AmbujaNeotia
THE NEOTIA UNIVERSITY
ज्ञानम् आत्म प्रदीपाय UGC Enlisted & Recognised

Matsya Purana

Department of Fisheries Science, School of Agriculture and Allied Science (SAAS)

Issued: **July, 2021**

Departmental Message

Fishing is an ancient practice that dates back at least to the Upper Paleolithic period which began about 40,000 years ago. Archaeological features such as shell middens, discarded fish bones and cave painting show that sea foods were important for survival and consumed in significant quantities. Over periods 'Fishing' evolved into 'Fisheries science' and developed culture fishery besides capture fishery as per the increased demand of the human beings.

In India the interest in fish and fishery dates back to the Third Millennium BC, and evidences of fish being used as food are available from excavations of the Indus Valley Civilization. In 1127AD, the son of King Vikramaditya, King Somesvara composed a book recording the common sport fishes of India and grouped them into marine and riverine forms.

But now India is the second-largest producer of fish and also the second-largest aquaculture nation in the world. The country has vast potential for fisheries because of our long coastline of 8,118 km apart from the inland water resources. During the financial year 2017-18, the total fish production in India was estimated at 12.61 million metric tonnes. Fish production has increased from 5.66 million metric tonnes (2.82 million metric tonnes for marine and 2.84 million metric tonnes for inland fisheries) in 2000-01 to 12.61 million metric tonnes (3.68 million metric tonnes for marine and 8.92 million metric tonnes for inland fisheries) in 2017-18 (DAHDF, 2019b). The gross value addition of the fisheries and aquaculture sector during 2016-17 was Rs. 1,33,492 cores, about 0.96% of the National Gross Value Added (GVA) and 5.37% to the agricultural GVA (2016-17). During the year 2017-18, the country has exported 13,77,244 tonnes of fish and fisheries products worth Rs. 45106.89 crore (7.08 billion US$) (DAHDF, 2019b). These numbers clearly portray the 'Fisheries and Aquaculture' as the fastest growing food-producing sector.

Thus in terms of contributing in this national growth, Department of Fisheries Science, School of Agriculture and Allied Sciences (SAAS), The Neotia University started B.F.Sc. (4 years degree programme 'Bachelor of Fisheries Science') to generate professional fisheries graduates and entrepreneurs with credible skills, capabilities and commitment to transform the sector through innovation and sustainable increase in fish production of the country. To establish itself as one of the premier fisheries institutes serving as a leader in quality fisheries education and research in India is the sole mission of this department. The B.F.Sc. degree programme is successfully running here by following the course curriculum as prescribed by Indian Council of Agricultural Research (ICAR), the nationalized platform under Department of Agricultural Research and Education, GOI. Cherishing the privilege and pleasure of being the one and only leading private Fisheries Institute of West Bengal.

10th July, 1957 is a red letter day for Indian fish farmers. In order to commensurate this day on which such a momentous breakthrough that dramatically transformed the fish cultural sector in India, the Government of India in 2001 declared 10th July as "National Fish Farmers' Day". National Fish Farmers Day is celebrated in the memory of scientists Dr H. L. Chaudhury and Dr K. H. Alikunhi. Both of them successfully demonstrated Hypophysation (technology of induced breeding) in Indian Major Carps on 10th July 1957. The Central Institute Fisheries Education (CIFE), Mumbai, the premier fisheries

education institution in India, was the first to celebrate the Fish Farmers' Day on 10th July, 2001. Since then, all fisheries research, education and extension institutes have been observing this historic day with great enthusiasm.

To recognize the accomplishments and contribution of fish farmers, aqua-entrepreneurs and fisher-folks in the growth of the fisheries sector in the country and to draw attention to changing the way the country manages fisheries resources to ensure sustainable stocks and healthy ecosystems, this day, the 10th July is celebrated every year as "National Fish Farmers' Day". On this occasion Department of Fishery is going to publish the half-yearly E- magazine (Matsya Purana) in The Neotia University website to encourage our students' hidden talent through this platform. Original idea of this magazine was initiated by our respected teacher Dr. P. K. Mukhopadhyay (Ex. Faculty).

We are thankful to honorable Vice Chancellor, Dr. Biswajit Ghosh, The Neotia University for providing required facilities to publish the e-magazine. Special thanks to Prof. S. K. Kothari, Dean of School of Agriculture and Allied Sciences, TNU and management of The Neotia University to give the approval for the publishing the magazine. Special thanks to the digital team for providing an e- platform to our students to represent their creative mind.

Department of Fisheries Science,
School of agriculture and Allied Sciences (SAAS)
The Neotia University

10th July is celebrated every year as National Fish Farmers'Day

Content

Vice Chancellor's Message

To me it is a privilege to share my perceptions and thoughts in developing human resources to address on the ecology, economy and empowerment at the eve of 75th Independence Day of our country and also on the National Fish Farmers Day. While addressing the sustainable development goal, the United Nation has created a technical agency entitled'Food and Agriculture Organization (FAO)' to explore the methodologies in removinghunger and poverty from the world. In this respect the FAO advocated for taking steps in enhancing the growth of enriched nutritious food items.Fish is one of such nutritious food items. The adoption of such steps slowed down due to theongoing COVID-19 pandemic situation. As a result, thisputs negative impacton economic growth andthat has direct impact on the national gross domestic products (GDP).

In our country about 30% of the total population lives in urban areas whereas more or less 70% lives in rural areas. At present our GDP is varying from 6-7% and 6.5-7% of our total population lives below the poverty lines. To push down the poverty line at zero level, the GDP required to be enhanced at a level more than 12% and this can be achieved if we able enhance the rural economy by activating the 70% of the rural population andinvolving them in rural economic activities.

Agriculture and allied items are the backbone of the rural economy. One of the allied item of agriculture is fisheries as fish is food item to the global communities. Normally fish is a nutritious food and it showed its potential growth both in the national and international food market. Moreover, sometimes its extracts are also used as the ingredient in medicinal items. This calls for need of human resources in the field of fisheries andaquaculture. In enhancing the capacity of pisciculture for further growth thrusts require to be given in intensifications of production, demands new sustainable aquaculture development strategies. Such strategies need to harness through technical developments on the aspects of feeds, genetic selection, biosecurity, disease control, and digital innovation, with business developments in investment and trade. This messages should reach to commons those are involved in fish farming.

The School of Agriculture and Allied Sciences (SAaS) of our University train our students on the above items such that they can make positive contributions on pisciculture.

To illuminate this the faculty members of our Fisheries Science Academic Unit initiated in publication of e-magazine 'Matysa Purana' which will provide a platform to the aspiring students to interact with the renowned academicians and scientists for exchanging scientific and technological thoughts and perceptions, personal and professional networking and translation of knowledge for innovation.

I personally thank our Dean and all the faculty members and students of SaaS for their untiring efforts in publishing this e-magazine, 'Matysa Purana' and I hope that this e-magazine will help in updating the knowledge and will further open up avenues to the aspiring students in building up their career on this subject.

Dr. Biswajit Ghosh
Vice Chancellor (V.C.), The Neotia University

Dean's Message

I am extremely happy to know that Department of Fisheries Science of School of Agriculture and Allied Science are coming out with thes econd issue of "Matsya Purana", an e-magazine on the eve of 'National Fish Farmers' Day' on 10th July 2021. The day is celebrated across the country in the memory of scientists Dr. K. H. Alikunhi and Dr. H. L. Chaudhury. Both of them successfully demonstrated Hypophysation (technology of induced breeding) in Indian Major Carps (common name for several species of fish) on 10th July 1957.This is also an occasion to pay tribute and express our gratitude to millions of fish farmers of the country for their contribution in ensuring nutrition and food security.The Department of Fisheries Science published the first issue of "Matsya Purana" on the eve of World Fisheries Day on 21st November 2020 highlighting the critical importance to human lives, of water and the lives it sustains. This was widely acclaimed by the management, faculty members, staff and students of The Neotia University.

I am informed that the e-magazine contain research article "Tilapia: Fish of the Future for Aquaculture Blooming in Bangladesh" by renowned experts Dr. Yahia Mahmud and Dr. AHM Kohinoor from the neighboring country Bangladesh and would have 4-segments (scientific, animation & drawing, students curriculum and photography). This would provide our students good opportunity on continuous basis to think on the subject as a whole / topic of their choice and apply their creative mind in developing / expressing it.

I congratulate our Fisheries Science faculty members and digital initiative team for encouraging young minds and providing them an opportunity to present their ideas on this e-magazine. I am sure this will not only benefit the participating students but will motivate the entire student community of the The Neotia University in pushing forward a new way of learning during the current pandemic. Also like to compliment the students of Fisheries Science for their hard work immediately after the completion of final examination. I wish a grand success of this e-magazine.

Prof. (Dr.) Sushil Kumar Kothari
Dean
School of Agriculture and Allied Sciences (SAAS)
The Neotia University

Dr. Shibam Saha

Assistant Professor

Department of Fisheries Science
School of Agriculture and Allied Sciences
The Neotia University

India is the second largest producer of fish in the world. Fisheries are an important source of food, nutrition, employment and income in India. Only after the Indian Independence, has fisheries together with agriculture been recognized as an important sector. To develop, manage, and promote fisheries to double the farmers' income there is urgent need of fisheries trained professionals. Fisheries education can full fill these requirement, therefore. The Neotia University is working on the objective of 'Universal Knowledge' through proper education. On the part of this journey the e-magazine, '**Matsya Purana**' will allow the students explore themselves beyond their conventional degree programs
I sincerely wish the grand success of the magazine. We hope to be extent this magazine for more helpful to farmers and students in upcoming days. Finally, I would like to thanks our all collaborators, specially our students, who are the backbone of this magazine. Without their whole hearted support, we could not be able to launch this E-magazine.

Dr. Siddhnath

Assistant Professor

Department of Fisheries Science
School of Agriculture and Allied Sciences
The Neotia University

Fish forms an important part of people's diets in West Bengal, particularly those that live near rivers, coasts, and other water bodies. Many of traditional societies and communities are rallied around the occupation of fishing.

The E-magazine released on Fish Farmer's Day will help in highlighting the critical importance of fish and fishery products in livelihood of farmers.

Mr.Animesh Ankuria

Teaching Assistant

Department of Fisheries Science
School of Agriculture and Allied Sciences
The Neotia University

Hailing from a country, as India, and also the state of West Bengal, both of which share a lion share of its boundary with the oceans, realising the importance of efficient procurement and culture of a rich and cheap source of protein, and further its immense potentiality towards the alleviation of malnutrition and uplifting of an economy, especially in a developing country as ours, is quintessential. This vision can only be achieved by the influx of innovative changes brought through the approach of extensive scientific researching and awareness.

A goal towards which '**Matsya Purana**', seeks to lay the cornerstone for.

Prof. Sushil Kumar Kothari
Dean, School of Agriculture and Allied Sciences (SAAS)
The Neotia University

Editors

Dr. Debasmita Jana
Assistant Professor
Department of Fisheries Science
School of Agriculture and Allied Sciences
The Neotia University

Dr. Sudeshna Sarker
Assistant Professor
Department of Fisheries Science
School of Agriculture and Allied Sciences
The Neotia University

Dr. Shibam Saha
Assistant Professor
Department of Fisheries Science
School of Agriculture and Allied Sciences
The Neotia University

Dr. Siddhnath
Assistant Professor
Department of Fisheries Science
School of Agriculture and Allied Sciences
The Neotia University

Mr. Animesh Ankuria
Teaching Associate
Department of Fisheries Science
School of Agriculture and Allied Sciences
The Neotia University

Member

1. Scientific Division

Mr. Shreyam Mandal
Mr. Abhirup Ghosh
Miss. Sayani Ka
Miss. Srijoni Dey

2. Animation/ Drawing Division

Mr. Abhinandan Paul
Mr. Pritam Pramanik
Miss. Bratati Das
Miss. Dipasree Roy

3. Students Curriculum

Mr. Arindam Jana
Mr. Abir Halder
Mr. Subhro Mondal
Mr. Abhishek Bhowmik
Mr. Sahil Pailan

4. Photography Division

Mr. Shouvik Sarkar
Mr. Swastik Mondal
Mr. Rishi Sukul

Dr. Debasmita Jana

Assistant Professor

Department of Fisheries Science
School of Agriculture and Allied Sciences
The Neotia University

Fish touch our lives in countless ways in terms of providing food, nutrition, livelihood, employment, recreation and many more.
I am very happy to announce that in the pandemic situation COVID-19, our Department of Fisheries Science is going to celebrate the National Fish Farmers' Day on 10th July, 2021. On this special occasion we are glad to launch the first ever E-Magazine "**Matsya Purana**" from our Department of Fisheries Science, (SAAS). This new step would not have been possible without our beloved talented students. I hope this magazine continues to evolve as a creative and vibrant space for the students to discover and nurture their talent.

Dr. Sudeshna Sarker

Assistant Professor

Department of Fisheries Science
School of Agriculture and Allied Sciences
The Neotia University

Fisheries science is the part and parcel of developing country, especially in India. It is one of the substantial contributor of food and nutritional security and livelihoods of millions of people. It shows significant impact on the global economy as well. Global fish production is estimated to have reached about 179 million tonnes in 2018, with a total first sale value estimated at USD 401 billion, of which 82 million tonnes, valued at USD 250 billion, came from aquaculture production. But wwithout sound conservation and management measures, fisheries will quickly become depleted and a basic component of global food security will be lost. Being more updated about the subject and new sustainable techniques could help us to maintain the resource and incline the growth further. In that case magazine, chronicles are handy way out to keep us updated. Magazines cater for special interests and give more recent information than books. Hope the E-Magazine '**Matsya Purana**' will serve the purpose being a creative platform in terms of gaining knowledge in a vivid way.

Scientific Division

Tilapia: Fish of the Future for Aquaculture Blooming in Bangladesh

Dr. Yahia Mahmud and Dr. A H M Kohinoor
Bangladesh Fisheries Research Institute (BFRI), Mymensingh, Bangladesh

Abstract

Tilapias are now considered as 'wonder fish' by some and as 'aquatic chicken' by others. The introduction of improved variety of tilapia and expansion of culture practice of this fish contributed significantly for the increase in aquaculture production. Tilapia production of Bangladesh is about 0.38 million tons in 2017. By the last 12 years (2005 – 2017) there has been a tremendous progress in tilapia farming in this country. Bangladesh Fisheries Research Institute (BFRI) introduced GIFT strain in 1994 from Philippines and conducted research for further stock improvement using family selection protocol and disseminated the improved strains and low cost appropriate aquaculture technologies to the end users. Meanwhile, BFRI developed improved generation (F-10 generation) of tilapia which showed 56% higher growth than founder stock. BFRI has a programme to distribute improved germplasm of tilapia in selected commercial tilapia hatcheries all over the country for sustainable quality tilapia fry production. Tilapias have great potential in Bangladesh and they are going to be the prime culture species in near future. The way tilapia aquaculture is expanding; it is expected that by 2030, tilapia production can be reached to 1.0 million tonnes.

Introduction

Tilapia is the most widely cultured fish in the world and is second only to carps as the most widely farmed freshwater fish in world aquaculture. Tilapia is grown in more than 85 countries. Asian countries are the leading producers of tilapia with a production of 5.60 million tones in 2015 (FAO Aquaculture Newsletter, 2017). Although a freshwater fish, tilapia can tolerate some salinity. It is harder than many other fish breeds, which can grow in adverse situations, and is quite disease resistant as well. Farming practices of the fish ranges from extensive to super intensive both in fresh and brackish waters have significantly expanded in many countries of the world. Bangladesh is one of the top ten countries in tilapia production and ranked fourth in the world after China, Indonesia and Egypt (Table 1).

COUNTRY	PRODUCTION (MILLION MT)
1. China	1.80
2. Indonesia	1.10
3. Egypt	0.875
4. Bangladesh	0.378
5. Viet Nam	0.258
6. Philippines	0.261
7. Brazil	0.219
8. Thailand	0.177
9. Colombia	0.061
10. Uganda	0.057

Table 1: Production of tilapia in top ten tilapia producing countries of the world (FAO Aquaculture Newsletter, 2017)

Tilapia (Oreochromis mossambicus) was first introduced in Bangladesh in 1954 and then O. niloticus in 1974, with a hope to contribute protein supplement to the people. These attempts were unsuccessful due to lack of knowledge of their biology and culture technologies. Subsequently, Bangladesh Fisheries Research Institute (BFRI) again introduced Oreochromis species in 1986, Genetically Improved Farmed Tilapia (GIFT) strain

in 1994 and 2005, and Chitralada strain in 2007 by Chitralada Aqua Park Ltd. All these species and strains came from Thailand except GIFT, which was brought from the Philippines. Breeding and culture technologies of these species have already been developed by BFRI. In the meantime, monosex (all male) tilapia hatcheries have been established in different places of the country. Over the last 15 years, its demand has gradually increased to the consumers as food fish. It has already emerged as an important species of aquaculture in Bangladesh. Already there has been a tremendous progress in tilapia production in the country (Fig. 1) in the last 12 years (2009–2019). According to the DOF, Bangladesh is now producing about 0.38 million tones of tilapia (FRSS, 2020).

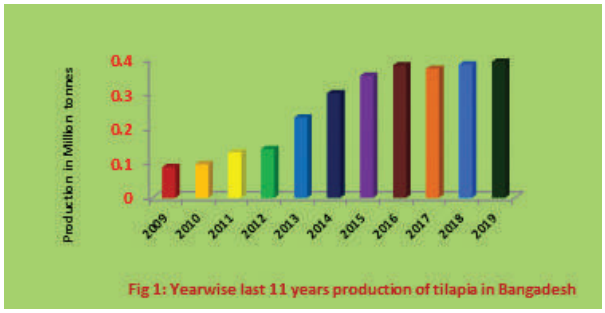


Fig 1: Yearwise last 11 years production of tilapia in Bangadesh

Aquaculture Potentials of Tilapia in Bangladesh

Tilapia has become the shining star in international aquaculture with farms starting and expanding across the globe. Production of tilapia for local consumption and export rose tremendously during the last decades. The commodity is considered as the most important aquaculture species of the 21st century. Some favourable characteristics of tilapia have made it extremely suitable for aquaculture such as:

- The fish can grow in low oxygen and adverse water conditions,
- Potential for high yield and faster growth,
- Able to grow both in fresh or brackish water,
- Tilapia is considered an important source of protein, especially for poor people,
- Tolerant to high-density aquaculture, and relatively disease resistant.

The development of Genetically Improved Farmed Tilapia (GIFT) that is based on traditional selective breeding technique as a means to improve commercially important traits of tropical farmed fish is a major milestone in the history of tilapia aquaculture. In on-station and on-farm trials of BFRI, the GIFT strain was reported to show 35 - 57% superior growth than that of the existing strain of the country.

Tilapia farming is gaining popularity day by day in Bangladesh. In the meantime, a large number of entrepreneurs have established tilapia hatchery in different parts of the country for commercial production of mono-sex tilapia seed for farming. More than 500 mono-sex tilapia seed production hatcheries established under the technical assistance of BFRI and producing 5-6 billion tilapia fry every year. Due to excellent growth performance and other better traits (survival, fecundity and disease resistance, etc.), the improved strain developed by BFRI has been named as BFRI-GIFT strain. Presently BFRI, as a center of excellence for genetic upgradation of tilapia strains, is distributing on an average 0.5 – 0.7 million improved tilapia germplasm every year to hatchery operators and entrepreneurs all over the country.

Stock Improvement of Tilapia

In Bangladesh, cultivation of tilapia in different types of culture systems has proven its value to both current and future fish producers. Both rural and urban consumers are likely to be benefitted from more widespread stocking of tilapia within conventional polyculture and intensive monoculture systems. However, ensuring availability of improved strains at the farm gate as well as maintaining consistent quality of seed stock is critical to this development. Production of monosex tilapia is already established in the private sector, but it requires high investment and critical inputs (hatchery and pond complex, chemicals, etc) which are affordable only by resource rich intensive producers and not by ordinary poor farmers.Over the last five years, more than 500 tilapia hatcheries have been established that are supplying over 5.0 billion tilapia fry to support commercial farming in >15000 tilapia farms all over the country. Rapid expansion of tilapia hatcheries contributed to this dramatic increase of seed production. However, genetic quality of those seeds could not be maintained due to poor brood stock management. On the other hand, most of these hatcheries function in genetic and reproductive isolation (i.e. no introductions or replaced by new stocks) and repeated use of the same stock every year just to maximize the quantity of seed production. As a result, tilapia grow out farmers are not in a position

to maximize their production and profit due to lack of quality seeds.

In view of overcoming this situation and meeting the growing demand for genetically improved tilapia brood stock for quality seed production in the country, BFRI has been implementing a family selection program since 1995 for continued improvement of the genetic quality of the GIFT strain. After ten generations of genetic selection, general linear model analysis indicated that the selected fish had 7.17, 13.60, 23.21, 30.30, 35.38, 39.25, 43.19, 49.09, 52.82, 56.25%, 58.46%, 61.19% and 64.44% higher harvest weight than that of the founder population in G-1, G-2, G-3, G-4, G-5, G-6, G-7, G-8, G-9, G-10, G-11, G-12 and G-13 generations, respectively (Fig. 2). The continued stock improvement of GIFT strain by family selection in every generation at BFRI, enable the institute to supply improved germplasm to over 200 tilapia hatcheries every year for the production of high-quality seed in the country. This achievement of BFRI greatly contributed to sustainable increase of tilapia production in Bangladesh.

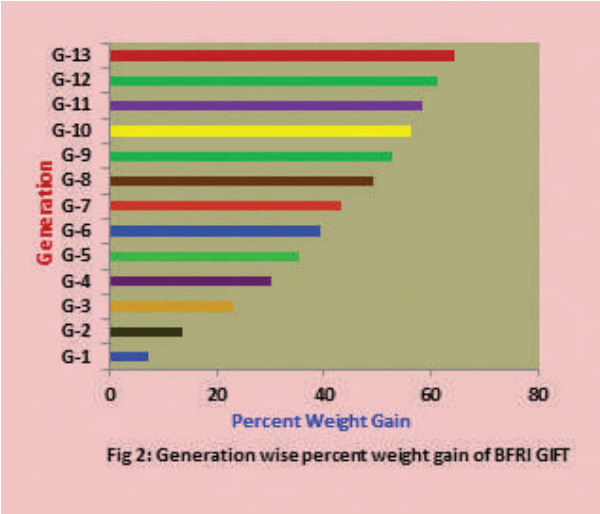


Fig 2: Generation wise percent weight gain of BFRI GIFT

Environmental Impacts of Tilapia species and culture system

Farming of tilapia does not generally pose adverse environmental impacts. However, poor fish husbandry practices (as in all forms of fish farming) can contribute to water pollution. Discharges of nutrient-rich water from commercial tilapia farms into natural water courses can cause water pollution. Daily application of large quantities of artificial feeds to fish cages in water bodies can place large nitrogen and phosphorus loadings on the water. Good husbandry and environmentally friendly farming practices are key requisites for minimizing these adverse environmental effects from tilapia farming.

Role of BFRI

Aquaculture has been one of the fastest-growing economic subsectors of Bangladesh, providing high-protein food, income, and employment and earning foreign exchange. Tilapia has great potential in Bangladesh and it is going to be the prime culture species in the near future for fresh and brackish water ecosystems. It is expected that about 50% of total aquaculture output can be contributed by tilapia farming. It can provide livelihoods for millions of people by employing them in small and large-scale tilapia aquaculture industries in the country.

BFRI has a programme for national seed distribution of tilapia particularly of GIFT strain. Under this programme, BFRI has initiated training on “Quality seed production techniques and improved Culture Management of Tilapia” for field level extension officers and technicians of major GO and NGOs of the country. Plans are being made to involve DoF for further spreading of tilapia farming in the country utilizing its Fish Seed Multiplication Farms for dissemination of BFRI evolved technology to farmers through their extension mechanisms.

Suitability of Tilapia for Export Market

There is a great demand for tilapia in the international market. During the first half of 2017, approximately 170 000 tonnes of tilapia (whole, fillets and beheaded) have entered the international market. Asian and Latin American markets continue to be strong as their production increasingly stays within their own domestic markets in addition to imports from China. Asia being the largest producer, exported approximately 145,000 tones of tilapias in Europe and USA. Approximately 55 percent of Asia’s total exports were comprised of frozen fillets and 45 percent whole frozen. The top five producers in the region other than Bangladesh are China, Indonesia, Taiwan, Thailand and Malaysia. No doubt, Bangladesh being the fourth largest producer of tilapia with a production of 0.38 m tones could be in the same line to export tilapia like shrimp to the world market.

Frozen beheaded and gutted whole or fillet from large or medium sized red or white tilapia have good potential for export in the international market. Price of red tilapia is 1.5 times higher than white tilapia. Tilapia farms of Bangladesh are now

in a position to make a steady supply of required size tilapia for international market. Both Frozen Food Exporters Association and the tilapia farmers should begin the process in this regard. Frozen Food Industries should take a lead in this regard.

Economics of Tilapia Farming

Tilapia farming has the lowest energy requirement for protein production. This indicates the suitability of tilapias as a subsistence system of protein production in those parts of the world, where there is a high level of malnutrition, but a low level of technology and where the economy is too poor to develop a sophisticated intensive or super intensive fishery development process.In terms of land and labour requirements, the tilapia farming unit has much less requirement than from any other fish farming system. In terms of protein production per unit area, tilapia is more productive than carps and catfish. In term of market price, the price of tilapia is not too less than carps in Bangladesh. Presently, in the markets of Dhaka, 1 kg tilapia is sold at US$ 1.25-1.50, whereas, carp is sold at US$ 1.5-2.0. The time is not too far, when tilapia will command a higher market price in Bangladesh like “Red tilapia” in Japan and Taiwan.

Future of Tilapia

Tilapia has a great potential in Bangladesh as an alternate and additional species for aquaculture. In view of taking tilapia as one of the important and potential aquaculture fish species, the following areas have been identified for necessary action. Among the South East Asian Countries, Bangladesh is particularly abounds in numerous seasonal water bodies like ditches, shallow ponds, road side canals, barrow pits etc. which retain water for 4-6 months and are not suitable for carp culture. In such cases, tilapia can be a promising candidate for aquaculture in the suitable seasonal water bodies.

- Recently, shortage of feed and low market price of exotic riverine catfish (Pangasiadon hypophthalmus) has severely affected farming of this fish in the country. Therefore, a large number of commercial catfish producers have found tilapia as an alternate species to culture in their farms to maximize profit.
- In brackish water zones and coastal farms (0.20 m ha) of the country, where shrimp culture is suffering from occasional disease outbreak, where tilapia farming will be an important alternative.
- Bangladesh has an extensive network of rivers and tributaries, haors and baors. These waters are suitable for commercial intensive cage culture of monosex tilapia. Entrepreneurs should come forward in cage culture of tilapia in larger scale.
- Frozen Food Exporters should initiate export of frozen fillets and whole tilapia, and should encourage entrepreneurs and farmers to culture tilapia following Good Aquaculture Practice (GAP) to ensure steady supply of tilapia for regular export.

Conclusion

The way of tilapia aquaculture is expanding at the level of small, medium and commercial scales,by 2030, tilapia production can be reached to 1.0 million tonnes. Tilapia aquaculture industries can also provide livelihoods for millions of people of the country.The Freshwater Station of Bangladesh Fisheries Research Institute (BFRI), Mymensingh is a pioneer in tilapia breeding and genetic research and development activities and in maintaining the gene pool of true breeding strains of “BFRI-GIFT” of the Nile and Red tilapia. The genetically improved strains have great potential to obtain higher production and can easily be fitted in the existing suitable water bodies. Semi-intensive or well managed aquaculture of these superior strains of tilapia can not only fulfill the demand of domestic consumption but also can earn substantial foreign exchange for the country by exporting in the form of whole frozen or fillet products. Therefore, it is the time to come forward to draw up and formulate appropriate policy to encourage and support tilapia farming in the country to export tilapia in the international market.

References

- FAO Aquaculture Newsletter, 2017. FAN: FAO Aquaculture Newsletter, No. 57.
- FRSS, 2020. Yearbook of Fisheries Statistics of Bangladesh. Fisheries Resources Survey System (FRSS), Department of Fisheries, Bangladesh.
  Volume 35: 124 p.

(Contributors: Scientists of Bangladesh Fisheries Research Institute (BFRI), Mymensingh-2201; e-mail: kohinoor41@gmail.com)

Application of Black Cumin (Nigella sativa) Against Fish Diseases

Dr. Sudeshna Sarker
Department of Fisheries Science, School of Agriculture and Allied Sciences
The Neotia University

Introduction

Several constraints have been put forth in freshwater aquaculture development. Diseases and poor farm management are some of the most noticeable reasons for reduced fish production in West Bengal (Abraham et al., 2020). Bacterial and parasitic disease outbreaks coupled with environmental stressors pose a major threat to the growth of freshwater aquaculture (Abraham et al., 2019). There are very few FDA approved drugs are available to combat fish diseases. Subsequently the tendency of using inappropriate and irrational use of antibiotics and chemicals by fish farmers, lead to the emergence of resistant bacteria. The most important issue of using antibiotics in aquaculture is the potential to accelerate the development of antibiotic resistance, which results in a decrease of the effectiveness to treat bacterial infections. To tackle the situation an eco-friendly alternative measure could be, development of herbal drug. There are 300,000 herbal species that exist globally, but only 15% have been explored for their pharmacological potential (Yimer et al., 2019). Among several medicinal plants, Nigella sativa L. (Ranunculaceae) has been considered one of the most treasured nutrient-rich herb in history around the world and numerous scientific studies are in progress to validate the traditionally claimed uses of small seed of this species (Yimer et al., 2019).

N. sative (whole plant, flower and seeds) Source: Ahmad et al. (2013)

Typical chemical composition of N. sativa seed:

GENERAL CHEMICAL COMPOSITION	% (W/W)
Fixed oil	22–38
Volatile oil	0.40–1.50
Protein	20.8–31.2
Carbohydrates	24.9–40
Alkaloids	0.01
Saponins	0.013
Minerals	3.7–7
Vitamins	1–4

Nigella sativa

N. sativa (Black cumin) has been used in diferent civilization around the world for centuries to treat various animal and human ailments. So far, numerous studies demonstrated the seed of N. sativa and its main active constituent, thymoquinone, to be medicinally very effective against various illnesses caused by various infectious diseases due to bacterial, fungal, parasitic, and viral infections. It is also act as an immunomodulator. Studies conducted by different scientists the diet enriched with N. sativa oil showed improved immunity and resistance towards bacterial and viral diseases of fish. The dominant chemical content contained in this plant is thymoquinone on of whose functions is as a

hepatoprotector. Thymoquinone causes bacterial protein inactivity by forming an irreversible complex with nucleophilic amino acids so that the protein loses its function (Musa, 2004). The black cumin seedling is a herb which can be used as an immunostimulant because it is capable of enhancing the non-specific and specific immune system (Dorucu et al., 2009; Shewita et al., 2011). Additionally, several studies have shown that black cumin has various pharmacological antiviral (Zaher et al., 2008), anti-fungal (Suthar, 2010), anti-bacterial (Hosseinzadeh et al., 2007; Hannan et al., 2008; Dorucu et al., 2009), and anti-parasitic effects (Ayaz et al., 2007).

Nigella sativa against fish diseases

Antibacterial properties of black cumin has been proven by several scientists. A study conducted by Khatun et al., (2015) showed that the diet enriched with N. sativa oil greatly improved the immunity and resistance of Anabas testudineus against Aeromonas hydrophila. Khondoker et al. (2016) demonstrated that, @4% dose of N. sativa oil enriched diet has an effective immune response and disease resistance for Cyprinus carpio against Pseudomonas fluorescens. Similarly Dey et al. (2020) found black cumin seed oil (@ 2%) effective as growth enhancer, immune booster and resistant against P. fluorescens infection in Nile tilapia Oreochromis niloticus. 2.5% black cumin seed supplemented diet showed increased growth and reduced oxidative stress related losses in Rohu Labeo rohita (Latif et al., 2021). In the report of Mohammed and Arias (2016), 5% N. sativa oil offered substantial protection against F. columnare (columnaris disease) in channel catfifish. It is assumed that the active components of Black cumin seeds are having beneficial effects on shrimp health as in humans. Nur et al. (2020) explore the antibacterial and immunostimulant potential of black cumin extract for disease control across V. harveyi infection in shrimp in their study, where ethanol extract of black cumin admixed feed @7500 ppm showed notable success. Hussein et al. (2000) found that dietary addition of N. sativa significantly ameliorated the adverse effects of dietary on Nile tilapia fish. In another report Sharputi (Puntius sarana) and Rohu (L. rohita) affected by EUS and red spot diseases, recovered with in 28 days when fed with kalojira seed oil admixed feed @ 6ml/kg feed (Alam et al., 2014). This could be due to black cumin seed possessed anti-fungal activity (Islam et al., 1989). Khan (1999) stated that, black cumin (kalojira seed) seed has many medicinal properties such as bronchodilatory, hypotensive, antibacterial, antifungal, analgesic, anti-inflamatory and immunopotentiating and were universally accepted as a panacea. The volatile oil of the seed possessed antibacterial activity against multiple drugs resistant bacteria including vibrio cholerae (Ferdous et al., 1992). It also possessed antimicrobial, anti-fertility, anticancer (tumor inhibiting) and cardio vascular activities (Siddique and Sharma, 1996). Even Alam et al. (2014) experienced better disease recovery in Kalojira seed oil admixed feed fed carps compare to Neem seed oil, Neem leaf extract and Mahogoni seed oil.

Conclusion

The dynamic nature of N. sativa include growth promoting capacity, immunostimulating properties, broad spectrum antimicrobial characteristics which will be of immense use in fish and shrimp culture industry. Use of black cumin extract at a proper quantity enriched in feed may be worthwhile to minimize disease incidents in fish farms in a cost friendly way. As the fish farmers of West Bengal are innovative and environment-conscious, its use can be promoted for easy adoption in lieu of negative effects of antibiotics and chemicals in aquaculture. Also N. sativa needs promotion from the pharmaceutical sectors for commercial production of the final product either in the form of crude extract or the active component.

References

Abraham, T.J., Ramudu, K.R., Rajesh, S.C., Banerjee, S., Adikesavalu, H., Dash, G. & Nagesh, T.S. (2019). Evaluation of health status of Indian major and minor carps cultured in West Bengal, India. Iranian Journal of Ichthyology, 6(1), 41-53.

Ahmad, A., Husain, A., Mujeeb, M., Khan., S. A., Najmi., A. K., Siddique, N. A., Zoheir A., Damanhouri & Anwar, F. (2013). A review on therapeutic potential of Nigella sativa: A miracle herb. Asian Pacific Journal of Tropical Biomedicine, 3(5), 337-352.

Alam, M. N., Ahmed, G. U., & Chowdhury, M. B. R. (2014). Performance of herbal extracts on diseased fish. Bangladesh Journal of Veterinary Medicine, 12(2), 225-230.

Ayaz, E., Yilmaz, H., Ozbek, H., Tas, Z., & Ozlem, O. (2007). Effect of Nigella sativa L. oil on rat-peritoneum macrophage phagocyte activity and capacity. Saudi Medical Journal, 28, 1654-1657.

Dey, B. K., Hossain, M. M. M., & Alam, M. E. (2020). Effect of black cumin seed oil on growth, innate immunity and resistance against Pseudomonas fluorescens infection in Nile tilapia Oreochromis niloticus. Aquaculture International, 1-15.

Dorucu, M., Ispir, U., Colak, S., Altinterim, B., & Celayir, Y. (2009). The effect of black cumin seeds,

Nigella sativa, on the immune response of rainbow trout, Oncorhynchus mykiss. Mediterranean Aquaculture Journal, 2(1), 27-33.

Ferdous. A.J, Islam, S.N., Hasan, C.M. & Ahmed, Z.U. (1992). In: Ghani, A. 2003. Medicinal plants in Bangladesh. Asiatic Society of Bangladesh, p. 319.

Hannan, A., Saleem, S., Chaudhary, S., Barkaat, M., & Arshad, M. U. (2008). Anti bacterial activity of Nigella sativa against clinical isolates of methicillin resistant Staphylococcus aureus. J Ayub Med Coll Abbottabad, 20(3), 72-74.

Hosseinzadeh, H., Fazly Bazzaz, B. S., & Haghi, M. M. (2007). Antibacterial activity of total extracts and essential oil of Nigella sativa L. seeds in mice. Pharmacologyonline, 2, 429-435.

Hussein, S. Y., Mekkawy, I. A. A., Moktar, Z. Z., & Mubarak, M. (2000, September). Protective effect of Nigella sativa seed against aflatoxicosis in Oreochromis niloticus. In Proc. Conf. Mycotoxins and Dioxins and the Environment, Bydgoszcz (pp. 25-27).

Islam, S.N., Hasan, M., Hasan, C.M. and Malek, M.A. (1989). In Ghani, A. 2003. Medicinal plants in Bangladesh. Asiatic Society of Bangladesh, p. 319.

Khan, M. A. (1999). Chemical composition and medicinal properties of Nigella sativa Linn. Inflammopharmacology, 7(1), 15-35.

Khatun, A., Hossain, M. M. M., Rahman, M. Z., Alam, M. E., Yasmin, F., & Islam, M. S. (2015). Effect of black cumin seed oil (Nigella sativa) on enhancement of immunity in the climbing perch, Anabas testudineus. Microbiology Research Journal International, 331-339.

Khondoker, S., Hossain, M. M. M., Hasan-Uj-Jaman, M., Alam, M. E., Zaman, M. F. U., & Tabassum, N. (2016). Effect of Nigella sativa (Black Cumin Seed) to enhance the immunity of common carp (Cyprinus carpio) against Pseudomonas fluorescens. American Journal of Life Sciences, 4(3), 87-92.

Latif, M., Faheem, M., Hoseinifar, S. H., & Van Doan, H. (2021). Dietary Black Seed Effects on Growth Performance, Proximate Composition, Antioxidant and Histo-Biochemical Parameters of a Culturable Fish, Rohu (Labeo rohita). Animals, 11(1), 48.

Mohammed, H. H., & Arias, C. R. (2016). Protective efficacy of Nigella sativa seeds and oil against columnaris disease in fishes. Journal of fish diseases, 39(6), 693-703.

Mukhtar, H., Qureshi, A. S., Anwar, F., Mumtaz, M. W., & Marcu, M. (2019). Nigella sativa L. seed and seed oil: Potential sources of high-value components for development of functional foods and nutraceuticals/pharmaceuticals. Journal of Essential Oil Research, 31(3), 171-183.

Musa, D., Dilsiz, N., Gumushan, H., Ulakoglu, G., & Bitiren, M. (2004). Antitumor activity of an ethanol extract of Nigella sativa seeds. Biologia, Bratislava, 59(6), 735-740.

Nur, I., Linianti., Munaeni, W., Abidin, L. O. B. & Maulidiyah. (2020). Assessment of antibacterial and immunostimulating activity of black cumin (Nigella sativa) extract against vibriosis in white shrimp (Litopenaeus vannamei). The Thai Journal of Veterinary Medicine, 50(4), 549-557.

Shewita, R. S., & Taha, A. E. (2011). Effect of dietary supplementation of different levels of black seed (Nigella Sativa L.) on growth performance, immunological, hematological and carcass parameters of broiler chicks. World Academy of Science, Engineering and Technology, 77, 788-794.

Siddique, A.A. & Sharma, P.K.R. (1996). In Ghani, A.2003. Medicinal plants in Bangladesh. Asiatic Society of Bangladesh p. 3198.

Suthar, M.P., Patel, P.N., Shah, T.G. and Patel, R.K. (2010). Invitro screening of Nigella sativa seeds for antifungal activity. Journal of Applied Pharmaceutical Science, 1, 86-91.

Yimer, E. M., Tuem, K. B., Karim, A., Ur-Rehman, N., & Anwar, F. (2019). Nigella sativa L.(black cumin): a promising natural remedy for wide range of illnesses. Evidence-Based Complementary and Alternative Medicine, 2019.

Zaher, K. S., Ahmed, W. M., & Zerizer, S. N. (2008). Observations on the biological effects of black cumin seed (Nigella sativa) and green tea (Camellia sinensis). Global Veterinaria, 2(4), 198-204.

Yimer, E. M., Tuem, K. B., Karim, A., Ur-Rehman, N., & Anwar, F. (2019). Nigella sativa L.(black cumin): a promising natural remedy for wide range of illnesses. Evidence-Based Complementary and Alternative Medicine, 2019.

Zaher, K. S., Ahmed, W. M., & Zerizer, S. N. (2008). Observations on the biological effects of black cumin seed (Nigella sativa) and green tea (Camellia sinensis). Global Veterinaria, 2(4), 198-204.

A Comparative study on nutritive value of Natural and Fattened mud Crab Scylla serrata from Sundarban, West Bengal

Dr. Shibam Saha
Assistant Professor, Department of Fisheries Science, School of Agriculture and Allied Sciences
The Neotia University

Abstract

In the present study, the biochemical composition such as proteins, lipid, ash and moisture of mud crab meat were studied. For this study, forty eight fresh samples of S. serrata (24 no natural and 24 no fattened) of different weight range from 250±0.05 g to 350±0.23g and sexes (M: F =1:1) were collected randomly from two different sources (i.e. natural resources and crab fattening farm) of Sundarban (Kakdwip area), West Bengal, during June, 2018.The biochemical analysis showed that protein and lipid content was higher in the meat of fattened crab than the meat of the crab collected from natural environment. But ash and moisture content in fattened crab meat was lower than the meat of naturally collected crab. This study also reviled that female of fattened crabs are comparatively superior to other crabs invariable to their size and sex, as its meat contain higher levels of protein and lipid which is considered as a better source of human nutrition.

Key words: Biochemical composition, Scylla serrata, livelihoods, human nutrition.

Introduction

Crab farming is widely envisioned in the coastal districts of West Bengal as it is having excellent prospects to provide livelihoods for the poor community by generating some lucrative income. Among the edible crabs specially species of mud crab, Scylla serrata is widely available in the coastal area of West Bengal and considered as the most valued species. It is because of its considerable size and high quality meat content. A major portion of exported mud crab comes from estuaries, tidal rivers and mangrove forests of the Sundarbans by wild catching, while some portion comes from fattening the crabs in the farms (Roy and Nandi, 2019). To know the nutritional value of the Crab meat collected from two different sources, the biochemical composition such as proteins, lipid, ash and moisture of these mud crab meat were studied.

Materials and Methods

For this study forty eight fresh samples of S. serrata (24 no natural and 24 no fattened) of different weight range from 250±0.05 g to 350±0.23 g and sexes (M: F =1:1) were collected randomly from natural source and crab fattening farm from Kakdwip area during the period of June, 2018. The crude protein, crude lipid, moisture and ash contents of the crab meat of two different sources were estimated by adopting the standard methods (Pearson, 1976; Katsutoshi and Low, 1992).

Fig:1 Collection of crab from Sunderban (Kakdwip area), West Bengal

Table 1. The proximate composition (Moisture, protein, lipid and ash) in the meat of crab, S. serrata

SOURCE	SIZE	SEX (M/F)	WEIGHT (G)	MOISTURE (%)	PROTEIN (%)	LIPID (%)	ASH (%)
Natural	Small	Male (6)	(<200)	72.35±1.15 %	17.60±0.62%	1.27±0.78%	3.6±0.21%
		Female (6)	(<250)	73.22±1.22%	18.85±0.57%	1.35±0.28%	3.8±0.42%
	Large	Male (6)	(<300)	75.03±1.25 %	19.85±0.42%	1.38±0.58%	3.4±0.31%
		Female (6)	(<350)	76.03±1.50 %	20.75±0.72%	1.42±0.62%	3.5±0.12%
Fattened	Small	Male (6)	(<200)	45.41±1.20 %	40.32±1.02%	5.42±0.68%	1.07±0.71%
		Female (6)	(<250)	48.07±1.30 %	43± 1.35%	6.85±0.38%	1.27±0.27%
	Large	Male (6)	(<300)	46.41±1.21 %	42.32±1.32%	5.98±0.78%	1.37±0.65%
		Female (6)	(<350)	51.07±1.18 %	44.33±1.42%	7.68±0.32%	1.47±0.28%

In small natural male crab, mean moisture contents was higher i.e 72.35±1.15 % and lower in small fattened male crab i.e 45.41±1.20 %. In case of small natural female crab, it was 73.22±1.22% and 48.07±1.30 % in small female fattened crab. In large natural male crab, mean moisture contents was higher i.e 75.03±1.25 % and lower in large fattened male crab i.e 46.41±1.21 %. In case of large natural female crab, mean moisture contents was higher i.e 76.03±1.50 % and lower in large fattened female crab i.e 51.07±1.18 %. But the protein contents in small natural male crab were lower i.e 17.60±0.62% than the small fattened male crab i.e 40.32±1.02%. Similarly In case of small natural female crab; it was 18.85±0.57% and 43± 1.35% in small fattened female crab. In large natural male crab, mean protein contents was lower i.e 19.85±0.42% and higher in large fattened male crab i.e 42.32±1.32%.In case of large natural female crab, mean protein contents was also lower i.e 20.75±0.72% and higher in large fattened female crab i.e 44.33± 1.42%.

Similarly the lipid contents were also higher in the small fattened male crab i.e 5.42±0.68% than the small natural male crab i.e 1.27±0.78%.In case of small natural female crab; it was 1.35±0.28% and 6.85±0.38% in small fattened female crab. In large natural male crab, mean lipid contents was higher lower i.e 1.38±0.58% and higher in large fattened male crab i.e 5.98±0.78%.In case of large natural female crab, mean lipid contents was also lower i.e 1.42±0.62% and higher in large fattened female crab i.e 7.68±0.32%.In small natural male crab, mean ash contents was higher i.e 3.6±0.21% and lower in small fattened male crab i.e 1.07±0.71%. In case of small natural female crab, it was 3.8±0.42% and 1.27±0.27% in small female fattened crab. In large natural male crab, mean ash contents was higher i.e 3.4±0.31% and lower in large fattened male crab i.e 1.37±0.65%.

In case of large natural female crab, mean ash contents was higher i.e 3.5±0.12% and lower in large fattened female crab i.e 1.47±0.28%. The results of present biochemical composition study of the meat of Scylla serrata are similar to the findings provided by the previous worker of Sarower et al. (2013). The female crab meat of two different sources (natural and fattened) as well as in two size groups (large and small) has shown higher nutritional content than the male crabs. Therefore, the demand as well as price of fattened female mud crab is much higher than the males.

Conclusion

From this study, it is concluded that fattened female crab is comparatively superior to other crabs invariable to their sources and sexes, as they provide higher levels of nutrients (i.e. protein and lipid) for human nutrition.

References

Roy, M.K.D. and Nandi, N.C. 2019.Culturable crabs of coastal West Bengal: an overview. J. Aquac. Mar. Biol. 8 (1):1-10.

Pearson, D .1976. The Chemical Analysis of Foods. Churchill Livingstone, Edinburgh. p 574.

Katsutoshi, M. and Low, S. 1992. Laboratory Manual on Analytical Methods and Procedure for Fish and Fish Products, 2nd edition (Marine Fisheries Research Department, Southeast Asian Fisheries Development Center in collaboration with Japan International Cooperation Agency,), ISBN 9971883295.

Sarower, G. Bilkis, S. Rauf, A. Khanam, M. and Islam, S. 2013. Comparative Biochemical Composition of Natural and Fattened Mud Crab Scylla serrata. J. of Sci. Res. 5 (3):545-553.

Fisheries play an important role in the economy of India

Sayan Chakraborty
B.F.Sc. 1st Year 2nd Semester

Fish also provides protein rich food and is also a big source of vitamin A, B, and D. There are about 30,000 species of fish in the world out of which about 18000 are found in India. Fish also forms an important part of diet of the people living in the coastal areas of Kerala, West Bengal, Andhra Pradesh, Tamil Nadu, Maharashtra, Karnataka, Goa, and Gujarat. The fish catch in India is of two types:

Marine Fisheries:

Marine fisheries are conducted in all the oceans and seas of the world, including bays and estuaries. The capture and culture of aquatic organisms in salt water accounts for the bulk of the fishery products that reach world markets.

According to Industry body has said that the marine and fish industry in India is expected to touch afigure of 68k by 2015. It said that growing at a compound annual growth rate (CAGR) of about 7% India's marine and fish industry is likely to reach Rs 67,800 crore by 2015 from the current level of nearly Rs 53,000 crore.

Inland fisheries:

India has vast and varied inland fisheries resources. Rivers, streams lakes, reservoirs, tanks, ponds, irrigation canals, multipurpose dams, and paddy fields provides an immense scope, perhaps richest in the world, for the propagation and production of fishes. India as also the third largest producer and second largest producer of Island fish in the world. The fish production in India has gone high about 2.5 times in a span of nearly two decades.

Fish cultures in India have been playing an important role in the economy of the country. As it helps in augmenting food supply, generating employment, raising nutritional level and earning foreign exchange by export.

The fisheries sector also provides employment to over 11 million people engaged fully, partially or in subsidiary pertaining to the sector and an equally impressive segment of the population engaged in ancillary activities and accounts for about one percent of the total agricultural production in India.

However, the fisheries division of the department of Agriculture has been under taking directly or through state governments various production-oriented programmes, input supply programmes and infrastructure development programmes besides formulating appropriate policies to increase production and productivity in fisheries sector. But the main objectives of fisheries development programmes are:

- Enhancing production and productivity of fishermen, fish farmers and fishing industry.
- Increasing nutritional standard of people through fish production.
- Earning of foreign exchange from export of marine products.
- Improving socio-economic conditions of traditional fisherman.
- Employment generation, and
- Conservation of depleted species of fish.

In recognition of the important role of Inland fisheries in overall production of fish, the government has been implementing two important programmes in inland fisheries since fifth/sixth plans. These are Fish Farmers Development Agencies and National programme for fish seed development. A network of more than 300 fish farmers development agencies is functioning now. A new scheme for development of reservoirs fisheries in cooperative sector was initiated during 1989-90 in collaboration with the National Cooperative Development Corporation for development of 27,000-hectare reservoir area in Gujrat, Maharashtra and Karnataka.

Economic Importance of Fish:

(i) Fish as food:

The fish flesh is an excellent source of protein, has very little fat, carries a good amount of minerals and vitamins A and D and rich in iodine. Above all man can digest it easily.

(ii) Fish for controlling diseases:

Diseases like malaria, yellow fever and other dreadful diseases that are spread through mosquitoes can be controlled. Larvivores fish eat larva of mosquito. The important larvivores fish are Gambusia, Panchax, Haplochitus, Trichogaster, etc.

(iii) Aesthetic value

A large number of fish are cultured in aquarium for their beauty and graceful movements. The important aquarium fish are Macropodus, Trichogaster, Carassinus (gold fish) and Pterophyllum (angel fish).

(iv) Fishery Bye-products:

(a) Fish oil:

It is extracted from the liver of the sharks, sawfishes, skates and rays and has medicinal value. These mainly include cod liver oil and shark liver oil.

(b) Fish Manure:

The fish waste after the extraction of oil, is used as fertilizers.

(c) Fish Glue:

It is a sticky product, obtained from the skin of the cod and is used as gum.

(d) Isinglass:

It is a gelatinous substance, obtained from the air bladder of perches, Indian Salmons and cat fish used in the preparation of special cement and in the clarification of wine and beer.

(e) Leather:

A highly durable type of leather is prepared from the skin of sharks and rays.

(f) Artificial pearls:

The silvery bony scales of cypnmids (a type of fish) are used in the manufacture of artificial pearls especially in France.

(v) Employment:

Developing in fishing industry generates more employment opportunities.

(vi) Source of Income:

The fishing industry has brought a lot income to the farmers and the country in general. Now we can say “Blue Revolution” (fish production) and “Green Revolution” (for producing enough food for all).

Fisheries sector in India has shown impressive growth with an average annual growth rate of 10.88% during the year from 2014-15 to 2018-19. The fish production in India has registered an average annual growth of 7.53% from 2014-2015 to 2018-19 and stood at an all-time high of 137.58 lakh metric tons during 2018-19. The export of marine products stood at 13.93 lakh metric tons and valued at Rs 46,589 crores during 2018-19 with an impressive average annual growth rate of about 10% in recent years.

According to the National Fisheries Development Board the Fisheries Industry generates an export earnings of Rs 334.41 billion. Centrally sponsored schemes will increase exports by Rs 1 lakh crore in FY25. 65,000 fishermen have been trained under these schemes since year 2017 to year 2020. Freshwater consists 55% of total fish production.

“Each year, India celebrates 10, July as the National Fish Farmers Day.”

ndia has 7,516 kilometres (4,670 mi) of marine coastline, 3,827 fishing villages and 1,914 traditional fish landing centres. India’s fresh water resources consist of 195,210 kilometres (121,300 mi) of rivers and canals, 2.9 million hectares of minor and major reservoirs, 2.4 million hectares of ponds and lakes, and about 0.8 million hectares of flood plain wetlands and water bodies. fish production in India has grown at a higher rate than food grains, milk, eggs, and other food items. Indian inland waters (rivers, reservoirs, wetlands, lakes and ponds) contribute 62–65% of the total fisheries production.

Conclusion

Fisheries has helped move our country’s economic system forward. It is the main source of income for millions of farmers. As it progresses, it will become a larger sector in the near future and will be able to meet the needs of the people and will growth our India’s economy further.

Evolution of cage culture in India

Ranit Nath
B.F.Sc. 2nd Year 2nd Semester

Cage culture is an aquaculture production system where fish are held in floating net pens. Cage culture of fish utilizes existing water resources but encloses the fish in a cage or basket which allows water to pass freely between the fish and the pond permitting water exchange and waste removal into the surrounding water. Cage culture was originated in 'Kampuchia' about 200 years ago. Sea cage farming in India was initiated by the CMFRI with support from the Ministry of Agriculture and the National Fisheries Development Board (NFDB) at Visakhapatnam, in Andhra Pradesh, in 2005.

Advantages of cage culture:

- Many types of water resources can be used, including lakes, reservoirs, ponds, strip pits, streams and rivers which could otherwise not be harvested.
- A relatively low initial investment is required in an existing body of water.
- Harvesting is simplified.
- Observation and sampling of fish is simplified.
- Allows the use of the pond for sport fishing or the culture of other species.
- Less manpower requirement.

Design and construction:

The cage may be square, rectangular, circular six sided or eight sided. Generally, square and rectangular cages are preferred for culture. Normal size of the cage is 20 to 60 m3. Small cages are more easily managed than large cages and usually provide a higher economic return per unit volume. A cage consists of:

- **Frame:** Cage frame can be constructed from wood, iron, and steel.
- **Flotation:** Floating cages require a flotation device to stay at the surface. Flotation can be provided by metal or plastic drums, sealed PVC pipe, or Styrofoam.
- **Sinkers:** They are made up of stone concrete or metal.
- **Net:** Three types of nets are present inner net, outer net & cover net. It is made up nylon, weld mesh or woven split bamboo.
- **Feeding ring:** Feeding rings are usually used in smaller cages to retain floating feed and prevent wastage. The rings consist of small-mesh (2 mm or less) screens suspended to a depth of 45cm or more.

Types of cages:

Four types of cage are used in cage aquaculture:

- **Fixed:** The fixed cage is the most basic and widely used in shallow water with a depth of 1-3 meters.
- **Floating:** Floating cages are generally used in water bodies with a depth of more than 5 meters.
- **Submersible and Submerged:** The net bags of submersible cages are suspended from the surface, have adjustable buoyancy, and may be rigid or flexible. Submerged net bags are fitted in a solid and rugged frame and submerged under the water. Their use is very limited.

Site selection:

Site selection is the most important part of the cage culture. Different types of sites may be adapted to cage culture. Lakes, reservoirs, ponds, rivers and streams can be used as potential sites provided that the water quality is suitable and there is adequate water depth beneath the cages to allow water movement. The critical issues in selecting sites are the following:

- The depth of the water column should be at least 5 meters.
- Water quality and circulation should be good, free from local and industrial pollution.
- In large and medium-sized reservoirs, sites should be in sheltered bays for protection from strong winds. In small reservoirs, the cage should be anchored in the deeper lentic sector to avoid the current flow through sluice gates and irrigation channel.
- They should be devoid of algal blooms to avoid fouling.
- They should be free of aquatic macrophytes and high populations of wild fish, which can cause oxygen stress.
- Cages should be placed where they will not hinder navigation.
- Sites should be secure.

Water quality:

The success of cage culture depends on maintaining good water quality around the fish cages and so it is in the farmer's best interests to minimize environmental impacts.

- **Dissolved oxygen:** Dissolved Oxygen (DO) level and its availability are critical to the health and survival of caged fish. In general, warm water species such as catfish and tilapia need a dissolved oxygen level of 4 mg/l Dissolved Oxygen levels below 3 mg/l can stress fish.
- **Temperature:** The most important physical factor controlling the life of a cold-blooded animal like fish is temperature. It is critical in growth, reproduction and sometimes survival.
- **pH:** The desirable range of early morning pH for fish production is from 6.5 to 9. Acid death point of the fish is approximately pH 4 and the alkaline death point is approximately pH 11. Slowed growth of fish, reduced reproduction, and susceptibility to disease increasing can be caused if the pH is not at the optimum range.
- **Other:** Turbidity, Nitrate and Phosphate levels, Alkalinity, and Salinity are also affecting on fish culture in cage.

Stocking:

Fish stocking in cages can be slightly different from specie to specie and also depends on the preferred stocking density and the size of fry stock. On the other hand high stocking density requires feed in adequate quantity and quality to promote and guarantee fish growth. Before stocking it is very important to check the condition of the fry that is going to be stocked in the cage. Fry must be free from diseases and should have the recommended size, according to the cage mesh size. Recommended stocking density for cages located in tanks are 225-285 fry/cm3 and for the cages in the ponds is 114fry/cm3. Recommended size of the fry is 2.5–3.0 cm for tilapia and carp species. The recommendation is to stock graded 6 to 8 inch fingerlings, which ensure best production of marketable sized fish at the end. For carps, Tilapia, and catfish, the recommended minimum stocking density is 80 fish/m3, higher densities are possible in some cases. Survival rates in well-placed and well-managed cages are typically 98 to 100%.

Culture species:

The selection of fish species for culture should be based on:

- Biological criteria, such as physiological, behavioral characteristics and level of domestication;
- Marketing criteria, for example demand, price, process and production for its trade;
- Environmental criteria, for example: temperature, distribution and habitat for the growth.

Many of the fish species are suitable for culture in cages. The most appropriate freshwater species are 'Basa' catfish, Carps, Snakeheads, Nila Tilapia, Red Tilapia. The marine species are Seabass, Cobia, Lobster, Grouper. And the brackish water species for cage culture are Milkfish, Crab, Crustaceans etc.

The desired species characteristics for cage culture are:

- Fast growth rate, in regional environmental conditions,
- Tolerance for crowded conditions.
- Good market value.

Feeding:

Feeding is the most important management practice that a fish farmer does each day. Simply stated, no feed will mean no growth. Without growth there will be no profit. Fish feed must be a nutritionally balanced which has adequate protein and energy levels, is balanced in amino acids, and in essential fatty acids, and is supplemented with a complete array of vitamins and minerals. Feeding fish twice daily at adequate rate depending on water temperature, species, size, culture and density is recommended. Caged fish should be fed a floating pelleted feed. Floating feed is trapped inside the feeding ring and will allow the fish farmer the opportunity to observe the fish. Sinking feed will fall through the cage and not be eaten by the fish. In general, warm-water species such as catfish, tilapia and carp can be successfully reared from large sized fingerlings on 32% protein complete diets although many fish farmers prefer 36%. Pellet sizes normally available include 1.5, 3, and 6 mm diameters. Usually large fingerlings can accept 6 mm pellets. Small fingerlings and species with small mouths may need to be started on 1.5 mm pellets. Since it takes about 24 hours for high quality floating pellets to disintegrate, fish may be fed once daily in the proper amount, but twice-daily feedings are better.

Table 1: Recommended daily feeding rates, expressed as percentage of body weight for fish of different sizes. Introduction: Introduction:

FISH WEIGHT (GRAMS)	FEEDING RATE (%)	FISH WEIGHT (GRAMS)	FEEDING RATE (%)
1	11.0	30	3.6
2	9.0	60	3.0
5	6.5	100	2.5
10	5.2	175	2.5
15	4.6	300	2.1
28	4.2	400	1.5

Problems:

- Fish are difficult to observe in cages. Sampling to observe may stress the fish and led to secondary infections. Therefore, the observation during the feeding, when the fish come up to eat at the water surface, is critical.
- Stress comes from the water body. Accumulation of the feed, organic materials, livestock waste and pesticides in the water body may be harmful to the fish. These factors can be avoided by doing an appropriate site selection and a proper maintenance of the cage.
- Human errors: Poor cage construction, stocking poor quality fingerlings, high or low density stocking, poor quality of feed, improper feeding methods, ignoring regular monitoring of fish, poor fish handling, improper site selection and inadequate cage maintenance can be considered as human errors.

References:

Halwart, M., Soto, D. and Arthur, J. R. (2007): Cage aquaculture, Regional reviews and global overview, FAO, Fisheries Technical Paper, 498.

A.K. Das, K.K. Vass, N.P. Shrivastava, P.K. Katiha. (2009): Cage Culture in Reservoirs in India. (A Handbook) WorldFish Center Technical Manual No. 1948. The WorldFish Center, Penang, Malaysia. 24 pp.

Advanced Pre-stocking management Practices

Debtanu Bera
B.F.Sc. 1st Year 2nd Semester

Introduction:

Pre-stocking management is necessary to manage the pond scientifically to give maximum yield of fish. Fish culture in ponds is basically a three-tier culture system which includes rearing of spawn up to fry (2–3 cm) stage for 2–3 weeks in nursery ponds followed by rearing of 2–3 weeks old fry for about 3 months up to fingerling stage (8–12 cm) in rearing ponds before they are finally released in stocking ponds for growing up to table size fish. To enhance the growth of fish and to increase the production, a package of management practices should be strictly followed. Pre-stocking management aims to ensure availability of natural food and dissolved oxygen in sufficient quantity. Pre-stocking part of the management involves the following sequential measures-

1. Drying of ponds:

If possible, ponds should be completely sun dried. This influences the physic-chemical and biological condition of the pond by improving fertility. Drying of fish pond will kill the fish parasites and its larvae and other disease producing organisms. This will also eradicate the unwanted or weed fishes.

2. Eradication and control of aquatic weeds and algae:

Fish ponds infested with weeds are undesirable and harmful for fish culture. They reduce the dissolved oxygen in water. The fishes are subjected to stress due to dissolved oxygen depletion and wide fluctuation between the dissolved oxygen values of the day and night. They also remove a large quantity of nutrients from the water, which otherwise would go into the production of planktons in the pond. Dense growth of the submerged weeds restricts fish movement and interferes with fishing operations. So, it is necessary to remove/eradicate the weeds before stocking of fish in the pond.

The unwanted weeds are controlled or eradicate by following methods:

- Manual or mechanical method,
- Chemical method, and
- Biological Method

Grass carp is the most effective biological control agent against most of the submerged and floating weeds except the water ferns. Grass carp normally consumes choiced aquatic weeds, at least 50% of their body weight in a day. About 300–400 fish, each of about 0.5 kg weight, are enough to clear 1 ha of Hydrilla infested water body in about a month. Normally Hydrilla infestation density ranges from 5–25 kg/m².

3. Eradication of Predatory and weed fishes:

Predatory fishes if present in ponds are harmful for cultured fishes as they prey upon them (Spawn, fry and fingerlings) and the weed fish compete with carp for food, space and oxygen. Therefore predatory and weed fishes should be completely eradicated from nursery, rearing and stocking ponds before these ponds are stocked. Predatory and weed fishes can be removed from the pond by repeated drag netting, but this does not ensure complete eradication. Therefore, dewatering and poisoning the pond are the only alternative methods as some species of fishes burrow into the mud and escape netting.

Predatory and weed fishes can be easily killed by sun drying the pond. However, this is not always possible or is uneconomical, hence, fish poisons are used to eradicate predatory and weed fishes. One should go for cheap and easily available fish poison. The effect of fish poison lasts for a week to 6 weeks depending upon type of poison used. So, poisoning should be done 2 – 6 weeks before stocking the fish to ensure detoxification of water. Seasonal ponds which dry up during summer months need not be treated with fish toxicants.

4. Control of aquatic insects:

Many aquatic insects in their larval and/or adult stages, prey upon fish hatchlings and fry and also compete with them for food. A number of predatory insects like back swimmer, giant water bug (Belostoma), Water scorpion (Nepa) and beetles enter the nurseries, especially during monsoon and prey on spawn and fry. The insects can be eliminated by repeated netting with small meshed nets. They can also be eradicated by use of insecticides, but this method is not recommended as these chemicals kill zooplanktons and fish spawn and fry. The basic method of eradication of insects is to apply a thin oily film over the pond surface which chokes the respiratory tubes of aquatic insects. Application of mixture of soap and oil is the most effective method for controlling aquatic insects.

5. Liming and Fertilization:

To maximize the fish production, lime and fertilizers must be properly applied to increase natural fish food. The natural productivity of a pond can be increased by using organic and inorganic fertilizers which provide nutrients, vitamins and minerals. Liming is done 15 days before the stocking the pond with fish fry and fingerlings. Generally 200kg/ha of quick lime is applied/spread on the bottom of the pond. Dose of the lime to be applied in the pond depends on pH of the pond water. The pond should be left to dry after application of lime to get full benefit.

Conclusion:

Pre-stocking management aims at proper preparation of ponds to remove the causes of poor survival, unsatisfactory growth, etc., and also to ensure ready availability of natural food in sufficient quantity and quality for the spawn/ fry/ fingerlings to be stocked.

References:

http://www.fao.org/3/T0555E/T0555E09.htm#:~:text=Pre%2Dstocking%20management%20aims%20at,fry%2Ffingerlings%20to%20be%20stocked

http://celkau.in/Fisheries/CultureFisheries/Carps/pondMangt.aspx

http://inlandfisheriesprestocking.blogspot.com/2012/09/prestocking-pond-management-it-is.html?m=1

Use of Organic matter as pond fertilizer

Nikhilesh Mahata
B.F.Sc. 1st Year 2nd Semester

Introduction:

Animal manures, grasses, agricultural by-products and other types of organic matter have been widely used in many countries as fish pond fertilizers and, to a lesser extent, to fertilize shrimp ponds. Plant and animal meals are sometimes applied to nursery ponds and production ponds for high-valued species during the first weeks of culture. Some shrimp farmers also apply molasses, an immediately available carbon source that can rapidly increase bacterial activity. This practice is especially common in heterotrophic floc systems.

Major role:

The primary role attributed to organic fertilizers is that of decomposing and releasing carbon dioxide, ammonia nitrogen, phosphate and other nutrients to promote the growth of phytoplankton and enhance the base of the food web – the same role of chemical fertilizers such as urea, triple superphosphate, ammonium phosphate, etc. However, particles of organic matter serve as surfaces for growth of microorganisms. This phenomenon enhances the protein content of particles, and zooplankton and other aquatic animals, including some aquaculture species, consume the nutritionally enriched particulate matter directly. Plant and animal meals can serve directly as food for postlarval or juvenile stages of some culture species. (Claude E. Boyd, Sep 2011)

Composition

The typical range in composition of major types of organic fertilizers reveals that these materials have much lower concentrations of nitrogen, phosphorus and potassium than those found in chemical fertilizers. Moreover, manures are not constant in composition like commercial chemical fertilizers.

Advantages

There are several advantages of organic fertilizers. They can serve directly as food for both zooplankton and zoo-benthos, eliminating the lag period between primary and secondary production that occurs in chemically fertilized ponds. Bacteria growing on organic particles not only increase the nutritional value of the particles, but also remove potentially toxic ammonia from water for use in synthesizing bacterial protein. Organic fertilizers often are available from other agricultural activities on family farms in developing countries, but if they must be purchased, they usually are cheap in comparison to chemical fertilizers. Moreover, utilization of organic fertilizers in aquaculture is ecologically desirable, because it results in waste recycling.

Disadvantages

The disadvantages of organic matter as pond fertilizer sometimes outweigh the advantages. The problems of low nutrient content, high application rate and elevated oxygen demand have already been mentioned, but there are several other issues. Organic fertilizers may not be available nearby, and transport of the large amounts of organic material needed to fertilize ponds is expensive. Soil quality may be impaired by organic matter that settles to pond bottoms. Fibrous, organic particles can be sites for growth of macrophytic algae that compete with phytoplankton for nutrients. Humic compounds in manures, especially grasses and other plant residues, can inhibit phytoplankton growth through direct toxicity, and discoloration of the water by these compounds can interfere with light penetration and photosynthesis. Off-flavor in fish and shrimp may result from odorous compounds in manure or produced by actinomycetes, a filamentous bacteria, growing on it. Manures often have a high trace metal content

that possibly could lead to increased trace metal concentrations in the culture species. Antibiotics used in land animal production have occasionally been passed from manure to fish or shrimp. It also is likely that many consumers would not like to know that their aquaculture products were produced in ponds treated with animal waste. This fear is compounded by the idea that human wastes may be used to fertilize fish ponds in a few countries. (Claude E. Boyd, Sep 2011)

Safety precaution

As a food safety precaution and to avoid possible consumer dissatisfaction, the use of animal manures as organic fertilizers should be discouraged when resulting aquaculture products are intended for export. Of course, animal manures that have been composted for several months before application to ponds would be more acceptable than fresh manures for production of export products. Nevertheless, manures, grasses and agricultural byproducts are extremely important for use in ponds to produce fish for family use and domestic markets by small-scale farmers in developing countries – especially in Asia and Africa. (Claude E. Boyd, Sep 2011)

Aquaculture Practices Based On Indigenous Knowledge

Amrita Chiney
B.F.Sc. 1st Year 2nd Semester

Introduction:

Aquaculture remained as the fastest-growing food production sector in the last decade. Interestingly, more than 70 percent of the total aquaculture production comes from small-scale farmers, who are also the major contributors of small-scale innovations and adaptations of aquaculture technologies. The indigenous knowledge practiced by fish farmers. Aquaculture is the controlled production, propagation and rearing of aquatic organisms of highly economic value in a controlled environment such as ponds, channels and enclosures, using a higher density of cultured aquatic organisms than normally found in nature. Many rural farmers have applied indigenous knowledge in various stages of aquaculture in order to meet their livelihood necessities. Wang2 defined Indigenous Technical Knowledge as the 'some of total knowledge and practices which are based on people's accumulative experiences in dealing with situations and problems in various aspects of life and such practices are special to a particular culture'.

Potential of herbal applications in aquaculture:

Herbs and medicinal plants are promising to be an important source of therapeutics in fish culture since these products provide a cheaper source for treatment and greater accuracy without causing toxicity. EUS was reported as a common disease of fish in study area which likely to be occurred during winter season. Reddish coloured ulcer in fish body was the outer symptom that farmer used to identify that. Several traditional practices were recorded from farmers to control this disease. They applied raw goat dung into the pond water @ 10 kg/0.16 ha or ash into the pond water @ 70 kg/0.16 ha. In both the cases, disease was cured after 12-15 days from the date of application, though it depended on the degree of disease spread. Mixture of raw turmeric paste (100 gm.) and banana stem juice (2 L) per 0.16 ha pond was applied and found effective to control EUS within an approximate duration of 15 days. Application of ash or banana leaf @ 40 kg/0.16 ha water area was found effective within two weeks to control EUS diseases.

Control of unwanted fishes:

Removal of unwanted fishes is pre-requisite in fish seed rearing and culture for the better survival of fish seed and growth of culture fish. Farmers of study area followed traditional technique to remove unwanted fishes before stocking fish seed in culture pond. Application of wild plant which is locally known as Bish lata (Glaricidia sepium) is commonTK to control unwanted fishes. Extract prepared from 18 - 20 kg plant was sufficient for one kani (0.16 ha) pond water and spreading method of application was used. Toxicity effect of the extract in pond water remained for 15 - 20 days and fish could be stocked after that.

Control of muscle damage:

In culture pond, muscle spoilage of Indian major carps was common in area. Farmers practice a traditional technique by making dip treatment of affected fish in salt water. They generally used 1 kg salt in 5 L of water and dipping the affected fish for1 -2 minutes. Farmers reported to get positive result within seven days of treatment.

Control of algal blooms:

A trend of high nutrient mass or heavy metal load creates the problem of algal bloom formation in fish culture pond. Such problem affects the health andgrowth of fish. Farmers followed traditional techniques to mitigate such problem using a floating aquatic plant i.e., water hyacinth (Eichhorniacrassipes). They used this invasive plant carefully in the pond water with algal bloom so as to absorb the nutrient and heavy metals. Besides this TK, farmers also reported to apply considerable quantities of cattleurine to control the problem of algal bloom formation in pond water. They applied cattle urine @ 17 L / ha spreading it evenly throughout the pond surface.

Checking water pH:

Scientific fish culture prefers a neutral to slightly alkaline water pH for better growth of fish. But the soil and water pH sometimes become acidic in nature and farmers hardly have laboratory facility to check it out. Theyfollowed a traditional technique to check water pH using blotting paper and red Camellia (Camellia japonica). Firstly, they rubbed red camellia in blotting paper to make it violet-bluish. Then the violet-bluish coloured paper soaked in pond water. Change of the paper colour to red indicated acidic nature and to blue indicated alkaline nature, whereas no change in colour indicates a neutral natureof water. Although the TK didn't provide very specificmeasure of water pH, but it provided the information whether the water was acidic or alkaline. Based upon this crude observation, farmers decided to take requiredaction to correct water pH suitable for fish culture.

Reduction of water turbidity:

Many fish pond encountered the problems of turbidity, since most of soil of the state has red clay soils and bathing was common. To control the turbidity farmers applied considerable pieces of banana leaf/stem after cutting into several pieces. When farmers remove these periodically, theygot better result.

Conclusion:

In the coming years, rural aquaculture is poised to play significant role in increasing freshwater fish production. This low-input aquaculture system is closely associated with Indigenous Technical Knowledge. Though efforts are made to identify, validate and recommend Indigenous Knowledge by some Governments, much indigenous knowledge remains undocumented. There is a need to recognize Indigenous Knowledge, compile, value and appreciate their interaction with local communities. It is also the need for the formulation of policies and programmes for identification of education and training needs to validate popularize the indigenous fisheries knowledge.

References:

1. FAO. The state of world fisheries and aquaculture, Rome: FAO, 2010, 197.

2. Edwards P. Traditional Asian Aquaculture. In: Burnell G, Allan G. Eds. New Technologies in Aquaculture. CRC Press, Wood head Publishing Limited, Oxford, 2009, 1029-1056.

3. Nandeesha MC. Asian experience on farmer's innovation in freshwater fish seed production and nursing and the role of women. In: Bondad-Reantaso MG. ed. Assessment of freshwater fish seed resources for sustainable aquaculture, FAO Fisheries Technical Rome: FAO 2007; 501:581-602.

4. Islam S, Datta M, Sankaran M, Prakash J, Das SP, Biswas S, Sulabidya A & Bhattacharjee T, Underutilized Pomological Crops of Tripura- An unexplored potential, Tripura Science

5. Congress, 2011, 22.Wang G, Indigenous communication systems in research anddevelopment, J Ext Sys, 4 (1988) 75-86.

7. Raychaudhari B, The moon and the net: transient community of fishermen in Jambudwip, (Anthropological Survey of India, Calcutta), 1980, 75.

8. Nirmale V, Indigenous Knowledge of coastal Fisher-Folk of Mumbai district of Maharashtra State, Karnataka, J Agric Sci, 17 (1) (2004) 43-47.

9. Yadava YS & Choudhury M, Bana fishing in beels of Assam, J Bom Nat Hist Soc, 83 (2) (1986) 452.

Recent trends in aquaculture Biofloc technology

Abhijit Basak
B.F.Sc. 1st Year 2nd Semester

Introduction:

The global population is expected to reach 9.6 billion by Yr. 2050 and as the demand for animal protein is increasing year by year it is a challenge to provide quality protein by safeguarding its natural resources for future generations. In this context, aquaculture plays a key role in promoting health by providing animal protein as well as generating employment and economic growth.

Biofloc Technology (BFT) is considered as new "blue revolution" since nutrients can be continuously recycled and reused in the culture medium, benefited by the minimum or zero-water exchange. BFT is an environment friendly aquaculture technique based on in-situ microorganism production. Biofloc is the suspended growth in ponds/tanks which is the aggregates of living and dead particulate organic matter, phytoplankton, bacteria and grazers of the bacteria. It is the utilization of microbial processes within the pond/tank itself to provide food resources for cultured organism while at the same time acts as a water treatment remedy. Thus, this system is also called as active suspension ponds or heterotrophic ponds or even green soup ponds.

How BFT Works:

- Biofloc system is a wastewater treatment which has gained vital importance as an approach in aquaculture.
- The principle of the technique is to maintain the higher C-N ratio by adding carbohydrate source and the water quality is improved through the production of high quality single cell microbial protein.
- In such condition, heterotrophic microbial growth occurs which assimilates the nitrogenous waste that can be exploited by the cultured species as a feed and also works as bioreactor controlling of water quality.
- Immobilization of toxic nitrogen species occurs more rapidly in biofloc because of the growth rate and microbial production per unit substrate of heterotrophs are ten-times greater than that of the autotrophic nitrifying bacteria.
- This technology is based on the principle of flocculation within the system.

Species Suitable for Biofloc Culture:

A basic factor in designing a biofloc system is the species to be cultured. Biofloc system works best with species that are able to derive some nutritional benefits from the direct consumption of floc. Biofloc system is most suitable for species that can tolerate highsolids concentration in water and are generally tolerant of poor water quality. Some of the species that are suitable for BFT are:

- Air breathing fish like Singhi (Heteropneustesfossilis), Magur (Clarias batrachus), Pabda (Ompok pabda), Anabas/ Koi (Anabas testudineus), Pangasius (Pangasianodan hypophthalmus)
- Non air-breathing fishes like Common Carp (Cyprinus carpio), Rohu (Labeo rohita), Tilapia (Oreochromis niloticus), Milkfish (Chanos chanos)
- Shellfishes like Vannamei (Litopenaeus vannamei) and Tiger Shrimp (Penaeus monodon)

Composition and Nutritional Value of Biofloc:

Biofloc is a heterogeneous aggregate of suspended particles and variety of microorganisms associated with extracellular polymeric substances. It is composed of microorganisms such as bacteria, algae, fungi, invertebrates and detritus, etc. It is a protein rich live feed formed as a result of conversion of unused feed and excreta into a natural food in a culture system on exposure to sunlight and vigorous aeration. Each floc is held together in a loose matrix of mucus that is secreted by bacteria and bound by filamentous microorganisms. A good nutritional value is found in Biofloc. The dry weight protein ranges from 25 –50%, fat ranges 0.5 – 15%. It is a good source of vitamins and minerals, particularly phosphorous. It has an effect similar to probiotics. The dried biofloc is proposed as an ingredient to replace the fishmeal or soybean in the feed.

Advantages of BFT:

- Eco-friendly culture system.
- It reduces environmental impact.
- Judicial use of land and water.
- Limited or zero water exchange system.
- Reduces water pollution and mitigate the risk of introduction and spread of pathogens.
- It reduces utilization of protein rich feed and cost of standard feed.

The cost of Biofloc fish tank and Biofloc farm investment cost:

The cost of Biofloc tank for fish farming is approximately Rs. 10,000/piece. The cost of Biofloc farm investment will be approximately Rs. 14 lakh/hectare.

Conclusion:

The Biofloc technology is to solve the problems of water pollution and improve the use of water resources, and recycling the nutrients found in the water by a community of heterotrophic bacteria. This Biofloc system has allowed aquaculture farms to reduce and sometimes eliminate water exchange, though providing added value through the products resulting from microbial metabolism.

References:

https://www.agrifarming.in/biofloc-technology-bft-in-aquaculture-india-a-full-guide

https://www.viv.net/articles/blog/biofloc-technology-for-fish-farming

https://organicabiotech.com/biofloc-fish-farming-in-india/

How can you reduce your feed cost with Organic Juice?

Shreyam Mandal
B.F.Sc. 1st Year 2nd Semester

In fish culture system feeding and fish health is one of the most important things.If farmers not take proper care of these two things the loss is unavoidable. But maintaining good feeding and good fish health can be very costly. So there is a cheaper way which is the organic juice. It is basically the mixture of molasses, yeast, rice bran and groundnut oil cake. It can reduce the feed cost significantly. Though it is very effective, it can't replace the traditional feeding. It should be use only as a supplement.

There is no exact recipe for this. We can use 2.5 kg groundnut oil cake, 3kg powdered rice, 500gm yeast powder, 3kg molasses, 1.5kg whole wheat flour per 1000 m2. After that we have to put it into a drum and we have to add approximately 3 times water. Then either we can close the lid for growth of anaerobic bacteria or we can give air flow for growth of aerobic bacteria in the drum. Then we have to leave mixture in the drum for approximately 2 days. After 2 days it will be ready to use.

The organic juice contains carbon which is necessary for maintaining the C:N ratio. If the C:N ratio is maintained, the beneficial microorganisms can efficiently reduce Ammonia. Those microorganisms brakes ammonia into nitrites and then into nitrates which is not that harmful for fish. Thus, it reduces ammonia which can cause stress to fishes and reduce the chances of many kinds of disease in culture system. It also promotes the growth of phytoplankton and zooplankton which is the natural source of food for fishes. This helps to grow the natural food stock for fish and reduce the FCR value for which the total cost of fish feed is reduced.

Problems farmers can face in Biofloc culture in India

Shreyam Mandal
B.F.Sc. 1st Year 2nd Semester

Introduction:

Biofloc technology is comparatively a new method in aquaculture. It was developed in Israel by Yoram Avnimelech (Books: Biofloc Technology: A Practical Guide Book), professor in Technion - Israel Institute of Technology in 1980. Unlike India, Israel has a dry summer season because of that there is limited supply of water. It makes any types of aquacultures hard. So, professor Yoram developed this method which eliminates the problem of limited water supply. Biofloc method used very less water than the traditional pond culture. After filling the tank with water, it requires only 10% water exchange monthly or even requires no water exchange throughout the culture period. Because of these biofloc technology become very popular though out the world in a short period of time.

Biofloc Technology in India:

Biofloc technology is already well practiced in some Asian countries like China, Indonesia, Vietnam, the Philippines, Thailand. But in India it is introduced recently and not that much developed compared to those countries mentioned earlier.

Problems farmers faced in Biofloc culture in India:

Every culture method comes with its own pros and cons and biofloc technology is also the same. Biofloc technology is becoming very popular in India in recent years. Many farmers are switching to this culture method and also facing many kinds of problems.

1. Climate:

There is a big climatic difference between Israel and India. Cyclones are one of the most destructive events. In Israel cyclones don not happen frequently and are not strong. But here in India things are much different. India is frequently hit by cyclones. Cyclones especially occurs in Bay of Bengal are much more destructive (Amphan 2020, Yash 2021) but in recent years cyclones in Arabian sea are also getting stronger due to the global warming. Cyclones are a great challenge for biofloc technology. It can damage or totally destroy biofloc setups. Because of these catastrophic events the electric supply can be cut off for several weeks. As we know we have to provide oxygen in biofloc tanks through air pumps and this require electricity. Absence of oxygen in like this closed culture system causes heavy mortality within few hours. If farmers want to prevent this problem, they have to rely on inverter batteries or have to plant solar panels. But things will not going to be cheap.

2. Species cultured

Basically, this technology is best for those fish species which can eat the floc made by beneficial microorganism in the tank and for this reason FCR value is very less compared to pond or any other tank culture systems. Tilapia is the first species as well as the most cultured species in Biofloc system. Pangas is also a great choice for this. As the biofloc technology is getting more and more popular, people are trying to experiment with many new species like both Magur species(Though Thai Magur,Clariasgariepinus, is ban in India), both species of Koi, Singhi, Murrels, Pabda,

3. Misleading information:

Nowadays internet is an important part of our modern lifestyle. It is very useful as it provides us with lots of information and help us to learn many new things. But good things always come at a price and in this case it is misleading information. It is true that that some online platform like Youtube is responsible for the increasing popularity of biofloc technology. But only for some money some people who don't have proper knowledge, create youtube channel. In their videos the information is not appropriate but they claim that farmers can earns lakhs of money without investing much money, it is very simple and easy method and it is better than pond cultureetc. This kind of things lure many fish farmers and they start culturing in biofloc system but without genuine information many farmers finally ended up with great loss. Those farmers who really want to avoid these problems and start a biofloc culture they should attend the training programmes held by government.

Conclusion:

Biofloc technology is very new method. Yes, biofloc technology is better in some criteria like it requires less space, FCR value comes very low and we can keep the stocking density very high but it can never replace the pond culture.

Common fish diseases in India

Ankita Debnath
B.F.Sc. 1st Year 2nd Semester

Bacterial Diseases

Innumerable disease is caused in fishes due to bacterial pathogens and several of them are caused in fishes due to bacterial pathogens and several of them are reported in Indian literature. They occur in nursery, rearing and grow out ponds causing serious concern to fish farmers. Some of them often wipe out the entire population of fish. Description of different bacterial diseases are given below –

Fin rot and tail rot:

Fin rot and tail rot in hatcheries, nurseries and grow out ponds have been reported in young and adult fishes. The disease is contagious and capable of causing immense damage. Fin and tail rot in young fish are due to a mixed infection of A.hydrophila.

Symptoms:

Erosion and disintegration of fin and tails. AS the lesion develops the outer in margin becomes frayed and disintegration of soft tissues between fin rays starts.

Control measures:

Give dip treatment to the infected fish with copper sulphate (CuS04) for 1-2 minutes at a concentration of mg/ lit. This may be followed by feeding tetracycline to the infected fish along with feed at a concentration of 10-15 mg/ kg body weight of fish.

Dropsy:

Dropsy is frequently encountered in catla, rohu and mrigal mostly in composite culture ponds in late winter. The epidermis and body cavities get filled with fluid and scales protrude out from their pockets leading to severe anemic condition A mixed infection of A . hydrophila and myxozoan parasite or malnutrition is frequently the cause of infectious dropsy in catla.

Symptoms:

Accumulation of body fluid/ water in the body cavity or in scale pockets, scales become loose, abdomen bulge large largely and pressing on it water comes out through the mouth etc.

Control measures:

Apply KMn04 (potash) at the rate of 4-5 mg/ lit of water to the infected fish pond.

Eye disease:

Liquefactions infects the eyes of rohu, catla and silver carp. The come a of the eyes gets vascularized leading to opacity and complete necrosis and even mass mortality of fish has been recorded investigation have isolated staphylococcus aureus from the affected eyes of diseases fish. Chloromycetin bath @ 8-10mg/L has been found effective in controlling the disease at an early stage. Disinfecting the environment with potassium permanganate at a dose of 0.1 ppm followed by liming @300 ppm check the disease.

Pop- Eye:

The name suggests the physical symptom the fish's eye starts to enlarge and looks almost as if it is ready to pop out of the body. The cause could be bacteria too much dissolved oxygen in the water may also lead to this condition there is no universal cure. Isolate the fish, and treat it with general anti-bacterial medicine.

Impact of use of biodiesel on Indian farmers

Gaurav Ghosh
B.F.Sc 2nd Year 2nd Semester

The recent drop of restrictions on the use and sale of Biodiesel for the respective purposes by the Bombay High court, the decision can prove to be a boon for both the cultivators & transporters if used with proper knowledge & wisdom. Through this article, we would try to predict the benefits by discussing the places where it can be used, & why this should be used. Before going to the main discussion, let's discuss what Biodiesel is in brief.

The biodiesel, by definition, is a renewable biodegradable fuel manufactured from vegetable oils, animal fats mainly. The main ingredient that is used for making Biodiesel is the oil extracted from the seeds of Jatropha sp. The Biodiesel is similar to Petroleum diesel in both chemical & physical aspects which to a layman, gives a benefit of using it on a regular Internal Combustion (IC) engines practically without any modifications. It is available in 2 forms B100 (pure form) & B80 (80% Biodiesel and 20% Ethanol). The forms are made as per the requirement. The physical characteristics of Biodiesel are as follows-:

Biodiesel's Physical Characteristics	
Specific gravity	0.88
Kinematic viscosity at 40°C	4.0 to 6.0
Cetane number	47 to 65
Higher heating value, Btu/gal	~127,960
Lower heating value, Btu/gal	~119,550
Density, lb/gal at 15.5°C	7.3
Carbon, wt%	77
Hydrogen, wt%	12
Oxygen, by dif. wt%	11
Boiling point, °C	315-350
Flash point, °C	100-170
Sulfur, wt%	0.0 to 0.0015
Cloud point, °C	-3 to 15
Pour point, °C	-5 to 10

The biodiesel, if used to power the generators instead of Kerosene or petroleum diesel, then it will not only ensure reduction in the environmental emissions, but also will drastically reduce the running cost of those respective IC machines as the Biodiesel is more lubricating and environment friendly to consider. As per one of the reports, Biodiesel burning produces lesser harmful gases when same quantity of Petroleum Diesel is burnt under the same conditions. Now, let us assume that in India, the fish farmers have positively taken up the use of it over the traditional fuel over some of the most obvious reasons-the fuel price. Honestly, to a farmer, pollution is never the prime concern regarding the machine operations; instead what they remain worried of is the reliability, which includes fewer breakdowns and easy engine starting all year long. The other factor they remain concerned of is the availability of the mechanics locally to do the then necessary things, i.e., repairing in the case of machine breakdowns. So, the mentioned concerns can be managed very easily as stated earlier, the use of this fuel requires

no mechanical modifications and as the engine remains mechanically intact, there is practically no change in the procedures that are to be followed for its maintenance and repairing. In other words, If the user wants, he can start using the fuel at the very next instant to fire his machines which is actually a very good point to ponder as adoption to this fuel not only reduces the monthly running cost, but also to some extent, maintains the machine & creates lesser pollution, thus, for the farmer's point of view, he/she will not have to compromise on the machine's use considering only the fuel prices.

The shrimp farmers, for example, are known to use paddle aerators that are generally powered by a diesel engine, if they use Biodiesel in place of the traditional petroleum diesel, a significant amount of fortune can be saved as it is way more cheaper than the petroleum diesel and certainly the savings will increase with the increase in the applications and thus, in short, a fish farmer can drastically reduce the running cost of all the heat-engines that he/she runs especially on Petroleum Diesel, thereby increasing his/her scope of widening the profit margin. If we think of electricity to power the respective machines and compare the benefits with the use of this fuel, then the first fact that arises is the process of getting the electricity to the farm can be a tricky task and the procurement of instruments like electric motors, inverters etc., will need a lot of fortune and time for making them ready to work and that forces the farmers to cling back to old existing techniques for the purpose.

The fact of huge initial investment of fortune and time that is required whenever the farmer wants to switch to newer non-conventional power sources that will run their machines marks itself a prime reason that the farmers avoid up-gradation process, besides confirming the availability of the personals who will ensure its maintenance and reliability becomes another challenge.

From the above, we can say that, Biodiesel has the required potential to benefit the farmers as it can substantially reduce the production cost in general from their existing technology. Another reason that will influence the farmers is that the taxation of Biodiesel is done following the GST principles, thus, the prices will not be dynamic & will remain constant for a good span of time, easing the farmers to draw a rough calculation on their target crop's production cost. The stated reason will benefit all the transporters also, as biodiesel is less polluting & diesel burning produces most quantity of harmful gasses, vehicular emissions can be reduced keeping the vehicles' engines healthy for a long time.

Thus, from the above general discussions, we can conclude the fact that the adoption of Biodiesel as an immediate alternative to the petroleum diesel has the potential to increase the farmer's earnings to a healthy extent as it ensures lesser running and maintenance cost of the machines. Thus, with proper manifestation of the benefits of this fuel's use to the farmer's population will create a drastic effect in their favor. The use of Biodiesel in farm-related equipments will show an immediate positive change than what we will see in implementing them to automobile machines. The reason for that is very technical and to conclude in short, it is because the farm related machines operate at constant revolutions per minute (RPM) unlike in the case of an automotive engine due to the fact that a car as to change its speed according to the traffic conditions and that means a variable amount of fuel is being injected into the piston chamber and that can trigger issues like hose blockage, injector clogging and eventually can stall the engine. The problem mentioned is due to the fact that, the viscosity gradient of Petroleum diesel is similar to Biodiesel, but not exactly same. Another problem with Biodiesel is that, it can cause engine to start late in cold climates, thus restricting its application tropical and sub-tropical climate having regions only. The main problem that will be faced by the motorists is mainly due to the viscosity nature & the tendency of Biodiesel to form crystals in cold temperatures. Also, as the production of Biodiesel is restricted to some few small start-up companies only, the availability of sound and certified quality Biodiesel is somewhat cumbersome and the quality is known to vary from supplier to supplier. An inferior graded Biodiesel will do no good than harming the engines it is being used in and care should be taken in checking the grade and quality of the fuel before filling.

In spite of the mentioned issues, the Biodiesel should be widely promoted to be used and in the recent times as the chances of support from the government's sides is very less due to very obvious reasons and thus, the initiative should be taken by the organizations that claim to work for the benefit of the cultivators. The prospects of Biodiesel and its effects are awaiting more studies and researches to be conducted so that a similar or even better alternative to the traditional Petroleum diesel can be obtained.

Effects of cyclones on fisheries and aquaculture system

Santanu Maiti
B.F.Sc. 1st Year 2nd Semester

Introduction:

A cyclone is a swirling atmospheric disturbance in regions of low pressure. It occurs in hot oceans and is accompanied by powerful winds. The direction of spiraling is counter clockwise in the Northern Hemisphere and clockwise in the Southern Hemisphere. The centre of the cyclone is called the eye of the cyclone.

What is cyclone?

A cyclone is a general term for a weather system in which winds rotate inwardly to an area of low atmospheric pressure. For large weather systems, the circulation pattern is in a counter clockwise direction in the Northern Hemisphere and a clockwise direction in the Southern Hemisphere.

Types of cyclone:

Types of cyclones include tropical cyclones, extratropical cyclones and tornadoes.

1. Tropical cyclone:

A tropical cyclone is an organized system of strong thunderstorms with a defined surface circulation and maximum sustained winds between 17 metres per second (33 km) (39 miles per hour (63 km/h)) and 32 metres per second (62 km) (73 miles per hour (117 km/h)). At this point, the distinctive cyclonic shape starts to develop, although an eye is not usually present.

2. Extra tropical cyclone:

Extra tropical cyclones are low-pressure systems that form outside of the tropics in response to a chronic instability of the westerly winds.These storms populate the middle and high latitudes, north of 35 degrees latitude in the Northern Hemisphere, and thus they also are called “mid-latitude cyclones.” If the barometric pressure of a mid-latitude cyclone falls by at least 1 millibar per hour for 24 hours, the storm is referred to as a “bomb cyclone.”

3. Tornado:

A tornado is a rapidly rotating column of air extending downward from a thunderstorm to the ground. The most violent tornadoes are capable of tremendous destruction with wind speeds of up to 300 mph. Tornadoes form in regions of the atmosphere that have abundant warm and moist air near the surface with drier air above, and a change in wind speed and wind direction with height above the ground.

Why and how cyclone does occur?

Cyclones develop over warm seas near the Equator. Air heated by the sun rises very swiftly, which creates areas of very low pressure. As the warm air rises, it becomes loaded with moisture which condenses into massive thunderclouds. Cool air rushes in to fill the void that is left, but because of the constant turning of the Earth on its axis, the air is bent inwards and then spirals upwards with great force. The swirling winds rotate faster and faster, forming a huge circle which can be up to 2,000 km across. At the centre of the storm is a calm, cloudless area called the eye, where there is no rain, and the winds are fairly light. Satellite view over a hurricane, with the eye at the centre As the cyclone builds up it begins to move. It is sustained by a steady flow of warm, moist air. The strongest winds and heaviest rains

are found in the towering clouds which merge into a wall about 20-30 km from the storm's centre. Winds around the eye can reach speeds of up to 200 km/h, and a fully developed cyclone pumps out about two million tonnes of air per second.

Where cyclone does occurs?

Cyclones begin in tropical regions, such as northern Australia, South-East Asia and many Pacific islands. They sometimes drift into the temperate coastal areas, threatening more heavily populated regions to the South. Northern Australia has about four or five tropical cyclones every year during the summertime wet season. For a cyclone to develop, the sea surface must have a temperature of at least 26°C.

How cyclone impact on fisheries and aquaculture system:

Severe tropical cyclones, namely, hurricanes and tropical storms, frequently affect important marine fish stocks and fisheries along the United States Atlantic and Gulf of Mexico coasts. As fish and fishery responses to these disturbances are poorly understood, tropical cyclone disturbances are not explicitly incorporated into stock assessment models. Here is some bad affects of cyclone to the aquaculture system.

1. Loss of habitat
2. Loss of juveniles and brood fishes
3. Loss of livelihoods of farmers and fishermen
4. Spread of diseases
5. Loss of capital assets
6. Loss of pens and cages
7. Loss of biodiversity
8. Tropical cyclones becoming more intense
9. Increased peak wind speeds
10. Higher mean and peak rainfall
11. Heavy rains create inland flooding
12. Damage to infrastructure

References:

https://wxguys.ssec.wisc.edu/2019/04/29/cyclone/https://www.researchgate.net/publication/267877254_Tropical_Cyclone_Effects_on_Fish_Stocks_and_Fisheries_in_the_Florida_Keys

http://aquafind.com/articles/Cyclone.php

How is COVID-19 affecting fisheries and aquaculture?

Abhishek Bhowmik
B.F.Sc. 1st Year 2nd Semester

The impacts of COVID-19 on the fisheries and aquaculture food systems vary, and the situation is rapidly evolving.

Fish and fish products that are highly dependent on international trade suffered quite early in the development of the pandemic from the restrictions and closures of global markets, whereas fresh fish and shellfish supply chains were severely impacted by the closure of the food service sectors (e.g. hotels, restaurants and catering facilities, including school and work canteens). The processing sector also faced closures due to reduced/lost consumer demand. This has had a significant impact, especially on women, who form the majority of the workforce in the post-harvest sector.

The lockdowns implemented by some countries have resulted in logistical difficulties in seafood trade, particularly in relation to transportation and border restrictions. The salmon industry, in particular, suffered from increased air freight costs and cancellation of flights. The tuna industry has reported movement restrictions for professional seafarers, including at-sea fisheries observers, and marine personnel in ports, thereby preventing crew changes and repatriation of seafarers.

Some shortages of seeds, feeds and related aquaculture items (e.g. vaccines) have also been reported, due to restrictions on transportation and travel of personnel, with particular impacts on the aquaculture industry.

As a result of the drop in demand, and resulting price drops, capture fishery production in some countries has been brought to a halt or significantly reduced, which may positively influence wild fish stocks in the short term. In aquaculture, there is growing evidence that unsold produce will result in an increase of live fish stocks, and therefore higher costs for feeding as well as greater risk of fish mortalities.

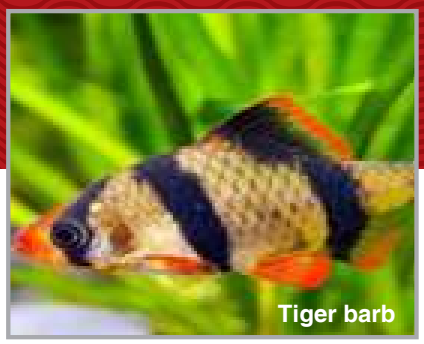
In some areas, an increase in retail sales has been reported due to the closure of the food service industry. Canned and other preserved seafood products with a longer shelf life have profited from panic buying at the beginning of the crisis. In some markets, suppliers have developed ways to provide direct supplies to consumers (e.g. box schemes) to replace lost fresh fish sales from established retailers.

There are still many uncertainties ahead, particularly with regard to the duration and severity of the pandemic, but a prolonged market downturn is likely to introduce long-term transformations to the sector.

Ornamental fishes of India

Rishi Sukul
B.F.Sc. 1st Year 1st Semester


Denison barb


Tiger barb


Tinfoil barb

Keeping colourful and fancy fishes, popularly known as ornamental fishes, aquarium fishes or live jewels is one of the oldest and most popular hobbies in the world. The ornamental fishes used in aquarium keeping, 10-15% constitute marine species and the rest from fresh and brackish water (Tissera, 2010). According to Gopakumar (2010), 1.5 to 2 million people are engaged in keeping for recreation or livelihood.

Prospects of this sector:

India is endowed with rich ornamental fish resource from many corners of this country. Indian fisheries comprise more than 350 ornamental fish species and contribute 24% of the total fish species in trade. Many innovative research programmes such as selective breeding, colour enhancement, SPF broodstock, recirculation aquaculture system (RAS) has helped to pull out the technologies commercially. Agencies like National Fisheries Development Board (NFDB) and Marine Products Exports and Development Authority (MPEDA) are providing subsidies for developing ornamental fish hatcheries to support entrepreneurs.

World Scenario:

With the increase in demand for ornamental fishes especially in USA, Europe and Japan, many countries in Asia have started capturing and culturing beautifully coloured ornamental fishes. The top exporting countries are Singapore, followed by Honkong, Malaysia, Thailand, Philippines, Srilanka, Taiwan, Indonesia and India. The largest importers are the US, followed by Europe and Japan. The emerging markets are China and South Africa. Not only the attractiveness and colour but also the rarity is important in an export market.

India Scenario:

The Indian ornamental fish sector is a small but vibrant segment, with potential for tremendous growth and large scale gainful employment generation. India's share in ornamental fish trade is estimated to be Rs 153.23 lakh which is only 0.008% of the global trade. At present, the market is mainly domestic. Ornamental fish export from India is dominated by the wild caught species, which cater to a small portion of the global market. In India, the first public aquaria "Taraporewala" was established in the middle of 20th century.

Freshwater Ornamental Fishes:

Barbs:

Barbs are cyprinid fish groups with small one or two pairs of barbels around their mouth. Roughly there are over 400 species around the world but only 150 species have ornamental value.

Loaches:

Loaches, commonly known as the cleaners of aquarium belong to Cobitidae and Balitoridae family. There are around 40 species of loaches known today.

Gourami:

Gourami, the ornamental fish with accessary respiratory organ known as labyrinth. These indigenous fishes found in freshwater ponds, streams and paddy fields of north eastern India and Bangladesh

Loaches:

Loaches, commonly known as the cleaners of aquarium belong to Cobitidae and Balitoridae family. There are around 40 species of loaches known today.


Zebra loach


Clown loach


Rainbow shark

Gourami:

Gourami, the ornamental fish with accessary respiratory organ known as labyrinth. These indigenous fishes found in freshwater ponds, streams and paddy fields of north eastern India and Bangladesh.


Honey gourami


Kissing gourami


Dwarf gourami

Snakehead:

Snakehead: The snakehead is the fishes with air breathing organs, come under family Channidae and genus Channa. Around 28 species of Channaare known today


Channa bleheri


Channa gachua


Channa pardalis

Live Bearers:

Four groups- guppy, molly, platy and sward tails belonging to the family Poecillidae, give birth to young ones known as live bearers in aquarium industry. The guppy, platy, swordtail platy, swordtails, black molly are the candidate species.


Guppy


Swordtail molly


Endler's livebearer

Goldfish and Koi Carp:

The goldfish is common and attractive exotic cyprinid fish in the aquarium trade. Large varieties like lion hear, oranda, fan tail, shubonkin etc. are known in trade. Koi carp, known to garden ponds which is morphologically common carp.

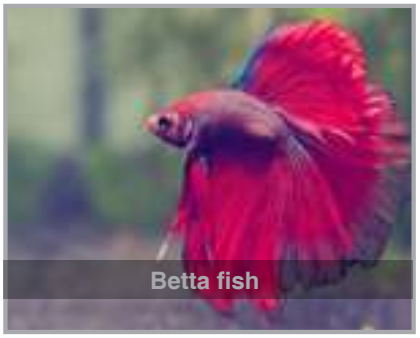
Fighter:

Fighter fish (Bettasplendens) is a popular live jewel in the industry belonging to family Osphronemidae. Male are more coloured and beautiful than female and are aggressive towards other males. Apart from coloration, the finnage also have varieties like veil tail, crown tail, half moon, spade tail, rose tail etc. Indian fighter also known as paradise fish is the indigenous variety of ornamental fish.

There are many more types of ornamental fish species which are cultivated and cultured in India but the above are the most common ones. From the above discussion, it is clear that there is very good opportunity for domestic as well as the international market of ornamental fish. There is need to give more emphasis on this sector also. Government needs formulate suitable policy specially to encourage export.


Oranda Goldfish


Koi carp


Betta fish

Animation/ Drawing

Bratati Das
B.F.Sc. 2nd Year 2nd Semester

Dipasree Roy
B.F.Sc. 1st Year 2nd Semester

Bidita Roychoudhury
B.F.Sc. 2nd Year 2nd Semester

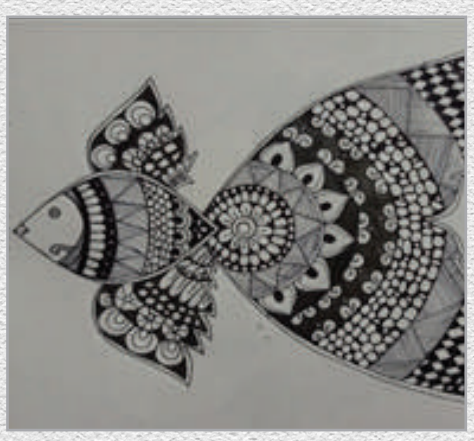
Bratati Das
B.F.Sc. 2nd Year 2nd Semester

Sayani Kar
B.F.Sc. 2nd Year 2nd Semester

Abhishek Bhowmik
B.F.Sc. 1st Year 2nd Semester

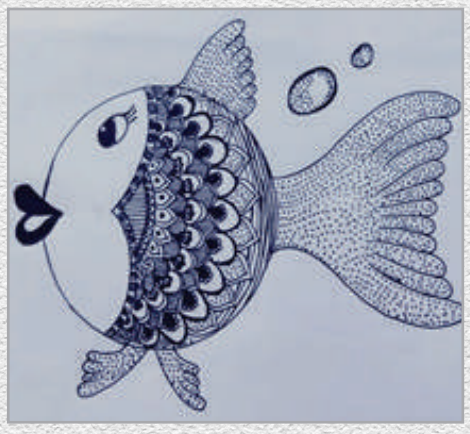
Dipasree Roy
B.F.Sc. 1st Year 2nd Semester

Dipasree Roy
B.F.Sc. 1st Year 2nd Semester



Dipasree Roy
B.F.Sc. 1st Year 2nd Semester

Animation/ Drawing



Amrita Chiney
B.F.Sc. 1st Year 2nd Semester

Priyamedha Saha
B.F.Sc. 1st Year 2nd Semester

Monidip Saha
B.F.Sc. 1st Year 2nd Semester

Bidita Roychoudhury
B.F.Sc. 2nd Year 2nd Semester

Monidip Saha
B.F.Sc. 1st Year 2nd Semester

Priyamedha Saha
B.F.Sc. 1st Year 2nd Semester

Srijoni Dey
B.F.Sc. 1st Year 2nd Semester

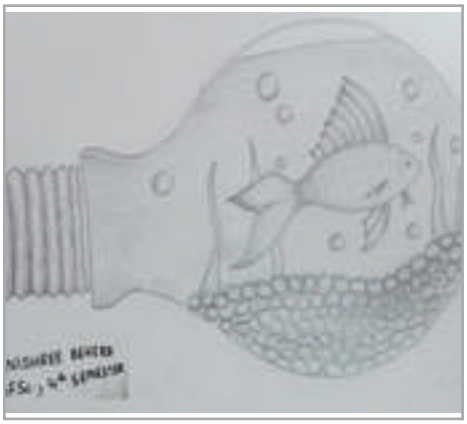
Monidip Saha
B.F.Sc. 1st Year 2nd Semester

Dipasree Roy
B.F.Sc. 1st Year 2nd Semester

Animation/ Drawing

Banishree Behera
B.F.Sc. 2nd Year 2nd Semester

Bratati Das
B.F.Sc. 2nd Year 2nd Semester



Banishree Behera
B.F.Sc. 2nd Year 2nd Semester

Neelagiri Yamini
B.F.Sc. 2nd Year 2nd Semester

Srijoni Dey
B.F.Sc. 1st Year 2nd Semester

Abhinandan Paul
B.F.Sc. 2nd Year 2nd Semester

Sayan Chakrabarty

Neelagiri Yamini
B.F.Sc. 2nd Year 2nd Semester

Priyamedha Saha
B.F.Sc. 1st Year 2nd Semester

Students Curriculum

দৈনন্দিন মাছের দাঁড়িপাল্লা

শুভ্রমণ্ডল; *2nd Year 2nd Semester*

কথাতেই আছে মাছে ভাতে বাঙালি। হ্যাঁ বাঙালির পাতে মাছ একটা আলাদা সুখ। একটু মাছ যদি থাকে তাহলে আর কি চাই।পুকুর, নদী- সমুদ্র থেকে খাবার থালা পর্যন্ত মাছ পৌঁছে দেওয়ার পেছনে এক বিশাল কর্মযজ্ঞ রয়েছে। আমরা খুব সহজেই ঘরে বা আশেপাশের বাজারে চাইলেই পেয়ে যেতেপারি যে কোনো মাছ, কিন্তু একবার ভেবেদেখুন একটা মাছ কোন উপায়ে আজ আমাদের হাতের মুঠোয়। বৈজ্ঞানিক পদ্ধতিতে মাছের উৎপাদন, প্রজনন ও সংরক্ষণের থেকে শুরু করে বাজারে পৌঁছে দেওয়া পর্যন্ত মৎস্য বিজ্ঞানের অবদান অতুলনীয়। ভারত নদীমাতৃক দেশ এবং মাছ রপ্তানির দিক থেকে সপ্তম স্থানে রয়েছে । কয়েক কোটি মানুষ মৎস্য শিল্পের সাথে প্রত্যক্ষ বা পরোক্ষ ভাবে জড়িত। দেশের প্রাকৃতিক সম্পদের সঙ্গে তাল মিলিয়ে নতুন প্রযুক্তির সাহায্যে মাছের ব্যবসা- বানিজ্যে বহুল উন্নতি সাধন ঘটছে। সাধারণত পুকুরে বা জলাভূমিতে বাণিজ্যিক ভাবে মাছ চাষ করা হয়। বিশ্বব্যাপী মাছ চাষের উৎপাদিত সবচেয়ে গুরুত্বপূর্ণ মাছ প্রজাতি হল কাপ, তেলাপিয়া, স্যালমন। মাছ আমাদের প্রাণিজ প্রোটিনের অন্যতম উৎস। কর্মসংস্থান, বৈদেশিক মুদ্রা উপার্জন এবং পুষ্টি সরবরাহে মাছের উল্লেখযোগ্য ভূমিকা রয়েছে। আমাদের দেশে প্রায় ২৬০টির ও বেশি প্রজাতির মাছ আছে। তবে চাষযোগ্য মাছগুলি হল- রুই, কাতলা, মৃগেল, গ্রাসকার্প, সিলভারকার্প, রাজপুটি, পাঙ্গাশ ইত্যাদি। এই সবমাছের কিছু বিশেষগুণাগুণ আছে। এই সব মাছ খুব দ্রুত বাড়ে, খাদ্য ও জায়গার জন্য অন্যের সঙ্গে প্রতিযোগিতা করেনা, পুকুরে বেশি সংখ্যায় চাষ হয় , লাভ বেশি হয়। এজন্য লাভজনক ভাবে এসব মাছের চাষ করা যায় অনায়াসে। শুধু চাষ নয় যারা মাছ ধরছে এবং বাজারে মাছ পৌঁছেদিচ্ছে তাদেরও কিন্তু অবদান কোনো অংশে কম নয়। অন্যান্য শিল্পের পাশাপাশি এই মাছ ধরাও একটি অন্যতম প্রধান শিল্প। রোদেপুড়ে, বৃষ্টিতে ভিজে একজন জেলে কঠোর পরিশ্রম দিয়ে মাছ ধরে এবং সেগুলোকে বাজারে নিয়ে আসে। দৈনন্দিন দিনে অন্যান্য জিনিসের মতোই মাছও নিত্য প্রয়োজনীয় জিনিস। আর বাঙালির তো মাছছাড়া কোনো উৎসবই জমেনা। বাঙালির রক্তে মাছ ও তপ্রোতভাবে জড়িত।তাই মৎস্যবিজ্ঞান, মৎস্যজীবীদের প্রতি আমাদের ভালোবাসা ও কৃতজ্ঞতা চিরকাল ছিল, আছে আর ভবিষ্যতেও থাকবে।

"ভাত মাছ খেয়ে বাঁচে বাঙালি সকল ধানে ভরা ভূমি তাই মাছ ভরা জল।"

Students Curriculum

মাছ – মাছ– মাছ

সৃজনী দে; *1st Year 2nd Semester*

রুই -কাতলা, ইলিশ–পবদা

মাছের হরেক নাম,

বাজারে গিয়ে দেখি,

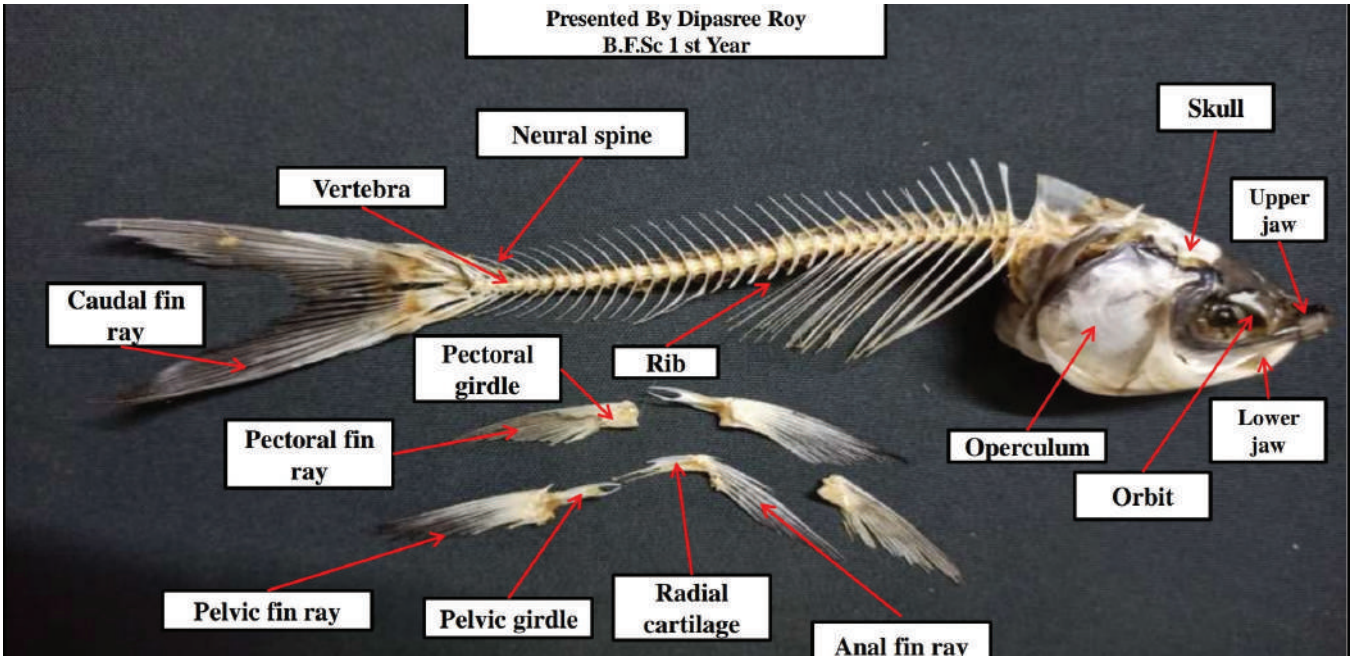
আগুন তাদের দাম।

বাঙালির পাতে রোজ মাছ ভাত চাই

তাই সবাই এসো, আমারা মাছের জোগান বাড়াই।

মাছের স্বাস্থ্য, মাছের যত্ন, মাছের খাবার চাই–

সবদিকেই নজর দিতে এসো, হাতে হাত মেলাই।



Students Curriculum

বাঙালী ও মাছ

দীপাশ্রী রায়।

1st year 2nd semester

সকাল হতেই ইচ্ছা হল
মাছ ভাত আজ জমিয়ে খাব
মাছে ভাতে বাঙালিয়ানা
নিরামিষেতে মন মানে না।

বাজারে গিয়ে দেখি আমি
মাছ নেই কোনো দামিদামি
গ্রাসকার্প, জাপানি পুটি, সিলভার
তিলাপিয়াতে ভরপুর পুরো বাজার।

নামে ভোলা কাজে নয়
চিরকাল সমুদ্রেই তার বাস
পমফ্রেট ভাই উঠছে জাতে
পকেট করে হাসফাঁস।

চাইনিজ বারগার থাকে নাকো মনে
বাঙালির মন শুধুই ইলিশের ঝোলে
চিংড়ি না ভেটকি ভেবেই নেই সময়
বাঙালির মাছের নেশা ফুরোবার নয়।

COVID – 19

Dipasree Roy

B.F.Sc 1st Year 2nd Semester

COVID-19 is the name,
It is playing a hide-and-seek game.
So wash your hands thrice
If you have to go out, think twice.
Wear your mask, be wise,
And after coming home, please sanitise.

Started in China, now, the world is sick,
Let us unite and find a cure, quick.
Until we find the cure,
Stay at home and shut the door.

Arrogant Endurance

Gaurav Ghosh

B.F.Sc 2nd Year 2nd Semester

Amidst that shady clouds,
who warns tinting all Sol's aura.
Seeing that, he shrugs a bit,
As if, there remains a master-pet relation,
Between the said relation.
The wrinkles of his visage,
Tells a trillion tale of what we can't empathise.
With the shrinking sunlight,
he ordered them to focus on the task instead of fortune.
With all his gears still in operation,
the weather tried to deter.
With his eyes struck on gears & blue,
"LONG LIVE HIS COURAGE"!!,
silently said one of his crews.
As the weather was growing dark,
with storm-clouds patrolling overhead,
Many decided to leave the set.
He was advised that too,
but he was the man of blues,
how can he leave his talent to subdue?
He was a known risk taker,
who loved his attitude a bit more,
So he continued what he was doing,
As if for paying tribute to that personality.
With the passing time the sea left empty,
as all of his fellow mates,
started to retreat with disparity.
With lights turned so dim,
it was growing difficult to see,
as if it was not enough for the nature to offer,
it also ordered to shake water that loud.
With the water growing rough,
strong winds stated to be felt.
The deck seemed to ask for a mercy,
and that's when he decided to start-back his journey.
On the way back home,
he saw the map once,
then he saw what he was taking back,
he felt content & that urge to see the land.
The wind gushing strong,
making the his crew to panic,
ignoring that, he only found it difficult to maintain his route,
even when there was no traffic!
So he went & took the wheel,
and himself steered through that choppy fluid!
Time passed & he continued,
but when they still couldn't see the land,
his men all started to cry,
in fear of not being able to see their land!
"Shut Up you rascals!" a voice commanded,
it was him watching them, from the room above them.
With nature harsh outside,
and a strange silence inside,
it really felt suffocating, to even move their eyes.
After a long since, the weather showed some relief,
As if it lost its hope, to conquer their belief.
"I see the land! I see the land!" exclaimed,
breaking that deathly silence.
With confirmation from all on board,
they rejoiced in sheer happiness.
their happiness knew no boundaries then,
seeing the most ordinary scene.
they saw their families waiting for them to anchor,
as the vessel hauled gradually near that scene.
Finally they made it,
made it with enough fortune,
for him to live life his way,
without jeopardising the lives of ones,
younger than his son's age.
That day he was both satisfied & happy,
but couldn't avoid society's "views" on his conduct.
For that day, his vessel marked some physical damage,
with scars both on his vessel & his being,
but yet he decided to walk that way,
of features that make his life,
worth of reciting as a folktale.

Damn Fishing

Abir Halder

B.F.Sc 2nd Year 2nd Semester

Bamboo stick and he flicks his wrist,
Swings the line across continents.
I can hear it swish, slice clouds.
It goes wherever there's water.
Its hook dangles from the slide at the city pool,
Claws at sewer caps, attacks a fireman's hose.
In the morning, I find it
Clipped to the soap dish in my shower:
Question marking listening steam.
I am too busy getting clean to answer.

Silent pain

Gaurav Ghosh

B.F.Sc 2nd Year 2nd Semester

As the nets drew closer ashore,
it contained things having life more.
It was both lucrative & unjust,
depending on viewer's trust.
Being the farmer, it meant money,
being the priest, example of an uncanny.
Out of water, as he was pulled out,
like him many tried to fight their lives out.
with things going blurry & pain becoming deathly,
it's hard to imagine that,
they were drowning in the open land!
With mouths mute,
they saw the pain unbearable,
They all were killed,
by the person who they think,
was there to fill their empty stomach.
The feeling of betrayal,
was the last feeling they had.
the last thing they saw,
was they being put stashed,
'nd compared with stones.
with this, he blacked-out,
and ended his ordeal.
This sounded bad to the emotionals,
and worthless to the professionals.
but thinking keeping romance aside,
it is a must,
to feed us as a population,
and also, to consider the B.FScians,
to be of some worth enough,
amidst the current trend of perception.

Photography Division

Abhijit Basak
B.F.Sc 1st Year 2nd Semester

Subrata Shil
B.F.Sc 1st Year 2nd Semester

Subrata Shil
B.F.Sc 1st Year 2nd Semester

Subrata Shil
B.F.Sc 1st Year 2nd Semester

Photography Division

Subrata Shil
B.F.Sc 1st Year 2nd Semester

Rishi Sukul
B.F.Sc 1st Year 2nd Semester

Rishi Sukul
B.F.Sc 1st Year 2nd Semester

Rishi Sukul
B.F.Sc 1st Year 2nd Semester

Rishi Sukul
B.F.Sc 1st Year 2nd Semester

Abhijit Basak
B.F.Sc 1stYear 2nd Semester

Rishi Sukul
B.F.Sc 1st Year 2nd Semester

Rishi Sukul
B.F.Sc 1st Year 2nd Semester

Rishi Sukul
B.F.Sc 1st Year 2nd Semester

Dipasree Roy
B.F.Sc 1st Year 2nd Semester

Dipasree Roy
B.F.Sc 1st Year 2nd Semester

Amrita Chiney
B.F.Sc 1st Year 2nd Semester

Sovan Samanta
B.F.Sc 1st Year 2nd Semester

Amrita Chiney
B.F.Sc 1st Year 2nd Semester

Amrita Chiney
B.F.Sc 1st Year 2nd Semester

Amrita Chiney
B.F.Sc 1st Year 2nd Semester

Rudra Khilari
B.F.Sc 1st Year 2nd Semester

Rudra Khilari
B.F.Sc 1st Year 2nd Semester

Rudra Khilari
B.F.Sc 1st Year 2nd Semester

Rudra Khilari
B.F.Sc 1st Year 2nd Semester

Subhajit Sardar
B.F.Sc 1st Year 2nd Semester

Rudra Khilari
B.F.Sc 1st Year 2nd Semester

Rudra Khilari
B.F.Sc 1st Year 2nd Semester

Subhajit Sardar
B.F.Sc 1st Year 2nd Semester

Shouvik Sarkar
B.F.Sc 2nd Year 2nd Semester

Subhajit Sardar
B.F.Sc 1st Year 2nd Semester

Swastik Mondal
B.F.Sc 2nd Year 1st Semester

Shouvik Sarkar
B.F.Sc 2nd Year 2nd Semester

Swastik Mondal
B.F.Sc 2nd Year 2st Semester

Shouvik Sarkar
B.F.Sc 2nd Year 2nd Semester

Adhirup Ghosh
B.F.Sc 2nd Year 2nd Semester

Shouvik Sarkar
B.F.Sc 2nd Year 2nd Semester

Swastik Mondal
B.F.Sc 2nd Year 2nd Semester

Adhirup Ghosh
B.F.Sc 2nd Year 2nd Semester

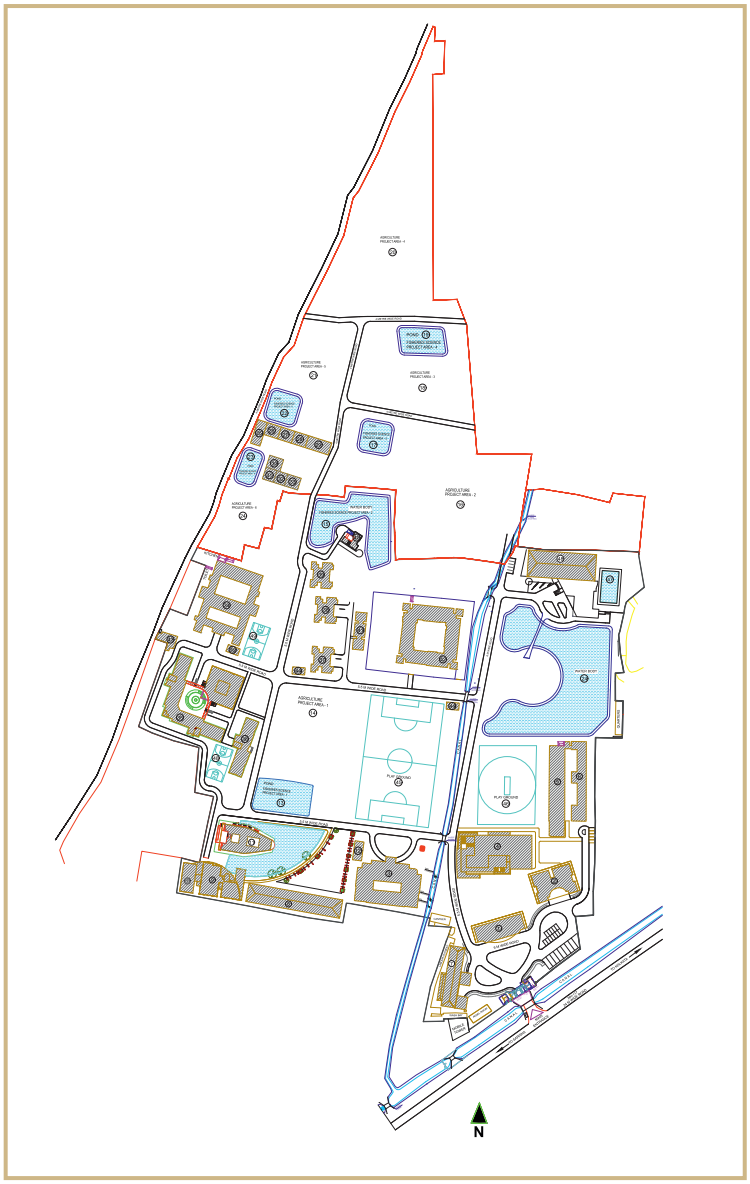
Swastik Mondal
B.F.Sc 2nd Year 2nd Semester

Adhirup Ghosh
B.F.Sc 2nd Year 2nd Semester

Shouvik Sarkar
B.F.Sc 2nd Year 2nd Semester

Shouvik Sarkar
B.F.Sc 2nd Year 2nd Semester

Swastik Mondal
B.F.Sc 2nd Year 2nd Semester



LEGEND- BUILDING

A. ADMINISTRATIVE BLOCK

1. ADMINISTRATIVE BUILDING (G + V)

B. ACADEMICS BLOCK

2. SCHOLASTIC BUILDING - 1 (G + III)
3. SCHOLASTIC BUILDING - 2 (G + II)
4. SCHOLASTIC BUILDING - 3 (G + III)
5. SCHOLASTIC BUILDING - 4 (G + III)
6. SCHOLASTIC BUILDING - 5 (G + III)
7. WORKSHOP BUILDING
8. NEW WORKSHOP BUILDING
9. NEW PHARMACY BUILDING (G + III)
10. PHARMACY BUILDING (G + III)
11. SHIP IN CAMPUS (G + III)

C. AGRICULTURE & FISHERY SCIENCE BLOCK

12. POLY HOUSE & NET HOUSE
13. FISHERY SCIENCE PROJECT AREA - 1
14. AGRICULTURE PROJECT AREA - 1
15. FISHERY SCIENCE PROJECT AREA - 2
16. AGRICULTURE PROJECT AREA - 2
17. FISHERY SCIENCE PROJECT AREA - 3
18. AGRICULTURE PROJECT AREA - 3
19. FISHERY SCIENCE PROJECT AREA - 4
20. AGRICULTURE PROJECT AREA - 4
21. AGRICULTURE PROJECT AREA - 5
22. FISHERY SCIENCE PROJECT AREA - 5
23. FISHERY SCIENCE PROJECT AREA - 6
24. AGRICULTURE PROJECT AREA - 6
25. MUSHROOM UNIT
26. FIELD LAB
27. STORE HOUSE
28. SERICULTURE UNIT
29. THRESHING FLOOR
30. BIO GAS PLANT
31. CATTLE SHED
32. VERMI COMPOST PIT
33. BIO FERTILIZER PLANT

D. RESIDENTIAL BLOCK

34. BOY'S HOSTEL - 1 & 2 (G + III)
35. BOY'S HOSTEL - 1 & 2 (G + III)
36. BOY'S HOSTEL - 1 & 2 (G + III)
37. OLD STAFF QUARTERS (G + III)
38. NEW STAFF QUARTERS (G + III)
39. NEW STAFF QUARTERS (G + III)
40. DIRECTOR'S RESIDENCE (G + I)
41. OLD STAFF QUARTERS (G + III)
42. GIRL'S HOSTEL - 3 (G + II)

E. UTILITY & SERVICES BLOCK

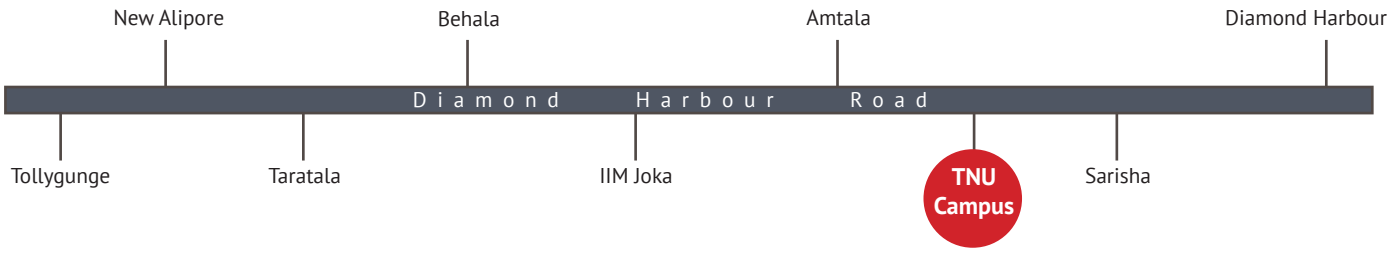
43. ELECTRICAL ROOM
44. PUMP ROOM

F. RECREATIONAL BLOCK

45. FOOTBALL GROUND
46. CRICKET GROUND
47. SWIMMING POOL
48. MULTI PURPOSE HALL
49. BASKETBALL COURT (3 NOS.)

G. HEALTH BLOCK

50. MEDICAL UNIT



AmbujaNeotia

THE NEOTIA UNIVERSITY
ज्ञानम् आत्म प्रदीपाय
UGC Enlisted & Recognised

NEOTIA INSTITUTE OF TECHNOLOGY MANAGEMENT AND SCIENCE
(Formerly ITME. Since 2002.)

Campus: Sarisha, Diamond Harbour Road, 24 Parganas (S), West Bengal - 743 368
Head Office: Vishwakarma, 86C Topsia Road (S), Kolkata - 700 046
Campus: +91 70444 46888 / **Head Office:** +91 70444 46999 | **Email:** contact@tnu.in