

**FISHERY AND BIOLOGY OF *Monopterus cuchia* IN THE
SOUTH-WEST COASTAL AREA OF BANGLADESH**

A project thesis

By

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FISHERY AND BIOLOGY OF *Monopterusuchia* IN THE SOUTH-WEST COASTAL AREA OF BANGLADESH

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Declaration

Fishery and Biology of *Monopterusuchia* in the South-West Coastal Area of Bangladesh

The results presented in this project thesis with the above mentioned title are entirely of the candidate's own investigations and no part of the results has been accepted for any degree nor is it being concurrently submitted for any degree.

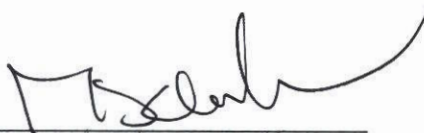


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Abstract

The South-West coastal region of Bangladesh has come out as an area of brackishwater shrimp culture. The species *Monopterus cuchia* is naturally available in this area. A large group of poor people from low caste Hindus are involved in catching Cuchia from the characteristic semi-saline habitats of shrimp gher, cricks and khals in the area. The species has some commercial importance; the poor people catching Cuchia earn their livelihoods from it, to some considerable level. The present study was based on the survey of the fishery and biology of Cuchia in the South-west coastal region of greater Khulna and Satkhira districts. Information was collected from 54 households involving a total of 109 fishermen through a structured questionnaire. Foods of Cuchia were reported to be consisted of aquatic insects, small fishes, frogs and small shrimp; however, the fishermen could not definitely tell the feeding habits of the species. The breeding season of Cuchia was known to start from April and continues up to July and August. Spawning usually takes place at night in the shallow inundated areas of the gher. The total length and weight of the specimens ranged from 26.67 – 66.15 cm and 10 - 210 g respectively. The co-efficient of correlation 'r' for the regression of total length and body weight was estimated to be 0.9378, which is highly significant at 1 % level. Harvesting of Cuchia takes place throughout the year; however, the peak season of harvest was from November to March. During peak season a fisherman could catch up to 7 kg Cuchia per day. During peak season Cuchia is sold at Tk. 30-40/kg. Cuchia is marketed alive and there is a marketing system Cuchia in the areas concerned. Hindus are the principal group who eat Cuchia. Other than use as food for humans, Cuchia is used as bait for catching crabs in the greater Sundarbans area. Considering the socio-economic and biodiversity importance of Cuchia in the coastal region, the fishery of the species should be conserved and protected with sustainable management.

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Chapter 1

Introduction



1.1 Background of the study

Bangladesh is the largest delta in the world. It is also blessed with the vast and varied types of water body such as canals, flood plains, lakes, beels, haors, baors, pond and a long coastline displaying wide diversity in their biotic and abiotic characteristics. Blessed with excellent climate, the country offers immense scope and great potential for a considerable production in fisheries. Fisheries contributes 80% of the national animal protein intake, about 6% of the total GDP (Gross Domestic Product) and more than 12.5% of the total foreign exchange earnings (Matshya Saptaha Sankalan, 1999). Thus the overall fisheries sector stands on a high priority in Bangladesh and thus influence the general livelihood patterns of its people very much.

Khulna region is in the South-Western part of Bangladesh; has a big potential for contribution in fisheries. There are a total of 1, 26,989 ghers covering an area of 1, 40,700 ha. The rivers and the coastal waters in Khulna Division stand at a total of 2, 32,405 ha. The total number of fishermen in this area is approximately 75249. Khulna region has been especially important for being endowed with yet another big fishery from the waters of the world largest mangrove-the Sundarbans (Fatema, 1998). Only fish, shrimp and prawns are given economic priority in this country, especially in this region but there are many other species such as cuchia, crocodile, turtle, crab, mollusks, and seaweeds etc which are being neglected but have the greater potential in this country.

Bangladesh has an extensive self area of about 69,900 km² which has a great potential in the fisheries sector of this country. The South-West coastal area of Bangladesh is found to be a very important area for the cuchia fishery although hitherto the species has been mentioned to be available only in the freshwaters of the country. The South-West coastal area includes the

greater Khulna areas of Khulna, Satkhira and Bagerhat. A large number of people many of whom living in the poverty line, are engaged in cuchia fishing in the area as a whole. Generally they are very much poor and come from the lower caste Hindus. Fishing cuchia is considered as a low class profession. In Bangladesh, most of the fishermen are illiterate and few have primary level of education (Rahman 1994a; Baily and Doulman, 1994) and only about 15% of them are literate. Their per capita income and living standard in this country are at the lowest ebb (Chowdhury, 1994).

Cuchia belongs to the Family Symbranchidae under the Class Actinopterygii. They are the demersal species and live in tropical area of 40°N - 10°N. They are distributed mainly in Pakistan, India, Nepal, Bangladesh and Myanmar. The species *Monopterus cuchia* is reported to be a freshwater one (Rahman, 1989). Rahman (1989) did not mention that the species is also available in the coastal, semi-saline waters of Bangladesh thus the present investigation relating to the biology and distribution and marketing of the species in the semi-saline waters in the coastal areas of South-West of the country was interesting.

They are eel like in shape and the cross section of the species is round. Color of *Monopterus cuchia* is brownish. Generally, the average length of a cuchia specimen is 70 cm and the average weight is 200g. A rudimentary dorsal fin originates a little anterior to vertical from anus. Presence of numerous spots is all over the tail region (Talwar, P.K. and A.G. Jhingran, 1991). They are known to hibernate in mud during cold season. They feed mainly small fishes, tadpoles and aquatic insects (Rahman, 1989). Rainy season is the high time for breeding. They lay egg for producing offspring (Rahman, 1989).

Cuchia fishery resource plays a vital role in the socio-economy of a large number of people in the area under study. Once upon a time the number of fishermen engaged in cuchia fishing was

very few and they did not take the activity as formal profession but now many people in the areas are found to be actively involved in the activities of cuchia fishery. The fishing is done in traditional methods. The market for cuchia is not that developed and thus the fishermen do get the just price in the market. The harvesting is done mainly from the ghers, flood plains, beels, lakes and also some from the tidal rivers in the coastal area.

Monopterus cuchia is an important food for human and also used as bait for capturing crab from Sundarbans. Mainly the lower caste Hindus take it as food. It is a highly nutritious food as is reported by the Hindu people who take it; they often take it as a food for convalescing patients.

A large quantity of cuchia harvested in the south-west of the country is used for harvesting crab in coastal area including the Sundarbans mangrove forest. Also considerable amount is dried for the purpose of preservation for future marketing. The species is found to constitute a valuable fishery in the South-West coastal region of the country.

The biological information of *Monopterus cuchia* is deemed important in view of their importance in the fishery. Generally the fishermen store the specimen in their house in big earthen pots in freshwater for selling to the customers. They also sell the harvest in the nearest market in their locality. Different market places are known for cuchia marketing in different Upazillas of Khulna, Satkhira and Bagerhat region.

However, to look into the biology and marketing of Cuchia fishery in some of the most promising areas of Khulna and Satkhira, the present experiment was undertaken. For this purpose 54 households were surveyed through a structured questionnaire when several visits were made for collecting the relevant information from the area. In Bangladeshi literature it was not known that Cuchia is available in the semi-saline waters of the coastal regions and thus it was interesting to record the data from the present study. A large group of people from the

low caste Hindus are involved in catching Cuchia from the bagda culture gher during the phase when the gher remain fallow after harvesting aman paddy in November onward; the water is not that saline at that time. There is local market for the species and sold for considerable price almost through out the year. The Cuchia is considered as a nutritional food and often used as convalescing food for patient. Other than human food, Cuchia is marketed as bait for catching crabs from the Sundarbans. Considering its importance in the socio-economy, as a number of poor people are engaged in fishing and earning livelihoods from its catch and for protection of biodiversity, the fishery should be conserved through sustainable management in the areas concerned.

1.2 Hypothesis setting

The greater Khulna and Satkhira areas are known having *Monopterus cuchia* fishery and sustain to some considerable level the livelihoods of a group of poor people in the area. The biology, ecology and marketing of the species in the area are not very much known. In the present study efforts will be made for collecting information with regard to the some aspects of biology, ecology and marketing of the harvest that is made by the people engaged in fishing of the species. Thus the hypothesis is made as such that the information obtained in the study would provide some knowledge for understanding the relevant aspects of biology in consideration of the ecology of the species and the marketing system so that some suggestions could be made for sustained management of the fishery.

1.3 Objective of the study

The South-West coastal area is rich in Cuchia fishery. The fishery is being exploited randomly and in an uncontrolled way. This potential sector can have a sustained contribution in the socio-economy of the people engaged in fishing of the species if proper care and management is undertaken for the fishery. Thus a proper investigation on the fishery and biology of the species - abundance, distribution, breeding habit, food and feeding habit etc are very much important. The present study, however, was based on the following objectives:

- To know the biology and ecology of *Monopterus cuchia*
- To obtain the information related to the fishery of the species



Chapter 2

Literature Review

Khuda Bukhsh, A.R. (1975) conducted experiment on the breeding behavior of *Monopterus cuchia*. He stated that sex chromosomes were not distinguishable in the species however; no banding technique was used in the study.

Rahman, A.K.A. (1989) stated that the male and female *Monopterus cuchia* are morphologically different. Generally the males are bigger than the females; however they have no specialized organ for sexual difference. Appearance and color of female is like the male. Any striking features of them are unknown. They are eel like in shape and the cross section of the body of the species is round. The mouth more or less normal in position; eye are small. . A rudimentary dorsal fin originates a little anterior to vertical from anus. Presence of numerous spots is in all over the body including the tail. He also stated that the breeding season of Cuchia is during April to June.

Shrestha, T.K. (1990) examined *Monopterus cuchia* and he found that they fed mainly on aquatic insects, small fish, debris of higher plants and tadpoles. They also feed on nekton, zoobenthos, shrimp and finfish. The predator stage of the specimen is mainly the adult and juvenile stages. Mainly they depend on food of animal sources. They hibernate in mud during cold season of the year. Hunting of macro-fauna is the principal feeding habit of *Monopterus cuchia*.

Talwar, P.K. and Jhingran A.G. (1991) stated that *Monopterus cuchia* is a demersal specimen and the maximum total length of the species gets to 70 cm. According to them Pakistan, India, Nepal, Bangladesh and Myanmar are the distribution area of Cuchia. They said that in Cuchia a rudimentary dorsal fin originates a little anterior to vertical from anus. There are numerous

spots present in all over the body including the tail. It is known to hibernate in mud during the cold season. They also stated that Cuchia feed on mainly the small fishes, tadpoles and aquatic insects. Cuchia inhabit freshwaters, brackish waters, caves, estuaries, lagoons, brackish seas, mangrove, marshes and swamps

Nelson, J.S. (1994) stated that Cuchia is mostly an air breather. Many are burrowers and some are cave dwellers. He also stated that Cuchia belongs to the Family Symbranchidae under the Class Actinopterygii. *Monopterus cuchia* is one of the important species of the coastal area.

Anon., (1996) described the distribution of *Monopterus cuchia* in Bangladesh. Cuchia is distributed in Chittagong hill tracks, Karnaphuli reservoir at Rangamati and Mymensingh area.

Nasar, S.S.T. (1997) pointed that the study the eel has always been an old subject. Many people regard it as an undesirable snake-like, mysterious animal. However, the economic importance of eels to a number of countries in the world is undisputed, at least for *Anguilla* eels.

Eel culture can be undertaken with a minimum investment, using locally available and cheap resources. Eels are long snake-like fish with a smooth, slimy, scaleless skin. There are hundreds of varieties of eels. *Monopterus albus* (rice field eel but in some literature also known as swamp eel), which disappeared locally for unknown reasons, was reintroduced by the International Institute of Rural Reconstruction (IIRR) in late 80s in the Philippines. Many farmers are raising this species for food.

The technology described in this paper is based on several years of successful practice by farmers in Indonesia, as well as on-station and on-farm trials in the Philippines. It has also been

successfully practiced in China and *Monopterus* eels, either caught from the wild or raised, are sold for a high price.

The genus *Monopterus* has six species and is found only in Asia. The rice field eel (also known as the swamp eel *M. cuchia*) is raised in cemented tanks. The advantages of raising this species are:

1. it can be raised in small cemented tanks;
2. it can be bred in captivity without using any chemical stimuli;
3. it is an air-breathing species and can survive in oxygen-depleted conditions, and is, therefore, very useful in areas where water is scarce; and
4. its natural foods are fish, snails, aquatic insects, invertebrates, worms, etc.



Carroll, R., (1988), G. Helfman, B. Collette and D. Facey (1997) stated that *cuchia* is a freshwater and brackish water species. Body is elongated; pelvic fins absent; gill openings is confined to lower half of body; ectopterygoid enlarged; mesopterygoid reduced or absent; premaxillary nonprotrusible and without ascending process. All species under the genus except three occur in freshwater.

Narejo, S.M. Rahmatullah and M. M. Rashid (2002) conducted experiment on the length-weight relationship and relative condition factor of *Monotperus cuchia*. They examined 146 male and 115 female specimens for the analysis and obtained highly significant correlation between the length and weight in the species.

Al-Mamun, A. (2003) used the common name mud eel for *Cuchia*. It is native to Bangladesh and referred to as freshwater species. He said the species as harmless and notes about having no use of *Cuchia* in Bangladesh.

Chapter 3

Materials and Methods

3.1 Study area

The coastal districts of Bangladesh are rich in *cuchia* fishery. Coastal habitats include different ghers, flood plains, lakes and the tidal rivers etc. The two districts, Khulna and Satkhira were selected for the survey. The Upazillas, Dakop, Batiaghata, Koyra, Paikgacha were selected from Khulna district and Kaligonj, Ashasuni and Debhata were selected from Satkhira district.

3.2 Preliminary Survey

A preliminary survey of the study site was done to assess the prevailing conditions of the site based on which a valid and informative structured questionnaire was prepared to obtain information relevant to fishery and biology of *cuchia* species.

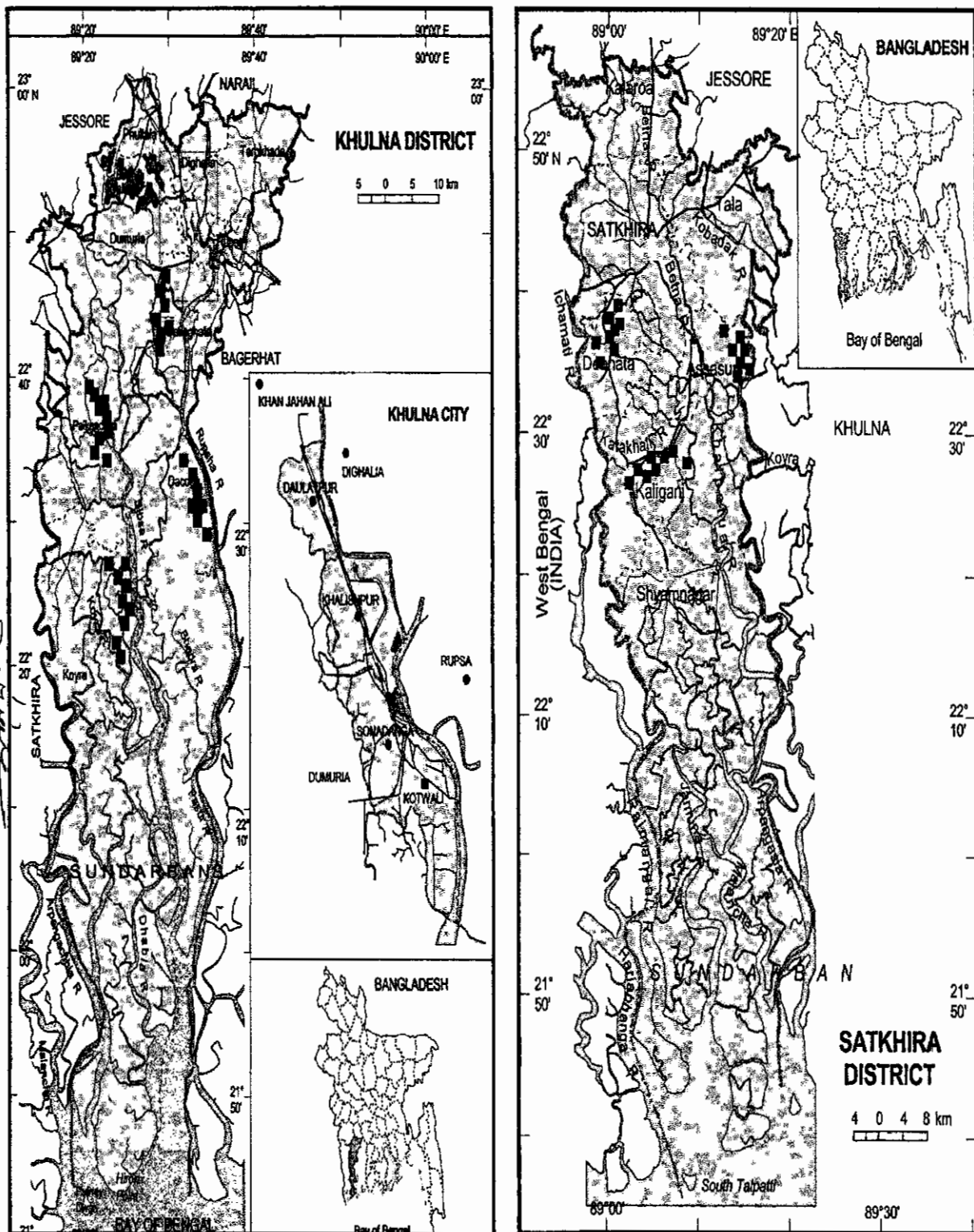
3.3 Data collection

Different information related to biology and fishery of the species was collected by interview of the fishermen in the area. For this several visits in the area were made. A total of 54 house holds were surveyed; often interviews were made with a few fishermen together at a time.

3.4 Data analysis

The collected data were carefully edited to eliminate errors. The data were then analyzed by statistical package MS excel and presented in graphical and tabular forms.

Area No-153



(Source: Banglapedia)

Figure 1: Survey area at Batiaghata, Dacop, Koyra and Paikgacha in Khulna and Ashasuni, Kaligonj, Debhata in Satkhira District

Chapter 4

Results and Discussion

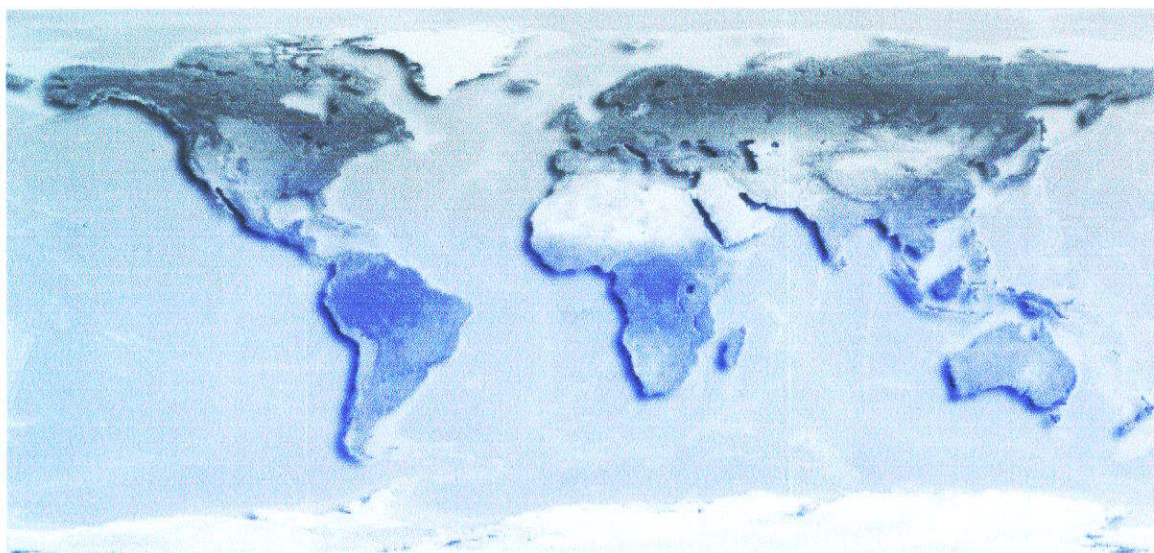
4.1 Area of collection

Cuchia is collected from all over the places of the bagda culture farms, khals and cricks in the south-west coastal region of Bangladesh. The present survey was made with the local traditional Hindu people collecting Cuchia from Botiaghata, Dacope, Koira, Paikgacha of Khulna district and Kaligong, Ashasuni, Debhata of Satkhira district. People were reported to collect Cuchia from within a range of about 15 km from their locality.



4.2 Distribution

Monopterus albus is distributed in 40°N - 10°N in the world. They are mainly freshwater, and occasionally brackish water of tropical and subtropical regions of the world. They are mainly distributed in Asia, Indo-Australian Archipelago, West Africa (Liberia), Mexico, Central and South America. It is an eel like fish (Nelson, J.S.1994).



(Source: <http://fishbase.sinica.edu.tw>)

Figure 2: The distribution areas of *Monopterus albus* throughout the world

It is also available in Pakistan, India, Nepal, Bangladesh and Myanmar (Talwar, and Jhingran, 1991). In Bangladesh Chittagong hill tracks, Karnaphuli reservoir at Rangamati, Maymenshingh of is the areas where *Monopterus cuchia* is available (Anon., 1996).

In the present study the species was found to be available in brackish water areas of Dakop, Paikgacha, Batiaghata, Koyra upazillas of Khulna district and Ashasuni, Kaligonj, Debhata upazillas of Sathkhira district. The principal habitats are the bagda culture farms however, during dry winter months of culture of bagda the species is not available as much as it is available after rainy season and at the onset of winter during November to March.

4.3 Morphology

The male and female Cuchia are morphologically difficult to identify. However, generally the male is larger than the female. They have no specialized organ for sexual difference. Appearance and color of the female is like the male. Striking features of them are unknown. They are eel like in shape and the cross section of the species is round. Mouth is terminal. A rudimentary dorsal fin originates a little anterior to vertical from anus. Presence of numerous spots is all over tail (Rahman, 1989).

Nelson (1994) provided that in Cuchia, no pectoral and pelvic fin are present and dorsal and anal fins are rudimentary. The caudal fin is small or rudimentary, or lacking altogether. Small eyes are present. Gill membranes are fused; gill opening is in a small slit or pore. Four to six branchiostegal rays present. There is no swim bladder in the species; no rib bones present in them. He said that there are 98-188 vertebrae in the species. They are mostly air breathers. Many are burrowers; there are some cave dwellers also.

They get to a maximum of 70 cm in total length. They have two stages of their life cycle - juveniles and adults.



Figure 3: *Monopterus albus*

4.4 Comparison between specimens from the semi-saline and freshwater habitat

Rahman (1989) did not mention as to the availability of Cuchia from the coastal saline fronts of the country and thus a comparison on the salient morphometric characters of specimens collected from the coastal waters and from waters of inland habitats was interesting to record. The following body proportions were obtained for the specimens from the two habitats:

Proportions	Specimen from semi-saline habitat	Specimen from freshwater habitat
Head : TL	1: 13.103	1: 11.132
Preorbital : HL	1: 7.259	1 : 8.833
Postorbital : HL	1: 3.500	1:1.341
Eye orbital to mouth gap : HL	1: 9.666	1: 5.888
Branchial opening: HL	1:3.052	1:2.864
Anus to tail end: TL	1:3.653	1:4.436

It is seen that the specimens from the two habitats differ in all the six different body proportions however; there can be further study on the taxonomy of the populations available in the two strikingly different habitats.

4.5 Habitats

Cuchia inhabit freshwaters, lakes, brackishwaters, caves, estuaries, lagoons, mangrove, marshes, swamps etc. (Talwa and Jhingran, 1991). Nelson (1994) suggested that they are mostly the air breathers. Many are burrowers and some are cave dwellers. In the present study they were found to inhabit in gher, lakes and beels. Occasionally they were reported to be available in the rivers, khals and cricks. They were also reported to survive easily in muddy water condition. The fishermen reported that Cuchia burrow hole in the drying mud and can stay in the hole for sometimes before the mud is completely dried. The further told that the Cuchia holes normally have three openings. The survivability Cuchia is very high even in harsh condition.

4.6 Natural food and feeding habit

Foods of Cuchia were reported to be consisted of aquatic insects, small fishes, frogs and small shrimp however, the fishermen could definitely tell the feeding habits of the species. A number of studies have been carried out on the food and feeding habits of Cuchi by some authors. Talwar and Jhingran (1991) reported that there is not a consistent pattern of food and feeding habit of Cuchia, however generally classified Cuchia as an omnivore or predator.

Srestha, T.K. (1990) suggested that Cuchia mainly feed on aquatic insects, small fish, debris of higher plants and tadpoles. They also feed on nekton, zoobenthos, finfish and bony fishes. The predatory stage of Cuchia is mainly the adult and juvenile stages. They are known to hibernate

in mud during cold season. Hunting of different macro-fauna is the feeding habit of the *Monopterusuchia*.

Table1: Food items of *Monopterusuchia*

Food I	Food II	Food III	Food name	Country	Predatory tage
Necton	Fin fish	Bony fish	Unspecified fin fishes	Nepal	Juveniles/adults
Others	Herbs	Toad/frogs	Unspecified tadpoles	Nepal	Juveniles/adults
Zoobenthos	Insects	Insects	Unspecified aquatic insects	Nepal	Juveniles/adults

(Source: Srestha, 1990)

4.7 Breeding Behavior

From the present study the breeding season of Cuchia was known to start from April and continues up to July and August. Spawning usually takes place at night in the shallow inundated areas of the gher. Courtship is preceded by highly aggressive encounters between males. Breeding takes place in shallow waters between isolated pairs of males and females. After breeding the eggs are placed in the hole and larvae are produced after hatching.

Narejo, Rahmatullah and Rashid (2002) suggested association of gonadal maturation and onset of rain. The same is influenced by the changes in water temperature and photoperiodicity and the final triggering of spawning is caused by a raise in water level due to rainfall. Graaf et al., 1995) studied the gonadosomatic development in *Monopterusuchia* and suggested that breeding in the species starts in March with the onset of heavy rains. They opined that breeding in Cuchia lasts upto July.

Sex chromosomes are not distinguishable. No banding technique used. There is no parental care for ensuring the survival of the cuchia offspring except by the careful choice of a suitable

site. Development of eggs and larvae is rapid and the larvae are capable of swimming within 48-72 hours. They have mainly two stages – juvenile and adult (Khuda Bukhsh, 1975).

4.8 Length Weight Relationship

The average length of the species was recorded at 48.87cm and for weight was recorded at 67.57g.

The length- weight relationship of *Monopterus albus* were studied by examining 54 specimens in the study. The total length and weight of the specimens ranged from 26.67 – 66.15 cm and 10 - 210 g respectively. The relation between the total length and weight is described in the following regression equation:

$$y = 5.3173x - 154.57$$

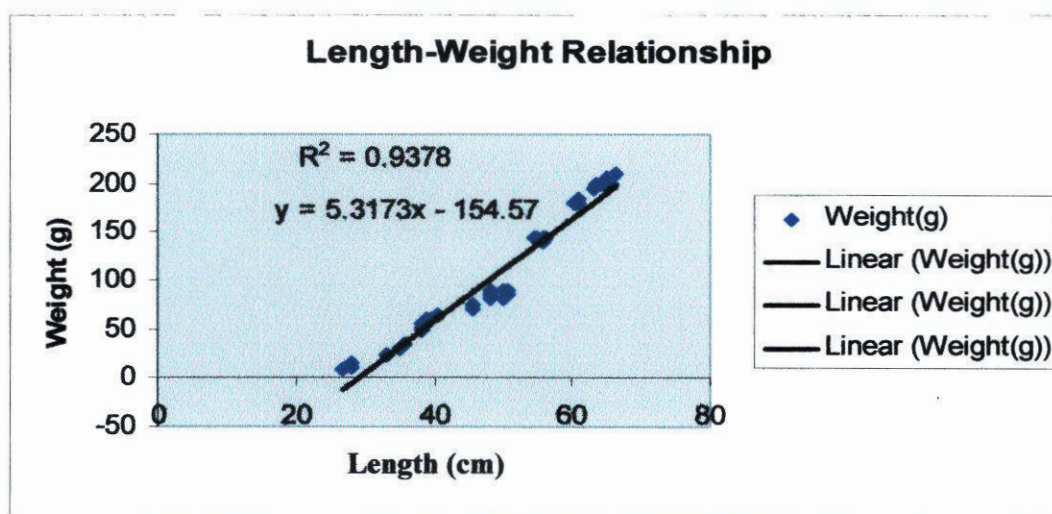


Figure4: Length Weight Relationship

As may be noted from the equations, the exponential values were practically identical. The coefficient of correlation 'r' for the regression of total length and body weight was estimated to

be 0.9378, which is highly significant at 1 % level. The agreement between the empirical values and the computed values from regressions can be termed as satisfactory.

Narejo, Rahmatullah and Rashid (2002) observed total length ranging from 19.0 - 79.7 cm and weight from 7.6 to 210g in 146 specimens of *Monopterus cuchia* and used in the analysis of length-weight relationship in the species. The co-efficient of correlation 'r' for the regression of total length and body weight were estimated to be 0.99, which is highly significant at 1 % level. However, a variation in 'b' value may occur due to different environmental factors.

4.9 Harvesting

Generally fishermen harvest Cuchia through out the year. The peak season of harvest is from November to March. During this time a fisherman can harvest up to 7 kg per day. In the off peak season the amount of harvest was reported to be 3.5kg per fisherman per day. The figure 5 shows the average amount of Cuchia caught in peak and off peak seasons in different Upazilas surveyed through out the year. It is seen that out of the seven Upazilas surveyed, the highest catch in the peak season was recorded in Dacope, followed by Asashuni Upazila.

The method of harvest is traditional where the fishermen mainly use their hands to catch. Catching Cuchia was reported to necessitate special skill; the body of Cuchia is full of slime and can escape very easily from the grip of hand. Cuchia's hole was seen to have three openings and when catching is done from the holes, the fishermen keep one of the three holes closed with their one leg while the other two holes are entered with hands to catch the specimen. Sometimes catching is done by hooks or even sometimes using nets.

Some fishermen take it as a profession. They move from one place to another for harvesting Cuchia. After harvesting, the catches are preserved in the earthen or plastic pot with water.



There were no available references on the method of harvest of Cuchia in Bangladesh or else where in the world.

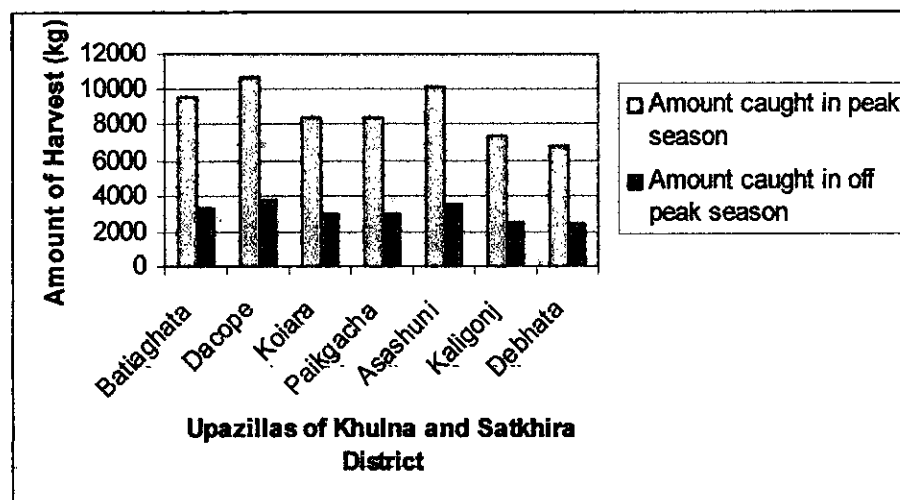


Figure5: Amount of Cuchia caught in peak season and off peak season in different Upazilas through out the year.

4.10 Marketing

Dhaka fish landing market is one of the largest places where sometimes Cuchia specimens are marketed (Anon, 1996).

Marketing of Cuchia was found to be traditional and limited in the area, in general. Generally the middlemen use to buy the catch from the houses of the fishermen. Sometimes the fishermen themselves take the catches to the nearby market for selling. Generally the live specimens are marketed by keeping alive in earthen pots. During peak season Cuchia is sold at Tk. 30-40/kg. When there are more supply in the market, however, during off peak season the price is little higher and is sold at Tk. 40-50/kg. Among the six Upazillas surveyed, the best known places for marketing of Cuchia were Kapilmoni, Koyra, Chalna and Paikgacha markets. It was not known if the harvests are marketed out side to different parts of the country.

4.11 Consumers of Cuchia

There is not a wider range of consumers for Cuchia. Mainly there are two types of consumers. The lower caste Hindus is the principal group who eat Cuchia. It was reported that often people from other castes take it as a convalescing food. Other than use as food for humans, Cuchia is used as bait for catching crabs in the greater Sundarbans area. Every year the demand for Cuchia was reported to increase in the area both for food and for use as bait.

Chapter 5

Conclusion

The study was conducted in an area which has come out as one of the promising area of *Monopterus cuchia* fishery in the country- the South-western coastal area. This area is highly important for the Cuchia fishery. The environmental and the other conditions are suitable for this species. It has market value for food and for other uses. A number of fishermen from the low caste Hindu religion are involved in catching Cuchia from the bagda culture gher in greater Khulna and Satkhira areas; the gher after the harvest of aman paddy remain fallow during November onward. The salinity of the water at that time is not that high and most harvesting of Cuchia takes place a time. There is a marketing system in the area; there are groups of middlemen who purchase the harvests from the houses of the fishermen; the harvests are marketed alive by keeping in earthen pots or the fishermen often take the catches to the nearby markets for sell. Cuchia is mainly eaten by the low castes Hindus. Other than human food, Cuchia was reported to be used in considerable amount as bait for catching crabs by hook from the Sundarbans waters; crabs have good international market and are caught at large scale in the area as a whole. Considering its socio-economic role and role in biodiversity in the area, the biology and fishery of the species should be known in detail; it should be protected and conserved with sustained management methods.

Chapter 6

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Appendices

Appendix-I

Structured Questionnaire

1. Name of the Collector:

Address:

2. Where do you collect the individuals?

A) Bill B) Gher C) Lake D) River

3. How much distance do you move from your locality for specimen collection?

A) 20-25km B) 25-30 C) 30-35 D) 35-40

4. Which type of habitat do the specimen live?

A) Bill B) Gher C) Lake D) River

5. When is the peak season of individuals' collection?

A) November- December B) January- February C) March- April D) May- June

6. How much individuals do you harvest per day in peak season?

A) 5-7 B) 8-10 C) 11-12 D) 13-15

7. How much individuals do you harvest per day in off season?

A) 3-5 B) 6-8 C) 9-11 D) 11-13

8. What is the maximum length in adult stage?

A) 18-22cm B) 23-27cm C) 28-32cm D) 33-37cm

9. How much weight is per the individual in adult stage?

A) 160-190g B) 191-220g C) 221-250g D) 251-280g

10. When is the suitable time for breeding of the individuals?

A) January- February B) March- April C) May- June D) July-August

11. What types of method do you apply for capturing the species?

A) By hand B) By hook with bait C) By net D) Other method

12. How much amount do you sell per kilogram in the market?

A) 20-35tk B) 36-50tk C) 51-65tk D) 66-80tk

13. Who are the main consumers?

A) Lower class Hindu family B) Middle class Hindu family C) High class Hindu family

D) Others

14. Marketing channel of *Monopterus albus*

15. Food value of the individuals

16. Other uses of the individuals

Appendix II

Table 3: Length and Weight of *Monopterus albus*

Length(cm)	Weight(g)	Length (cm)	Weight(g)	Length (cm)	Weight(g)
63.5	200	50.8	90	39.5	60
48.26	80	39	55	64.05	200
26.67	10	55.88	145	38.95	60
33.02	25	63.5	200	56	145
50.8	85	45.72	75	28.05	15
60.96	180	33.02	25	60.5	180
50.08	80	66.15	210	50.55	90
38.1	50	48.26	90	54.66	145
45.72	70	38.1	55	35.05	30
55.88	140	50.55	90	50.15	90
38.1	52	39	60	40.45	65
50.8	90	60.96	180	56.05	145
35.56	35	50.8	85	54.7	145
48.26	85	65.5	200	50.56	90
27.94	12	60.08	180	60.15	180
38.1	55	33.05	25	64.55	200
55.8	140	49.95	90	63.02	195
60.96	185	65.04	205		
		27.94	15		

Table 4: Average Length and Weight of *Monopterus albus*

Features	Length(cm)	Weight(g)
Sum of the length and weight of 54 specimens	1771.81	3649
Average of the length and weight of 54 specimens	48.87	67.57

Table5: Harvesting amount per year in different Upazillas

Name of Upazilla	No. of Household	Involvement of Fishermen in Cuchia Harvesting	Average Catching(kg) in Peak Season (5 months)16 days/ Month	Average Catching(kg) in off peak Season(7 months) 8 days/ Month	Total Catching (kg) per Year
Batighata	8	17	9520	3332	12852
Dakop	7	19	10640	3724	14364
Koyra	9	15	8400	2940	11340
Paikgach a	7	15	8400	2940	11340
Ashasuni	7	18	10080	3528	13608
Kaligonj	8	13	7280	2548	9828
Debhata	8	12	6720	2352	9072
Total	54	109	61040	21364	82404

Appendix III: Pictures



Figure 6: Gher, an ideal environment of Cuchia



Figure 7: Fishermen are searching for Cuchia



Figure 8: Continuous searching for Cuchia specimen



Figure 9: A fisherman got hold of a Cuchia



Figure 10: Holding a live specimen of Cuchia needs skill



Figure 11: A live, clean specimen of Cuchia



Figure 12: Live stored specimens of Cuchia in earthen hundy for sell



Figure 13: Interviewing a Cuchia fisherman during the survey



Figure 14: About to catch a Cuchia by a fisherman from semi dry gher bottom



Figure 15: A fisherman got a catch of Cuchia from semi dry mud of a gher bottom

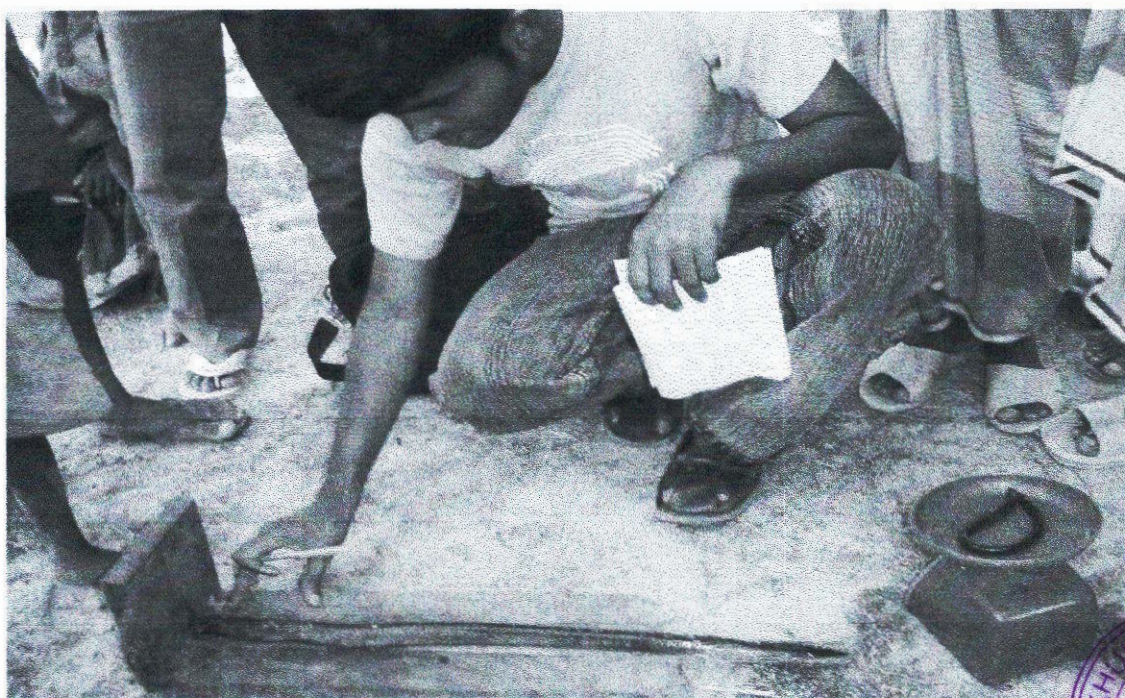


Figure 16: Sampling for length of a Cuchia specimen



Figure 17: Sampling for weight of a Cuchia specimen



Figure 18: The catches of Cuchia are being put for drying for preservation.

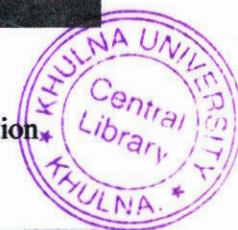


Figure 19: The coastal polder area: the usual habitats for Cuchia