0,26	0,186	0,11	0,18	0,15	0,22	0,22	0,4	0,41	0,3	0,22	**3,029**
11.Pampus argenteus	1,5	1	0,63	0,44	0,45	0,4	0,56	0,93	1,3	1,75	1,2	0,9	**11,06**
12. Pampus chinensis	0,75	0,52	0,37	0,3	0,29	0,26	0,4	0,41	0,67	1,3	0,5	0,45	**6,22**
13. Pampus SPP (Black pomfret)	1,2	0,78	0,37	0,26	0,15	0,13	0,19	0,22	1	1,34	0,93	0,22	**6,79**
14. Lethrinus spp	0,19	0,15	0,07	0,08	0,07	0,069	0,11	0,12	0,2	0,22	0,15	0,11	**1,539**
15. Argyrosomus amoyensis	0,75	0,5	0,3	0,26	0,28	0,27	0,37	0,5	0,67	1,34	0,56	0,48	**6,28**
16. Amphotistius zugei	0,74	0,56	0,33	0,26	0,34	0,3	0,37	0,45	0,67	1,34	0,6	0,45	**6,41**
17. Rastrelliger spp	0,37	0,22	0,26	0,186	0,15	0,12	0,3	0,22	0,29	0,45	0,3	0,22	**3,086**
18. Eleutheronema tetradactylum	0,37	0,26	0,15	0,11	0,15	0,1	0,186	0,27	0,34	0,45	0,3	0,22	**2,906**
19. Eleutheronema spp	0,186	0,13	0,075	0,037	0,074	0,075	0,07	0,13	0,15	0,22	0,14	0,11	**1,397**
20. Lopholatilus chamaeleonlipeps	0,74	0,5	0,3	0,2	0,26	0,25	0,44	0,45	0,67	1,34	0,63	0,48	**6,26**
21. Cephalopholis spp	0,37	0,26	0,15	0,11	0,186	0,13	0,18	0,19	0,33	0,45	0,3	0,15	**2,806**
22. Polynemus paradiseus	0,78	0,5	0,3	0,22	0,33	0,298	0,37	0,48	0,63	1,35	0,6	0,48	**6,338**
23. Liza parsia	2	1,3	0,78	0,59	0,82	0,67	1	1,1	1,7	2	1,6	1,2	**14,76**
24. Arius spp	4	2,6	1,5	1,2	1,45	1,3	1,86	2,2	3,5	4,5	3	2,3	**29,41**
25. Ilisa spp	0,75	0,5	0,26	0,22	0,33	0,26	0,41	0,37	0,7	1,3	0,56	0,4	**6,06**
26. Metapenaeus monoceros	0,74	0,56	0,26	0,3	0,33	0,67	1	1,2	0,7	1,3	0,6	1,2	**8,86**
27.Penaeus indicus	0,75	0,5	0,3	0,15	0,26	0,26	0,37	0,45	0,63	1,45	0,36	0,48	**5,96**
28.Penaeus japonicus	1,5	1	0,6	0,44	0,63	0,4	0,48	0,67	1,34	1,79	1,2	0,67	**10,72**
29.M. rude	1,2	0,74	0,48	0,26	0,41	0,3	0,37	0,45	1	1,8	0,9	0,45	**8,36**
30. Argyrosomus spp	-	-	-	-	-	-	-	-	-	-	-	-	**0**
Total	**27,539**	**18,24**	**11,151**	**8,133**	**10,38**	**9,142**	**13,662**	**15,94**	**24,49**	**36,5**	**21,32**	**16,06**	**212,557**

Appendix- VI

Length – Weight data in four fish landing center:

Species : *Pampus argenteus*

No. of fish: 317

TL(cm)	BW(g)	TL(cm)	BW(g)	TL(cm)	BW(g)	TL(cm)	BW(g)	TL(cm)	BW(g)
10	40	13	105	15,5	190	17	225	20	362
10	45	13	100	15,5	200	17,5	200	20	370
10	47	13	105	15,5	140	17,5	210	20	360
10	45	13	105	15,5	165	17,5	280	20	360
10	45	13	105	15,5	195	17,5	245	20	365
10	50	13	105	15,5	200	17,5	267	20	355
10	45	13	100	15,5	175	17,5	245	20	370
10,5	50	13,5	110	15,5	195	17,5	260	20	365
10,5	50	13,5	139	15,5	200	17,5	265	20	360
10,5	51	13,5	110	15,5	200	17,5	245	20,5	350
10,5	52	13,5	112	15,5	195	17,5	275	20,5	340
10,5	50	13,5	110	15,5	200	17,5	265	20,5	380
10,5	55	13,5	115	15,7	206	18	240	20,5	400
10,7	46	13,5	105	16	200	18	260	20,5	395
11	50	13,5	110	16	170	18	280	21	400
11	60	13,5	110	16	170	18	270	21	400
11	50	13,5	115	16	200	18	245	21	440
11	55	13,5	105	16	180	18	250	21	435
11	55	13,6	115	16	165	18	245	21	440
11	56	13,7	128	16	185	18	250	21	450
11	55	14	150	16	196	18	255	21	430
11	60	14	110	16	180	18	255	21,5	450
11	55	14	120	16	180	18	250	21,5	410
11,1	52	14	120	16	200	18	250	21,5	445
11,5	60	14	120	16	195	18	250	21,5	450
11,5	80	14	120	16	185	18	250	21,5	455
11,5	81	14	130	16	175	18,5	250	21,5	455
11,5	225	14	153	16	200	18,5	160	22	480
11,5	75	14	125	16	195	18,5	245	22	480
11,5	70	14	132	16	200	18,5	265	22	475
11,5	75	14	138	16	185	18,5	270	22	425
11,5	65	14	135	16	180	18,5	280	22	480
11,5	75	14	138	16,5	180	18,5	290	22	475
11,6	74	14	135	16,5	210	18,5	270	22	475
11,6	82	14	140	16,5	230	18,5	265	22	485
12	80	14	140	16,5	210	18,5	280	22	485
12	80	14	135	16,5	190	18,5	275	22	470
12	95	14,5	150	16,5	195	18,5	270	22,5	395
12	105	14,5	160	16,5	190	19	250	22,5	495
12	87	14,5	140	16,5	205	19	310	22,5	480
12	85	14,5	160	16,5	200	19	275	23	500
12	85	14,5	140	16,5	210	19	260	23	495
12	95	14,5	150	16,5	210	19	255	23	500
12	95	14,5	150	16,5	225	19	280	23	495
12	95	14,5	145	16,5	210	19	290	23	500
12	85	14,5	150	16,5	200	19	270	23	505
12	80	14,5	150	16,5	205	19	275	23	500
12,5	100	15	150	17	200	19	300	23,5	550
12,5	100	15	160	17	240	19	305	23,5	510
12,5	110	15	150	17	210	19	285	23,5	505
12,5	95	15	140	17	210	19,5	300	23,5	510
12,5	97	15	145	17	230	19,5	295	23,5	515
12,5	95	15	155	17	220	19,5	320	23,5	505
12,5	96	15	160	17	210	19,5	320	24	550
12,5	100	15	160	17	225	19,5	315	24	545
12,5	100	15	155	17	220	19,5	315	24,5	560
12,7	100	15	150	17	225	19,5	310	24,5	562
12,8	105	15	155	17	230	19,5	310	24,5	550
13	100	15	160	17	215	19,5	315	24,5	555
13	105	15	160	17	230	19,5	320	25	570
13	105	15	160	17	220	20	450	25	570
13	120	15,5	210	17	210	20	380		
13	115	15,5	180	17	225	20	375		
13	120	15,5	200	17	230	20	364		

Appendix- VII

Length – Weight data in four fish landing center:

Species : *Liza parsia*

No. of fish: 317

TL(cm)	BW(g)	TL(cm)	BW(g)	TL(cm)	BW(g)	TL(cm)	BW(g)	TL(cm)	BW(g)
6	5,5	9	8	10,5	17	12,2	56	13,6	66,5
6	5,6	9	8,5	10,5	11	12,3	28	13,7	41
6	5	9	8	10,5	11	12,3	32	13,7	67
6	5,6	9	8	10,5	11	12,3	59	13,8	68
6	5,5	9,1	9	10,5	11,5	12,3	58	13,8	68
6,5	6	9,1	8,5	10,6	16	12,3	59	13,8	66,5
6,5	6	9,1	8,4	10,7	18	12,3	59	14	60
6,5	6	9,1	8	10,7	11,5	12,3	59	14	65
7	6,4	9,2	10	10,7	18	12,3	57	14	70
7	6,5	9,2	9	10,8	16,5	12,4	31	14	70
7	6,4	9,2	9	10,9	19,5	12,4	60	14	68
7	6	9,2	9	11	20	12,4	58	14	67
7	6,5	9,2	8,6	11	25	12,5	74	14	70
7	6,5	9,2	8,6	11	20	12,5	37	14	71
7,1	6,5	9,3	9	11,1	25	12,5	34	14	71
7,2	6,5	9,3	9,4	11,1	20	12,5	50	14	69
7,2	6,5	9,3	9,5	11,1	20	12,5	60	14	70
7,2	6	9,3	8,6	11,2	21	12,5	60	14	71
7,2	6,5	9,3	8,6	11,2	20,5	12,5	60	14	69
7,2	6,7	9,4	10	11,2	20	12,5	61	14	70
7,3	6,6	9,4	9	11,2	20,5	12,5	60	14	70
7,4	7	9,5	10	11,2	20	12,5	61	14,1	70,5
7,5	7	9,5	9	11,2	20,5	12,6	35	14,2	71
7,5	6,9	9,5	8,5	11,3	24	12,6	61	14,2	71
7,5	7	9,5	9	11,3	21	12,6	60	14,25	72
7,5	6,5	9,6	9,5	11,4	25	12,6	62	14,3	71
7,6	7,5	9,6	10	11,4	21	12,7	38	14,3	71
7,7	7,5	9,6	10,2	11,4	21	12,7	33	14,3	71
7,8	7	9,6	9	11,4	21	12,7	62	14,4	72
7,8	7	9,6	9	11,5	25	12,7	63	14,4	71
7,9	7,5	9,6	9,4	11,5	21,5	12,8	32,5	14,5	70
8	7,5	9,7	9,5	11,5	21	12,9	33,5	14,5	80
8	7,5	9,7	10	11,5	21	13	63,5	14,5	72
8,1	8	9,7	9,5	11,5	21	13	63,5	14,5	72,5
8,2	6	9,7	9,5	11,5	21	13	63	14,5	72,5
8,2	6	9,7	9,5	11,6	25	13	63,5	14,5	72,5
8,2	6,5	9,8	10	11,6	25	13	63	14,5	73
8,2	6	9,8	9,6	11,6	21,5	13	61	14,6	74
8,3	6,5	9,9	10	11,6	21,5	13	63,5	14,6	72
8,3	7,8	10	10,5	11,7	26	13,1	64	14,7	85
8,4	6,5	10	12	11,7	22	13,1	64	14,7	79
8,4	7,5	10	10,5	11,7	21,5	13,2	40	14,7	74
8,5	8	10	15	11,7	21,5	13,2	64	14,8	80
8,5	7	10	13,5	11,8	56	13,2	64,5	15	85
8,5	7,5	10	11	11,8	22,5	13,2	64,5	15	86
8,5	8	10	10,5	11,8	24,5	13,2	64,5	15	83
8,5	8	10	10,5	12	57,5	13,2	65	15	85
8,5	8	10	10,5	12	35	13,3	62	15	84,5
8,5	8	10	9,5	12	30	13,4	40	15	85
8,6	8,2	10,1	10	12	31	13,4	39	15	84
8,6	8	10,1	15	12	38	13,4	64,5	15	86
8,7	7,2	10,1	11	12	45	13,4	65	15,1	85
8,7	8	10,1	10,5	12	37,5	13,4	65,5	15,2	86
8,7	8	10,2	16	12	57,5	13,5	65,5	15,2	86
8,8	8,5	10,2	10,6	12	55	13,5	66	15,2	86,5
8,9	8	10,2	10,6	12	57,5	13,5	65,5	15,3	86,5
8,9	8,5	10,2	10,7	12	57	13,5	66	15,4	87
8,9	8	10,2	10,5	12	57,5	13,5	65	15,5	79
8,9	8,5	10,2	10,7	12	56,5	13,5	63,5	15,5	77
8,9	8	10,3	15	12,1	30	13,6	40	16	82
8,9	8	10,3	10,5	12,1	56	13,6	66	16	89
9	8	10,4	10,9	12,1	57	13,6	67		
9	8,5	10,5	10	12,2	58	13,6	66		
9	8	10,5	16	12,2	58,5	13,6	66		

Appendix- VIII

Length – Weight data in four fish landing center:

Species : *Lates calcarifer*

No. of fish: 317

TL(cm)	BW(g)	TL(cm)	BW(g)	TL(cm)	BW(g)	TL(cm)	BW(g)	TL(cm)	BW(g)
15	410	25	670	32	840	36	1030	40	1275
17	459	25	680	32	890	36	1045	40	1410
17,5	465	25	675	32	875	36	1042	40	1250
17,5	460	25,5	691	32	906	36	1040	40,5	1290
18	480	25,5	380	32	910	36	1035	41	1640
18	490	26	702	32	880	36	1035	41	1635
18	475	26	430	32	830	36	1040	41	1650
18,5	510	26	430	32,5	920	36	1015	41	1645
19	516	26	705	32,5	850	36,5	1160	41,5	1325
19	517	26	700	32,5	925	36,5	1020	41,5	1650
19	510	26	630	32,5	930	36,5	1040	41,5	1450
19	525	26,5	436	32,5	870	36,5	1045	42	1660
19	520	26,5	708	32,6	885	37	1000	42	1650
19,5	540	26,5	720	33	930	37	1060	42	1650
20	540	26,5	745	33	930	37	1060	42	1640
20	544	26,5	720	33	943	37	1200	42	1665
20	539	26,5	730	33	940	37	1100	42,5	1665
20,5	556	27	730	33,5	935	37	1030	42,5	1665
20,5	550	27	495	33,5	957	37	1100	42,5	1670
20,5	560	27	735	33,5	945	37	1099	42,5	1650
21	760	27	740	33,5	960	37	1090	43	1692
21	572	27	750	33,5	935	37	1100	43	1710
21	560	27	725	33,5	940	37	1210	43	1720
21	565	27	740	33,8	915	37	1020	43,5	1735
21	580	27	745	34	960	37	1070	43,5	1740
21,5	562	27,5	725	34	965	37,5	1115	43,5	1750
21,5	582	27,5	745	34	965	37,5	1107	43,5	1720
21,5	575	27,5	743	34	945	37,5	1125	44	1940
22	595	27,5	745	34	980	37,5	1130	44	1740
22	598	28	498,5	34	990	38	1200	44	1745
22	595	28	500	34	971	38	1200	44	1740
22	590	28	780	34	980	38	1260	44	1735
22	570	28	759	34	950	38	1110	44	1750
22	540	28	760	34	965	38	1250	44	1730
22	590	28	795	34	950	38	1105	44	1930
22	580	28,5	500	34	950	38	1200	45	2040
22,5	620	28,5	772	34	990	38	1175	45	2050
22,5	630	28,5	770	34	1125	38	1125	45	1780
22,5	590	28,5	775	34	955	38	1130	45	1790
22,7	620	29	650	34,5	980	38	1120	45	1780
23	432	29	805	34,5	970	38	1120	45	1795
23	624	29	640	34,5	980	38	1135	45	1750
23	627	29	786	34,5	1000	38,5	1240	46	1825
23	625	29	830	35	950	38,5	1150	46	1820
23	620	29	825	35	1000	38,5	1265	46	1810
23	620	29	750	35	1010	39	1300	46	1790
23	620	29	820	35	1020	39	1400	46,5	1855
23,5	631	29,5	835	35	987	39	1280	47	1865
23,5	660	30	850	35	1010	39	1390	47	1840
24	650	30	675	35	1050	39	1247	48	1905
24	645	30	800	35	1000	39	1245	48	1900
24	648	30	849	35	1015	39	1245	48	1900
24	340	30	852	35	1015	39	1140	48,5	1935
24	650	30	850	35	1010	39	1240	49	1945
24	645	30	850	35	965	39,5	1440	49	1950
24,5	664	31	775	35,5	1050	39,5	1420	50	1980
24,5	640	31	877	35,5	1050	39,5	1265	50	1970
25	650	31	790	35,5	1039	40	1480	51	2030
25	677,5	31	760	36	1170	40	1400	51	2050
25	676	31	760	36	1040	40	1265	53	1990
25	675	31	755	36	1012	40	1250	53,5	2100
25	655	31,5	860	36	1000	40	1277		
25	670	31,5	770	36	1015	40	1405		
25	670	31,5	785	36	1065	40	1280		

Appendix- IX

Length – Weight data in four fish landing center:

Species : *Metapenaeus monocers*

No. of fish: 317

TL(cm)	BW(g)	TL(cm)	BW(g)	TL(cm)	BW(g)	TL(cm)	BW(g)	TL(cm)	BW(g)
4	1,6	4,5	1,9	4,9	2,1	5,3	3,3	5,9	4
4	1,5	4,5	1,8	4,9	2,4	5,3	2,7	5,9	4,1
4	1,6	4,5	2	4,9	2,8	5,3	2,8	5,9	4
4	1,5	4,5	2	4,9	2,7	5,3	2,7	5,9	3,8
4	1,5	4,5	2	4,9	2,4	5,3	2,7	5,9	4,1
4	1,5	4,5	2	4,9	2,5	5,3	2,8	6	5
4	1,6	4,5	2	4,9	2,6	5,3	2,7	6	5
4	1,5	4,5	2	4,9	2,6	5,3	2,8	6	5
4	1,6	4,5	2	4,9	2,3	5,3	2,7	6	5
4,1	1,6	4,5	2	4,9	2,3	5,3	2,7	6,1	5
4,1	1,6	4,6	2,3	4,9	2,4	5,3	2,7	6,1	5
4,1	1,6	4,6	2,2	4,9	2,3	5,4	3,3	6,1	5
4,1	1,6	4,6	2,2	4,9	2,4	5,4	3,8	6,1	5
4,1	1,6	4,6	2,1	4,9	2,3	5,4	3	6,2	5,7
4,1	1,5	4,6	2,1	4,9	2,3	5,4	3	6,2	4,6
4,1	1,6	4,6	2	5	2,6	5,4	2,9	6,2	5
4,1	1,5	4,6	2,1	5	2,7	5,4	3	6,2	5
4,2	1,6	4,6	2,2	5	2,5	5,4	3,1	6,2	5
4,2	1,5	4,6	2,1	5	2,4	5,4	3	6,3	5,1
4,2	1,6	4,6	2,1	5	2,8	5,4	3,1	6,3	5,1
4,2	1,6	4,6	2	5	2,5	5,4	3	6,3	5,4
4,2	1,6	4,6	2	5	2,5	5,4	3,2	6,4	5,7
4,2	1,6	4,6	2	5	2,6	5,4	3	6,4	6,1
4,2	1,6	4,6	2	5	2,2	5,5	3,1	6,4	5,8
4,2	1,6	4,6	2	5	2,6	5,5	3,7	6,4	5,4
4,2	1,6	4,6	2	5	2,5	5,5	3,7	6,4	5,2
4,2	1,6	4,6	2	5	2,6	5,5	3,7	6,4	5,2
4,2	1,6	4,6	2	5	2,6	5,5	3,7	6,4	5,3
4,3	1,7	4,7	2	5	2,5	5,5	3,7	6,5	5,7
4,3	1,7	4,7	2,2	5	2,5	5,5	3,6	6,5	5,7
4,3	1,7	4,7	2,3	5	2,6	5,6	3,6	6,5	5,7
4,3	1,7	4,7	2,3	5	2,5	5,6	3,8	6,5	5,7
4,3	1,7	4,7	2,1	5	2,5	5,6	3,8	6,6	6,3
4,3	1,7	4,7	2,4	5	2,5	5,6	3,8	6,6	5,8
4,3	1,7	4,7	2,2	5	2,6	5,6	3,8	6,6	5,6
4,3	1,7	4,7	2,2	5	2,5	5,6	3,8	6,6	5,8
4,3	1,7	4,7	2,1	5,1	2,3	5,6	3,8	6,6	5,8
4,3	1,7	4,7	2,1	5,1	2,8	5,6	3,6	6,6	5,8
4,3	1,7	4,7	2,2	5,1	2,7	5,6	3,8	6,7	7,2
4,3	1,7	4,7	2,1	5,1	2,7	5,6	3,7	6,7	5,7
4,4	1,8	4,7	2,1	5,1	2,6	5,6	3,7	6,7	8,1
4,4	1,9	4,7	2,1	5,1	2,6	5,7	3,9	6,8	5,8
4,4	2	4,7	2,2	5,1	2,7	5,7	3,7	6,9	6
4,4	1,8	4,7	2,1	5,1	2,6	5,7	3,8	7	8,1
4,4	1,9	4,7	2,1	5,1	2,6	5,7	3,8	7	7,7
4,4	1,9	4,7	2,1	5,2	3	5,7	3,9	7	8,1
4,4	1,9	4,7	2,1	5,2	2,7	5,7	3,7	7	8,1
4,4	1,8	4,8	2,3	5,2	3,1	5,7	3,8	7	8
4,4	1,9	4,8	2,4	5,2	3,4	5,7	3,8	7,1	8,1
4,4	2	4,8	2,3	5,2	2,8	5,7	3,8	7,2	8,3
4,4	1,9	4,8	2,4	5,2	2,7	5,8	3,7	7,2	8,3
4,4	2	4,8	2,4	5,2	2,9	5,8	3,9	7,2	8,2
4,4	2	4,8	2,3	5,2	2,2	5,8	4,1	7,3	8,3
4,4	1,9	4,8	2,5	5,2	2,7	5,8	3,8	7,3	8,3
4,4	2	4,8	2,7	5,2	2,6	5,8	3,9	7,3	8,3
4,5	2,2	4,8	2,5	5,2	2,7	5,8	3,9	7,4	7,5
4,5	2	4,8	2,4	5,2	2,7	5,8	3,8	7,4	8,5
4,5	2	4,8	2,2	5,2	2,7	5,8	3,9	7,4	8,3
4,5	1,8	4,8	2,2	5,3	3,3	5,8	3,8	7,5	8,6
4,5	1,7	4,8	2,3	5,3	3,2	5,8	3,8	7,5	3,7
4,5	2,1	4,8	2,2	5,3	3,3	5,8	3,9	5,9	4
4,5	2	4,8	2,2	5,3	3,1	5,9	4,4	5,9	4,1
4,5	2	4,8	2,2	5,3	2,5	5,9	4,5	5,9	4
4,5	1,9	4,8	2,3	5,3	3,1	5,9	4	5,9	3,8

Appendix- X

Craft and Gear data:

Name of landing center: Parerhat Matsu Arat.

No. of craft: 90

Boat					Gear
Length (m)	Width (m)	Depth (m)	Capacity (MT)	Fisher number	
13,5	3,5	1,37	56	14	shore net
12,8	3	1,35	50	14	-L=100-350 m
13	3,5	1,38	52	14	W=2.5-3.5m
12,6	3,4	1,25	50	12	Mesh =1.5-2.5cm
13	3,6	1,36	53	14	
13,7	3,7	1,4	56	14	shore seine net
12,5	2,8	1,37	48	14	L=150-200m
10,5	2,5	1,2	45	10	W=1.8-4.5m
11,5	2,5	1,25	46	10	mesh =1.2-2.5cm
12	2,7	1,2	48	12	
12,5	3	1,29	50	12	Hilsha gill net
13,7	3,6	1,36	55	14	L=1000-3000m
0,9	1,8	1,1	34	4	mesh =10.5-11.5cm
9,5	2	1	35	6	
8,5	1,5	1	32	4	Set bag net
13,6	3,5	1,35	56	14	L=18-40m
12	2,7	1,3	52	12	W =6-15 m
12,8	3	1,35	54	14	
13,7	3,5	1,37	57	14	Hook and line
13,4	3,5	1,36	55	14	L=5-6m
13	3,2	1,32	50	14	Hook size =2-2.5cm
13,5	3,5	1,36	53	14	
13,2	3,3	1,3	52	14	
12,5	3	1,35	48	12	
12,8	3	1,34	50	12	
13	3,5	1,38	50	14	
13,8	4	1,39	58	14	
10	2	1,1	36	6	
9,5	1,8	1	34	6	
9	1,5	1	33	4	
10	2,5	1	35	4	
11,5	3	1,1	40	6	
11	2,7	1,1	38	4	
12,5	2,8	1,25	46	12	
12,8	2,8	1,3	48	12	
13	3,6	1,35	52	14	
13,4	3,5	1,35	54	14	
13,7	3,7	1,37	56	14	
13,5	3,6	1,36	55	14	
13	3,5	1,34	52	14	
13,2	3,5	1,28	53	12	
13,5	3,6	1,35	55	14	
12	2,7	1,2	45	12	
12,5	2,8	1,26	48	12	
12,4	2,8	1,27	46	12	
12	2,7	1,2	45	14	
12,4	3,4	1,25	48	12	
13	3,5	1,35	50	14	
12,5	3	1,25	48	12	
13,2	3,5	1,35	52	14	

13,5	3,4	1,37	55	14	
13,7	3,5	1,37	56	14	
12,8	3	1,28	50	14	
10	2	1,19	33	6	
11,5	2,5	1,18	35	8	
12,8	3,5	1,26	50	12	
13,6	3,5	1,38	56	14	
7,5	1,8	1,1	28	4	
8,5	2	1	30	4	
9	2	1	32	6	
0,8	1,5	1,2	32	4	
8,5	1,5	1,2	32	4	
9	1,8	1,22	35	6	
10	2	1,25	38	10	
11,5	2,5	1,28	40	10	
12	2,7	1,32	45	12	
12,5	3	1,32	50	12	
13	3	1,35	52	14	
12,6	3,5	1,32	50	12	
13,2	2,9	1,34	52	14	
12,8	2,8	1,32	50	14	
13,5	3,5	1,33	54	14	
13,6	3,5	1,36	55	14	
13,5	3,5	1,35	54	14	
13,7	3,5	1,37	56	14	
10	1,8	1,19	40	10	
11,5	2,5	1,2	45	12	
12	2,7	1,22	46	12	
13,5	3,5	1,35	54	14	
13,6	3,5	1,35	55	14	
12,5	3	1,25	48	12	
12,6	3	1,25	50	12	
11	2,8	1,24	42	12	
12,8	3	1,28	50	12	
13,2	3	1,3	50	12	
13,6	3,5	1,37	54	14	
13,7	3,5	1,37	56	14	
9	1,6	1,1	35	6	
8	1,5	1	32	6	
12,5	3	1,25	42	12	

Appendix- XI

Craft and Gear data:

Name of landing center: BFDC

No. of craft:75

Boat					Gear
Length (m)	Width (m)	Depth (m)	Capacity (MT)	Fisher number	
12,8	2,74	1,82	14,92	16	shore net
10,6	2,13	1,52	13,05	14	-L=100-350 m
11,6	2,13	1,82	13,8	14	W=2.5-3.5m
10,3	1,82	1,21	9,32	12	Mesh =1.5-2.5cm
10,9	2,13	1,52	10,26	12	
10,7	2,13	1,22	9,32	13	shore seine net
8,8	1,52	0,914	7,46	12	L=150-200m
9,75	1,82	1,22	8,39	12	W=1.8-4.5m
10,4	1,82	1,22	9,32	12	mesh =1.2-2.5cm
10,6	2,13	1,83	14	14	
9,75	1,82	1,22	9,32	13	Hilsha gill net
11,6	2,13	1,83	14,92	14	L=1000-3000m
10,6	1,98	1,52	14	14	mesh =10.5-11.5cm
11,3	2,13	1,83	15,85	14	
10,9	1,82	1,52	13,05	12	Set bag net
9,75	1,52	1,22	7,46	12	L=18-40m
10,36	1,83	1,52	10,26	12	W =6-15 m
8,8	1,52	0,914	8,02	12	
9,45	1,52	1,22	10,26	13	Hook and line
10,67	2,13	1,22	10,26	13	L=5-6m
10,97	2,13	1,21	11,19	12	Hook size =2-2.5cm
11,58	2,13	1,83	14,36	13	
10,36	1,68	1,22	9,14	12	
11,89	2,28	1,83	15,85	14	
12,5	2,59	1,82	14,92	14	
10,67	1,98	1,52	12,13	13	
11,28	1,68	1,52	14,92	14	
13,11	3,05	1,83	16,79	16	
12,19	2,74	1,68	15,85	14	
10,97	1,68	1,37	12,13	12	
9,14	1,83	1,52	8,39	12	
10,36	1,98	1,52	10,26	12	
11,28	2,13	1,52	14,92	14	
10,67	1,83	1,52	9,88	12	
10,97	1,82	1,67	14	13	
11,58	1,98	1,67	15,85	14	
12,19	2,59	1,83	14,92	16	
9,45	1,83	1,37	8,95	12	
8,84	1,52	1,37	8,39	12	
9,75	1,52	1,22	9,32	12	
11,28	2,13	1,83	14	14	
12,8	3,05	1,67	16,79	16	
11,89	2,44	1,83	15,85	16	
10,97	1,83	1,52	13,05	13	

11,58	2,13	1,67	16,79	14	
12,5	2,74	1,83	15,85	16	
8,8	1,52	1,06	8,39	12	
10,36	1,98	1,22	10,26	12	
10,97	1,83	1,52	12,13	12	
11,58	2,13	1,83	14,92	14	
11,28	2,13	1,52	14,92	14	
10,67	1,83	1,52	12,87	14	
9,75	1,83	1,52	10,26	12	
12,19	2,44	1,52	14	16	
9,45	1,52	0,914	7,46	12	
10,67	1,98	1,52	13,05	14	
10,36	1,83	1,37	9,7	13	
10,97	1,83	1,67	13,05	12	
12,8	2,89	1,83	16,79	16	
11,28	1,83	1,52	12,13	14	
10,97	3,05	1,37	21,8	10	
8,5	1,83	0,914	13,05	08	
12,5	2,74	2,44	14,92	10	
16,5	4,11	2,89	22,38	11	
15,24	3,05	1,52	14,92	12	
11,58	2,74	1,37	13,05	12	
12,19	2,13	1,52	13,05	12	
12,8	2,28	1,68	14,92	12	
11,58	1,83	1,37	11,19	10	
13,72	1,98	1,22	16,79	13	
14,63	2,44	1,82	20,5	16	
10,67	1,98	1,52	12,13	12	
8,8	1,52	1,22	9,32	12	
11,28	2,13	1,52	14,92	14	
13,11	2,74	1,52	15,85	16	

Appendix- XII

Craft and Gear data:

Name of landing center: KB Matsu Arat.

No. of craft:50

Boat					Gear
Length (m)	Width (m)	Depth (m)	Capacity (MT)	Fisher number	
12,8	3,35	1,67	6,5	14	Shore net
13,72	3,35	1,83	9,5	16	-L=100-350 m
12,19	2,74	1,83	6	12	W=2.5-3.5m
11,89	2,74	1,98	6	12	Mesh =1.5-2.5cm
12,8	3,05	1,83	6	14	
12,19	3,05	1,98	6,5	12	Shore seine net
11,58	2,74	1,67	5	10	L=150-200m
13,72	3,35	1,98	10	16	W=1.8-4.5m
12,8	3,05	1,83	5,5	14	mesh =1.2-2.5cm
11,89	3,05	1,67	6	12	
12,19	2,49	1,83	6	12	Hilsha gill net
12,8	3,35	1,98	7	14	L=1000-3000m
12,8	3,05	1,67	6	14	mesh =10.5-11.5cm
13,72	3,2	1,83	9	16	
11,89	2,74	1,98	5,5	12	Set bag net
13,72	3,35	1,98	10	16	L=18-40m
12,8	3,35	1,83	10	14	W =8-15 m
12,19	3,05	1,83	8	12	
12,8	3,35	1,67	9,5	14	Hook and line
13,41	3,35	1,83	9,5	16	L=5-6m
12,8	3,35	1,83	9,5	14	Hook size =2-2.5cm
13,72	3,35	1,97	10	16	
11,89	2,74	1,67	8	13	
12,8	3,2	1,83	8	14	
13,72	3,05	2,44	11	16	
12,19	2,74	2,44	9	12	
12,8	3,05	2,44	10	12	
15,24	3,05	2,44	12	16	
12,19	3,05	2,44	10	12	
12,8	3,05	2,28	9,5	12	
12,8	3,05	2,44	10	12	
13,72	3,05	2,44	10	16	
15,24	3,05	2,44	11	16	
12,8	2,89	2,28	9,5	12	
13,72	3,05	2,44	10	16	
15,24	4,26	2,44	12	16	
13,72	2,74	2,44	10	16	
12,8	2,74	2,28	9	14	
13,72	3,05	2,44	11	16	
12,8	2,74	2,28	8,5	12	
12,8	2,74	2,44	9	12	
13,72	3,05	2,44	11	16	
15,24	4,26	2,44	12	16	
12,8	2,74	2,44	9	14	
12,19	2,74	2,44	8	12	
13,72	4,26	2,44	12	16	
12,8	3,05	2,44	10	14	
12,19	2,74	2,28	8	12	
12,8	3,05	2,44	9,5	14	
15,24	4,26	2,44	12	16	