BOOK OF ABSTRACTS

FSB2021

FISHERIES SOCIETY OF BANGLADESH

BIENNIAL CONFERENCE

25-26 December 2021

Faculty of Fisheries
Bangladesh Agricultural University
Mymensingh, Bangladesh

FSB2021 Book of Abstracts is dedicated to the memory of
Late Professor Dr Md Aminul Islam

Vice Chancellor

Bangladesh Agricultural University

Mymensingh

MESSAGE

It is indeed a great pleasure and privilege for me to have the opportunity to write a few words on the occasion of 'Fisheries Society of Bangladesh 2nd Biennial Conference 2021' hosted by the Faculty of Fisheries, Bangladesh Agricultural University and scheduled during 25-26 December 2021.

Since research and education in the areas of fisheries and aquaculture has been expanding and advancing rapidly, keeping pace with its advancement, exchanging and updating scientific and societal views and innovative ideas are crucial towards attaining sustainable development. Sustainability and consistency appears to be the key challenges in these areas. I hope that this two-day event will feature recent findings from experts, and will play roles to achieve the SDG in fisheries sub-sector and agriculture sector as a whole.

I hope that the recommendations made in this conference are communicated to appropriate authorities so that the policy planners are able to look at those while formulating policy guidelines regarding sustainable exploitation of fisheries resources and steady growth of aquaculture production. I call on all the scientists and researchers attending this conference from home and abroad to build a smart Bangladesh with the application of science, technology and innovation. I wish this conference a great success.

It is a great pleasure to welcome all delegates and participants to this conference coming from home and abroad. BAU needs little introduction to agricultural scientists coming to Bangladesh, having long been known as one of South Asia's leading academic institutions. Moreover, you are welcome to enjoy BAU's outstanding natural beauties.

I would like to congratulate the Fisheries Society of Bangladesh and my colleagues of the Faculty of Fisheries for their commitment and superb drive in organizing this conference. I am very certain that this occasion will be able to provide a platform towards strengthening our relationships in knowledge sharing while at the same time provide the necessary thrust in joint research collaborations. It is my aspiration that this conference will be a foundation for the growth of new ideas towards a better tomorrow. My best wishes to all the delegates. I wish the Conference all success.

Professor Dr. Lutful Hassan

Director General

Department of Fisheries

Ministry of Fisheries and Livestock

MESSAGE

Bangladesh is one of the world`s leading fish producing countries with a total production of 4.38 million mt. in the Fiscal Year 2018-19. Last 10 years average growth performance of this sector is 5.26 percent, which seems quite consistent and encouraging. According to the FAO report (2020), Bangladesh ranks 3rd in inland capture fisheries production and 5th in aquaculture. The fisheries sector contributes 3.5% to the national GDP and 25.72% to the agricultural GDP. The diversified fisheries resources of the country are very significant in the socio-economic context of Bangladesh. The sector this sector play an important role in the national economy to meet the needs of animal Protein (60%) and employment generation (19.5 million). The government also paid special emphasis on the development of this sector towards achieving nutrition security in the path of becoming a 'Middle Income Country'. In these regards, fisheries sector could be contributed by increasing its production to alleviate poverty and creating employment. It would be only possible by the collaboration and cooperation of different stakeholders of this sector. The fisheries graduates from different universities could be played an important role in these aspects and Fisheries Society of Bangladesh could be a great platform.

I am very glad to know that the Fisheries Society of Bangladesh is going to be arranged its 2nd Biennial Conference 2021. I would like to reiterate the dynamic and pragmatic leadership of the Hon'ble Prime Minister Sheikh Hasina for resolution of long standing dispute over maritime boundary with neighboring countries settling sovereign right over maritime area of 118,813 sq. km. This extends sea fronts and opportunity for exploring the potential of Blue Economy and achieving sustainable development goals (SDGs). In my belief, the fisheries graduates from different corners could be able to harness the untapped potentialities of blue economy by developing research, modern technology, management tools and utilization of harvested recourses.

I firmly believe that the 2nd Biennial Conference of Fisheries Society of Bangladesh will benefit the sector as well as fisheries graduates of all levels including government and non-government officials, entrepreneurs, students, teachers and researchers by its updated information and knowledge sharing. I sincerely thank all those who have worked tirelessly for organizing the conference during this critical moment of Covid-19 pandemic. I wish every success of the conference.

Quazi Shams Afroz

Director General

Bangladesh Fisheries Research Institute

Ministry of Fisheries and Livestock

MESSAGES

It is a great pleasure for me to express my felicitations to the distinguished participants and delegates from home and abroad at the 2nd Biennial Conference 2021 of the Fisheries Society of Bangladesh (FSB). Bangladesh is a riverine as well as maritime country. During the Covid-19 pandemic, the country's fisheries sector has faced a lot of challenges. Fisheries research too, has faced challenges and trying to overcome them with efforts and courage.

Bangladesh has shown continued success in fisheries sector by achieving the landmark of self-sufficiency in fish production. The country now globally ranks 3rd in inland open water fish production and 5th in global aquaculture production. However, we should keep in mind that the population of the country is expected to reach 200 million very soon and there is a pressing need of enhancing fish supply for the nation. As we move forward into an era of growing population, depleted natural resources and striking consequences of climate change, we should strive with confidence to combat these challenges to fulfill our stewardship responsibilities for the best interests of our future generation.

The United Nations' 2030 Agenda for Sustainable Development and its 17 Sustainable Development Goals (SDGs) offer a unique, transformative and integrative approach to shift the world to a sustainable and resilient path that leaves no one behind. The present Government of Bangladesh rallies its support for the implementation of SDG-14 and its noble aim of conserving and sustainable use of openwater and marine resources for sustainable development. I am confident that the researchers, academicians and policy makers in the conference will share their views, ideas and knowledge for fish food security and other related concurrent issues focusing SDGs. It is also important to consider discussing post-Covid measures in fisheries sector of Bangladesh so as to develop the sectors strength against any such natural disaster.

Finally, I wish the FSB Conference a grand success.

Dr. Yahia Mahmud

Dean

Faculty of Fisheries

Bangladesh Agricultural University

& Chair, FSB2021

MESSAGE

I am happy to learn that the 2nd Biennial Conference of the Fisheries Society of Bangladesh (FSB) is going to be held during 25-26 December 2021. The FSB Conference provides a platform for our students and researchers to get experience in presenting and reporting their findings in acceptable manner to the scientific community. It also provides opportunity to the graduate students, faculties and researchers to enrich their knowledge through the lecture and interaction with the eminent scientists who will share their knowledge with them during the Conference.

The prime focus of the Conference includes themes pertaining to various disciplines in fisheries and aquaculture, blue economy and Covid-19 challenges in this sector. The inter-disciplinary scope of the conference aims to enhance and promote new research ideas among the participants.

The technologies that were used during the past have evolved a lot. In this context, the future technologies are bound to replace the technologies that are practiced today. Innovations of new methods and technologies by research will offer stimulating insights into the future development of fisheries sector of Bangladesh. The Conference participants perhaps would discuss on the type of technologies which will be used in fisheries, aquaculture, environment, market, and industry to face the challenge of the 21st century. I congratulate the organizers of the 2nd Biennial Conference for their sincere efforts to bring researchers together. I hope that all the participants will actively participate in the Conference, although it is virtual, and trust that they will have the opportunity to acquire knowledge and share their ideas. I also congratulate and wish the team of FSB and my fellow colleagues from BAU Faculty of Fisheries for making the event a success.

Professor Dr. Md. Mahfuzul Haque

President

Fisheries Society of Bangladesh

& Chair, FSB2021

MESSAGE

Fish is a unique food in the diet of Bangladeshi people. It is not only a general diet, it rather supplies with a major proportion of animal protein for the nation. It also supports livelihood of a lot of people and supports export-earning. Therefore, professionals working to support fisheries sector of the country are serving a very important purpose. Fisheries Society of Bangladesh (FSB) was established in 1977 as a professional, non-profit and non-political organization to work and bring research findings under a single umbrella. In this connection, I would like to thank the founding President of the society Prof. Dr. A. K. M. Aminul Haque and all founding members of FSB for their hard work in establishing the esteemed learned society.

Today, on this occasion it is a great pleasure for me to extend sincere greetings and felicitation to the members of FSB and participants of the FSB2021 Biennial Conference (25-26 December 2021). You have contributed immensely with great sincerity to the promotion of the Society activities. It makes me very happy to see a good number of scientists participating this auspicious even during this Covid-19 pandemic. This Conference has made an excellent opportunity among the scientists to exchange their research views and share ideas for promoting and strengthening of research collaboration.

FSB represents scientists and professionals working in different disciplines under the broad umbrella of Fisheries. This is the reason it forms a vibrant interface of multidisciplinary research. I hope that FSB will continue to shape Bangladesh fisheries into prosperity based on rapid expansion of fisheries education and research in the country. I sincerely thank all our guests, speakers, participants, media, and all the Committee members for helping us make the Conference a success.

Professor Dr. Muhammad Shahidul Haq

Convenor **Member Secretary**

Abstract, Publication & Documentation Committee, FSB2021

MESSAGE

The Biennial Conference of the Fisheries Society of Bangladesh is going to be organized during 25-26 December 2021. After a long preparation, the Conference is going to be successfully organized virtually hosted by the Faculty of Fisheries, Bangladesh Agricultural University (BAU), Mymensingh, Bangladesh. We would like to express our heartfelt gratitude to Prof. Dr. Lutful Hassan, the honorable Vice-Chancellor of BAU, for his kind and continuous support towards organizing this event.

The conference is a get-together of Bangladeshi scholars working in different areas of fisheries and aquaculture. A good number of keynote presentations, orals and posters will be presented by the participants attending the Conference. It is expected that all the sessions will be well attended by the participants. We would like to thank the Conference Organizing Committee for the plan to publish the Conference Proceedings. We are thankful to all the participants of the Conference for their participation.

The 2nd Biennial Conference 2021 will be a regular event where all fisheries and aquaculture scientists can reconnect with each other and enjoy the technical sessions and poster presentations during which they will exchange ideas, thoughts, and views, that will further help us to advance country's fisheries and aquaculture sector in order to achieve food and nutritional security. Finally, we sincerely express our gratitude to all who supported the Abstract, Publication & Documentation Committee for reviewing the abstracts and compiling and publishing the Conference Book of Abstracts.

Professor Dr. Md. Ali Reza Faruk
Professor Dr. Md. Shaheed Reza

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Chief Guest:

PROF. DR. LUTFUL HASSAN

Honorable Vice Chancellor, **Bangladesh Agricultural University (BAU)**

Special Guests:

Dr. Yahia Mahmud, Director General, Bangladesh Fisheries Research Institute (BFRI)

Mr. Azizul Haque, Director, Department of Fisheries (DoF)

Welcome Address by:

Prof. Dr. Muhammad Shahidul Haq, President, Fisheries Society of Bangladesh (FSB)

Chaired by:

Prof. Dr. Md. Mahfuzul Haque, Dean, Faculty of Fisheries, BAU

KeyNote Presentation by:

Prof. Dr. Md. Shah Alam, Center for Marine Science, University of North Carolina Wilmington, USA

Title: **Marine finfish aquaculture for blue economy**

Zoom: **https://bdren.zoom.us/j/4433002211** (Meeting ID: 443 300 2211)

CONFERENCE PROGRAM

Day-1: **25 December 2021**

9:30 am – 12:30 pm | **INAUGURAL SESSION**

Zoom: https://bdren.zoom.us/j/4433002211 (Meeting ID: 443 300 2211)

2:00 – 5:00 pm | (3 parallel) **TECHNICAL SESSIONS**

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11:00 am – 12:30 pm | AWARDING CEREMONY & BUSINESS SESSION

Zoom: https://bdren.zoom.us/j/4433002211 (Meeting ID: 443 300 2211)

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Session-1: Blue Economy (Coastal-Marine Fisheries)

Day-1: **25 December 2021**, **2:00 pm**
Zoom: https://bdren.zoom.us/j/4433002211 (Meeting ID: 443 300 2211)

Session Chair:	**Prof. Dr. Dr. Md. Abul Mansur**, FoF, BAU
Co-chairs:	**Prof. Dr. Md. Sadiqul Islam**, FoF, BAU
Rapporteurs:	**Dr. Ferdous Ahamed**, FoF, PSTU; **Dr. Md. Shakhawate Hossain**, FoF, BSMRAU

KeyNote Paper: Sustainable seafood and nutrition security (SSNS) in higher education
By: **Prof. Dr. Ram C. Bhujel**, Aqua-Centre, Asian Institute of Technology (AIT), Thailand

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2	Introducing Capture-Based Mariculture (CBM) in Bangladesh Coast: On-growing culture practices of wild-source Seabass and Mullet in net cages Presenter: **Ehsanul Karim**
3	Genetic diversity and population structure of two commercial Pomfret species (*Pompus argenteus* and *Pompus chinensis*) in the Bay of Bengal, Bangladesh Presenter: **Md Jayedul Islam**
4	Assessment of stock and maximum sustainable yield of the Hooghly croaker *Panna heterolepis* from the Bay of Bengal (Southern Bangladesh): Implications for sustainable management Presenter: **Wasim Sabbir**
5	Population structure, Length-weight relationship, Condition and Form factor of the *Sillaginopsis panijus* in the Bay of Bengal Presenter: **Farzana Akter**
6	Estimation of size at sexual maturity, spawning and peak spawning season of the Hooghly Croaker *Panna heterolepis* Trewavas, 1977 from the Bay of Bengal, Southern Bangladesh: A key to fix appropriate fish banning period Presenter: **Wasim Sabbir**
7	Estimation of population structure, growth and condition of *Parastromateus niger* in the Bay of Bengal: Suggestions for catchable sizes Presenter: **Asmaul Husna/ Md. Yeamin Hossain**
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12	Assessment of the factors associated with early gonadal maturation of Indian Shad, *Tenualosa ilisha* populations in Bangladesh Presenter: **A. K. Shakur Ahammad**
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Day-1: **25 December 2021**, **2:00 pm**
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Session Chair:	**Prof. Dr. Md. Ali Reza Faruk**, FoF, BAU
Co-chairs:	**Prof. Dr. Mohd Golam Quader Khan**, FoF, BAU
Rapporteurs:	**Prof. Dr. Imran Parvez**, FoF, HSTU; **Dr. A. K. Shakur Ahammad**, FoF, BAU

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15	Whole genome sequencing and development of snp markers for rohu carp *Labeo rohita* (Hamilton) Presenter: **Md. Samsul Alam**
16	Reproductive biology of *Anodontostoma chacunda* in the Bay of Bengal: Confirm to sustainable management and conservation Presenter: **Md. Rabiul Hasan**
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Session-3: Aquatic Resources Management & Post-Harvest Fisheries

Day-1: **25 December 2021**, **2:00 pm**
Zoom: https://bdren.zoom.us/j/2360602191 (Meeting ID: 236 060 2191)

Session Chair:	**Prof. Dr. Md. Kamal**, FoF, BAU
Co-chairs:	**Prof. Dr. Md. Tariqul Islam**, FoF, RU
Rapporteurs:	**Prof. Dr. Md. Nurul Haider**, FoF, BAU; **Dr. Kizar Ahmed Sumon**, FoF, BAU

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Convener:	**Dr. Md. Enamul Hoq**, BFRI
Member secretary:	**Prof. Dr. Kazi Ahsan Habib**, FFAMS, Sher-e-Bangla Agricultural University

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5	Use of copra meal as a partial substitute for soybean meal in the diet of Nile tilapia, *Oreochromis niloticus* fingerlings (Presenter: **Md. Hamidur Rahman)**
6	Biofloc, an environment friendly technological breakthrough in aquaculture sector of Bangladesh to support several SDGs : Prospects and challenges (Presenter: **Md. Atique Ashab)**
7	Effect of biofloc wastewater on growth performance and pigment content of *Chlorella sp.* (Presenter: **Evana Afrin**)
8	Occurrence of bacteriological fish diseases in Bangladesh : A review (Presenter: **Md. Atique Ashab)**
9	Introduction of invasive exotic fish species *Pterygoplichthys spp. :* A potential threat to aquatic ecosystems of Bangladesh (Presenter: **Md. Atique Ashab**)
10	Production performance of Gulsha (*Mystus cavasius*) monoculture with variation of water and soil quality parameters (Presenter: **Md. Hamidur Rahman**)
11	Microplastics ingestion brings changes in histo-architecture of *Clarias batrachus* liver (Presenter: **Tasnia Islam Auditi**)
12	Study of hemato-biochemical parameters of walking catfish *Clarias batrachus* exposed to microplastics (Presenter: **Shema Biswas**)
13	Microplastics ingestion by fish and crab species in the Sundarbans mangroves waters (Presenter: **M. A. Mamun Siddiquee**)

Fisheries Photo Contest

Convener:	**Prof. Dr. Md. Shaheed Reza**, FoF, BAU
Member Secretary:	**Prof. Dr. Md. Nurul Haider**, FoF, BAU

Day-2: 26 December 2021

11:00 am – 12:30 pm | AWARDING CEREMONY & BUSINESS SESSION

Zoom: https://bdren.zoom.us/j/4433002211 (Meeting ID: 443 300 2211)

KEYNOTE ABSTRACTS

PC: ***Saokat Ahamed***

KEYNOTE PAPER-1

Marine finfish aquaculture for blue economy: Control breeding, larviculture, intensive grow-out production and sustainable feed development of high value marine fish species in recirculation aquaculture systems in southeastern USA

Md. Shah Alam, Wade O. Watanabe and Patrick C. Carroll
University of North Carolina Wilmington, Center for Marine Science, Aquaculture Program, 601 S. College Rd., Wilmington, NC-28403, USA
Correspondence: Md. Shah Alam (alamm@uncw.edu)

Biography

Dr. Md. Shah Alam is a Research Associate Professor at University of North Carolina Wilmington, Center for Marine Science, USA. Dr. Alam spent about 8 years in Kagoshima University, Japan and completed his Masters, Ph. D. in Fisheries Science (Major: Aquaculture Nutrition) and JSPS Postdoctoral Fellowship. He has completed his B. Sc. Honors in Fisheries (1993) and M.S. (1995) from Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh. Dr. Alam has been awarded several research grants, published several papers in scientific journals and presented papers in USA, Japan, Australia, China, Greece, Thailand, and Malaysia. Dr. Alam is a graduate research faculty member at UNCW, USA and working on the Editorial Board of Fisheries and Aquatic Science, and reviewer of several professional international journals. Dr. Alam is a co-author of a Book Chapter: Marine Finfish Aquaculture, In: Aquaculture: Farming Aquatic Animals and Plants, 3rd Edition 2019, published by Wiley-Blackwell and Sons Ltd. He has worked as an international aquaculture consultant (June 2015) for USAID/Bangladesh.

Abstract

Blue economy is ocean-based economic activities utilizing marine resources. Marine fish culture is one of the most important areas to focus on blue economic development. A brief review paper will be presented on finfish mariculture research at the University of North Carolina Wilmington (UNCW), Center for Marine Science (CMS), Aquaculture Program. Our UNCW Aquaculture Facility is a mariculture research, educational and developmental facility located on Harbor Island (Wrightsville Beach), southeastern North Carolina. The goals are to develop and transfer to commercial users cost-effective, environmentally sound technologies for marine food production and to mitigate depletion of marine populations through commercial cultivation or stock enhancement. UNCW's Aquaculture Facility currently conducts research on premium value marine finfish species such as southern flounder (*Paralichthys lethostigma*), black sea bass (*Centropristis striata*), red porgy/pink snapper (*Pagrus pagrus*) and gag grouper (*Mycteroperca microlepis*). New candidate species for commercial mariculture will be evaluated in the future. A high degree of environmental control, conserving the use of water, and culturing marine finfish at high densities in land-based Recirculating Aquaculture System (RAS) tanks are utilized to develop aquaculture technologies for various marine finfish species. The presentation will provide a brief description of our high valued finfish mariculture research, including broodstock rearing, spawning, larviculture, juvenile production and grow-out culture in recirculating aquaculture systems. The live feed, microdiets and cost-effective, nutritionally balanced ecofriendly diets for marine fish production at UNCW will also addressed. Economics, environmental issues and fish feed are factors vital to the sustainability of the aquaculture industry. Therefore, one of the goals of our research is to develop sustainable marine finfish feed with less inclusion of fish meal but high inclusion of alternative protein sources in recirculating aquaculture system (RAS) that are widely considered to be "environmentally friendly". At UNCW Aquaculture Facility, a series of experiments were conducted to test the effects of different dietary levels of soybean meal, ultra-low gossypol based glandless cottonseed meal, poultry meal in the diet of southern flounder, red porgy and black sea bass. These findings will be addressed and could be used to develop environmentally sound and cost-effective pre-dominantly alternative protein-based diets for high value marine fish culture.

KEYNOTE PAPER-2

Sustainable seafood and nutrition security (SSNS) in higher education

Ram C. Bhujel
Aqua-Centre, Asian Institute of Technology (AIT), Thailand
Correspondence: Ram C. Bhujel (bhujel@ait.ac.th)

Biography

Dr Ram Bhujel is the founding Director of Aqua-Centre Research Associate Professor Asian Institute of Technology (AIT), Thailand. He has over 25 years of experience in the sector. He is well-known due to his two popular and useful books, "Statistics for Aquaculture" and "A Manual for Tilapia Business Management". During his long time career, he has designed and implemented several projects in many countries to address the issues of food and nutrition security, low income and unemployment. His on-going project is "Curriculum Development for Sustainable Seafood and Nutrition Security (SSNS)" which is funded by EU Erasmus+ programme addresses the issues of sustainability of seafood through curriculum development for higher education. As the Team Leader he has coordinated the project which involves over 60 lecturers from Asia and Europe. Current project was developed building on the previous two curriculum development projects funded by EU under Asia Link programme. He will be presenting the objectives and the outcomes this project.

Abstract:

Seafood is nutritious, delicious and probably the healthiest among the food items. Its demand is rapidly increasing in each country and globally as more people are becoming aware of the health and thus are shifting their food habits from red meat to white meat and then to seafood. Therefore, seafood sector has been increasingly important for food security, nutrition, income and employment. Annually 96 million tons of seafood is caught from the oceans and the natural water bodies while 82 million tons is produced from aquaculture (FAO data). Fish catch from the wild is declining due to overfishing. Aquaculture is rapidly expanding with the technological advancement often creating environmental problems causing frequent collapses of some aquaculture systems e.g. shrimp farming. Therefore, seafood insecurity has been a global issue urging the need to ensure long-term sustainability. Recognizing the key role of higher education in shaping the industry, a project entitled, "Curriculum development project for Sustainable Seafood and Nutrition Security (SSNS)" co-funded by EU Erasmus+ programme, was launched in Oct 2017. The main objectives of the programme were to identify the problems and missing gaps in the existing fisheries curricula in higher education institutions in Indonesia, Thailand and Vietnam, and improve the curricula by developing specialized courses in changing context. Other objectives were to establish specialized SSNS centres and offer vocational training courses and internship programs so that the industry could get new dimension and better understanding. The project engaged over 60 lecturers from Asia and over 15 from Europe. A total of 57 MSc courses (target was 20, nearly 3 times more) have been either newly developed or improved from existing ones. Amongst them, more than 75% have already been accredited, incorporated into the curricula and offered to over 200 students (target 90). Typical new courses include Seafood and Human Nutrition, Seafood and Sustainable Development Goals, Seafood safety, Fish Quality and Traceability, Smart and Environmentally Friendly Aquaculture, Innovations in Fish Product Development among others. All the nine Asian partners established a new SSNS centre each or revived or strengthened the one which had earlier. Six of them have established new ones each and three of them strengthen their existing centres to contribute to the project objectives. All the nine centres were also strengthened providing new equipment using the budget from the project. More than 63 vocational training courses have also been developed, and nearly half of them were already offered during the project period to update the knowledge and also provide specific skills to over 600 professionals. The project also developed 48 Internship programs (target 45) to offer higher education degree students so that they could get exposure to the industry and get hands-on work experience. However, due to COVID-19, it was not possible to offer, although two partners managed to offer somehow, even though the project was

extended for 12 months ended by Oct 14, 2021. The project organized two study trips to Europe; Norway and UK during which about 50 lecturers visited the renowned universities of Europe and learn how the courses are delivered. They also visited salmon farms and processing plants. They have learned how the courses are delivered and are encouraged to do more. Due to COVID-19, program for Indonesia was organized online. A final conference was organized to review the outcomes and disseminate the outcomes of the project. Overall, the project team considers it very successful.

KEYNOTE PAPER-3

Aquaculture value chains in Bangladesh: Impacts of COVID-19 pandemic

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Biography:

Dr. M. Gulam Hussain, an expert in Fisheries and Aquaculture, Blue Economy and Wetland Management having PhD in Aquaculture Biotechnology, M.Sc. in Aquaculture Management and B.Sc. in Fisheries (Honors). He did his PhD in 1992 from the Stirling University, Scotland, UK. Dr. Hussain has >35 years of extensive professional experience in blue economy, coastal and freshwater aquaculture R & D in South and east Asia regions has also fish Hatchery Management, Genetic Stock Improvement and Mass Seed Production Experiences. Dr. Hussain is presently working as the Asia Regional Coordinator with USAID funded Feed the Future Fish Innovation Lab (FIL) funded projects are being implemented in Bangladesh and Cambodia under Mississippi State University, USA. He was recently involved as National Aquaculture Expert with FAO for short term period (July – October, 2020), Fisheries Expert with Institute of Wetland Management (IWM) for two years (July 2018 – June, 2020) and Key Expert: Fisheries and Aquaculture for two years (August 2016 – July 2018) with EU Technical Assistance project EU-BGD Joint Collaboration on Blue Economy implemented under the auspices of Ministry of Foreign Affairs, Govt. of Bangladesh, responsible in formulation of Policy Framework for Blue Economy development in Bangladesh. Previously Dr. Hussain was working (2013-2016) with WorldFish, Bangladesh and South Asia as Fish Genetic Specialist. He was the former Director General of Bangladesh Fisheries Research Institute (BFRI) and served long years (1986 – 2011) in various capacities of scientific positions and build up a long professional career in his expertise. Dr. Hussain was a UNV Fisheries and Aquaculture Specialist (1981 – 1986) under UNDP posted in Syrian Arab Republic. He has proven track record in R & D projects both nationally and internationally due to his work in Bangladesh and other countries viz. Japan, Malaysia, Nigeria, Syria, Thailand and United Kingdom. He is author and co-author >200 peer reviewed scientific papers and technical reports, a number books and book chapters in the field of his expertise.

Abstract:

Present study was conducted during the month of July and August, 2020 to cover all the selected aquaculture (both finfish and shellfish) seed producing segments to assess COVID 19 impacts and the survey was carried out at the administrative districts of Mymensingh, Gazipur, Jashore, Bhola, Khulna, Satkhira, and Cox's Bazar. This study revealed that i) Among 8 carp hatcheries investigated and studied, average carp seed production in the hatcheries reduced to 32%. ii) At 10 tilapia hatcheries, average fry production registering a 40% reduction; iii) The average pangas spawn production of 4 hatcheries investigated, reduced to 34.11%; iv) Anabas and most of the other high value catfishes seed production drastically fell down and production reduced to 40 – 91.25%. Data and information provided by private sector agencies and DoF officials suggest that seed production of 50 shrimp hatcheries in Cox's Bazar and Satkhira regions registered a reduction of 44.43%. The accumulated average data of commercially cultured freshwater finfish and shellfish species groups, such as carps, tilapia, pangas, anabas, black tiger shrimp, giant prawn have been analysed and average farm production figures estimated of entire such aquaculture farms of Mymensingh and Khulna regions. Production has been reduced due to COVID-19 in all the aquaculture farms, but aquaculture farm production of black tiger shrimp was affected the most with a decrease in production 33%. The farmgate sale prices of aquaculture species in Mymensingh, Jashore, and Satkhira regions were investigated and found negatively influenced due to the COVID-19 pandemic. Among such aquaculture species giant prawn and black tiger shrimp had the largest decline in price

(31.26 – 41.17%); however, all other species also showed a considerable reduction in price. Fishers, small-scale fish-farmers, and fish-farm laborers, including women and youth, along the value chains have been the worst victims of the COVID-19 pandemic in the country. An estimated 14.7 million fish farmers, including all finfish seed producers; 0.83 million shrimp farmers, including shrimp seed producers; and 1.36 million fishers are directly involved in the value chain. Present study revealed that unlike other countries, COVID-19 pandemic halted the whole value chain activities, severely hampered fish seed and grow-out production systems and severely distorted the source of income and livelihoods means of millions of value chain actors and many more millions' access to nutrient-dense fish for food in Bangladesh.

Keynote Paper-4

Post-harvest losses in fish in Bangladesh, quality and safety issues and mitigation measures

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Biography

Dr. A K M Nowsad Alam is a Senior Grade Professor of Fish Processing, Quality Control and Seafood Safety in the Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh. Dr. Nowsad has enjoyed superb professional track records in his career, as Senior International and National Expert in many organizations like UNIDO, FAO, UNDP, DFID, WorldFish, ACI, Hortex Foundation, etc. He led 3 international technical missions in West African countries on climate resilient fisheries value chain development and published about 150 scientific papers, 26 books and many articles. He has pioneered a model of participatory self-facilitated training of trainers (ToT) for agricultural extension - the approaches and methods are published by the FAO and BFRF. He has supervised 8 PhD and 65 MS students and conducted more than 35 research projects. Present focus of Prof Nowsad's research is stabilization of unsaturated lipids in hilsa shad to produce stable products, storable at room temperature. He has developed the technology of stabilization of unsaturated fatty acids in hilsa and using this technology, has developed several noble products from popular hilsa shad, pangas and other fishes - hilsa powder, soup and noodles, crispy pangas pickles, etc. while those have received tremendous local and international attractions. He has developed several popular environment-friendly technologies for improvement of low-cost fish processing, like FAO Tank Ice Box (FTIB) for long distance transport of bulk fish, hanging ring and box tunnel for pesticide-free dry fish production, manual ice-crusher, self-powered oxygen accumulator to carry live fish, ice-chamber installed low-cost fishing boat, etc. These technologies have been popularly used in the field, both in country and abroad. Almost 70% of the country's wet fish are being commercially transported by the FTIB now, which have been able to reduce post-harvest loss of fish from 30% to <15% by a decade and saved a sum of about BDT 10-12 thousand crore per annum in the country. Ice-chamber installed fishing boats have been upscaled widely in inland capture fisheries in Bangladesh, while reduces post-harvest fish loss during fishing to landing substantially. Recently, Prof Nowsad has developed and popularized successful rural entrepreneurship with numerous value-added fish products from low-cost fish through rickshaw van-based production and selling in grassroots markets. These have created opportunity to increase farm price of low-cost fishes, mainly pangas and tilapia. Dr. Nowsad has been closely working with many international organizations, like ICAR, Quality Council of India, APO-Japan, IFS, APFAN, etc. and served Bangladesh Fisheries Research Forum and JUAAB as the elected President for 2 terms and BJSPSAA as Senior Vice-President for 4 years. He was awarded "Life-Time Achievement Award" by Bangladesh Food Safety Association and Agroshor Bikrampur Foundation for his contribution in seafood quality and safety research.

Abstract:
Small-scale fisheries in Bangladesh suffer from serious post-harvest fish loss (PHFL) every year, accounting about 30% total loss and 15% wet fish quality loss. The loss occurs mainly due to ignorance and negligence of the people involved in different stages from harvest to retail distribution and lack of technical know-how and handling appliances. The PHFLs are mainly of two types: qualitative loss and quantitative loss. Qualitative PHFLs are caused by biochemical and microbiological spoilage that occur in fish after death. Quantitative losses, i.e., reduction in quantity of harvested fish, occur in fish due to various reasons. This means that fish operators along the supply chain (fishers, processors, traders, and other stakeholders involved in ancillary operations) lose potential income, less fish is available to the consumers, and the consumers are supplied with low quality fish and fish products. Whether quantitative or qualitative, fish loss is a threat to food

and nutritional security, seafood safety, livelihoods of market actors and the sustainable management of fisheries resources. Therefore, the effort to reduce the PHFLs must begin with a value-chain improvement approach. Food security and food quality and safety are synonymous, since modern science defines food as only those consumables which are safe for human being, as these meet the dietary needs to lead active and healthy human life. Post-harvest loss often leads to unsafe food and nutritionally unsound food. In this paper, the post-harvest fish loss, along with quality and safety issues in seafood in Bangladesh are discussed and possible mitigation measures are highlighted.

Session-1

BLUE ECONOMY
(COASTAL-MARINE FISHERIES)

PC: ***Dr. Md Asaduzzaman***

FSB2021-O.01

Knowledge, practice, and economic impacts of COVID-19 on small-scale coastal fishing communities in Bangladesh: Policy recommendations for improved livelihoods

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COVID-19 has profoundly impacted global livelihoods and disrupted the food supply chain, including the aquaculture and fisheries industries. Little is known about the response to COVID-19 and the impact it has on incomes, livelihoods and knowledge and practice in the coastal artisanal fishers' communities of Bangladesh. Therefore, the aim of this study was to determine the socio-demographics of selected coastal fishers, their knowledge about COVID-19 and the preventive practice taken to reduce it. The impact on their fishing habits and income was also examined to determine potential policy areas. Data were collected via a structured questionnaire from 250 respondents from three coastal districts, Cox's Bazar, Patuakhali and Barguna, Bangladesh during April–June 2020. The research shows that the fishers' knowledge about COVID-19 and measures taken to reduce it were significantly higher in Patuakhali and Barguna than in Cox's Bazar. The pandemic caused lower consumer demand, reduced fish prices and created fish transportation issues due to movement restrictions enforced during the lockdown. Irrespective of geographical location, fishing trips were reduced by frequency and duration compared with the pre-COVID-19 period, consequently lowering the income of fishers. Fishers have received little or no support from private, non-governmental or governmental sources. Considering the evidence in this paper of economic hardship, this paper recommends artisanal fishers in Bangladesh should be provided with support to improve their health education, access to professional health facilities and financial services. This will contribute to improved food security and sustainable livelihoods that can better withstand local and/or global crises.

Keywords: COVID-19 impacts; artisanal fishers; coastal Bangladesh; public health risk; socio-economic impacts

FSB2021- O.02

Introducing capture-based mariculture (CBM) in Bangladesh coast: On-growing culture practices of wild-source seabass and mullet in net cages

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Capture Based Mariculture (CBM) combines the practice of mariculture and capture fisheries in the coastal or marine environment. CBM offers significant opportunities for sustainable food production and the economic development of coastal communities, especially in regions where the availability of land, nearshore space and freshwater source are limited. Cage culture practice in the coastal and marine environment appears to be the most favorable 'Mariculture Practice' in the world and it offer opportunities even on a small scale. Nevertheless, marine hatchery production of candidate species still not developed, Bangladesh Fisheries Research Institute came forward to introduce fattening of most commercial coastal fishes i.e. Seabass (*Lates calcarifer*) and Mullets (*Mugil cephalus, Liza persia*) – which in principal based on the use of wild-source 'Seed' under the financial support of 'SCMF Project of WB-DoF in the South-east coast, Cox's bazar and South-west coast, Bagerhat of Bangladesh. Under CBM concept, six circular net cages (3 for Seabass and 3 for Mullet) of 3*3 meters in 110 mm HDPE pipe frame with 20-40 mm nylon net were installed at near shore point of Maheshkhali Channel, Cox's Bazar during May, 2021 and wild collected sub-adults of Seabass and Mullets were transferred in the net cages in the last week of May 2021. Chopped tilapia was supplemented as feed for Seabass and commercial feed was applied for Mullet. The growth performances of stocked Seabass after three and half months rearing showed 532 to 859 g net weight gain at 40-50 nos. stocking densities per cage with 72-85% survival rate. In case of Mullet the net growth increment was 519-601 g with 80-83% survival rate. This result specifies higher growth in weight in circular cage with lower stocking densities and the growth rate progressively decreased with increased densities. Both fishes are survived in the extreme temperature ranged from 26-29^{0}C and very humid condition in monsoon.

Keywords: Mariculture, Cage culture, Seabass, Mullet, Cox's Bazar

FSB2021- O.03

Genetic diversity and population structure of two commercial Pomfret species (*Pompus argenteus* and *Pompus chinensis*) in the Bay of Bengal, Bangladesh

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Pompus argenteus and *Pompus chinensis* are two important commercial fish species of Bangladesh. In this study, we investigate the population genetic structure of these two species using the mitochondrial DNA (mtDNA) marker in the Bay of Bengal (BoB), Bangladesh and other neghbouring seas. Samples were collected from Chittagong-Cox's Bazar coast (CC) and Kuakata- Pathoghata coast (KP) of the northern Bay of Bengal, Bangladesh in 2020. All sequences of the mtDNA d-loop region of *P. argenteus* defined 68 haplotypes where 14 haplotypes were found in the BoB population. Among fourteen haplotypes of the BoB, twelve haplotypes were unique for the Bangladesh coast of the northern BoB. On the other hand, all sequences of *P. chinensis* defined 33 haplotypes where eight haplotypes belong to the BoB, of which seven haplotypes were unique for the Bangladesh coast of the northern BoB. The nucleotide diversities (π) were very low in each population estimating from 0.003 to 0.004 in *P. argenteus* and 0.006 in *P. chinensis* while the haplotype diversities (*h*) were relatively high which was calculated from 0.66 to 0.88 in *P. argenteus* and 0.85 in *P. chinensis* populations of the northern BOB, Bangladesh. High level of haplotype diversities in contrast with low nucleotide diversity in the BOB population indicates that both fish species has experience population expansion after a period of low effective population. The fixation index (F_{ST}) between the two Bangladeshi populations of *P. argenteus* was 0.008 (P=0.41) i.e. no significant deviation from the random mixing. Estimates of F_{ST} between the BOB populations of *P. argenteus* & *P. chinensis*, and each of the compared populations of neighboring seas were ranged from 0.121 to 0.309 with significant difference (P=0.00). This result indicates a unique population genetic structure of *P. argenteus* & *P. chinensis* was established in the Bay of Bengal region compared to other seas. Exact test of the population differentiation also showed significant differentiation between BoB and each of other populations investigated suggesting a non-panmictic population of the BoB compared to other seas. The neutrality tests i.e. the values of Tajima's *D* (D = -1.82 & -0.17, P = 0.008) and Fu's *F*s (F_S = – 6.48 & -3.35, P < 0.03) were significantly negative in the BoB populations implying a demographic expansion in this region. Mismatch distributions of the d-loop sequences also suggests the history of demographic expansion for the Bay of Bengal population.

Keywords: Pomfret, Population, Mitochondrial DNA

FSB2021- O.04

Assessment of stock and maximum sustainable yield of the Hooghly croaker *Panna heterolepis* from the Bay of Bengal (Southern Bangladesh): Implications for sustainable management

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The Hooghly Croaker (*Panna heterolepis* Trewavas, 1977) is a very popular marine fish species in Bangladesh. This species is locally known as *Poa* and commercially very important as a table food item. The study describes growth pattern, growth parameter, mortality, recruitment pattern, exploitation rate (*E)* and maximum sustainable yield (MSY) to *Panna heterolepis* from the Bay of Bengal (Bangladesh). A total of 1223 specimens were collected from commercial fishermen for 12 consecutive months from January to December, 2019. Length–frequency data were analyzed with FAO-ICLARM Stock Assessment Tool. Moreover, our study recorded different water quality and environmental parameters including pH, rainfall, temperature and DO (dissolved oxygen) from the Bay of Bengal. The findings of the study revealed that the allometric co-efficient (*b*) value indicated negative allometric growth (< 3.00) for *P. heterolepis* population. Whereas, the population dynamic parameters showed growth coefficient (*K*) 0.13 year^{-1}, life-span (t_{max}) 3.85 year and growth performance index (*Ø'*) 2.30. Along with this, *P. heterolepis* was found to grow rapidly with an asymptotic length (L_∞) of 39.08 cm. We found that the natural mortality (M =0.44 year^{-1}) rate was almost similar with fishing mortality (F = 0.42 year^{-1}). Consequently, the standing stock was not quite sustainable with the existing fishing strategy. Furthermore, the maximum allowable exploitation rate (E_{max} = 0.471) was lower than the recorded exploitation rate (E=0.490). Subsequently, overfishing is the most focal threat to the wild stock. The recruitment pattern was almost continuous throughout sampling period. Finally, the MSY was assessed at 10234.47 metric tons. Additionally, the environmental parameters denoted that the ecosystem was in a balanced condition for the wild population. However, the findings of our study might be a potential tool for fishery biologists to initiate alternative management approaches to conserve this prominent fish species from possible future collapse.

Keywords: Bay of Bengal, Stock assessment, Panna heterolepis, Bangladesh

FSB2021- O.05

Population structure, Length-weight relationship, Condition and Form factor of the *Sillaginopsis panijus* in the Bay of Bengal

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The Flathead sillago, *Sillaginopsis panijus* (Hamilton 1822) is a marine water species represent length-frequency (LFDs) distributions, length-weight (LWRs) relationships, length-length (LLRs) relationships, condition and form factor from the marine population of the Bay of Bengal. Sampling was done from the marine ecosystem during January to December 2020 by several fishing gears e.g., cast net, gill net and square lift net (mesh size ranges: 1.5-2.5 cm, 1.52.0 cm, & ~2.0 cm, respectively). For each individual, Total length (TL), Fork length (FL), Standard length (SL) were measured by digital slide caliper's and Body weight was also taken by digital weight balance. Total length (TL) ranged between 11.5 to 34.5 cm for males and 11.5 to 37.0 cm for females. Body weight (BW) varied between 6.79 to 225.57 g for male and 10.57 to 368.49 g for female population. The allometric growth co-efficient (b>3) value denoted positive allometric growth for both sexes. The calculated Fulton's condition factor (K_F) was found most suitable for this species. Form factor ($a_{3.0}$) was 0.0056. The relative weight W_R indicated the balance habitat with food availability related to the present status of predator. These results will be supportive to implement sustainable fishery management and conservation in the marine and coastal water of Bangladesh.

Keywords: length-frequency distributions, length-weight relationships, form factor, *Sillaginopsis panijus*, Bay of Bengal

FSB2021- O.06

Estimation of size at sexual maturity, spawning and peak spawning season of the Hooghly Croaker *Panna heterolepis* Trewavas, 1977 from the Bay of Bengal, Southern Bangladesh: A key to fix appropriate fish banning period

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The Hooghly Croaker, *Panna heterolepis* is locally called Poa and commercially significant as a popular food fish for the coastal people of Bangladesh. This study highlights the reproductive biology of Hooghly Croaker, *P. heterolepis* (Trewavas, 1977) which is one of the dominant fish in the Bay of Bengal (Southern Bangladesh) based on monthly sampling of 569 female individuals from January to December 2019. We observed the effect of different environmental factors (temperature, rainfall, dissolved oxygen, and pH) on the reproduction of *P. heterolepis*. Measurement of each individual like total length (TL) and body weight (BW) were taken by means of measuring board and digital balance. Gonads were carefully removed through ventral dissection from females and weighed to 0.01 g accuracy. To assess the size at sexual maturity (L_m), spawning season and its peak; the GSI (gonadosomatic index in %), MGSI (modified gonadosomatic index in %) and DI (Dobriyal index) were considered. Based on these indices, the L_m was documented 15.0 cm in TL. Moreover, L_{50} was predicted by logistic calculation as 15.0 cm TL. Further, greater values of GSI, MGSI, and DI denoted the spawning season as January to July, with a peak in February. Additionally, Fulton's condition factor (K_F) was significantly correlated with GSI values. In addition, GSI was statistically correlated with temperature. However, other environmental factors (rainfall, dissolved oxygen, and pH) did not show any significant relation with GSI. Therefore, we recommend that the adults be conserved during the February peak for sustainable exploitation of this species. Finally, the outcomes of our study might be useful to carry out specific management programs for *P. heterolepis* in the Bay of Bengal and nearby aquatic ecosystem.

Keywords: size at sexual maturity, environmental factors, spawning season, Panna heterolepis, Bay of Bengal

FSB2021- O.07

Estimation of population structure, growth and condition of *Parastromateus niger* in the Bay of Bengal: Suggestions for catchable sizes

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Black pomfret, *Parastromateus niger* (Bloch, 1795) is one of the commercially important species of pomfrets fishery in Bangladesh. The present study illustrates the population structure (Length Frequency Distribution, LFD), length-weight relationships (LWRs), length-length relationships (LLRs), condition factor (Fulton's condition factor, *K*), relative weight (W_R) and standard weight (W_S) of *P. niger* in the Bay of Bengal which allow the catchable size. A total of 225 *P. niger* were collected from the four fish landing centre (Chattogram; Cox's Bazar; Kuakata, Potuakhali; Patharghata, Borguna) during January to December, 2020. All the lengths including total length (TL), standard length (SL) and fork length (FL) were measured by using the measuring scale and total body weight (BW) was measured using an electronic balance with 0.01g accuracy. LFD analysis indicates three length class peaks at 24-25 cm, 31-32 cm and 36-37 cm, respectively. On the basis of *b* (2.981) values, *P. niger* showed isometric growth pattern that indicates that the size and weight of *P. niger* increases proportionally. Also this growth pattern indicates that the surrounding habitat provides favourable environment for the growth. The LWRs (TL *vs* BW) were highly significant with r^2 values (0.951). LLRs were significant with all r^2 values (TL *vs* SL, r^2=0.845; TL *vs* FL; r^2=0.861) as well. In the present study, the mean value of Fulton's condition factor (*K*) was found 1.60 which indicates that the fish was in good condition in their natural habitat. The mean value of relative weight (W_R=101.09) indicates that the relationship between prey and predator is in balanced condition. The present study suggests optimum catchable length for *P. niger* at 36 cm. Therefore, the results from the study would be an effective tool for fishery biologists, managers and conservationists to initiate early management strategies and regulations for the sustainable conservation of this species.

Keywords: length-length relationships, length-weight relationships, *Parastromateus niger*, Bay of Bengal

FSB2021- O.08

Effect of solvents on bioactive compounds and antioxidant activity of *Padina tetrastromatica* and *Gracilaria tenuistipitata* seaweeds collected from Bangladesh

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Seaweeds are now recognized as a treasure of bioactive compounds. However, the bioactivity of seaweed originating in Bangladesh is still unexplored. So, this study was designed to explore the secondary metabolites and antioxidant activities of solvent extracts of Padina tetrastromatica and Gracilaria tenuistipitata. Phytochemical screening and FTIR spectra confirm the diverse type of bioactive compounds. Antioxidant activity of extracts were evaluated by 1,1-diphenyl-2-picrylhydrazyl (DPPH), 2, 2-Azino-bis (3-ethylbenzothiazoline-6-sulfonic acid) (ABTS), reducing power (RP), phosphomolybdenum, hydrogen peroxide and nitric oxide (NO) scavenging assays. Here, methanolic extract of P. tetrastromatica showed highest amount of total phenolic content (85.61 mg of GA/g), total flavonoid content (41.77 mg of quercetin/g), DPPH (77.07%), ABTS (77.65%), RP (53.24 mg AAE/g), phosphomolybdenum (31.58 mg AAE/g), hydrogen peroxide (67.89%) and NO (70.64%) assays compared to its methanolic extracts of G. tenuistipitata. This study concluded that methanol as a solvent extract of brown seaweed (P. tetrastromatica) exhibited bioactivity and antioxidant potentiality which will be useful for pharmacological as well as in functional food application.

Keywords: *Padina tetrastromatica; Gracilaria tenuistipitata;* bioactive compounds; antioxidant activity; FTIR

FSB2021- O.09

New records of harmful dinoflagellate species in the Bay of Bengal, Bangladesh (2021) towards an early warning system

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In response to anthropogenic activities, harmful algal blooms have aggravated in intensity, frequency and geographical distribution over the past few decades. The Bay of Bengal is renowned for its exceptional biological diversity and productivity; however, possesses several unique features that lead the Bay congruous to harmful and toxic marine phytoplankton threatening the potentiality of the Blue Economy context. Today, phytoplankton dynamics are affected by eutrophication and climate change, due to altering physic-chemical parameters of water bodies. Therefore, this study aims to provide key information about dinoflagellate diversity and abundances, with the special endeavor to harmful species in respect of dynamic environmental conditions of the Bay of Bengal, Bangladesh. Dinoflagellates are of particular interest among the harmful phytoplankton species because of their adaptation strategies to thrive in various ecological niches, high species richness and morphological diversity. About half of the species of dinoflagellates are evident to cause exceptional or harmful blooms, most of which are accountable for specific poisoning syndromes. However, among the identified taxa in this study, *Ceratium* spp., *Dinophysis* spp., *Prorocentrum* spp., and *Protoperidinium* spp. were potentially noxious, allowing the possibility of blooms keeping pace with the global reports and deleterious impacts on human health and fisheries nowadays. Thus, the present study elucidates the record of harmful dinoflagellate species in the Bay of Bengal, Bangladesh along with essential environmental factors, i.e., temperature, salinity, dissolved oxygen, pH, chlorophyll-a, NO_3−N and PO_4−P, in order to effectively manage or prevent algal blooms.

Keywords: harmful algae, abundance, Dinoflagellate, Bay of Bengal, blue economy

FSB2021- O.10

Extraction, characterization and antioxidant activity evaluation of fucoidan from *Sargassum* sp.

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Fucoidan is a sulfated polysaccharide commonly found in the cell walls of brown seaweeds. In this study fucoidan was extracted by water extraction method, salt extraction method, and enzyme extraction method from *Sargassum* sp of Saint Martin Island. Fucoidan yield was obtained highest in enzyme extraction method about 7%, where 5.7% in water extraction method and 4.1% in salt extraction method. FT-IR analysis was studied to determine the functional groups of extracted fucoidans which are in agreement with the previous finding. Compositional study of extracted fucoidans was done by carbohydrate, sulfate, and protein content analysis. 1H NMR spectroscopy analysis was carried out for the structural study of extracted fucoidans. The antioxidant activities of the fucoidan fractions were further evaluated by DPPH radical scavenging assay, ABTS radical scavenging assay, Nitric Oxide (NO) radical scavenging assay, and Phosphomolybdenum assay. The correlation of sulfate content with antioxidant activities was positive. This study also provides comparative compositional, structural, and antioxidant study among the fucoidans from three different extraction methods.

Keywords: *Sargassum* sp; Saint Martin Island

FSB2021- O.11

Reproductive biology of Lyrate Hard Clam *Meretrix lyrata* in relation to climate in the Bay of Bengal, Bangladesh

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The marine fishery is an important component of blue economy in Bangladesh. The coastal region of Bangladesh is a great resource of marine bivalves and contributes in Blue economy significantly. This study stated size at sexual maturity, spawning and peak spawning season of lyrate hard clam *Meretrix lyrata* in the Bay of Bengal, Bangladesh. Shell length (SL), body weight and gonad weight of each samples were measured, sex identification and matured females were recognized with the help of microscope in every month. The size at sexual maturity was calculated through the relationship between gonadosomatic index (GSI) *vs.* SL, modified gonadosomatic index (MGSI) *vs.* SL and Dobriyal index (DI) *vs.* SL. The spawning period was observed by variation of female gonadal in every month using the indices GSI, MGSI, and DI to predict spawning and peak spawning time. The estimated size at first seual maturity for *M. lyrata* was 4.2 cm. The observed spawning season was January to June and December and peak spawning period was May for this species. The environmental parameters also studied to assess the effects of environment factors on reproduction. However, dissolve oxygen and salinity significantly influence the spawning season of *M. lyrata*. In peak spawning period, the recorded DO was 6 mg/l and salinity was 34 ppt. This information may help artificial breeding and culture of this species and to get appropriate management policy for wild population of *M. lyrata* in the Bay of Bengal.

Keywords: size at sexual maturity, spawning period, *Meretrix lyrata*, Bay of Bengal

FSB2021- O.12

Assessment of the factors associated with early gonadal maturation of Indian Shad, *Tenualosa ilisha* populations in Bangladesh

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In recent years, attaining gonadal maturation in smaller Hilsa (*Tenualosa ilisha*) has become a burning issue for Hilsa fishery of Bangladesh. Causes of early maturation are not yet clearly understood. Along with environmental parameters, genetic differentiation within the population was hypothesized as the main driver, and therefore, assessing the correlation between gonadosomatic index (GSI) and environmental factors and analyzing genetic diversity were set as objectives of the present study. To address these complex issues, six diverse habitats across Bangladesh were chosen for Hilsa sample collection. For GSI, gonad was dissected from fresh fish and preserved in Bouin's fluid for histological observation. Water quality parameters such as temperature, dissolved oxygen, pH, and salinity were also assessed. 35 fish from each habitat were used to extract and amplify DNA through the PCR technique, and genetic diversity was examined. Further, to draw a firm conclusion, the phylogenetic tree of the Hilsa population was developed by the unweighted pair-group method of arithmetic mean method based on the Cyt b gene of mitochondrial DNA. Results of GSI studies revealed that peak spawning months of *T. ilisha* were in October and February, where October showed the highest values in all six habitats. Histological examination showed different stages of gonadal development in different sizes and ages of Hilsa. Among all sampling sites, no statistical difference was observed for GSI value; however, smaller sized and aged Hilsa being ripped were evident in Gaglajur Haor and Kali River. Among the observed water quality parameters, temperature correlated with GSI strongly. Increased GSI was observed with temperature augmentation from downstream to upper stream, irrespective of body size and age. A perplex correlation between dissolved oxygen of observed habitats and GSI was executed. Other physico-chemical parameters viz. pH and salinity exhibited weak and moderate positive association with the GSI, respectively. Haplotype diversity of mitochondrial DNA divided the Hilsa population into three possible sub-populations, where the most distant group (Gaglajur Haor and Kali River) was subjected to early gonadal maturity. Results of this study make clear conclusions regarding the role of environmental and genetic factors on early gonadal maturations, pointing fingers at the curse of climate change and anthropogenic stressors for the migration of the Hilsa fishery of Bangladesh.

FSB2021- O.13

Estimation of nutrient flux and primary productivity in the major nursery grounds of hilsa

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Estimation of nutrient flux and primary productivity are very important for open water fisheries management. However, information on how these factors affect water quality and fish production, especially in the sanctuary of hilsa is still inadequate. To address this issue, a study was conducted to estimate the nutrient flux and primary productivity of two hilsa sanctuaries. Monthly data from four sampling locations of the sanctuaries (S1, Katakhali and Char Monipur, Chandpur) (S2, Tarabunia, Shariotpur and Padma-Meghna confluence, Chandpur) were collected and analyzed. The results revealed temporal and spatial variations of nutrient flux, primary productivity and other water quality parameters. The highest average concentration of nitrate and phosphate were found at S1 (Char Monipur, 0.031±0.018 mg/L and Katakhali, 0.013±0.004 mg/L, respectively) and the lowest at S2 (Tarabunia, 0.021±0.009 mg/L and Char Monipur, 0.004±0.004 mg/L, respectively). The highest average Gross Primary Productivity (GPP) was also found at S1 (Char Monipur, 0.873±0.022 gC/m^3/day) and the lowest at S2 (Tarabunia, 0.691±0.008 gC/m^3/day). The higher abundance of jatka (CPUE, 316 nos./100m net/hour/boat) was found at Char Monipur which established a coherence with nutrient flux and GPP. The ranges of all studied water quality parameters were found within the acceptable limits. Phytoplankton largely dominated over the zooplankton in all sampling locations. The highest number of taxa were identified at S1 (Katakhali: 20 taxa; phytoplankton-17 and zooplankton-3) and the lowest at S2 (Padma-Meghna confluence: 15 taxa; phytoplankton-11 and zooplankton-4). Among the phytoplankton, Bacillariophyceae (>35%) and Chlorophyceae (>70%) were dominating whereas among the zooplankton, Rotifera and Copepoda were dominating (>40%) groups. The concentration of limiting nutrients for primary producers (nitrate and phosphate) complies the acceptable limit of World Health Organization (WHO) for river ecosystem. The findings of the study will help us to know the present status of nutrient eutrophication in the major nursery grounds of hilsa and to formulate future management interventions accordingly.

Keywords: estimation, nutrient flux, primary productivity, nursery grounds, Hilsa

Session-2

FISHERIES BIOLOGY / BIOTECHNOLOGY & AQUACULTURE

PC: ***Parvez Chowdhury***

FSB2021- O.14

Deciphering the technical and economic feasibilities of aquaponics system for commercial successs: A critical review

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Even though the adoption rate of aquaponics systems has been increasing in the United States, this system's technical and economic feasibilities have not been fully realized yet as it deals with three different concepts of fish, plant, and microorganism together. Failure to maintain the unique water quality parameters, mainly the pH stabilization and nutrient balance, are likely to jeopardize the whole system. Moreover, specific technical issues also need to be addressed while transforming this system from a small scale to a commercial level: These include (1) improved nutrient solubilization and recovery for better use of the nutrient input and reducing extra-mineral addition, e.g., phosphorus recycling; (2) adapted pest management; (3) reduce water consumption to a high degree by limiting the need for water exchange; (4) use of alternative energy sources for hot/cold and arid areas. Overall, the deep-water culture system and nutrient film technique could be an excellent option to adopt commercially. Lettuce, herbs, and specialty greens such as spinach, chives, basil, and watercress are suggested as they have low to medium nutritional requirements and are well-adapted to aquaponics systems. Vegetables yielding plants such as tomatoes, bell peppers, and cucumbers have a higher healthy demand and perform better in a heavily stocked, well-established aquaponics system. Among warm and cold-water species, tilapia, trout, perch, Arctic char, and bass are well-adapted to recirculating the aquaculture system (RAS). Tilapia is highly favored in commercial aquaponics systems due to their highly adaptive nature and tolerating capacity in fluctuating water conditions. In terms of economic profitability, vegetables and other plants derived from the hydroponic system is likely more profitable than fish produced from RAS. Hence, additional costs and risks analyses related to the aquaponics system are required before investing money in adopting this system.

Keywords: aquaponics, phosphorus recycling, recirculating aquaculture system

FSB2021- O.15

Whole genome sequencing and development of snp markers for rohu carp *Labeo rohita* (Hamilton)

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Aquaculture and fisheries have long been recognized as a means by which Bangladesh can help feed and increase the nutritional health and wellbeing of its people. *Labeo rohita* (rohu) is one of several carp species that account for much of the protein in the diets of Bangladeshis. To provide insight into genes that can be used to increase the efficiency of aquaculture of rohu, we sequenced the whole genome of *Labeo rohita*. Briefly, blood from a single male rohu was used to isolate DNA. The DNA was sequenced using Illumina and Oxford Nanopore Technologies (ONT) platforms. Contigs were assembled using the ONT reads, and the Illumina data was used to correct errors in the ONT contigs. Hi-C chromatin configuration sequencing was conducted to further assemble the contigs into scaffolds. Functional annotations were done with Uniport Swisprot and InterproScan. The rohu genome assembly indicated that the rohu genome size is about 939.5 Mb in length, a value less than half the reported size of the rohu genome as determined by Feulgen densitometry (1C = 1950 Mb). To explore this discrepancy, we performed our own flow cytometric determinations of rohu genome size and found our flow cytometry estimates to be close to our predicted genome size (1C = 968 Mb average for five male rohu). The current assembly of the rohu is composed of 6,175 scaffolds, L50 is 26, and N50 is 1.29 Mb. Functional annotations indicated there are 29,494 genes with 30,480 mRNAs predicted. The Illumina sequences from fish collected from three different river systems (Padma, Jamuna and Halda) had a mapping rate around 99% against the genome assembly. From this mapped data filtering to SNPs between known NsiI-MspI restriction sites, the number of predicted SNPs found to be 469,392. SNP analysis indicated that fish collected from the Padma and Jamuna are genetically closer compared to Halda fish. The productivity of species depends on two things, management and biological potential of the species. By completing a high quality whole genome sequencing and assembly and developing SNP markers, we have created an opportunity to improve the biological/genetic potential of rohu. For this, it is essential to utilize this information to develop improved rohu strain by marker assisted selection.

Keywords: carp, SNP, whole genome sequencing Padma, Jamuna, Halda

FSB2021- O.16

Reproductive biology of *Anodontostoma chacunda* in the Bay of Bengal: Confirm to sustainable management and conservation

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Anodontostoma chacunda or Chacunda gizzard shad is a small species of gizzard shad found in the marine waters. This is an important food fish as is enriched with high amounts of protein, iron and calcium. The current research demonstrates the population structure, length weight relationship (LWR), size at sexual maturity and spawning- and peak-spawning season of *A. chacunda* in an important marine ecosystem (Bay of Bengal) of Bangladesh with an aim of its sustainable conservation and management. A total of 1061 individuals captured from the Bay of Bengal (BoB) through monthly sampling from January to December 2020. Total length (TL) and body weight (BW) of individual fishes were measured. The size ranges were with 12.5-26.7 cm TL, 22.16–255 g BW. Allometric coefficient (*b*) value was 3.34 for *A. chacunda* that indicate the growth was positive allometric for this species. Minimum and maximum value of Fulton's condition factor (K_F) was 0.87- 2.02. Gonads were removed carefully through ventral dissection and weighted. L_m was 15.39 and 16.3 cm based on maximum length (L_{max}) and TL *vs.* GSI (%), respectively. Monthly variations of GSI were confirmed in January to February and November to December as spawning season and December as peak spawning month. K_F was found to be with significant relations with GSI values. The study recommended the policy guidelines to pave the ways of the conservation and management of *A. chacunda* in the Bay of Bengal and surrounding ecosystem.

Keywords: *Anodontostoma chacunda*; Bay of Bengal; condition factor; size at sexual maturity; spawning season

FSB2021- O.17

Reproductive biology of *Heteropneustes fossilis* in the Padma River, northwestern Bangladesh

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Reproduction plays an important role in fish population efficiency and its resiliency to fishing and environment changes. The present study described the comprehensive information on reproductive feature of stinging catfish, *Heteropneustes fossilis* (Bloch, 1794) including size at sexual maturity, spawning season and fecundity using 622 female individuals sampling by the use of gill net from January to December 2020 in the Padma River. We calculated the influences of various environmental parameters which include temperature, dissolved oxygen, pH and rainfall on the reproductive feature of *H. fossilis* in the Padma River. For every specimen, total length (TL), standard length (SL) and body weight (BW) were estimated by measuring board and electronic weighing scale. With ventral dissection of fishes, female gonads were cautiously removed and measured to 0.01 g precision. The gonadosomatic index (GSI), modified gonadosomatic index (MGSI) and Dobriyal index (DI) were used to assess the size at sexual maturity (L_m) and spawning season. According to the results of these indices L_m was obtained 15.5 cm in TL. Also, TL_{50} was determined through logistic function as 15.5 cm in TL. Moreover, the highest GSI, MGSI and DI values indicated the spawning season as of March - August, with peak in May-June. Total fecundity (F_T) varied from 2059 to 59984 with a mean of 25028 ± 15048. Temperature and rainfall was statistically correlated with GSI. In addition, long climatic data series analysis denoted that yearly mean atmospheric temperature is rising in 0.028 °C/year and yearly mean rainfall is declining in 2.98 mm/year. The results of our study might be more useful in imposing particular management and conservation for *H. fossilis* in the Padma River and the surroundings.

Keywords: Size at sexual maturity, spawning period, *Heteropneustes fossilis*, Bay of Bengal

FSB2021- O.18

Isolation, screening and production of protease as potential fish feed supplement from indigenous bacteria

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Dietary protease is an effective tool in improving feed utilization and growth performance of aquaculture species. The aim of the current study was to isolate extracellular protease producing bacteria from salt water collected from Uttor Nuniachara, Cox's Bazar. Sample was serially diluted and streaked on agar plate for pure colony separation. A total of 7 bacteria were isolated and purified based on colony morphology and biochemical characterization. Among them 4 isolates produced clear zone on casein media indicated having proteolytic activity. UCW-1 isolate was chosen for further procedure based on clear zone diameter. Crude enzyme was prepared by casein broth and activity was assessed by Lowry method (total protein estimation). Maximum activity (OD_{750} 3.52) was found at 35° C temperature, pH 7 and 36-hours fermentation. Crude enzyme was purified through ammonium sulfate precipitation and comparative activity (U/mg) with Sigma protease enzyme (P2143-5G) was determined using tyrosine standard curve through universal protease activity assay. Activity of UCW-1 protease was found 0.187 U/mg whereas Sigma protease activity was 0.493 U/mg. The above results indicate that this bacterial isolate can be used as biotechnological tool for fish feed industry.

Keywords: fermentation, UCW-1 protease, Cox's Bazar

FSB2021- O.19

Investigation of emerging tilapia lake virus disease (TiLVD) in farmed raised Nile tilapia of several districts in Bangladesh

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Tilapia lake virus (TiLV) or *Tilapia tilapinevirus* is a globally emerging infectious virus, reportedly affecting Nile tilapia (*Oreochromis niloticus*) and its hybrids. In early 2017, FAO declared Bangladesh is in the high risk zone of TiLV disease spread. The present study was designed to investigate the occurrences of TiLV from cultured Nile tilapia in Bangladesh. In this study, several unusual tilapia mortality incidences were investigated. A total of 102 organ samples (34 of each liver, kidney and brain pooled samples) were collected from 34 ponds of 25 farms in regions of 12 Upazilas located in Mymensingh, Khulna, Bogura, Jhalokati, Jashore, Jhenaidah and Chandpur districts of Bangladesh from May to October 2019. At first, infected fish were externally examined and histopathological analysis was performed. Conventional and Real-time PCR assays were done for 102 organ samples but no samples showed positive result for TiLV. Besides, histopathological analysis did not provide pathognomonic lesions for TiLV infection of these samples. Therefore, this finding suggested that the collected samples might be affected by other bacterial or viral infections rather than TiLV infection. On the basis of above results, it can be concluded that at least the study sites of Bangladesh (Mymensingh, Khulna, Bogura, Jhalokati, Jashore, Jhenaidah and Chandpur) are free from TiLV. However, these findings are not the confirmatory statement that Bangladesh is free from TiLV. Large-scale study comprising more samples collecting throughout Bangladesh as well as the application of viral metagenomics approach may be helpful to reach a conclusion regarding unusual mortalities of tilapia in Bangladesh.

Keyword: TiLVD, Nile tilapia, histopathology, real-time PCR

FSB2021- O.20

Immune epitopes identification and designing of an epitope-based vaccine against antibiotic resistant *Aeromonas veronii* in fish species: A molecular dynamics and immune simulation approaches

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In addition to being ubiquitous in different aquatic environments, *Aeromonas veronii* is able to cause a variety of diseases in a wide variety of fish species. *A. veronii* outbreaks in tilapia and barramundi farming have resulted in significant mortality rates, and the bacteria is resistant to a variety of antimicrobials often employed in aquaculture. *A. veronii* is uniformly resistant to first generation cephalosporins and recent study reported that this bacteria species is susceptible to third and fourth generation cephalosporins also. Despite these devastating complications, there is still no cure or vaccine for the bacteria. As a result, we used an immunoinformatics approach to develop an epitope-based vaccine against most pathogenic cadaverine reverse transporter (*CadB*) and maltoporin (*LamB*) gene of *A. veronii*. The immunodominant T- and B-cell epitopes were identified using the *CadB* and *LamB* protein. We developed a vaccine employing two possible epitopes: cytotoxic T-lymphocytes and linear B-lymphocyte epitopes, after thorough testing. The vaccine was developed to be antigenic, immunogenic, and non-allergenic, as well as having a better solubility. Molecular dynamics simulation revealed significant structural stiffness and binding stability. In addition, the immunological simulation generated by computer revealed that the vaccination might elicit immune reactions in the actual life after injection. Finally, using Escherichia coli K12 as a model, codon optimization yielded ideal GC content and a higher CAI value, which was then included into the cloning vector pET2+ (a). Altogether, our experiment imply that the proposed peptide vaccine might be a good option for aeromonads prophylaxis.

Keyword: *Aeromonas veronii*, T-lymphocytes, peptide vaccine

FSB2021- O.21

Production enhancement of carps and tilapia in creeks of Chattogram hill tract districts, Bangladesh

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An experiment was conducted to know the production performance of carps and tilapia in creeks of Chittagong Hill District in 2018. A total of 09 creeks (average size 60 decimal) were selected in three *upazillas* (Langadu and Rangamati Sadar *upazila* under Rangamati district and Mahalchari *upazila* under Khagrachori District) of Chittagong Hill District for evaluating growth, survival and production performance of carps and tilapia in a completely randomized design into three different treatments where each treatment was three replications for 300 days. Fishes were stocked with same stocking density with combination of Rui 14, Catla 14, Mrigal 12 and Monosex tilapia 20 individuals/decimal which weight 21.28±10.64, 53.45±30.33, 32.55±9.75 and 1.95±1.23 g; respectively. Artificial feed was used containing 25-28% protein. The highest final weight of Rui (825.12±35.18 g), Mrigal (775.15±102.42 g) and Monosex Tilapia (515.1±35.15 g) were recorded in T_1 (Rangamati Sadar) whereas highest final weight of Catla (984.10±85.24) was recorded in T_3 (Langadu). The highest SGR of Rui (*Labeo rohita*), Mrigal (*Cirrhinus cirrhosus*) and Monosex Tilapia (*Oreochromis mossambica*) were recorded in T_1 (Rangamati Sadar) whereas highest SGR of Catla (*Catla catla*) found in T_3 (Langadu). The Lowest FCR 1.35 was found in T_2 (Mahalchari). The highest BCR 1.59 was found in T_2 (Mahalchari). Fish productions were 8067.02 kg/ha/300days, 8286.85 kg/ha/300days and 7879.30 kg/ha/300days in T_1, T_2 and T_3 respectively. The net benefit/ha was BDT 420798.00, 480551.00 and 371587.00 in T_1, T_2 and T_3 respectively. The highest net return per ha (BDT 480551.00) and lowest gross cost per ha were found in T_2.

Keyword: production, enhancement, creek aquaculture, livelihood and CHT

FSB2021- O.22

Blue LED light positively regulates the growth, chlorophyll, β-carotene contents and proximate composition of *Chlorella ellipsoidea*

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Chlorella ellipsoidea, freshwater microalga has a great potential for sustainable aquaculture as an alternative single-cell protein source. Optimal lighting conditions for efficient photosynthesis are a vital factor for mass culture and economic algal biomass production. The present study aimed to investigate the effects of the wavelengths of white (380-750 nm), green (510 nm), blue (475 nm), and red (650 nm) light-emitting diodes (LEDs) on growth, pigment content (chlorophyll and β-carotene), and proximate composition of *C. ellipsoidea* with a photoperiod of 12 h: 12 h light: dark cycle under indoor environmental conditions. In this study, *C. ellipsoidea* was cultured in Bold's Basal Medium for 18 days. The cell density (125.36×105 cells ml^{-1}), cell dry weight (58.9±4.57 mg L^{-1}), optical density (1.66±0.08 g L^{-1}), chlorophyll-a (7.31±0.04 µg ml^{-1}), chlorophyll-b (2.73±0.13 µg ml^{-1}), and β-carotene (0.39±0.04 µg ml^{-1}) content of *C. ellipsoidea* were significantly ($P < 0.05$) higher at 15th-day culture under blue LED light exposure. Significantly lower growth and nutritional values were obtained under red LED light exposure compared to the control and other LEDs spectra. In Pearson correlation analysis, the cell density and cell dry weight values showed a strong positive correlation with the values of pigment contents of *C. ellipsoidea* in all the treatments. Proximate composition differed significantly by the effect of different LEDs light spectra. *C. ellipsoidea* cells were 3-7.04 µm in size, and the maximum area of the cell was 38.94 $µm^2$ in blue LED treatment. Protein and lipid levels of *C. ellipsoidea* were significantly higher in blue LED growth conditions compared to white, green, and red LEDs. Therefore, it was concluded that blue LED light spectra is the most suitable lighting condition to induce nutritionally rich biomass production of *C. ellipsoidea.*

Keywords: *Chlorella ellipsoidea*, blue LED, biomass production, pigment content, proximate composition

FSB2021- O.23

Development of native probiotic formulations for enhanced fish production in Bangladesh

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With increasing demand for protein the aquaculture industry around the globe are trying to produce high quality fish and fish products with low production inputs. To do that, different synthetic chemicals, antibiotics, growth promoters are being used but their indiscriminate use adversely affect the aquatic organisms and their habitat. Probiotics is a promising alternative to synthetic chemicals and have been proven as the positive promoters for fish growth and survival. Probiotics used in aquaculture in Bangladesh are mostly imported and expensive. Considering the above facts, a study was conducted to isolate, characterize (biochemical and molecular) gut bacteria followed by testing their effectiveness in different culture systems. A total of 90 bacteria were isolated from the gut of Stinging catfish and Tilapia. Following a series of biochemical tests, 4 bacterial isolates from Tilapia (ON consortium) and 5 bacterial isolates from Stinging catfish (HF consortium) were selected and used for probiotic formulation. These two consortiums were tested in Stinging catfish fingerling and Tilapia fry in a mini-bioflock system including a commercial probiotic and a control for comparison. Results suggest that Tilapia fry showed 75% higher growth than the control after two months of rearing where ON probiotic consortium was used as native probiotic, whereas in case of commercial probiotic it was 60% higher. In case of HF probiotic consortium 35% higher growth was observed over control whereas 5% higher growth was found over commercial probiotic. Positive effects have been observed in intestinal villi and gonad development, and hematological parameters (Hb, glucose, RBC, WBC) were improved by native probiotics formulation over commercial probiotic and control. In a nutshell, the native probiotics developed from Stinging catfish and Tilapia showed significant improvement of fish growth and other physiological parameters and can be recommended as potential probiotics in commercial fish production after further trials at field level.

Keywords: fish probiotics, stinging catfish, tilapia, bacterial consortium, aquaculture

FSB2021- O.24

Replacement of fish meal with blood meal in diet for butter catfish (*Ompok pabda)*

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An experiment was carried out to find the effect of the replacement of fish meal (FM) with blood meal (BM) on growth performance, body composition and hematology of butter catfish (*Ompok pabda*). The experiment was carried out in 15 glass aquaria with 5 treatments, each with 3 replications. FM protein was replaced by BM protein at 0%, 5%, 10%, 15%, and 20% levels in the five treatments of T_0, T_5, T_{10}, $T_{15,}$ and T_{20}, respectively. The stocking density was 45 fish per aquarium, and the water capacity of each aquarium was 180 L. Fish were fed daily two times (at 8 am and 5 pm) near satiation level. The sampling of fish was done fortnightly to monitor fish growth. During the experimental period, the water quality parameters such as ammonia, dissolved oxygen, pH, and temperature were within the suitable range for butter catfish culture. At the end of 8 weeks rearing periods, the highest average weight gain of fish was found in treatment T_{15} and that was 3.5 ± 0.22 g. Specific growth rate was also the highest in T_{15} treatment, and that was 1.42 % day^{-1}, feed conversion ratio (FCR) was observed at the minimum level in T_{10} treatment. The 2nd lowest FCR was observed in treatment T_{15}. The survival rate was found 94-98% in all the treatments and there was significant difference ($P<0.05$) among the treatments. The whole-body protein and lipid contents were the maxima in T_{15} treatment. However, hemoglobin (Hg) content was found in the higher level as 8.3 g/dl in T_{15} treatment, where 15% FM protein was replaced with BM protein. Red blood cell (RBC), white blood cell (WBC) count, mononucleosis (MONO), eosinophil (EOS), total hemoglobin concentration (Hg), and hematocrit (HCT) of butter catfish were better in T_{15} treatment, where 15% FM protein was replaced with BM protein, compared with other treatments. Based on the results, it was concluded that 15% fish meal protein can be replaced with blood meal protein in diet for butter catfish.

Keywords: FM protein, FCR, butter catfish

FSB2021- O.25

Evaluation of dietary microalgae as growth enhancer and immunostimulant in fish

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Microalgae are a wide group of photosynthetic heterotrophic organisms consisting of vital amino acids, protein, minerals, vitamins, chlorophylls, and some forms of antioxidants and bioactive substances. The use of microalgae could have significantly beneficial effects and could potentially replace or reduce common feedstuff because of their nutritional quality and positive effect on growth performances of aquatic species due to increased triglyceride and protein deposition in muscle, improved resistance to disease, decreased nitrogen output into the environment, omega-3 fatty acid content, physiological activity, and carcass quality. Algal supplements have been reported to contain many compounds that serve as non-specific immunostimulants, improving the defense mechanisms in the fish, providing enhanced resistance to pathogens, and thus improving immunity. Dietary algal supplements increased the level of catalase, lysozyme, and IgG (Immunoglobulin G) value in tilapia. It already seems that microalgae will play a significant role in the effort of formulating of aquafeed to a more sustainable way. This comprehensive review summarizes the most important and recent developments of microalgae use as a supplement or feed additive to replace fishmeal and fish oil for use in aquaculture. Furthermore, from this review paper, it would be possible to find out the effect of using microalgae as fish feed ingredients for enhanced growth and immunity of fish.

Keywords: Microalgae, growth performances, immunity, alternative protein, feed additives

FSB2021- O.26

Molecular characterization of the growth hormone gene and selection of fast growing stinging catfish *(Heteropneustes fossilis*, Bloch) by marker assisted selection

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Genetic improvement of Stinging catfish (*Heteropneustes fossilis*, Bloch) may enhance its production that could be achieved through a marker assisted selection program. The aim of this studies was to detect polymorphisms in the growth hormone gene and to find out association between the polymorphisms with variation in growth in order to select fast growing fish by marker assisted selection. *H. fossilis* were reared in a pond for six months and 175 individuals were randomly collected. Based on the size, the fish were divided into four fish groups such as Large female, Large male, small female and small male. A total of 60 individuals were selected from the four groups and used for molecular analysis. Genomic DNA was extracted and an approximately 500bp fragment was amplified using primer sets designed from the published growth hormone gene sequences. The DNA sequences were edited and aligned for 485 bp which included Exon1(partial), Intron1, Exon2, Intron2 and Exon3 (partial). A total of 16 nucleotide polymorphisms were detected among which three single nucleotide polymorphisms (SNPs) were observed in two introns which were specific for the large and small fish groups. No size group-specific SNPs were detected in the exons and so no amino acid polymorphisms were found. SNPs in intron position may be associated with overall body weight. The values of genetic variability parameters including the number of polymorphic sites, mutations, nucleotide differences and haplotype diversity were found to be higher in the small fish group compared to the large fish group. The comparative study of genetic variation possesses that polymorphisms in growth hormone gene DNA, particularly the size group-specific SNPs that have been detected in introns could be used to screen a large group of fish by genotyping and association analysis to facilitate selection of fast growing fish by marker assisted selection.

Keywords: stinging catfish, single nucleotide polymorphism (SNP), marker assisted selection, genetic variability, haplotype

FSB2021- O.27

Effects of synbiotics on growth, persistence and immune responses in stinging catfish (*Heteropneustes fossilis*)

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Synbiotics are a combinational supplementation of probiotics with prebiotics to improve the health status and productivity of the host animal. Our study investigated the effects of dietary synbiotic (a group of probiotics at a dose of 8.3×10^7 CFU/ml with a mixture of prebiotics) supplementations on growth performance, body indices, and hematological and biochemical parameters in *Heteropneustes fossilis*. A total of 180 *H. fossilis* fries with an average initial weight of 5.7±0.61 gm and an average length of 9.7±0.58 cm was randomly stocked into three groups T1 (control; no synbiotic), T2 (3%) 8.3×10^7 CFU/ml and T3 (7%) 8.3×10^7 CFU/ml groups. Fishes were fed twice a day at the rate of 3% body weight for 60 days, while T2 (3% synbiotic) and T3 (7% synbiotic) received synbiotic supplementations (3% and 7% of basal feed, respectively) once in a 15-day interval throughout the feeding trial. At the end of the study, it was observed that synbiotic supplemented groups showed significant increment in five growth parameters, weight gain (WG), length gain (LG), percent weight gain (PWG), daily weight gain (DWG), and specific growth rate (SGR) gain compared to the control. Besides, among three body indices (hepatosomatic index (HSI), viscerosomatic index (VSI), and carcass yield (CY)), VSI and CY were significantly affected by the synbiotic supplement in the feed of stinging catfish. Furthermore, the blood hemoglobin was significantly higher in T3 (7%) compared to control, while blood glucose level was unaffected. Some parameters were not changed significantly after 15 or 30 days of treatment with the synbiotic, but after 60 days, their differences with the control became significant, which indicates a substantial effect of culture period on these parameters. Therefore, it could be concluded that this synbiotic can potentially change the growth and health status of stinging catfish, and the results will be more prominent if the fish is treated with the synbiotic for a longer period.

Keywords: synbiotic, *H. fossilis*, growth parameters, body indices, hemoglobin

Session-3

AQUATIC RESOURES MANAGEMENT & POST-HARVEST FISHERIES

PC: ***Kbd Mehedi Hasan***

FSB2021- O.28

Diversity of adaptive gear and their impacts on Kaptai lake fisheries

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Kaptai Lake is one of the most important open water fisheries resources in Bangladesh which create in 1961 for power generation by damming at kaptai upazila of Rangamati hill tract district. The production of this lake is lower (154 kg per hectre) compared with River & Estuary, Beel and floodplain fish production of Bangladesh. Due to Unplanned use of few gears; the natural recruitment process seriously hampered in Kaptai Lake. With these considerations study was conducted from August 2020 to April 2021 in 05 sampling sites of Kaptai Lake. During Sampling 11 types of fishing gear, 07 types fishing trap and many Brush shelter were found. Among these three gears are more harmful for kaptai lake fisheries production and biodiversity. Kechki net or seine net which mesh size 2.0 mm; length 91.44-822.96 m; Wide 10.72-22.86 m; haul time 01-4.5 hour; CPUE 0.7-80 kg where water depth 3.65-24.38 m and about 35 species were found. Among the species smaller size *Gudusia chapra* (Chapila) 0.18-1.6 gm; *Labeo calbasu* (Kalibaush) 97-180 gm; *Mystus aor* (Air) 04-35 gm; *Glossogobius giuris* (Bele) 0.09-5.24 gm and *Hyporhamphus limbatus* (Ekthuta) 0.08-1.80 gm. Current net or gill net locally known as chapila net which mesh size 0.02-3.5 cm; length 58.5-877.82 m; wide 67 -30.48 m; CPUE 0.21-3.35 kg; haul time 38 min-17 hour where water depth 03-21.42 m and 25 species were found. Harmful catch by this gill net *M. aor* 13.87-74 gm; *G. giuris* 0.14-5.70 gm and *Johnius coitor* (koitor poa) 2.16-17.78 gm. Dharmo jal or Square Shaped Ber net made by three to six types mesh size 0.5-28 cm; Length 91.44-292.6 m; haul time 30-50 min; CPUE 0.38-2.2 kg and 15 Species were found. Smaller size *M. aor* 23-137 gm; *J. coitor* 2.42-15.55 gm and *G. giuris* 0.7-6.08 gm caught by this gear.

Keywords: Adaptive gear, mesh size, biodiversity, Fish Production, Kaptai Lake

FSB2021- O.29

Population parameters of ten commercially important small indigenous fish species (SIFS) in the Oxbow lake, Southwestern Bangladesh

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This study focuses on population parameters including growth pattern (length-weight relationships, LWRs), condition factors, form factor ($a_{3.0}$), size at first sexual maturity (L_m), age at first sexual maturity (t_m), life span (t_{max}), natural mortality (M_w), asymptotic length (L_∞) and *optimum catchable length* (L_{opt}) of ten commercially important small indigenous fish species (SIFS) from the Bukvora *Baor*, Jashore. A total of 1500 specimens were sampled during January to December 2020 with traditional fishing gears including seine nets, gill nets, and lift nets. Individual total length (TL) and body weight (BW) were measured by digital slide calipers and digital balance, respectively. To calculate the L_m, empirical maximum length based model were considered and L_{opt} was calculated based on L_∞. The TL *vs.* BW relationships was estimated. According to Spearman correlation test, Fulton's condition factor (K_F) *vs.* BW were highly correlated (P<0.001), indicating better wellbeing for these species. Moreover, $a_{3.0}$ indicates *B. badis, C. punctata, C. striata, G. giuris, H. limbatus, L. guntea,* were elongated; *C. nama, P. sophore,* were short and deep; *G. chapra* was fusiform and *M. pancalus* was eel like body shape respectively. The minimum t_m and t_{max} were obtained as 0.74 year and 2.66 year for *C. striata* and maximum were 0.93 year and 3.31 year for *B. badis,* respectively. This study provided information on t_m and t_{max} for ten SIFS that is globally absent. From empirical models, the smallest mean value of L_m was found for *B. badis* (3.98 cm) and greatest was found for *C. striata,* (16.96 cm). The minimum L_{opt} was obtained as 3.78 cm TL for *B. badis* and maximum was 14.09 cm TL for *C. punctata.* The minimum M_w was documented as 1.39 for *B. badis* and maximum was 1.73 for *C. striata*. The output of this research will be helpful for the developing of sustainable management policies and protection of SIFS through the application of mesh size based on L_m and L_{opt} in the Oxbow lakes, Bangladesh and neighboring countries.

Keywords: growth pattern, size at first sexual maturity, *optimum catchable length*, SIFS, *baor*

FSB2021- O.30

Stock assessment and management of Bombay duck *Harpadon nehereus* in the Bay of Bengal

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The research has been undertaken for an appraisal and assessment of Bombay duck *Harpadon nehereus* (Hamilton, 1822) stock in the Bay of Bengal for sustainable management of this valuable fish species in the marine waters of Bangladesh. Stock assessment entailed the modeling of age and growth, obtaining recruitment pattern, estimation of both natural and fishing mortalities, and eventually determination of its maximum sustainable yield. Bombay duck known as lotya in Bengali is an excellent food fish having commercial importance. Conventional models were employed to estimate life-history parameters. Sampling was carried out monthly over a calendar year from January to December from the industrial fishery based in Chittagong. The standard length of H. *nehereus* individuals collected over the study period ranged from 3.5 to 25.3 cm, and the body weight varied from 0.8 to 131 g. Fitting the time-series length data with ELEFAN I model revealed that an individual Bombay duck reached a theoretical maximum standard length of 30 cm with a growth coefficient of 0.73 per year. The asymptotic body weight was 198.14 g, and the growth coefficient was 0.67 per year. Recruitment occurred at SL about 7.61 cm and at age of 0.40 years. Length at first capture was calculated 9.95 cm ($L_{C75\%}$). The natural and fishing mortalities were 1.12 and 2.58 per year. The maximum yield per recruit obtained was 10.16 g at the fishing mortality of 1.3 per year. The biomass analysis, however, estimated that the species attained about 3.99 kg when they are 1.58 years old if 1000 individuals recruited to the adult stock. The output parameters obtained in this study were used to propose a simple guide to *H. nehereus* fishery for its sustainable management in the Bay of Bengal which was the eventual goal of the research.

Keywords: stock assessment, fisheries management, *Harpadon nehereus*, Bay of Bengal

FSB2021- O.31

Current status of the small fish species in the Gorai and the Horai rivers from the central Bangladesh

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This study for the first time is documenting the wide-ranging information on the availability, size variation, conservation status, global trend and biodiversity index of riverine small fish species (SFS) from the Gorai and Horai Rivers for a period of one year (June 2020 to May 2021). Water flow and availability divide these two rivers in two different types, where the Gorai is a perennial river and the Horai is a calm dry river. Data were collected at two month interval, field survey, focus group discussions and personal interviews of fishermen using questionnaire. During this period, there were 36 (belonging to 18 families) and 26 (belonging to 15 families) SFS were observed from the Gorai and Horai Rivers, respectively, in which 25 species are common. The maximum size ranges were 7-15 cm and Cyprinidae was found to be the richest family in both rivers. Moreover, 75 and 84.62% SFS were commonly available in the Gorai and Horai River, respectively; whereas 11% fishes were rare. According to IUCN Red List Status for Bangladeshi species, four vulnerable SFS were recorded from studied area including *Chela cachius, Gudusia chapra, Lepidocephalichthys annandalei* and *Pethia ticto*. The global trend has been shown that, about 5 and 3 species are decreasing tremendously from the Gorai and Horai Rivers, respectively. The Simpson's Dominance Index of the Gorai (0.97) was higher than that of the Horai River (0.96). On the flip of site, Pielou's Evenness Index was lower for the Gorai (0.97) than that of Horai (0.98). The leading threat for the SFS was the reduced navigability of the rivers by both natural and anthropogenic activities. On the basis of such study, different managerial plans should be created and needs to prioritize the river dredging projects for the protection and management of small fishes from Bangladeshi waters.

Keywords: biodiversity index; evenness index; availability; threat; small fish species (SFS)

FSB2021- O.32

An assessment of underwater biodiversity in Saint Martin's Island of Bangladesh

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Coral reefs have the highest biodiversity of any ecosystem on the planet, even more than a tropical rainforest. Occupying less than one percent of the ocean floor, coral reefs are home to more than twenty-five percent of marine life. Saint Martin's Island (SMI) is the only island of Bangladesh where coral colonies are found. We have conducted an underwater survey to uncover the underwater biodiversity in this island during the winter season from 2016 to 2019. The photographs of these species were captured by scuba diving and snorkeling in the water depth of about 3 to 7 meter in the adjacent area of Saint Martin's Island, Bangladesh. This study reveals 131 faunal and 18 floral species representing different groups of organisms viz. Bivalves (5 species), Crabs (5 spp.), Feather star (1 sp.), Fireworm (1 sp.), Fishes (53 spp.), Flatworm (1 sp.), Hard corals (27 spp.), Hermit crab (1 sp.), Jelly fishes (3 spp.), Lobster (1 sp.), Octopus (1 sp.), Sea anemones (3 spp.), Sea cucumber (1 sp.), Sea fans (8 spp.), Sea fern (1 sp.), Sea slug (6 spp.), Sea turtle (1 sp.), Sea snail (1 sp.), Sea star (1 sp.), Sea urchin (1 sp.), Sea whip (1 sp.), Sponges (3 spp.), Tubeworms (4 spp.), Zoanthid coral (2 spp.), and Seaweed (18 spp.). Coral bleaching was also observed in this study. Present study exposes the hidden beauties of rich underwater biodiversity of this island to the people with a hope to take part in supporting and conserving this island by the tourists, related stakeholders and government. The study also signifies the necessity of immediate declaration of this ecologically critical area (ECA) as a marine protected area (MPA) of Bangladesh.

Keywords: underwater survey, hard coral, reef fish

FSB2021- O.33

Assessment of ecological risk of the River Halda: A tidal fed natural spawning ground of major carps in Bangladesh

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The river Halda, one of the important natural spawning grounds of major carps in Bangladesh is facing multiple and inter linked ecological risks endorsed through metal pollution from lithogenic and anthropogenic sources. In order to assess this, sediment samples from 4 sampling locations (Khondokia Khal, Katakhali Khal, Madari Khal and Madarshah) were collected by Bangladesh Fisheries Research Institute and analyzed using Inductively Coupled Plasma-Optical Emission Spectrometry (ICP-OES), Perkin Elmer Avio 200 (USA). Seven heavy metals orderly arranged as Fe>Mn>Zn>Cr>Pb>Cu>Cd (mg/kg) were detected. The results from different indices indicated that the river Halda is under an ecological risk of metal pollution. The geo-accumulation (I_{geo}) and improved nemerrow (I_N) index values showed moderate pollution. The contamination factor (CF) values for all heavy metals exhibited low contamination except Cd (>3.0). The mean pollution load index (PLI, 0.37±0.10) considered to be unpolluted. Similarly, the mean degree of contamination (C_d, 2.68±1.84) and modified degree of contamination (mC_d, 0.37±0.18) indicated nil to lower degree of contamination. The mean enrichment factor (EF, 0.08±0.02 to 4.16±0.0) demonstrated none to moderate enrichment of the river. The mean ecological risk factor (E^i_r, 28.95±3.18 to 759.14±192.26) and risk index (RI, 711.26±122.55 to 1272.04±175.19) exposed low to serious ecological risk in different sampling sites of the river Halda. The mean probable effects level (PEL, 0.04 to 1.09), and probable effects level quotient (PEL-Q, 0.26 to 0.45) indicated that the combination of heavy metals may have a 21 % probability of being toxic. The connotation among metals conceded with the Pearson's correlation matrix, (95% confidence level, p = 0.05) exhibited significant correlation among the metals, denoting a common source of metals especially from industrial effluents, municipal wastes, and agricultural inputs. The results of the present study ratify immediate steps to protect the only natural spawning ground of major carps from the environmental risk of heavy metals.

Keywords: ecological risk, river halda, spawning ground, heavy metals and major carps

FSB2021- O.34

Effect of arsenic on the growth and development and gene expression of commercially important fish *Labeo rohita*

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A study was designed to determine the effects of arsenic on the growth and development of commercially important fish *Labeo rohita.* Fish fry (weight: 387.5 ± 169.25 mg, length: 3.35 ± 0.37 cm) were collected from a local hatchery and acclimatized for a week before starting the exposure with arsenic. Fish were exposed for a period of 14 days with three concentration solution of $NaAsO_2$ (T1: 2.5, T2: 15, and T3: 30 ppm) based on LC_{50} value for 96 h. Remarkable morphological anomalies and deformities of arsenic exposed *Labeo rohita* has been observed in this study. Caudal fin erosion of some fish was a prominent deformity in 30 ppm exposed fish. No significant RNA: DNA ratio difference was observed among the treatments. The overall weight of fish was decreased by increasing arsenic concentration. Statistically significant negative weight gain (-0.05±0.07 g) was observed in T3 fish whereas there was no significant weight gain difference among other treatments (T1 and T2) and control fish. Mortality was simultaneously increased by increasing arsenic concentration. Different types of histopathological changes were observed in the gill of arsenic treated *Labeo rohita*. Necrosis and severe damages was found in the secondary lamellae in T3 fish. Epithelial lifting was also observed in the primary lamellae of the gill of T3 fish. Irregular shape and damages also occurred in the gill raker of some T3 fish. In the study, the expression of *Metallothionein* (*MT*) gene was also assessed by qPCR and this gene was significantly up regulated for all the treatments. The results of the present study suggest that arsenic significantly hampers the growth and development of fish fry.

Keywords: arsenic, growth, development, *Labeo rohita*

FSB2021- O.35

Ichthyotoxicity and growth characteristics of a noxious blue-green algae *Planktothrix* sp.

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Nuisance algal problems are frequently amalgamated with cyanobacteria (blue-green algae), especially blooms and associated scum. Blue green algae are morphologically diversified with photosynthetic activity, known for their capabilities in releasing potent toxin that results mortality of fishes by deteriorating water quality. Among them, *Planktothrix* sp. was isolated to estimate its growth characteristics under 5 different concentration of pH (pH 7.5 to 9.5, at 0.5 interval) and to determine its ichthyotoxicity by using modified kosaric medium. During the course of the experiment, *Planktothrix* sp. grew at pH from 7.5 to 9.5, with the optimum 8.5 to 9.5. There was a clear decrease in growth rate at lower pH (< 8.5) where the best growth of *Planktothrix* sp. was observed at pH 9.0 with an optical density at 620 nm of 1.88. Similar trend was observed in case of dry cell weight, optical density, chlorophyll-a, total biomass and specific growth rate of the algae. During conducting ichthyotoxicity test, *Puntius sarana* (standard length 3.8 cm, weight 0.42 g) did not die when they were exposed in live cells but all the fishes were died when they are exposed in broken cells of *Planktothrix* sp. The broken cells of *Planktothrix* sp. took only 12-15 minutes to kill fish at optical density of 2.6 (cell weight 820 mg/L). Deaths of fishes were observed within 15-18 and 45-50 minutes and 7-7.5 hours at the optical density of 1.5 (cell weight 482 mg/L), 1.1 (cell weight 360 mg/L) and 0.8 (cell weight 258 mg/L) respectively which clearly indicate that fish mortality is observed earlier with the increasing trend of broken cell concentration of *Planktothrix* sp. The present study elucidates the isolation and culture of *Planktothrix* sp. at different pH concentration along with the observation of its growth and ichthyotoxicity in Bangladesh for the first time.

Key words: Cyanobacteria, *Planktothrix* sp., Growth characteristics, Water quality, Ichthyotoxicity

FSB2021- O.36

Effect of pH on mixed culture and ichthyotoxicity of noxious blue-green algae, *Planktothrix subtilissima* and *Microcystis aeruginosa*

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Blue-green algae have an extensive range of morphological and metabolic diversity and can be utilized for a variety of purposes in economic development and environmental management, however, the toxin-producing blue-green algae can induce serious illnesses, posing a threat to aquaculture sustainability and recurring harmful algal blooms. Mixed culture of such two blue-green algae, *Planktothrix* sp. and *Microcystis aeruginosa* were developed at different pH (pH 7.5 to 9.5) levels to observe the effect of pH on their growth as well as to estimate cell density, cell weight (dry weight), chlorophyll-a, optical density and other physical-parameters (light intensity, temperature) of culture media. The culture was carried out in a modified Kosaric medium where growth was significantly affected by pH changes. The best growth was obtained at pH 9.0 with an optical density of 1.36 at 620 nm. At pH 8.5 and 9.5, with optical densities of 0.39 and 0.29, good growth was also observed. The optical density declined significantly as the pH was reduced from 8.0 to 7.0. The cell count, weight and chlorophyll-a content of the algae all followed a similar pattern. The ichthyotoxicity of these two species was also studied at different developmental phases of culture. *Puntius sarana* (standard length 3.8 cm, weight 0.42 g) did not die when exposed to live cells during the ichthyotoxicity test but all of the fish died when exposed to broken cells. At optical densities of 1.08 and 0.82, mixed cultivated cells of *Planktothrix* sp. and *M. aeruginosa* took 20-22 and 48-52 minutes respectively to kill fish indicating that mixed culture cells kill fish faster due to presence of *M. aeruginosa*. The focus of this research was to determine the growth and different physical parameters of *Planktothrix* sp. and *M. aeruginosa* in mixed culture at different pH level and their ichthyotoxicity at various stages.

Key words: mixed culture, *Planktothrix* sp., *Microcystis aeruginosa*, pH effect, ichthyotoxicity.

FSB2021- O.37

Seasonal variation of plankton and physicochemical parameters of Kaptai Lake, Bangladesh

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The present investigation studied the seasonal changes in plankton diversity and water quality of Kaptai Lake. Quantitative samples were collected every month from August 2020 to July 2021. The air and water temperature, pH, conductivity, salinity, total dissolved solids, hardness, ammonia, and transparency were measured in-situ using a multiparameter, test kit, and Secchi disk. The dissolved oxygen, free carbon dioxide, and alkalinity were measured ex-situ in the laboratory using Winkler's method. Plankton samples were collected using nylon plankton net and preserved with 5% formalin. Air temperature, water temperature, dissolved oxygen, pH, conductivity, TDS, and hardness were maximum during the pre-monsoon season and started to decrease the onset of the monsoon season. Ammonia, transparency, salinity, free CO_2, and alkalinity were higher during the post-monsoon season, whereas these values and TDS were minimum during the monsoon season. The physicochemical parameters with seasonal variation were in a suitable range for aquatic life and fish production. There were 69 phytoplankton genera identified, belonging to 10 different classes; Cyanophyceae (33%) and Chlorophyceae (22%) were the most dominant phytoplankton classes during the study period. The zooplankton community was composed of 39 genera divided into six groups, with dominating group Rotifera (46%). Seasonal differences, as well as nutrient availability, had a substantial impact on the plankton species. During the pre-monsoon season, phytoplankton abundance peaked (2.95×10^4 cellsL^{-1}) while zooplankton abundance peaked (2.01×10^3 indL^{-1}) during the monsoon. Phytoplankton showed a strong positive relationship with dissolved oxygen (r=+0.712) and strong negative relation with free carbon dioxide (r=-0.803), whereas zooplankton showed a strong positive relation with pH (r=+0.634). Our study revealed that dissolved oxygen, pH, and free Carbon-dioxide are the most important physicochemical parameters for the seasonal variation of plankton in Kaptai Lake.

Keywords: Kaptai Lake, phytoplankton, zooplankton, physicochemical parameters, seasonal variation

FSB2021- O.38

Public health risks associated with pesticides and heavy metal exposure through consumption of common dried fish in coastal regions of Bangladesh

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The chemical contaminants in dried fish are of great food safety concern and emerging public health issue in Bangladesh. The aim of this study was to assess the public health risk associated with exposure to pesticides (organochlorine and organophosphorus) and heavy metals (lead, mercury, cadmium, chromium, arsenic) through the consumption of dried fish (Bombay duck, ribbon fish, silver jewfish, shrimp, Chinese promfret) in coastal districts (Cox's Bazar, Chattogram, Bhola, Patuakhali, Khulna) of Bangladesh. Dried fish consumption data were collected from 500 adult respondents (100 from each district) using a food frequency questionnaire (FFQ). Pesticides residues were determined using QuEChERS extraction coupled to Gas Chromatography and Gas Chromatography Mass Spectrometry, and heavy metals were estimated using atomic absorption spectrophotometric method. The results revealed that the frequency and amount of dried fish consumption was highest for Bombay duck in Cox's Bazar (11.57g/capita/day) and ribbon fish (12.10 g/capita/day) in Chittagong. The estimated daily intake (EDI) and harmonized risk indicator (HRI) values expressed no health risk from pesticide residues in all the positive samples. For heavy metals, target hazard quotients (THQ) for non-carcinogenic health risk were below 1, indicating no health risk for all samples. However, carcinogenic risk R value indicated a potential health risk for chromium, and carcinogenic RT value indicated a potential health risk for all the metals. The study suggests producer's capacity buildings training, consumer's awareness, and policy makers to establish risk management strategy that control pesticides and heavy metals in dried fish consequences ensure safe food for local and global consumers.

Keywords: dried fish; food safety; consumption frequency and tendency; chemical contaminants exposure; coastal Bangladesh.

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Effects of delayed icing on the histamine production in Hilsa shad (*Tenualosa ilisha*)

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Histamine poisoning is a great concern of eating the hilsa shad (*Tenualosa ilisha*) for some people. The study aimed to know the effects of delayed icing on histamine production and histamine producing bacteria (HPBs) after catching hilsa. For this purpose, hilsa fishes were collected onboard just after catching in Patharghata, Barguna and added ice at 3h intervals (0h, 3h, 6h, 9h, 12h, and 15h) and kept separately in iceboxes and brought to the laboratory to determine the histamine content and HPB count on the 2^{nd}, 5^{th} and 8^{th} day during ice storage. The initial histamine content on the 2^{nd} day was 13.1 mg/100g in the sample of immediate icing (0h) and then gradually increased with the delaying of icing. However, there were no significant ($p>0.05$) differences observed among samples of icing at 0h, 3h, and 6h. On 5^{th} and 8^{th} day, a more or less similar gradually increasing trend in histamine content was observed. The histamine content was less than 50 mg/100g, regarded as a "hazard action level" during entire storage period in samples of icing on and before 6h. In addition, HPB count steadily increased with the delaying of icing in almost the entire storage period. However, HPBs were not significantly influenced ($p > 0.05$) by the storage period. Among 62 selected isolates, 16 isolates showed positive results on Niven's medium which were further confirmed presumptively by biochemical tests as follows: *Shigella* spp. *(5 strain)*, *Pseudomonas aeruginosa* (3), *Citrobacter freundii* (2), *Hafnia alvei* (1), *Edwardsiella tarda* (1), *E. coli* (1), *Enterobacter cloacae* (1), *Acinetobacter baumannii* (1), and *Lactobacillus* spp. (1). All those isolates were confirmed as histamine producers producing 32.37 - 66.38 mg/100g histamine. In conclusion, histamine production and spoilage could be kept within acceptable limit by icing hilsa within six hours of catching irrespective of storage period which will ensure the supply of hilsa for all sorts of consumers.

Keywords: Hilsa, histamine, icing, preservation

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A study on the quality and safety aspect of Giant Tiger Prawn (*Penaeus monodon*) and related characteristics of seawater of the Bay of Bengal along the Cox's Bazar coast of Bangladesh

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This research was conducted to know the nutritional composition, quality and safety (heavy metal) of Giant Tiger Prawn (Penaeus monodon) and related characteristics of seawater of the south east part of the Bay of Bengal along the Cox's Bazar coast of Bangladesh. Parameters for nutritional composition were protein, lipid, ash and moisture. Parameters for quality were TVB-N and TMA-N, safety parameter was heavy metal in particular Cd, Cr, Pb, Cu and Zn. In (*Penaeus monodon*) during autumn season, protein content was 18.2%, lipid content was 6.08%, ash content was 2.1 %and moisture content was 74.93%. TVB-N content was 2.75 mg/100g flesh and TMA-N content was 2.11 mg/100g flesh. Both of these two quality parameters remained within the maximum allowable (TVB-N <30 mg/100g; TMA-N <8-10 mg/100g). Incase of safety parameter i.e. heavy metal Cd was 0.587 ppm, Cr was 7.47 ppm, Pb was 4.50 ppm, Cu was 33.17 ppm and Zn was 84.89 ppm. Result indicates that in autumn season Cd, Cr, Pb, Cu concentration in *Penaeus monodon* was above the maximum allowable limit. In seawater collected from Cox's Bazar coast the pH was 6.64, salinity was 22.18 PSU, Dissolved oxygen was 50%. Heavy metal concentration in seawater was Cd 0.001 ppm, Cr 0.071 ppm, Pb 0.03 ppm, Cu 0.001 ppm, Zn was 0.004 ppm.

Keywords: quality, safety, prawn, seawater, Bay of Bengal

POSTER ABSTRACTS

PC: ***Hamidur Rahman Himel***

FSB2021- P.01

Occurrence of harmful cyanobacteria (*Oscillatoria* spp.) in the Bay of Bengal, Bangladesh

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Harmful cyanobacterial blooms (CyanoHABs) are a global phenomenon, perceived by a widespread occurrence of one or several species that have an opposed impact on human health and marine ecosystems. Cyanobacterial blooms and the accumulation of several cyanotoxins in water bodies pose severe ecological consequences with high risk to aquatic organisms and global public health. An outbreak of harmful cyanobacteria, *Oscillatoria* spp. was recorded along the coastal waters of Bakkhali River Estuary and Maheshkhali Channel of the Bay of Bengal (BoB), Bangladesh during winter 2021. Hence, this study investigated the exigent environmental parameters of the BoB, Bangladesh which depicted obvious effects on the occurrence, abundance and blooms of *Oscillatoria* spp. Fluctuation in temperature, salinity, pH, dissolved oxygen and chlorophyll-a can stimulate the density of the recorded species in this largest Bay. However, *Oscillatoria* spp. are cognizant to be potentially noxious and toxic cyanobacteria related to organ and neuromuscular distress as well as external contact irritation in marine habitats. Accordingly, the coastal and marine waters of Bangladesh are in constant threat because of the lack of research and monitoring systems emphasizing the blue economy. This paper deals with the blooms of *Oscillatoria* spp. and their relationship with environmental parameters.

Keywords: Algal blooms, Cyanobacteria, *Oscillatoria* spp., Blue economy, Bay of Bengal

FSB2021- P.02

Occurrence of antibiotic-resistant genes associated with *Salmonella* isolated from Pangasius catfish (*Pangasianodon hypophthalmus*) farms in Trishal and Phulpur Upazila, Mymensingh

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Aquaculture farms are often contaminated with pathogenic bacteria, including antibiotic-resistant *Salmonella* spp.. The study aimed to determine the occurrence of antimicrobial-resistant gene(s) in *Salmonella* spp. associated with *Pangasianodon hypophthalmus* farms in Trishal and Phulpur upazila of Mymensingh district. A total of 10 Pangasius catfish, 6 sediment and 6 water samples were collected and subjected to *Salmonella* spp. isolation using SS-agar and XLD agar. Among the 67 isolates tested, 23 were identified as pathogenic *Salmonella* spp. by PCR-based method through detection of *invA* virulence gene having 284 bp amplicon product. The isolates were screened for antibiotic-resistant gene(s) through PCR. Among the antibiotic-resistant genes studied, the occurrence of *tetA* (17.5% for tetracycline), *sul1* (12.5% for sulfonamide) and *cat1* (7.5% for chloramphenicol) was highest followed by *tetB* (2.5% for tetracycline) and *sul2* (2.5% for sulfonamide). Multidrug resistant *Salmonella* spp. was confirmed for isolates collected from both Trishal (*sul1*, *sul2* and *tetA*) and Phulpur (*tetA* and *cat1*) upazila. It can be inferred that the different resistance profiles of isolated pathogenic S*almonella* could be due to use of aquaculture inputs. Farm owners and other stockholders need to be concerned about the presence of these pathogenic bacteria that may contribute to human health risk. Appropriate management strategies should be in place for responsible aquaculture to ensure the quality and safety of Pangasius catfish products.

Keywords: *Salmonella*, PCR, antibiotic-resistant genes

FSB2021- P.03

Study of different enzymes on production of bioactive peptide from several farmed fishes of Bangladesh

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Fish peptide powder (FPP) was prepared from washed mince of 4 farmed fish species of Bangladesh: silver carp (*Hypophthalmichthys molitrix*), grass carp (*Ctenopharyngodon idella*), Nile tilapia (*Oreochromis niloticus*) and Pangasius catfish (*Pangasianodon hypophthalmus*) using proteolytic enzyme sources viz., commercial papain (0.02%, w/w). Production yield of FPP ranged between 0.73 ± 0.17 to 2.11 ± 0.04% with highest from silver carp and lowest from Nile tilapia . Proximate composition data of silver carp, grass carp, Nile tilapia, and Pangasius catfish FPP showed 70.79 ± 1.21% to 89.25 ± 1.30% crude protein with highest from Nile tilapia and lowest from Pangasius catfish, 1.96 ± 0.02% to 17.42 ± 1.40% lipid with highest from Pangasius catfish and lowest from Nile tilapia, 0.89 ± 0.06% to 2.28 ± 0.06% ash with the highest from grass carp and the lowest from Pangasius catfish, 3.90 ± 0.06% to 10.28 ± 0.64% moisture with highest from Pangasius catfish and lowest from Nile tilapia. Functional properties of protein such as foaming, emulsifying properties, solubility were also observed in the FPP prepared from these 4 species. The expansion stability of foam was increased when sample concentrations increased. FPP prepared using commercial papain enzyme showed the highest solubility than. Chemical property such as degree of hydrolysis (%) increased with increasing time where values after 2 h of hydrolysis was highest for each species. These results suggest that silver carp, grass carp, Nile tilapia and Pangasius catfish FPP possesses more or less similar functional and chemical properties compared to peptides produced from other fish species.

Keywords: bioactive peptide, papain, papaya peel

FSB2021- P.04

Evaluating the effect of Alfalfa (*Medicago sativa*) extract on growth, digestive enzyme activity, body composition and gut morphology of common carp (*Cyprinus carpio* L.) fingerlings

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The present study has been designed to investigate the possible effect of alfalfa (*Medicago sativa*) leaves extract on various health parameters such as growth performance, body composition, digestive enzyme activity and intestinal histomorphology of common carp (*Cyprinus carpio* L.) fingerlings. In addition, bacterial challenge test with *Aeromonas hydrophila* was done to evaluate the bacterial resistant capacity. Fingerlings with an average weight of 6.51 ±0.3 g were distributed in five treatment groups with triplicates. Fish were fed with diet containing alfalfa extract in different concentration for each group as 0.0% (T0) control, 0.25% (T1), 0.50% (T2), 0.75% (T3) and 1.0% (T4). At the end of feeding trial fish were sampled for growth performance, body composition, enzyme activity and gut morphology. The fish in T4 showed significantly high ($p < 0.05$) values for Specific growth rate (SGR), daily gain, live weight gain, feed conversion efficiency (FCE) and protein efficiency ratio (PER). While the feed conversion ratio (FCR) was significantly ($p < 0.05$) low in T4. Furthermore, the fish in T4 group shows intestinal protease (6.72 ± 0.00) and amylase (0.7111 ± 0.00) activities significantly ($p< 0.05$) higher with respect to the control (T0) group. Significantly low ($p< 0.05$) values of intestinal cellulase activity were observed in T0 (0.8393 ± 0.005) while the group T3 shows significantly highest activity ($p< 0.05$) of cellulase (1.6197 ± 0.011). The crude protein percentage in fish carcass was observed significantly ($p< 0.05$) higher in group T4 when compared with control. While alfalfa extract had no significant ($p< 0.05$) effect on intestinal histomorphology, a visible difference in villi length observed. The survival rate was higher in T4 after *Aeromonas hydrophila* challenge test. The present study revealed that supplementation of alfalfa extract can enhance digestive enzyme activity and disease resistance and consequently increase growth and survival in common carp.

Keywords: aquaculture, *Medicago sativa*, growth, fish nutrition, gut morphology

FSB2021- P.05

Use of copra meal as a partial substitute for soybean meal in the diet of nile tilapia, *Oreochromis niloticus* fingerlings

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The experiment was carried out to evaluate the effect of copra meal (Coconut oilcake) as a partial substitute of soybean meal on the growth and survival rate of Nile tilapia (*Oreochromis niloticus*) fingerlings for a period of eight weeks in twelve experimental cisterns. For the experiment, 672 fingerlings of initial weight of 1.54 ± 0.65g were released at the same stoking density (30/m^3) in the cistern. Four different treatments (T_1, T_2, T_3 and T_4) with three replications were used where amount of copra meal such as 0% copra meal in T_1(control), 25% copra meal in T_2, 30% copra meal in T_3, 35% copra meal in T_4. Feed was supplied at the rate of 5% for first two weeks, 4% for following two weeks and 3% of the body weight for the rest of the experimental period. Water quality parameters were within the acceptable range during the study period. Final weight (g), weight gain (g), percent weight gain (%), feed conversion ratio(FCR), specific growth rate (%/day), protein efficiency ratio (PER) and daily growth co-efficient (DGC) varied from 14.11 to 18.92g, 12.47 to 17.28g, 760.36 to 1053.35%, 1.34 to 1.89, 4.3 to 4.89, 2.69 to 1.88 and 0.25 to 0.35, respectively. The highest FCR (1.89) was found in T_1 and the lowest (1.34) was found in T_4. The highest PER (2.69) was found in T_4 whereas the lowest (1.88) was found in T_1. The highest survival rate (98.28%) was found in T_4 and the lowest (93.71%) was found in T_2. Best growth performance and survival rate was found in T_4 followed by T_3, T_2 and T_1. The present research finding suggest that the best growth performance and survival rate of tilapia was obtained from supplementation of 10.5% copra meal/kg of replacement of soybean meal of feed containing diet which can be added to the diet for the improved growth of this fish.

Keywords: copra meal, growth performance, tilapia, FCR, survival rate

FSB2021- P.06

Biofloc, an environment friendly technological breakthrough in aquaculture sector of Bangladesh to support several SDGs: Prospects and challenges

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Due to increasing global demand for fish and fishery products, production of fish has been steadily increasing. Aquaculture shares a big portion of total fish production globally and this contribution are needed incessantly arising to accomplish demand for aquatic products worldwide. But there remains some barrier on it's way of advancement as aquaculture is a resource-based industry. In this case, it is important to intensify the aquaculture and also necessary to ensure more production and development by using less resources and capitals; with this boundary of advancement, it should have to be environment friendly. Biofloc is such an eco-friendly aquaculture technique that works on the dynamism of microorganisms thorough balancing carbon and nitrogen in the culture system. The purpose of this paper is to highlight developmental history of biofloc, it's functioning system, the potential role in modern high-tech aquaculture and to describe how it may help to achieve several sustainable development goals (SDGs) by focusing on it's current status, scope and challenges in prospective of Bangladesh. Biofloc has become popular in Bangladesh now a days. It can play an important role in ensuring food security in the country by enhancing fish production with a little or no environmental impact and there is a lot of potential for developing the fisheries economy. It can be considered as a sustainable aquaculture method as it uses less water, less resources and ensures more fish production than traditional aquaculture systems. It is revealed that nearly entire all SDGs and about more than 34 targets are directly or indirectly connected with aquaculture sector. Biofloc has brought out a technological breakthrough in aquaculture, as an improved aquaculture technique and thus it may support several SDGs (SDG 1: No poverty, SDG 2: Zero Hunger, SDG 8: Decent Work and Economic Growth, SDG 12: Responsible Consumption and Production, SDG 13: Climate Action).

Keywords: biofloc, environment friendly, SDGs

FSB2021- P.07

Effect of biofloc wastewater on growth performance and pigment content of *Chlorella* sp.

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Intensifying aquaculture techniques for higher fish production raises the question of sustainable aqua-feed supply and the impact of aquaculture wastewater in the open environment. Biofloc is one of the intensified aquaculture approaches, but wastewater from biofloc could cause eutrophication due to high nitrogen and phosphorus contents. *Chlorella sp.*, a freshwater microalga, is considered an alternative single cell protein for sustainable aquafeed sources due to its rich nutritional value. Nevertheless, culture in the expensive inorganic medium is a major challenge for microalgae production. Thus, the present study was designed to determine the potentiality of biofloc wastewater as a culture medium for *Chlorella sp.* The experiment was conducted in a completely randomized design (CRD) with five treatments, each with three replications. Bold Basal Medium (BBM) was used as a control medium (T1). In contrast, biofloc wastewater (BWW) was replaced at 25%, 50%, 75%, and 100% and levelled as T2, T3, T4, and T5, respectively. The physicochemical parameters viz. dissolved oxygen, pH, and temperature were within the suitable range for the culture of *Chlorella sp.* Significantly highest ($P<0.05$) cell dry weight (CDW), optical density (OD), cell density, specific growth rate (SGR), chlorophyll *a*, chlorophyll *b*, and β-carotene content of *Chlorella sp.* were found in T4 treatment, and the values are 49.4±0.75mg/L, 1.164±0.05 g/L, 239.1(×105 cells/ml), 0.240mg/d, 0.611±0.004, 0.21±0.007 and 0.503±0.006 µg/ml, respectively. Similarly, the NH3, NO2, PO4 removal efficiency of *Chlorella sp.* was significantly higher ($P<0.05$) 92.2%, 95.4%, 94.6%, respectively in T4. Therefore, it can be concluded that biofloc wastewater can replace bold basal media up to 75% for better growth performance and pigment content of *Chlorella sp.*

Keywords: *Chlorella* sp.*;* biofloc; wastewater; microalgal growth; nutrient remediation efficiency

FSB2021- P.08

Occurrence of bacteriological fish diseases in Bangladesh: A review

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Bacteria can create serious disease problems in fish. They can be directly responsible for creating the disease problems. Again, many times play a secondary role. Disease occurance seems variations in different seasons and there also some constrains in fish health management.Fin and Tail Rot, Red spot, Bacterial Gill/Fin Rot,Dropsy are the main bacterial diseases in rural freshwater aquaculture of Bangladesh.There also some variety of bacterial species which cause different bacterial diseases in different fish species; such as *Aeromonas* sp., *Pseudomonas* sp., *Vibrio* sp., *Staphylococcus* sp., *Flavobacterium* sp., *Edwardsiella* sp., *Citobacter* sp., and *Enterobacter* sp. etc. are the major causes of bacterial diseases to different fish species.They show different sensitivity to different antibiotics. Occurance of Fish bacteriological disease, disease associating season, constraints in fish health management, bacterial pathogen investigation, their sensitivity to different antibiotics and result of different research related to fish bacterial disease performed in Bangladesh has been reviewed in this paper through study of obtainable literature.

Keywords: pathogen, infection, disease, season, constraint, antibiotic, sensitivity

FSB2021- P.09

Introduction of invasive exotic fish species *Pterygoplichthys* spp.: A potential threat to aquatic ecosystems of Bangladesh

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Pterygoplichthys spp. (Family: Loricariidae, Order: Siluriformes) is not a Bangladeshi native fish species; it's native to the Amazon river basin and figured out as one of the most effectual invasive taxa due to achieveit's global distribution. Though being familiar as an aquarium fish species, it has been first reported during 2007 in the native ecosystem of Bangladesh, which is a matter of increasing concern as this types of invasive alien fish species may cause the greatest threats to native commercial fishery ecosystems and unique indigenous aquatic biodiversity. The main objectives of this paper is to highlight all probable socio-economic and environmental threat that may be created in future by this fish species in terms of aquatic ecosystem of Bangladesh for wising up government and proper stakeholders as well for concernment and to give apt recommendation of this fact by analyzing it's typical features and invasive biology, global distribution, impacts of distribution in different regions worldwide, scenario of Bangladesh and it's a control mechanism. This paper has been done by surveying all available scientific literature on *Pterygoplichthys* spp. The findings of this review are that this opportunistic invader can reproduce rapidly, consume large amounts of food which disrupt aquatic food chain, keep impact on the native species and also on the surrounding environment; due to this terror fish species report on fishermen's economic loss also has been found. Though this species has been found in local ecosystems of Bangladesh, the effects of this introduced fish has not been properly assessed. More research is needed to record the number of this species existing in the country's environment and finding out their impact on the native ecosystem. Creating awareness among people, government surveillance, transboundary management with neighboring countries are important for lessening the risk of this invasive alien species.

Keywords: *Pterygoplichthys spp.*; sucker mouth sail fin catfish; invasive exotic species

FSB2021- P.10

Production performance of Gulsha (*Mystus cavasius*) monoculture with variation of water and soil quality parameters

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An on-farm experiment was conducted for a period of four months from May to September to compare the growth and production of Gulsha (*Mystus cavasius*) at different environmental conditions. Two locations were selected: one in Gazipur Sadar and other one in Narsingdi Sadar. At each location, there were five ponds of almost similar size and water depth. The stocking density of Gulsha was 500 fry per decimal for each location. Pre-stocking (pond preparation), stocking (fry size, stocking time) and post-stocking (feeding, monitoring water and soil quality) management were similar in both locations. While variations in water qualities (Temperature, DO, pH, Ammonia, Alkalinity) and soil properties of all ponds at either of Gazipur or Narsingdi were similar, there were considerable variations in most of the water and soil qualities between two locations. The significantly lower ($p<0.05$) value of soil pH (5.5±4.1) in Gazipur location caused pond water acidic and imbalanced the water buffering system for maintaining primary productivity. After four months of rearing, significantly the highest ($p<0.05$) mean harvesting weight of Gulsha was 48.10 ± 7.12 g in Narsingdi, as compared to that of 23.18 ± 6.24 g in Gazipur. Pond in Narsingdi region resulted the highest ($p<0.05$) survival rate of 68%. The calculated mean production of Gulsha in Gazipur and Narsingdi region were 7.55 ± 5.61 $kgdec^{-1}$ /120days and 16.31 ± 6.13 $kgdec^{-1}$ /120days respectively, which were significantly different ($p<0.05$) from each other. Ponds of Narsingdi district in general, showed almost all of its physico-chemical and biological features suitable for fish production, while ponds of Gazipur district were apparently less productive for the production of Gulsha (*Mystus cavasius*) at least when lower primary and secondary productivity, with the resultant effect of physico-chemical water and soil quality were considered.

Keywords: gulsha, water quality, Gazipur, Narsingdi

FSB2021- P.11

Microplastics ingestion brings changes in histo-architecture of *Clarias batrachus* liver

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With the increasing usage of plastic materials, abundance of microplastics are increasing day-by-day all over the world. Studies showed that these microplastics find their ways to different types of aquatic environments. The present study investigates the ingestion of two different types and shapes of microplastics (fragments and pellets) by walking catfish *Clarias batrachus.* This study also investigates changes in histo-architecture of liver after ingestion of microplastics by *C. batrachus* bound to the formulated diets. Sampling was done after 60 days of exposure and pronounced changes in liver were observed in treatment compared to control. The water quality parameters (*viz.* temperature, pH, DO, free CO_2 and total alkalinity) were recorded weekly, but they did not vary significantly among the treatments. Few plastics fragments were found on the gills, but higher amounts were found in the gastrointestinal tracts (GIT) of *C. batrachus*. Pellets were mostly rejected or expelled after uptake by the fish and they were comparatively few in numbers in the GIT. Intense changes in the liver histological structure were found such as - necrosis, infiltration, fatty degeneration, karyorrhexis, multinucleid hepatic cells, hemorrhage, cytoplasmic degeneration and change in normal architecture of the liver. Intensity of changes was higher in the liver fishes exposed to microplastic fragments-diet than pellets-diets. These results show that microplastics might be ingested by *C. batrachus* if they are available in its natural habitats which are capable of causing different histological alterations in its important organ like liver.

Keywords: microplastic, ingestion, walking catfish, liver, histology

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Study of hemato-biochemical parameters of walking catfish *Clarias batrachus* exposed to microplastics

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Microplastics are becoming growingly abundant in freshwater habitats. They are available in various shapes and sizes and are ingested by many organisms including fish. In the present study, a freshwater fish *Clarias batrachus* (walking catfish) was exposed to two types of microplastics (fragments and pellets) bound to their diets. The aim of the study was to determine the possible effects of microplastics on hematological and biochemical parameters of *C. batrachus*. Four groups of fishes were fed with four different microplastics diets for 60 days, *viz*. control (only commercial feed, T_0), commercial feed and PET fragments fed separately (T_1), PET fragments-mended commercial feed (T_2) and pellets-mended commercial feed (T_3). Some hematological indices (hemoglobin, red blood cells - RBCs) showed a decline, whereas white blood cells (WBCs) increased after exposure, compared to control. Further, microplastics exposure caused increment in the levels of blood glucose, urea, serum glutamic pyruvate transaminase (SGPT), serum glutamyl oxaloacetic transaminase (SGOT) activity and decrease in total protein and triglyceride levels. Changes of haemato-biochemical parameters in microplastics-exposed fishes indicate that microplastics ingestion is capable of imposing physiological stresses to freshwater fish like *C. batrachus.*

Keywords: microplastics, walking catfish, hemato-biochemistry

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Microplastics ingestion by fish and crab species in the Sundarbans mangroves waters

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The Sundarbans, situated in the south-western coast of Bangladesh along the Bay of Bengal, is the largest halophytic tidal mangrove forest of the world. It is estimated to be about 6017 km^2, of which 1874 km^2 is occupied by waterbodies and 4143 km^2 is landmass. Furthermore, Sundarbans is one of the optimum breeding and nursery ground of various aquatic animals. A significant proportion of freshwater received by Bangladesh part of the Sundarbans is fed by Genges-Brahmaputra-Meghna estuary which is the mouth of many transboundary rivers heavily polluted with microplastics (MPs). MPs are becoming growing concerns for aquatic habitata because they can be ingested and incorporated into and accumulated in the body tissues of many organisms especially fishes. In this research, 10 fish and 1 crab species (n = 20) were sampled pre-monsoon from the Pashur River and surrounding waters of the Sundarbans. Gut samples from 4 fish species and 1 crab species (n = 20) were digested, filtered and finally observed under microscope for MPs identification. Results showed that mean body weight (BW) of gray eel-catfish *(Plotosus canius)* was 1193.61 ± 269.60 g and the number of MPs/fish were 20.95 ± 2.05; mean BW of Asian sea bass (*Lates calcarifer)* was 254.58 ± 20.94 g and the number of MPs/fish were 4.20 ± 1.19; mean BW of lined silver grunter *(Pomadasys hasta)* was 246.72 ± 113.60 g the number of MPs/fish were 4.60 ± 1.05; mean BW of Bele *(Glossogobius giuris)* was 19.91 ± 1.51 g and the number of MPs/fish were 3.70 ± 2.50; mean BW of mud crab *(Scylla serrata)* was 100.39 ± 8.17 g the number of MPs/fish were 3.80 ± 0.37. These findings demonstrate widespread plastics pollution in the Sundarbans waters that are ingested by commercially important pelagic and demersal fish and non-piscine species living in this critical habitat.

Keywords: Mangrove forest, Sundarbans, microplastics pollution, pelagic fish, demersal fish

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