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Editorial and advertising enquiries
Article submission
marhossain@bau.edu.bd
hoq_me@yahoo.com

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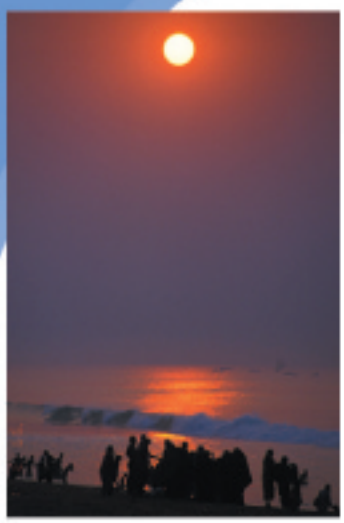

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Dr. Benoy Barman
B.Barman@cgiar.org 01712-192423
Sk. Abid Hussain
abid_bfrf@yahoo.com 01742-250250

editor's column

Editor's Column

The fact has been agreed upon globally that fisheries sector is one of the mainstays in achieving food security, poverty alleviation and increasing national income. The sustainable expansion of the sector in Bangladesh, however, is facing a variety of socio-physical, environmental and technological challenges and can be assisted through quality research and development. In addition, there is an urgent need to educate and to establish a greater understanding and appreciation of Country's water bodies and aquatic organisms to people from all strata to pave the way of their sustainable management to meet the nutrition demands of a rapidly expanding population of this region. GoB and the donors have placed major emphasis on culture and capture fisheries, promotion of integrated farming, conservation, management, and development of institutional framework and need-based training. This is the high time for all concerned and working for the betterment of the fisheries sector in Bangladesh-fish farmers, fishers, general people, local leaders, university teachers, researchers, media personnel, policy makers, GO and NGO workers to come forward to manage the systems and organisms and to increase the fish production through effective coordination, long-term programme and sustainable approaches.

Bangladesh Fisheries Research Forum (BFRF) is a national, non-political and non- profit professional body with the memberships from the universities, DOF, BFRI, BFDC, NGOs, private sectors and all other departments involved and committed to fisheries and aquatic resources development. There continues to be exciting new challenges in terms of the research needs to support the ongoing rapid development of the national and regional aquaculture and fisheries sector in ensuring that it grows in a sustainable and responsible manner. Hence the BFRF has important role to play in providing forums and vehicles for the discussions and communication of cutting edge research and technology.

As you know FAN is the first ever English popular journal in Bangladesh that covers all the aspects of fisheries and aquaculture in the country and in the region. The first issues created a sensation regarding content, design and response from the readers. It has been distributed widely allover the country and also in overseas. This is the second issue of the magazine.

The e-version of the magazine is available in the webpage of the Forum - www.bfrf.org. We welcome your suggestions for any content you would like us to include in the future issues of FAN-Bangladesh, as well as article submissions on topics of current interest in the national and global fisheries and aquaculture sector. We encourage all our readers to write to us with their innovative and novel views on what you think the future direction of FAN-Bangladesh should be. Thank you very much for your sincere support in our endeavours.

Mostafa A R Hossain

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Soft Shell Turtle Culture by Adivasi Households

A.K.M. Nowsad Alam and Saifullah Bin Aziz*
Bangladesh Agricultural University, Mymensingh 2202
* Department of Zoology, Ananda Mohan Govt. College, Mymensingh
nowsad12yahoo.com

The biodiversity of turtles in Bangladesh has been seriously threatened due to excessive exploitation and habitat degradation for increasing demand for its tasty flesh as food. Being an important food item for certain classes of people and as an exportable commodity, its exploitation from the natures has increased manifolds. So far neither any management measures have taken to conserve the turtle nor its culture practice has been initiated in the country. Considering these backdrops, culture potentials of freshwater turtles by Adivasi communities was investigated under a co-management approach. Adivasis such as Garo, Hajong, Cooch, Dalu etc. inhabit in the districts Mymensingh (Haluaghat and Dhobaura), Netrokona (Durgapur and Kalmakanda) and Sherpur (Nalitabari and Jhinaigati). In most cases the Adivasi people are always abstained from the mainstream development activities and live in isolation within own boundary. The purpose of the study was to develop an appropriate culture technique for freshwater turtle compatible with the local conditions and identifying the potentials and constraints of turtle culture in Adivasi areas.

Baseline survey and scooping research

A baseline survey was conducted in the boarder areas of Mymensingh, Netrokona and Sherpur districts for physical resource assessment of freshwater turtle and its culture potentials. Baseline survey included collection of information on the sources and availabilities of the turtle species, habitats, collection and marketing, consumption pattern, people involved and their indigenous knowledge with turtles.

A scooping research was also carried out to select suitable locations and ponds in Adivasi villages for culture of turtles. Community people were organized and PRA was conducted in each location for collecting desired information. Report generated from the survey and scooping study provided guidelines for further study on habitat restoration and culture method development through co-management approach.

Status of water body in term of turtle availability

Location	Water-body status							
	Total pond	Perennial	Seasonal	Fish culture	Without fish culture	Inundated	Not inundated	Ponds with turtle
Haluaghat	271	-	-	253	18	nil	271	*T. hurum* *T. gangetica*
Dhobaura	183	5	-	173	10	nil	183	nil
Durgapur	145	4	1	105	40	40	105	*L. punctata*
Kalmakanda	183	nil	3	173	10	78	105	-
Nalitabari	271	3	3	251	20	-	-	-
Jhinaigati	201	-	-	177	24	nil	201	-

Turtle species and culture practice

There are 4 species of turtle found in the study areas. Baseline survey revealed that at present there has been no existence of cultivable soft shell or flapped shell turtles in the natural water bodies in Adivasi localities of Mymensingh, Netrokona and Sherpur, although they were found in huge number in the past. Common freshwater box turtle, Kachuga kachuga were frequently found. Peacock soft shell turtle *(Trionyx hurum)*, Gangetic soft shell turtle *(Trionyx gangetica)* and spotted flapped shell turtle *(Lissemys punctata)* were found to be released in several fish ponds out of curiosity.

The biology of freshwater soft shell and spotted flap shell turtles were studied in ponds of BAU campus and in ponds belong to Adivasi people in Birishiri, Durgapur, Haluaghat and Kalmakanda for 6 months from June to November. Five ponds owned by the community in three locations were brought under turtle culture. The ponds were renovated in suite of turtle culture with the involvement of the community. Turtles were released with adequate male: female ratio and the community were trained on nursing, feeding, breeding techniques and sampling of turtles. Turtles were fed with mixed diet of mostly animal origin viz., chicken entrails, earthworm, snail, mollusk, leftover human food and formulated fish feed at a rate of 4% of the body weight twice a day. Turtles in ponds were sampled at regular intervals with scoop nets and their growth and gonadal maturity were studied.

Local turtle species

English name	Local name	Scientific name	Availability	
			Present	20 yrs back
Small box turtle	কড়ি কাইট্টা	*Kachuga kachuga*	Still observed	Huge
Spotted flap-shell turtle	তারা কাইট্টা	*Lissemys punctata*	Hardly observed	Available
Soft shell turtle	ধুম কাইট্টা	*Trionyx hurum*	Hardly observed	Available
River soft shell turtle	গঙ্গা কাইট্টা	*Trionyx gangetica*	Hardly observed	Available

Soft shell turtle (*T. hurum*) and spotted flapped shell turtle (*L. punctata*) grew well in pond conditions with an average length of 15.4 1.6 and 3.4 0.3 cm and average weight of 1900 230 and 640 75 g for *T. hurum* and *L. punctata*, respectively. Both the species were found to be healthy and active with no sign of disease. *T. hurum* was found to breed during March to July as it lays eggs on April and the egg hatches in July. On the other hand, *L. punctata* was found to breed during September to March with egg laying on October and hatching on February. While monitoring breeding performance it was found that *T. hurum* passed the breeding season before the study conducted. *L. punctata* were, however, found to be grown for breeding adequately as it laid eggs in October inside the sandy soil of the bank. The eggs were collected, examined and the fertilized eggs were kept in holes in sand-vein of the artificial hatchery developed at pond side. After keeping the eggs inside the holes, the top of the whole area was covered with a shed to protect from rain. It is expected that the eggs would be hatched out within 2 months.

Eggs laid by the turtles were collected, examined and the fertilized eggs were kept in holes in sand-vein of artificial hatchery developed at pond side (deep: 4 cm; distance between holes: 2-3 cm). After keeping the eggs inside the holes, the area was covered with a shed.

Co-management activities

Adivasi communities were found to be reluctant to take any ownership of this culture study. Turtles are expensive food item; one animal of moderate size could be sold at Tk.400-600/kg and easily been theft from the pond. Several experimental species were theft while conducting the study. Pouching was found to be the most important single reason for poor response towards developing co-management initiatives among Adivasi communities. However, through scooping studies and with series of consultations and awareness building, five ponds owned by innovative Adivasis in three locations were brought under turtle culture. Very informal pond-site demonstration trainings were conducted in all locations. A total of 27 community people were trained (5 in Birishiri in Durgapur, 10 in Haluaghat and 12 in Kalmakanda) while 22 of them have own ponds and interested to culture turtle independently.

The major constraints were: lack of knowledge on turtle culture, lack of own suitable pond, lack of capital for renovation of pond and purchase of brood/seed-initial high investment, lengthy and cumbersome culture method, unavailability of seed/brood in time, dependency on Indian brood/adult supply, not possible to culture fish in a same pond, high feed cost, pouching, self eaten-out during festival, risk associated with unknown business and unknown culture method. In spite of all these constraints the Adivasis of the north had made the turtle culture possible showing their strength as they were comparatively better organized community.

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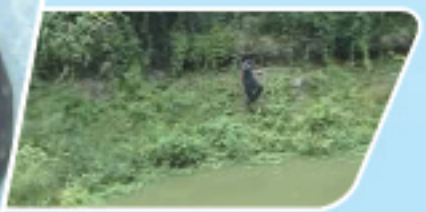


Potentiality of Eel Culture

A.B.M Shamsul Alam
Agro-3, Ukilbari, Trisal, Mymensingh
agrothree@yahoo.com

It's been one and a half year since I first thought about eel culture in Bangladesh. One Chinese company owned by Mr. Lee of Ubay province, China has encouraged me to initiate eel culture in Bangladesh. On February 2011, I received about 100 kg Asian swamp eel (*Monopterus albus*) from Mr. Lee. It is also popularly known as rice field eel. The eel usually found in our country is cuchia (*Monopterus cuchia*). There are some differences between the two species in colour, body and head shape. *Monopterus albus* has an elongated, snake like body with a blunt, rounded nose. It does not appear to have any fins and its slippery skin is darker green or brown on the top, growing lighter towards under belly. They can grow to a length of 1 meter and weight up to 500 g.

The time when I got the eel stock from China, the temperature of our country was about 25 °C but the temperature of Ubay province, China was 4 °C. Due to temperature difference, massive mortality was found (about 50% of the total imported stock). I was looking for the information to keep the remaining eel alive and to breed them. Finally I went to China and learnt the feeding, breeding and culture of eel. The theoretical information about eel culture and breeding was provided to me by Prof. Dr Jhaa of Ubay Agricultural University. It is the largest Agricultural University of China and Prof. Jhaa has been working with eel for 20 years. Now I have succeeded in breeding as well as culture of Asian swamp eel.

Facts of Asian swamp eel *(Monopterus albus)*

After hatching, all fry are female. With growing as mature females, some females changes sex to males. Males can changes sex to females if female density is low. The sex changes may continue up to one year. Reproduction can occur throughout the year. Up to 1000 eggs per female per spawning event may result. Eggs are laid in bubble nest located in shallow water. Bubble nests float at water surface and are not attached to aquatic vegetation.

Asian swamp field eel is a favorite dish of Chinese people. In recent years the eel culture has increased manifolds in China with the price of US$ 4-5/kg (mean individual weight 200g). Chinese traders are willing to buy the eel fish from Bangladesh. The eel market is very wide. The people of eastern countries like China, Thailand, Cambodia, Vietnam, Japan etc are the main consumers of eel as food fish. Through culturing eel in our water bodies, we can expand our export commodity and earn valuable foreign currency.

Water Quality of Dhaleshwari River and its Impact on Aquatic Life

Md. Sirajul Islam, Nowara Tamanna Meghla and Suravi
Department of Environmental Science & Resource Management
Mawlana Bhashani Science and Technology University, Tangail-1902
islammstazu@yahoo.com

The Dhaleshwari is a silt carrying, flooding and eroding distributory River of the mighty Jamuna. During monsoon it becomes full of water where as the river tends to die in dry season. The river plays a vital role in the economy of catchment area as its water mainly used for agricultural purposes.

Now a day over exploitation of fisheries resources, river bank erosion and human activities hampered its aquatic environment. Due to over use of fertilizers and pesticides in the surrounding cultivable land that washed out through surface runoff which degraded the quality of the water. River bank erosion occurred drastically in monsoon season. At the same time, encroachment and filling up the river bed destroyed its natural soundness

The present investigation showed that the levels of EC, DO, BOD, Hardness, Sodium, Potassium and Copper level were within the standard limit set for fisheries, where as the contents of Kjeldahl Nitrogen (total), Phosphorus (P) and Cadmium (Cd) in water exceeded the permissible limit of the standard values. Moreover, pH was decreased and TDS was increased in both post and pre-monsoon period. The excessive presence of Nitrogen and Phosphorus made the river prone to eutrophication, which ultimately resulted into degradation of water quality and phytoplankton blooms. Nutrients from fertilizers, human activities and other animal wastes could be the main causes of this problem. The phosphoric fertilizers, paints and dyes could be the main reason of excessive concentration of Cd in the studied river water which is the responsible factor for occasional fish mass mortality.

Water quality parameters of the Dhaleshwari River at Tangail area

Parameters	Seasons (mean ± SD, N=5)			Standard
	Monsoon (Jun.-Sep.)	Post-monsoon (Oct.-Jan.)	Pre-monsoon (Feb.-May)	
Temperature (°C)	31.52 ± 1.19	23.09 ± 1.62	32.43 ± 0.49	20-30 (EQS 1997)
Transparency (cm)	15.05 ± 6.69	-	-	40 or less (Rahman 1992)
EC (µs/cm)	155.20 ± 22.83	437.60 ± 136.33	365.50 ± 10.61	700 (EQS 1997)
TDS (ppm)	78.40 ± 9.71	236.40 ± 75.44	204.50 ± 13.43	165 (Huq and Alam 2005)
pH	7.52 ± 0.07	5.60 ± 0.14	5.33 ± 0.47	6.5-8.5 (Das 1997)
DO (ppm)	6.63 ± 1.21	6.43 ± 1.83	6.37 ± 0.19	5.0 (EQS 1997)
Alkalinity (ppm)	151.60 ± 20.71	404.60 ± 150.85	497.0 ± 131.52	> 100 (Rahman 1992)
Hardness (ppm)	50.08 ± 13.04	32.00 ± 7.53	41.60 ± 3.39	123 (Huq and Alam 2005)
Total Nitrogen (ppm)	14.56 ± 5.29	10.92 ± 1.53	9.10 ± 0.99	1.0 (ECR 1997)
Phosphorus (ppm)	0.12 ± 0.04	0.15 ± 0.10	0.09 ± 0.01	0 (ECR 1997)
Sodium (ppm)	5.69 ± 0.93	14.59 ± 8.03	17.04 ± 0.68	200 (ECR 1997)
Potassium (ppm)	2.92 ± 0.74	3.96 ± 0.78	4.73 ± 0.00	12 (ECR 1997)

Limnology of River Dhepa, Dinajpur

Kazi Rakiba and Zannatul Ferdoushi
Department of Fisheries Management
Hajee Mohammad Danesh Science and Technology University, Dinajpur-5200
zannatul99bd@yahoo.com

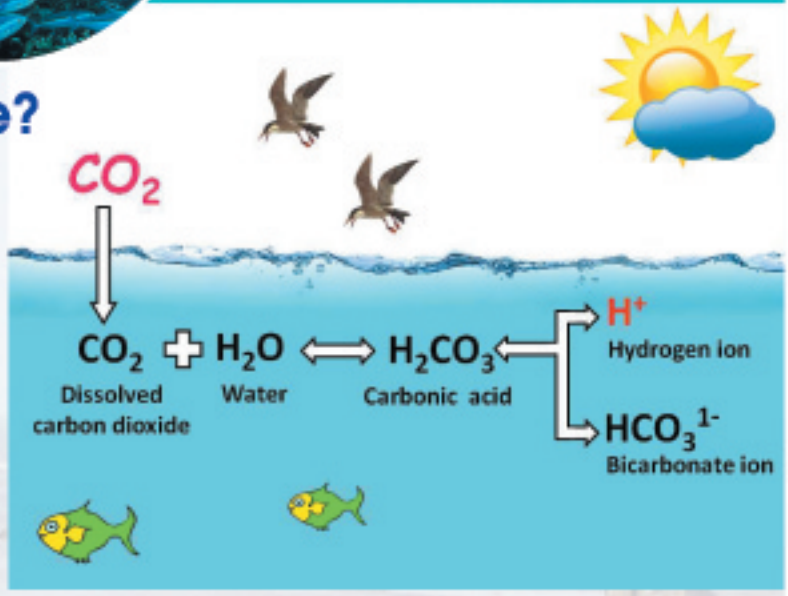
River Dhepa is an offshoot of the Karatoya-Atrai (Buri Tista) river originated from the right-bank of the Atrai near Mohanpur of Dinajpur district. The total length of the river is about 40 km. The river has substantial impacts on the ecology and fisheries biodiversity of the surrounding areas. It plays an important role in the regional economy and food security of the local people.

A study on planktonic biodiversity and their relationships with other environmental factors was carried out in Dhepa river from June 2011 to May 2012. Water samples were collected from eight different points of the river during the study period. Different physico-chemical characteristics of the river water were found to vary with different study points. From the study, it has shown that Dhepa is very rich in planktonic diversity. The dominant phytoplankton groups are Chlorophyceae and Bacillariophyceae. The dominant species are *Pediastrum* sp., *Gloeocapsa* sp., *Fragilaria* sp. and *Closterium* sp. from July to October. It was also observed that during winter, different filamentous algae-*Ulotrix* sp., *Stegioclonium* sp. and *Spirogyra* sp. are mostly common in different parts of Dhapa river. The average dissolved oxygen content was found to vary with a range of 6.9 to 8.2 mg per liter.

Present status of this ecosystem is not encouraging. Some parts of the river are completely dried up during winter and puts the ecosystem under threat. Moreover, unplanned urban and agricultural developments and the related anthropogenic disturbances predominantly throwing of garbage, discharge of sewage and municipal wastes into water body, unload of sand, overexploitation of aquatic resources are also reported as increasing problems responsible for destroying the overall ecosystem of Dhepa river.

Will marine fish cope with this high CO_2 episode?

Md. Yusuf Sarker
Kieler Str. 15, 24143 Kiel, Germany
yusufsarker@yahoo.com



High CO_2 and our ocean

CO_2 has come increasingly into focus in researches and international politics as well over this decade. World community is now aware that the increasing level of anthropogenic CO_2 is a matter of great concern for the sustainability of the earth, due to its global impacts namely global warming and climate change. However, based on present understanding, today scientists are telling that this was just the half of the CO_2 problem that made the world community worried. The other half of the CO_2 problem was unnoticed until the beginning of the 21st century. This unnoticed phenomenon currently known as ocean acidification has started to draw attentions of the policymakers over the past few years, although it is not widely known among the mass people yet. Ocean acidification - the changes in the chemistry of seawater in the surface layers of the oceans caused by dissolving the atmospheric CO_2, is not just another name for climate change or these two are not same; although both share a common cause, i.e. increase of CO_2 in the atmosphere. Ocean acidification, often called as "the evil twin of global warming", is independent of global warming or climate change and it poses different nature of impacts on the life of our planet.

The underlying cause behind ocean acidification is very simple and therefore, it can be called a simple problem with complex consequences. When the atmospheric CO_2 comes in contact with the surface water of the ocean, CO_2 dissolves in the seawater to form carbonic acid (H_2CO_3). Carbonic acids are very unstable and convert into hydrogen ions (H+) and bicarbonate ions (HCO_3^{1-}). Since the 18th century, we have released more and more CO_2 in the atmosphere and the ocean has absorbed a greater amount of CO_2 at increasingly rapid rates which is too much for the ocean's natural ability to adjust to changes in CO_2. Studies show that our oceans have already absorbed about a third of all CO_2 released by different human activities since the beginning of the industrial revolution. As a result, chemical balance of the ocean is significantly changing causing too much increase in the hydrogen ions (H+) which are ultimately causing the acidity of the water to increase (i.e. decrease in the pH) - the phenomenon named "ocean acidification".

Since the origin of this earth, the atmospheric CO_2 level has not always been constant. This planet has experienced several high CO_2 episodes in its history of millions and millions of years. During those episodes, CO_2 level climbed up and afterwards the level came down gradually and such changes occurred over the timescale of thousands of years. Scientists have suggested a detrimental role of those high CO_2 episodes to contribute to the past mass extinction events - the events when major losses of biodiversity occurred in Earth's history. At present, what worries scientists is the current rate of CO_2 rise and eventually the rate of acidification in the oceans. Current rate of acidification is about 100 times faster than that experienced by marine ecosystems globally for the last 20,000 years. Therefore, scientists are worried whether the existing marine communities would be able to cope with this high CO_2 episode which is going to occur within just few hundred years compared to the past episodes which occurred over the time span of thousands of years.

How might fish be affected?

The major changes that would occur in the seawater chemistry due to this acidification include lowering of the pH, an increase in dissolved CO_2 and bicarbonate ions (HCO_3^{1-}) and a decrease in carbonate ions (CO^{-3}). Studies have already reported severe negative effects of ocean acidification for many groups of marine organisms; particularly shell building calcifying organisms (which need carbonate ions for their calcification process) such as corals, calcareous plankton and algae, molluscs (oysters, mussels, clams), and echinoderms (sea urchins, starfish, brittle-stars). Compared to other groups of organisms, knowledge is very limited on its likely direct effects on fish. Direct effects on fish could be observed due to the pH change as well as increased level of CO_2 and bicarbonate ions in seawater. Such changes can affect molecular, cellular, tissue and whole organism functions. Generally, pH reduction can impact physiological process in marine organisms through changing the pH of extracellular and intracellular fluids. But adult fish are generally thought to be relatively insensitive to ocean acidification since usually they have effective acid-base regulatory systems compared to most invertebrates. However, early life stages such as eggs and larvae which have not yet fully developed such regulatory functions might be affected. In adults, increased CO_2 would require additional energy expenditure for acid-base regulation which might impact their normal growth.

Fish might be affected indirectly as well through the impacts on their food availability and quality (on the food webs or on the organisms they prey upon, e.g. planktons) and habitats they depend on to complete their life cycle. It is being predicted that like other shell-building organisms, corals which also use carbonate ions (CO^{-3}) for building their three dimensional structures, would be badly affected due to ocean acidification. Coral reefs are among the most diverse, productive and spectacular ecosystems on our planet. They offer spawning, nursery and feeding grounds to many species and thus provide habitat for at least a quarter of all marine species. Currently, most of the coral reefs all over the world are already threatened due to bleaching (response of corals to a stress caused by warmer waters), overfishing, destructive fishing and pollution. Ocean acidification, if not controlled, would exacerbate the situation and could destroy all the coral reefs by this century. If reefs disappear, many of the reef associated species would face extinction. Consequently, worldwide reef fisheries which provide 9-12% of the world fish landings might collapse. Furthermore, ocean acidification could help increase abundance of jellyfish in the oceans as the other competitive species will decline giving the jellyfish more space to take over. This might affect fish since jellyfish are key predators and affect the recruitment of fish population.

What do we know actually so far?

There exist some earlier studies investigating the effects of CO_2 on fish. These studies report that hypercapnia - the term used for an increased CO_2 level in the blood, affects many physiological functions such as blood circulation, respiration, central nervous system, behaviour, metabolism and finally growth. Very high CO_2 even kill fish causing cardiac failure. However, most of the earlier findings reporting the effects of hypercapnia on fish cannot be considered relevant for predicting the effects of ocean acidification since those studies have been performed under CO_2 levels too high to be projected realistically for the future oceans. Therefore, scientists are not totally clear how marine fish will respond to the levels of acidification that would occur by the end of this century. Until recently, fisheries scientists assumed that marine fish would not be under direct threat from acidification in the oceans since they possess mechanisms that enable them to tolerate high CO_2 concentrations.

Within last few years, couple of studies have been conducted to investigate potential direct effects of ocean acidification on fish. The majority of these studies have been done by the researchers from the James Cook University in Australia. The fish species studied so far are mostly coral reef species. In these studies, future levels of CO_2 have been found to alter or impair their activity levels, brain functions (i.e. learning ability, behavioral lateralization) as well as sensory responses such as response to odours, visual cues and auditory response. Naturally fish rely on these functions and sensory behaviours to find foods, select habitat during settlement and to avoid predators and potential risks. In case of Atlantic herring, increased CO_2 was found to affect metabolism of embryos negatively which could reduce the growth of the larvae. All these changes observed particularly in the early life stages of fish can reduce their individual fitness and could increase their vulnerability to predation which would ultimately affect larval survival and consequently, hamper population replenishment of fish species in a future high CO_2 ocean.

Recently a group of researchers from the Leibniz Institute of Marine Science in Germany has reported detrimental effects of ocean acidification on Atlantic cod - a fish species of high commercial value.

Will marine fish cope with this high CO_2 episode?

In their study, exposure to high CO_2 resulted in severe lethal tissue damage in many internal organs of the fish larvae. In another study done with an estuarine fish species, researchers from the Stony Brook University in USA have showed that ocean acidification can severely reduce survival and growth in early life stages of this species. These two studies were published in the journal Nature Climate Change in January his year. If results found in these studies can be generalized to other fish species, the impacts would be much threatening which surely challenges the belief that ocean acidification will not directly affect fish. However, evidences are still too limited for generalizations of such effects.

Scientists are predicting that the marine communities and ecosystems will undergo a big change in near future and the future oceans may not be able to support the productive food chain that we have today. Both directly and indirectly marine fisheries and aquaculture industries all over the world are at great risk from future ocean acidification as well as from some other climate related stressors and local impacts simultaneously. Scientists are trying to apply geo-engineering to reduce atmospheric CO_2 but still no practical solution exists for us. Until now, the only realistic action the human society can take is to reduce the global CO_2 emissions significantly. In addition to climate change, ocean acidification is a very powerful reason for taking actions to stabilise CO_2 emissions at a safe level since unlike climate change (which mostly affects the poor countries) most of the major CO_2 emitting developed countries would be hardest hit by ocean acidification.

Sharks as a Nutritional Food Supplement

Enamul Hoq
Bangladesh Fisheries Research Institute
Mymensingh-2201
hoq_me@yahoo.com

Shark fishing is an important part of marine fish production of Bangladesh and most of the artisanal boats/fishing trawlers regularly harvests sharks as targeted or non-targeted catch. Catching shark is now a lucrative business for a large number of coastal fishermen as shark skin, meat, fin, teeth & bone is sold at high prices abroad. Shark meat, which has been used as food in coastal areas for thousands of years, has less economically valuable than shark fins or meat from other more popular pelagic fish species, such as tuna and swordfish. Shark meat is consumed dried, salted or smoked in many Asian and African communities. Dried shark is popular in Oman and other Gulf countries. Dried and salted shark meat is popular as this processing method provides a convenient form in which to transport the product in areas where shelf-life would otherwise be limited. Shark meat contains up to 2.5% urea and has high nitrogen content in the form of volatile bases, ammonia and trimethylamine. It therefore has an unpleasant specific odor and pungent-acid taste. As sharks have a high content of urea, they should be cut and bled immediately after capture.

In Chinese culture, the serving of shark fins has come to symbolize honor and respect, in part because it was once a luxury dish that few could afford. Now shark fin soup is widely consumed around the world, remaining popular specially in Far East where it is also customarily served on special occasion. In addition to its high nutritional value, shark fin soup is believed to provide people with a range of medicinal benefits.

Traditionally, shark is sundried and is usually kept at room temperature and consumed without any further thermal treatment. Before drying, fresh shark is filleted, washed, lightly salted, and then dried under the sun. The process is not standardized, and variations occur in the salting method (dry vs. brine), salt concentration, size and density of fish pieces, and humidity, temperature, and time of drying.

Proximate and mineral composition of common shark species of Bangladesh coast

Species	Proximate composition (mg/100g)			
	Moisture	Ash	Protein	Lipid
Dog shark	32.55	19.20	79.28	0.57
Black shark	44.47	19.47	78.23	1.13
Hammer head shark	39.45	21.84	78.34	0.30
Shark fin	32.35	36.15	60.06	0.64
	Mineral composition (mg/kg)			
	Na	Ca	Fe	Zn
Dog shark	39,544.69	1,368.76	54.15	12.12
Black shark	45,219.84	2,261.29	41.87	9.86
Hammer head shark	43,245.60	1,261.20	28.83	8.44
Shark fin	40,390.83	24,572.71	80.63	17.07

Sharks as a Nutritional Food Supplement

Squalene, found in the liver oil of all sharks, has been used in many products, including cosmetics, other health and beauty products and fuel for street lamps, and in the production of vitamin A. Squalene is an adjuvant that stimulates the immune system and is used in several vaccines, including some for the H1N1 flu virus, malaria and is being used in clinical trials for hepatitis B, human papilloma virus and tuberculosis. In addition, shark skin is used as leather, jaws and teeth are sold as souvenirs, dogfish are used as dissection specimens and sharks can be used in fishmeal and/or as fertilizer.

Although shark meat is considered to have a favorable nutritional value, there are, nevertheless, certain substances that may be present in shark meat which can have adverse effects on human health.

Prospect of Sea Cucumber Aquaculture

Md Arif Chowdhury and Khairun Yahya
Centre for Marine and Coastal Studies (CEMACS)
Universiti Sains Malaysia (USM)
arifait@yahoo.com

Sea cucumbers are marine animals with leathery skin and elongated body found on the sea floor. Historically, sea cucumbers have been harvested for Chinese consumers for at least 400 years and have been economically important in the western Pacific for over a century. Throughout the world, 66 species of sea cucumbers are commonly exploited, but the most valuable and most well-known are the temperate species *Apostichopus japonicus*, commonly known as Japanese sea cucumber, and the tropical species *Holothuria scabra*, commonly known as sandfish.

Sandfish is greyish-black on the upper side with dark-coloured wrinkles but paler on the underside. The body is oval and stout with flattened ends. They are found in many countries in the Indo-Pacific region. The preferred habitats of sandfish are shallow tropical waters, usually less than 20 m deep, such as sheltered areas with high levels of nutrients, including muddy substrata, sea grass beds and sometimes brackish water. The animals often spend the most part of the day buried in the muddy sand.

Kingdom: Animalia
Phylum: Echinodermata
Class: Holothuroidea
Order: Aspidochirotida
Family: Holothuriidae
Genus: *Holothuria*
Species: *H. scabra*

The total global production (aquaculture and capture) of sea cucumber was 158,659 tonnes in 2010 where 82% was contributed by aquaculture. In terms of monetary value, this likely represents an estimated total market of USD5.1 billion, due to the large quantity of Japanese sea cucumber produced and the market price for the species. In fact, Japanese sea cucumber alone accounts for USD4.1 billion of the market size.

The increasing demand for dried sea cucumber (also known as beche-de-mer), the drastic decline of natural population due to overfishing, the corresponding decline of harvests and the high value of sandfish on the market have promoted interest in aquaculture programmes in numerous countries. This aquaculture only limited with naturally collected juveniles as hatchery techniques are still not established. Hatchery production and aquaculture of sandfish has been carried out in research-scale since 1994, and so far they have shown limited success in India, Madagascar, Australia, Vietnam, Philippines and other South Pacific countries. Establishment of hatchery to produced fry/juveniles are essential for expansion of sea cucumber aquaculture.

Conservation of estuarine fish species- a need of the time

Md. Rakeb-Ul Islam
Department of Fisheries & Marine Science
Noakhali Science & Technology University, Sonapur, Noakhali
mpakeb_rstu@yahoo.com

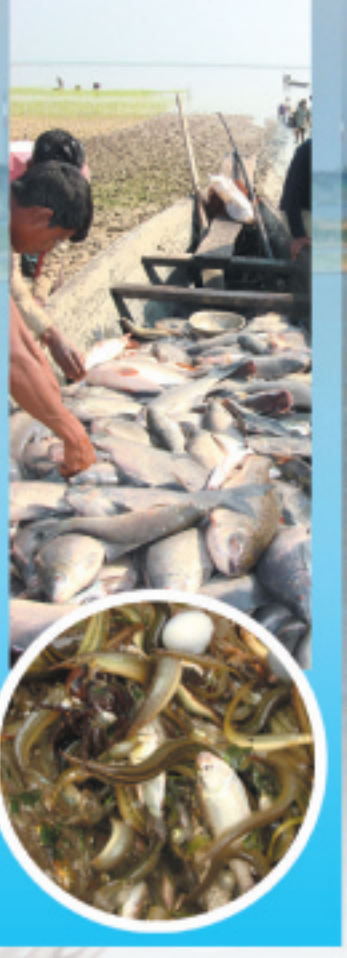
The prevalence of malnutrition in Bangladesh is among the highest in the world. Millions of children and women suffer from one or more forms of malnutrition including low birth weight, wasting, stunting, underweight, vitamin A deficiencies, iodine deficiency disorders and anemia. Fish is one of the most important sources of animal protein and has been widely accepted as a good source of minerals and vitamins. It was observed that small species contain high levels of protein, minerals and vitamins. Particularly mola (*Amblypharyngodon mola*), darkina (*Esomus danricus*) and dhela (*Osteobrama cotio cotio*) contain high levels of vitamin-A. Malnutrition problem of the nation can be effectively reduced by increasing the production of such type of small fish species.

Bangladesh is blessed with an extensive coastline of about 710 Km. The estuarine coastal and adjacent areas of the country support a variety of economically important fishes. In the estuarine area, Hilsa (*Tenualosa ilisha*), tiger shrimp (*Penaeus monodon*), giant freshwater prawn (*Macrobrachium rosenbergii*) and vetki (*Lates calcarifer*) are commercially important species. Besides, some other species such as lal chewa (*Odontamblyous rubicundus*), chiring (*Apocryptes bato*), tular dandi (*Sillaginopsis panijus*), nona tengra (*Mystus gulio*), vacha (*Eutropicthys vacha*), silong (Silonia silondia), khorol bata (*Rhinomugil corsula*), garua (*Clupisoma garua*), taposi (*Polynemus paradiseus*) and baila (*Glossogobius guiris*) are commonly available fishes in the coastal market of the country. The price of these fish species is relatively lower than those of other fish species like vetki, Indian major carps, tilapia and ilish. Hence, the poor people can easily buy this fish species to meet their nutritional requirement. Now-a-days, these fishes are found in various municipal markets of the major cities in the country and the commercial demand is growing throughout the country for their taste and nutritional value. The proximate composition of these small fish species are comparable to large carp species, though the price of these fishes are much lower than that of large fish. Therefore, these fish species play a significant role to fulfill the nutrient demand of poor people of the country to get rid of malnutrition.

Proximate composition of some estuarine fish species

Fish species	Moisture (%)	Lipid (%)	Crude Protein (%)	Ash (%)	Carbohydrate (%)
Eutropiichthys vacha	64.20	16.90	15.90	2.40	0.60
Clupisoma garua	79.23	1.25	13.43	5.85	0.24
Silonia silondia	77.45	5.32	13.71	2.11	1.41
Apocryptes bato	77.77	4.00	15.62	2.41	0.20
Odontamblyous rubicundus	77.43	5.27	15.14	2.04	
Rhinomugil corsula	72.00	5.98	15.00	5.65	1.37
Sillaginopsis panijus	77.60	2.65	16.56	2.50	0.70

Fish biodiversity is rapidly decreasing day by day in coastal and estuarine region. Many fish species are now vulnerable, endangered and critically endangered in coastal area. The major factors responsible for the losses of biodiversity are destruction of habitat for nursery, feeding and breeding ground of those fish species, overexploitation of biological resources, intense population pressure, natural hazards, deforestation, agriculture and industrial pollution and flood control related activities. However, restoration of biodiversity of these valuable species received very little attention from both government and private sector. As fisheries and aquaculture in Bangladesh are of prime importance in view of biodiversity conservation, natural balance, food security, income generation, poverty alleviation and employment opportunity, we should give proper attention to the conservation and restoration of habitat of the estuarine fish species.



The Checklist of the Riverine Fishes of Bangladesh

Mostafa A.R. Hossain, Md. Abdul Wahab and Ben Belton*
Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh-2202
*The WorldFish Center, Bangladesh and South Asia Office, Dhaka
marhossain@yahoo.com

The fishes of Bangladesh exhibit a wonderful diversity in their size, shape, colour, habitat, feeding habits and breeding behaviour. Considering size alone, there are fish such as the rice fish which attain only an inch long at maturity and weigh less than a gram, whilst others such as the river shark or goonch reach more than two meters in length and weigh more than 100 kg. Bangladesh also possesses splendid, vibrantly coloured fish - queen loach and other loaches and those such as pipe fishes which look more like a crocodile. The male pipe fish provides all postzygotic care of its offspring by brooding embryos on its ventral surfaces, while the rice fish are live bearers.

The biodiversity of riverine fishes is presently in great danger. Many fishes are either endangered or critically endangered. Many have already become extinct from the waters of Bangladesh. The Red Book of Threatened Fishes of Bangladesh published by the IUCN-Bangladesh is already more than a decade old. According to the Red List, 54 indigenous riverine fishes of Bangladesh are threatened- vulnerable, endangered and critically endangerd (IUCN-Bangladesh 2000). However, there have been massive changes in riverine fish biodiversity over the last 12 years. According to the survey conducted by the Fish Museum & Biodiversity Centre (FMBC), Bangladesh Agricultural University, Mymensingh, Bangladesh during 2009-10, more than 100 riverine fishes are presently under threat and a number of species are already lost.

At least 293 fish species from 13 orders and 61 families are found in the rivers, streams, ponds, ditches, beels , haors , baors , lakes and floodplains of Bangladesh. This figure includes fishes which normally inhabit estuarine rivers but are also found upstream in freswater rivers. It is noteworthy that, among the fish usually referred to as freshwater fishes in Bangladesh, about half can tolerate moderate salinity (up to 10 ppt) and often are found in brackish rivers. In addition, many freshwater fishes aggregate in the nutrient-rich areas of river mouths during the monsoon. This makes it difficult to distinguish between many freshwater and brackishwater species. For this reason, estuarine fishes which move upstream for either short or relatively long distances and stay there for several days to months without any physiological difficulties are also included in the list of riverine fishes.

A number of estuarine gobies, ponyfishes and flatfishes are caught in the River Meghna close to Dhaka city, far from Bay of Bengal. Flatfishes are even available in the haors of Sunamgonj in the northeastern part of the country. Though considered as estuarine or marine, fishes including pike conger eel, a number of clupeids, pipe fishes, eel gobies, sleepers, ponyfishes, flatheads, threadfins, scats, and croakers may live in upstream in freshwater rivers far from coast for long periods of time, and are frequently caught in fishermens' nets. On the other hand, fish species generally considered to be

freshwater species including goonch, yellowtail catfish, freshwater eels, mud eel, long whiskered catfish, bagrid catfish, river sprat, featherbacks and glassy perchlet are also often found in estuarine rivers.

The riverine fishes: category and checklist

The major groups of riverine fishes of Bangladesh include major carp, minor carp, barbs, loach, catfish, perch, river shad, snakehead, eels, featherback, anchovies, glass fish and mullet. Felts et al. (1996) divided the fishes of Bangladesh into two categories - small fish, or small indigenous species of fish (SIS), and large fish. According to these authors, the fish which attain a size of 5 - 25 cm are small fish and all others are large fish. Since the publication of Felts et al.s' article, the term SIS has become popular among the scientists, researchers and policy makers. However, classification based on this simple definition has created confusions. For example, under this classification, many medium sized fishes like- bronze featherback, tank goby, chacunda gizzard shad etc. that never grow more than half a meter, are considered to fall in the same category as some of the largest fishes like freshwater shark, goonch etc that may grow more than 2 meter with weight more than 100 kg. On the other hand, tiny fishes like blue panchax or flying barb barely grow to 5 cm and weigh only a few grams (2-3 g), but considered to fall into the same category as fishes like climbing perch or bronze featherback which may reach 250 g or more. To rationalise this classification we propose to divide the riverine and other inland water fishes of Bangladesh to 4 categories based on size.

Size-based classification of the riverine fishes of Bangladesh

Fish type	Tiny fish	Small fish	Medium fish	Large fish
Bangla name	Gura machh	Choto machh	Majhari machh	Boro machh
Total length at maturity (cm)	< 5	5 - 15	>15 - 30	> 30

The maximum average weight of fish presently available in rivers, beels, ditches, floodplain, haor and baor, landing centers and fish markets were given priority in this classification rather than the fish weights previously published in books, papers and the internet. However, for fish which are not yet part of the collection, published weights have been taken in to consideration.

We have listed 293 fishes in the checklist of the riverine fishes of Bangladesh. We believe this is a complete list of the fish so far described, documented or reported. Some species have never before been recorded in a checklist of Bangladeshi fishes. For example, the croaking gourami, *Trichopsis vittata*, has only been reported from Southeast Asian countries such as Cambodia, Thailand and Vietnam to date. We, however, found the fish from the river Meghna, near Rekabi Bazar in Munshigonj district. The number of riverine fishes of Bangladesh has been given variously as 260, 265 or 270 in different books, reports, papers and popular articles to date. We hope this more complete list of Bangladeshi riverine fishes will solve the predicament.

Checklist of the riverine fishes of Bangladesh

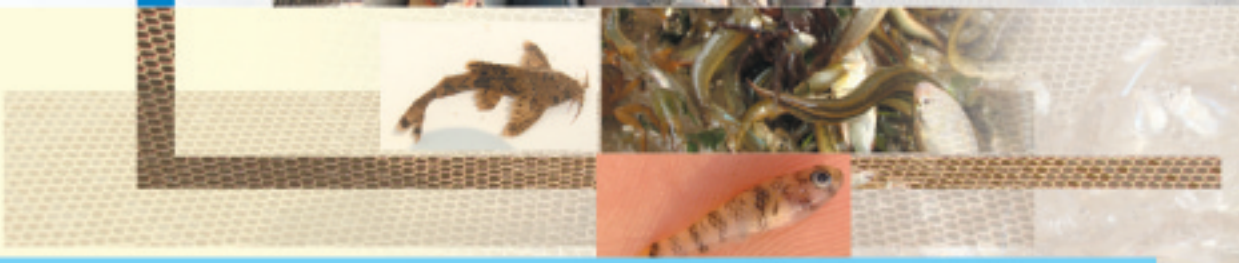
	Family	Species	English name	Bengali name	Type of fish	Habitat
		Order$_1$ Anguiliformes (8 fishes)				
1	Anguillidae	*Anguilla bengalensis*	Indian Mottled Eel	Banchara	Large	E-R
2	Moringuidae	*Moringua raitaborua*	Purple Spaghetti Eel	Rata Boura	Large	E-R
3	Muraenesocidae	*Congresox talabon*	Yellow Pike Conger	Kamila	Large	E-R
4		*Congresox talabonoides*	Indian Pike Conger	Kamila	Large	E-R
5		*Muraenesox bagio*	Common Pike Conger	Kamila	Large	E-R
6	Muraenidae	*Gymnothorax tile*	Moray Eel	Bamos	Large	E-R
7	Ophichthidae	*Pisodonophis boro*	Rice-paddy Eel	Kharu	Large	E-R
8		*Pisodonophis cancrivorus*	Longfin Snake Eel		Large	E-R
		Order$_2$ Osteoglossiformes (2 fishes)				
9	Notopteridae	*Chitala chitala*	Clown Knifefish	Chitol	Large	R-E
10		*Notopterus notopterus*	Bronze Featherback	Foli	Medium	R-E
		Order$_3$ Elopiformes (1 fish)				
11	Megalopidae	*Megalops cyprinoides*	Megalops		Large	E-R
		Order$_4$ Clupeiformes (18 fishes)				
12	Clupeidae	*Anodontostoma chacunda*	Chacunda Gizzard Shad	Chakunda	Medium	E-R
13		*Corica soborna*	Ganges River Sprat	Kachki	Tiny	R-E
14		*Gonialosa manmina*	Ganges River Gizzard Shad	Chapila	Small	E-R
15		*Gudusia chapra*	Indian River Shad	Chapila	Small	R
16		*Hilsa kelee*	Kelee Shad	Gurta Ilish	Medium	E-R
17		*Nematalosa nasus*	Blochs Gizzard Shad	Borong	Medium	E-R
18		*Tenualosa ilisha*	Hilsa Shad	Ilish	Large	E-R
19		*Tenualosa toil*	Toli Shad	Chandona Ilish	Large	E-R
20	Engraulidae	*Coilia dussumieri*	Goldspotted Anchovy	Olua	Medium	E-R
21		*Coilia ramcarati*	Ramcarat Anchovy	Olua	Medium	E-R
22		*Setipinna phasa*	Gangetic Hairfin Anchovy	Phasa	Medium	E-R
23		*Setipinna taty*	Scaly Hairfin Anchovy	Teli Phasa	Medium	E-R
24		*Thryssa hamiltonii*	Hamilton's Thryssa	Ram Phasa	Medium	E-R
25		*Thryssa purava*	Oblique-jaw Thryssa	Ram Phasa	Small	E-R
26	Pristigasteridae	*Ilisha filigera*	Coromandel Ilisha	Choukkha Phasia	Medium	E-R
27		*Ilisha megaloptera*	Bigeye Ilisha	Chapila	Medium	E-R
28		*Ilisha melastoma*	Indian Ilisha	Khorchuna	Medium	E-R
29		*Pellona ditchela*	Indian Pellona	Choukkha	Small	E-R
		Order$_5$ Cypriniformes (9 fishes)				
30	Balitoridae	*Acanthocobitis botia*	Mottled Loach	Bilturi	Small	R
31		*Acanthocobitis zonalternans*	River Loach		Small	R
32		*Balitora brucei*	Grays Stone Loach		Small	R
33		*Nemacheilus sikmaiensis*			Small	R
34		*Schistura beavani*	Creek Loach		Small	R
35		*Schistura corica*	Polka Dotted Loach	Khorka	Tiny	R
36		*Schistura dayi*			Small	R
37		*Schistura savona*	Half Banded Loach	Savon Khorka	Tiny	R
38		*Schistura scaturigina*	Victory Loach	Dari	Tiny	R
39	Cobitidae	*Botia dario*	Queen Loach	Bou Machh	Small	R

	Family	Species	English name	Bengali name	Type of fish	Habitat
40		*Botia dayi*	Hora Loach	Rani Machh	Small	R
41		*Botia lohachata*	Reticulated Loach	Rani Machh	Small	R
42		*Botia rostrata*	Gangetic Loach	Rani Machh	Small	R
43		*Lepidocephalichthys annandalei*	Annandale Loach	Gutum	Tiny	R
44		*Lepidocephalichthys berdmorei*	Burmese Loach	Puiya	Small	R
45		*Lepidocephalichthys guntea*	Peppered Loach	Gutum	Small	R-B
46		*Lepidocephalichthys irrorata*	Loktak Loach	Puiya	Small	R
47		*Neoeucirrhichthys maydelli*	Goalpara Loach		Tiny	R
48		*Pangio oblonga*	Java Loach	Panga	Small	R
49		*Pangio pangia*	Cinnamon Loach	Panga	Small	R
50		*Somileptus gongota*	Gongota Loach	Cheng Gutum	Small	R
51	Cyprinidae	*Amblypharyngodon microlepis*	Indian Carplet	Mola	Small	R
52		*Amblypharyngodon mola*	Mola Carplet	Mola	Small	R
53		*Aspidoparia jaya*		Joya	Small	R
54		*Aspidoparia morar*		Morari	Small	R
55		*Barilius barila*	Barna Baril	Barali	Small	R
56		*Barilius barna*	Ozola Barb	Koksa	Small	R
57		*Barilius bendelisis*	Hamilton's Barila	Joiya	Medium	R
58		*Barilius shacra*	Shacra Baril	Koksa	Small	R
59		*Barilius tileo*	Tileo Baril	Pathorchata	Small	R
60		*Barilius vagra*	Vagra Baril	Koksa	Small	R
61		*Bengala elonga*	Megarasbora	Along	Small	R
62		*Chagunius chagunio*		Chaguni	Small	R
63		*Chela cachius*	Silver Hatchet Barb	Chhep Chela	Small	R-B
64		*Chela laubuca*	Indian Glass Barb	Chhep Chela	Small	R-B
65		*Laubuca brahmaputraensis*		Chhep Chela	Small	R
66		*Salmostoma acinaces*	Silver Razorbelly Minnow	Chela	Small	R
67		*Salmostoma bacaila*	Large Razorbelly Minnow	Katari	Small	R-B
68		*Salmostoma phulo*	Finescale Razorbelly Minnow	Phul Chela	Small	R
69		*Salmostoma sardinalla*	Sardinella Razorbelly Minnow		Small	R
70		*Securicula gora*		Ghora Chela	Medium	R
71		*Crossocheilus latius*	Gangetic Latia	Kalabata	Small	R-B
72		*Danio dangila*	Moustached Danio	Nipati	Small	R
73		*Danio rerio*	Zebra Danio	Anju	Tiny	R
74		*Devario aequipinnatus*	Giant Danio	Chhebli	Small	R
75		*Devario anomalus*			Small	R

	Family	Species	English name	Bengali name	Type of fish	Habitat
76		*Devario devario*	Sind Danio	Debari	Small	R
77		*Esomus danricus*	Flying Barb	Darkina	Small	R-E
78		*Esomus lineatus*	Striped Flying Barb	Darkina	Tiny	R-E
79		*Rasbora daniconius*	Slender Rasbora	Darkina	Small	R-E
80		*Rasbora rasbora*	Gangetic Scissortail Rasbora	Luizza Darkina	Small	R-E
81		*Garra annandalei*	Annandale Garra	Ghorpoiya	Small	R
82		*Garra gotyla*	Sucker Head	Ghorpoiya	Small	R
83		*Gibelion catla*	Catla	Catla	Large	R-E
84		*Cirrhinus mrigala*	Mrigal	Mrigel	Large	R-E
85		*Cirrhinus reba*	Reba carp	Raek	Medium	R
86		*Labeo angra*		Ranga Rui	Medium	R
87		*Labeo ariza*	Reba	Reba	Medium	R
88		*Labeo bata*	Bata	Bata	Large	R
89		*Labeo baga*		Bhangon	Medium	R
90		*Labeo baggut*		Gonia	Medium	R-E
91		*Labeo calbasu*	Orange-fin Labeo	Kahibaus	Large	R
92		*Labeo dero*	Kalabans	Kursa	Medium	R
93		*Labeo dyocheilus*		Ghora Machh	Large	R
94		*Labeo fimbriatus*	Fringed-lipped Carp		Large	R
95		*Labeo gonius*	Kuria Labeo	Ghora	Large	R
96		*Labeo nandina*	Kulta Labeo	Nandina	Large	R
97		*Labeo pangusia*		Baitka	Large	R
98		*Labeo rohita*	Rohu	Rui	Large	R-E
99		*Tor putitora*	Putitor Mahseer	Mohashol	Large	R
100		*Tor tor*	Mahseer	Mohasheer	Large	R
101		*Neolissochilus hexagonolepis*	Copper Mahseer		Large	R R
102		*Oreichthys cosuatis*	Kosuati Barb	Kosuati	Small	R
103		*Osteobrama cotio*		Dhela	Small	R
104		*Osteochilus hasseltii*	Silver Sharkminnow		Medium	R
105		*Puntius chola*	Swamp Barb	Chala Punti	Small	R
106		*Puntius conchonius*	Rosy Barb	Kanchon Punti	Small	R
107		*Puntius gelius*	Golden Barb	Jeli Punti	Tiny	R
108		*Puntius guganio*	Glass Barb	Mola Punti	Small	R
109		*Puntius phutunio*	Spattedtail Barb	Phutani Punti	Small	R
110		*Puntius puntio*	Puntio Barb	Punti	Small	R
111		*Puntius sarana*	Olive Barb	Sar Punti	Large	R-E
112		*Puntius sophore*	Pool Barb	Bhadi Punti	Medium	R
113		*Puntius terio*	Onespot Barb	Teri Punti	Small	R
114		*Puntius ticto*	Ticto Barb	Tit Punti	Small	R
115		*Raiamas bola*	Trout Barb	Bhol	Large	R
116		*Raiamas guttatus*	Burmese Trout	Bhol	Medium	R
117	Psilorhynchidae	*Psilorhynchus balitora*	Balitora Minnow	Balitora	Small	R
118		*Psilorhynchus gracilis*	Rainbow Minnow	Balitora	Small	R
119		*Psilorhynchus rahmani*			Small	R
120		*Psilorhynchus sucatio*	River Stone Carp	Titari	Small	R
		Order$_6$ Siluriformes (59 fishes)				
121	Amblycipitidae	*Amblyceps laticeps*	Indian Torrent Catfish		Small	R
122		*Amblyceps mangois*	Indian Torrent Catfish		Small	R
123	Ariidae	*Arius gagora*	Engraved Catfish		Large	E R

	Family	Species	English name	Bengali name	Type of fish	Habitat
124		*Nemapteryx caelata*	Thickspined Catfish	Kata	Large	E-R
125		*Nemapteryx nenga*	Gagora Catfish	Gagla	Medium	E-R
126		*Batrachocephalus mino*	Beardless Sea Catfish	Katabukha	Medium	E-R
127		*Osteogeneiosus militaris*	Soldier Catfish	Apuiya	Large	E-R
128	Bagridae	*Batasio batasio*		Tengra	Small	R
129		*Batasio tengana*		Tengra	Small	R
130		*Hemibagrus menoda*	Menoda catfish	Ghagla	Large	R
131		*Mystus armatus*	Kerala Mystus	Tengra	Medium	R-E
132		*Mystus bleekeri*	Day's Mystus	Golsa Tengra	Medium	R
133		*Mystus cavasius*	Gangetic Mystus	Kabasi Tengra	Medium	R-E
134		*Mystus gulio*	Long Whiskers Catfish	Nuna Tengra	Large	E-R
135		*Mystus tengara*	Pyjama Catfish	Bujuri Tengra	Small	R
136		*Mystus vittatus*	Striped Dwarf Catfish	Tengra	Medium	R-E
137		*Rama chandramara*	Hummingbird Catfish	Gura Tengra	Small	R
138		*Rita rita*	Whale Catfish	Rita	Large	R-E
139		*Sperata aor*	Long Whiskered catfish	Air	Large	R-E
140		*Sperata seenghala*	Giant River Catfish	Guizza Air	Large	R-E
141	Chacidae	*Chaca chaca*	Squarehead Catfish	Chaka	Medium	R
142	Clariidae	*Clarias batrachus*	Walking Catfish	Magur	Medium	R-E
143	Erethistidae	*Conta conta*	Conta Catfish	Kutakanti	Small	R
144		*Erethistes pusillus*		Kutakanti	Tiny	R
145		*Laguvia shawi*		Kani Tengra	Tiny	R
146		*Laguvia ribeiroi*	Painted Catfish	Kani Tengra	Small	R
147	Heteropneustidae	*Heteropneustes fossilis*	Stinging Catfish	Shing	Medium	R-E
148	Olyridae	*Olyra kempi*			Medium	R
149	Pangasidae	*Pangasius pangasius*	Yellowtail Catfish	Pangas	Large	R-E
150	Plotosidae	*Plotosus canius*	Gray Eel Catfish	Kain Magre	Large	E-R
151	Schilbeidae	*Ailia coila*	Gangetic Ailia	Kajoli	Small	R-E
152		*Ailia punctata*	Jamuna Ailia	Kajoli	Small	R-E
153		*Clupisoma garua*	Garua Vacha	Ghaura	Large	R-E
154		*Eutropiichthys murius*	Murius Vacha	Muri Bacha	Medium	R
155		*Eutropiichthys vacha*	Batchwa Vacha	Bacha	Large	R-E
156		*Pseudeutropius atherinoides*	Indian Potasi	Batasi	Small	R-E
157		*Silonia silondia*	Silond Catfish	Shilong	Large	R-E
158	Siluridae	*Ompok bimaculatus*	Butter Catfish	Kani Pabda	Large	R-E
159		*Ompok pabda*	Pabdah Catfish	Pabda	Medium	R
160		*Ompok pabo*	Pabo Catfish	Modhu Pabda	Medium	R
161		*Pterocryptis gangelica*			Medium	R
162		*Wallago attu*	Freshwater Shark	Boal	Large	R-E
163	Sisoridae	*Bagarius bagarius*	Dwarf Goonch	Baghair	Large	R-E
164		*Bagarius yarrelli*	Goonch	Baghair	Large	R-E
165		*Gagata cenia*	Clown Catfish	Gang Tengra	Medium	R-E
166		*Gagata gagata*	Yellow Spotted Trevally	Gang Tengra	Medium	R-E

	Family	Species	English name	Bengali name	Type of fish	Habitat
167		*Gagata youssouft*	Indian Gagata	Gang Tengra	Small	R E
168		*Gogangra viridescens*	Huddah Nangra	Gang Tengra	Small	R E
169		*Glyptothorax cavia*	Sisorid Torrent Catfish	Kani Tengra	Medium	R
170		*Glyptothorax telchitta*	Sisorid Torrent Catfish	Dhal Magur	Small	R
171		*Glyptothorax sp.* (Koilla Khal)			Small	R
172		*Glyptothorax sp.* (Jagat River)			Small	R
173		*Hara hara*	Moth Catfish	Kutakanti	Small	R
174		*Hara jerdoni*	Asian Stone Catfish	Kutakanti	Tiny	R
175		*Nangra bucculenta*		Gang Tengra	Tiny	R
176		*Nangra nangra*		Gang Tengra	Tiny	R
177		*Nangra ornata*		Gang Tengra	Tiny	R
178		*Pseudecheneis sulcata*	Sucker Throat Catfish		Tiny	R
179		*Sisor rabdophorus*	Whiptail Catfish	Chenua	Medium	R
		Order$_7$ Cyprinodontiformes (1 fish)				
180	Aplocheilidae	*Aplocheilus panchax*	Blue Panchax	Kanpona	Tiny	R E
		Order$_9$ Syngnathiformes (3 fishes)				
181	Syngnathidae	*Ichthyocampus carce*	Freshwater Pipefish	Kumirer Khil	Small	R E
182		*Microphis cuncalus*	Crocodile-tooth Pipefish	Kumirer Khil	Small	R E
183		*Microphis deocata*	Deocata Pipefish	Kumirer Khil	Small	R E
		Order$_9$ Synbranchiformes (6 fishes)				
184	Synbranchidae	*Monopterus cuchia*	Mud Eel	Kuchia	Large	R E
185		*Ophisternon bengalense*	Bengal Eel	Bamos	Large	R E
186	Mastacembelidae	*Mastacembelus armatus*	Zig Zag Eel	Baim	Large	R E
187		*Macrognathus aculeatus*	Lesser Spiny Eel	Tara Baim	Medium	R E
188		*Macrognathus aral*	One-stripe Spinyeel	Tara Baim	Medium	R E
189		*Macrognathus pancalus*	Barred Spiny Eel	Guchi	Medium	R E
		Order$_9$ Perciformes (87 fishes)				
190	Ambassidae	*Ambassis nalua*	Scalloped Perchlet	Nalua Chanda	Small	R E
191		*Chanda nama*	Elongate Glass Perchlet	Chanda	Small	R E
192		*Parambassis ranga*	Indian Glassy Fish	Ranga Chanda	Small	R E
193		*Parambassis lala*	Highfin Glassy Perchlet	Lal Chanda	Tiny	R E
194		*Pseudambassis baculis*	Himalayan Glassy Perchlet	Phopa Chanda	Tiny	R E
195	Anabantidae	*Anabas cobojius*	Gangetic Koi	Koi	Medium	R
196		*Anabas testudineus*	Climbing Perch	Koi	Medium	R
197	Badidae	*Badis badis*	Blue Perch	Napit Koi	Tiny	R
198		*Badis chittagongis*	Blue Perch	Napit Koi	Tiny	R
199	Centropomidae	*Lates calcarifer*	Giant Perch	Bhetki	Large	E-R
200	Channidae	*Channa barca*	Barca Snakehead	Pipla	Large	R



	Family	Species	English name	Bengali name	Type of fish	Habitat
201		*Channa gachua*	Dwarf Snakehead	Cheng	Medium	R
202		*Channa marulius*	Great Snakehead	Gojar	Large	E R
203		*Channa orientalis*	Walking Snakehead	Raga	Medium	E R
204		*Channa punctata*	Spotted Snakehead	Taki	Medium	E R
205		*Channa striata*	Snakehead Murrel	Shol	Large	E R
206	Datnioididae	*Datnioides polota*	Four-banded Tigerfish	Rekha	Medium	E R
207	Eleotridae	*Butis butis*	Duckbill Sleeper	Kuli	Small	E R
208		*Butis melanostigma*	Black-spotted Gudgeon	Kalo Baila	Medium	E R
209		*Eleotris fusca*	Dusky Sleeper	Bhut Baila	Medium	E R
210		*Eleotris lutea*	Lutea Sleeper	Kuli	Small	E R
211	Gobiidae	*Acentrogobius caninus*	Tropical Sand Goby	Nuna Baila	Small	E R
212		*Acentrogobius cyanomos*		Nuna Baila	Small	E R
213		*Acentrogobius viridipunctatus*	Spotted Green Goby	Nuna Baila	Small	E R
214		*Apocryptes bato*		Dali Chewa	Medium	E R
215		*Awaous grammepomus*	Scribbled Goby	Bele	Small	E R
216		*Awaous guamensis*	Pacific River Goby	Baila	Small	E R
217		*Boleophthalmus boddarti*	Boddarts Goggle-eyed Goby	Dahuk	Small	E R
218		*Brachygobius nunus*	Bumblebee Goby	Nuna Baila	Tiny	E R
219		*Eugnathogobius oligactis*	Tiger Goby		Tiny	E R
220		*Glossogobius giuris*	Tank Goby	Bele	Medium	E R
221		*Gobiopsis macrostoma*	Longjaw Goby	Chuna Bele	Small	E R
222		*Gobiopterus chuno*	Glass Goby	Raja Chewa	Tiny	E R
223		*Odontamblyopus rubicundus*	Rubicundus Eelgoby	Nuna Baila	Medium	E R
224		*Oxyurichthys microlepis*	Maned Goby	Dali Chewa	Small	E R
225		*Parapocryptes batoides*		Dahuk	Medium	E R
226		*Periophthalmodon schlosseri*	Giant Mudskipper	Dahuk Chewa	Medium	E R
227		*Periophthalmus barbarus*	Atlantic Mudskipper	Dahuk	Small	E R
228		*Pseudapocryptes elongatus*	Pointed-tailed Goby	Raja Chewa	Medium	E R
229		*Scartelaos histophorus*	Walking Goby	Sada Chewa	Small	E R
230		*Stigmatogobius sadanundia*	Spotted Goby	DetoChanda	Small	E R
231		*Taenioides buchanani*	Burmese Gobyeel	Tak Chanda	Medium	E R
232		*Taenioides cirratus*	Bearded Eel Goby	Thutni Chanda	Medium	E R
233		*Trypauchen vagina*	Burrowing Goby	Tak Chanda	Medium	E R
234	Lenognathidae	*Gazza minuta*	Toothed Ponyfish	Tak Chanda	Small	E R
235		*Secutor ruconius*	Pignosed Ponyfish	Samudra Koi	Small	E R
236		*Secutor insidiatoe*	Slenderbarred Ponyfish	Bata	Small	E R
237		*Leiognathus bindus*	Orangefinned Ponyfish	Bata	Small	E R
238		*Leiognathus equulus*	Greater Ponyfish	Bata	Small	E R
239	Lobotidae	*Lobotes surinamensis*	Atlantic Tripletail	Bata	Large	E R
240	Mugilidae	*Liza parmata*	Broad-mouthed Mullet	Parse	Medium	E R

	Family	Species	English name	Bengali name	Type of fish	Habitat
241		*Liza parsia*	Gold-spot Mullet	Parse	Small	E R
242		*Liza subviridis*	Greenback Mullet	Bata	Large	E R
243		*Mugil cephalus*	Striped Mullet	Bhangon Bata	Large	E R
244		*Rhinomugil corsula*	Corsula Mullet	Khorsula	Large	E R
245		*Sicamugil cascasia*	Yellowtail Mullet	Kachki Bata	Small	R
246	Nandidae	*Nandus nandus*	Gangetic Leaffish	Bheda	Small	R E
247	Osphronemidae	*Colisa chuna*	Honey Gourami	Chuna Kholisa	Tiny	R
248		*Colisa fasciata*	Banded Gourami	Kholisa	Small	R
249		*Colisa labiosa*	Thick-lipped Gourami		Small	R
250		*Colisa lalia*	Dwarf Gourami	Lal Kholisa	Small	R
251		*Ctenops nobilis*	Frail Gourami	Neftani	Small	R E
252		*Pseudosphromenus cupanus*	Spiketail Paradisefish	Koi	Small	R E
253		*Trichopsis vittata*	Croaking Gourami		Small	R
254	Platycephalidae	*Platycephalus indicus*	Bartail Flathead	Mur Baila	Large	E R
255	Polynemidae	*Eleutheronema tetradactylum*	Four Finger Threadfin	Taila	Large	E R
256		*Leptomelanosoma indicum*	Indian Tasselfish	Lakhua	Large	E R
257		*Polydactylus sexfilis*	Sixfinger Threadfin	Son a Taila	Large	E R
258		*Polynemus paradiseus*	Paradise Threadfin	Taposhi	Medium	E R
259	Scatophagidae	*Scatophagus argus*	Spotted Scat	Bistara	Medium	E R
260	Sciaenidae	*Dendrophysa russelii*	Goatee Croaker	Goti Poa	Medium	E R
261		*Johnius coitor*	Coitor Croaker	Koitor	Medium	E R
262		*Johnius gangeticus*	Gangetic Bola	Bata	Small	E R
263		*Johnius vogleri*	Sharpnose Hammer Groaker	Poa	Medium	E R
264		*Macrospinosa cuja*	Cuja Bola	Kuizza Poa	Large	E R
265		*Otolithoides pama*	Pama Croaker	Poa	Large	E R
266		*Panna microdon*	Panna Croaker	Poa	Medium	E R
267		*Pterotolithus maculatus*	Botched Tigertoothed Croaker	Goti Poa	Large	E R
268	Sillaginidae	*Sillaginopsis panijus*	Flathead Sillago	Tular Dandi	Large	E R
269	Sparidae	*Acanthopagrus latus*	Yellow Seabream	Datina	Large	E R
270	Stromatidae	*Parastromateus niger*	Black Pomfret	Rup Chanda	Large	E R
271		*Pampus argenteus*	Silver Pomfret	Pholi Chanda	Large	E R
272		*Pampus chinensis*	Chinese Pomfret	Rup Chanda	Large	E R
273	Terapontidae	*Terapon jarbua*	Jarbua Terapon	Borguni	Medium	E R
274	Toxotidae	*Toxotes chatareus*	Largescale Archerfish	Poitke	Medium	E R
275	Trichiuridae	*Eupleurogrammus muticus*	Smallhead Hairtail	Chhuri	Large	E R
276		*Lepturacanthus savala*	Savalani Hairtail	Chhuri	Large	E R
		Order$_{11}$ Beloniformes (7 fishes)				
277	Adrianichthyidae	*Oryzias caenaticus*	Spotted Ricefish	Beehi	Tiny	
278		*Oryzias dancena*	Ricefish	Beehi	Tiny	
279	Belonidae	*Xenentodon cancila*	Asian Needlefish	Kakila	Medium	
280	Hemiramphidae	*Dermogenys brachynotopterus*	Gangetic Hallbeak	Ekthuita	Small	

	Family	Species	English name	Bengali name	Type of fish	Habitat
281		*Dermogenys pusilla*	Wrestling Halfbeak	Ekthuita	Small	R.E
282		*Hyporhamphus limbatus*	Congaturi Halfbeak	Ekthuita	Small	E.R
283		*Zenarchopterus ectuntio*	Ectuntio Halfbeak	Ekthuita	Small	E.R
		Order 12 Pleuronectiformes (7 Fishes)				
284	Cynoglossidae	*Cynoglossus arel*	Largescale Tonguesole	Kukurjib	Medium	E.R
285		*Cynoglossus cynoglossus*	Bengal Tonguesole	Kukurjib	Small	E.R
286		*Cynoglossus lingua*	Long Tonguesole	Lomba Kukurjib	Medium	E.R
287		*Paraplagusia bilineata*	Doublelined Tonguesole	Duline Kukurjib	Medium	E.R
288	Paralichthyidae	*Pseudorhombus arsius*	Largetooth Sand Flounder	Serbeti	Medium	E.R
289	Soleidae	*Brachirus orientalis*	Orientalsole	Botpata	Medium	E.R
290		*Brachirus pan*	Pan Sole	Kathalpata	Small	E.R
		Order 13 Tetraodontiformes (3 Fishes)				
291	Tetraodontidae	*Chelonodon patoca*	Milkspotted Puffer	Potka	Medium	R.E
292		*Tetraodon cutcutia*	Ocellated Pufferfish	Tapa	Small	R.E
293		*Tetraodon fluviatilis*	Green Pufferfish	Potka	Medium	E.R

* Only most commonly used local names are given
** R: Live only in freshwater rivers. R-E: The major habitat is freshwater rivers but also available in coastal rivers.
E-R: The major habitat is coastal rivers but also available in freshwater rivers
A number of fishes included in the list can also be found in marine waters

The biodiversity of indigenous fishes of Bangladesh has come under grave threat in recent years. Due to manifold reasons, many species of fish are disappearing from the country's waterbodies. The day is not too far when many of our fishes will be extinct in our waters. Therefore, documenting all the indigenous fishes of the country carries an enormous value. In this treatise, we have attempted to record all the fishes documented between 1822 and the present day. The key reason for doing so is this: if we do not know what we had, how will we realize what we are loosing now and what else we are going to lose in the coming days? We believe that the checklist presented here will provoke the thought of the people of all strata - consumers, fishers, fish farmers, researchers, donors, policy makers and others, and will encourage them to come forward to find effective ways to preserve fish biodiversity - the pride, heritage and livelihood of Bangladesh - before many species are lost forever.

Laterality in foraging behavior of cuttlefish, *Sepia lycidas*

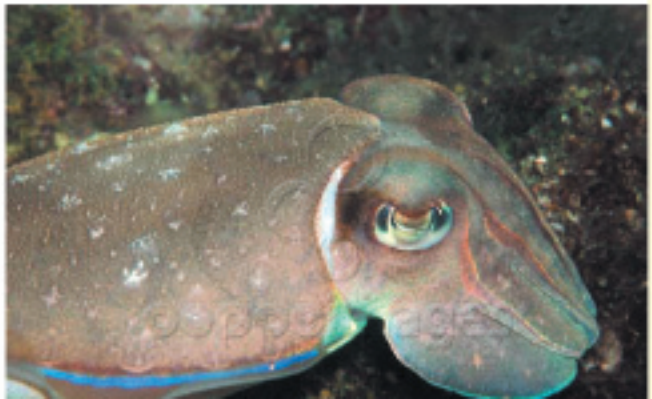
Nahid Sultana Lucky
Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh-2202
nahidlucky@yahoo.com

Laterality has now been well known in vertebrate species. It has been suggested that the structural and functional superiority of one side of the body, especially the brain, over the other are involved in several lateral behaviors, such as, foraging behavior, agonistic response, or escape behavior in vertebrates. Laterality has been present at the population level when most of the individuals in a population become specialized for a particular side, i.e. population biased either to the right or left. Individual laterality found when individuals showed half right and left biased in a population.

Recently, it has been revealed that many fish exhibit lateral dimorphism in foraging behavior, every population studied has been composed of two types of individuals; a left-dominant (called lefties) and a right-dominant (righties). The lateral dimorphism of fishes seems to be maintained by frequency-dependent natural selection through predominance of cross-predation with its prey. In this system when there is more righty predator than lefty ones, lefty prey is more exploited, because the lefty prey is poorer at dodging the attack of righty predator than that of lefty predator. As a result, righty prey may increase in a population, which ultimately leading to an increase of lefty predator than righty ones.

In invertebrates, very few examples on laterality have been reported so far, but recently increasing interest has been found in this topic (Tobo et al. 2012). In cephalopods, *Octopus vulgaris* showed lateral dimorphism in eye use. It was predicted that this lateral foraging behavior of each individual of O. vulgaris may be advantageous for the catching of prey. Another group of cephalopods, cuttlefish, also shows a lateralized behavior in approaching prey and other situations. When juvenile of European common cuttlefish, *Sepia officinalis*, attempt to attack a crab, they avoid the claws by swimming above the crab and turning around rightward or leftward to approach it from behind, although individual bias of the turning direction has not been documented for this foraging behavior.

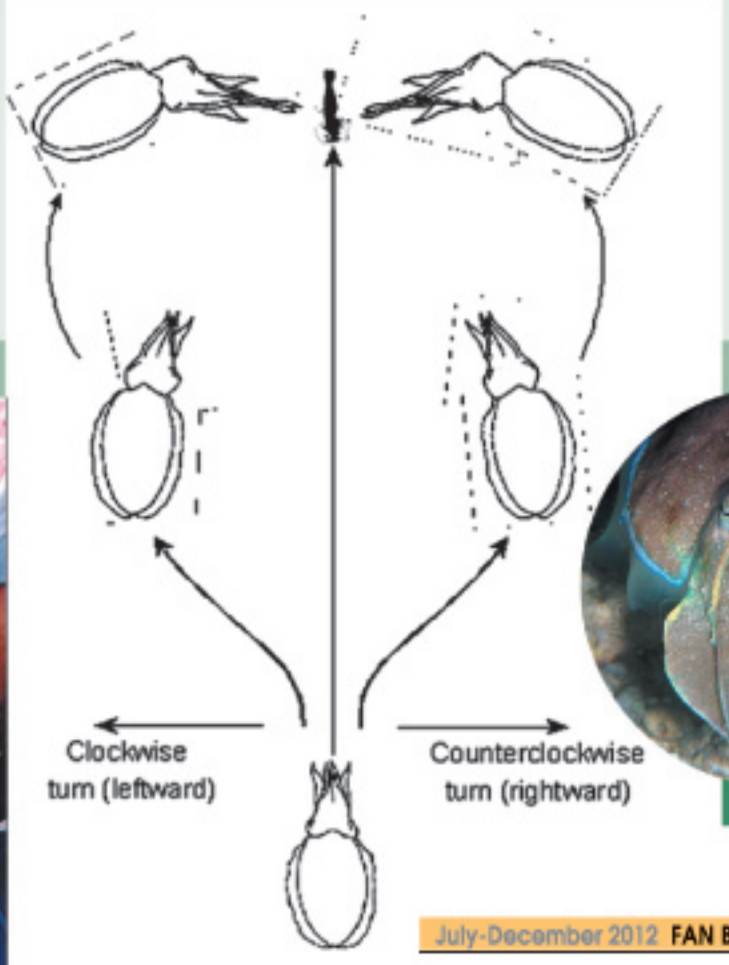
The present study demonstrates that the cuttlefish individuals have a left or right behavioral bias during their capture of a prey shrimp. The subject was kisslip cuttlefish, *Sepia lycidas* Gray 1849, a common and a large-sized (38 cm adult mantle size)



common and a large-sized (38 cm adult mantle size) univoltine cuttlefish found in littoral areas around Japan and Southeast Asia, which is available for rearing under laboratory conditions.

Foraging behavior was observed in an arena (a square glass tank, 370×400×100 mm depth) using a digital video camera. The arena was filled with filtered seawater of 5 cm depth, and the bottom was covered with a 20 mm layer of fine sand to allow the subject individuals to hide themselves. In the behavioral tests young (body length 2 to 3 cm) palaemonid shrimp, *P. pacificus*, was used as prey. In each trial, a shrimp was attached to a needle with a long shaft and was manually presented to the subject cuttlefish so the subject and shrimp were positioned face to face and at least 10 cm apart from each other. When the cuttlefish noticed the shrimp being presented face to face, it began to swim slowly and directly toward the shrimp. When reaching a distance of two to three times its body length from the prey, the cuttlefish began to turn rightward or leftward. The cuttlefish then continued to turn while keeping its head toward the prey (watching the target with both eyes), raising its arms up and eventually raising the body upward. It then took a position to the side, or sometimes diagonally, behind the prey, stretched its tentacles downward and held the abdomen of the prey, and engulfed the prey by jumping on it. This process took three to four seconds from the start of turning to the capture of the target. Thirty attacks toward the prey were recorded for each subject cuttlefish. The maximum recording time was 5 min for each observation.

Of the 35 young cuttlefish examined, 14 exhibited significant bias for clockwise (leftward) and 14 for counterclockwise (rightward) turning in foraging behavior (chi-square test, $p<0.05$). Moreover, the distribution pattern of index of behavioral laterality was bimodal, with a few exceptional individuals turning both rightward and leftward evenly. Thus, it can be said that the cuttlefish shows behavioral dimorphism in its hunting of shrimp. Behavioral dimorphism has also been found in tests examining cuttlefish behavior in turning into a T-maze and in eye use by octopuses watching subjects. The study confirms that cephalopods exhibit laterality in their foraging behavior.



Parasite corner: Spot check!

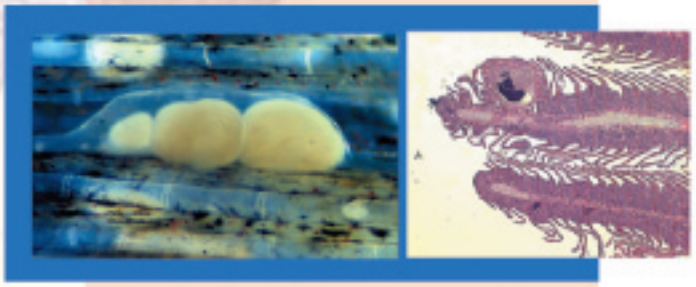
A.P. Shinn
Institute of Aquaculture, University of Stirling, Stirling, FK9 4LA, UK
aps1@stir.ac.uk

For those that manage fish, whether it be ornamentals, wild fisheries or captive held, commercially reared stock, the appearance of white spots on the body surface of freshwater fish species are an unwelcome sight. These "spots" are the parasitic stage or trophonts of the ciliate protozoan Ichthyophthirius multifiliis which, if left untreated, can cause substantial mortality in freshwater fish populations.

Commonly known as "Ich", "Itch" or plain old "whitespot", *I. multifiliis* has a low host specificity and can infect all known freshwater fish species from the arctic to the tropics. This parasite has a direct life-cycle, which is temperature dependent such that the warmer the water temperature the faster the life-cycle completes. The life-cycle comprises five stages: a parasitic trophont (1) that sits within the host's epidermis, an exiting, free-swimming protomont stage (2) that settles on the substrate to become an encysted tomocyst (3). Within the tomocyst, the parasite undergoes binary division to produce between 50-3000 tomites (4). The tomites are then released and subsequently differentiate into infective free swimming theronts (5) which must find a host within a short window of time to successfully complete the life-cycle by penetrating the epidermis and developing into the trophont stage. Host pathology occurs when a significant number of large, mature parasites, which can measure up to 1 mm in diameter, exit the fish causing respiratory stress and osmoregulatory dysfunction. High numbers exiting the gills of smaller sized fish may result in the direct mortality of fish. For those that do survive, they are prone to secondary bacterial or water mould ("fungal") infections that may increase the likelihood of mortality. Given the rapid rate of parasite proliferation, which can increase several thousand-fold with each infection cycle, the appearance of I. multifiliis trophonts on fish stock cannot be ignored and must be managed.

There are, however, relatively few effective control strategies for the management of *I. multifiliis* infections in farm, pond or open systems. The parasitic trophont stage is protected lying underneath the host surface epithelium whilst the tomocyst is protected by a resistant coat and as such, are rarely susceptible to treatment. The free-living protomont is a short-lived stage and the window for treatment is narrow (a few minutes to 3 hours). The theront stage, however, can survive for up to 92 h at low water temperatures in which it must infect a host or die from depleted energy reserves; their survival being inversely proportional to the ambient water temperature. Historically, malachite green was commonly used for the control of *I. multifiliis* and a range of other fish diseases due to its demonstrable efficacy, however, its potential harmful impacts upon human health led to its use in food fish being banned by many countries worldwide. The most commonly used approaches are 1) the use of short, daily bath treatments of 30 min-4 h for a period of 10 days in tanks or flow-through systems, or, 2) the use of a long, 7-15 day, in-bath duration treatment in pond culture, which target the free-swimming stages of the parasite (i.e. protomonts and theronts) only. This approach attempts to manage infections by reducing the number of parasites in the water column that would otherwise infect fish.

Current treatments include the use of formaldehyde, sodium chloride (salt), copper sulphate and potassium permanganate, however, a number of more environmentally friendly drugs are now under consideration (e.g. bronopol and a range of peracetic acid-based products). These treatment regimes have been comprehensively reviewed in a recent account by Picon-Camacho and colleagues (2012, *Parasitology*, 139, 149-190). Whilst a number of non-chemical management strategies for the control of *I. multifiliis* have been explored including increases in temperature (above 30°C) and in water flow rates, water filtration and mechanical removal of cysts from the bottom of culture systems, each method has its drawbacks. For the present many of these approaches are limited to tank and hatchery systems and we must wait for the development of effective management strategies for use in pond and large-scale open water systems.



Faculty of Fisheries Hajee Mohammad Danesh Science & Technology University, Dinajpur

Zannatul Ferdoushi
Faculty of Fisheries
Hajee Mohammad Danesh Science & Technology University, Dinajpur
zannatul99bd@yahoo.com

Hajee Mohammad Danesh Science & Technology University (HSTU) is the first Science and Technology University in the northern region of Bangladesh. HSTU has been established in 1999, located in the northern side of Dinajpur district. Faculty of Fisheries of HSTU is the only institute of higher education in fisheries in the northwest part of the country. The faculty has started its journey since 2005 with four departments: Fisheries Biology and Genetics, Aquaculture, Fisheries Management, and Fisheries Technology. The faculty aims to be a centre of excellence for fisheries education and research and to produce scholars for the country's economic development.

Faculty of Fisheries in HSTU is contributing in fisheries sector of the northwest part of Bangladesh. There are numerous fisheries resources in the region, and the research and education of the faculty can flourish their exploitation and better management. To date Faculty of Fisheries has successfully completed a number of researches on fish biodiversity of Northwest Bangladesh, landmark based shape analysis of *Cirrhinus reba* from different stocks, climate change impact on fisheries, limnological study on Punarbhava and Dhepa river funded by different national and international organizations. Currently some research projects on SIS and Tilapia farming in the northwest part of Bangladesh are goning on in Faculty funded by Ministry of Science and Inormation & Communication Technology and the University Grant Commission.

The mission of the Faculty of Fisheries, HSTU is to produce outstanding internationally accredited graduates in the fields of fisheries who are innovative, analytical, adaptable, with capabilities of life-long learning and research. The teachers of the faculty are committed to community service to conserve natural environment by contributing to the management, protection, and sustainable use aquatic resources in the northwest part of Bangladesh through teaching and research.

PRACTICAL ACTION
Technology challenging poverty

Practical Action, House # 12/B Road # 4
Dhanmondi R/A, Dhaka - 1209, Bangladesh

Local Knowledge Centre (Gyaner Haat): experience of Practical Action on operational model

Frauk-Ul-Islam, Saikat Shubra Aich, Kamrul Islam Bhuiyan and A.M. Samsuddula
faruk.islam@practicalaction.org.bd

Decentralsied knowledge service is vital for empowering the knowledge deprived poor people. Practical Action's knowledge management programme is more about creating the provision of contextualised and localised knowledge for the poor communities and developing a channel of reliable information and knowledge from the grassroot to policy makers about real needs for technical assistance in poverty reduction program. Aiming to create diverse entities for decentralsied knowledge service Practical Action Bangladesh promotes grassroot Knowledge Centre in various locations called Gyaner Haat. Based on its experience on working with rural technology extensionist for 10 years, rural ICT or technology centre for 4-5 years and managing farmers technical inquiry service for many years, Practical Action adapted a model of grassroot knowledge centre attached with NGOs, Union Councils and High Schools over last 3 years. This account describes experiences on operational model of knowledge centre from several Practical Action projects and one on-going action research.

With varying start-up investment cost (2-10 lakhs), a centre can run by its own if it earns 10,000-15,000 taka per month. One of the unique character of the centre is its local expert pool of around 20 self-employed rural technology extensionists linked with one self-employed knowledge entrepreneurs having one assistant in each centre for local knowledge service. They are governed by a local multi-stakeholder committee and are well-linked with Govt., other NGO and Practical Action's experts. The centre served range of farming and non-farming technology booklets, leaflets, CDs and fact sheets of local problem solving answers to its clients. It is also well-equipped with internet resources, website - www.practicalation.org and other similar websites. The operational model does not require project based support, and in long run can run independently following a cost recovery method and local institutional support. It was recorded that each Gyaner Haat responded around 1800 enquires per year, reached around 2500 households covering 15 villages. Services at the centre such as computer compose & training, digital photo printing, knowledge material distribution, audio-visual show, distribution of various Govt. forms, photocopy was found useful. However, slow internet connectivity coupled with poor electricity supply was the key constraint.

The Gyaner Haat was capable to serve mostly low and medium well-being category people, however, didn't completely exclude the richer.

Finally it was learnt how knowledge worked for its clients. It was found that only advice has less to do with the knowledge seekers as there is scarcity of necessary inputs and lack of skill and services to act. Therefore, an effective working model combining with advice (information, knowledge), input (e.g. quality seed, vaccine) and service (pushing vaccine, animal treatment) made a big difference in knowledge services. Sustainability of such centre lies with the capacity of local drivers, suitable legal and institutional arrangement and local ownership of the centre. Subsidy may require running such centre in very remote locations.

PRACTICAL ACTION
Technology challenging poverty

Transforming lands, Transforming lives

Sandbar Cropping:

An appropriate solution for millions living on the edge of mighty rivers in Bangladesh

AZM Nazmul Islam Chowdhury and Nirmal Chandra Bepary
nazmul@practicalaction.org.bd.

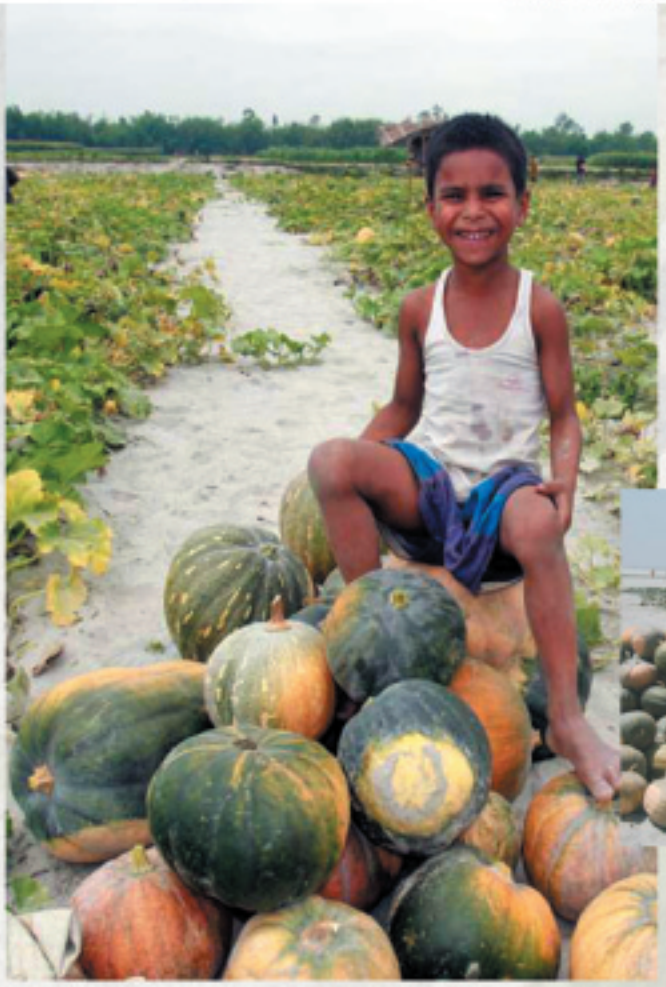
Agriculture production in barren and unproductive sand bar is an innovative technology for the river eroded communities. The technology has been developed initially in 2005 and tested by Practical Action in Gaibandha in the north-west Bangladesh. The initiative has shown very significant impact on the displaced communities in terms of food security, improved income and alternative risk management. Now the proven technology could be an opportunity for many millions of displaced communities living on the edge of the mighty rivers at home in Bangladesh and abroad.

Agriculture production in barren sandbar is an effective low cost technology for the river eroded communities, whose villages and farms have been lost through river erosion in northwest Bangladesh and who are forced to live illegally on flood protection embankments. The technology has been developed through series of action research since 2005-2009 in Gaibandha as a part of Asia-pacific (APFED) gold award wining Disappearing Lands Project of Practical Action Bangladesh. The end results of this farm based trial has shown highly significant impacts on the resource poor displaced communities providing opportunity for food production in barren lands, handsome income, asset generation, increased consumption & nutrition and alternative risk management during lean season.

Every year after monsoon, large sandy islands appear in the major rivers of northwest Bangladesh. The 'lands' are common property resources including privately owned lands and until now, have not been used for any productive purpose. The project has successfully demonstrated that the growing of pumpkins in small compost pits dug into the sand is not only possible but profitable as well. Since its initiation in November 2005, under Disappearing lands project ,3,273 beneficiaries have produced 33,608 metric tons (from 791 ha. land using 663,928 pits) of pumpkins worth £2.2 millions net return based on local market value (estimated value at urban market £5.57 millions). The average net return per beneficiaries in four years stood £490 within 5-6 month in each year. The project monitored a representative sample of household's incomes over the period and calculated cost benefit ratios on a regular basis, which averaged a staggering 1:11.5.

The sandbars that emerge each year as the rivers recede are not stable enough to support natural vegetative growth and remain barren until the river rises again. By digging small pits and lining these pits with compost, the project has demonstrated that these areas can be made productive. Large scale irrigation is not necessary as the sand bars are usually close to the river and watering is done by hand in some areas, where water channel is active or water can harvest easily from underground as the layer is very close to the surface. Generally, no pesticides or huge application of inorganic inputs are necessary.

The sandbar cropping measures its achievements by the levels of adoption of the technology by traineess and the spread of technology to new areas. No credit was supplied to subsidize production system, however, minimum inputs i.e. seeds and quick



composts/fertilizers were provided to the farmers to run the demonstration. The current project is supporting only extreme poor households with little different approach based on asset transfer mode of project operation (providing full costs demonstration), aiming to help extreme poor household to come out from poverty.

Based on its multidimensional impacts on the poorer livelihoods, the technology is replicating in wider areas in North-west and could replicate in similar geographical environment in Bangladesh to benefit wide range of people in the production, processing and marketing chain. The pumpkins produced on the sandbars can be stored in people's houses for up to 12-15 months and therefore, greatly assists poor households from both income generation and food security perspectives. In addition to the pumpkins, the twigs and flowers of the plant can be used for food, and the entire plant fed to livestock at the end stage, or composted for the following year.

Sandbar cropping transforms a barren landscape and the 'mini deserts' into productive green fields which also supports a wide range of insect, birds and other small animal species by creating suitable micro-habitats.

Bangladesh is desperately short of arable lands and struggles to feed its growing population. The technology would seem to have a much wider application in other dry areas and could even become an important coping strategy in some areas adversely affected by climate change.

The sandbar technology appears to be of low risk yet shows an impressive financial return. This is an effective development idea that could replicate to use barren resources and to benefit millions in the near future by formulating appropriate policy to support landless poor struggling for survival below poverty line in fragile environment.

Based on the huge success on food production in sandy barren lands by resource poor erosion affected displaced communities in Gaibandha, during 2004 - 2009 funded by Big Lottery UK, following the funding by GoB-DFID shiree - the activities of the Asia Pacific gold award winning project has been started in much wider scale under a new project namely "Pathways From Poverty" in four erosion prone districts of northwest Bangladesh.

INNOVISION Consulting Private Limited
endless possibilities

Innovision

Innovision Consulting Private Limited works in the field of economic development for poverty alleviation. Headquartered in Dhaka, Bangladesh, Innovision Consulting provides research and management services to development projects, national and international NGOs and the development partners to design, manage, monitor, evaluate and communicate market based interventions that increase income of the poor and creates job opportunities in industrial and agricultural sectors or value chains. With 22 full time professionals, more than 30 part time researchers and consultants, internet based office set-up and logistics support, Innovision is capable of moving our professionals across the country at any given time.

Innovision is a leading consulting firm in Bangladesh specializing in the holistic market based approach also called M4P. The Market Development Approach or Making Markets Work for the Poor (M4P) provides the government and the agencies a way to promote shared or inclusive growth and achieve sustained impact on poverty by changing how market systems operate. M4P focuses on the underlying causes or failures that prevent market systems from working for the benefit of poor people. It is a comprehensive approach with application in both economic and social fields.

Innovision has specialized experience in Bangladesh fisheries sector from the implementation of two previous value chain strengthening projects- Market Development of Madaripur and Shariatpur culture fish sector' and 'Stimulating Growth in Culture of Tilapia, Pangus & Koi and Promoting their Forward Market Access (in collaboration with BFRF), both funded by Katalyst.

In implementation of these projects, Innovision has gained thorough knowledge about the fisheries sector, about the actors and about support market functions and regulatory issues surrounding the sector. A strong network have been established with the fish farmers, hatchery owners, nursery owners, processors, marketing intermediaries and government officials, which will help us revealing further information required in the sector.

Innovision's clients include- ACDI/VOCA, Action for Enterprise (AFE), Bangladesh Fisheries Research Forum (BFRF), CIMMYT, GRM International, Intercooperation, International Development Enterprise (IDE), International Finance Corporation (IFC), International Labour Organization (ILO), Malaria Consortium, Montrose Africa, Opportunities Unlimited, Practical Action, Project Concern International (PCI), Small Micro Enterprise Promotion Service (SMEPS), Swiss Agency for Development and Cooperation (SDC), Swisscontact, Traidcraft Exchange, United Nations Development Programme (UNDP), World Food Programme (WFP), World Vision, WorldFish Center, Bangladesh Furniture Industries Owners Association (BAFIOA), Chars Livelihoods Programme (CLP), Development Wheel (DeW), Giant Agro Processing Limited, Hatil Complex Limited, Palli Karma Shahayak Foundation (PKSF), Swisscontact-Katalyst and others.

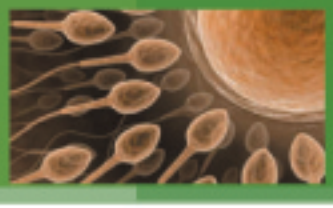
The List of some of the best Known Journals with impact factor's in fishereis & aquaculture and pertinent aspects

The Journal List

Advances in Water Resources
Agricultural Systems
Ambio - A Journal of the Human Environment
American Zoologist
Animal Conservation
Animal Genetics
Animal Reproduction Science
Aquacultural Engineering
Aquaculture
Aquaculture International
Aquaculture Nutrition
Aquaculture Research
Aquatic Botany
Aquatic Conservation: Marine and Freshwater Ecosystems
Aquatic Ecology
Aquatic Ecosystem Health and Management
Aquatic Ecosystems
Aquatic Living Resources
Aquatic Sciences
Aquatic Toxicology
Australian Journal of Agricultural and Resource Economics
Canadian Journal of Fisheries and Aquatic Sciences
Coastal Management
Conservation Biology
Cryobiology
Diversity & Distributions
Ecology of Freshwater Fish
Environmental Biology of Fishes
Environmental Pollution
Estuarine, Coastal and Shelf Science
Fish & Shellfish Immunology
Fish Physiology
Fish Physiology and Biochemistry
Fish and Fisheries
Fisheries

Fisheries Oceanography
Fisheries Research
Fisheries Management and Ecology
Fishery Bulletin
Folia Parasitologica
Journal of Northwest Atlantic Fishery Science
Journal of Fish Biology
Lakes and Reservoirs: Research and Management
Land and Marine Hydrogeology
Limnology
Limnology and Oceanography
Marine and Coastal Fisheries: Dynamics, Management, and Ecosystem Science
Marine and Freshwater Research
Marine Biology
Marine Biotechnology
Marine Chemistry
Marine Ecology
Marine Fisheries Review
Marine Policy
Food Security
Food & Nutrition Bulletin
Freshwater Biology
Functional Ecology
Genes & Genomics
Hydrobiologia
Invertebrate Biology
Journal of Animal Ecology
Journal of Applied Aquaculture
Journal of Applied Ichthyology
Journal of Aquaculture Economics and Management

The Journal List



Journal of Aquaculture Research & Development
Journal of Aquatic Animal Health
Journal of Aquatic Ecosystem Stress and Recovery
Journal of Biology
Journal of Coastal Conservation
Journal of Evolutionary Biology
Journal of Experimental Animal Science
Journal of Experimental Biology
Journal of Experimental Marine Biology and Ecology
Journal of Experimental Zoology
Journal of Fish Disease
Journal of Freshwater Ecology
Journal of Ichthyology
Journal of Marine Biotechnology
Journal of Marine Research
Journal of Marine Science and Technology
Journal of Marine Systems
Journal of Phycology
Journal of Plankton Research
Journal of Sea Research
Journal of Shellfish Research
Journal of Sustainable Agriculture
Journal of the Marine Biological Association of the United Kingdom
Journal of Theoretical Biology
Journal of Tropical Ecology
Journal of World Aquaculture Society
Journal of Zoology
Journal for Parasitology
Nature
North American Journal of Aquaculture
North American Journal of Fisheries Management
Ocean & Coastal Management
Phycological Research
Parasitology
Reviews in Fish Biology and Fisheries
Reviews in fisheries science
Systematic Zoology
Transactions of the American Fisheries Society
Wetlands Ecology and Management
Zoological Journal of the Linnaean Society
Zoological Science
Zoological Studies
Zoology

ELSEVIER

Fish File

Photo & Morphometrics Mostafa A R Hossain
Text www.fishbase.org & FMBC

Actinopterygii
Siluriiformes
Sisoridae
Sisor rabdophorus Hamilton, 1822

Synonum: *Sisor rhabdophorus, Sissor rhabdophorus*

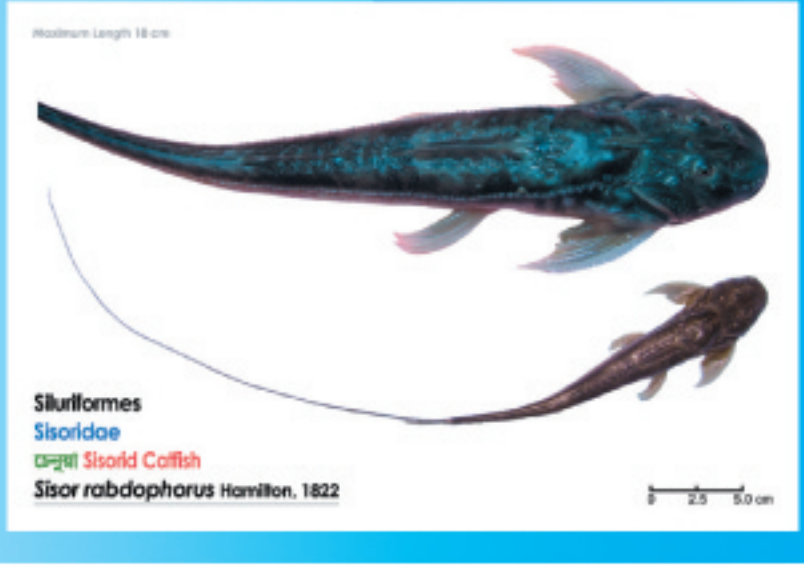
Common Name: Whiptail Catfish

Local name: Chenua, Sissor

Collection: The Brahmaputra, Mymensingh, March 04, 2011

Preserved in Fish Museum & Biodiversity Center, BAU, Mymensingh, Bangladesh

Biodiversity Status : Critically Endangered



Key character: Elongated, tapering body. Dorsal side behind dorsal fins and the dorsal base covered by plate like scales. 12 osseous rings at the posterior part of the body like a pipe fish or crocodile. Upper caudal ray greatly extended, longer than main body length.

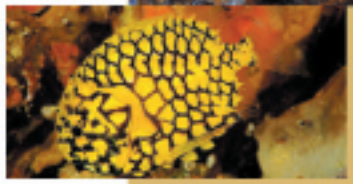
Total length: 10.0 cm (standard length)

Natural habitat: Freshwater, demersal, potamodromous. Live in the sandy bottom of the hilly rivers, rivulets with strong currents. Occasionally caught. Found in the rivers of Jaflong area, Sylhet, the Mohananda and Kakra of Dinajpur, and the Brahmaputra, Kangsa and Someswari of Mymensingh. Also available in India, Nepal and Pakistan.

Morphometric	cm	Meristic	Number
TL	-	D	I/6
SL	10.0	P1	I/8
HL	4.0	P2	7
EL	-	A	6
BD	2.5	C	11

Fishes of the World

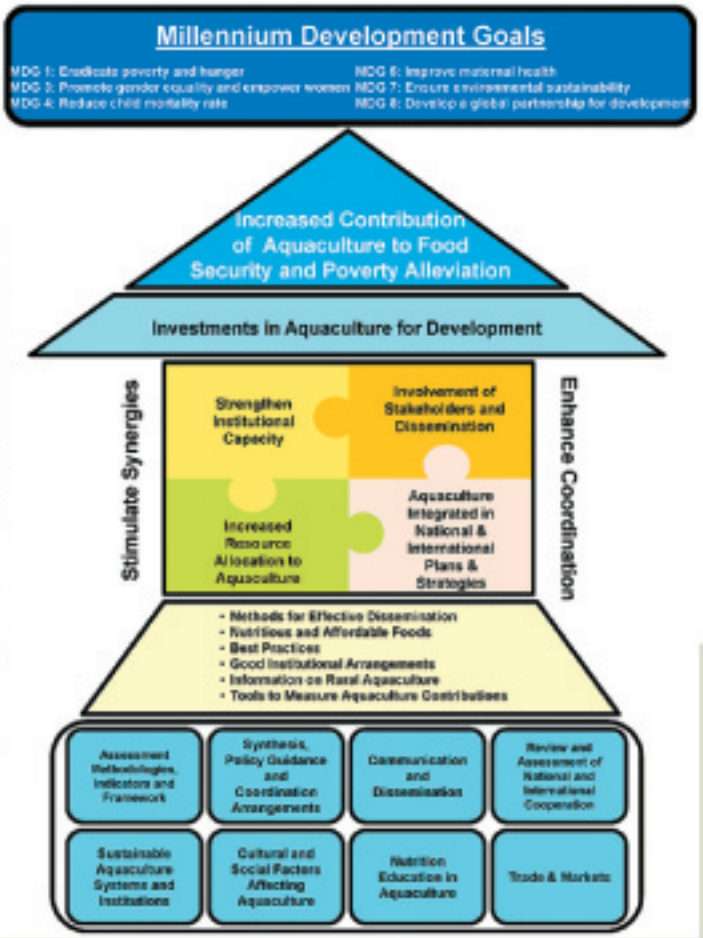
This pineapple fish owes its name to its shape and its large scales with black margins. The background colour varies from yellow to orange. Generally the pineapple fishes are observed in the deep sea cave hiding with a number of Roughies (deep sea perches). Some of the pineapple fish are often seen by divers on shallow coastal reefs, but is caught in deeper offshore waters up to 250 m deep.



Two common pineapple fish are - *Monocentris japonicus* and *Cleidopus gloriamaris*. Most of the pineapple fish have powerful spines on both the dorsal and ventral surface that can lock in position and give them a formidable defense. This enables the fishes to wedge into rock crevices.

On the lower side of the jaw, a light organ is situated with bio-luminescent bacteria that gives off an orange colour in the daytime and a weak bluish-green light at night. The fish is capable of turning its light on and off by covering up the light organ with a skin-fold as it wishes. The nocturnal fish venture out into open water to feed on small fish and crustaceans (shrimps) that are attracted to its shimmering light. The ocean depths are full of creatures that adapt to extreme surroundings such as the lack of light and the bio-luminescence is therefore extremely helpful as a way of recognizing animals of the same species as well as for nuptial display and capturing prey. The pineapple fish is a popular aquarium species.

AFSPAN



FAO-BFRF Collaboration
AFSPAN

AFSPAN Project is a three-year initiative to improve our understanding of the role of aquaculture in food security, poverty alleviation and human nutrition. The project is developing new methodologies to quantify the impact of aquaculture in developing nations and low income food deficit countries. It is funded by the European Commission's 7th Framework Programme.

Aquaculture is widely considered an important component for enhancing food security, income and nutrition. However, little information is available concerning the direct and indirect impacts of aquaculture on food security and poverty alleviation in most developing countries.

Strengthening the knowledge base surrounding aquaculture and food and nutrition security through the AFSPAN Project will provide the evidence upon which sound resource allocation and strategies can be based. It will enable the efficient planning, coordination and implementation of research and development programmes supporting the sustainable expansion of aquaculture, and increasing its impact on food security and poverty alleviation.

The project is being implemented by a nymber of partners including 11 from selected low income food deficit countries, 3 EU partners, and 3 international organisations. Project partner countries were selected based on varied human development conditions and national level efforts in including aquaculture for improving national food security and alleviating poverty. They represent all major aquaculture regions where aquaculture has made a major contribution to the national economy, involves large numbers of small-scale aquaculture farmers, and with significant international trade of fish and fisheries products.

The results of the project will be brought to the attention of countries and development partners, particularly the EU. The outputs will help low income food deficit countries and various development partners to improve efficiency and coordination in development initiatives focused on aquaculture as a means of promoting food security and poverty alleviation.

The first meeting of the AFSPAN Project has concluded in Penang, Malaysia, hosted by the WorldFish Center from 10 to 13 September 2012. The inception workshop was convened to allow technical and country partners to discuss the work programme, identify in-country data gathering requirements and to develop implementation strategies for the project.

FAO-BFRF Collaboration AFSPAN

The partners

Food and Agriculture Organisation of the United Nations	Dr Rohana Subasinghe
WorldFish Center	Dr Shakuntala Haraksingh Thilsted
Institute of Development Studies	Dr Chris Bene
Centre of the Economics and Management of Aquatic Resources University of Portsmouth, UK	Professor Trond Bjorndal
Department of Human Nutrition, University of Copenhagen, Denmark	Dr Nanna Roos
University of Stavanger, Norway	Dr Frank Asche
Network of Aquaculture Centres in Asia-Pacific	Dr Simon Wilkinson
Bangladesh Fisheries Research Forum, Bangladesh	Professor Mostafa A R Hossain
Freshwater Fisheries Research Center, Chinese Academy of Fishery Sciences, China	Professor Yuan Xinhua
National Fisheries Development Board India	Dr Vishnu Bhat
Aquaculture Department, Southeast Asian Fisheries Development Center, The Philippines	Dr Felix G. Ayson
Research Institute for Aquaculture No. 1, Vietnam	Dr Phan Thi Van
Fisheries Department, Ministry of Fisheries Development, Kenya	Ms. Beatrice Nyandat
Department of Food Science and Technology, Makerere University, Uganda	Professor John H. Muyonga
School of Agricultural Sciences, University of Zambia, Zambia	Dr Drinah Banda Nyirenda
Marine Science Institute, Federal University of Ceara, Brazil	Dr Luis Parente Maia
School of Marine Sciences, Pontificia Universidad Catolica de Valparaiso, Chile	Professor Exequiel P. Gonzalez
Investigation Center, Universidad Centro Americana, Nicaragua	Carlos Jose Rivas Leclair

The project is being implemented through a set of nine work packages investigating different aspects including the role of aquaculture systems, social and cultural issues, nutrition, trade and markets and international cooperation.

1. **Project management**
2. **Assessment methodologies, indicators and framework**
3. **Review and assessment of national and international cooperation**
4. **Sustainable aquaculture systems and institutions**
5. **Social and cultural factors affecting aquaculture**
6. **Nutrition education in aquaculture**
7. **Trade and markets**
8. **Synthesis, policy guidance and coordinating arrangements**
9. **Communication and dissemination**

AFSPAN-BD Inception Meeting

A 2-days long workshop was arranged by the AFSPAN-BD team in the office of Bangladesh Fisheries Research Forum (BFRF), Dhaka, Bangladesh during 26-27.09.2012. The workshop was attended by all four AFSPAN-BD team members - Prof. Mostafa A R Hossain, Prof. Md. Saifuddin Shah, Dr. M. Enamul Hoq and Dr. Md. Akhtar Hossain. Mr. Md. Anwarul Haque, Research Manager, BFRF also attended

Project Activities for the first year, based on AFSPAN Activity Packages was the main agenda to discuss in the workshop. At the workshop, Dr. Hossain explained the AFSPAN project concept, goals and objectives, work packages, activities under each work package, the role of FAO, work package leaders and country partners, the deadlines and the outcomes in detail to the AFSPAN-BD team. He shared the learning and experience from the inception workshop in Penang, Malaysia. The team then thoroughly discussed the presentation made by Dr. Rohana Subasinghe and other work package leaders in Penang during inception workshop.

Then work package-wise discussion was started. Dr. Hossain thanked everyone for helping in the preparation of the "Review and assessment of national and international cooperation" under Work Package 3. The review that submitted in the AFSPAN dropbox was shared among the AFSPAN-BD team. The review was discussed step by step and mode of further study and desk-work were discussed in detail.

In the second day, the categorization of the aquaculture farms in Bangladesh was the first item to discuss. Dr. Hossain presented the draft categories to the team what he presented in Penang. All four members gave their feedbacks and comments to improve the six categories of aquaculture farms in Bangladesh.

The team then thoroughly discussed about the site selection for the field activities covering all the different categories of aquaculture activities. The team decided to collect the primary data and secondary data (if necessary) from the following districts and sub districts -

The region	Sub districts
Dinajpur-Bogra-Rajshahi region	Parbatipur, Pirgonj, Adamdighi and Bagmara
Greater Mymensingh region	Bhaluka, Trishal, and Muktagachha
Khulna-Satkhira- Jessore-Bagerhat region	Dumuria, Dakope, Kaligonj, Shyamnagar, Jessore sadar, Morolgonj and Sarakkhola
Comilla-Noakhali-Chittagong-Cox's Bazar region	Daudkandi, Chandpur sadar, Hajigonj, Noakhali sadar, Cox'sbazar sadar, Moheshkhali, Teknaf

The team decided to go to the reconnaissance survey on the first week of the November, 2012. They also agreed to employ 3-4 Research Assistants (preferably fresh BSc graduates (in Fisheries) or MS in Fisheries (if available). After recruiting the Research Assistants, the team will train them about how to collect data and will work at the beginning with the Research Assistants for a week or so in the field. In addition, the team members will frequently visit the survey sites to oversee the work of the Research Assistants and to assist them.

Dr. Hossain then highlighted on keeping the records of the working hours by each of the team members under AFSPAN-BD. Finally the team discussed on the feedback from the work package leader regarding questionnaire and other tools to collect data, the format of submitting activity- and financial- reports. The team suggested that Dr. Hossain should keep close contact with FAO and different Work Package leaders. Dr. Hossain informed about AFSPAN dropbox and the webpage afspan.net to the team members. Finally AFSPAN-BD team thanked BFRF and decided to have next meeting at the 3rd week of November after the reconnaissance survey.

The Peer Reviewed Papers

List of the papers published during 2011-2012 on Bangladesh fisheries, aquaculture and related aspects in international peer reviewed journals with impact factors - mostly by the Bangladeshi authors along with a number of overseas scientists

- Ahamed, F., M.Y. Hossain, B. Fulanda, Z. F. Ahmed and J. Ohtomi. (2012) Indiscriminate exploitation of wild prawn postlarvae in the coastal region of Bangladesh: A threat to the fisheries resources, community livelihoods and biodiversity. Ocean & Coastal Management 66:56-62.
- Ahmed, N. and S.T. Garnett. (2011) Integrated rice-fish farming in Bangladesh: Meeting the challenges of food security. Food Security 3(1): 81-92.
- Amin A.K.M.R., Islam M.A., Kader M. A., Bulbul M., Hossain M.A. R. and Azim M. E. (2011) Production performance of sutchi catfish Pangasianodon hypophthalmus S. in restricted feeding regime: effects on gut, liver and meat quality. Aquaculture Research 1-7
- Barman, B.K. and D. C. Little. (2011)Use of hapas to produce Nile tilapia (*Oreochromis niloticus* L.) seed in household foodfish ponds: A participatory trial with small-scale farming households in Northwest Bangladesh. Aquaculture 317(1-4): 214-222.
- Belton, B. and A. Azad. (2012) The characteristics and status of pond aquaculture in Bangladesh. Aquaculture 358-359:196-204
- Belton, B., M. M. Haque, D. C. Little and L. X. Sinh. (2011) Certifying catfish in Vietnam and Bangladesh: Who will make the grade and will it matter? Food Policy 36(2): 289-299.
- Belton, B. and D.C. Little. (2011) Immanent and Interventionist Inland Asian Aquaculture Development and its Outcomes. Development Policy Review 29(4): 459-484.
- Bhuiyan, M.J.A.N. and D. Dutta. (2012) Assessing impacts of sea level rise on river salinity in the Gorai river network, Bangladesh. Estuarine, Coastal and Shelf Science 96:219-227.
- Deb, A. K. and C. E. Haque. (2011) 'Every mother is a mini-doctor': Ethnomedicinal uses of fish, shellfish and some other aquatic animals in Bangladesh. Journal of Ethnopharmacology 134(2): 259-267.
- Evans , L., N. Cherrett and D. Pemsl (2011) Assessing the impact of fisheries co-management interventions in developing countries: A meta-analysis. Journal of Environmental Management 92(8): 1938-1949.
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- Habiba, U., R. Shaw and Y. Takeuchi. (2012) Farmer's perception and adaptation practices to cope with drought: Perspectives from Northwestern Bangladesh. International Journal of Disaster Risk Reduction, In Press, Corrected Proof, Available online 12 June 2012.
- Hassan M.M., M. Nahiduzzaman, S.N.A. Mamun, M.A. Taher and M.A.R. Hossain. (2012) Fertilization by refrigerator stored sperm of the Indian major carp, *Labeo calbasu* (Hamilton, 1822). Aquaculture Research, 1-9. doi:10.1111/j.1365-2109.2012.03214.x.
- Hossain, M. A. R., M. Nahiduzzaman, and T. R. Tiersch. (2011) Development of a Sperm Cryopreservation Approach to the Fish Biodiversity Crisis in Bangladesh. In: Cryopreservation in Aquatic Species, 2nd Edition. T. R. Tiersch and C. C. Green, editors. World Aquaculture Society, Baton Rouge, Louisiana. pp. 852-861.
- Hossain M.A.R., Nahiduzzaman M., Hassan M.M., Sultana M.A., Akter S. and Hossain M. A. (2011) Sperm cryopreservation of an endangered freshwater spiny eel, *Mastacembelus armatus* (Lacepede, 1800) for biodiversity conservation in Bangladesh. ISESCO Journal of Science and Technology 7(12): 57-66.
- Hossain M. A. R., Nahiduzzaman M., and Tiersch T. R. (2011) Development of a Sperm Cryopreservation Approach to the Fish Biodiversity Crisis in Bangladesh. In: Cryopreservation in Aquatic Species, 2nd Edition. T. R. Tiersch and C. C. Green, editors. World Aquaculture Society, Baton Rouge, Louisiana. Pp. 852-861
- Islam, G.M.N., T. S. Yew, N. M. R. Abdullah and K. K. Viswanathan. (2011) Social capital, community based management, and fishers' livelihood in Bangladesh. Ocean & Coastal Management 54(2): 173-180.
- Islam, Q.T., M.A. Razzak, M.A. Islam, M.I. Bari, A. Basher, F.R. Chowdhury, A.B.M. Sayeduzzaman, H.A.M.N. Ahasa-n, M.A. Faiz, O. Arakawa, M. Yotsu-Yamashita, U. Kuch and D. Mebs. (2011) Puffer fish poisoning in Bangladesh: clinical and toxicological results from large outbreaks in 2008. Transactions of the Royal Society of Tropical Medicine and Hygiene 105(2) 74-80.

- Jahan, K.M.E. and D. E. Pemsl. (2011) The impact of integrated aquaculture-agriculture on small-scale farm sustainability and farmers' livelihoods: Experience from Bangladesh. Agricultural Systems 104(5): 392-402.
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Upcoming Seminars

9th International Conference on Molluscan Shelifish Saferty
www.icmss2013.com
17th to 22nd March 2013
Location: Sydney, Australia
Contact: icmss2013@iceaustralia.com

Aridland Aquaculture Symposium & Workshop 2013
www.was.org
24th to 25th March 2013
Location: Al Ain, United Arab Emirates (UAE)
Contact: worldaqua@aol.com

Aceh Development International Conference (ADIC) 2013
www.adic2013.yolasite.com
26th to 28th March 2013
Location: Kuala Lumpur, Malaysia
Contact: adickl2013@gmail.com

International Seminar-Workshop on Mud Crab Aquaculture and Fisheries Management (ISMAF 2013)
www. rgca.org.in
10th to 12th April 2013
Location: Sirkazhi Taluk, Tamil Nadu, India
Contact: rgcaho@gmail.com

International Conference on Nanotechnology, Health and Environmental Sciences (ICNHES'2013)
www. psrcentre.org/listing.php?subcid=201&mode=detail
15th to 16th April 2013
Location: Johannesburg, South Africa
Contact: info@psrcentre.org

European Seafood Exposition
www.euroseafood.com
23rd to 25th April 2013
Location: Brussels, Belgium

INTERNATIONAL SEMINAR ON MARINE SCIENCE & AQUACULTURE
www.ums.edu.my/ipmb/isomsa
19th to 21st March 2013
Location: KOTA KINABALU, SABAH, Malaysia
Contact: isomsa.usm@gmail.com

Recirculation and Aquaponics Workshops
www.was.org
26th to 27th March 2013
Location: Abu Dhabi, UAE
Contact: worldaqua@aol.com

13th Aquaculture Insurance and Risk Management Conference
www. aquacultureinsurance.com/Aquaculture-insurance-and-risk-management-conferences
4th to 5th April 2013
Location: Istanbul, Turkey
Contact: info@aums.com

International Conference on Chemical and Environmental Engineering (ICCEE'2013)
www. psrcentre.org/listing.php?subcid=204&mode=detail
15th to 16th April 2013
Location: Johannesburg, South Africa
Contact: info@psrcentre.org

International Conference on Integrated Waste Management and Green Energy Engineering (ICIWMGEE' 2013)
www. psrcentre.org/listing.php?subcid=202&mode=detail
15th to 16th April 2013
Location: Johannesburg, South Africa
Contact: info@psrcentre.org

3rd International Conference on Ecological, Environmental and Biological Sciences (ICEEBS'2013)
www.psrcentre.org/listing.php?subcid=207&mode=detail
29th to 30th April 2013
Location: Singapore
Contact: info@psrcentre.org

10th Asian Fisheries & Aquaculture Forum and fourth International Symposium on Cage Aquaculture in Asia (CAA4)
www. koference.org
30th April to 04th May 2013
Location: Yeosu, Korea
Contact: 10afaf@koference.org

Water Resources Management 2013
www.wessex.ac.uk/13-conferences/water-resources-management-2013.html
21st to 23rd May 2013
Location: New Forest, United Kingdom
Contact: enquiries@wessex.ac.uk

World of Seafood
www.worldofseafood.com
22nd to 26th May 2013
Location: Bangkok, Thailand
Contact: s.teo@koelnmesse.com.sg (Sharon Teo)

Euro-American Conference for Academic Disciplines (Prague 2013)
www.internationaljournal.org/prague.html
28th to 31st May 2013
Location: Prague, Czech Republic
Contact: ManuscriptSubmission@gmail.com

Shrimp Pathology Short Course-Disease Diagnosis and Control in Marine Shrimp Culture
www.http://microvet.arizona.edu/research/aquapath/ index.htm
03rd to 14th June 2013
Location: University of Arizone - Tucson Arizona, USA
Contact: ritar@email.arizone.edu

Vietfish 2013
www.vietfish.com.vn
25th to 27th June 2013
Location: Ho Chi Minh City, Vietnam
Contact: info@vietfish.com.vn

Multiphase Flow 2013
www.wessex.ac.uk/multiphase2013
3rd to 5th July 2013
Location: A Coruna, Spain
Contact: wit@wessex.ac.uk

2nd International Conference on Chemical, Ecology and Environmental Sciences (ICEES'2013)
www. psrcentre.org/listing.php?subcid=217&mode=detail
16th to 17th May 2013
Location: Venice, Italy
Contact: info@psrcentre.org

River Basin Management 2013
www.wessex.ac.uk/13-conferences/river-basin-management-2013.html
22nd to 24th May 2013
Location: New Forest, United Kingdom
Contact: enquiries@wessex.ac.uk

4th Aquatech Aquaculture Expo and Convention Philippines 2013
23rd to 24th May 2013
Location: Tagaytay City, Philippines
Contact: mgv.equipinc@yahoo.com
(Mary Ann Venturina)

Aquarama 2013
www.aquarama.com.sg
30th May to 02nd June 2013
Location: Singapore
Contact: squarama_2013@online.ubmasia.com.sg

19th International Interdisciplinary Conference on the Environment
www.ieaonline.org/?page_id=68
14th to 17th June 2013
Location: Portland, Oregon, United States of America
Contact: shane.epting@unt.edu

Aquaculture Europe 2013
www.easonline.org
09th to 12th August 2013
Location: Trondheim, Norway

International Conference on Bio-Diversity 2013
www.futureevents.org/biodiversity
1st to 2nd July 2013
Location: Colombo, Sri Lanka
Contact: info@theicrd.org, icbd@futureevents.org

2013 3rd International Conference on Environmental and Agriculture Engineering (ICEAE 2013)
www.iceae.org
6th to 7th July 2013
Location: Hong Kong, China
Contact: iceae@cbees.org

International Conference on Agricultural and Animal Sciences 2013
www.agrianimal.com
8th to 9th July 2013
Location: Colombo, Sri Lanka
Contact:info@agrianimal.com,abstract@agrianimal. com

24th International Conference of the World Association for the Advancement of Veterinary Parasitology
www.waavp2013perth.com
25th to 29th August 2013
Location: Perth, Western Australia, Australia
Contact:info@eecw.com.au,kylie.skinner@eecw.com.au

Genomics in Aquaculture Symposium (GIA 2013)
www.gia2013.org
04th to 06th September 2013
Location: BodØ, Norway
Contact: secretariat@gia2013.org

Aquaculture 2013
www.aquaculture-conference.com
3rd to 7th November 2013
Location: Las Palmas, Gran Canaria, Spain
Contact:

International Conference on Tourism and Hospitality Management (ICTHM 2013)
www.tourismconference.net
9th to 10th December 2013
Location: Colombo, Sri Lanka
Contact: cheerslanka@gmail.com, info@theicrd.org

2013 3rd International Conference on Asia Agriculture and Animal (ICAAA 2013)
www.icaaa.org
27th to 28th July 2013
Location: Moscow, Russian Federation
Contact: icaaa@cbees.org

The Aquaculture Roundtable Series (TARs 2013) - Finfish Aquaculture
www.tarsaquaculture.com
21st to 22nd August 2013
Location: Singapore
Contact: conference@tarsaquaculture.com

The 2nd Pacific Rim Energy and Sustainability Conference
www.presdafoundation.org/pacific-rim-energy-sustainability-conference
27th to 29th August 2013
Location: Hiroshima, Japan
Contact: presco.coordinator@presdafoundation.org

7th International Conference on Asian and Pacific Coasts
www.apac2013.org
24th to 26th September 2013
Location: Bali, Indonesia
Contact:info@apac2013.org,treasury@apac2013.org

Expo Pesca & AcuiPeru
www.thaiscorp.com
07th to 09th November 2013
Location: Lima, Peru
Contact: thais@amauta.rcp.net.pe

Fish Week 2012

Fish Week 2012

"Fish week"- an inspiring and colorful event, being observed every year with the participation of fish farmers, fishers, fish traders, institutions involved- the Ministry of Fisheries and Livestock (MoFL), Department of Fisheries (DoF), Bangladesh Fisheries Research Institute (BFRI), Bangladesh Fisheries Development Corporation (BFDC), Universities, NGOs, associate national and international organizations like Bangladesh Fisheries Research Forum (BFRF) and World Fish Center (WFC), private organizations, people's representative from different strata and the mass people, has now become a festival in our country.

Bangladesh is the third largest fish producing country of the world followed by China and India. Fish contributes about 60% of the animal protein supply of our people. About 10.5% of our population directly or indirectly involved in fisheries activities.

The aim of observing fish week regularly is to produce more fish, create employment opportunity and earn foreign currency through more export of frozen food and thus supply more nutrients to the people, creating investment opportunity and overall poverty reduction.

The objective is to create awareness for the wise management of fisheries resources and disseminate modern fish culture technologies to the farmer. To raise social awareness, this was first introduced by the father of the nation Bongobondhu Sheikh Mujibur Rahman in 1973 by stocking fish fingerling in the Gonobhabon Lake.

A day before commencement of the week a colorful rally with different banners, posters, and slogan moved around the main roads of the capital city followed by a news conference. This year the main attraction was a living mermaid leading the rally.

On 7th July 2012, the opening ceremony was graced by Honorable Prime Minister Sheikh Hasina, as she was kindly present as Chief Guest. Most successful twenty fish farmers and exporters were awarded for their valuable contribution for the promotion of fisheries sector. Fish fingerlings were stocked in Gonobhabon Lake as a token to accelerate fish production.

An art competition for the children was held to give them the opportunities to know the importance of fisheries sector and encourage them to know more about fish culture and to abide by the rules and regulations of fisheries. A five day long Fish fair, one of the most colorful and regular event of fish week was held at Ramna Bata Mul. Lots of visitors including students visited the fair to enjoy and to know modern fisheries technologies.

Publication of a compendium rich with different fisheries technology is a very important part of fish week. Scientific papers from different corners of this sector enriched the compendium which can be used as a source of information to the farmers, students and researchers. This event has duly been observed in the district, upazila and in some cases at union levels following the Ministry approved schedule.

Fisheries Information in Print & Electronic Media of Bangladesh

A.B.M. Mohsin and Shams Muhammad Galib
Department of Fisheries, University of Rajshahi, Rajshahi-6205
abmmohsin@bdfish.org

At present day, electronic media is the easiest, cheapest, fastest and most advanced source of information. Print media, however, is still a very important source of information due to some specific advantages. In comparison to many other developing countries of the world, availability of fisheries information of Bangladesh in various media is far behind but advancing rapidly. The available sources of fisheries information of Bangladesh in different print and electronic media are highlighted here.

Daily Newspapers

Several newspapers publish agricultural featured page including fisheries on weekly basis. There are no pages based on only fisheries information. Brief description of these newspapers are presented here.

Newspaper	News section	Day	Web address
Daily Ittefaq	Mati O Manusher Krishi	Sunday	www.ittefaq.com.bd
Daily Nayadiganta	Chashabad	Saturday	www.dailynayadiganta.com
Daily Destiny	Krishi O Poribesh	Wednesday	www.dainikdestiny.com
Daily Kalerkantho	Chasbas	Saturday	www.dailykalerkantho.com
Daily Amar Desh	Chasbas	Monday	www.amardeshonline.com
Daily Jugantor	Alor Ishara	Monday	www.jugantor.com
Bangladesh Protidin	Krishi O Unnayan	Fortnightly	www.bd-pratidin.com
Daily Jai Jai Din	Krishi O Samvabana	Sunday	www.jaijaidin.com

Television Channels

Like newspapers, there are no programs based on only fisheries in different TV channels of Bangladesh. A number of TV channels are telecasting agriculture related programs. Fisheries related stories get focused in these programs. A comprehensive record of these programs is listed here -

TV Channel	Name of the program
BTV	Mati O Manush, Krishi Dibanishi, Krishok O Unnayan
Channel i	Krishi Sangbad, Hridoye Mati O Manush, Hridoye Mati O Manusher Dak
ATN Bangla	Matir Subas
Bangla Vision	Shamol Bangla
Baishaki TV	Krishi O Jibon
Diganta TV	Sufala Jibon
Islamic TV	Sobuj Biplob
GTV	Sabuz Bangla

Websites

There is no complete Bangladesh fisheries information based site in Bangladesh except BdFISH (www.bdfish.org). BdFISH is only website in Bangladesh based on absolutely fisheries info of the country. Websites of some fisheries relevant organizations like WorldFish Center, BFRI, BFRF, DoF are fisheries based but they publish information, report and other documents based on their own activities only. On the other hand, different encyclopedias and agriculture based websites provide fisheries info as part of their whole publication. Here is a comprehensive list of such websites -

Name	Web address	Language	Remarks
BdFISH	www.bdfish.org bn.bdfish.org en.bdfish.org	Bangla and English	Bangladesh Fisheries information based largest website in Bangladesh
Bangladesh Agriculture	www. bangladeshagri.com	Bangla	Agriculture (including Fisheries) info based site
Rural Info Bangladesh	www.ruralinfobd.com	Bangla	Agriculture (including Fisheries) info based site (Only registered members watch content, Reg. fee Tk. 50 and Subscription fee Tk. 50/month)
Jeeon	www.jeeon.com.bd	Bangla	Agriculture (including Fisheries) is focused as a part of this website
Teletathya	www.teletathya.com	Bangla	Instant communication about life and Career (including Fisheries)
Krishi Market	www. krishimarket.com	Bangla	Marketing info of agricultural (including Fisheries) products
E Krishi	www.ekrishi.com	Bangla	Agriculture (including Fisheries) info based site
BFRI	www.fri.gov.bd	Bangla and English	Official website. Activities of Bangladesh Fisheries Research Institute and its station and substation
MoFL	www.mofl.gov.bd	English	Official website of Ministry of Fisheries & Livestock
DoF	www.fisheries.gov.bd	Bangla and English	Official website, activities and publications can be found
BARC	www.barc.gov.bd	English	Official website of BARC
BFRF	www.bfrf.org	English	Official website, activities and publication of BFRF can be found
BFDC	www.bfdc-gov.org	Bangla and English	An official webpage of Bangladesh Fisheries Development Corporation
BMFA	www.bmfabd.com	English	An official webpage of The Bangladesh Marine Fisheries Association (BMFA)
BIDS	www.bids.org.bd	English	An official webpage of Bangladesh Institute of Development Studies including fisheries
WorldFish	www. worldfishcenter.org	English	Official website. Project reports and activities are available based on fisheries
FAO	www.fao.org	English	Official website. Many publications are based on fisheries
FishBase	www.fishbase.org	English	Fish info worldwide including Bangladesh
IUCN	www.iucn.org	English	Organism Conservation info worldwide including Bangladesh
Wikipedia	en.wikipedia.org bn.wikipedia.org	English, Bangla and others	Wikipedia is a free, collaboratively edited and multilingual Internet encyclopedia supported by the non-profit Wikimedia Foundation. Its 22 million articles (over 3.9 million in English alone) have been written collaboratively by volunteers around the world.
Banglapedia	www.banglapedia.org	Bangla and English	The largest encyclopedia based on Bangladesh
Jatiyo e-Tathyakosh	www.infokosh. bangladesh.gov.bd	Bangla	Providing available information on livelihood and other aspects including fisheries

BFRF – Ongoing Researches

Research Title	Executing Institute/Organization
BFRF Core Funding	
Market chain of marine small fishes	Bangladesh Fisheries Development Corporation (BFDC), Department of Fisheries (DoF)
National Extension Strategy (Aquaculture/ Fisheries): Present and Future	Department of Fisheries (DoF)
Climate change adaptations: Ongoing activities and future options	Khulna University
Sustainability of breeding nucleus of tilapia established in private sector hatcheries in Luxmipur, Bangladesh	Noakhali Sceince & Technology University, WorldFish
Floodplain Aquaculture: Impacts on ecology and biodiversity	University of Rajshahi
Factors affecting the wetland biodiversity in the haor region of Bangladesh	Sylhet Agricultural University
Production biology of cuchia in the natural habitat and its importance on the livelihoods of the poor indigenous communities in Bangladesh	Department of Fisheries (DoF)
Tilapia seed marketing and rural employment opportunities: Case studies	Agro 3 Fish Hatchery and Culture Farm
Feed the Future Aquaculture (FtF), WorldFish Funding	
Development of commercial aquaculture – pros and cons with potential and development of effective strategies for its sustainable development	Bangladesh Agricultural University
Impact of mola farming in ponds and pond connected rice fields on production, biodiversity, nutrition and income of target and non-target households	Sher-e-Bangla Agricultural University, Patuakhali Science & Technology University
Comparative study on the adoption of different component in homestead aquaculture pond	Hajee Mohammad Danesh Science and Technology University
Development for technical and business plan for fish hatcheries	WorldFish
Two PhD Researches	
Morphometry, breeding and larval development of mola, *Amblypharyngodon mola* (Hamilton, 1822)	Bangladesh Agricultural University, WorldFish
Genetic improvement of rohu, *Labeo rohita* stock in Bangladesh	Bangladesh Agricultural University, Bangladesh Fisheries Research Institute, WorldFish
ANEP-WorldFish Funding	
Production of fish and vegetable in Integrated Floating Cage-Aquaponics System (IFCAS) in shaded ponds for enhancing production and households' nutrition in Barishal District of Bangladesh	Bangladesh Agricultural University
European Commissions Seventh Framework Program – FAO Funding	
Aquaculture for food security, poverty alleviation and nutrition (AFSPAN)	Bangladesh Agricultural University, Khulna University, University of Rajshahi, Bangladesh Fisheries Research Institute

BFRF Executive Committee - 2012-2013

Sl.	Name and Address	Position	Mobile & Email
1	**Prof. Dr. M. A. Wahab** Professor, Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh	President	01715099156 wahabma_bau2@yahoo.com
2.	**Dr. Md. Jahangir Alam** Professor, Faculty of Fisheries Bangobandhu Sheikh Mujibur Rahman Agricultural University, Gazipur	Vice-President	01715143521 alammj_bfri@yahoo.com
3	**Prof. Dr. Nizmul Naser** Professor, Department of Zoology, University of Dhaka, Dhaka	Vice-President	01711707217 mnnaser@yahoo.com
4	**Dr. Benoy Kumar Barman** Senior Scientist, WorldFish, Bangladesh and South Asia House 22B, Road 7, Block F, Banani, Dhaka 1213	General Secretary	01712192423 b.barman@cgxchange.org b.barman@cgiar.org
5	**Dr. Kabir Ikramul Haque** Director-Fisheries, Bangladesh Agricultural Research Council, Farmgate, Dhaka	Join- Secretary	01711466424 ikramfish@yahoo.com
6	**Khandoker Lutfunnesa** Project Director, Bangladesh Fisheries Development Corporation (BFDC) 24-25 Dilkusha C/A, Motijheel, Dhaka 1000	Treasurer	01714245716 bfdc@citechco.net bfdc_64@yahoo.com
7	**Prof. Dr. Md. Ashraful Azam Khan** Director, Institute of Marine Science and Fisheries, University of Chittagong	Member	01817 227288 aakimscu@yahoo.com
8	**Prof. S. M. Bazlur Rahman** Professor, FMRT Discipline, Khulna University, Khulna	Member	01914325048 riti_rahaman@yahoo.com
9	**Dr. Md. Istiaque Hossain** Associate Professor, Department of Fisheries, University of Rajshahi	Member	01726514232 hitanrubd@yahoo.com
10	**Md. Rakeb-ul-Islam** Assistant Professor & Chairman, Noakhali Science & Technology University, Noakhali	Member	01716783991 mrakeb_nstu@yahoo.com
11	**Dr. Md. Mahbub Iqbal** Asst. Professor, Dept. of Fish. Biology and genetics Sylhet Agricultural University, Sylhet	Member	01714021213 mmiqbal5@yahoo.com
12	**Dr. Sultan Mahmud** Associate Professor, Faculty of Fisheries Patuakhali Science & Technology University, Patuakhali	Member	01720650263 sultanmahmud77@yahoo.com
13	**Dr. Zannatul Ferdousi** Associate Professor, Haji Danesh University of Science & Technology, Dinajpur	Member	01712159970 zannatul99bd@yahoo.com
14	**Dr. Md. Anisur Rahman** Associate Professor & Dean, Faculty of Biological Science and Technology Jessore University of Science and Technology, Jessore	Member	01710814526 anis_1963@yahoo.com
15	**Dr. Kazi Ahsan Habib** Associate Professor, Dept. of Animal Husbandry, Sher-e-Bangla Agricultural University	Member	01713682290 ahsan_sau@yahoo.com
16	**Dr. Md. Sirajul Islam** Associate Professor & Chairman, Mowlana Bhasani Science & Technology University	Member	01710660209 islammstazu@yahoo.com
17	**Prof. Dr. Shah Alam Sarker** Professor (Fisheries), School of Agriculture and Rural Development Bangladesh Open University, Gazipur-1705	Member	01718630776 sarkeralam@yahoo.com
18	**Sk. Mustafizur Rahman** Department of Fisheries, Matshya Bhaban, Romna, Dhaka	Member	01712521682 mustafiz59@gmail.com
19	**Md. Arifur Rahman Tarafder** PCD, Department of Fisheries, Romna, Dhaka.	Member	01711192608 arif@fisheries.gov.bd
20	**Mr. Muhammad Zaher** Chief Scientific Officer, Shrimp Research Center, Bagherhat	Member	01712009498 zaherbfri@yahoo.com
21	**Dr. Md. Zulfikar Ali** Senior Scientific Officer, Bangladesh Fisheries Research Institute Freshwater Station, Mymensingh - 2201	Member	01711780422 zulfikar_bfri@yahoo.com
22	**Dr. S M Shamsur Rahman** Senior Aquaculture Specialist, Winrock International	Member	01730729320 smsrahman_bau@yahoo.com
23	**S M Istiak** Program Chief, Bangladesh Shrimp and Fish Foundation House # 465 (1st Floor), Road # 08 (East), DOHS, Baridhara Dhaka-1206	Member	01711943019 smistiak@yahoo.com
24	**ABM Shamsul Alam Badal** Proprietor, Agro3, 37 Lichu Bagan Akua, Mymensingh	Member	01714-010740 agrothree@yahoo.com
25	**Prof. M. Saifuddin Shah** VC, Khulna University	Ex-Officio	01776761939 drmsshahbd@yahoo.com
26	**Prof. Mostafa A R Hossain** Professor, Department of Fish. Biology & Genetics, BAU, Mymensingh-2202	Ex-Officio	01711045364 marhossain@yahoo.com

BFRF Activities

Bangladesh Fisheries Research Forum (BFRF) foresees ahead to be flourished as an organization to provide a platform for scientific collaboration, team work and create future horizon of research and development activities in fisheries sector. Major objectives of BFRF are to develop networking among fisheries professionals and institutions; to share knowledge and experience to promote growth of the sector; to initiate discussion and dialogue among different stakeholders; to assist public and private sector, donors and development partners; to secure funding from donors and other sources to offer research awards to scientist/s to address demand-led research; to organize workshops, seminars, conferences, dialogues and trainings ; and to offer support services to industries, government and private sectors

www.bfrf.org

photos : mostafa hossain
concept : anis
graphics : shadin graphics 01716288015