

BOOK OF ABSTRACTS

FSB2019
FISHERIES SOCIETY OF BANGLADESH
BIENNIAL CONFERENCE
27-28 December 2019



Faculty of Fisheries
Bangladesh Agricultural University
Mymensingh, Bangladesh



Fisheries Society of Bangladesh (FSB) is an organization for all persons possessing a Degree or Diploma in any branch of fishery science or engaged in research and development activities connected with fisheries. The Society is dedicated to general advancement in fisheries education, research and extension programmes and their application to practical problems facing by the nation. Through its publications, meetings, and committees the Society is an energising force in the conservation, development and wise utilization of all aquatic resources. It stimulates interests and promotes research in the field of aquatic biology, genetics, aquaculture, limnology, marine science, fisheries management and fish processing & quality control. In dealing with these and other important issues of public concern, the Society performs a valuable service by disseminating scientific knowledge and technical information by direct contact with the people and through other media. Every two years the Society holds conference of scientists from home and abroad and discuss critical areas in which the members are deeply involved. In addition, each year the Society provides an opportunity for gathering of fisheries workers to learn new application of technology, and to exchange information with fellow professionals. Through mass media, the Society generates among the people an awareness of the nature and causes of malnutrition and the role of the people can play to combat the same. Although not a lobbying organization, the Society does not hesitate to express its opinion on legislation and governmental policies, and to make recommendations to the Government on fishery matters so as to help the Government formulate a national policy on the same commensurate with the hopes and aspirations of the nation.

Society Office: Faculty of Fisheries, Bangladesh Agricultural University
Mymensingh, Bangladesh

Society Homepage: <http://fish.bau.edu.bd>

Society Email: info.fsb@bau.edu.bd



FISHERIES SOCIETY OF BANGLADESH

Honours the Pioneers



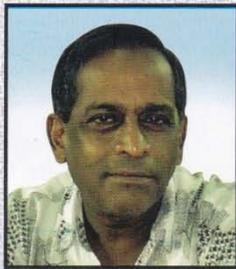
Prof. Dr. A. K. M. Aminul Haque
FATHER OF FISHERIES IN BANGLADESH



Prof. Dr. Muhammad Asadur Rahman
Former Vice-Chancellor, BAU



Prof. Dr. Md. Anwarul Islam
Former Vice-Chancellor, BAU



Prof. Dr. Md. Aminul Islam
Former Dean, Faculty of Fisheries, BAU



Prof. Dr. Somen Dewan
Former Dean, Faculty of Fisheries, BAU



**Vice Chancellor
Bangladesh Agricultural University
Mymensingh**

MESSAGE

It is indeed a great honour and privilege for me to have the opportunity to write a few words on the occasion of 'Fisheries Society of Bangladesh Biennial Conference 2019' hosted by the Faculty of Fisheries, Bangladesh Agricultural University and scheduled during 27-28 December 2019.

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 Sustainable Development Goal (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. May 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.

Prof. 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 4.28 million mt. in the Fiscal Year 2017-18. Last 10 years average growth performance of this sector is 5.26 percent, which seems quite consistent and encouraging. According to the FAO report (2018), Bangladesh ranks 3rd in inland capture fisheries production and 5th in aquaculture. The fisheries sector contributes 3.61% to the national GDP and 25.71% to the agricultural GDP (BER 2019). 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%), employment generation (17.13 million) and foreign exchange earnings (1.51%). The government also paid special emphasis on the development of this sector. There is a political pledge to build the country as 'Middle Income Country' by 2021 in the current Government's development strategies. 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 Biennial Conference 2019. The theme of the conference is 'Fisheries in the Bangladesh Blue Economy: Challenges & Opportunities' is very much timely. 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 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. I wish every success of the conference.

Quazi Shams Afroz



**Executive Chairman
Bangladesh Agricultural Research Council
Farmgate, Dhaka**



MESSAGE

It is my immense pleasure to know that the Biennial Conference of Fisheries Society of Bangladesh is going to be held on 27-28 December 2019. Scientific Conference is a platform where the researchers and scientists of home and abroad can meet each other and exchange their views.

Fisheries is an important sector of the agro-based country. The role of Fisheries sector in socioeconomic development, fulfilling food and nutrition requirements, income generation and poverty alleviation is very crucial. Fisheries sector contributes 3.6 percent to national GDP and around one-fourth (25%) to the agricultural GDP. Fish and fisheries products contribute 1.4 percent to total export earnings. Around 60% of animal protein in our diet is coming from fish. Six million people are engaged in fishing and aquaculture activities and another 10 million people are involved either directly or indirectly in fish trade and related activities.

As the inland water bodies is shrinking alarmingly due to urbanization, construction of roads and highways and dams, only intensification of culture practices and judicious management of the open water bodies can help increase and sustain fish production to keep pace with the increasing population. Intensification is very challenging requiring good quality fish seed, availability of good quality feed, capacity for health management and proper marketing system. The fish farmers of Bangladesh have little choice about fish seed and production technologies. I hope the scientists participating in the two-day conference will discuss about the challenges of aquaculture and fisheries and develop pragmatic research and development strategies to overcome the challenges.

I am very much thankful to the Fisheries Society of Bangladesh for organizing such an important scientific conference. It will create an opportunity for the young scientists to enrich their knowledge and experience and initiating collaboration among the scientists of home and abroad. Besides, the conference will help the policy planners to design effective programs for sustainable fish production.

I wish a grand success of the conference.

Dr. Md. Kabir Ikramul Haque



**Director General
Bangladesh Fisheries Research Institute**



MESSAGES

It is a great pleasure for me to express my felicitations to the distinguished participants and delegates from home and abroad at the International Conference 2019 of the Fisheries Society of Bangladesh (FSB). The theme of the conference is "**Fisheries in the Bangladesh Blue Economy-Challenges & Opportunities**". The blue economy is the sustainable use of Ocean resources for economic growth, improved livelihoods, and jobs preserving the health of Ocean ecosystem. In Bangladesh, marine fisheries are considered as an integral part of social and economic structure. We have a large diversity of living resources in the Bay of Bengal. Mariculture of commercially important finfish, shellfish and Seaweeds are highly important components of the blue economy.

Recently, Bangladesh has shown stunning success by achieving the landmark of self-sufficiency in fish production (2017-18). The country now globally ranks 3rd in inland open water fish production and 5th in global aquaculture production. Now, in many respects, Bangladesh has become as the laboratory for the future global aquaculture. However, we should keep in mind that the population of the country is expected to reach 200 million by 2050, ensued a pressing need of fish supply. As we move forward into an era of growing population, depleted natural resources and striking consequences of climate change, we should whole heartedly strive with confidence to combat this 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 on 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 reserachers, academicians and policy makers in the conference will share their views, ideas and knowledge for fish food security and other related concurrents issues focusing SDGs.

Finally, I wish the International Conference 2019 of the FSB a grand success.

Dr. Yahia Mahmud



**Dean
Faculty of Fisheries
Bangladesh Agricultural University**

MESSAGE

I am happy to learn that the Biennial Conference of the Fisheries Society of Bangladesh (FSB) with the theme “Fisheries in the Bangladesh Blue Economy-Challenges & Opportunities” is going to be held during 27-28 December 2019. 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 like- Advances in aquaculture, Biotechnology in Fisheries and Aquaculture, Climate Change and Fisheries, Emerging Aquatic Pollution, Emerging Fish diseases, Hilsa Fisheries-aspects and prospects, Management of Critical Aquatic Resources, Marine Fishery Resources as a part of Blue Economy, and Post-harvest fisheries and food safety. 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 do not exist now. In this context, the future technologies are bound to replace the technologies that are practiced today. The future technologies could become reality and also offer stimulating insights into the future development. 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 Biennial Conference for their sincere efforts to bring the researchers together. I wish all the participants to actively take part in the Conference, and trust that they will have the opportunity to acquire knowledge and share their ideas. I also congratulate and wish the team of FSB to make the event a grand success.

Prof. Dr. Md. Ahsan Bin Habib



**President, Fisheries Society of Bangladesh
Chair, FSB2019**

MESSAGE

Fish is a unique food in the diet of Bangladeshi people. It is not only a general diet rather cover major protein percentage to our daily life. It is also a very important economical resource earning foreign currencies as well. Indeed, in order to develop its natural resources there should be coordination among the stakeholders who are performing their utmost efforts. 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 Prof. Dr. A. K. M. Aminul Haque and all founder members of FSB for their hard work in establishing the esteemed learned society. I should, however, say that due to some unavoidable circumstances its journey was not in a due path. This time I must say that we have started our intended journey and vow to persist henceforth for the requirements of the nation.

Today, on this occasion it is a great pleasure for me to extend sincere greetings and felicitations to the members of FSB and participants of the FSB 2019 Biennial Conference to be held during 27-28 December. You have contributed immensely with great sincerity to the promotion of the Society activities. I feel proud to say that we have received overwhelming response from fisheries scientists and professionals of many different organizations/institutions in home and abroad who will participate in the two days Conference. This Conference has made an excellent opportunity among the scientists to exchange their research views and share ideas for promotion and strengthening of research collaboration. If it happens, it would be a step forward towards development in an international arena.

Indeed, we want to extend our connection with FSB beyond the Conference by inviting all our Bangladeshi scientists to join the Society. 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 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, sponsors, media, speakers, participants, and all the Committee members for helping us making the Conference a great success.

Professor Dr. Muhammad Shahidul Haq



**Convenor, Publication and Documentation Committee
FSB2019**

MESSAGE

The Biennial Conference of Fisheries Society of Bangladesh is going to be organized during 27-28 December 2019. After a long preparation, the Conference is going to be successfully organized at 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 for the program.

We are grateful to the Executive Chairman, Bangladesh Agricultural Research Council; Director General, Department of Fisheries; Director General, Bangladesh Fisheries Research Institute for their generous and prodigious support in organizing the program. We are very much thankful to Professor Dr. Md. Ahsan Bin Habib, Dean of Faculty of Fisheries, BAU for continuously being with us in the whole preparatory process of the Conference.

The conference is a get-together of Bangladeshi scholars working in different areas of fisheries and aquaculture all over the world. A total of 130 speakers will present oral presentations and 95 posters will be displayed by the participants attending the Conference, of which a good number of participants are from the outside of the country. All the sessions- inaugural, nine technical sessions, two poster sessions, and the award giving ceremony are anticipated to be very 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 Biennial Conference 2019 will be the annual event where all fisheries and aquaculture scientists can reconnect with each other and enjoy the technical sessions, poster presentations and FSB Award Giving Ceremony, during which they will exchange ideas, thoughts, and views, that will further help us to advance the country's fisheries and aquaculture status in order to achieve the Food and Nutritional Security of the country. Finally, I sincerely express my gratefulness to all members of the Publication and Documentation Committee who have done the hard job of reviewing the abstracts and compiling and publishing the Conference Book of Abstracts.

Professor Dr. Md. Samsul Alam

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FSB2019
Conference Program

INAUGURAL SESSION (Day 1: 27 December 2019)	
08:30-09:10	Registration
09:10-09:20	Guests and participants take their seats
09:20-12:20	Inaugural Session: Syed Nazrul Islam Conference Hall, BAU
Session Chair	Prof. Dr. Muhammad Shahidul Haq , President, Fisheries Society of Bangladesh (FSB)
Master of Ceremony	Prof. Dr. Harunur Rashid , Co-chair, FSB2019
09:20-09:30	Welcome address: Prof. Dr. Md. Ahsan Bin Habib , Dean, Faculty of Fisheries, BAU
09:30-10:00	Plenary Speech: Dr. Khan Kamal Uddin Ahmed , Director (R & P), BFRI Title: Fisheries research towards Bangladesh blue economy development
10:00-10:10	Address by Guest of Honour: Dr. Yahia Mahmud , Director General, BFRI
10:10-10:20	Address by Guest of Honour: Dr. Md. Kabir Ikramul Haque , Executive Chairman, BARC
10:20-10:30	Address by Guest of Honour : Quazi Shams Afroz , Director General, DOF
10:30-10:45	Address by Guest of Honour: Prof. Dr. Md. Anwarul Islam , Former VC, BAU
10:45-11:05	Address by the Chief Guest & Inauguration of FSB2019: Prof. Dr. Lutful Hassan , Honorable Vice-Chancellor, BAU
11:05-11:40	<u>FSB Honour & Award</u> Father of Fisheries in Bangladesh: Professor Dr. A. K. M. Aminul Haque , Founder of Fisheries Education & Research in Bangladesh, Founding President of FSB, Former Vice-Chancellor of BAU, National Professor Lifetime Achievement Award: Prof. Dr. Muhammad Asadur Rahman , Former Vice-Chancellor, BAU Prof. Dr. Md. Anwarul Islam , Former Vice-Chancellor, BAU Prof. Dr. Md. Aminul Islam , Former Professor & Dean, Faculty of Fisheries, BAU Prof. Dr. Somen Dewan , Former Professor & Dean, Faculty of Fisheries, BAU Session Moderator: Prof. Dr. Zoarder Faruque Ahmed , Secretary, FSB
11:40-11:50	Vote of thanks: Prof. Dr. Gias Uddin Ahmed , Convener, Organizing Committee, FSB2019
11:50-12:05	Closing Remarks: Prof. Dr. Muhammad Shahidul Haq , Chair, FSB2019
12:05-12:20	Group Photo
12:20-14:30	Lunch & Prayer Break and Poster Viewing

TECHNICAL SESSIONS (Day 1: 27 December 2019)	
[Day-1] Technical Session 1: Marine Fishery as a part of Blue Economy	
Venue: Dean's Conference Room, 1 st Floor, Prof. Aminul Haque Building, FF, BAU Chair: Prof. Dr. Md. Kamal, FF, BAU Co-chair: Prof. Dr. Mrityunjoy Kunda, FF, SAU Rapporteurs: Prof. Dr. Fatema Hoque Shikha & Prof. Dr. Md. Jasim Uddin, FF, BAU	
14:45-14:55	Introduction by Session Chair & Co-chair
14:55-15:10	Keynote Paper-1: Potentials of marine fisheries and mariculture under the concept of blue economy development in Bangladesh By: Dr. M. Gulam Hussain , Bangladesh Country Coordinator, Feed the Future Innovation Lab for Fish, Mississippi State University, USA
15:10-15:35	Keynote Paper-2: Value Chains in Aquaculture and Fisheries in Bangladesh: Recent Advancements and Future Research Directions By: Prof. Dr. Madan Mohan Dey , Department of Agricultural Sciences, Texas State University, Texas, USA

15:35-15:45	Analysis of bioactive compounds and antioxidant activities of red seaweed <i>Gracilaria tenuistipitata</i> . Md. Ariful Islam , Department of Fisheries Biology and Aquatic Environment, BSMRAU, Gazipur, Bangladesh
15:45-15:55	Marine sponge and sponge-associated bacteria of the Bay of Bengal inhibiting fish pathogens. Sulav Indra Paul , Department of Biotechnology, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur, Bangladesh
15:55-16:20	Prayer & Tea-Break
16:20-16:30	Interactive effects of environmental and intrinsic factors on the reproductive biology of green mussel (<i>Perna viridis</i>): A chemometric. Aysha Rahi Noor , Department of Marine Bioresource Science, Faculty of Fisheries, Chittagong Veterinary and Animal Sciences University, Chittagong, Bangladesh
16:30-16:40	Biometrics and condition factors of commercially important three Pomfrets of Bay of Bengal, Bangladesh. Ahmad Fazley Rabby , Bangladesh Fisheries Research Institute, Marine Fisheries & Technology Station, Cox's Bazar
16:40-16:50	Present status of mud crab population in Bangladesh, Binay Kumar Chakraborty , Mud Eel, Mud Crab, Aquaculture & Management Research Centre
16:50-17:00	Study of marine gastropod diversity along the coastal region of Bangladesh through morphological study and DNA barcoding. Sonia Sultana , Department of Fisheries Biology and Genetics, Sher-e-Bangla Agricultural University, Dhaka, Bangladesh
17:00-17:10	Diversity and spatiotemporal changes of red macroalgae recorded from the Sundarbans mangrove forests, Bangladesh. Md. Ariful Islam , Aquatic Botany Laboratory, Department of Bioresource Science, Graduate School of Biosphere Science, Hiroshima University, Japan
17:10-17:20	Harmful algal blooms, fisheries and human health: Challenges and opportunities. Saleha Khan , Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh, Bangladesh
17:20-17:30	Seasonal changes in the biochemical composition of three bivalve species off the coast of Moheshkhali Island, Cox's Bazar, Bangladesh. Maliha Khanam , Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh, Bangladesh
17:30-17:40	Ovarian cycle of Asiatic hard clam (<i>Meretrix meretrix</i> L, 1758) collected from the coast of Moheshkhali Island, Cox's Bazar, Bangladesh. Sharmin Afroj , Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh, Bangladesh
17:40-18:00	Prayer Break and Poster Viewing
18:00-20:30	Cultural Program and Conference Dinner

[Day-1] Technical Session 2: Climate Change & Fisheries

Venue: Meeting Room, 3rd Floor, Prof. Aminul Haque Building, FF, BAU

Chair: Prof. Dr. Md. Mahfuzul Haque, FF, BAU | Co-chair: Prof. Dr. Shahroz Mahean Haque, FF, BAU

Rapporteurs: Prof. Dr. Md. Sirajul Islam, MBSTU & Prof. Dr. Mohammad Mahfujul Haque, FF, BAU

14:45-14:55	Introduction by Session Chair & Co-chair
14:55-15:20	<u>Keynote Paper:</u> Impact of Climate Change on Fisheries: Challenges and Opportunities <u>By:</u> Professor Dr. Golam M. Mathbor , School of Social Work, Monmouth University, New Jersey, USA & President of American Institute of Bangladesh Studies
15:20-15:30	Temporal distribution of ichthyofaunal composition and relationship with physico-chemical changes in PandovPoint, Payra River, Patuakhali. Md. AsikurRahaman Rahat , Faculty of Fisheries, Patuakhali Science and Technology University, Dumki, Patuakhali, Bangladesh

15:40-15:50	Effects of acclimation temperature on gut evacuation, oxygen consumption and thermal coefficient of Malabar blood snapper (<i>Lutjanus malabaricus</i> Bloch & Schneider, 1801). Sabuj Kanti Mazumder , Department of Genetics and Fish Breeding, Faculty of Fisheries, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur, Bangladesh
15:50-16:00	Spatial and temporal variation of nutrient dynamics in the Pasur river estuary of Bangladesh. Shoaibe Hossain Talukder Shefat , Department of Fisheries Management, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur, Bangladesh
16:00-16:20	Prayer & Tea-Break
16:20-16:30	Impacts of saltwater intrusion on fishers' livelihoods and coping strategies in the Nabaganga River of Bangladesh. Md. Shariful Islam , Bangladesh Fisheries Research Institute, Freshwater Sub-Station, Chanchra, Jashore, Bangladesh
16:30-16:40	Effects of photoperiods on growth and reproductive functions of rohu, <i>Labeo rohita</i> . Md. Al-Emran , Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh, Bangladesh
16:40-16:50	Effect of different salinity level on physiology and survivability of Tilapia (<i>Oreochromis niloticus</i>) at the juvenile stages of development. Md. Golam Azom , Department of Fisheries Biology and Genetics, Bangladesh Agricultural University, Mymensingh, Bangladesh
16:50-17:00	Characterization of salt tolerant genes in F1 generation of tilapia hybrid through microsatellite DNA markers. Nusrat Easmin , Department of Fisheries Biology and Genetics, Bangladesh Agricultural University, Mymensingh, Bangladesh
17:00-18:00	Prayer Break and Poster Viewing
18:00-20:30	Cultural Program and Conference Dinner

[Day-1] Technical Session 3: Hilsa Fisheries: Aspects & Prospects	
<u>Venue:</u> New Gallery, Ground Floor, Prof. Aminul Haque Building, FF, BAU	
<u>Chair:</u> Prof. Dr. Md. Samsul Alam, FF, BAU <u>Co-chair:</u> Prof. Dr. Md. Ismail Hossain, FF, BAU	
<u>Rapporteurs:</u> Prof. Dr. Ferdous Ahmed, PSTU & Dr. Mohammad Ashraful Alam, BFRI	
14:45-14:55	Introduction by Session Chair & Co-chair
14:55-15:20	Keynote Paper: Revival of Hilsa Shad (<i>Tenualosa ilisha</i>) in Bangladesh Waters through biodiversity conservation and adaptive co-management By: Prof. Dr. Md. Abdul Wahab , WorldFish Bangladesh and South Asia Office, Dhaka
15:20-15:30	Reproductive biology of hilsa shad <i>Tenualosa ilisha</i> of the river Meghna in Bangladesh. Kaisir Mohammad Moinul Hasan , Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh, Bangladesh
15:30-15:40	Shelf life of mustard hilsa in various packing conditions during storage at low temperatures. Fatema Hoque Shikha , Department of Fisheries Technology, Bangladesh Agricultural University, Mymensingh, Bangladesh
15:40-15:50	Pearson's correlation and likert scale based investigation on socioeconomic status of hilsa fisher community in Kirtankhola River of southern Bangladesh. Prosun Roy , Department of Fisheries Biology and Genetics, Patuakhali Science and Technology University, Dumki, Patuakhali, Bangladesh
15:50-16:00	Population genetic structure, phylogeography and demographic history of <i>Tenualosailisha</i> in the Indo-west Pacific. Kazi Ahsan Habib , Department of Fisheries Biology and Genetics, Faculty of Fisheries, Aquaculture and Marine Science, Sher-e-Bangla Agricultural University, Dhaka, Bangladesh
16:00-16:20	Prayer & Tea Break
16:20-16:30	Assessment of biological parameters of hilsa shad, <i>Tenualosailisha</i> from three

	different unit-stocks in Bangladesh: A key for sound management. Md. Ataur Rahman , Department of Fisheries, University of Rajshahi, Rajshahi, Bangladesh
16:30-16:40	Stock assessment of three different unit-stocks of hilsa shad, <i>Tenulosailisha</i> in Bangladesh through length-based models. Md. Yeamin Hossain , Department of Fisheries, University of Rajshahi, Rajshahi, Bangladesh
16:40-14:50	Maximum sustainable yield (MSY) estimates of industrial finfish fishery in Bangladesh marine waters using trawl catch log. Suman Barua , Marine Fisheries Office, Department of Fisheries, Chattogram, Bangladesh
16:50-17:00	Studies on the causes of early gonadal development of hilsa, <i>Tenulosailisha</i> in Bangladesh. A. K. Shakur Ahammad , Department of Fisheries Biology and Genetics, Bangladesh Agricultural University, Mymensingh, Bangladesh
17:00-17:10	Seasonal diet and feeding habits of juvenile hilsa fishes along the Meghna River estuary, Bangladesh. Md. Jahangir Sarker , Department of Fisheries and Marine Science, Noakhali Science and Technology University, Noakhali, Bangladesh
17:10-18:00	Prayer Break and Poster Viewing
18:00-20:30	Cultural Program and Conference Dinner

[Day-1] Technical Session 4: Biotechnology in Fisheries & Aquaculture	
<u>Venue:</u> FF Gallery, Ground Floor, Main Building, FF, BAU	
<u>Chair:</u> Prof. Dr. Md. Fazlul Awal Mollah, FF, BAU <u>Co-chair:</u> Prof. Dr. Md. Rafiqul Islam Sarder, FF, BAU	
<u>Rapporteurs:</u> Prof. Dr. Md. Sadiquul Islam, FF, BAU & Prof. Dr. S. M. Rafiquzzaman, FF, BSMRAU	
14:45-14:55	Introduction by Session Chair & Co-chair
14:55-15:20	Keynote Paper: Tilapia aquaculture for employment, income and nutrition security <u>By:</u> Prof. Dr. Ram C. Bhujel , Aqua-Centre, Asian Institute of Technology, Thailand
15:20:15:30	Population genetic analysis of mola (<i>Amblypharyngodon mola</i>) using partial sequence analysis of mtDNA COI gene. Ummey Kulsum , Department of Biotechnology, Bangladesh Agricultural University, Mymensingh, Bangladesh
15:30-15:40	Genetic diversity in <i>Pangasius</i> spp. based on mitochondrial cytochrome b gene sequence analysis. Md. Samsul Alam , Department of Fisheries Biology and Genetics, Bangladesh Agricultural University, Mymensingh, Bangladesh
15:40-15:50	Stock improvement of the GIFT strain by family selection in Bangladesh. AHM Kohinoor , Freshwater Station, Bangladesh Fisheries Research Institute, Mymensingh, Bangladesh
15:50-16:00	Feasibility of utilizing seaweed biomass to produce eco-friendly and cost-effective liquid bio-fuel (CNG) through modern technology: Marine biotechnology can act as a sign of “Blue Economy” Md. Mohidul Islam , Marine Fisheries & Technology Station, Bangladesh Fisheries Research Institute, Cox's Bazar
16:00-16:20	Prayer & Tea Break
16:20-16:30	Molecular identification of native and exotic strains of snakehead fish (<i>Channa striata</i>) in Bangladesh by mitochondrial gene sequences. Mohammad Shafiqul Alam , Department of Genetics and Fish Breeding, Faculty of Fisheries, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur Bangladesh
16:30-16:40	Genetic variation of wild populations of endangered catfish <i>Rita rita</i> (Hamilton, 1822) revealed by heterologous DNA microsatellite markers. Md. Rafiqul Islam Sarder , Department of Fisheries Biology and Genetics, Bangladesh Agricultural University, Mymensingh, Bangladesh
16:40-16:50	Cryopreservation of sperm of Catla (<i>Catla catla</i>) and its use in seed production in hatcheries. Md. Arif Hossain , Department of Fisheries Biology and Genetics,

	Bangladesh Agricultural University, Mymensingh, Bangladesh
16:50-17:00	Production of gynogenetic sex-reversed males (XX) of silver barb, <i>Barbonymus gonionotus</i> and growth performance of their all-female progeny. Mohammad Rafiqur Rahman , Department of Fisheries Biology and Genetics, Bangladesh Agricultural University, Mymensingh, Bangladesh
17:00-17:10	Nucleotide sequence and gene organization of the mitochondrial genome of <i>Labeo rohita</i> . Moumita Chakraborty , Genetics and Molecular Biology Laboratory, Department of Zoology, University of Dhaka, Dhaka, Bangladesh
17:10-17:20	Smart production of biofuel and bioelectricity through culture of spirulina (<i>Spirulina platensis</i>) insupernatant of digested rottenpotato (<i>Solanum tuberosum</i>). M. Al-Amin , Department of Aquaculture, Bangladesh Agricultural University, Mymensingh, Bangladesh
17:20-18:00	Prayer Break and Poster Viewing
18:00-20:30	Cultural Program and Conference Dinner

[Day-1] <u>Technical Session 5: Emerging Fish Diseases</u>	
Venue: Class Room- 4002, 3 rd Floor, Prof. Aminul Haque Building, FF, BAU	
Chair: Prof. Dr. Kirtunia Juran Chandra, FF, BAU Co-chair: Prof. Dr. Md. Mahbubur Rahman, IBGE, BSMRAU	
Rapporteurs: Dr. Tanvir Rahman, FF, BAU & Dr Mohammad Shamsur Rahman, DU	
14:45-14:55	Introduction by Session Chair & Co-chair
14:55-15:20	Keynote Paper: Fish disease challenges and health management strategies in aquaculture of Bangladesh By: Prof. Dr. Md. Ali Reza Faruk , Faculty of Fisheries, BAU
15:20-15:30	Zebrafish as a model for aquaculture vaccines. Ishrat Zahan Anka , Chattogram Veterinary and Animal Sciences University, Chattogram, Bangladesh
15:30-15:40	Virulence-associated genes of <i>Aeromonas veronii</i> causing motile <i>Aeromonas septicaemia</i> and bio-control of the disease by application of native probiotic bacteria and herbal extracts. Md. Mahbubur Rahman , Fisheries Biotechnology Discipline, Institute of Biotechnology and Genetic Engineering, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur
15:40-15:50	Molecular identification and antibiogram profile of the pathogens causing tail and fin rot disease in koi (<i>Anabas testudineus</i>). Rakib Ehsan , Fisheries Biotechnology Discipline, Institute of Biotechnology and Genetic Engineering, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur
15:50-16:00	Genetic variations, virulence and toxicity of AHPND-positive <i>Vibrioparahaemolyticus</i> in <i>Penaeus monodon</i> . Nawshin Farjana , Department of Fisheries and Marine Bioscience, Jashore University of Science and Technology, Jashore
16:00-16:20	Prayer & Tea Break
16:20-16:30	Molecular detection of tilapia lake virus (TiLV) in farmed mono-sex Nile tilapia (<i>Oreochromis niloticus</i>) in Bangladesh. Rukaiya Afroz , Department of Fisheries and Marine Bioscience, Jashore University of Science and Technology, Jashore.
16:30-16:40	Status of bacterial diseases in two different species of cultured fin fishes (Shing and V. Koi) of Mymensingh region, Bangladesh. Md. Ashikur Rahman , Bangladesh Fisheries Research Institute, Mymensingh.
16:40-16:50	Comparative study of bacterial association of <i>Tenuulosa ilisha</i> and <i>Pangasius pangasius</i> of Padma river in Mawa, Bangladesh. Kamrun Naher Azad , Department of Aquaculture, Bangladesh Agricultural University, Mymensingh
16:50-17:00	Constraints of health management of commercially cultured high value fishes. K.M. Abdul Halim , Department of Aquaculture, Bangladesh Agricultural

	University, Mymensingh.
17:00-17:10	Gut microbiota and hematological analysis of stinging catfish (<i>Heteropneustes fossilis</i>) cultured under different probiotic supplementation. Md. Abdullah Al Mahamud , Department of Aquaculture, Bangladesh Agricultural University, Mymensingh
17:10-18:00	Prayer Break and Poster Viewing
18:00-20:30	Cultural Program and Conference Dinner

TECHNICAL SESSIONS (Day 2: 28 December 2019)	
[Day-2] <u>Technical Session 6</u> : Advances in Aquaculture	
<u>Venue</u> : FF Gallery, Ground Floor, Main Building, FF, BAU	
<u>Chair</u> : Prof. Dr. Gias Uddin Ahmed, FF, BAU <u>Co-chair</u> : Prof. Dr. Md. Abdus Salam, FF, BAU	
<u>Rapporteurs</u> : Dr. A. M. Shahabuddin, Sher-e-Bangla Ag.Uni.& Dr. Abdullah-Al Mamun, NSTU	
09:00-09:10	Introduction by Session Chair & Co-chair
09:10-09:35	Keynote Paper: Snakehead Fish, Haruan (<i>Channa striata</i>): Emerging Potential for Nutraceutical, Active Pharmaceutical Ingredient (API) and Biomedical Applications By: Prof. Dr. Abdull Manan Mat Jais , Abmanan Biomedical Sdnbhd, Selangor, Malaysia
09:35-09:45	Supplementation of zinc in diet enhance growth performances and bone mineralization of stinging catfish <i>Heteropneustes fossilis</i> . Muslima Akter Lima , Department of Aquaculture, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur.
09:45-09:55	Growth performance and survival of stinging catfish (<i>Heteropneustes fossilis</i>) cultured under different probiotic supplementations. Md. Umor Khoiam , Department of Aquaculture, Bangladesh Agricultural University, Mymensingh.
09:55-10:05	Economics of rohu based polyculture in Bangladesh: Yield gap, efficiency and nutritional perspectives. Md. Akhtaruzzaman Khan , Department of Agricultural Finance, Bangladesh Agricultural University, Mymensingh.
10:05-10:15	Aquaponics: the future food production system to feed the world. M. A. Salam , Department of Aquaculture, Bangladesh Agricultural University, Mymensingh
10:15-10:25	Mixed culture potentials of high valued galda (<i>Macrobrachium rosenbergii</i>) with two native catfish, shing (<i>Heteropneustes fossilis</i>) and magur (<i>Clarias batrachus</i>) under different stocking densities in South-western Coastal Ghers of Bangladesh. Khan Kamal Uddin Ahmed , Bangladesh Fisheries Research Institute, Shrimp Research Station, Bagerhat
10:25-10:35	Culture potentials of brown shrimp, <i>Metapenaeus monoceros</i> (Fab.) under different stocking densities in south-western region of Bangladesh. Nilufa Begum , Bangladesh Fisheries Research Institute, Brackishwater Station, Paikgacha, Khulna
10:35-11:00	Tea Break & Poster Viewing
11:00-11:10	Black soldier fly larvae will enhance sustainability in aquaculture industry in Bangladesh. M. A. Salam , Department of Aquaculture, Bangladesh Agricultural University, Mymensingh
11:10-11:20	Nutrition sensitivity of coastal aquaculture of Bangladesh. Abdullah-Al Mamun , Department of Fisheries and Marine Science, Noakhali Science and Technology University, Noakhali.
11:20-11:30	Biofloc technology: A microbial based low-cost aquaculture system. A. M. Shahabuddin , Department of Aquaculture, Sher-e-Bangla Agricultural University, Dhaka.

11:30-11:40	Particle size distribution and nutritional values in a biofloc system. Md. Abul Kashem , Faculty of Fisheries, Sylhet Agricultural University, Sylhet, Bangladesh.
11:40-11:50	Nutritional intervention in Tilapia, <i>Oreochromis niloticus</i> fish through the application of Silica nanoparticle. Abul Bashar , Department of Aquaculture, Bangladesh Agricultural University, Mymensingh.
11:50-12:00	Growth of aquaculture systems in Bangladesh: scope of future research and development. Mohammad Mahfujul Haque , Department of Aquaculture, Bangladesh Agricultural University, Mymensingh.
12:00-12:10	Production performance of pabda (<i>Ompok pabda</i>) and gulsha (<i>Mystus cavasius</i>) with Rohu (<i>Labeo rohita</i>) in polyculture management. Parvez Chowdhury , Bangladesh Fisheries Research Institute, Mymensingh.
12:10-12:20	Effects of probiotics on growth and survival of Nile tilapia (<i>Oreochromis niloticus</i>). Kazi Atiah Taiyebi , Department of Fisheries, Bangladesh.
12:20-14:00	Poster Viewing, Lunch & Prayer Break

[Day-2] **Technical Session 7: Management of Critical Aquatic Resources**

Venue: New Gallery, Ground Floor, Prof. Aminul Haque Building, FF, BAU

Chair: Dr. Md. Khalilur Rahman, BFRI | **Co-chair:** Prof. Dr. Md. Amzad Hossain, FF, BSMRAU

Rapporteurs: Prof. Dr. Mohammad Lokman Ali, FF, PSTU & Prof. Dr. Kazi Ahsan Habib FF, SBAU

09:00-09:10	Introduction by Session Chair & Co-chair
09:10-09:35	Keynote Paper: High-valued marine invertebrates from the Bay of Bengal: Exploration and Management By: Prof. Dr. M. Aminur Rahman , Department of Fisheries & Marine Bioscience, Jashore University of Science and Technology, Jashore
09:35-09:45	Prediction of algal chlorophyll and transparency using two machine learning and one regression approaches in a reservoir. Md Mamun , Department of Bioscience and Biotechnology, Chungnam National University, Daejeon 34134, South Korea
09:45-09:55	Longitudinal gradients of nutrients and chlorophyll in Daechung Reservoir, Korea and the analysis of trophic state deviation. Ji Yoon Kim , Department of Bioscience and Biotechnology, Chungnam National University, Daejeon 34134, South Korea
09:55-10:05	Genetic diversity and population structure of Scalloped hammerhead shark (<i>Sphyrna lewini</i> , Griffith & Smith 1834) in the Bay of Bengal, Bangladesh. Md Jayedul Islam , Aquatic Bioresource and Research Lab, Department of Fisheries Biology and Genetics, Faculty of Fisheries, Aquaculture and Marine Science, Sher-e-Bangla Agricultural University, Dhaka
10:05-10:15	Monsoonal plankton distribution and physico-chemical water qualities in a rain-fed lake, Sonapur, Noakhali district, Bangladesh. Najmus Sakib Khan , Department of Oceanography, Noakhali Science & Technology University, Noakhali
10:15-10:25	Assessment of the catch-based maximum sustainable yield (CMSY) of marine commercial captured shrimp of Bangladesh: Required more conservative management approach for sustainability. Ehsanul Karim , Bangladesh Fisheries Research Institute, Marine Fisheries & Technology Station, Cox's Bazar.
10:25-10:35	Spatio-temporal variations of fish assemblages in the three estuarine habitats (Naf, Maheshkhali Channel and Rejukhal) of Cox's Bazar, Bangladesh. Jakia Hasan , Bangladesh Fisheries Research Institute, Marine Fisheries & Technology Station, Cox's Bazar
10:35-11:00	Tea Break & Poster Viewing
11:00-11:10	Reproduction of <i>Xenentodon cancila</i> (Hamilton, 1822) in the GajnerBeelWetland

	Ecosystem (NW Bangladesh) with special reference to potential influence of climate and environment changeability. Md. Akhtarul Islam , Department of Fisheries, Faculty of Agriculture, University of Rajshahi, Rajshahi
11:10-11:20	Outwelling of nutrients into the Pasur River estuary from the creeks of Sundarbans mangrove. Dinesh Chandra Shaha , Department of Fisheries Management, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur
11:20-11:30	An export of salinity and nutrients from Shibsra river estuary into the Pasur river estuary through connecting channels. Dinesh Chandra Shaha , Department of Fisheries Management, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur
11:30-11:40	Biodiversity, abundance and seasonal succession of zooplankton in the Old Brahmaputra River and their relation to some water quality parameters. Sharmin Nesa Bithi , Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh
11:40-11:50	Freshwater snail (<i>Pilaglobosa</i>) breeding technique at farmer's gher/ditches and aquarium. Md. Shariful Islam , Bangladesh Fisheries Research Institute, Shrimp Research Station, Bagerhat
11:50-12:00	Population Biology of the Catfish <i>Mystus cavasius</i> (Hamilton, 1822) in the Padma River and its management policy implications in Bangladesh. Sumaya Tanjin , Department of Fisheries, Faculty of Agriculture, University of Rajshahi, Rajshahi
12:00-12:10	Stock assessment of Nile tilapia <i>Oreochromis niloticus</i> in Kaptai Lake, Bangladesh. Zoarder Faruque Ahmed , Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh
12:10-12:20	Biological features of <i>Salmostoma bacaila</i> (Cyprinidae) from the tributary of the Payra River, southern Bangladesh. Ferdous Ahamed , Faculty of Fisheries, Patuakhali Science and Technology University, Patuakhali
12:20-12:30	Ichthyodiversity of River Narasunda. Md. Khalilur Rahman , Bangladesh Fisheries Research Institute, Mymensingh
12:30-14:00	Poster Viewing, Lunch & Prayer Break

[Day-2] **Technical Session 8: Post-harvest Fisheries & Food Safety**

Venue: Dean's Conference Room, 1st Floor, Prof. Aminul Haque Building, FF, BAU
Chair: Prof. Dr. Subhash Chandra Chakraborty, FF, BAU | **Co-chair:** Prof. Dr. Md. Abul Mansur, FF, BAU

Rapporteurs: Dr. Md. Tariqul Islam, RU & Dr. Md. Nurul Haider, FF, BAU

09:00-09:10	Introduction by Session Chair & Co-chair
09:10-09:35	Keynote Paper: Metagenomic approaches in aquatic bioscience: significance of studies on a marine bay and an urban river for productivity, biotechnological applications, and food safety By: Prof. Dr. Shugo Watabe , Laboratory of Marine Genomics Science, Kitasato University School of Marine Biosciences, Japan
09:35-09:45	Quality assessment of ethnic fermented product Nga-pi, traditionally prepared at Cox's Bazar region. Fatema Hoque Shikha , Department of Fisheries Technology, Bangladesh Agricultural University, Mymensingh
09:45-09:55	Comparative quality analysis of dried fish (<i>Harpadonnehereus</i>): Traditional vs. improved (UC Davis Chimney Dryer Produced). Md. Sazedul Hoque , Department of Fisheries Technology, Faculty of Fisheries, Patuakhali Science and Technology University, Dumki, Patuakhali
09:55-10:05	Simultaneous and faster method for determination of antibiotics as nitrofurans

	metabolites in fish and shrimp muscle using enzyme-linked immunosorbent assay. Md. Mezanur Rahman , Quality Control Laboratory, Department of Fisheries, Chattogram
10:05-10:15	Shelf-life of ready-to-cook (RTC) hilsa fish ball under modified atmosphere packaging at refrigerated (4°C) storage condition. Md. Tariqul Islam , Department of Fisheries, University of Rajshahi, Rajshahi.
10:15-10:25	Seaweed-based functional food attributes: Effects of edible brown seaweed <i>Undaria pinnatifida</i> in improving memory functions to prevent age-related neurodegeneration. Md. Mohibullah , Department of Biotechnology, Pukyong National University, Busan, Republic of Korea
10:25-10:35	Biochemical and microbiological perspectives of semi-fermented fish products of Bangladesh. Muhammad Mehedi Hasan , Department of Fisheries Technology, Bangladesh Agricultural University, Mymensingh
10:35-11:00	Tea Break & Poster Viewing
11:00-11:10	Characterization of <i>Escherichia coli</i> and <i>Staphylococcus aureus</i> isolated from shrimp farm areas of Satkhira district, Bangladesh. KHM Nazmul Hussain Nazir , Department of Microbiology and Hygiene, Faculty of Veterinary Science, Bangladesh Agricultural University, Mymensingh
11:10-11:20	Health benefits of bioactive peptides produced from silver jewfish (<i>Johnius argentatus</i>). Jasmin Akter Jarin , Department of Fisheries Technology, Bangladesh Agricultural University, Mymensingh
11:20-11:30	Study on TVB-N curve and TMA-N curve of two carp species available in the fish market of Bangladesh. Dr. Md. Abul Mansur , Department of Fisheries Technology, Bangladesh Agricultural University, Mymensingh
11:30-11:40	Shrimp: An important source of multidrug resistant <i>Vibrio</i> species in Bangladesh. Ripon Sarker , Department of Microbiology and Hygiene, Faculty of Veterinary Science, Bangladesh Agricultural University, Mymensingh
11:40-11:50	Development of ready-to-cook (RTC) tilapia fish (<i>Oreochromis niloticus</i>) curry and extension of shelf-life by vacuum and modified atmosphere packaging at refrigerated storage. Taposhi Mariam Begum , Department of Fisheries, University of Rajshahi, Rajshahi
11:50-12:00	Post-mortem changes in three fresh water eels, <i>Mastacembelus armatus</i> , <i>Macrognathus aculeatus</i> and <i>Mastacembelus pancalus</i> during ice storage. Fatema Hoque Shikha , Department of Fisheries Technology, Bangladesh Agricultural University, Mymensingh
12:00-12:10	Effects of salt and other preservatives on the quality and insect infestation of dried silver jewfish (<i>Johnius argentatus</i>). Nadia Nusrat , Department of Fisheries Technology, Bangladesh Agricultural University, Mymensingh
12:10-12:20	Comparison on fatty acid profile in the different body parts of freshwater crab (<i>Paratelphus halamellifrons</i>). Md. Badrul Islam , Drugs & Toxins Research Division, BCSIR Laboratories, Rajshahi
12:20-12:30	Investigation of shrimp/prawn farming status in south-west region of Bangladesh in context with its quality control and food safety issues. Mst. Subrina Khatun , Bangladesh Fisheries Research Institute, Shrimp Research Station, Bagerhat
12:30-14:00	Poster Viewing, Lunch & Prayer Break

[Day-2] Technical Session 9: Water Quality & Aquatic Pollution

Venue: Meeting Room, 3rd Floor, Prof. Aminul Haque Building, FF, BAU

Chair: Prof. Dr. Md. Abdul Wahab, WorldFish Bangladesh | Co-chair: Dr. Md. Enamul Hoq, BFRI

Rapporteurs: Dr. A. K. Shakur Ahammad & Dr. Kizar Ahmed Sumon, FF, BAU

09:00-09:10	Introduction by Session Chair & Co-chair
09:10-09:35	Keynote Paper: Development of national ecological stream health assessment model using fish indicators in Korea and the integrative stream health diagnosis By: Prof. Dr. Kwang-Guk An , Chungnam National University, South Korea
09:35-09:45	A Study on heavy metal pollution in freshwater fish and marine fish of Bangladesh. Mohammad Abul Mansur , Department of Fisheries Technology, Bangladesh Agricultural University, Mymensingh
09:45-09:55	Assessment of heavy metal contamination in the sediment and bivalves from the coast of Bay of Bengal, Bangladesh. Sanjida Afreen Semme , Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh.
09:55-10:05	Acute toxicity of chromium to striped catfish <i>Pangasianodon hypophthalmus</i> . Md. Fazle Rohani , Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh
10:05-10:15	Profenofos, an organophosphate insecticide alters the haematological parameters of Nile Tilapia (<i>Oreochromis niloticus</i>). Md. Al-Emran , Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh
10:15-10:25	Acute toxicity of thiamethoxam insecticides on banded gourami (<i>Trichogaster fasciata</i>). Md. Mohibul Hasan , Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh
10:25-10:35	Maintaining C/N ratio for optimum water quality and increase growth performance of tilapia in a biofloc culture system. Shompa Sarker , Department of Aquaculture, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur
10:35-11:00	Tea Break & Poster Viewing
11:00-11:10	Comparative study on proximate composition and heavy metal concentration of molacarplet (<i>Amblypharyngodon mola</i>) and spotted snakehead (<i>Channa punctatus</i>) collected from pond water and open water. Fatema Hoque Shikha , Department of Fisheries Technology, Bangladesh Agricultural University, Mymensingh
11:10-11:20	Heavy metals accumulation in striped catfish <i>Pangasianodon hypophthalmus</i> (Sauvage, 1878) cultured in Mymensingh region of Bangladesh and human health risk assessment. Mohammad Shamsur Rahman , Aquatic Animal Health Group, Department of Fisheries, Faculty of Biological Sciences, University of Dhaka, Dhaka
11:20-11:30	Abundance of noxious <i>Anabaena crassa</i> in pangasiid catfish (<i>Pangasianodon hypophthalmus</i>) ponds. Zinia Rahman , Department of Genetics and Fish Breeding, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur
11:30-11:40	Biocontrol of Mosquito Larvae using Larvivorous Fishes. Harunur Rashid , Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh
11:40-11:50	Community structure assessment of phytoplankton and ecological pollution in Payra River, Bangladesh. Maria Binta Safa , Faculty of Fisheries, Patuakhali Science and Technology University, Dumki, Patuakhali
11:50-12:00	Peripheral erythrocytes and histological responses of silver barb and their recovery patterns to varying concentrations of profenofos. Md. Moniruzzaman , Department of Fisheries Biology & Genetics, Bangladesh Agricultural University, Mymensingh
12:00-12:10	Isolation and molecular detection of pathogenic bacteria from freshwater mussels (<i>Lamellidens marginalis</i> and <i>L. corrianus</i>) of Old Brahmaputra River. Md.

	Abdullah Al Mamun , Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh
12:10-14:00	Poster Viewing, Lunch & Prayer Break

POSTER SESSION (Day 1 & 2)	
Chair: Prof. Dr. A. K. M. Nowsad Alam, FF, BAU Co-chair: Prof. Dr. Md. Shaheed Reza, FF, BAU	
Poster Evaluators	Dr. Md. Abdul Mojid , DOF, Mymensingh Division Dr. A. H. M. Kohinoor , BFRI Dr. Md. Abdul Alim , DOF, Headquarters, Dhaka Dr. Md. Yeamin Hossain , Department of Fisheries, RU Dr. Mohammad Shafiqul Alam , FF, BSMRAU

CLOSING & AWARD GIVING CEREMONY (Day-2, 14:00-15:00)	
Chief Guest	Professor Emeritus DR. M. A. SATTAR MANDAL , BAU
Chaired by	Prof. Dr. Md. Ali Reza Faruk Convener, Event Management & Decoration Committee, FSB2019
Moderated by	Prof. Md. Sazzad Hossain Member Secretary, Event Management & Decoration Committee, FSB2019
Event	Best Oral Presentation and Poster Award
Vote of Thanks	Prof. Dr. Md. Rafiqul Islam Sarder , Treasurer, FSB
15:00-15:15	Tea break

BUSINESS SESSION (Day-2, 15:15-16:15)	
Chaired by	Prof. Dr. Muhammad Shahidul Haq , President, FSB
Moderated by	Prof. Dr. Zoarder Faruque Ahmed , Secretary, FSB
Event	FSB AGM

PLENARY LECTURE

Fisheries research towards Bangladesh blue economy development

Khan Kamal Uddin Ahmed

Director (Research and Planning)

Bangladesh Fisheries Research Institute, Headquarters,

Mymensingh 2201, Bangladesh

Correspondence: Khan Kamal Uddin Ahmed (kkuabd@gmail.com)

Abstract

Blue Economy offers opportunities for sustainable blue growth in marine fisheries sector of Bangladesh. Marine fisheries and aquaculture may contribute 22% gross value added (GVA) in ocean economy of Bangladesh, which worth 6.2 billion USD. However, opportunities for the development of blue economy in Bangladesh mostly depend on research and sustainable uses of mariculture, fisheries resources, biotechnology etc. In Bangladesh, concept on blue economy started after the settlement of maritime boundary delimitation dispute with Myanmar and India under the dynamic leadership of the present govt.

Bangladesh Fisheries Research Institute (BFRI) through its Marine, Brackishwater and Riverine Stations conducted notable research on blue economy. Meanwhile, a total of 125 seaweeds have been identified in Bangladesh coast. Culture technology of 3 species of seaweeds using horizontal net method has been developed in the coast. The pick breeding season of 13 commercial fin fishes has been identified, in argument with the present banning of 65 days for trawl fishing in the Bay of Bengal. Successful breeding and crablet production technology of mud crab (*Scylla olivacea*) with a survival rate of 7.5% in the hatchery has been developed, which will increase export potentialities of live crab. On the other hand, breeding and culture technology of brackishwater catfish, *Mystus gulio* and green back mullet, *Chelon subviridis* showed potential culture species in coastal areas. All those research initiatives would contribute in blue economy of Bangladesh. Research initiatives on mariculture of seabass (*Lates calcarifer*), extraction of bioactive compounds from seaweeds, nutritional profiles and culture of marine oysters, culture & breeding of green mussel, assessing microplastic pollution in the coast, culture & breeding of brown & white shrimp, spatial planning of marine resources by research and academic institutions leading to contributed to blue growth in Bangladesh coast.

With those illustration, blue economy and blue growth for sustainable development are not possible without research capacity development in the country. Moreover, conserving marine living and non-living resources, preventing marine pollution, exploitation of unutilized marine resources in the high seas and EEZ areas, climate change are the major challenges for future ocean economy. With the potentialities and possibilities, priority activities in marine sector includes marine stock assessment, developing marine protected areas, strengthening fisheries communities, improving sanitation and quality of fish products, human resource development etc.

Day 1: 27 December 2019

**Technical Session 1:
Marine Fishery as a part of Blue Economy**

KEYNOTE PAPER 1

Potentials of marine fisheries and mariculture under the concept of blue economy development in Bangladesh

Dr. M. Gulam Hussain

Bangladesh Country Coordinator, Feed the Future Innovation Lab for Fish, Mississippi State University, USA

Correspondence: M. Gulam Hussain (hussain.mgulam@gmail.com)

Biography

Dr. M. Gulam Hussain, an expert in Fisheries and Aquaculture as well as in blue economy from Bangladesh. He did his PhD in 1992 from Stirling University, Scotland, UK. He has >35 years of extensive professional experience in aquaculture R & D in South Asia regions. Dr. Hussain was the former Director General of Bangladesh Fisheries Research Institute and presently working as the Country Coordinator for Bangladesh under Feed the Future Innovation Lab for Fish, Mississippi State Univ. USA. He was most recently involved as Fisheries and Aquaculture Expert under the EU-BGD joint collaboration on Blue Economy in Bangladesh. Previously, he was working as Fish Genetic Specialist with WorldFish, Bangladesh and South Asia. Dr. Hussain has an impressive track record in research and scholarly publication in the field of blue economy, fish genetics and biotechnology, aquaculture and fisheries having >120 scientific papers and articles published in peer reviewed international and national journals, a number of books, book chapters and many technical reports.

Abstract

This paper lays out to address the potentials and prospects of developing marine fisheries and marine aquaculture in Bangladesh due to the country owns vast coastal and marine water resources enriched recently after the end of the final settlement of maritime boundary disputes with neighbouring countries viz. Myanmar and India. Meanwhile, the country broadly identified a total of 26 important sectors of Blue Economy, among which 12 sectors have been prioritized as major sectors including Marine Fisheries and Aquaculture. Emphasis has been given to this sector as the most potential one for overall economic benefit and livelihood development of hundreds and thousands of coastal rural peoples of the country. Prospects for developing marine fisheries specifically the mariculture opportunities of both brackish and marine fish species as well as mariculture of non-traditional marine species in the coast, near shore and offshore areas have been highlighted. The paper also describes the current framework of marine fisheries resource management in the Bay of Bengal, delves into the challenges of mariculture development under the concept of blue economy has been mentioned in EU-BGD joint collaboration on Blue Economy mission study as well as in the seventh 5 Year Plan of the Govt. of Bangladesh and also recommends ways to advance blue economy governance in order to address pressures, challenges and ensure sustainable development of marine aquaculture in the country.

KEYNOTE PAPER 2

Value chains in aquaculture and fisheries in Bangladesh: Recent advancements and future research directions

Prof. Dr. Madan Mohan Dey

Department of Agricultural Sciences, Texas State University, 601

University Drive, San Marcos, Texas 78666, USA

Correspondence: Madan Mohan Dey (mmd120@txstate.edu)

Biography

Professor Madan Dey is currently serving as the Chair of the Department of Agricultural Sciences, Texas State University, USA. He is an agricultural economist with 30 years of post-Ph.D. experience in teaching, research, outreach, and governance in a variety of agricultural and natural resources contexts. Dr Dey was a professor of aquaculture economics and marketing in the Department of Aquaculture and Fisheries, University of Arkansas at Pine Bluff, USA, from 2007-2013. He worked at the WorldFish Center for about 13 years in various capacities, including its Regional Director for East and South East Asia from 2004-2007. Professor Dey has so far published more than 90 referred journal articles, mostly on topics related to aquaculture and fisheries economics. Dr Dey has been serving as the (elected) Vice-President of the International Association of Aquaculture Economics and Management since 2009. Over the past 30 years, he has led and implemented a number of pioneering, innovative, and inter-disciplinary agricultural projects in the U.S., Asia, and Africa.

Abstract

Bangladesh is currently the world's 5th largest producer of farmed fish. Rapid growth of aquaculture in Bangladesh has made possible higher per capita fish consumption despite increasing population. Aquaculture as a method of fish production has become more intensified and diversified in response to market demand. In particular, in some regions small and medium-sized enterprises (SMEs) are becoming increasingly important in aquaculture production, replacing household/homestead production. These SMEs involved in aquaculture have contributed to higher production, productivity, increased food availability, as well as employment, economic growth and improved livelihoods. This paper reviews some of the salient features of this transformation in aquaculture value chains, their implications for livelihood, and explore future research priorities.

The fish value chain in Bangladesh presents tremendous opportunities for research into production, distribution, and socioeconomics of changes in food value chains. While some aspects of this transformation such as consumption patterns, production agglomeration, clustering, and welfare have received attention, there are several other aspects that deserve to be analyzed better. We need to analyze factors influencing the entry (and exit) decisions of entrepreneurs, drivers of entrepreneurial investment at the regional and national levels, and approaches to improve rural economic opportunities. Commercialization of aquaculture in Bangladesh has been accompanied by regional agglomeration and clustering of production to achieve lower transaction costs and facilitating co-innovation along the value chain. Lower transaction costs are expected to lead to better integration of spatial markets. The drivers and linkages of such clustering need to be better understood for identifying future sources of growth in entrepreneurial aquaculture. Implications of production clustering for product market integration need to be investigated.

FSB2019-BE-01

Analysis of bioactive compounds and antioxidant activities of red seaweed *Gracilaria tenuistipitata* from Bangladesh

Md. Ariful Islam, S. M. Rafiquzzaman

Department of Fisheries Biology and Aquatic Environment, BSMRAU, Gazipur-1706, Bangladesh

Correspondence: S. M. Rafiquzzaman (rafiquzzaman@bsmrau.edu.bd)

Body cells naturally produce oxidants during metabolic processes which are usually neutralized by antioxidants. An imbalance between oxidants and antioxidants, in the favor of oxidants, can cause oxidative stress; which is responsible for many degenerative diseases. Scientists are searching for natural sources of antioxidants to prevent this type of physiological problems. In some recent studies, seaweeds have been found to be a very good source of bioactive compounds and natural antioxidants. This study was designed to analyze the presence of bioactive compounds and antioxidant activities of different crude extracts of *Gracilaria tenuistipitata*. Methanol, ethanol and water were used as solvents to get crude extracts. Presence of terpenoids, saponins, phlobatannins, cardiac glycosides, phenolics and flavonoids were qualitatively assayed and FT-IR was performed to identify different functional groups. Total phenolic content (TPC) was determined by Folin-Ciocalteu method and total flavonoid content (TFC) was determined by aluminum chloride method. 2,2-Azino-bis(3-ethylbenzothiazoline-6-sulfonic acid (ABTS) radical scavenging assay and Phosphomolybdenum assay were performed to determine total antioxidant activity. In phytochemical screening, methanol extract contained highest number of phytochemicals followed by water and ethanol extracts in terms of the presence of terpenoids, saponins, phlobatannins, cardiac glycosides, phenolics and flavonoids. FT-IR analysis showed the presence of phenols, carboxylic acids, ketones, ethers, aromatics, alkanes, ethers and sulfonates in different extracts. TPC and TFC were highest in methanol extract (78.2 ± 0.32 mgGAE/g and 36.17 ± 0.58 mgQE/g respectively). Methanol extract showed highest antioxidant activity measured by different assays such as DPPH ($67.89 \pm 1.41\%$), Phosphomolybdenum assay (absorbance 3.272 at 695nm wavelength), ABTS ($65.27 \pm 1.58\%$) and Reducing Power assay (absorbance 1.991 at 700nm wavelength) followed by ethanol and water extracts. So, it can be concluded that, *G. tenuistipitata* is a potential good source of natural antioxidants.

Keywords: antioxidants, phytochemical screening, red seaweed

FSB2019-BE-02

Marine sponge and sponge-associated bacteria of the Bay of Bengal inhibiting fish pathogens

Sulav Indra Paul, Md. Mahbubur Rahman

Department of Biotechnology, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur-1706, Bangladesh

Correspondence: Md. Mahbubur Rahman (mahbub-biotech@bsmrau.edu.bd)

Marine sponges are the oldest metazoans living on earth and are considered to harbor one of the richest microbial symbiont communities among marine invertebrates. Sponge and their associated bacteria are known to produce diversified antibiotics and antimicrobial compounds. This study was conducted to identify native marine sponge of the Saint Martin's Island and their associated bacteria inhibiting fish pathogen. Seven sponge samples were collected from different location of Saint Martin's Island. These sponges were identified based on their morphological

characteristics as *Niphates erecta*, *Mycale macilenta*, *Plakortis dariae*, *Cliona celata*, *Haliclona rosea*, *C. carteri* and *C. viridis*. Antibacterial activity of ethyl acetate extracts of the sponges was screened following the disc diffusion method. Among the sponges, the ethyl acetate extracts of *P. dariae* exhibited distinct antibacterial activity against fish pathogenic bacteria *Aeromonas veronii* and *Stenotrophomonas maltophilia*. The active compound was separated by Thin Layer Chromatography technique. Ethyl acetate and Methanol at 9:1 ratio was used for separation of the active compound. One nonpolar compound was found in the TLC plate that strongly inhibited the same fish pathogenic bacteria. The Rf value of that compound was 0.92. A total of 180 bacterial isolates were screened for their antibacterial activity against 8 different fish pathogens by agar well diffusion assay. Among them isolate WS1A inhibited the growth of *S. maltophilia* and isolate YS5 inhibited the growth of *S. maltophilia*. These two isolates were identified by 16S rRNA gene sequence as *Bacillus subtilis* (MK910097.1) and *Shewanella chilikensis* (MK910102.1), respectively. These bacteria were isolated from *H. rosea* and *M. macilenta* sponge, respectively.

Keywords: marine sponge, *Plakortis dariae*, *Haliclona rosea*, *Bacillus subtilis*, inhibition of fish pathogen

FSB2019-BE-03

Interactive effects of environmental and intrinsic factors on the reproductive biology of green mussel (*Perna viridis*): A chemometric approach

Aysha Rahi Noor, Md Asaduzzaman, Sumi Akter, Nayeema Ferdausy Hoque, Abrar Shakil
Department of Marine Bioresource Science, Faculty of Fisheries, Chattogram Veterinary and Animal Sciences University, Chattogram-4225, Bangladesh
Correspondence: Md. Asaduzzaman (a_zamanbau@yahoo.com)

A multidimensional chemometric approach was applied to get the actual scenario of the effect of exogenous (environmental condition) and intrinsic (feeding habit, lipid content in gonad) factors on the reproductive traits of *Perna viridis* at Moheshkhali Channel. Five gametogenic stages were identified from the histological analysis of 242 gonad samples with an annual spawning season (January to April). Gonadosomatic index (GSI) also displayed seasonality with one spawning and a long resting phase. The GSI values were strongly correlated with majority of the studied environmental parameters, ingested plankton groups and gonadal fatty acids. In principal component analysis, first two principal components showed that seasonality explained >60% of variability in all datasets, and the multivariate spaces of seasonality corresponded to the gonad development. High salinity, nutrients, chlorophyll-*a* and plankton availability in the water column initiated gonad development and spawning of mussels. But higher current speed and turbidity created unfavorable condition for reproduction (resting phase). This species showed selective feeding behavior according to gametogenic cycle. During development stage, mussels ingested more planktons particularly Bacillariophyceae which were the source of increased n-3 polyunsaturated fatty acids (PUFAs) accumulation in gonads. On the other hand, gonads accumulated more lipids and saturated fatty acids during mature and spawning stages to provide sufficient energy required for embryogenesis and early larval development. Saturated fatty acids were the major lipid source in gonad specially n-3 PUFAs. This resourceful study will provide a new era towards a better understanding of reproductive biology in aquaculture and sustainability.

Keywords: multidimensional, chemometric, bacillariophyceae, polyunsaturated fatty acids.

FSB2019-BE-05

Biometrics and condition factors of commercially important three Pomfrets of Bay of Bengal, Bangladesh

Ahmad Fazley Rabby, S. Rahman, M. M. Hoque, S. J. Hasan, M. Z. Ali

Bangladesh Fisheries Research Institute, Marine Fisheries and Technology Station, Cox's Bazar-4700, Bangladesh

Correspondence: Ahmad Fazley Rabby (ahmed.bfri@gmail.com)

Length–weight relationship (LWR), length–length relationships (LLRs) and condition factors with comparative assessment of commercially important three Pomfrets fish species from Bay of Bengal, Bangladesh are depicted for the first time. Fishes were sampled with commercial fishing gear such as seine net and trawling net during July 2017 to June 2019. Allometric coefficient (b) values for *Pampus chinensis*, *Pampus agenteus* and *Parastromateus niger* were 3.16, 3.13, 2.83 respectively. Additionally, the LLRs were highly significant with $r^2 \geq 0.975$ for three Pomfrets. Form factor of three Pomfrets were illustrated as short and deep in body shape. Size at sexual maturity of *P. chinensis*, *P. agenteus* and *P. niger* were 24.8 cm, 25.1 cm and 35.4 cm respectively. Among the four types of condition factors, Fluton's condition factor (K_F) was highly correlated with total length (TL) and Body weight (BW) for *P. chinensis* and *P. niger* (Spearman rank-correlation test), ($P < 0.0001$). In case of *P. argenteus*, all types of condition factors were highly correlated in relationships with body weight. Wilcoxon signed rank test specified that, the W_R did not show any significant difference from 100 ($p=0.080$), indicating a balanced population for commercially important three Pomfrets in Bay of Bengal. The present observations would be an effective tool for their demographic trends of Pomfrets in the Bay of Bengal, Bangladesh and surrounding ecosystems.

Keyword: commercially important pomfrets, length-weight relationships, form factor, size at sexual maturity, condition factors

FSB2019-BE-06

Present status of mud crab population in Bangladesh

Binay Kumar Chakraborty

Mud eel, Mud crab, Aquaculture and Management Research Centre, Department of Fisheries, Bangladesh

Correspondence: B.K. Chakraborty (bborty@gmail.com)

Apparent declines in abundance of mangrove crabs *Scylla* species in the coastal area of Bangladesh have prompted concern regarding long-term determination of this important cultural and economic resource. From the survey of ten districts according to treatment T_1 , T_2 and T_3 the total production of the coastal area was decreased from 32255.06 ± 178.18 mt to 25404.22 ± 138.34 between 2013 and 2017 and The percentage of the total production of the experimental area was declined 9.55, 15.36, 20.50 and 22.22% within the year 2013-14, 2014-15, 2015-16 and 2016-17. The decreasing trends or regression type was Exponential and the equation was $y = 4.315 \times + 6.12$; where R^2 is 0.9533. There is a significant trend in case of male, female and immature mud crab of coastal area. In case of female mud crab total catch percentage was decreased from 43.11% to 25.17 % between 2013 and 2017. In case of male and immature mud crab total catch percentage was increased from 29.08% to 39.57 % and 27.81% to 35.82 % between 2013 and 2017. Rising pressure of trap, line and CAD and decreasing pressure of net was detected to catch *Scylla* spp.

So, eco-friendly catch of mud crab is to be practiced until established mud crab hatchery to minimize the requirement of seed production of crab population in aquaculture of crab field.

Keywords: mud crab, sex, biodiversity, production.

FSB2019-BE-07

Study of marine gastropod diversity along the coastal region of Bangladesh through morphological study and DNA barcoding

Sonia Sultana^{1,2}, Parsha Shanjana Brishti¹, Md Jayedul Islam¹, Sumaiya Ahmed², Kazi Ahsan Habib^{1,2}

¹*Aquatic Bioresource Research Lab (ABR Lab), Department of Fisheries Biology and Genetics, Faculty of Fisheries, Aquaculture and Marine Science, Sher-e-Bangla Agricultural University, Dhaka-1207, Bangladesh;* ²*Department of Zoology, Jagannath University, Dhaka-1100, Bangladesh*

Correspondence: Kazi Ahsan Habib (ahsan.sau@gmail.com)

The coastal area of Bangladesh is rich with diverse genetic resource of marine organisms. Gastropoda, the 2nd largest taxonomic class belonging to the Phylum Mollusca. They are one of the most diverse group of invertebrates in size, body and shell morphology, habits and habitats. In Bangladesh, about 280 marine gastropods were described until now. However, these are sometimes misidentified due to similar appearance and cryptic states. DNA barcoding is advocated as a quick method for species identification and classification and has been widely used especially for revealing cryptic species and discovering new species. Present study has been designed to investigate marine gastropods diversity in Bangladesh based on morpho-meristic study and DNA barcoding. From June 2017 to till date, samples were collected from coastal area of Bangladesh where 104 species of gastropods were identified based on morphological study of shell. Genomic DNA was extracted from those samples which possess muscle inside their shell. Until now, 15 species were successfully barcoded from extracted DNA samples. The problem faced in conducting DNA barcoding of gastropod during study was non-amplification of mitochondrial COI barcode gene region of all species in PCR with commonly used DNA barcode primers. Therefore, design of new barcoding primers is necessary for successfully DNA barcoding of gastropods.

Keywords: diversity, marine gastropod, morphology, DNA barcoding, Bangladesh

FSB2019-BE-08

Diversity and spatiotemporal changes of red macroalgae recorded from the Sundarbans mangrove forests, Bangladesh

Md. Ariful Islam¹, MST Zannatun Mauya², Lawrence M Liao¹

¹*Aquatic Botany Laboratory, Department of Bioresource Science, Graduate School of Biosphere Science, Hiroshima University, Japan;* ²*Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh*

Correspondence: Lawrence M Liao (lliao@hiroshima-u.ac.jp)

A survey of macroalgal diversity and their seasonal occurrence was conducted in the Sundarbans. Twenty different sampling points (14 upstream and 6 downstream) were selected from two out of the four major forest ranges. Macroalgae were collected during the low tide adhering to

pneumatophores and other solid substrates in February and March (dry season), November and December (wet season), 2018. Previously, seven species of red macroalgae belonging to four genera namely, *Bostrychia* (2), *Caloglossa* (2), *Catenella* (2) and *Xiphosiphoniapennata* were documented from the forests. In our recent study, a total of 15 species of red macroalgae were identified and classified into five genera namely, *Bostrychia* (2), *Caloglossa* (5), *Catenella* (6), *Chondriaintertexta* and *Polysiphoniahowei*. All species except *Caloglossaadhaerens* were recorded during the dry season whereas, 13 species were found during wet season and 12 species were observed throughout the year. Only 10 species were recorded from downstream, while all species were recorded at upstream stations. *C. intertexta*, *P. howei* and three undetermined species of *Catenella* were absent in downstream stations but recorded from the upstream stations during the dry season. Eleven species of red seaweed were newly recorded in the Sundarbans, while ten species (except *Catenellaimpudica*) are new additions to the marine flora of Bangladesh. Mangrove intertidal is muddy, experiences natural calamities and twice tidal inundation a day, thus the algal diversity there is subjected to a unique set of environmental conditions.

Keywords: estuarine ecology, phycology, rhodophyta, seaweed, taxonomy

FSB2019-BE-09

Harmful algal blooms, fisheries and human health: Challenges and opportunities

Saleha Khan, Md. Mahfuzul Haque

Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Correspondence: Saleha Khan (khansaleha64@gmail.com)

An important challenge of the “Blue Economy” is to understand and better manage the many aspects of oceanic sustainability, ranging from sustainable fisheries to ecosystem health to preventing pollution. Unfortunately, the impact of marine toxic algal pollution is being seen through a variety of disturbing symptoms including a world-wide decline and collapse of fisheries. “Harmful Algal Blooms” (HABs) are a recognized global problem as there are reports of more toxic algal species, more fisheries resources affected, more human diseases due to algal toxins and more economic losses from HABs than ever before. Marine toxic dinoflagellates and diatoms may negatively affect marine environment in at least three ways. First: blooms of some species can grow so dense that they can cause indiscriminate kills of marine fishes and invertebrates due to oxygen depletion. Second: some species which can kill fishes and invertebrates by damaging or clogging their gills. Third, there are many marine toxic algae which can produce potent toxins that can find their way through the food chain to humans causing a variety of gastrointestinal and neurological illnesses. Some “Algal Toxins” are 1,000 times more potent than cyanide which can cause illnesses and deaths in fishes, birds, mammals, and humans. Marine harmful algal blooms and their negative impact on fishes, invertebrates and mammals are completely an unknown phenomenon in Bangladesh. Mass mortalities of marine fishes in different parts of the Bay of Bengal, Bangladesh are very common during the heavy blooms of different species of toxic algae. “Incidents of Hepatitis, Dysentery, Diarrhoea” etc. are also very common in this densely populated country which might have direct or indirect link with the algal toxins as it is reported elsewhere in the world. Discussions on research needs, management strategies and international cooperation of “Harmful Algal Blooms” are very important. Public awareness and education of “HAB” and their impact on marine waters of each country should be included in International Action Plan to protect “World Fisheries and Public Health”.

Keywords: blue economy, marine algal bloom, fisheries, human health

FSB2019-BE-10

Seasonal changes in the biochemical composition of three bivalve species off the coast of Moheshkhali Island, Cox's Bazar, Bangladesh

Maliha Khanam¹, Md. Sazzad Hossain², Mohammad Moniruzzaman³, Md. Jasim Uddin¹

¹Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh; ²Department of Aquaculture, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh; ³Freshwater Station, Bangladesh Fisheries Research Institute, Mymensingh-2201, Bangladesh

Correspondence: Md. Jasim Uddin (jasimfm@bau.edu.bd)

Mollusks such as oysters, clams, cockles, scallops and mussels have great importance in world fishery today contributing 11.5% of global fish production. Current study was carried out on the seasonal changes in biochemical composition of Asiatic hard clam (*Meretrix meretrix*), blood cockle (*Anadara granosa*), and oyster (*Crassostrea cuttackensis*) off the coast of Moheshkhali Island, Cox's Bazar, Bangladesh. Samples were drawn monthly from July 2018 to June 2019 to quantify the seasonal fluctuations in lipids, proteins, carbohydrates, moisture, ash and crude fiber contents for specifying the suitable time of harvesting nutritionally rich animals. The proximate compositions of the collected samples were analyzed at Fish Nutrition laboratory of the Faculty of Fisheries using standard protocol. In Asiatic hard clam, the protein content ranged from 11.45 to 15.56% with the highest proportion in April; the lipid content varied from 0.48 to 3.77% with maximum in April; the carbohydrates fluctuated from 0.32 to 5.88% with the highest in October; and the moisture content varied from 76.1 to 82.21% with the highest proportion in December. In *A. granosa*, the protein, lipid, carbohydrate and moisture contents ranged from 11.89 to 15.64%, 1.01 to 3.96%, 0.78 to 3.42% and 76.18 to 82.52% respectively. The highest proportions of protein, lipid, carbohydrate and moisture contents were reported in March, May, October and December respectively. In *C. cuttackensis*, the protein content varied from 10.09 to 15.68% with the highest proportion in February; the lipid content ranged from 1.25 to 4.72% with maximum in April; the carbohydrates fluctuated from 0.89 to 7.21% with the highest in December; and the moisture content varied from 71.44 to 79.46% with the highest proportion in July. The information provided could be useful by the fishery managers for declaration of harvesting period of nutritionally rich natural population of the investigated species in the habitat.

Keywords: clam, cockle, oyster, biochemical composition, seasonality

FSB2019-BE-11

Ovarian cycle of Asiatic hard clam (*Meretrix meretrix* L, 1758) collected from the coast of Moheshkhali Island, Cox's Bazar, Bangladesh

Sharmin Afroj¹, Md. Sujon Mia¹, Gias Uddin Ahmed², Mohammad Moniruzzaman³, Md. Jasim Uddin¹

¹Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh; ²Department of Aquaculture, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh; ³Freshwater Station, Bangladesh Fisheries Research Institute, Mymensingh-2202, Bangladesh

Correspondence: Md. Jasim Uddin(jasimfm@bau.edu.bd)

Annual ovarian cycle of the Asiatic hard clam, *Meretrix meretrix* was studied for a period of 1 year from July 2018 to June 2019 by monthly observation of gonadal sections and condition

index of a natural population collected from the coast of Maheshkhali Island, Cox's Bazar. Samples were collected monthly for biometric analysis and histological study. Water quality parameters such as water temperature, salinity, dissolved oxygen (DO) and pH were monitored monthly to correlate them with female gametogenic phenology of *M. meretrix* in that habitat. Condition index of females as the ratio of tissue wet weight (g) to shell length (cm) ranged from 1.06 (May) to 2.49 (August) by mean. Histological observation of ovaries exhibited six gametogenic stages as, 1) early developing 2) late developing 3) ripe 4) spawning 5) spent and 6) indifferent stage. Histology revealed that oogenesis of *M. meretrix* initiated in June and December. Ripe females occurred from January to April and from June to September. Two distinct spawning pulses were noted over an annual cycle. First spawning event occurred during February to June with peak spawning activity from March to May and another spawning pulse was noted during August to October ascertained from the presence of spawning individuals in the histological preparations. The undifferentiated stage as a preparatory step for next oogenesis extended from June to August and November to December. The findings were also in consistent with the condition indices (CIs) as a drastic decline in its value was noted from January to May. An attempt can be made for artificial propagation of Asiatic hard clam in laboratory conditions by knowing the ovarian cycle, spawning time and duration along with environmental parameters suitable for spawning reported in the current study.

Keywords: Asiatic hard clam, *Meretrix meretrix*, histology, ovarian cycle, condition index

Day 1: 27 December 2019

**Technical Session 2:
Climate Change and Fisheries**

KEYNOTE PAPER:
Impact of climate change on fisheries: Challenges and opportunities

Prof. Dr. Golam M. Mathbor^{1,2}

¹*School of Humanities and Social Sciences, Monmouth University, New Jersey, USA;* ²*President, American Institute of Bangladesh Studies (AIBS)*

Correspondence: Golam M. Mathbor (gmathbor@monmouth.edu)

Biography

Golam M. Mathbor is Professor in the School of Social Work at Monmouth University in New Jersey, USA. Currently, he is serving as President of the American Institute of Bangladesh Studies (AIBS), and as a Member, Board of Directors of the Council on American Overseas Research Centers (CAORC), USA. His teaching areas include research, social policy, program evaluation, international development and international social work. He conducts research in the fields of coastal community development, disaster relief and management, social planning, sustainable development, and community participation in coastal development. Dr. Mathbor has published extensively on coastal zone management, disaster relief, community preparedness, social development, migration, health, economics, and international social work education. He is the author of *Effective Community Participation in Coastal Development* (ISBN 978-1-933478-54-8) published by Lyceum Books, Inc. Chicago, Illinois, USA.

Abstract

There has never been a more critical time on Earth than now to grasp the implications of ignoring climate change. Science has shown us that since Earth's creation, climate has been affected by natural occurrences, both within and outside the climate system, but in recent years, climate is also being affected by actions and inactions of the human race. Climate system changes affect all life on earth, but fisheries are affected in particular, because almost three-quarters of the Earth's surface is water and home to a variety of aquatic life. Changing weather is producing more droughts, floods, rising sea levels, salt water intrusion of fresh water, acidity in the oceans and ocean warming. This paper discusses how climate change is affecting both marine life in the oceans and aquatic species in fresh water, as well as the effects of these changes on the seafood supply chain and other revenue sources in coastal areas. Factors causing climate change and actions needed to mitigate these changes are also discussed.

FSB2019-CC-01

Temporal distribution of ichthyofaunal composition and relationship with physico-chemical changes in Pandov Point, Payra River, Patuakhali

Md. Arifur Rahman¹, Md. Asikur Rahaman Rahat², Nitai Roy³

¹Department of Fish Biology and Genetics, Faculty of Fisheries, Patuakhali Science and Technology University, Dumki, Patuakhali-8602, Bangladesh; ²Faculty of Fisheries, Patuakhali Science and Technology University, Dumki, Patuakhali-8602, Bangladesh; ³Department of Biochemistry and Food Analysis, Faculty of Nutrition and Food Science, Patuakhali Science and Technology University, Dumki, Patuakhali-8602, Bangladesh
Correspondence: Md. Arifur Rahman (marahman@pstu.ac.bd)

The present study has been conducted to evaluate the spatio-temporal ichthyofaunal distribution in Payra River at Pandov point, Patuakhali. During the study, a total of 61 fish species including 59 native and 2 exotic species were recorded under 22 families belonging to 11 orders. The order wise fish species availability showed that the Perciformes (29.51%) was the dominant order and Beloniformes (1.64%) and Cyprinodontiformes (1.64%) were the rarest. Among them 2 endangered, 7 vulnerable, 4 near threatened, 43 least concern and 5 data deficient species were found. During the study period, the average Shannon-Weaver diversity index (H') value was (3.33±0.10) indicates a good spread of fish population around Pandov point. Margalef richness index (d) value was (7.60±0.25), Pielou's evenness index (J') value was (0.48±0.04) and Simpson dominance index © value was (7.60±0.25). Nine different kinds of fishing gears were identified under 3 major groups including 5 nets (Estuarian Set Bag Net, Set Bag Net, Gill Net, Behundi Net, Surrounding Net) 3 hooks and lines (Long Line, Line, Hook) and 2 traps (Box Trap and Chai) at Pandov point, Payra river. Canonical correspondence analysis (CCA) ordination plot showed that rainfall and humidity were the most influencing driving forces among the meteorological parameters. From the hydrological data, TDS and turbidity were the most influential factors in shaping species diversity in Payra River around Pandov point. The cluster analysis showed that winter season formed a separate clustering based on Bray-Curtis similarity matrix. Findings of the conducted study are expected to be helpful for the respective researchers, policy makers, managers and conservationist for the sustainable management of this water body.

Keywords: fish diversity; ecology; environment; Payra River

FSB2019-CC-02

Effects of acclimation temperature on gut evacuation, oxygen consumption and thermal coefficient of Malabar blood snapper (*Lutjanus malabaricus* Bloch & Schneider, 1801)

Sabuj Kanti Mazumder¹, Mazlan Abd. Ghaffar², Simon Kumar Das³

¹Department of Genetics and Fish Breeding, Faculty of Fisheries, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur-1706, Bangladesh; ²Institute of Tropical Aquaculture, University of Malaysia Terengganu, 21030 Kuala Terengganu, Malaysia; ³School of Environmental and Natural Resource Sciences, Faculty of Science and Technology, Universiti Kebangsaan Malaysia, 43600 UKM Bangi Selangor, D.E., Malaysia
Correspondence: Sabuj Kanti Mazumder (sabujgfb@bsmrau.edu.bd)

Interest in the culture of Malabar blood snappers (*Lutjanus malabaricus*) has developed throughout the world because of declines in wild stocks combined with a consistent high demand and market value. This study tested the gut evacuation time (GET) & rate (GER), oxygen consumption rates (OCR), energy respired, and thermal coefficient of juvenile *L.*

malabaricus (4.53±1.14 g) at four temperatures of 22, 26, 30 and 34 °C. During 30 days of experimental period fish were reared at 15 nos. tank⁻¹ at 30 psu with three replicates in intermittent flow respirometers in a recirculatory system under laboratory conditions. The results of X-radiography and serial slaughtering showed that fastest GET and GER were seen in the 30 °C group (18 h), where the proportion of meal remaining in the stomach decreased from 100% to less than 8% after 12 h of starvation. A significant delay in gut emptying was observed in the 22 °C group (28 h). *L. malabaricus* fish mass (*W*, g) also incorporated into a modified square root model [$S_t = S_0 (1 - S_0^{(a-1)} \rho^{(1-a)} t)^{1/(1-a)} + \zeta$], fit the wet mass gut evacuation data, regardless of temperature ($r^2 > 0.99$). As expected, oxygen consumption rates increased significantly ($P < 0.05$) from 1.39 ± 0.07 to 3.11 ± 0.09 ml O_2 h⁻¹ with an increase in the exposed temperature from 22 to 34 °C. The corresponding respired energy values also increased from 27.59 ± 1.03 to 61.78 ± 0.66 Jh⁻¹ at 22 and 34 °C respectively. The maximum and minimum temperature quotients (Q_{10}) were observed between 22-26 (2.02) and 26-30 °C (1.82) respectively. Final preferred temperature (thermal coefficient) estimated between 26 and 30 °C. These bioengineering information would be helpful for the fishery biologists and resource managers for the conservation of this important fisheries resources by coping with global warming effects.

Keywords: X-radiography, serial slaughtering, gut evacuation, oxygen consumption rate, preferred temperature

FSB2019-CC-03

Spatial and temporal variation of nutrient dynamics in the Pasur river estuary of Bangladesh

Shoaibe Hossain Talukder Shefat, Mohammed Anas Chowdhury, Dinesh Chandra Shaha
Department of Fisheries Management, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur-1706, Bangladesh

Correspondence: Shoaibe Hossain Talukder Shefat (shoaibeshefat@gmail.com)

The Pasur River Estuary (PRE) is the most commercially important estuary in the southwestern coastal zone of Bangladesh. Recently, salt plug formation has been discovered in the PRE during the dry season. The zone of salt plug acts as a barrier that prevents the seaward flushing of riverine waters and the landward intrusion of ocean waters which should have significant impacts on water-quality conditions, no information is available yet on this. This study was conducted to investigate the spatial and temporal variation of nutrient distribution in the PRE during the dry season under different tidal cycles. Sixteen experimental sites were set for collection of surface water samples under different tidal conditions. In-situ measurement and laboratory analysis were performed to assess the nutrient parameters and other physico-chemical properties. Mean DO was recorded between 6.05 to 8.43 mgL⁻¹ within an average 7.24 mgL⁻¹. Highest DO was observed in January whereas the lowest was in April. Water pH ranged between 7.48 to 7.78 which is suitable for biological productivity. Average pH value is higher at low tide than at high tide. However, pH value was highest in the salt plug region at Chalna. Mean ammonium concentration was ranged between 0.69 to 1.16 mgL⁻¹. Higher Ammonium concentration was noticed at low tide than at high tide. Nitrite, Nitrate and Phosphate were found to be present in very poor concentration with an average range of 0.005 to 0.144 mgL⁻¹, 0.02 to 0.06 mgL⁻¹ and 0.16 to 1.59 mgL⁻¹ respectively. Average Chlorophyll-a content was ranged between 13 to 28.7 ugL⁻¹. The highest Chlorophyll-a was found in the salt plug area with higher concentration at high tide than at low tide. This work will provide an ecological baseline for future hydrological and environmental studies in the PRE linking the physical phenomena with chemical and biological properties.

Keywords: mangroves, salt plug, estuarine flushing, physico-chemical parameters

FSB2019-CC-05

Impacts of saltwater intrusion on fishers' livelihoods and coping strategies in the Nabaganga River of Bangladesh

Md. Shariful Islam¹, Md. Abdul Wahab², Muhammad Shahidul Haq², Shahroz Mahean Haque², Nafia Binte Ryhan³

¹Bangladesh Fisheries Research Institute (BFRI), Freshwater Sub-Station, Chanchra, Jashore-7402, Bangladesh; ²Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh; ³AgroAid Foundation, Mymensingh-2202, Bangladesh
Correspondence: Md. Shariful Islam (sharif.bfri@gmail.com)

Saltwater intrusion is one of the major problems in the Southwest coastal zone of Bangladesh. It is increasing terrifyingly due to natural and anthropogenic reasons. This study tried to trace out the impact of saltwater on fishers' livelihoods strategies and responses of fishers to solve the saltwater problem in the Kalia upazila of Narail district of Bangladesh. Both primary data and secondary sources were carried out to serve the objectives of the research. It has been observed that increased saltwater caused the reduction of fish species in Nabaganga River from 41 to 35 species during the period of 1970-2014 and 6 fishes has already been disappeared. Total fish catch has been reducing day by day. Aged people mentioned that fish availability has decreased to 75% in the Bordia fish market of Narail after the 45 years of independence of Bangladesh. In adaptation aspects, about 85% respondents were practicing shrimp cultures, 60% were doing crab culture as their adaptation measures. About 30% people have started saline tolerant fish culture and net making and mending (20%) were also taking places. It also observed that, people were changing their occupations, such as fishers' to shrimp farming, prawn seed collection, shopkeepers, and laborer, etc. In this perspective, immediate steps have to be taken to protect saltwater intrusion and to find out suitable ways for adaptation with saltwater problems through collaboration of Government institutions and local NGOs.

Keywords: saltwater intrusion, fishers' livelihoods, adaptation

FSB2019-CC-07

Effects of photoperiods on growth and reproductive functions of rohu, *Labeo rohita*

Md. Al-Emran, Md. Shahjahan

Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Correspondence: Md. Shahjahan (mdshahjahan@bau.edu.bd)

Photoperiod plays an important role in growth and reproduction of fish like other environmental factors. The present study was conducted to assess the effects of photoperiod on growth and reproductive functions of rohu, *Labeo rohita*. Two separate experiments were conducted with three different photoperiod treatments, such as 6 hours of light and 18 hours of dark 18 (06L:18D), 12 hours of light and 12 hours of dark (12L:12D), and 18 hours of light and 6 19 hours of dark (18L:06D). In the first experiment, fingerlings were exposed in the three photoperiod conditions for 30 days and sampled fishes were sacrificed on 7, 15 and 30 days of exposure to measure growth parameters and major hemato-biochemical parameters (Hemoglobin, Hb; Red blood cell, RBC; White blood cell, WBC and blood glucose). In the second experiment, sexually matured females were exposed in the three photoperiod conditions for 30 days and the sampled fishes were sacrificed on 0, 15 and 30 days of exposure to know GSI and gonadal histology. Final weight gain (g), percent weight gain, specific growth rate (SGR) and feed

conversion ratio (FCR) were significantly highest in 12L:12D and lowest in 18L:06D conditions. In prolonged photoperiod (18L:06D), the Hb and RBC decreased significantly, while WBC and blood glucose level increased significantly during initial days of exposure. The mean GSI values, oocyte diameter and proportions of vitellogenic oocyte were maximum in the fishes of 06L:18D treatment indicating stimulation of vitellogenesis. On the other hand, the same parameters were minimum in the fishes of 18L:06D, revealing the inhibition of vitellogenesis. This study indicates that prolonged photoperiod negatively affect growth and reproductive performances of rohu.

Keywords: rohu; photoperiods; hematological parameters; reproduction

FSB2019-CC-08

Effect of different salinity level on physiology and survivability of Tilapia (*Oreochromis niloticus*) at the juvenile stages of development

Md. Golam Azom, Bhakta Supratim Sarker, Md. Sadiqul Islam

Department of Fisheries Biology and Genetics, Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh.

Correspondence: Md. Sadiqul Islam (sadiqul1973@yahoo.com)

There are very few information available out there about the changes of physiological parameters in response to salinity stress in the young hatchlings of Nile tilapia. This study was attempted to investigate the changes in four physiological parameters: blood glucose, blood hemoglobin, number of white blood cells (WBC) and number of red blood cells (RBC) along with the survival rate in different salinity level at the juvenile stages of development of Nile tilapia. Two experiments were conducted by using spawns from two different sources: hatchery (exp. 1) and lab (exp. 2) and for each experiment, samples were taken from two separate age groups; 5 day after hatch (5 DAH) and 15 day after hatch (15 DAH). They were placed into 6 tanks (0, 5, 10, 15, 20 and 25 ppt of salinity) each containing 30 individuals with 30 L of water. In case of experiment 1, the mean blood glucose level in 15 DAH (6.62 ± 2.19) is significantly higher ($P < 0.05$) than that of 5 DAH (3.15 ± 0.70), but no significant variation was observed among different salinity levels. In contrast, other 3 parameters (blood hemoglobin, WBC and RBC) produced no significant difference between the age groups or among the salinity levels. In the experiment 2, blood hemoglobin, WBC and RBC showed no statistically significant difference between the age groups or among the salinity levels while the rate of survivability for both the experiments exhibited a significant difference among the various level of salinity. Again, when the results of the two experiments were combined, 15 DAH group showed a significantly higher blood glucose level (6.62 ± 2.19) than 5 DAH (3.78 ± 1.58) when the blood hemoglobin was not significantly different between the two groups. In addition, the WBC and RBC counts and the survivability demonstrated a significant variation among the measured salinity levels.

Keywords: Nile tilapia, salinity, physiological parameters, survivability, age groups,

FSB2019-CC-09

Characterization of salt tolerant genes in F1 generation of tilapia hybrid through microsatellite DNA markers

Nusrat Easmin, Bhakta Supratim Sarker, Md. Samsul Alam, Md. Sadiqul Islam

Department of Fisheries Biology and Genetics, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Correspondence: Md. Sadiqul Islam (sadiqul1973@yahoo.com)

The study was conducted to identify polymorphisms in the microsatellite loci located in two salt regulatory genes prolactin and transferrin in F1 hybrid of *O. niloticus* (♀) × *O. mossambicus*. Genomic DNA was isolated from 20 fish (10 male and 10 female) samples (♂) and five microsatellite markers namely Prl (L-K), Prl (S-K), Prl-MS01, TFA and TFB were amplified by polymerase chain reaction, separated on polyacrylamide gel electrophoresis and visualized by ethidium bromide staining. All five loci were found to be polymorphic in this hybrid population. Locus Prl (L-K) had the highest numbers of six alleles while the locus Prl (S-K) and Prl-MS01 had the least number of four alleles each. All alleles were found in male hybrid but three alleles (236bp, 246bp and 271bp) were absent in female hybrid sample. All alleles were present in Prl (S-K) locus which ranged from 507 to 531bp. On the contrary, among 4 alleles in Prl-MS01 locus, the male hybrid sample lacked two alleles (256bp and 288bp) while the female hybrids carried all the alleles. In case of transferrin genes, a total of five alleles were found in both TFA (300-380) bp and TFB locus (177 to 215) bp. In case of male, allele 300bp was absent at TFA locus whereas alleles 177 and 195bp were absent at TFB. The average observed heterozygosity (H_o) value in male hybrids (0.380) was lower than that in female (0.400) hybrid. The test for fit to Hardy-Weinberg expectation revealed that both male and female hybrid samples were found to be deviated from Hardy-Weinberg expectations in 8 out of 10 tests. The deviation from Hardy-Weinberg Equilibrium at locus Prl (S-K) in male hybrid sample and at two of loci Prl (S-K) and Prl-MS01 were high ($p < 0.0001$). The deviation from Hardy-Weinberg expectation at locus Prl-MS01 ($p < 0.01$) and TFA ($p < 0.05$) in male hybrid sample was relatively low compared to that in female hybrid population at locus Prl-MS01 ($p < 0.001$) and TFA ($p < 0.01$).

Keywords: polymorphism; microsatellite loci; polymerase chain reaction; heterozygosity; Hardy-Weinberg expectation

Day 1: 27 December 2019

**Technical Session 3:
Hilsa Fisheries: Aspects & Prospects**

KEYNOTE PAPER

Revival of hilsa shad (*Tenualosa ilisha*) in Bangladesh waters through biodiversity conservation and adaptive co-management

Prof. Dr. Md. Abdul Wahab^{1,2}

¹WorldFish Bangladesh and South Asia Office, House 2B, Road 4, Block B, Banani, Dhaka 1213, Bangladesh; ²Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh
Correspondence: Md. Abdul Wahab (wahabma_bau2@yahoo.com)

Biography

Dr. Md. Abdul Wahab obtained both Bachelor of Science, BSc Fisheries (Hons), and Master of Science, MSc in Fisheries from the Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh, Bangladesh. He joined the Faculty Fisheries in the position of a Lecturer in November 1979. He was awarded the Commonwealth Scholarship in 1983 for pursuing higher study the University of Stirling, United Kingdom. He obtained PhD in Aquaculture in 1986. He became Professor in 1995 and was the founder Head of the Department of Fisheries Management. He was the Dean of the Faculty of Fisheries for two years. He dedicated himself over 39 years in teaching and demand-led research focusing on freshwater and brackish water aquaculture, water quality and pond dynamics, environmental impacts of shrimp farming, periphyton-based aquaculture, nutrient-rich small fish (SIS) culture, prawn-fish polyculture, and ecology of small-scale inland fisheries. He developed 10 aquaculture technologies; some of them are widely used in Bangladesh and neighboring countries. He has published 100 scientific papers of which 56 in international peer reviewed journals, 44 in national and regional journals, and 14 book chapters as author and co-authors. BAU Research Systems (BAURES) has officially recognized Dr. Wahab's achievements with the BEST Researcher award in 2017 for his outstanding contribution in research based on global ResearchGate *h*-index. His present ResearchGate *h*-index is 38. Dr. Wahab, so far, supervised 23 PhDs (Supervisor 18, co-supervisor 5) and 107 Masters Student at the Faculty of Fisheries. Currently, Prof. Wahab has been leading USAID funded Enhanced Coastal Fisheries in Bangladesh (ECOFISH-Bangladesh) project of WorldFish for improving the resilience of the Padma-Meghna River systems and the communities reliant on coastal fisheries, and conservation of Hilsa fishery.

Abstract

Hilsa shad (*Tenualosa ilisha*) is the most popular national fish and GI product of Bangladesh. About 260 million Bengali speaking people of the region or all over the world rely on this fish for its excellent look, taste, flavor and nutritional value. It is harvested by over 0.5 million coastal small-scale fishers and another 2.5 people are involved in its value chain. Its scarcity has significant impacts on nutrition security, income and livelihoods of the millions of poor fishers and various stakeholders reliant on hilsa shad in the countries within the Bay of Bengal region. Owing to the decline of hilsa fishery as low as <2 million tons in 2002-2003, the Government of Bangladesh introduced Hilsa Fisheries Management Action Plan that included declaration of fish sanctuaries to allow uninterrupted breeding and nursing of juveniles, enforcement of patrolling against the use of monofilament nylon nets (*B. current jal*), and introduction of modest compensation of food grains to the poor fishers during fishing ban periods. While these have positively impacted on the hilsa production, the annual production however, increased at only 5% per year until 2013-2014. Considering the scarcity of supply of hilsa shad and national urge on its conservation and development, WorldFish and Department of Fisheries (DoF) jointly initiated a USAID funded ECOFISH-BD activity since June 2014 with the objective of improving the resilience of the Padma-Meghna River/Estuarine ecosystems and the fishers reliant on coastal fishery. This WorldFish-DoF collaboration, along with over a dozen of implementing partners,

emphasized the science-based decision-making, strengthened fisheries adaptive co-management in all sanctuaries, and enhanced livelihood supports and Alternative Income Generating Activities (AIGAs) for the poor fishing households in 136 coastal fishing villages along the major rivers. The innovative trainings to 20,000 fishers men and women, introduction of 148 fishers women community savings schemes (CSGs), recruitment of 400 community fish guards (CFGs), and rigorous efforts of mobilization and awareness building throughout the value chain involving all major stakeholders created a sense of national unity in conserving hilsa. Through the establishment of adaptive co-management at the union to district levels in all 6 hilsa sanctuaries, and stimulating a concerted efforts of various administrative and law enforcing agencies of Bangladesh resulted in an increased hilsa catch by around 33.5% from 387,200 MT in 2015 to 517,000 MT in 2018 with even a higher increase by 71% in the inland riverine catch. ECOFISH findings suggest that successful community engagement and timely enforcement ensured spawning success and recruitment of juvenile hilsa (*Jatka*) that has resulted in revival hilsa fisheries and development to a satisfactory level. While hilsa population apparently revived, the combination of local and transboundary approaches in its management may further ensure its sustained production in the Gangetic River systems and in the Bay of Bengal. The restoration of habitats through major river excavation programs, maintenance of uninterrupted water flows, control of pollution along the rivers courses, and improvement in the fishers livelihoods may ensure sustained hilsa shad production. The lessons learned from revival and sustenance of hilsa fishery in the Gangetic River systems of Bangladesh may be useful elsewhere for managing the declining fishery.

FSB2019-HF-01

Reproductive biology of hilsa shad *Tenualosa ilisha* of the River Meghna in Bangladesh

Kaisir Mohammad Moinul Hasan¹, Zoarder Faruque Ahmed², Md. Abdul Wahab²

¹Department of Fisheries, Bangladesh; ²Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Correspondence: Zoarder Faruque Ahmed (zoarder2000@yahoo.com)

Reproduction of hilsa shad *Tenualosa ilisha* (Hamilton, 1822) was studied to determine spawning season, spawning frequency, length at sexual maturity and fecundity. Monthly samples were collected from the river Meghna at Chandpur during January to December 2014, among which 704 fish were male (12-40 cm TL, and 20-637 g BW), and 393 female (18-48 cm TL, and 56-1309 g BW). Spawning season was determined based on gonadosomatic index (GSI), and external features and histology of gonads. Higher values of mean percent GSI for male and female were observed during September and October with a peak in October. However, GSIs of several individuals (both male and female) in any month were greater than the highest mean GSI in October. Monthly GSI values of male and female primarily indicated that hilsa shad might spawn throughout the year. External features classified gonads into 5 arbitrary developmental stages as immature, developing, premature, mature and spent. Mature stages were observed during whole year and maximum occurrences were in September and October in both testis and ovary. Histological examination revealed that spermatozoa and mature stages of ovaries were present over the year with maximum occurrences in September and October. The study, therefore, confirmed that *T. ilisha* spawned continuously throughout year with the peak during September to October. The minimum lengths at sexual maturity of male and female were 17 and 22 cm, while the mean lengths at sexual maturity (TL_{m50%}) were 21.5 and 28.01 cm respectively. Absence of postovulatory follicles and hydrated eggs, and existence of one major mode of eggs in mature gonads evidenced that hilsa shad was a single spawner. Present study calculated fecundity in million, and the relationship between total length and fecundity, and body weight and fecundity were expressed as $F = 0.000006TL^{3.33}$, and $F = 0.00164BW - 0.01$ respectively.

Keywords: hilsa shad, *Tenualosa ilisha*, reproduction, fecundity

FSB2019-HF-02

Shelf life of mustard hilsa in various packing conditions during storage at low temperatures

Fatema Hoque Shikha, Md. Ismail Hossain, Sadia Mahmuda

Departemtn of Fisheries Tehcnology, Bangaldesh Agricultural University, Mymensingh-2202, Bangladesh

Correspondence: Md. Ismail Hossain (ihossain.ft@bau.edu.bd)

Sensory, chemical and microbiological changes of mustard hilsa prepared from Hilsa shad (*Tenualosa ilisha*) were determined to evaluate the shelf life of mustard hilsa under different storage conditions. Survey on consumer preference was carried out at Kamal-Ranjit Market, Kewatkhali, Mymensingh and Faculty of Fisheries. It was observed that the percent moisture, protein, lipid, ash content and pH value in mustard hilsa decreased compared to those obtained for fresh fish. On the other hand, peroxide and TVB-N values increased compared to the values found in fresh fish. At refrigeration temperature (5°C to 8°C) and frozen temperature (-18°C to -20°C) percent moisture and ash contents increased but protein content and lipid content decreased gradually. pH value of the mustard hilsa reduced from 5.24±0.01 to 4.51±0.11 and 4.49±0.90 at refrigeration and frozen temperatures, respectively. The TVB-N value increased progressively

throughout the storage period irrespective of storage temperatures. Vacuum sealed mustard hilsa showed slower changes than non-sealed and sealed mustard hilsa. The microbial load increased in refrigeration and frozen temperatures though the growth of microbes was slower at frozen temperature. So, it was concluded that, at refrigeration temperature mustard hilsa may remain in good condition up to 45 days and at frozen temperature (-18°C to -20°C) for about 120-150 days in vacuum sealed pack. Study on consumer preference showed that, most of the respondents liked the product and also they showed their interest to buy from shop as “ready to eat” form while shop owners showed interest to sell this product. Therefore, it can be assumed that business with “ready to eat” value added products like mustard hilsa in Bangladesh has a very good prospect and there is a great feasibility of exporting mustard hilsa at “ready to eat” from Bangladesh.

Keywords: shelf life, mustard hilsa, packing, low temperature, storage

FSB2019-HF-03

Pearson’s correlation and likert scale based investigation on socioeconomic status of hilsha fisher community in Kirtankhola River of southern Bangladesh

Shaharior Hossen^{1,2}, Zahid Parvez Sukhan², Prosun Roy³, Md. Rajib Sharker^{1,2}

¹Department of Fisheries Biology and Genetics, Patuakhali Science and Technology University, Dumki, Patuakhali-8602, Bangladesh; ²Department of Fisheries Science, Chonnam National University, Yeosu 59626, Korea; ³Department of Aquaculture, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Correspondence: Md. Rajib Sharker (mrsharker@pstu.ac.bd)

The investigation was conducted to evaluate the socioeconomic profile of the hilsha fishermen community, using Pearson’s correlation and Likert scale in the three selected area of Kirtankhola River, Barisal, Bangladesh during the period of January to December 2015 by interviewing 120 fishermen. Among fishermen, 45% were engaged in fulltime fishing and 21.66% were subsistence fishermen. Maximum fishermen (60%) were middle aged and 60% were found Illiterate. 80% fishermen were lived with joint family and 65% fishermen had 7-10 family members. Average annual income of most of the fishermen ranged from was BDT 56,000-70,000 (35%), whereas 15% had above BDT 70,000 and 20% had less than BDT 56,000. 35% women of the fishermen family supported their family by livestock rearing. Age of fishers and income was negatively correlated ($r = -0.015$, $p = 0.01$), however positive relationship ($r = 0.380$, $p = 0.01$) were observed between age and savings (Table 1). Although the drinking water facility in area is good enough, 100% used tube-well water, the sanitation condition is not good, 70% fishers used traditional toilet and 15% had no sanitary facilities. Problem tree analysis revealed that river erosion, lack of sufficient fishing craft, lack of education due to poverty and lack of alternative income source during ban-period were very critical in the studied area (Table 2). Poor socioeconomic conditions of fishermen were forced to overfishing round the year without considering government rules related to hilsha diversity.

Keywords: socioeconomic status, hilsha fishermen, Kirtankhola River, constraints, correlations

FSB2019-HF-04

Population genetic structure, phylogeography and demographic history of *Tenualosa ilisha* in the Indo-west Pacific

Kazi Ahsan Habib

Department of Fisheries Biology and Genetics, Faculty of Fisheries, Aquaculture and Marine Science, Sher-e-Bangla Agricultural University, Dhaka-1207, Bangladesh
Correspondence: Kazi Ahsan Habib (ahsan.sau@gmail.com)

Genetic diversity, population structure and historical demography of Hilsa shad, *Tenualosa ilisha* were assessed using mitochondrial DNA (mtDNA) marker. A total of 157 individuals were collected from four populations located in Bangladesh (Chandpur-CP and Cox's Bazar-XP), West Bengal of India (IP), Myanmar (MP) Pakistan (PP) and Kuwait (KP). The hyper variable of 5' site of the mtDNA D-loop region and COI gene were analyzed. DNA barcoding of COI gene confirmed the collected fish samples are *T. ilisha*, not other clupeidae species. For D-loop region, 108 polymorphic sites and 107 haplotypes were found. The nucleotide diversities (π) were very low for all of the six populations (MP, XP, CP, IP, PP and KP) which ranged from 0.06 – 0.62 while the haplotype diversities (h) were very high, 0.84 – 0.99. Pairwise comparisons of F_{ST} values indicate significant genetic population structure between each of the population pair except populations of Bangladesh (XP, CP) vs. Myanmar (MP), and Pakistan (PP) vs. Myanmar (MP). Non-significant exact P values showed that XP, CP and MP are panmictic populations. The migration analysis indicated asymmetry migration existed among populations. Phylogeny of D-loop haplotypes revealed three distinct lineages: three Bay of Bengal clades and an Arabian Sea-Persian Gulf Clade. COI gene did not reveal any significant clades or clusters associated with any particular sampling localities in haplotype network. Neutrality tests such as Tajima's D and Fu's F_s statistics of D-loop region suggested that all the populations of hilsa shad showed population expansion except the KP population which showed stable population with long evolutionary history. This study will help to establish appropriate fishery management and conservation strategy for this species in its distribution area.

Keywords: *Tenualosa ilisha*, population, D-loop, phylogeography

FSB2019-HF-05

Assessment of biological parameters of hilsa shad, *Tenualosa ilisha* from three different unit-stocks in Bangladesh: A key for sound management

Md. Yeamin Hossain¹, Md. Ataur Rahman¹, Md. Akhtarul Islam¹, Md. Ashekur Rahman¹, Md. Rabiul Hasan¹, Zannatul Mawa¹, Asam Afroz Chowdhury¹, Akhery Nima^{1,2}, Md. Abul Bashar², Mohammad Ashraful Alam², Yahia Mahmud³

¹Department of Fisheries, University of Rajshahi, Rajshahi-6205, Bangladesh; ²Bangladesh Fisheries Research Institute, Chandpur-3602, Bangladesh; ³Bangladesh Fisheries Research Institute, Headquarter, Mymensingh-2201, Bangladesh

Correspondence: Md. Yeamin Hossain (hossainyamin@gmail.com)

This study focuses on some biological parameters including sex ratio, growth pattern, conditions, prey-predator status (W_t) and size at sexual maturity (L_m) of Hilsa shad, *Tenualosa ilisha* from three different unit-stocks in Bangladesh. Monthly samples were collected from three different habitats covering the Padma (PR), Meghna (MR), and the Bay of Bengal (BoB) during July 2018 to June 2019. Total length (TL) and body weight (BW) were nearest to the 0.01 g and 0.01 cm accuracy, respectively for each individual. The length-weight relationship (LWR) was calculated as $W = a \times L^b$, where W is BW (g), L is TL (cm), a and b was the parameters of regression analysis.

Additionally, condition factors were calculated as Fulton's condition factor (K_F): $K_F = 100 \times (W/L^3)$; relative condition factor (K_R): $K_R = W/(a \times L^b)$ and allometric condition factor (K_A): W/L^b , where W is BW, L is TL, a and b is the LWR parameter. The prey-predator relationships were estimated using relative weight (W_R) as $W_R = (W/W_S) \times 100$, where W is the weight of a particular individual and W_S is the predicted standard weight for the same individual as calculated by $W_S = a \times L^b$ where the a and b values are obtained from the LWR. The L_m was calculated by the relationship between TL and GSI. Females were dominant in three different unit-stocks. The length-frequency distributions indicated that 45% hilsa were within 16-20 cm TL in PR, 25% individuals were within 28-33 cm TL in MR and 30% individuals were within 25-30 cm TL in the BoB. The b values of LWRs were 3.08, 3.04 and 2.97 for PR, MR and BoB, respectively. All unit-stocks were in good condition (value ~ 1.0). The estimated W_r values were close to 100, which indicating three unit-stocks of *T. ilisha* are in good condition based on prey-predator status. The calculated L_m was attained 20.0 cm TL in the PR which is smaller than MR (23.0 cm TL) and the BoB (25.0 cm TL). This study would be very effective for sustainable conservation of *T. ilisha* in Bangladesh considering the three different unit-stocks' findings.

Keywords: *Tenulosa ilisha*, growth pattern, condition, size at sexual maturity, unit stocks

FSB2019-HF-06

Stock assessment of three different unit-stocks of hilsa shad, *Tenulosa ilisha* in Bangladesh through length-based models

Md. Yeamin Hossain¹, Md. Akhtarul Islam¹, Md. Ataur Rahman¹, Md. Rabiul Hasan¹, Zannatul Mawa¹, Md. Ashekur Rahman¹, Sumaya Tanjin¹, Md. Abul Bashar², Akhery Nima^{1,2}, Mohammad Ashraful Alam², Yahia Mahmud³

¹Department of Fisheries, University of Rajshahi, Rajshahi-6205, Bangladesh; ²Bangladesh Fisheries Research Institute, Riverine Station, Chandpur-3602, Bangladesh; ³Bangladesh Fisheries Research Institute, Headquarter, Mymensingh -2201, Bangladesh
Correspondence: Md. Yeamin Hossain (hossainyeamin@gmail.com)

The Hilsa shad, *Tenulosa ilisha* is the country's most important aquatic resource and affords the largest single species fishery in Bangladesh. The present study assesses the growth parameters (asymptotic length, L_∞ ; asymptotic weight, W_∞ ; growth co-efficient, k ; age at zero length, t_0), growth performance index (ϕ), longevity (t_{max}), size at first sexual maturity (L_m), age at sexual maturity (t_m), mortality (fishing mortality, F ; natural mortality, M ; total mortality, Z), exploitation rate (E) and maximum sustainable yield (MSY) of *T. ilisha* from three different unit-stocks in Bangladesh. A total of 2050 individuals of *T. ilisha* were collected from three different habitats including Padma River (PR), Meghna River (MR) and the Bay of Bengal (BoB) from October 2018 to September 2019 using commercial fishing trawlers. Total length (TL) and whole body weight (BW) was measured by the digital slide calipers and electronic balance with 0.01cm and 0.01 g accuracy, respectively. The growth parameters were described through the von Bertalanffy (VBG) model (von Bertalanffy, 1938) as $L_t = L_\infty [1 - \exp\{-k(t-t_0)\}]$ for length basis and $W_t = W_\infty [1 - \exp\{-k(t-t_0)\}]^b$ for weight basis. Growth parameters were calculated by $\log L_\infty = 0.044 + 0.9841 * \log(L_{max})$, $W_\infty = a * (L_\infty)^b$, $\log t_{max} = 0.5496 + 0.957 * \log(t_m)$, $t_{max} = 3/K$, $\log(-t_0) = -0.3922 - 0.2752 \log L_\infty - 1.038 \log K$ and $\phi' = \log_{10} K + 2 \log_{10} L_\infty$. The Z was estimated by the length converted catch curve using growth parameters: $\ln(N_t/\Delta_t) = a + b * t$. Once Z and M were obtained, fishing mortality (F) was estimated using the relationship: $F = Z - M$; where Z is the total mortality and M , natural mortality. The exploitation rate (E) was estimated by the equation: $E = F / Z = F / (F + M)$. The smallest and largest specimens of *T. ilisha* were 9.3-55.5 cm TL. The calculated L_∞ , W_∞ , L_m , t_m (year), k (year⁻¹), and ϕ of *T. ilisha* were 43.80 cm, 983.94 g, 20.0 cm, 0.76 year, 0.70/ year and 3.13 for PR; 57.62, 2024.61, 23.0, 0.74, 1.13 and 3.38 for MR and

55.06,1592.81, 25.0, 0.74, 1.13 and 3.53 for the BoB. The estimated t_{max} (year), t_0 (year), M , F , and Z of *T. ilisha* were 4.29, 0.027,1.07, 1.12 and 2.19 for PR; 4.17, 0.09,1.10, 0.84, 1.94 for MR and 4.66, 0.009,0.99, 1.44, 2.24 for the BoB. The E was 51%; 43% and 56% of Padma, Meghna River and BoB. The results of this study would be very effective to host appropriate fishing for better management of *T. ilisha* from three different habitats in Bangladesh.

Keywords: hilsa, unit-stock, length-model

FSB2019-HF-07

Maximum sustainable yield (MSY) estimates of industrial finfish fishery in Bangladesh marine waters using trawl catch log

Suman Barua

Marine Fisheries Office, Department of Fisheries, Chattogram-4000, Bangladesh.

Correspondence: Suman Barua (sbarua123bd@gmail.com)

After inclusive assessment being conducted in three decades ago, this is the first analytical stock assessment of finfish in Bangladesh marine waters. A time series of annual catch per unit effort (CPUE) is derived from commercial logbook data from 2007 to 2018 and used as a tuning series for a Schaefer biomass model. The estimated maximum sustainable yield (MSY) reference points are optimal biomass $B_{MSY} = 206082$ t and optimal harvest rate $u^{MSY} = 38\%$. The current stock size is estimated to be around 211000 t and the annual harvest rate around 55%, slightly higher than the estimated optimal stock size and much higher than optimal harvest rate respectively. The average annual catch in last five years was 95924 t, higher than the estimated MSY of 79325 t. Overall, the stock is therefore estimated to be in an overfishing state. The catch rate of high value and large demersal species have gradually declined whereas low valued species such as small pelagic and miscellaneous groups have been appeared as major percentage in catch composition for the last couple of years.

Keywords: finfish, stock status, MSY, trawl catch log, Bangladesh

FSB2019-HF-09

Studies on the causes of early gonadal development of hilsa, *Tenulosa ilisha* in Bangladesh

Md. Borhan Uddin Ahmed¹, A. K. Shakur Ahammad¹, Md. Shahjahan², Biraj Kumar Datta¹, Md. Fazla Rabbi¹, Yeamin Hossain³, Mohammad Ashraful Alam⁴, Md. Abul Bashar⁴, Yahia Mahmud⁴

¹*Department of Fisheries Biology and Genetics, Bangladesh Agricultural University,*

Mymensingh-2202, Bangladesh; ²*Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh;* ³*Department of Fisheries, Rajshahi University,*

Bangladesh; ⁴*Bangladesh Fisheries Research Institute, Bangladesh*

Correspondence: A. K. Shakur Ahammad(sahammad09@yahoo.com)

Recently, there is an alarming issue on early gonadal developmental in hilsa that produced reduced number of spawn is declining the hilsa production in Bangladesh. Based on this circumstance, assessment of age and growth patterns provides crucial information on numerous aspects of the population dynamics in fish, which can, in turn, be used to determine a sustainable fishing rate and inform effective resource management practices. However, studies on the age and growth pattern of *Tenulosa ilisha* (commonly referred to as hilsa) are plagued by a lack of essential information; addressing this data gap is the aim of the present study. Six diverse habitats (the Meghna river estuary, Bay of Bengal, the Kali River, the Tetulia River, the Padma River and the Gaglajur haor) across Bangladesh were chosen as sampling sites for hilsa collection. For age

determinations, the lunar rings in the otolith of the hilsa fish that are periodically-deposited in accordance with the lunar cycle were used to reflect 14-day increments of time. The length and weight of each fish were recorded prior to otolith extraction. The resulting otoliths were polished to enable the visualization and quantification of their lunar rings with a high-magnification microscope. Except for the Kali River and Gaglajur Haor samples, the age of the fish correlated strongly with both their length and weight ($r > 0.95$; $p < 0.05$). Again, except for those from the Kali River and Gaglajur Haor, all of the samples exhibited positive allometric growth patterns ($b > 3$) with the fish from the Tetulia River being the most positive ($b = 3.48$). The causes of these variations are not yet clearly understood, however; the nutrient availability, environmental variation, and gene-environment interaction might be attributable to the diversities displayed by the hilsa from different regions of Bangladesh.

Keywords: hilsa, *Tenualosa ilisha*, otolith, age determination, length-weight relationship, Bangladesh

FSB2019-HF-10

Seasonal diet and feeding habits of juvenile hilsha fishes along the Meghna River Estuary, Bangladesh

Md. Jahangir Sarker¹, Afsana Kabir Dipty¹, Karnis Tamanna Akter¹, Riaduzzaman Bhuiyan¹, Shakila Akter¹, Jesmin Akter Poly¹, Yahia Mahmud², Md. Abul Basahr², Md. Monjurul Hasan²

¹Department of Fisheries and Marine Science, Noakhali Science and Technology University, Noakhali, Bangladesh; ² Bangladesh Fisheries Research Institute, Bangladesh

Correspondence: Md. Jahangir Sarker (mjsarker@nstu.edu.bd)

To date no detailed studies have examined seasonal and spatial diet variation among juvenile Hilsha (*Tenualosailisha*) fishes in Meghna River estuary recently in Bangladesh although this species contributes almost 1% in Gross Domestic Product (GDPs). We sampled 471 species from 5 sites (Noakhali, Luxmipur, Hatiya, Chandpur and Bhola) during November 2018 to May 2019, to examine seasonal diet and spatial feeding habit variation. Bacillariophyceae composed the bulk of the diet considering % Vol and % IRI (Index of Relative Importance) and formed the most important prey in seven size groups of Hilsha in Meghna estuary. The second most important prey was observed as cladocera, copepoda and cyanophyceae. Interestingly, cladocera, the second most important prey in Hatiya during January-February, composed 19.79 and 18.37% (N and IRI) while copepod was found as the second most important prey as well in April and May in Luxmipur and Bhola. Dinophyceae was the only other prey that accounted for >2-3% of the diet, and they composed 1.05-1.48% (IRI) in March and April in Hatiya and luxmipur respectively. Monthly variations in the bulk content of diets was also observed in Meghna River estuary during the study. Despite lower number of ingestion, Rotifera was found second most important prey during the study except in February (Rotifera ranked 3rd) in Bhola whereas copepod and cladocera formed the second most important prey in other sites of study areas. Despite the regular appearance of sand particles (as % volume and % frequency of occurrence) in study sites except Bhola during the study it is mentionable that they did not play roles as important diet (absence of %IRI). Two-way ANOVA (0.05%) with replication showed the significant ($P=0.00$, $F=32.06$, $F_{crit} 2.25$) shift of feeding habit from phytoplankton to zooplankton with their size increment.

Keywords: hilsha, diet, feeding habit, Meghna estuary

Day 1: 27 December 2019

**Technical Session 4:
Biotechnology in Fisheries & Aquaculture**

KEYNOTE PAPER

Tilapia aquaculture for employment, income and nutrition security

Dr. Ram C. Bhujel

Research Associate Professor, Aqua-Centre, Asian Institute of Technology, Thailand

Correspondence: bhujel@ait.asia

Abstract

Although tilapias are originated from Africa its culture methods have been well-developed and consumption has been widespread in Asia and also Latin America. Among the hundreds of species of tilapias, Nile tilapia (*Oreochromis niloticus*) and its hybrids of *O. mossambinus*, *O. aureus* etc. are commercially important ones. Global production of Nile tilapia and its hybrids is almost tripling in each decade and expected to reach over 7 million mt by the end of 2020. It has already become #1 species overtaking grass carp, silver carp, salmon and other carps (Fig. 1). Unlike many carnivorous species, they feed on planktons and can be grown in green water. They are favored by the relatively poor farmers. They can also utilize commercial pellets and grow fast that enables farmers earn in a short period. Tilapias mostly consumed locally but are also exported to USA, Europe, and African countries and still available at cheap prices. Therefore, they also contribute to food and nutrition security of the people in developed nations as well. Their mild taste, pleasant smell, firm texture of flesh and boneless white meat are preferred by consumers worldwide. In various parts of the world tilapia is considered poor men's fish as its prices are low. Production costs may vary from less than a US dollar kg^{-1} to US\$2 and are sold normally at US\$1-3/kg of fresh tilapia. In some countries, consumers pay up to US\$7 for a kilo of fresh tilapia. Low price is good as it enables a large number population to afford nutritious food and makes competitive for export. Even the price may be low, but it still contains the same level of protein, minerals and vitamins. Only omega-3 is relatively low but still it can be enhanced through feeding and growing in green water systems. A wide range of culture systems have been used to grow tilapia in cages, ponds, and tanks. Monosex culture has greatly contributed to high volume production. Well-developed hatchery technique has made it possible to produce and supply over a million of monosex fry daily by some hatcheries. Hundreds of such hatcheries have emerged to produce well over a billion fry annually in some countries e.g. Bangladesh and Thailand and support industry. Some of these hatcheries employ over hundreds of staff creating jobs. Over 300,000 farmers grow tilapia in Thailand and perhaps over a million in Bangladesh, China and Indonesia. Tilapia aquaculture is an established business. Various workshops with farm/hatchery managers during training at AIT showed net profits from grow-out and hatchery range from 25% to over 100%. In addition to traditional methods of processing, world-class filleting factories exist which can process hundreds of tons daily. Well-developed markets for tilapia and marketing channels have facilitated accesses to healthy protein for all.

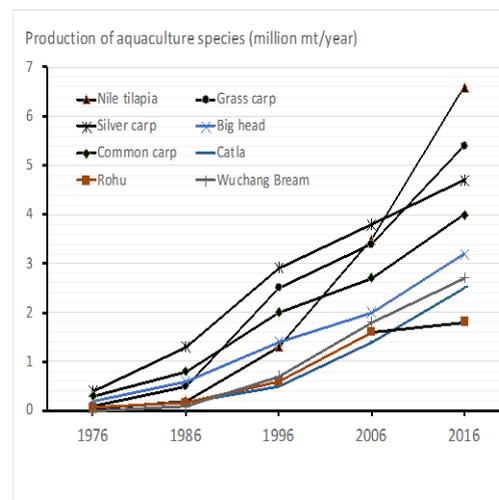


Figure 1 Production trend of some commercially important species

FSB2019-BT-02

Population genetic analysis of mola (*Amblypharyngodon mola*) using partial sequence analysis of mtDNA COI gene

Ummey Kulsum¹, Md. Samsul Alam² and Md. Shahidul Islam¹

¹*Department of Biotechnology, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh;* ²*Department of Fisheries Biology and Genetics, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh*

Correspondence: Md. Shahidul Islam (m.s.islam@bau.edu.bd)

Amblypharyngodon mola is one of the most significant small indigenous fish species of Bangladesh. It is known as living capsule of vitamin A because of its high vitamin A content. In this study, partial sequencing of mitochondrial DNA cytochrome oxidase I (COI) gene of mola (~655bp) was carried out for estimation of the genetic variation in the three populations viz. Khulna, Rangpur and Sunamganj populations. PCR amplification of the mtDNA COI gene from 10 fish of each of the three populations was performed using universal COI (forward) and COI (reverse) primers. Amplified nucleotide sequences had 98-100% sequence homology with COI gene region of *A. mola* mitochondrion complete genome (GenBank Accession number MK070910.1) in nucleotide BLAST search. Nucleotide sequences ranged from 652-675 bp and they were G-deficient (18.8%) compared to other three bases (A- 25.5%, C- 26.5% and T- 29.2%). A total of 21 polymorphic sites were identified in multiple sequence alignment by clustalW of three populations with MK070910.1 as a reference genome; among which 8 were insertion mutation sites. Number of polymorphic sites identified in Khulna, Rangpur and Sunamganj populations were 9, 13 and 1, respectively. Sequence data revealed 4 point mutations with a frequency of 0.04 specific to Khulna populations. The transition mutation rates were 48.28% (AG) and 17.25% (CT), whereas the transversion mutations were 31.04% (CA) and 3.45% (CG). The overall transition and transversion ratio was 1.9:1. In pairwise genetic distance analysis, the distance among the three populations ranged from 0.000 to 0.0014. The overall mean inter-population genetic distance was found to be the highest (0.004) between Khulna and Rangpur populations and the lowest (0.002) between Rangpur and Sunamganj populations. Phylogenetic tree constructed following Neighbor-Joining method showed 2 clusters: 4 samples of Khulna population formed one cluster and the other fish made the second cluster, whereas the second cluster was further segregated into two sub-clusters containing 2 samples of Rangpur population in one sub-cluster. All polymorphic sites, population specific mutations, genetic distances and phylogenetic tree revealed considerable intra- and inter-population genetic variation among the three different populations of *A. mola*.

Keywords: genetic variation, COI gene, population specific mutation, *Amblypharyngodon mola*

FSB2019-BT-03

Genetic diversity in *Pangasius* spp. based on mitochondrial cytochrome b gene sequence analysis

Tran Thi Thuy Ha¹, Tran Thi Nga¹, Md Samsul Alam²

¹*Centre of Aquaculture Biotechnology, Research Institute for Aquaculture No. 1 Dinh Bang-Tu Son-BacNinh, Ha Noi, Viet Nam;* ²*Department of Fisheries Biology and Genetics, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh*

Correspondence: Md Samsul Alam (samsul.alam@bau.edu.bd)

Information on genetic variation in a population is useful to develop plans for sustainable management. Mitochondrial cytochrome *b* (cyt *b*) gene sequences analysis has been found to be a powerful tool for assessing intraspecific genetic diversity of fish and other animals. In order to assess genetic diversity, fin clips of *Pangasius hypophthalmus* of Thailand were collected from five different farms and of Viet Nam origin from three farms. Fin clips of *Pangasius pangasius*, of Bangladesh origin were collected from the Jessore Station of Bangladesh Fisheries Research Institute (BFRI). We analyzed the 408 bp partial fragments of mtDNA cyt *b* gene from a total of 111 individuals of hatchery-bred Thai and Viet Nam *P. hypophthalmus* introduced to Bangladesh and indigenous wild *Pangasius pangasius*. We have detected a low level of genetic diversity in the Thai pangas compared to the Viet Nam pangas as far as haplotype and nucleotide diversities are concerned. On the other hand, we observed a high level of haplotype and nucleotide diversities in Bangladeshi *P. pangasius*. The population differentiation statistic (F_{ST}) between Bangladesh-Thai, Bangladesh-Vietnam and Thai-Vietnam population pairs were significant. The present study revealed that the Thai pangas population experienced expansion in recent past while the Bangladesh and Viet Nam pangas populations might be either subdivided or have passed through a bottleneck situation. The present study proved that the cyt *b* gene sequence is a powerful tool for estimating genetic diversity in *Pangasius* catfish.

Keywords: mtDNA, cytochrome *b*, *Pangasius*, diversity, bottleneck

FSB2019-BT-04

Stock improvement of the GIFT strain by family selection in Bangladesh

AHM Kohinoor, M. Moshiur Rahman, M. K. Rahman

Freshwater Station, Bangladesh Fisheries Research Institute, Mymensingh-2201, Bangladesh

Correspondence: AHM Kohinoor(kohinoor41@gmail.com)

The growing demand for genetically improved tilapia brood stock for quality seed production in the country, Bangladesh Fisheries Research Institute (BFRI) has undertaken a family selection program since 1995 to continue improving genetic quality of the GIFT (Genetically Improved Farmed Tilapia) strain. The aim of the present study was to evaluate growth performance of the Genetically Improved Farmed Tilapia (GIFT) strain after 11 generations of genetic selection for increasing body weight. The founder stock comprised of 30 families having 300 individuals of the GIFT strain from Malaysia in 2005. The brooders (40 females and 40 males) with the highest breeding values in the founder stock were selected to produce progeny of the first generation (G1) in 2007. From each family 20 each male and female fingerling was randomly Passive Integrated Transponder (PIT) tagged and reared in a pond for continuation of the selection program. The same protocol was followed in subsequent generations in 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016 and 2017. General linear model analysis indicated that the selected fish had 7.17, 13.60, 23.21, 30.30, 35.38, 39.25, 43.19, 49.03, 52.82, 56.25 and 58.46% greater harvest weight than that of the offspring of founder population in G1, G2, G3, G4, G5, G6, G7, G8, G9, G10 and G11 generations, respectively. This achievement greatly contributed to sustainable increase of tilapia production in Bangladesh.

Keywords: stock improvement, family selection, GIFT strain, growth performance evaluation

FSB2019-BT-05

Feasibility of utilizing seaweed biomass to produce eco-friendly and cost-effective liquid bio-fuel (CNG) through modern technology: Marine biotechnology can act as a sign of “Blue Economy”

*Ehsanul Karim, Shanur Jahedul Hasan, M Zulfikar Ali, Md. Mohidul Islam, Yahia Mahmud
Bangladesh Fisheries Research Institute (BFRI)
Correspondence: M Zulfikar Ali (zulfikar_bfri@yahoo.com)*

Marine biotechnology can provide an important contribution to satisfy growing need of energy on a global scale in many ways. One of the important marine flora, “seaweeds” offers an unmatched potential for scalability by growing directly on the ocean surface and extracting nutrients from flowing water. Seaweeds have photosynthetic capacity to convert carbohydrates as sugars which can be further converted into alcohol and other fuels by biotechnology. The chemical composition of seaweed biomass is significantly different from land plants containing various types of glucans which are polysaccharides- composed of glucose. Seaweeds are classified into three broad groups based on their pigmentation: i) brown seaweed (Phaeophyceae), ii) red seaweed (Rhodophyceae) and iii) green seaweed (Chlorophyceae). The brown group can contribute to produce laminarin and mannitol; while the red can contribute in ethanol production that is composed of cellulose, glucan and galactan. Thus, the absence of lignin and the low content of cellulose make them a simpler material for bioconversion than land plants. For this reason, new biotechnology will be needed to produce renewable, eco-friendly and cost-effective liquid bio-fuel (CNG). Actually, production of biofuel as well as ethanol from different biomass is not a big approach, but when using some renewable source, it may affect in fuel world. In addition, existing extraction processes are unsatisfactory and inefficient, labor intensive, time consuming and require large amount of organic solvents. Recently, Pressurized liquid extraction (PLE) and Ultrasonic-assisted extraction (UAE) methods has proved economically efficient to extract chemical constituents from plants or herbal materials. However, this effort is mainly related to eco-friendly extraction and also it still needs more innovation before it goes commercially.

Steps of the procedure:

- Collected Seaweed samples will be freeze-dried and kept in desiccators containing silica gel, at room temperature. Biochemical composition (Proteins, carbohydrate, crude lipid, fibre, ash and moisture contents) of seaweeds will be determined according to the standard method and minerals by flame atomic absorption spectrophotometry.
- Several trials will be performed to extract energy through both ways: 1) Energy extraction (dry seaweeds) - direct combustion, pyrolysis and gasification (conventional) & 2) Energy extraction (wet seaweeds) - hydrothermal treatments and anaerobic digestion. Recently developed PLE extractions will be carried out using a Dionex (Sunnyvale, CA, USA) and ultrasound energy will be delivered to the extracting solvent via an ultrasonic cleaning bath.
- Isolation of effective yeast strain will be done for improved fermentation and also marine micro-organism (bacteria) for efficient methanisation. Technique of reducing cationic activity will be followed to optimize salt concentration through anaerobic digester.
- Effective methane fermentation process including hydrolysis, acidogenesis, acetogenesis and methanogenesis will be monitored.
- Initially produced methane and carbon dioxide-mix will be contained in a digester, then stored and finally compressed for liquefied and thus will be used as a transport fuel (i.e. CNG).

Keywords: biotechnology, seaweeds, bio-fuel, pressurized liquid extraction (PLE), ultrasonic-assisted extraction

FSB2019-BT-06

Molecular identification of native and exotic strains of snakehead fish (*Channa striata*) in Bangladesh by mitochondrial gene sequences

Bushratul Jannat, Kaniz Fatema Kanon, Tahsina Sharmin, Mohammad Shafiqul Alam
Department of Genetics and Fish Breeding, Faculty of Fisheries, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur-1706, Bangladesh
Correspondence: Mohammad Shafiqul Alam (msalamjp@gmail.com, msalambd@bsmrau.edu.bd)

The freshwater snakehead *Channa striata*, locally known as ‘Shol’ is extensively distributed across southern Asia, southern China, Indochina, and the Sunda Islands. This native Shol has high commercial value but not included yet in aquaculture in Bangladesh. Recently, Vietnamese Shol was introduced and aquaculture is expanding by some fish hatcheries. However, the present study was conducted to investigate the genetic variations between native and Vietnamese populations of *C. striata* by sequence analysis of mitochondrial *Cytb* gene. A total of 136 samples of native Shol was collected from Rangamati, Sylhet, Patuakhali, Dinajpur, Natore, Kishoregaonj, Netrokona, Mymensingh and Gazipur in Bangladesh and 400 samples of Vietnamese Shol was collected from Biswas Agro Fisheries and Reliance Aqua Farms. As first samples were used for morphometric and meristic examination to confirm samples morphologically. Subsequently, 70 samples from nine native populations and 50 samples from two Vietnamese populations were used for amplification of partial *Cytb* gene (836bp). The sequence result showed five haplotypes from nine populations of native and one haplotype from two populations of Vietnam Shol. The highest haplotype diversity (0.80) was found in Netrokona population and lowest haplotype diversity (0) was found in Rangamati, Natore, Sylhet, Mymensingh and Vietnam populations. The Pair wise, highest *Fst* values (1.0) was observed between native and Vietnam populations, indicating higher genetic differentiation, whereas the values was observed zero in the following population pairs like Rangamati vs. Natore, Rangamati vs. Sylhet, Natore vs. Mymensingh, Natore vs. Gazipur, Sylhet vs. Mymensingh, Sylhet vs. Gazipur, Mymensingh vs. Gazipur and Biswas Viet vs. Reliance Viet. that indicating the lower genetic differentiation of these populations. The preliminary phylogenetic tree with online data separates native Shol populations from Vietnamese Shol strain. Consequently, present findings may be used as a molecular evidence for future identification of native and exotic Shol fish in Bangladesh.

Keywords: snakehead fish, genetic variation, *cytb* gene, Bangladesh

FSB2019-BT-07

Genetic variation of wild populations of endangered catfish *Rita rita* (Hamilton, 1822) revealed by heterologous DNA microsatellite markers

Md. Rafiqul Islam Sarder¹, Muhammad Forhad Ali², Md. Abdus Salam¹, Mohammad Matiur Rahman¹, Md. Fazlul Awal Mollah¹

¹*Department of Fisheries Biology and Genetics, Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh;* ²*Department of Aquaculture, Sheikh Fajilatunnesa Mujib Fisheries College, Melandah, Jamalpur, Bangladesh*

Correspondence: Md. Rafiqul Islam Sarder (rafiqulsarder@yahoo.com)

This study was conducted to assess the genetic variation in the riverine stocks of *Rita rita* which are endangered in Bangladesh. Two hundred individuals of the catfish, 50 from each of the four

rivers, the Old Brahmaputra, Jamuna, Meghna and Kangsa were collected and analysed using five microsatellite primers (*Cba06-KUL*, *Cba08-KUL*, *Cba09-KUL*, *Phy03-KUL* and *Phy07-KUL*). Four of the five amplified loci were found to be polymorphic (P_{95}) in the four studied populations and a total of 46 alleles were recorded with 9 to 14 alleles per locus. The average observed heterozygosity (H_o) value was highest in the Meghna population (0.7550) followed by the Jamuna (0.7000), the Brahmaputra (0.6050) and the Kangsa (0.5700) populations. All the populations significantly deviated ($P < 0.001$) from the Hardy-Weinberg Equilibrium for all the polymorphic loci. Comparatively highest population differentiation (F_{ST} : 0.0168) and lowest gene flow (N_m : 14.6175) were observed between the Jamuna-Kangsa population pair; while the least F_{ST} (0.0071) and uppermost N_m (34.7476) were found between the Jamuna-Meghna populations. The highest genetic distance (0.2563) was observed in the Jamuna-Kangsa population pair compared to other population pairs. The UPGMA dendrogram based on genetic distance resulted in two major clusters. The Jamuna and the Meghna populations formed one cluster and the Old Brahmaputra and Kangsa populations remained in another cluster. The DNA microsatellite analysis revealed a moderate level of genetic diversity, and deficiency in genetic heterogeneity in the populations of *R. rita*, and suggested for natural management, conservation and rehabilitation measures of this species.

Keywords: *Rita rita*, DNA microsatellite, cross species amplification, polymorphism, genetic variation

FSB2019-BT-08

Cryopreservation of sperm of catla (*Catla catla*) and its use in seed production in hatcheries

Md. Arif Hossain^{1,2}, Md. Abdur Rouf², Nigar Sultana¹, Md. Rafiqul Islam Sarder¹, Mohammad Matiuir Rahman¹, Md. FazlulAwal Mollah¹

¹Department of Fisheries Biology and Genetics, Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh; ²Department of Fisheries, Bangladesh

Correspondence: Md. Rafiqul Islam Sarder (rafiquilsarder@yahoo.com)

Experiments were conducted to develop the cryopreservation protocol of *Catla catla* sperm as well as to determine the effects of cryostored sperm on fertilization and hatching of eggs in commercial hatcheries. The physico-chemical parameters of fresh milt were examined to know the sperm biology of the species. It was found that the sperm volume, concentration, pH and motility of the species were 1.02 ± 0.15 μ l/g, $1.42 \pm 0.08 \times 10^{10}$ /ml, 8.00 ± 0.5 and $90.0 \pm 3.0\%$ respectively. The activation of sperm was investigated in different osmolalities (48-319 mOsmol/kg) of NaCl solution. The sperm motility was decreased with the increasing osmolality of NaCl solution and it was completely stopped at 319 mOsmol/kg. The toxicity of the cryoprotectants to sperm was evaluated at 5, 10 and 15% concentrations and best motility was obtained at 10% concentration during 10 min incubation. Three extenders such as Alsever's solution, Urea-egg-yolk and Egg-yolk citrate and two cryoprotectants viz. DMSO and methanol were used to cryopreserve the sperm. Among the different combinations of diluents, the highest post-thaw motility ($83.67 \pm 0.58\%$) was observed from Alsever's solution with 10% DMSO. Sperm preserved for 4 weeks did not show significant decrease in motility ($86.33 \pm 0.58\%$ to $79.33 \pm 1.0\%$) compared to those of fresh ($89.3 \pm 0.58\%$), whereas the motility reduced significantly ($64.67 \pm 1.53\%$) ($P < 0.05$) after 8 weeks of cryostorage. Fertilization rates of eggs inseminated with 4 and 8 weeks-old cryopreserved sperm were $62.7 \pm 3.2\%$ and $57.6 \pm 1.5\%$, closed to that of fresh sperm ($70.6 \pm 3.7\%$ and $67.0 \pm 2.65\%$) ($P > 0.05$) respectively. Hatching rates of 4 and 8 weeks-old cryopreserved sperm-originated embryos ($55.3 \pm 2.5\%$ and $51.6 \pm 2.5\%$ respectively) were also not significantly ($P > 0.05$) different from that of fresh sperm ($62.3 \pm 4.0\%$). This successful fertilization and hatching rates of eggs using cryopreserved sperm of *C. catla* indicates the

development of cryopreservation protocol of the species which can be used in seed production in commercial hatcheries.

Keywords: *Catla catla*, sperm cryopreservation, fertilization, hatching, seed production

FSB2019-BT-09

Production of gynogenetic sex-reversed males (XX) of silver barb, *Barbonymus gonionotus* and growth performance of their all-female progeny

Mohammad Rafiqur Rahman, Rafiul Islam, Ananaya Ahmed Nishat, Md. Rafiqul Islam Sarder
Department of Fisheries Biology and Genetics, Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Correspondence: Md. Rafiqul Islam Sarder (rafiqulsarder@yahoo.com)

The study was carried out to produce meiotic and mitotic gynogenetic sex-reversed males (XX) of silver barb, *Barbonymus gonionotus* and to compare the growth and production of their monosex all-female progeny with mixed-sex progeny. Meiotic and mitotic gynogenesis were initiated by fertilizing eggs with UV treated sperm that denatured the DNA of sperm. The fertilized eggs were heat shocked at 40 °C for 1 min applied after 1.5 min of fertilization for meiotic gynogenesis, and those were heat shocked at 40 °C for 1 min applied after 27.5 min of fertilization for mitotic gynogenesis. Both the meiotic and mitotic gynogens were verified by karyotyping and DNA microsatellite analysis which confirmed the inheritance of maternal alleles in meiotic and mitotic gynogens and no paternal inheritance in any of them. Sexing of fish demonstrated that meiotic and mitotic gynogens were nearly all-female, ranging 98.18 to 100% and 96.43 to 100% female sex respectively. Sex-reversed meiotic and mitotic gynogenetic males (XX) were produced by feeding masculinizing hormone-treated feed (17 α -methyl testosterone @ 30mg/kg of feed) to meiotic and mitotic larvae for a period of 28 days and they are known as neomales. The efficacy of neomales (XX) was verified by progeny testing, i.e. neomales were mated with normal females and the resultant progenies were identified nearly all-female (98.10 to 100% female) upon sexing. The growth performance of progenies of neomales (all-female) were compared with control (mixed-sex) in earthen ponds and a significantly ($p < 0.05$) higher growth was obtained from the all-female progenies. The production (kg ha^{-1}) of all-female progenies ($5027.18 \pm 59.7 \text{ kg ha}^{-1}$) was significantly ($p < 0.05$) higher than that of control ($4094.78 \pm 89.6 \text{ kg ha}^{-1}$), i.e. 22.77% more production was obtained from the all-female progenies. Therefore, the technology for production of sex-reversed males of *B. gonionotus* has been developed through this study and needs to disseminate among the hatchery operators for commercial seed production.

Keywords: *Barbonymus gonionotus*, meiotic and mitotic gynogenesis, sex-reversed males, growth and production

FSB2019-BT-10

Nucleotide sequence and gene organization of the mitochondrial genome of *Labeo rohita*

Rowshan Ara Begum, Moumita Chakraborty, Hawa Jahan, Mohammad Shamimul Alam
Genetics and Molecular Biology Laboratory, Department of Zoology, University of Dhaka, Dhaka, Bangladesh

Correspondence: Rowshan Ara Begum (rowshanbegumdu@yahoo.com)

The complete mitochondrial genome is a circular DNA molecule and contained 16kb which consists of 13 protein coding genes, 22 tRNA genes, 2 rRNA genes and a D-loop region. *Labeo rohita* is one of the most popular fish species and the genomic DNA was extracted using CTAB method. Twenty-four pairs of primers were designed for DNA amplification. The primers were 20-22bp long and melting temperatures (T_m) were 50-55°C. Amplification of DNA fragments were conducted by

polymerase chain reaction and the amplified products were purified for sequencing. Around 80% of the mitochondrial genome was determined successfully and contained 13,123 bp. In total 9 protein coding genes were determined namely ND1, ND2, COI, A8, A6, ND3, ND4L, ND4 and ND6. Out of 22 tRNA genes 19 genes were determined namely tRNA^{val}, tRNA^{Leu}, tRNA^{Ile}, tRNA^{Gln}, tRNA^{Met}, tRNA^{Trp}, tRNA^{Ala}, tRNA^{Asn}, tRNA^{Cys}, tRNA^{Tyr}, tRNA^{Ser}, tRNA^{Asp}, tRNA^{Lys}, tRNA^{Gly}, tRNA^{Arg}, tRNA^{His}, tRNA^{Ser(AGY)}, tRNA^{Leu} and tRNA^{Glu}. Both of the rRNA genes namely, 12S rRNA and 16S rRNA genes, were also determined completely. All of the mentioned tRNA genes were folded into secondary cloverleaf structure except for tRNA^{Ser(AGY)}. The total content and arrangement of the mentioned genes are similar with those of other fish mtDNA. Nucleotide sequence of a D-loop region and few tRNA and protein coding genes were not determined yet. This nucleotide sequence data of mitochondrial genome of *Labeo rohita* is the first so far to be done in Bangladesh and the data would provide necessary information for further studies including population genetics, toxicological study and phylogenetics of carp fishes.

Keywords: protein coding gene, phylogenetic study, ribosomal DNA

FSB2019-BT-11

Smart production of biofuel and bioelectricity through culture of spirulina (*Spirulina platensis*) in supernatant of digested rotten potato (*Solanum tuberosum*)

M. Al-Amin¹, M. Sazzad Hossain¹, Saleha Khan², M. Ahsan Bin Habib¹

¹Department of Aquaculture, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh;

²Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Correspondence: M. Ahsan Bin Habib (ahsanmphd@yahoo.com)

An experiment was conducted to evaluate culture and growth performance of spirulina (*Spirulina platensis*) in supernatant of three different amount of digested rotten potato (DRP), and Kosaric medium (KM) as control. Three different concentrations such as 20, 40 and 60% of DRP were digested under aeration and the reddish white coloured supernatant was collected. Spirulina was inoculated in supernatant of DRP with the addition of 9.0 g/L NaHCO₃ and micronutrients, and KM for a period of 14 days. The cell weight of spirulina was attained a maximum of 12.42 ± 0.21 mg/L in KM followed by 8.35 ± 0.21, 6.26 ± 2.34 and 9.51 ± 0.43 mg/L in supernatant of 40, 20 and 60% DRP, respectively on the 10th day of culture. Similar trend was also observed in the cases of optical density, chlorophyll *a*, total biomass, specific growth rates, light intensity, temperature, pH, dissolved oxygen, salinity and electric conductivity of spirulina. Cell weight of spirulina grown in these media had highly significant (p<0.01) correlation with the chlorophyll *a* content and total biomass. The growth performance of spirulina grown in supernatant of 60% DRP was significantly higher than that of spirulina grown in supernatant of 20 and 40% DRP. The percentage of crude protein (55.15%) of spirulina grown in supernatant of DRP was little bit lower than that of spirulina cultured in KM (58.70%). The crude lipids (17.15%) of spirulina cultured in supernatant of 60% DRP was almost two and half times higher than that of spirulina grown in KM (6.33%). So biofuel from lipids should be produced high from spirulina cultured in supernatant of 60% DRP. Production of dissolved O₂ and readings of electric conductivity in culture media of spirulina were the indication for production of bioelectricity where dissolved O₂ was produced high on 14th day of culture and the same of EC was high on 10th day of culture. Large scale production of biofuel from lipids and bioelectricity may be done from the culture of spirulina in supernatant of digested rotten agro-products. This spirulina may be used to produce fish feed replacing fish meal because spirulina contains protein equal of higher than fish meal.

Keywords: *Spirulina*, rotten potato, supernatant, waste

Day 1: 27 December 2019

**Technical Session 5:
Emerging Fish Diseases**

KEYNOTE PAPER

Fish disease challenges and health management strategies in aquaculture of Bangladesh

Prof. Dr. Md. Ali Reza Faruk

*Department of Aquaculture, Bangladesh Agricultural University,
Mymensingh-2202, Bangladesh*

Correspondence: hasin96@yahoo.com; faruk.mar@bau.edu.bd

Biography

Dr. Md. Ali Reza Faruk is a Professor at the Department of Aquaculture, Bangladesh Agricultural University, Bangladesh. He obtained his PhD in Fish Disease and Immunology from the University of Stirling, UK and post-doc in Molecular Mycology from the University of Aberdeen, UK. He was the head of the Department of Aquaculture, BAU and was a recognised teacher at the University of Stirling, UK for a master's programme in Aquatic Resource Development by distance learning. He has been working on fish disease and health management over 20 years and involved in a variety of research projects funded by different national and international organizations.

Abstract

Aquaculture in Bangladesh is under heavy expansion and gradually heading towards intensification. The country has made a tremendous breakthrough in aquaculture production through securing 56.24 % contribution to the total fish production during 2011-18 and has emerged as the 5th highest aquaculture fish producing county in the World. Bangladesh contributed 2.8% in world total aquaculture production in 2016. A major challenge to the intensification of aquaculture production is the outbreak of diseases. Fish disease problems constitute the largest single cause of economic losses in aquaculture and according to World Bank data, a global estimate of disease losses to aquaculture is over US\$ 6 billion per annum. A range of diseases including epizootic ulcerative syndrome (EUS), motile aeromonas septicemia (MAS), edwardsiellosis, streptococcosis, saprolegniasis, tail and fin rot and argulosis are common in freshwater aquaculture of Bangladesh. Coastal shrimp farming has also been suffering from white spot syndrome (WSS), black gill and soft shell diseases. Recently, tilapia lake virus (TiLV) and acute hepatopancreatic necrosis disease (AHPND) in cultured shrimp have emerged as new problems that severely put the global tilapia and shrimp industry including Bangladesh at a risk. There is lack of regular disease surveillance and quarantine of aquatic animals in Bangladesh. Also, there is no disease diagnostic laboratory and adequate fish health professional to support aqua farmers for accurate disease diagnosis and treatment. Farmers generally use a range drugs indiscriminately to control fish diseases without knowing their proper applications. Thus, the problems of diseases, the huge losses in productivity that are incurred and the inappropriate use of unlicensed drugs are the largest factors preventing Bangladesh from producing high quality safe aquatic products for consumption by home and foreign markets. This paper highlights major disease challenges and suggests health management strategies for sustainable aquaculture production in Bangladesh.

FSB2019-DIS-01

Zebrafish as a model for aquaculture vaccines

Ishrat Zahan Anka^{1,3}, Pantelis Katharios², M. Pavlidis¹

¹University of Crete, Department of Biology, Greece; ²Hellenic Centre for Marine Research, Institute of Marine Biology, Biotechnology and Aquaculture, Greece; ³Chattogram Veterinary and Animal Sciences University, Chattogram-4225, Bangladesh
Correspondence: Ishrat Zahan Anka (ishratanka@gmail.com)

Disease incidence and reduced survival caused by *Aeromonas veroniibv. sobria* have been reported recently in farmed European seabass (*Dicentrarchus labrax*). Vaccination has been proposed as an effective prevention to overcome this problem. However, research on vaccine efficacy in seabass under laboratory conditions has several limitations. Therefore, zebrafish (*Danio rerio*) was selected in this study as a model organism to assess the efficacy of three adjuvanted (Montanide™ ISA 763) and autogenous vaccines of *A. veronii* (Vaccine 1 - NS, Vaccine 2 - PDB and Vaccine 3 - 5.28.6). Intraperitoneal injection was performed at a dose of 10 µL/fish (N = 50) for the vaccines and control-adjuvant groups. Vaccine efficacy was assessed through subsequent challenge tests (N = 12, 10 µL/fish) using NS, PDB, 50 A and NS 2 strains (total count - 10⁷ cfu mL⁻¹ each). In terms of survival and immunity, vaccinated fish were compared with non-vaccinated (control-adjuvant and control-naive) groups. All three tested vaccines showed high efficacy against different challenge strains. High survival has been resulted in NS (100%), PDB (100%) and NS 2 (91.67%) trial from Vaccine 3. However, 50 A strain was classified as non-virulent for zebrafish. Cumulative mortality from control-naive groups was found to be higher than that of vaccines in NS (66.67%), PDB (41.67%) and NS 2 (58.33%) challenge. Vaccine 3 has been reported with the highest (100%) relative percentage survival (RPS) against NS, PDB and 50 A. Vaccine 1 and Vaccine 3 revealed high RPS (85.71%) in NS 2 challenge, whereas the lowest RPS (14.29%) was recorded in the control-adjuvant group. Vaccine efficacy testing has been proven as a successful screening tool, using zebrafish as a model organism for aquaculture. It would be very useful to conduct further research regarding the impact of the tested vaccines and adjuvant on fish health in long run.

Keywords: *Aeromonas veroniibv. sobria*, zebrafish, vaccine

FSB2019-DIS-02

Virulence-associated genes of *Aeromonas veronii* causing motile *Aeromonas* septicemia and bio-control of the disease by application of native probiotic bacteria and herbal extracts

Md. Mahbubur Rahman¹, Md. Javed Foysal², Hammadul Hoque², Sulav Indra Paul¹, Tomoo Sawabe³

¹Fisheries Biotechnology Discipline, Institute of Biotechnology and Genetic Engineering, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur-1706, Bangladesh; ²Department of Genetic Engineering and Biotechnology, Shahjalal University of Science and Technology, Sylhet-3114, Bangladesh; ³Laboratory of Microbiology, Graduate School of Fisheries, Hokkaido University, 3-1-1 Minato-Cho, Hakodate, Hokkaido, Japan
Correspondence: Md. Mahbubur Rahman (mahbub-biotech@bsmrau.edu.bd)

Motile species of Aeromonads causes *Aeromonas* septicemia which is one of the most devastating pathogens in aquaculture. The virulence genes associated with the MAS in carp fish in Bangladesh is yet to be known. The objectives of present study were to (i) assess virulence of the different *Aeromonas veronii* isolates; (ii) detect major putative virulence associated genes in *A.*

veronii; and (iv) develop bio-control measures of the MAS in carp fish. Thirty three isolates were collected from MAS infected fishes and identified as *A. veronii* through *Aeromonas* species specific PCR-RFLP method. The aerolysin, hemolysin (1, 2 and 3), nuclease, lipase, serine protease and metalloprotease (elastase) genes were detected by the aid of polymerase chain reaction. Among these, aerolysin, hemolysin-3, elastase, lipase, serine protease and nuclease genes were detected in 25, 19, 17, 135 and 4 isolates, respectively. Artificial infection challenge test revealed that 18 and 5 isolates are high and moderate virulent while two type strains are low virulent. Virulence of the pathogens seemed multigenic. However, a strong correlation was found between high virulence of the isolates with the presence of a combination of aerolysin and serine protease; aerolysin, hemolysin-3 and serine protease or aerolysin and hemolysin-3 genes in the *A. veronii*. Moderate and low to moderate virulent isolates hold either aerolysin or hemolysin-3 genes but, the low and avirulent isolates contained either of the two genes. The *A. veronii* isolates were multiple antibiotic resistant. A marine isolate of *Bacillus subtilis* exhibited inhibitory effects against most of the isolates and successfully prevented the infection in fish in *in vivo* artificial infection test by a virulent strain. A total of 120 aqueous and methanol extracts of herbs were tested, among these, leaves of *Embllica officinalis* and buds of *Syzygium aromaticum* exhibited moderate to strong antibacterial activity against the isolates and recovered 100% and 80% of artificially infected fish by a high virulent *A. veronii* isolate.

Keywords: motile *Aeromonas septicaemia*, *Aeromonas veronii*, aerolysin, hemolysin, bio-control

FSB2019-DIS-03

Molecular identification, putative virulence gene detection and antibiogram profile of the pathogens causing Streptococcosis in *Barbodes gonionotus*

Rakib Ehsan, Md. Mahbubur Rahman

Fisheries Institute of Biotechnology and Genetic Engineering (IBGE), Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur-1706, Bangladesh

Correspondence: Md. Mahbubur Rahman (mahbub-biotech@bsmrau.edu.bd)

Streptococcosis is one of the most prominent diseases that cause severe economic losses in freshwater and marine fishes all over the world. In Bangladesh, the disease is suspected to be present in *Barbodes gonionotus* along with Tilapia. But, no studies have yet been reported regarding its existence in the country. Bacteria belong to the genera *Streptococcus*, *Enterococcus*, *Lactococcus*, etc. are reported as the causative agents of the disease. From culturing the suspected sample in KF media, a total of 47 isolates were randomly selected for initial phenotypic identification, where 17 isolates were identified as *Enterococcus* sp. To confirm the pathogenic potential of the isolates, three randomly selected isolates (PS-1, PS-3, PS-6) and three laboratory isolates (S-20, S-22, S-38) of *Enterococcus* sp. were used for artificial infection challenge test in *B. gonionotus* and *Oreochromis niloticus* where, all but one isolate exhibited moderate to high virulence in fish. Based on 16S rRNA gene sequence analysis five out of six isolates exhibited 99~100% sequence homology with *Enterococcus faecalis*. The other isolate was identified as *E. hirae*. PCR amplification was done by using specific primers for detection of five virulence genes *viz.*, *esp*, *cyl*, *agg*, *hyl* and *gel*, where the *esp* gene was found in all of *E. faecalis* isolates. Eleven commercial antibiotic discs were used to determine the antibiogram profile of *E. faecalis* by disk diffusion assay where all of *E. faecalis* isolates were found resistant to multiple antibiotics specifically, amoxicillin, ampicillin, cefradine, cefuroxime, erythromycin, and penicillin-G. These results provide information for understanding the mechanism of the pathogenicity and treatment measure against the disease.

Keywords: streptooccosis, *Enterococcus faecalis*, *E. hirae*, antibiogram profile, *esp* gene
FSB2019-DIS-05

Genetic variations, virulence and toxicity of AHPND-positive *Vibrio parahaemolyticus* in *Penaeus monodon*

Md. Mer Mosharraf Hossain¹, Md. Imtiaz Uddin², Habiba Islam¹, Jannatul Fardoush¹, Md. Ariful Haque Rupom¹, Md. Monjur Hossain², Nawshin Farjana¹, Rukaiya Afroz¹, Hasan-Uj-Jaman³, Hironmoy Sovon Roy⁴ and Md. Anisur Rahman¹

¹Department of Fisheries and Marine Bioscience, Jashore University of Science and Technology, Jashore-7408, Bangladesh; ²Biotechnology Division, Bangladesh Institute of Nuclear Agriculture, Mymensingh-2202, Bangladesh; ³PCF Feed Industries Ltd. Bagherhat, Khulna; ⁴CP Bangladesh Ltd, Dhaka, Bangladesh

Correspondence: Md. Mer Mosharraf Hossain (mmm.hossain@just.edu.bd)

Acute hepatopancreatic necrosis disease (AHPND) is an emerging shrimp (*Penaeus monodon*) disease caused by *Vibrio parahaemolyticus* (VP). Since its first outbreak in 2013, this disease has caused serious economic losses in the aquaculture industry of Bangladesh. In the present study, all samples were subjected to PCR in the presence of VP by using highly conserved, species-specific genetic markers, namely, 16SrRNA, *bla*CARB-17 and *atpA*, as detection targets. Primers used for the expression of virulence and toxicity genes *toxR*, *pirA* (AP3), *toxA*, *tlh*, *tdh* and *trh* of AHPND-positive *P. monodon* outbreaks in Bangladesh remained unclear. The sequence of PCR amplicons of 23 among the 30 suspected isolates showed 100% identity and significant alignment with *V. parahaemolyticus*. The primers confirmed that 6 among the 23 isolates (ahpn-3, ahpn-8, ahpn-15, ahpn-20, ahpn-25 and ahpn-30) contained *toxR*, 16SrRNA, AP1, AP2, *pirA* (AP3), *toxA*, *bla*CARB-17, *tlh*, *atpA*, *tdh* and *trh* genes. The *tox*, 16SrRNA, *pirA*, *bla*CARB-17 and *tlh* genes yielded 100% specificity in *V. parahaemolyticus* compared with another *Vibrio* species. In the amplification of the target genes using AHPND-positive representative ahpn-25 strain, 1% agarose gel provided positive amplicons, whereas non-AHPND isolates ahpn-2 provided no amplicons. The sequence of target genes in neighbour-joining methods showed phylogenetic relationships with closely related sequences from GenBank, indicating that all genes evolved from a common ancestor and clades have different traits with very low genetic distance. The amplified sequences of target genes aligned with the reference strain with low variability. The *atpA* gene showed high homology and 100% pairwise alignment, and the scores of *atpA*, *tox*, *bla*CARB, 16sRNA and *pirA* genes are 100.0, 98.90, 98.89, 95.53 and 41.42, respectively. Variations included a missing nucleotide position in the sequence of target genes because of the deletion or insertion of amino acids in the presence of a conserved domain protein. RT-qPCR exposed variable expression levels of *toxR*, 16SrRNA, *pirA* (AP3), *toxA*, *bla*CARB-17, *tlh*, *atpA*, *tdh* and *trh* in AHPND-positive strain. In homology analysis, species-specific genes *atpA*, *bla*CARB-17 and 16SrRNA exhibited the lowest similarity and most divergence, offering the highest specificity for detecting *V. parahaemolyticus*. The homology distance matrix revealed the highest distance for virulence and the divergence of toxicity genes *trh*, *tdh* and *trh*, resulting in the highest specificity for identifying *V. parahaemolyticus*. In this study, the expression and variability of target genes may lead to subsequent vaccine research for AHPND in *P. monodon*.

Keywords: genetic variations, virulence and toxic gene, *Penaeus monodon*, *Vibrio parahaemolyticus*, acute hepatopancreatic necrosis disease (AHPND)

FSB2019-DIS-06

Molecular detection of tilapia lake virus (TiLV) in farmed mono-sex Nile tilapia (*Tilapia niloticus*) in Bangladesh

Md. Mer Mosharraf Hossain¹, Md. Imtiaz Uddin², Md. Monjur Hossain², Habiba Islam¹, Al-Amin¹, Nawshin Farjana¹, Rukaiya Afroz¹

¹Department of Fisheries and Marine Bioscience, Jashore University of Science and Technology, Jashore-7408, Bangladesh; ²Biotechnology Division, Bangladesh Institute of Nuclear Agriculture, Mymensingh-2202, Bangladesh

Correspondence: Md. Mer Mosharraf Hossain (mmm.hossain@just.edu.bd)

Tilapia lake virus (TiLV) has recently been remarked as an emerging infectious agent that may threaten by mass die-offs in farmed mono-sex Nile tilapia (*Tilapia niloticus*) in Bangladesh. Its indicates urgently requires a stable and rapid diagnostic assays. The research aims to the detection of TiLV followed by complementary techniques of PCR based approaches such as reverse-transcription polymerase chain reaction (RT-PCR), and RT-quantitative (q)PCR using SYBR green I dye. The etiological agent of this disease, a novel RNA virus, was reported and procedures allowing its clinical signs lethargy, skin erosion, exophthalmia, detached scales with 15 to 82% morbidity rate were revealed. The RNA quantification, followed by a PCR protocol entailing, complementary deoxyribonucleic acid (cDNA) synthesis and detection of TiLV by either conventional PCR or quantitative identification via qPCR using SYBR green I dye. The virus was detected in nine cDNA sample derived from the liver of diseased tilapia using a diagnostic RT-PCR amplified a 491-bp fragment of segment 3. Additionally, 6 RNA samples obtained from the head kidney of diseased tilapia amplified a 491-bp fragment from segment 3. The standard curve and ten ten-fold serial dilutions method were applied to determine a PCR amplification efficiency of 98.5% over a wide linear range of 2.98×10^1 to 2.98×10^{10} TiLV copies, while the NTC (no template control) produced no fluorescence and therefore no amplification. The amplified PCR products of the target genes of one TiLV-positive strain was sequenced received 100%, 98% and 97% identity. The phylogenetic relationship of seventeen TiLV sequences was chosen to compare from GeneBank resulting a common ancestor while closely related with Columbia, India, Malaysia and Thailand. The highest pair-wise alignment score was received 90.20 for MH338228.1 (Columbia), 85.57 for MF582636.1 (India), 85.30 for MH213048.1 (Malaysia), and 86.93 for MH213039.1 (Thailand) using the sequence of TiLV segments of one TiLV-positive strain. The mono-sex Nile tilapia was infected with common fish pathogens, such as *Aeromonas* and *Streptococcus*. This newly developed SYBR green-based RT-qPCR assay can be an essential tool for TiLV diagnostics and should help to control the dissemination of this virus worldwide.

Keywords: tilapia lake virus (TiLV), Nile tilapia, *Tilapia niloticus*, PCR, RT-PCR and RT-qPCR

FSB2019-DIS-07

Status of bacterial diseases in two different species of cultured fin fishes (Shing and V. Koi) of Mymensingh region, Bangladesh

Md. Ashikur Rahman¹, Shirin Akter², Md. Khalilur Rahman¹, Yahia Mahmud¹, Md. Alimul Islam³

¹Bangladesh Fisheries Research Institute, Mymensingh-2201, Bangladesh; ²Department of Fisheries and Marine Bioscience, Bangabandhu Sheikh MujiburRahman Science and Technology University; Gopalganj-8100, Bangladesh; ³Department of Microbiology, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Correspondence: Md. Ashikur Rahman (apu.m1989@gmail.com)

In Bangladesh, bacteria are known as the major causative agents of most infectious diseases for cultured fin fishes. In the present study, we tried to investigate the presence of pathogenic bacteria which are responsible for mass mortality and morbidity of Shing (*Heteropneustes fossilis*) and Vietnamese Koi (*Anabas testudineus*) fishes over six months period from July to December 2017 in the infected ponds of Mymensingh Region. The clinical symptoms manifested by the diseased Shing fish were loss of equilibrium, grayish white spot slight lesion on body, erosion on the body and tail, hemorrhage in the base of fin and edge of head, move with whirling. In the case of Koi fish, they showed sluggish movement, loss of appetite, spinning, scale loss, eye protrusion & opaqueness, swollen abdomen and hemorrhages at the base of fins & in opercula. The bacteria as causative agents were isolated from different organs (ulcerative body lesion, liver and kidney) of the diseased (dead and infected) fishes of both the species using selective media and the pathogens were identified by morphological, cultural and various biochemical tests. The isolated bacterial populations were *Aeromonas* and *Streptococcus* spp. from different organs of both the species of infected cultured fishes. Bacterial load of the body lesion varied from 7.1×10^5 CFU/g to 8.9×10^7 CFU/g and 2.9×10^6 CFU/g to 9.4×10^7 CFU/g for Shing and Koi respectively. On the other hand, their load in the liver and kidney in the Shing ranged from 1.8×10^3 CFU/g to 5.7×10^4 CFU/g and 5.3×10^3 to 8.9×10^4 CFU/g whereas for Koi fish their load was 3.3×10^3 CFU/g to 8.2×10^4 and 4.9×10^3 CFU/g to 3.1×10^4 CFU/g respectively. Findings of the present study clearly indicated that the causative agents of the dead and infected cultured Shing and Koi fishes of Mymensingh region was bacteria.

Keywords: disease, bacterial infestation, bacterial load, Shing, Vietnamese Koi

FSB2019-DIS-08

Comparative study of bacterial association of *Tenualosa ilisha* and *Pangasius pangasius* of Padma River in Mawa, Bangladesh

M. Mamnur Rashid, Kamrun Naher Azad, S. M. Mehrab Hossain

Department of Aquaculture, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh
Correspondence: Kamrun Naher Azad (kamrunnaherkeya003@gmail.com)

A study was conducted to determine and compare the bacterial load and association of bacterial species in ilish *Tenualosa ilisha* and pangas *Pangasius pangasius* of Padma River. The samples were collected from Padma river of Sreenagar in Munshigonj from February to August, 2018. Through bacteriological analysis in Microbiology laboratory, Total viable counts (TVC) and the prevalence of the isolated bacteria were determined. Results revealed that the mean Log value of CFU/g of bacteria in gill was 6.739 and 7.232, kidney was 6.659 and 7.800, liver was 6.676 and 6.758, intestine was 7.725 and 7.653, and in spleen was 6.659 and 7.481 in pangas and ilish respectively. The highest bacterial load, 7.384 log cfu/g was observed in ilish and the lowest bacterial load, 6.891 log cfu/g in pangas. *Escherichia coli*, *Salmonella* and *Vibrio* bacteria were isolated. Colonies of them showed different morphological characteristics in different media. *E. coli* colonies were found large, thick, grayish, white, moist, smooth and translucent in MS agar. *Salmonella* colonies were black, opaque, smooth and round in XLD agar and *Vibrio* colonies were yellow in TCBS agar. All of them were gram (-) and motile. All the isolated bacteria grew at 37°C temperature and showed good growth containing 0-3% NaCl. Biochemical tests showed that all bacteria were catalase positive, fermented dextrose, maltose and mannose. Lactose fermentation was positive in *E. coli*, not in *Salmonella* and *Vibrio*. Sucrose fermentation was positive in *E. coli* and *Vibrio*, not in *Salmonella*. All isolated bacteria were positive in MR test, negative in VP test. However, the findings indicated that the prevalence of all types of observed bacteria was lower in pangas than ilish. In addition, the bacterial load complied with ICMSF

(International Commission on Microbiological Specification for Foods) standard for both of the ilish and pangas samples.

Keywords: bacteria, *Tenualosa ilisha*, *Pangasius pangasius*, compare, Padma River

FSB2019-DIS-09

Constraints of health management of commercially cultured high value fishes

K.M. Abdul Halim, Md. Nawshad Ali, Md. Ali Reza Faruk

Department of Aquaculture, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh
Correspondence: K.M. Abdul Halim (halimdof@gmail.com)

A study was carried out to understand the constraints of health management of commercially cultured high value fishes including gulsha (*Mystus cavasius*), shing (*Heteropneustes fossilis*) and koi (*Anabas testudineus*). One hundred farmers were interviewed through structured questionnaire in Mymensingh and Jessore districts. Most of the farmers practiced polyculture of gulsha with shing and monoculture of koi with high densities. It was found that all the three species suffered from a number of diseases. Most prevalent clinical signs of diseases were ulcerative hemorrhagic lesion, white spot, red spot, ventral and mouth reddening and fin rot. The most susceptible species to disease was shing with a higher average mortality of 43.33% followed by gulsha (36.71%) and koi (38.76%). Mortality was found higher with gulsha and shing in Mymensingh and with koi in Jessore. The present study also identified some risk factors associated with such diseases. Diagnosis of disease was the single most important constraints of health management followed by lack of farmer's knowledge on fish health and diseases, presence of huge number of poor quality medicine, ineffectiveness and indiscriminate use of such medicine, lack of farmer's ability on application of medicine and absence of qualified fish health adviser. Lack of good quality fish seed, feed and water were identified as the main resource problems associated with fish health management. The study also identified a number of general constraints of farming of high value fish which included low price of fish, higher feed cost, and outbreak of diseases, high land tax, electricity bill and marketing problem. Further studies should focus on the development of strategies for better health management practices of commercially cultured high value fishes.

Keywords: constraints, health management, high value fishes

FSB2019-DIS-10

Gut microbiota and hematological analysis of stinging catfish (*Heteropneustes fossilis*) cultured under different probiotic supplementation

Md. Abdullah Al Mahamud, Rejowana Alam, MT. Nur- A- Sharmin Aktar, Ashikur Rahman, Md. Umor Khoiam, Tamanna Tabassum, Rassidul Hassan, Tanvir Rahman, Gias Uddin Ahmed
Department of Aquaculture, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh
Correspondence: Tanvir Rahman (tanvir.nishi@gmail.com)

The present study was conducted to determine the effects of probiotics on gut microbiota and hematological parameters of the stinging catfish (*Heteropneustes fossilis*) reared under different probiotic supplementations. The experiment was carried out with five treatments of earthen ponds having three replications (each pond is 0.75 decimal), contained 413 fish/ pond. Feeding trials were performed for 90 days. The experimental designs were, basal feed + Soil probiotic (T₁), feed + gut probiotic and starch (T₂), feed with gut + soil probiotics, water additive probiotic + rice

starch (T₃), water additive for (T₄) and T₅ for control. Gut probiotic added with feed and introduced in the pond twice a day. Water quality parameters *e.g.*, dissolved oxygen (DO) (mg/L), water temperature (°C), pH and free ammonia (NH₃) were monitored fortnightly. Average gut bacterial loads were determined using trypton soya agar (TSA) and deMan, Rogosa and Sharpe (MRS) agar media in duplicate. After exposure to probiotics, fish were sacrificed at 0, 30, 45, 60, 75 and 90 days randomly from each treatment. Hemoglobin levels (g/dL) were ranged from 1.90±1.0 to 3.6± 0.28 and highest was found in T₃. Blood glucose levels were highest in T₃ and lowest in T₁. RBC values were ranged from 0.65±0.25 to 3.55±1.89 and highest in T₄ and the lowest was in T₃. The highest average WBC was reported in T₁ and lowest in T₃. In addition, the highest mean corpuscular hemoglobin (MCH) was observed in T₄ and the lowest in T₂. All the water quality parameters were favorable for *H. fossilis* culture. The highest average gut bacterial load on TSA media was found as 1.95× 10⁶ CFU/mL in T₂ but the highest average gut bacterial load on MRS media was found in T₃ as 8.85× 10⁴ CFU/mL. Incorporation of probiotics modified hematological parameters and gut bacterial load of *H. fossilis* and hence, it could be recommended as an eco-friendly health management approach in the catfish farming.

Keywords: probiotic, hematology, gut bacteriology, *Heteropneustes fossilis*

Day 2: 28 December 2019

**Technical Session 6:
Advances in Aquaculture**

KEYNOTE PAPER

Snakehead fish, haruan (*Channa striata*): Emerging potential for nutraceutical, active pharmaceutical ingredient (API) and biomedical applications

Prof. Dr. Abdull Manan Mat Jais¹

Prof. Dr. M. Aminur Rahman²

¹*Abmanan Biomedical Sdnbhd, Lot 38, Arked MARA*

Kajang, JalanReko, 43000 Kajang, Selangor, Malaysia;

²*Department of Fisheries and Marine Bioscience, Faculty of*

Biological Science and Technology, Jashore University of Science and Technology,

Jashore-7408, Bangladesh

Correspondence: Abdull Manan Mat Jais (abdullmanan_matjais@yahoo.com)

Abstract

Striped snakehead, *Channa striata* (Bloch, 1793), locally known as Haruan, is one of the eight species of the family Channidae, and is found in Malaysia together with giant-snakehead or Toman (*C. micropeltes*), Bujok (*C. Lucius*) and black-Haruan or Haruan-hitam (*C. melanosome*). It is considered as one of the prominent fish among 614 freshwater species in Malaysia. Haruan is a good source of protein, game to anglers and more interestingly is an oral traditional medicine inducing quick recovery for ladies after giving birth to children through surgical operations. The species is indigenous based on Restriction Fragment Length Polymorphism (RFLP) where six-nucleotide sequences with accession no JF826031 - JF 826036 as marker has been deposited in GenBank. It always inhabits clean warm, shallow stagnant or slow-running water with aquatic-flora or dead-wood as hiding/resting place and ambushing preys. The fish is hardy and can be able to tolerate adverse environments, survive long drought either by boring into mud or crawling out to preferable water-body as long as skin and breathing apparatus remain moist. This comprehensive environmental and physiological data is established through a drug discovery R & D since 1985, and to be translated into farming, ensuring a sustainable commercial scale aquaculture complying International Union for Conservation of Nature (IUCN) and Convention on International Trade in Endangered Species (CITES). Haruan is having a unique biochemistry for being carnivorous, consuming other fishes, amphibian, reptiles and aquatic birds; containing high-protein ($\geq 60\%$), low-fat ($\leq 3\%$) and comprehensive dietary minerals. It has a good amino acid profile with high in Glycine and fatty acid with Ω -6 (Arachidonic Acid), Ω -3 (Docosahexaenoic Acid or DHA), albumin and cyclic-peptide N-arachidonylglycine @ NAGly. Accordingly, a proprietary standard operating procedure (SOP) technology had been established, and successfully performed to extracting the biochemistry through a Pressurized In-Water Extraction (PIWE), and the extract is termed as HaruanManan (HM). The actual protocol is a trade-secret, and HM is bioactive key ingredient in every Haruan Biomedical Product (HBP), inducing wound-healing, reducing-pain, treating inflammation and inhibiting growth of pathogenic bacteria (including *Staphylococcus aureus* and *Helicobacter pylori*), as well as containing the four physiological steps to healing, curing and treating damage, injury, ulcer, cancer, disorder, malfunction, dysfunction and diseases. HM is a signature, an Active Pharmaceutical Ingredient (API). It is here to discussing, demonstrating and high-lighting the potential of Haruan as functional-food, nutraceutical and API.

Keywords: snakehead, *Channa striata*, biology, aquaculture, medicinal properties biomedical products, Nutraceuticals

FSB2019-AQ-01

Supplementation of zinc in diet enhance growth performances and bone mineralization of stinging catfish *Heteropneustes fossilis*

Muslima Akter Lima¹, Md. Amzad Hossain¹, Taslima Akter¹, Md. Mahbubur Rahman²

¹Department of Aquaculture, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur-1706, Bangladesh; ²Institute of Biotechnology and Genetic Engineering, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur-1706, Bangladesh
Correspondence: Md. Amzad Hossain (amzad@bsmrau.edu.bd)

A growth study was conducted to determine the dietary zinc (Zn) requirement of the stinging catfish, *Heteropneustes fossilis* fingerlings. Purified diets with five levels of supplemental Zn (0, 10, 20, 30 and 40 mg kg⁻¹ diet in the form of zinc sulfate, ZnSO₄) were fed to *H. fossilis* for 10 weeks. Each diet was fed to three replicate groups of fish. Water temperature, dissolved oxygen, and pH were within suitable range of for *H. fossilis* culture. Results indicated that the highest ($P < 0.05$) weight gain was for the fish fed the diet supplemented with 30 mg Zn kg⁻¹, followed by fish fed the diets with 40, 20 and 10 mg Zn kg⁻¹, and the lowest in fish fed the Zn unsupplemented control diet. Higher specific growth rate and lower feed conversion ratio were also found in fish fed diet with 30 mg Zn kg⁻¹. Bone, muscle mineralization was all affected significantly ($P < 0.05$) by dietary Zn levels. Zn contents in bone, muscle was linearly increased up to the 30 mg kg⁻¹ dietary Zn and then remained stable beyond this level. Blood parameters were independent of dietary Zn supplementation except serum alkaline phosphate, which increased with dietary Zn supplementation and attained maximum at 30 mg kg⁻¹ dietary Zn level. It was concluded that a dietary supplementation of 30 mg Zn kg⁻¹ is suitable for growth, feed utilization, hematological characteristics and maintaining bone Zn level in *H. fossilis*.

Keywords: zinc requirement, *Heteropneustes fossilis*, growth, bone mineralization

FSB2019-AQ-02

Growth performance and survival of stinging catfish (*Heteropneustes fossilis*) cultured under different probiotic supplementations

Md. Umor Khoiam, Rejowana Alam, Md. Abdullah Al Mahamud, Fahmida Akter, MT. Nur- A-Sharmin Aktar, Ashikur Rahman, Drubo Mustofa Evan, Rassidul Hassan, Tanvir Rahman, Gias Uddin Ahmed

Department of Aquaculture, Bangladesh Agricultural University, Mymensingh 2202, Bangladesh
Correspondence: Tanvir Rahman (tanvir.nishi@gmail.com)

A 90-days long feeding trial was conducted to determine the effects of probiotic supplementations on the growth performance and survival of stinging catfish, *Heteropneustes fossilis*. The experiment was designed using 15 earthen ponds (0.75 decimal each) located besides the Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh. Healthy 413 fingerlings (6.41±0.05 g) were released in each pond. No feed was given for 72 hours for initial conditioning. Commercially available gut probiotic - Mutagen, water additive probiotic - pH FIXER and soil probiotic - Super PS were used in the experiment where Mutagen was added with commercial feed (SMS, Bangladesh) and introduced in the pond twice a day at the rate of 10-5% of their body weight. Based on the recommended dose, Super PS and pH fixer was applied on weekly basis. Basal feed + Super PS was designed as treatment 1 (T₁), feed + 10 g/ kg Mutagen for (T₂), feed + 10 g Mutagen + Super PS + 13 g pH FIXER + rice starch for (T₃), only 13 g pH FIXER for (T₄) and T₅ for control. Water quality parameters, morphometric measurements and body weight of the

experimental fish were determined fortnightly using portable kits. The results showed that all water quality parameters were favorable for fish culture. Morphometric measurements revealed that net weight gain (31.58 ± 3.47 g), percent weight gain ($481.26 \pm 67.28\%$), specific growth rate ($1.95 \pm 0.13\%$), protein efficiency ratio (1.60 ± 0.12) and food conversion efficiency (0.57 ± 0.04) were significantly higher ($P < 0.05$) in T_3 compared to other treatments. Feed conversion ratio (1.77 ± 0.13) was significantly lowest in T_3 compared to others. Control fish showed lower growth and feed efficiencies compared to the probiotic supplemented treatments. The results clearly indicated the effectiveness of probiotic supplementations and suggested that combinations of feed additive, water additive and soil probiotic might be beneficial for commercial *H. fossilis* production.

Keywords: probiotic, water quality parameters, FCR, FCE, catfish farming

FSB2019-AQ-03

Economics of rohu based polyculture in Bangladesh: Yield gap, efficiency and nutritional perspectives

Emran Hossain¹, Md. Akhtaruzzaman Khan¹, Madan Mohan Dey², Md. Samsul Alam³
¹Department of Agricultural Finance, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh; ²Department of Agricultural Sciences, Texas State University, USA; ³Department of Fisheries Biology and Genetics, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Correspondence: Md. Akhtaruzzaman Khan(azkhan13@yahoo.com)

Rohu (*Labeo rohita*) based aquaculture contributes significantly in terms of income, nutrition and employment generations in past decades in Bangladesh. In this study, we are trying to assess the challenges and need for the development of rohu based polyculture with particular focus on profitability, yield gap, efficiency and risk, species preference, consumption and nutritional perspective. This study uses the stochastic frontier production function, sensitivity analysis and Tobit regression to fulfil the objectives among a sample of 183 farms practicing rohu based polyculture located in three districts of Bangladesh namely Mymensingh, Rajshahi, and Jashore. The results reveal that rohu based polyculture is profitable, though it changes with the alteration of feed price and fish price. The result of technical efficiency shows that the farmers are efficient; nevertheless, the sample farmers operate below the production frontier and hence that they still have a chance to achieve targeted yields. Yield gap exists due to the inefficiency of farmers and technical constraints (biotic and abiotic). However, the result indicates that abiotic factors are more responsible for losing yield than biotic factors in the study areas. In polyculture practice, most of the farmers prefer rohu as main species on account of higher production, high demand, better feed conversion ratio and better flavour. Rohu alone contributes more than half to total fish consumption in the sampled household and have a significant contribution to daily protein requirements. Therefore, feed price reduction and proper extension service need to be ensured for further development for the sustainability of this sector.

Keywords: *Labeo rohita*, polyculture, yield gap, nutrition

FSB2019-AQ-04

Effects of probiotics on growth and survival of Nile tilapia (*Oreochromis niloticus*)

Kazi Atiah Taiyebi^{1,2}, Ram C. Bhujel²

¹Department of Fisheries, Bangladesh; ²Aqua-Centre, School of Environment, Resources and Development, Asian Institute of Technology, Thailand

Correspondence: Ram C. Bhujel (bhujel@ait.asia)

Tilapia, especially Nile tilapia (*Oreochromis niloticus*) is an increasingly popular aqua cultured species for its hardiness. But due to recent breakdown of diseases, use of probiotics may use in tilapia culture as an alternative to antibiotics. However, more scientific research is needed in these areas. Therefore, present study was conducted using six indoor concrete tanks (1.09 m³) to investigate the effects of probiotics on the growth and survival of Nile tilapia (*Oreochromis niloticus*) and on the water quality as well. Two treatments; Tilapia monoculture with no probiotics (T1) and Tilapia monoculture with probiotics (T2) were randomly allocated to the six (06) tanks in triplicate. A commercial probiotics, “Secure Yield” (composition of *Bacillus subtilis*, *Bacillus licheniformis* and *Bacillus pumilus*. Concentration of bacteria: 2×10¹² CFU/kg) was used as probiotics and the study lasted for 47 days. Advanced size (9.10-10.10g) tilapia fingerlings were stocked at 10 fish m⁻³ in all the treatments. Results showed that final individual weight, weight gain, daily weight gain and specific growth rate in T2 were 53.80 ± 3.55 g, 44.30 ± 3.75g, 0.90 ± 0.08 and 3.54 ± 0.18(%), respectively which were significantly higher than T1 (44.60 ± 1.06 g, 35.50 ± 0.98 g, 0.72 ± 0.02 g fish⁻¹ day⁻¹ and 3.24 ± 0.03 (%), respectively). Feed Conversion Ratio (FCR) was lower in T2 (0.92± 0.97) than T1 (1.07 ± 0.05) and unit production was significantly higher in Treatment 2 (T2) (0.86 ± 0.06 kg m⁻³) than in Treatment 1 (T1) (0.71 ± 0.02 kg m⁻³). There were no significant differences in water quality parameters (temperature, pH, DO, ammonia and NO₂-N) and survival rate between the two treatments and the survival rate of tilapia was 100%. The result indicates that use of probiotics in tilapia culture leads to better growth and survival compared to tilapia culture without probiotics.

Keywords: tilapia, probiotics, growth, survival, water quality.

FSB2019-AQ-05

Aquaponics: the future food production system to feed the world

Md. Abdus Salam

Department of Aquaculture, Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Correspondence: Md. Abdus Salam (masalambau@gmail.com)

Environmental degradation, social and economic problems drive the need for new, innovative and improved solutions for food production and consumption for the ever increasing population worldwide. Food production within a sustainable way requires innovations exceeding traditional systems, keeping in mind the complexity arising from human activities. Conversely, there is shortage of appropriate knowledge to resolve the problems related to climate change, loss of soil fertility, biodiversity, diminishing arable lands, river erosion, drought, cyclone, flood, and scarcity of resources and shortage of safe drinking water. One pioneering approach that promises to address these problems is aquaponics. The aquaponics (AP) integrates recirculation aquaculture system (RAS) and hydroponics (crops growing without soil) in a closed system for organic food production. The system uses fish culture water to feed the plants in a conventional way and considered environmentally sustainable as it utilizes the nitrifying bacteria to convert the toxic nitrogenous compound presence in water and more plants and fish can be grown per square meter area without soil and fertilizer compared to traditional agriculture. The system introduced the first time at BAU in 2011 and now adopting enthusiastic gardeners throughout the country. In the tilapia based system, a wide range of vegetables like tomato, beans, taro, water spinach, lettuce, papaya, red amaranth, reddish, beetroot, water gourd, snake gourd, better gourd etc. were possible to grow. The advantage of the system to grow fish and vegetables is that it requires less water, space and can set at the backyard, rooftop, balcony and non-arable land which otherwise

remains fellow. Aquaponics is eco-friendly and will be the future food production system as it is 100% organic, no growth hormones, antibiotics, pesticides, herbicides or other harmful chemicals are used to grow fish and crops, certifying healthy and wholesome food for human consumption. Therefore, aquaponics would be the future food production system to feed the world.

Keywords: aquaponics, vegetables, tilapia, organic, sustainable

FSB2019-AQ-06

Mixed culture potentials of high valued galda (*Macrobrachium rosenbergii*) with two native catfish, shing (*Heteropneustes fossilis*) and magur (*Clarias batrachus*) under different stocking densities in south-western coastal ghers of Bangladesh

Rakhi Das, Md. Shariful Islam, Khan Kamal Uddin Ahmed

Shrimp Research Station, Bangladesh Fisheries Research Institute, Bagerhat-9300, Bangladesh
Correspondence: Khan Kamal Uddin Ahmed (kkuabd@gmail.com)

Prawn culture is socially more acceptable, technically and economically viable and sustainable. It can tolerate slightly brackish water. The fish adapts well to hypoxic water bodies and high stocking densities as well. So, freshwater catfish (Shing, Magur) may be a good candidate to culture with Prawn (*M. rosenbergii*) in ponds/ghers to save the farmers from losing their investment due to shrimp mortality and getting additional income from fish. With this view, this study was conducted to evaluate the feasibility of polyculture in the Village-Betaga, Upazilla – Fakirhat of Bagerhat District. In this study stocking, three treatments were set with three replications in each treatment. Stocking density of Shing was variable i.e., 200 nos./decimal in Treatment-1 (T₁), 300 nos./decimal in Treatment-2 (T₂) and 400 nos./decimal in Treatment-3 (T₃). On the other hand, stocking density of Magur and Prawn juveniles was 50 nos./decimal and 30 nos./decimal were considered respectably for all treatments. During the culture trial, ghers were treated with salt (NaCl) (150g/decimal), Potassium permanganate (5g/decimal) along with lime (125 kg/ha) to prevent fish from disease. After stocking fish were fed using floating nursery feed (Protein 32%, Lipid 7%, Moisture 7%) at the rate of 10-2% for Shing and Magur nursing, floating oil coated grower feed (Protein 27%, Lipid 6%, Moisture 9%) at the rate of 6-2% for Shing and Magur grow out and Prawn grower (Protein 30%, Lipid 7%, Moisture 7%) at the rate of 6-2.5% of estimated fish and prawn biomass. At least 10% of stocked Catfish and Galda was sampled fortnightly using cast net. Physico-chemical parameters of the experimental gher water were monitored at weekly intervals. Soil parameters were analyzed with the assistance of SRDI, Khulna. After six months of culture the highest growth performance (47.0 g) and survival (19.94%) for Shing obtained from T₃. Whereas the average growth of Shing was recorded 37.02 and 41.14g; growth of Magur 99.21 and 99.51g and growth of Galda 69.74 and 70.19 for Treatment T₁ and T₂ respectively. Except ammonia and iron content the other observed parameters of gher water found congenial for fish health. Due to sudden natural disaster (flash flood) some fishes escaped from different compartments of the experimental gher. It is also assumed that death of some fishes might be occurred due to water quality deteriorated by the leaves of surrounding 'Mahogoni' (*Swietenia macrophylla*) tree. It is assumed that the survival rate might have been higher than the present survival rate. Even then the value of Benefit-Cost Ratio (BCR) with present survival rate found 1.4 that seems to be profitable and feasible of this polyculture practice.

Keywords: Benefit-Cost Ratio (BCR), Polyculture, Galda (*Macrobrachium rosenbergii*)

FSB2019-AQ-07

Culture potentials of brown shrimp, *Metapenaeus monoceros* (Fab.) under different stocking densities in south-western region of Bangladesh

Nilufa Begum, Syed Lutfor Rahman

Brackishwater Station, Bangladesh Fisheries Research Institute, Paikgacha, Khulna, Bangladesh

Correspondence: Syed Lutfor Rahman (rahman397@gmail.com)

An experiment was conducted to evaluate production potentials of brown shrimp, *Metapenaeus monoceros* (Fab.) at a management strategy affordable for marginal to medium farmers under three different stocking densities such as 100000, 200000 and 300000/ha under treatments T₁, T₂ and T₃ in Brackishwater station ponds of Bangladesh Fisheries Research Institute. After 90 days of culture total production was recorded 577 kg/ha, 608 kg/ha and 764 kg/ha in T₁, T₂ and T₃ respectively. Total production was significantly highest ($p < 0.05$) in T₃ than T₁ and T₂. Net benefit was recorded Taka 143109/ha, Taka 121825/ha and Taka 162516/ha in T₁, T₂ and T₃ respectively. Cost benefit ratio, BCR was 2.23, 1.80 and 1.91 in T₁, T₂ and T₃ respectively. Net benefit in T₃ (Taka 162516/ha) is higher than T₁ and T₂ which implies that net economic return is higher in 300000/ha densities. The brown shrimp have high rates of growth, together with that they tolerate wide ranges of salinity and environmental parameters, makes them highly attractive for culture purposes. Indeed, further study is needed to validate the present findings before planning for extension to the farmers.

Keywords: brown shrimp, *Metapenaeus monoceros*, stocking density, brackishwater

FSB2019-AQ-08

Black soldier fly larvae will enhance sustainability in aquaculture industry in Bangladesh

Md. Abdus Salam, Sadia Sultana

Department of Aquaculture, Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Correspondence: MA Salam (masalambau@gmail.com)

Aquaculture production is steadily increasing since late eighties around the world. However, scarcity and the high price of aquafeed ingredients increase the fish farming cost and reduce the profit margin of the farmers. Recently, insect as fish feed ingredients has gained considerable interest worldwide. For instance, high protein, lipid, and minerals containing insect the black soldier fly (*Hermetia illucens*; BSF) larvae seem a potential cheap protein source for fish feed formulation. Therefore, the present study was undertaken based on the attraction of adult BSF to come and lay eggs depending on the availability of wild BSF at the surrounding of the Faculty of Fisheries (FoF), BAU to develop appropriate techniques for larvae farming to formulate fish feed to reduce aqua farming cost round the year. Three types of media used to attract the mature BSF in an open house to lay eggs. In the first week, the BSF did not show up, however, later they came and lay eggs regularly near the media which signifies the availability of BSF around FoF, BAU. The higher egg production observed on substrates of brans compared to vegetables waste and banana as media. Proximate composition analysis exhibited that BSF larvae contained: 62% moisture, 7% lipid, 16% crude protein, 3% ash, 3.2% crude fiber and 9% carbohydrate on a live weight basis. The nutritional profile of the open system BSF larvae indicates its potential to serve as cheap and sustainable ingredients of aquafeed sources. Therefore, it can be recommending that

small-scale fish farmers can adopt BSF larvae cultivation as the way of reducing fish feed costs and also contributing to the national economy and enhance the livelihood of marginal fish farmers.

Keywords: insects, organic waste, protein, sustainability

FSB2019-AQ-09

Nutrition sensitivity of coastal aquaculture of Bangladesh

Abdullah-Al Mamun¹, Dave Little²

¹*Department of Fisheries and Marine Science, Noakhali Science and Technology University, Noakhali-3814, Bangladesh;* ²*Institute of Aquaculture, University of Stirling, UK*

Correspondence: Abdullah-Al Mamun (mamun_au22@yahoo.com)

Aquaculture is among the fastest growing food production sectors in many Low and Medium Income countries (LMIC), yet the specific impact on nutrition and livelihood in local communities where commercial and/or export-orientated aquaculture activities are developed, is largely unknown. Previous research has often been anecdotal and concluded that any export from production locales impoverishes local diets. This multidisciplinary work was aimed at identifying the role of coastal floodplain aquatic foods on health and nutrition for LMIC using anthropometric and biometric data from Bangladesh. Multiple domains were considered including production, availability, access/intake, anthropometric measurements and biomarkers. On the basis of surface water salinity level, the shrimp-prawn farming areas were divided into four different agro-ecological zones: (high saline (HS)>10ppt, medium saline (MS)<10>5, low saline (LS)<5ppt; freshwater (FW) area 0.5ppt). In depth surveys of households disaggregated by social well-being level (better-off and worse-off) were carried out. 24hr food recall and food frequency questionnaires were developed and administered with two replications and anthropometric data height, weight, age, sex, MUAC were collected to address the health status of adolescent women. Blood samples from finger tips were collected and dried on a sample pad to identify the n-3 fatty acid level as a key biomarkers of health status that could be mostly related to seafood consumption. About 57 different aquatic species were commonly available and tiger shrimp, speckled shrimp, mud crab, freshwater prawn are the main export commodities that varied from 20-48% in terms of volume and with the rest being consumed locally and regionally. Regarding the intra-household allocation of fish consumption of adolescent girls were 93 g/day while the household head father consumed 114 g/day. The BMI and MUAC values of the adolescent girls were in the acceptable range. The n-3 long chain PUFA and PUFA ratio in the whole blood samples of adolescent girls were gradually decreased from higher saline to lower saline areas however there was no significant differences between better off and worse-off in the same agro-ecology. These findings are quite different as most previous assertions are based on poorly generalisable 'worst case' scenarios. This paper attempted to consider the aquatic and terrestrial diversity and the relationship between farming systems, consumption and nutritional outcomes for more targeted and sensitive identification of nutritional wellbeing in adolescent girls in Bangladesh.

Keywords: nutrition-sensitive aquaculture, shrimp, adolescent girl, food security, Bangladesh

FSB2019-AQ-10

Biofloc technology: A microbial based low-cost aquaculture system

A. M. Shahabuddin¹, Shahrear Hemal¹, Antara Ghosh¹, Afshana Ferdous², Md. Abdul Hannan³

¹*Department of Aquaculture, Faculty of Fisheries, Aquaculture and Marine Science, Sher-e-Bangla Agricultural University, Dhaka-1207, Bangladesh;* ²*Department of Marine Fisheries and Oceanography,* ³*Department of Aquatic Animal Health Management, Faculty of Fisheries,*

Aquaculture sector offers plenty of opportunities to mitigate hunger and malnutrition, as well as maximizing the better use of natural resources. Expansion of aquaculture is restricted due to the land use conflict and for its strong dependence on fishmeal and fish oil, become expensive hence increase the production cost of the cultured species. Biofloc technology (BFT) is a low-cost aquaculture technique where beneficial bacteria are used to enhance water quality within the system. It is a sustainable and environmentally friendly aquaculture system where heterotrophic bacteria reduce cost of feed and water management by converting harmful ammonia into microbial protein. The flocculation is closely related with the proper maintenance of ammonia, dissolved oxygen and temperature. The supply of suitable carbon source with appropriate carbon and nitrogen ratio help to reduce the ammonia level in the aquaculture system. BFT is a microaggregate of diatoms, bacteria, protozoa, algae, fecal pellets, remains of dead organisms and invertebrates. These microaggregates are rich in protein and lipid source available in the culture conditions could be an important resourced to enhance production and lowering the feed cost. The consumption of biofloc has demonstrated innumerable benefits in fish production, decreasing FCR and operational costs. BFT demonstrated higher growth rates of fish and decreased of protein content in diets. BFT would be advantageous in minimizing consumption and release of water, pathogens introduction and hence improving farm biosecurity. Moreover, BFT could help in indiscriminate use chemicals. BFT can be a novel strategy for disease management in compared to conventional approaches. Less feed cost, low energy input, minimum natural resource use, higher production and the tropical climatic conditions of Bangladesh are the key factors for sustaining the technology in Bangladesh.

Keywords: aquaculture, biofloc, water quality, bacteria

FSB2019-AQ-11

Particle size distribution and nutritional values in a biofloc system

Md. Abul Kashem¹, Marc Verdegem², Joost Van Loo²

¹*Faculty of Fisheries, Sylhet Agricultural University, Sylhet-3100, Bangladesh;* ²*Wageningen University and Research, the Netherlands*

Correspondence: Md. Abul Kashem (kashemma@sau.ac.bd)

The study about particle size distributions in a biofloc system is limited. The experiment was aimed for the effect of the bioflocs harvesting on particle size distributions and nutritional values of bioflocs at different locations in a biofloc system. Two differently sized swirl separator were used for the harvesting of bioflocs using sedimentation principle. Five different sampling locations were used for bioflocs size distributions study and the bioflocs source was same for all sampling locations. A laser particle analyzer with laser obscuration time principle was used for the measurement of particle diameters at the water suspension. The percentages number distributions showed monomodal peak and the majority of the bioflocs were in smaller size classes. The multimodal peaks were observed for percentages bioflocs volume based distributions. The percentages volume distributions peaks were at different size classes at different location. The peaks were skewed toward left side for the top big swirl separator and top small swirl separator. Right side skewness of bioflocs volume distributions were observed for the location bottom big swirl separator and bottom small swirl separator. Right side skewness was prominent for bottom small swirl separator. The mean volume diameters of bioflocs were differ significantly at different locations. The mean volume diameters of bioflocs were 127 ± 37 μm for buffer tank, 85 ± 14 μm for top big swirl separator, 134 ± 32 μm for bottom big swirl separator, 75 ± 15 μm for

top small swirl separator and $177 \pm 25 \mu\text{m}$ for bottom small swirl separator. The volatile suspended solids and total organic nitrogen differ significantly at the locations having higher mean volume diameters and the value was robust.

Keywords: biofloc, particles size distributions, laser particle analyzer, skewness, nutritional values

FSB2019-AQ-12

Nutritional intervention in tilapia, *Oreochromis niloticus* fish through the application of Silica nanoparticle.

Abul Bashar, Md. Rakibul Islam, Israt Zarin, Md. Fazle Rohani, Md. Mahfujul Haque, Md. Sazzad Hossain.

Department of Aquaculture, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh
Correspondence: Md. Sazzad Hossain (sazzadbau@gmail.com)

The rate of nutrients utilization and digestibility of a feed largely determine the growth performance of cultured fish species, water quality, total yield and eventually the profitability of aquaculture business. Aiming to increase the growth performance and protein digestibility in Tilapia, *Oreochromis niloticus* fish through the application of Silica nanoparticles in diet, the current experiment was carried out in 4*2 factorial designed Recirculatory Aquaculture System (RAS). Fish fry was stocked with a stocking density of $200/\text{m}^3$ in each 160 L fibre glass tank and feeding trial was continued for 56 days with 28% protein rich diets. Three graded levels of activated Silica nanoparticles at 100 mg/kg (T_1), 200 mg/kg (T_2), and 300 mg/Kg (T_3) were incorporated with diets and a control diet (T_0) without nanoparticle was formulated to feed the experimental fish. Growth performance in control (T_0) was significantly lower than other treatments. T_2 showed best growth performance over T_1 and T_3 whereas T_1 did over T_3 . FCR was found to be lowest in T_2 and highest in control (T_0). Protein digestibility of diet in fish followed the sequence of $T_2 > T_1 > T_3 > T_0$. Water quality parameters, nutrient composition of final harvest, and the mortality rate had no significant influence from Silica nanoparticles throughout the experiment. Thus, a feed containing 200 mg/kg dietary Silica nanoparticle can increase nutrient utilization to promote growth performance with optimum FCR.

Keywords: silica nanoparticles, protein digestibility, tilapia, nanotechnology, RAS

FSB2019-AQ-13

Growth of aquaculture systems in Bangladesh: scope of future research and development

Mohammad Mahfujul Haque, Zannatul Ferdous, Alif Layla Bablee

Department of Aquaculture, Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Correspondence: Zannatul Ferdous(zferdous58@yahoo.com)

Globally aquaculture is the fastest growing protein-rich animal food producing sector. Bangladesh is one of the 5th largest leading aquaculture producing countries. The aquaculture production in Bangladesh was 2.33 million MT in 2016-2017, accounting for 56% of national fish production. This clearly indicates that fish consumption of fish eating Bengalis largely depends on fish production by aquaculture systems. Globally, depending on the location, aquaculture practices can be categorized into land-based (e.g. pond, tank, raceway farming); specialized land-based (e.g. hatchery; recirculatory aquaculture); water-based (e.g. cage, mollusk on- and off-bottom culture); specialized water-based (e.g. oceanarium); and integrated land and water-based systems (e.g. IFCAS). Aquaculture systems can be further classified depending on complexity of

environment (e.g. fresh, brackish, marine water aquaculture); nature of containment (e.g. ponds, raceways, cages, net pens); intensity of practice (e.g. extensive, semi-intensive, intensive, super-intensive); species combination (e.g. monoculture, polyculture, integrated); and ownership of farming (family to corporate ownership). These diversified aquaculture systems fit very well with the agro-ecological conditions of Bangladesh however, aquaculture production mainly depends on pond system. Over the last couple of years, cage-based aquaculture system developed in open waterbodies which acquired entrepreneurial shape avoiding the need of expensive land for pond construction. Besides that, crab culture in cage, pen culture of both fish and crab and intensification of shrimp farming emerged in the recent years. However, there is a lack of in-depth understating among the stakeholders on aquaculture systems because of emerging complex array of systems components. Potential aquaculture systems for fresh, brackish and marine water, including pond culture, cage culture, tank and raceway aquaculture, pen culture, mollusk on- and off-bottom culture need to be brought into the holistic research and development programs. The recent emergence of intensive aquaculture systems including RAS, aquaponics, IFCAS, IMTA, biofloc, spirulina culture, live food culture, etc. showed countless potentials of aquatic production in limited space in urban areas. To support this growth, many local and international companies are emerging for supplying structural and operating inputs for aquaculture systems. Various kits, equipment and electronic devices for water and soil quality assessment, oxygenation, feed quality assessment, disease diagnosis etc. are teeming in the market. To exploit such potential of emerging aquaculture systems, scientists, developers and other value-chain stakeholders need to work together.

Keywords: aquaculture systems, intensive, Bangladesh

FSB2019-AQ-14

Production performance of Pabda (*Ompok pabda*) and Gulsha (*Mystus cavasius*) with Rui (*Labeo rohita*) in polyculture management

Parvez Chowdhury, Md. Shahidiul Islam, Anuradha Bhadra, A.H.M. Kohinoor
Bangladesh Fisheries Research Institute, Mymensingh-2201, Bangladesh
Correspondence: Parvez Chowdhury (nitoldhk@gmail.com)

A trial on the production performance of Pabda (*Ompok pabda*) and Gulsha (*Mystus cavasius*) with carp in polyculture management was carried out to evaluate the production performance of Pabda (*Ompok pabda*) and Gulsha (*Mystus cavasius*) with carp culture in the on-farm condition during 15 May to 15 October 2017. Three stocking densities of Pabda (*Ompok pabda*) and Gulsha (*Mystus cavasius*) were tested keeping the Rui (*Labeo rohita*) stocking density similar. Each stocking density of Pabda and Gulsha was considered as treatment and replicated thrice. Fingerlings of Pabda and Gulsha were stocked in Treatments-1, 2 and 3 were 125000 and 50000; 187500 and 75000; 250000 and 100000/ha, respectively. In all the treatments, the stocking density of Rui was same and it was 1250/ha. Supplementary feed containing 30% crude protein was applied at the rate 2-10% in all the ponds. After five months rearing, the production obtained were 5875±458, 7786±550 and 8690±249 kg/ha from Treatment-1, Treatment-2 and Treatment-3, respectively. The highest production was obtained from Treatment-3, where Pabda and Gulsha were stocked at highest stocking density. The lowest production was obtained in Treatment-1. The production levels showed significant difference ($P<0.05$) was observed in Treatment-1 with Treatment-2 and Treatment-3. But Treatment-2 and 3 did not show any significant difference ($P<0.05$). The relative contribution of Pabda and Gulsha in total production was 85.82%, while in Treatment-2 and Treatment-3 were 90.45 and 91.66%, respectively.

Keywords: growth performance, pabda, gulsha, polyculture

Day 2: 28 December 2019

**Technical Session 7:
Management of Critical Aquatic Resources**

KEYNOTE PAPER

High-valued marine invertebrates from the Bay of Bengal: Exploration and management

Prof. Dr. M. Aminur Rahman

*Department of Fisheries and Marine Bioscience, Faculty of
Biological Science and Technology, Jashore University of
Science and Technology, Jashore-7408, Bangladesh*

Correspondence: M. Aminur Rahman (aminur1963@gmail.com)

Biography

Md. Aminur Rahman has completed Doctoral degree (D.Sc.) in Marine and Environmental Sciences from the University of the Ryukyus, Japan in 2001 and Post-doctoral researches from the same University in Japan (2003-2005) and the Smithsonian Tropical Research Institute, Panama, USA (2007-2009). He worked as a Professor in the FAO World Fisheries University, Busan, South Korea from September 2017 to February 2019. He also worked as a Senior Research Fellow in Universiti Putra Malaysia (UPM) during January 2010–August 2017. He was also affiliated as a Chief Researcher in the Ocean Critters Ranch, Inc. Texas, USA. Before that he worked as a Scientist in Bangladesh Fisheries Research Institute from 1988 to 2007 and was actively engaged in transferring and disseminating fish breeding, seed production, aquaculture and conservation technologies of commercially important native and endangered fish species of Bangladesh. Dr. Rahman also hold Visiting Professor Positions in the Dalian Fisheries University, China, King Abdulaziz University, Saudi Arabia and Halu Oleo University, Indonesia. Currently, he is working as a Professor in the Department of Fisheries and Marine Bioscience, Jashore Science and Technology University, Bangladesh. His expertise areas broadly lie in marine and freshwater biology, limnology, aquatic ecology and environmental sciences, reproductive biology and fertilization kinetics, population dynamics, stock assessment, breeding and seed production, aquaculture and conservation, and taxonomy and evolution. He supervised more than 20 undergraduate and postgraduate students, and around 30 national and international research projects in the above fields of his expertise. Through his research works, Dr. Rahman has published more than 140 scientific papers in international and nationally reputed high impact journals, 2 books, 17 book chapters and 33 referred proceedings with a total Google Scholar Citations of 1453 and H-index of 21. A remarkable number (>30) of scientific papers have also been presented and published in international conferences, symposia and seminars. Dr. Rahman has received 38 professional awards from the reputed international and national organizations/institutes.

Abstract

The Bay of Bengal (largest bay in the world) forms the northeastern part of the Indian Ocean. It is bordered mostly by the Eastern Coast of India, southern coast of Bangladesh and Sri Lanka to the west, and Myanmar, Andaman and Nicobar Islands to the east. It belongs to the Northern Indian Ocean in the Indo-Pacific region, and is considered to be the “Centre of accumulation and speciation” of many diverged taxa and thus stands famous for its distinctive culture and stunning marine environment. Nearby ecosystems offer excellent opportunities for marine research, including adjacent coral reefs, coastal and intertidal habitats, active hydrothermal vents, and the deep sea environment. The Bay of Bengal is full of biological diversity, diverging amongst coral reefs, estuaries, spawning and nursery areas, and mangroves, including echinoderms, mollusks, crustaceans etc. in the oceanic systems and thus provides excellent opportunities for the studies of breeding biology, reproductive ecology, aquaculture, population genetics as well as species and speciation mechanisms (evolution) of many diverged taxa. It is one of the World's 64 largest marine ecosystems. And it is important to mention here that a Hague-based International Court

has awarded Bangladesh 19,467 square kilometers out of 25,602 square km disputed areas in the Bay of Bengal. In addition to that, the present government has been given the highest priority to initiate marine-based research activities including resource exploration to boost up the blue economy of Bangladesh. As mentioned above, various types of high-valued marine bioresources including invertebrates (sea urchins, sea cucumbers, seastars, corals, sponges, mollusks, bivalves, crustaceans and jelly fishes), seaweeds, seagrasses etc. are abundant in the Bay of Bengal. In addition to the high food values, most recently, a number of important bioactive compounds have been isolated from marine invertebrates (such as sea cucumbers, sea urchins, starfishes, corals, sponges, jelly fishes, squids etc.), having distinctive biological and pharmacological activities including anti-cancer, anti-stroke, anti-angiogenic, anti-coagulant, anti-hypertension, anti-inflammatory, anti-microbial, anti-oxidant, anti-thrombotic, anti-tumor, anti-diabetic and wound healing activities. However, development patterns of invertebrate fisheries are largely expectable, often unsustainable and frequently too rapid for effective management. Due to higher biological, ecological, aquacultural, conservational, pharmaceutical and nutritional values, it is very important nowadays to investigate and utilize these important bioresources in a very productive, significant, sustainable and worthwhile manner. Therefore, in order to fully explore and use these richest marine invertebrates, an understanding on their biological and ecological events, taxonomic status, population genetic structure and speciation processes are of prime importance. Meanwhile, proper steps need to be undertaken on the potential ecosystem and human community consequences, appropriate aquaculture management strategies, better monitoring and reporting of catch and abundance, proper scientific research for stock enhancement, and consideration of international biodiversity and trade regulations to ensure sustainable development and utilization of high-valued marine invertebrates in the Bay of Bengal large marine ecosystem.

FSB2019-MAN-01

Prediction of algal chlorophyll and transparency using two machine learning and one regression approaches in a reservoir

Md Mamun, Kwang-Guk An

Department of Bioscience and Biotechnology, Chungnam National University, Daejeon 34134, South Korea

Correspondence: Kwang-Guk An (kgan@cnu.ac.kr)

The prediction of algal chlorophyll and transparency levels in the reservoir is an emerging issue due to deterioration of water quality and eutrophication. Our key objectives of the study were to predict long-term algal chlorophyll and transparency, measured as Secchi depth, using multiple linear regression (MLR), support vector machine (SVM) and artificial neural network (ANN) in spatially heterogeneous and temporally dynamic reservoirs largely influenced by the Asian summer monsoon during 2000 - 2017 and then to compare their predictive performance. For this reason, we tested the models in the spatial patterns of the riverine zone (Rz), transitional zone (Tz), and lacustrine zone (Lz) and temporal patterns of premonsoon, monsoon and postmonsoon. Monthly physicochemical parameters and precipitation data (2000 - 2017) were used to build up the models of MLR, SVM, and ANN and then validated by cross-validation (CV, K =5). Results revealed that the SVM model showed better predictive performance than MLR and ANN, in both before validation and after validation. The value of Root mean square error (RMSE) and mean absolute error (MAE) was lower in SVM in comparison to MLR and ANN, means that the SVM model was better than MLR and ANN. The coefficient of determination (R^2) value was higher in the SVM model compared to MLR and ANN. Analysis of the importance of input variable indicated that water temperature (WT), total phosphorus (TP), total suspended solids (TSS), total nitrogen (TN), total nitrogen:total phosphorus (TN:TP ratios) and precipitation influenced the chlorophyll-a and transparency level in the reservoir. Moreover, this study provides a reference for the monitoring and modeling of chlorophyll-a and transparency level in different zones and seasons.

Keywords: multiple linear regression, support vector machine, artificial neural network, chlorophyll-a, transparency

FSB2019-MAN-02

Longitudinal gradients of nutrients and chlorophyll in Daechung Reservoir, Korea and the analysis of trophic state deviation

Ji Yoon Kim, Dae-Yeul Bae, Kwang-Guk An

Department of Bioscience and Biotechnology, Chungnam National University, Daejeon 34134, South Korea

Correspondence: Kwang-Guk An (kgan@cnu.ac.kr)

The study was to determine zonal characteristics of nutrients and chlorophyll and evaluate their trophic relations in Daechung Reservoir, Korea. For this study, we compared more than 10 year long-term water quality data among three zones of riverine, transition, and lacustrine sites along with trophic state. Total phosphorous (TP), Secchi depth (SD) and chlorophyll (CHL) showed typical longitudinal declines from the riverine to lacustrine zone, but total nitrogen (TN) was not evident. Largest seasonal variations in TP and CHL occurred during the summer monsoon. In the reservoir, ambient TN averaged 1.67 mg L^{-1} and ratios of TN: TP averaged 88.04, indicating that nitrogen is not likely limited but phosphorus limitation was evident. Trophic State Index (TSI),

based on CHL, TP, and SD, varied depending on the zones and seasons. Mean TSI (TP) was maximum in the riverine zone during the monsoon and the TSI (CHL) showed maximum in the transition zone during the monsoon. The deviation analysis of TSI showed that about 65% of TSI (CHL)-TSI (TP) and TSI (CHL)-TSI (SD) values were less than zero and the lowest values were -42, indicating an effect of inorganic turbidity on algal growth in the reservoir. Correlation analysis of CHL vs. SD showed greater correlation coefficient ($p < 0.001$, $r = -0.47$) in the transition than other two zones ($p < 0.001$, $r = -0.40$). Correlation analysis of TP vs. CHL was greatest in the lacustrine and TP was minimum in the lacustrine zone, indicating a lowest yield of algal biomass in the lacustrine. Overall data suggests that zonal response of chlorophyll yield at a given nutrient unit is clearly differed among the longitudinal gradients, so the management strategy such as cross sectional modelling should be provided in each zone.

Keywords: nutrient, phosphorus, nitrogen, trophic state index

FSB2019-MAN-04

Genetic diversity and population structure of Scalloped hammerhead shark (*Sphyrna lewini*, Griffith & Smith 1834) in the Bay of Bengal, Bangladesh

Md Jayedul Islam^{1,2}, A H M Safiullah Habib², Kazi Ahsan Habib¹

¹Aquatic Bioresource and Research Lab, Department of Fisheries Biology and Genetics, Faculty of Fisheries, Aquaculture and Marine Science, Sher-e-Bangla Agricultural University, Dhaka-1207; ²Department of Zoology, Jagannath University, Dhaka-1100, Bangladesh

Correspondence: Kazi Ahsan Habib (ahsan.sau@gmail.com)

The IUCN globally endangered scalloped hammerhead shark (Griffith & Smith 1834), *Sphyrna lewini* is abundant along continental margins and also occur near shore, especially around submerged reefs. Genetic diversity and population structure of this shark from the Bay of Bengal (BoB), Bangladesh was investigated using the mitochondrial DNA (mtDNA) analysis. Tissue samples of thirty-three *S. lewini* individuals were collected from whole sharks in 2018 from landing center of Cox's Bazar of Bangladesh. For comparing genetic structure of BoB population with the populations of other seas and oceans, mtDNA d-loop sequences (520 bp) of 504 samples from six regions viz. Arabian Sea Basin, Red Sea, Indo-Pacific, Pacific Ocean, Indian Ocean and Atlantic Ocean were used. Most of the nucleotide substitutions were transitional in the studied sequences. About 37% of the nucleotide substitutions were transversion. An indel was detected in all the sequences analyzed. Variations in the D-loop region defined 8 haplotypes with 9 polymorphic sites. Six haplotypes were unique for the BoB, that is, not present in the global data set. One unique haplotype was found in five individuals. The nucleotide diversity (π) were as low as 0.002 nucleotide differences per site. On the other hand, the haplotype diversity (h) were relatively high providing the values of 0.58. Estimates of F_{ST} values between BoB and each of the population of different global seas were ranged from 0.308 to 0.530 with significant difference ($P = 0.00$) from random mixing, indicating a unique population genetic structure (i.e. a genetic stock) was established in the Bay of Bengal region. Exact test of population differentiation also showed significant differentiation between BoB and each of other populations investigated suggesting a non-panmictic BoB population. This genetic population in BoB indicates the presence of nursery ground of *S. lewini* in this largest bay of the world.

Keywords: Scalloped hammerhead shark, population, mitochondrial DNA

FSB2019-MAN-06

Monsoonal plankton distribution and physico-chemical water qualities in a rain-fed lake, Sonapur, Noakhali district, Bangladesh

Najmus Sakib Khan, Md. Saiful Islam, Jaber Bin Abdul Bari

Department of Oceanography, Noakhali Science & Technology University, Noakhali-3814, Bangladesh

Correspondence: Najmus Sakib Khan (nsakib.iium@gmail.com)

The present study focused on the monsoonal distribution of plankton in a rain fed partial lake in Sonapur, Noakhali district, Bangladesh. There were three sampling sites were chosen between Sonapur zero point and Noakhali Science and Technology University. A total four groups of phytoplankton were identified as Chlorophyta (11 genera), Bacillariophyta (6 genera), Cyanophyta (6 genera) and Euglena (3 genera). Furthermore, there were four groups of zooplankton as Rotifera (10 genera), Cladocera (3 genera), Copepode (2 genera) and Crustacea (2 genera). Additionally, organic pollution index of this lake was also determined according Palmer's algal pollution index. The sampling lake was found confirms organic polluted (Palmer's algal pollution index value: 22.23). The water quality of partial Sonapur Lake was also evaluated by using wetland zooplankton index (WZI). The average WZI value of this lake was estimated 3.72 means moderate water quality. During the sampling periods some important physico-chemical parameters like temperature ($29.58 \pm 0.25^{\circ}\text{C}$), p^{H} (7.9-8.5), transparency (11.08 ± 0.25 cm), free CO_2 (10.66 ± 0.17 mg/l), total alkalinity (13.68 ± 0.23 mg/l), ammonia (0.35 ± 0.08 mg/l), nitrate (0.11 ± 0.01 mg/l), nitrite (0.05 ± 0.007), phosphate (0.12 ± 0.026 mg/l) and dissolved oxygen (2.58 ± 0.24 mg/l) were also determined as supporting water quality statement. Sonapur rain fed lake contributes local economy and plays a crucial role to maintain eco-balance.

Keywords: rain-fed lake, Palmer's algal pollution index, wet land zooplankton index

FSB2019-MAN-08

Assessment of the catch-based maximum sustainable yield (CMSY) of marine commercial captured shrimp of Bangladesh: Required more conservative management approach for sustainability!

Ehsanul Karim, Shanur Jahedul Hasan, M Enamul Hoq

Marine Fisheries and Technology Station, Bangladesh Fisheries Research Institute, Cox's Bazar, Bangladesh

Correspondence: Ehsanul Karim (ehsan_tony@yahoo.com)

Commercial trawl catch shrimp is one of the most significant segments in the marine capture in Bangladesh with respect to local consumption, employment opportunity as well as foreign exchange earnings and presently 37 shrimp trawlers are involved in fishing within the fishing grounds of the Bay of Bengal. As estimated, shrimp trawl catch composition is collectively recorded as 'Shrimps' that mainly based on penaeid shrimp species i.e. giant black tiger shrimps (*Penaeus monodon*), brown shrimps (*Metapenaeus monoceros*, *M. brevicornis*, *M. spinulatus*), white shrimp (*P. indicus*) and other less valued shrimps (e.g. *Acetes indicus*, *P. stylifera*). According to the FRSS data from 1995 to 2016 (22 years) of DoF, overall CPUE (Catch per unit effort) has showed significantly diminishing trends that signals a reducing stock. Thus, it is very crucial to find out a reliable method for estimating MSY or TAC of a data poor fishery like maritime captured shrimps of Bangladesh. The ultimate goal of any capture fishery management is to conserve resources for the forthcoming days through a sustainable way in

which public interests are not being hampered. In this study, globally most suitable method named 'CMSY' is used to estimate MSY and total allowable catch (TAC) as it needs only catch data, resilience and exploitation history at the first and final years. Furthermore, the classical SPMs (surplus production models) are also accomplished by software packages CEDA and ASPIC to compare with the performance of CMSY. The assessed MSYs from all models were found about 2587-3199t and exact TAC was 2884t that was 15% less from the last catch, while CMSY produced more reasonable population parameters estimates r (intrinsic population growth rate) and k (carrying capacity). The estimated BRPs of B/B_{MSY} smaller than 1.0, while F/F_{MSY} higher than 1.0 revealed an over-exploitation state of marine commercially captured shrimp fishery of Bangladesh that needs more conservative management approaches for sustainability.

Keywords: shrimps, CMSY, Catch-based maximum sustainable yield, CPUE, catch per unit effort, over-exploitation

FSB2019-MAN-09

Spatio-temporal variations of fish assemblages in the three estuarine habitats (Naf, Maheshkhali Channel and Rejukhal) of Cox's Bazar, Bangladesh

Ehsanul Karim, Jakia Hasan, M Zulfikar Ali, M Enamul Hoq

Marine Fisheries and Technology Station, Bangladesh Fisheries Research Institute, Cox's Bazar-4700, Bangladesh

Correspondence: Ehsanul Karim (ehsan_tony@yahoo.com)

The estuarine zone is one of the exclusive and vital part of the aquatic habitat that actually forms the shifting or transition zone between the fresh water inland onshore and the seawater lying offshore. The Cox's Bazar coast of Bangladesh is mostly enclosed with a complex estuarine ecosystem having strong interactions of abiotic and biotic aspects. The spatio-temporal variations of the fish assemblages in the estuarine habitats of Cox's bazar, Bangladesh are poorly understood. A study was carried out to record the species composition, abundance and to assess the fish diversity status in both spatial and temporal measures of the three selected estuarine habitats (Moheshkhali Channel, Naf river channel and Rejukhal estuaries) from July, 2016 to June, 2018. A total of 1048 individuals belonging to the 17 orders, 67 families, 113 genera were collected from the above fish harvesting stations. Among those, the maximum species richness was found in the Moheshkhali channel estuary encompassing 53 families whereas 39 families and 23 families were found from the Naf and Rejukhal estuarine zones accordingly (one way ANOSIM test). Non-metric Multidimensional Scaling (NMDS) was also applied to compare fish assemblage structures from the upstream to downstream during three seasons i.e pre-monsoon, monsoon and post-monsoon whereas post-monsoon showed the greatest abundance of the fishes diversity. Species assemblages differed along the dominant freshwater flow over the seawater, but there was little apparent change associated with the seasons. Species richness and Shannon-Weaver index (H') tended to increase along the freshwater flow continuation from the upstream to downstream with the maximum proportion of herbivorous or planktivorous fishes while significantly decrease along the continuation with a parallel significant increase in the percentage of omnivores. Fish assemblages were significantly related to both water quality and habitat structure variables. Canonical Correspondence Analysis ordinations (CCA) revealed that 7 of the 14 selected environmental variables had significant relationships with the fish assemblage such as distance to source, water depth, turbidity, altitude, pH, salinity, temperature and water velocity and different sampling sites were associated with different environmental variables in different seasons. The main differences in fish assemblage structure and diversity within the whole watercourse are probably related to large-scale factors such distance to source, turbidity,

temperature and altitude. However, data on fish habitat preferences, diet, reproduction mode as well as vulnerability to fertilizers and pesticides are not included for most species sampled during the study period. Although the present study included most of environmental variables, there is still a need to focus on other issues. Thus, above information on relationship between environmental variables and fish assemblages can help us to maintain and manage aquatic biodiversity under human-induced threats such as pollution, global climate change and so on.

Keywords: spatial, temporal, estuarine; abundance, diversity

FSB2019-MAN-10

Reproduction of *Xenentodon cancila* (Hamilton, 1822) in the Gajner *Beel* Wetland ecosystem (NW Bangladesh) with special reference to potential influence of climate and environment changeability

Md. Yeamin Hossain¹, Most. Shakila Sarmin¹, Md. Ataur Rahman¹, Md. Akhtarul Islam¹, Md. Rabiul Hasan¹, Zannatul Mawa¹, Zoarder Faruque Ahmed²

¹Department of Fisheries, Faculty of Agriculture, University of Rajshahi, Rajshahi-6205, Bangladesh; ²Department of Fisheries Management, Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Correspondence: Md. Yeamin Hossain (hossainyamin@gmail.com)

The Freshwater garfish, *Xenentodon cancila* (Hamilton, 1822) is commercially important indigenous fish species in the Gajner *Beel* Wetland Ecosystem, northwestern (NW) Bangladesh. Current study emphasizes on reproduction aspects of *X. cancila* containing size at sexual maturity, spawning and peak spawning season. Total individuals of 241 female are captured monthly via cast net, gill net, seine net and square lift net in the Gajner *Beel* through January to December 2018. Also, we study on special effects of environmental parameters (hydrological) and climate variation comprising temperature and rainfall on reproduction of *X. cancila* in the Gajner *Beel*. Measurement of each individual like as lengths (total length, TL; standard length, SL) and body weight (BW) were taken by slide caliper and digital balance, correspondingly. By dissection of abdominal side of female gonads (ovaries) were occupied prudently and weighed to the closest 0.01 g exactitude. To assess the size at sexual maturity and spawning season the gonadosomatic index (GSI (%)) = (GW/BW)×100, modified gonadosomatic index (MGSI (%)) = (GW/BW–GW)×100, and Dobriyal index (DI = $\sqrt[3]{GW}$) were estimated. The TL was detected as 15.8 cm and 16.2 cm focused on GSI, MGSI and DI for female, respectively. The TL where 50% of individuals attain maturity was predicted by logistic equation TL₅₀ as 15.8 cm. Moreover, we examined that there were no correlation of biotic condition factors with GSI but relationship with GW was found. Also, considered on higher values of GSI, MGSI, and DI, spawning season was extended from March to October, through GSI peaked in April and another was in July, representing the peak reproductive period for *X. cancila*. Among five important hydrological parameters; temperature, DO and total alkalinity were highly correlated with GSI, while the pH and TDS did not show any correlation with GSI. Additionally, substantial correspondence between temperature and GSI was observed and with an average of 29 °C water temperature ranged from 23 to 34 °C during the spawning period. Also, the spawning season allied with the peak rainfall and showed notable relation between rainfall and GSI. In addition, annual average air temperature is rising by 0.029 °C per year whereas annual average rainfall is falling by 2.96 mm/year was observed by exploring lengthened data series. Finally, the consequences and basic information of present study would be operative to undertake specific management for *X. cancila* in the Gajner *Beel* and elsewhere.

Keywords: reproduction, *Xenentodon cancila*, climate change, environmental parameters, Gajner

FSB2019-MAN-11

Outwelling of nutrients into the Pasur River estuary from the creeks of Sundarbans mangrove

Dinesh Chandra Shaha¹, Jahid Hasan¹, Shaيدا Akter¹, Rabina Akther Lima¹, Salman Ahmed¹, Shahroz Mahean Haque²

¹Department of Fisheries Management, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur-1706, Bangladesh; ²Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Correspondence: Dinesh Chandra Shaha(dinesh@bsmrau.edu.bd)

In this study, we investigated the distributions of salinity, dissolved nutrients, different physico-chemical parameters and Chl. *a* in the Pasur River estuary (PRE) and the creeks connected to the Sundarbans mangrove ecosystem. Vertical salinity was taken using a conductivity-temperature-depth (CTD) profiler. Dissolved oxygen (mg/L) and pH were measured by water quality checker. NH₄N, Nitrate, nitrite, phosphate and Chlorophyll *a* were analyzed by standard methods using a spectrophotometer. In the estuary, concentrations of nitrate (NO₃⁻) and nitrite (NO₂⁻) were higher in dry winter than those in the monsoon. However, ammonium (NH₄⁺) and Phosphate concentration (PO₄³⁻) concentration were higher in monsoon, suggests that these nutrients are exported from the mangrove area into the Pasur River estuary due to inundating during rainy season and vigorous tidal mixing. Phosphate is the available nutrients among all of the dissolved inorganic nitrogen during the spring tide, while sometimes ammonia tended to dominate in the monsoon, indicating the predominance of orthophosphate inside the estuary. Concentrations of most nutrients except nitrite in the PRE channel were higher than those of estuarine water, indicating the nutrient outwelling from the mangrove swamp and ammonium regeneration from mangrove litter in the creek sediments. These variations of nutrient availability in different seasons and locations are related with spring-tide outwelling from the mangrove swamp through the creeks.

Keywords: outwelling, nutrients, mangrove ecosystem, creeks, water quality

FSB2019-MAN-12

An export of salinity and nutrients from Shibsra river estuary into the Pasur river estuary through connecting channels

Dinesh Chandra Shaha¹, Jahid Hasan¹, Shaيدا Akter¹, Rabina Akther Lima¹, Salman Ahmed¹, Md. Abdul Wahab²

¹Department of Fisheries Management, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur-1706, Bangladesh; ²Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Correspondence: Dinesh Chandra Shaha(dinesh@bsmrau.edu.bd)

The natural variability of river inflows to estuaries has been greatly modified by dam construction upstream. In this study, we investigated the spatiotemporal distributions of salinity, dissolved nutrients, different physico-chemical parameters and Chlorophyll *a* in the Shibsra and Pasur River estuaries and its connecting channels for determining the impacts of decreasing river discharge due to the Farakka barrage. Vertical salinity were taken using a conductivity-temperature-depth (CTD) profiler. Dissolved oxygen (mg/L) and pH were measured by water quality checker. Ammonia-N, Nitrate, nitrite, phosphate and Chlorophyll *a* were analyzed by standard methods using a spectrophotometer. Prior studies have examined the salt plugs associated with evaporation

in arid region estuaries. In this work, we discovered a new type of salt plug formation in the Pasur River Estuary (PRE) caused by decreasing river discharges resulting from an upstream Farakka barrage. The formation of a salt plug in response to changes in river discharge was investigated using a conductivity-temperature-depth (CTD) recorder in the dry seasons in 2014, 2018 and 2019. An exportation of saline water from the Shibsra River Estuary (SRE) to the PRE through the connecting Channels occurred during the dry season, and a salt plug was created and persisted in the PRE during the dry season (December-June). The salt plug traps nutrients and other organic and inorganic substances in the PRE for longer periods during the dry season, potentially creating water quality problems. The low dissolved oxygen level dropped $< 5.0 \text{ mg L}^{-1}$ is a sign of possible pollution in the salt plug area of the PRE in the dry season, indicating that nearby aquatic life is subjected to stress.

Keywords: salt plug, nutrients, mangrove ecosystem, channels, water quality

FSB2019-MAN-13

Biodiversity, abundance and seasonal succession of zooplankton in the Old Brahmaputra River and their relation to some water quality parameters

Sharmin Nesa Bithi¹, Md Mahfuzul Haque¹, Md Ahsan Bin Habib², Saleha Khan¹

¹Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh; ²Department of Aquaculture, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Correspondence: Saleha Khan (khansaleha64@gmail.com)

Zooplankton play a pivotal role in aquatic ecosystems and biogeochemical cycles and they function as prey for economically important fishes, grazers of primary production, and drivers of carbon and nutrient cycles. The biodiversity, abundance and seasonal dynamics of zooplankton and their relation with some environmental parameters in the Old Brahmaputra River, Mymensingh, Bangladesh were studied for a period of one year. Samples were collected monthly from six different stations in the river beside the BAU campus, normally at the middle of each month, and between 9 am to 12 noon. A total of 12 genera from three different zooplankton groups were identified, which included seven rotifers (*Brachionus*, *Keratella*, *Polyarthra*, *Asplanchna*, *Filinia*, *Trichocerca* and *Hexarthra*), two cladocerans (*Daphnia* and *Diaphanosoma*) and three copepods (*Cyclops*, *Diaptomus* and Nauplius). The mean abundance of each zooplankton group during the study period was in the following order: rotifers > copepods > cladocerans. Among the genera *Brachionus*, *Cyclops* and Nauplius were found to be most abundant and they were present in each month. The occurrence and abundance of the zooplankton were found to be related with some environmental parameters. They were abundant during the summer months which might be due to elevated water temperature, alkaline pH and higher concentration of nutrients.

Keywords: zooplankton, rotifers, copepods, Old Brahmaputra River

FSB2019-MAN-15

Freshwater snail (*Pila globosa*) breeding technique at farmers gher/ditches and aquarium

Rakhi Das¹, Md. Shariful Islam¹, Mohammad Moniruzzaman, Khan Kamal Uddin Ahmed

Shrimp Research Station, Bangladesh Fisheries Research Institute, Bagerhat-9300, Bangladesh

Correspondence: Khan Kamal Uddin Ahmed (kkuabd@gmail.com)

Snail plays an important role in the ecosystem in maintaining healthy aquatic environments by acting as a biofilter, a pre-requisite for conserving biodiversity. Snails are not consumed by humans within the Muslim community of Bangladesh. However, 29 groups of tribal people consume snail flesh. Snail meat is more extensively used in freshwater prawn (*Macrobrachium rosenbergii*) farming in the south-western part of the country. The average application of snail meat to the prawn ghers is 66.5 kg/ha/day during June to October. Snail meat is also utilized as supplementary feed in indigenous catfish (*Clarias batrachus*) farms and domestic ducks. Snail shell is used to produce lime and animal feed additive due to its rich CaCO₃ content. In Bangladesh, to date nobody has become interested in snail farming. Snail capturing and its utilization as human food, poultry feed and in large scale as supplementary feed for prawn farms are lavishly going on. Especially over exploitation of *P. globosa* for prawn farming is an alarming condition. The ecologically and economically important such a biological resource will become extinct within a very short time if no steps are taken to reproduce of this species immediately. Considering the above facts, the present research study attempt is taken to identify the breeding behavior and culture potential of this species for ensuring the sustainable natural population. Two research sites have been selected for breeding of snail in natural habitat ez. a total area of 0.21 ha in Gopalganj sadar and 0.16 ha in Kotalipara has been selected. Bamboo split fence locally called 'bana' along with fine meshed nylon net and bamboo were used to fence on the dykes around the gher to prevent the snail escaping. Dikes have maintained as snail lay eggs on the dykes that locally called (Ail) in rice field. Aquatic vegetation planted on the dykes for ensuring proper breeding ground for snail. Wild snails collected from the Chaitarbari beel, Boalmari Upazilla, Faridpur, stocked at the rate of 50/m² as brood stock. Breeding of *Pila* takes place in the rainy season. In the nature, snails normally start to breed just after first monsoon raining. Before stocking liming was applied at the rate of 30g/m² and then filled up with water up to 30cm. Then organic compost (cow-dung, mustard oilcake and urea at the ratio of 1:1:0.5 @ 600kg/ha respectively) spreaded throughout the gher. Several male and female specimens collected from experimental gher and brought to the laboratory aquarium to observe their breeding behavior. At the bottom of aquarium substrate like plastic bottle, marble, artificial tree etc. provided for egg laying. Breeding involves three processes: copulation, fertilization and laying. Copulation occurs in water on moist land and it takes about 3-4 hrs, then both separated. Fertilization is internal in *Pila*. Egg laying starts 2 or 3 days after copulation. They lay eggs in sheltered places or moist land near water in the dyke. A single female lays eggs ranged 200-800 per clot at a time. Eggs are rounded, seems like pea seeds covered by whitish shell. Collected from the experimental field eggs are brought also in the laboratory aquarium for further observation with continuous aeration. Snail start hatching from 13 days. Its need about 25 days for full clot hatch. In the laboratory condition hatching success was observed about 80%.

Keywords: snail, breeding, copulation, fertilization

FSB2019-MAN-17

Population biology of the catfish *Mystus cavasius* (Hamilton, 1822) in the Padma River and its management policy implications in Bangladesh

Sumaya Tanjin¹, Md. Ashekur Rahman¹, Farzana Akter Rima¹, Asma Afrose Chowdhury¹, Md. Rabiul Hassan¹, Zannatul Mawa¹, Md. Yeamin Hossain¹, Md. Akhtarul Islam¹, Zoarder Faruque Ahmed²

¹Department of Fisheries, Faculty of Agriculture, University of Rajshahi, Rajshahi-6205, Bangladesh; ²Department of Fisheries Management, Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Correspondence: Sumaya Tanjin (tanjin.sumaya18@gmail.com)

The Gangetic catfish *Mystus cavasius* is one of the commercially high nutritional valuable food fish in Asian countries. This study describes the population biology of *M. cavasius* including sex ratio, population structure (LFD), growth pattern (LWR), condition factor (K_F), reproduction (size at sexual maturity (L_m), spawning- and peak-spawning season and fecundity) in the Padma River, northwestern Bangladesh. Sampling was done using traditional fishing gears including cast net, square lift net and conical trap during July 2018 to June 2019. Total length (TL) was measured to the nearest 0.01 cm using digital slide calipers, and body weight (BW) was measured using an electronic balance with 0.01 g accuracy. Whole gonads were removed from each individual and weight with an electric balance with accuracy of 0.01g. A total of 1200 individuals ranging from 5.02-15.80 cm TL and 1.60-31.3 g BW were analyzed. The overall sex ratio showed no significant differences from the expected value of 1:1 ($\chi^2 = 2.57$, $P > 0.05$), and there was no significant difference in the LFD between the sexes ($P = 0.376$). The allometric coefficient (b) for the LWR indicated isometric growth ($b \sim 3.00$) in males and combined sexes, but positive allometric growth (< 3.00) in females. The ANCOVA revealed significant differences between sexes for the intercepts (a) and slopes (b) of the regression lines ($F = 4.556$, $df = 346$, $P = 0.033$). The K_F was not significantly different between the sexes ($P = 0.638$). The L_m was considered to be 7.5 cm TL and individuals with a GSI $> 7\%$ could be roughly defined as mature female and 8.00 cm TL and individuals with GSI $> 2\%$ could be roughly defined as mature male. The spawning season of *M. cavasius* in the Padma River is April to July and the peak spawning season is May and June. The mean total fecundity was 21430 ± 8890 . The results of this study should be useful for the sustainable conservation of this cat fishery within the Padma River and surrounding ecosystems in Bangladesh and neighboring countries through the establishment of banning period during its peak-spawning season.

Keywords: *Mystus cavasius*, sex ratio, population structure, reproduction, Padma River

FSB2019-MAN-18

Stock assessment of Nile tilapia *Oreochromis niloticus* in Kaptai Lake, Bangladesh

Mst Kaniz Fatema, Zoarder Faruque Ahmed

Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Correspondence: Mst. Kaniz Fatema (kanizfatemafm@bau.edu.bd)

The research assessed stock parameters of Nile tilapia, *Oreochromis niloticus* (Linnaeus, 1758) in Kaptai Lake of Bangladesh. Nile tilapia as exotic fish species was introduced to Kaptai Lake in 1986 under cage aquaculture implemented by Department of Fisheries, Government of Bangladesh—a fact that led the fish species emerging as permanent population there over decades. Conventional models were employed to estimate stock parameters using length data of 1200 specimens from monthly samples collected at fish landing center of Kaptai Lake in Rangamati town over a year for its sustainable management advice. Length data were used to evaluate age and growth, recruitment, natural and fishing mortalities, and maximum sustainable yield of the stock. Growth parameters were estimated through fitting age-length data to three common growth models, and age-weight data to model judged best. Length at recruitment was calculated applying Bhattacharya method. Length-based catch curve and approximation of life-history data were assigned to estimate total and fishing mortalities respectively. Yield per recruit and biomass models determined maximum sustainable yield of the stock. The total length ranged from 9.36 to 38 cm, and the body weight varied from 17.7 to 1550 g over study period. Growth analysis revealed that an individual tilapia reached asymptotic total length of 48.02 cm with

growth coefficient of 0.50 per year. The asymptotic body weight was 1293.76 g with growth coefficient of 0.52 per year. Recruitment occurred at total length of 14.67 cm, and at age of 0.48 years. Lake tilapia suffered from natural and fishing mortalities estimating 0.80 and 1.85 per year respectively. The maximum yield per recruit was 205.85 g at fishing mortality of 0.9 per year. The biomass analysis, however, estimated that Nile tilapia attained 79.39 kg relatively, when they were 0.65 years old if 1000 individuals recruited to the fishery in Kaptai Lake.

Keywords: Nile tilapia, *Oreochromis niloticus*, Kaptai Lake, stock assessment

FSB2019-MAN-19

Biological features of *Salmostoma bacaila* (Cyprinidae) from the tributary of the Payra River, southern Bangladesh

Ferdous Ahamed¹, Zoarder Faruque Ahmed²

¹Faculty of Fisheries, Patuakhali Science and Technology University, Patuakhali, Dumki-8602, Bangladesh; ²Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Correspondence: Ferdous Ahamed (ferdous@pstu.ac.bd)

The cyprinid fish *Salmostoma bacaila* (Hamilton, 1822) is commonly known as large razorbelly minnow. This species is usually found in slow running streams but also occurring in rivers, ponds, and inundated fields throughout the South Asian countries including Bangladesh, Pakistan, India, Nepal and Afghanistan. Some biological features including sex ratio, length-frequency distributions (LFDs), size at sexual maturity, spawning season, length-weight relationships (LWRs) and condition factor of *S. bacaila* were studied. Samples were collected seasonally during June 2017 to May 2018 from the tributary of the Payra River, southern Bangladesh. Total length (TL) and body weight (BW) for each individual was measured. Sex was determined by visual inspection of the gonad and the gonad weight was recorded. The gonadosomatic index (GSI) was calculated as $GSI (\%) = (GW / BW) \times 100$. Size at sexual maturity was estimated using two approaches: i) from the relationship between TL and GSI, ii) from the relationship between the percent mature females and TL class. Spawning season was estimated based on the seasonal variations of GSI. LWRs were calculated according to the equation: $BW = a \times TL^b$. Fulton's condition factor (K) was estimated using the equation: $K = (BW / TL^3) \times 100$. The overall sex ratio was significantly different from the expected value of 1:1 ($p < 0.001$) in favor of male specimens. Females were significantly larger than males. Size at sexual maturity was estimated at 7.6~7.7 cm TL. Seasonal variations in gonadosomatic index indicate that the main spawning season is from spring to summer. The LWRs showed negative allometric growth in both sexes; however, with clear seasonal variation. Fulton's condition factor varied in both sexes and was attributed to variations in GSI with maturity. The findings of this study will be helpful to formulate management and conservation strategies of *S. bacaila* population.

Keywords: *Salmostoma bacaila*, sexual maturity, spawning season, length-weight relationship, condition factor

FSB2019-MAN-20**Fish diversity in the River Narshunda at Tarail, Kishoreganj, Bangladesh**

Md. Khalilur Rahman¹, J. N. Akhter², T. Ahmed³

¹Freshwater Station, Bangladesh Fisheries Research Institute, Mymensingh-2201; ²Headquarters, Bangladesh Fisheries Research Institute, Mymensingh-2201; ³Riverine Station, Bangladesh Fisheries Research Institute, Chandpur-3602, Bangladesh.

Correspondence: M. K. Rahman (krahman2863@yahoo.com)

The River Narshunda is connected to a number of rivers beels and haors of Kishoreganj district. The diversity of fish fauna of the River Narshunda at Tarail Upazila of Kishoreganj District has been studied from the period of January, 2003 to December, 2017. The aim of the study was to find out the riverine fish species diversity in the River Narshunda of Kishoreganj district. About 114 fish species were recorded and identified during the investigation under 10 orders, 27 families and 68 genera. Among 114 species, 78 species were found under the order Cypriniformes, 17 species were found under the order Perciformes, 5 species were from the order Clupeiformes, 4 species were found under the order Channiformes, 2 species were from the order Synbranchiformes, Tetraodontiformes and Beloniformes and a single species was found under the order Syngnathiformes, Anguilliformes and Cyprinodontiformes each. No exotic species was recorded during the study period. During the study period, only 19 endangered fish species were recorded from the study sites.

Keywords: endangered fish, Narashunda River

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**Technical Session 8:
Post-harvest Fisheries & Food Safety**

KEYNOTE PAPER

Metagenomic approaches in aquatic bioscience: significance of studies on a marine bay and an urban river for productivity, biotechnological applications, and food safety

Prof. Dr. Shugo Watabe

Laboratory of Marine Genomics Science, Kitasato University

School of Marine Biosciences, Kanagawa, Japan

Correspondence: Shugo Watabe (swatabe@kitasato-u.ac.jp)

Biography

Shugo Watabe is currently serving as Project Professor at the Laboratory of Marine Genomics Science, Kitasato University School of Marine Biosciences, Japan. He is currently serving as the Vice President of Association of Japanese Agricultural Scientific Society and Member of Science Council of Japan. Before that he served as the President of the Japanese Society of Fisheries Science from 2012 – 2016. He obtained his Ph.D. from the Department of Fisheries Science, Graduate School of Agriculture at the University of Tokyo in 1976, and a visiting scientist at the College of Agriculture, Faculty of Food Science, the University of Arizona, USA from 1983 to 1985. From 1994 to 2012, he was the Professor of Aquatic Molecular Biology and Biotechnology at the University of Tokyo and acted as the Director of Fisheries Laboratory, Graduate School of Agricultural and Life Sciences, the University of Tokyo from 2004 to 2007. From 2007 to 2010, he served as the Director of Technology Advancement Center, Graduate School of Agricultural and Life Sciences, The University of Tokyo. Besides serving as Kitasato University, he is an honorary professor at the University of Tokyo, Japan. With over 50 years of experience in teaching and research, he published over 180 scientific papers in reputed journals. Professor Watabe served as the President of Japanese Society of Fisheries Science from 2012 to 2016, President of Marine Biotechnology of Japan from 2013 to 2017. For his outstanding contributions in the field of fisheries, Professor Watabe received a number of prestigious awards from different international organizations including the Japanese Society of Fisheries Science Award from the Japanese Society of Fisheries Science in 2006 and Japan Prize of Agricultural Science from the Association of Japanese Agricultural Scientific Societies in 2015.

Abstract

In recent years, the dramatic progress in molecular biology has greatly changed the way of our thinking and how to proceed with aquatic bioscience research. Since the declaration of complete human genome, the whole genome sequencing has been attempted to all organisms. The advent of the next-generation sequencing, which serves sequencing with a reasonable cost, further enhanced above-mentioned attempts. This trend has led to metagenomic analysis on biotic cells present in any environments. Now it is possible to generate a comprehensive picture of biodiversity, the functions of genes and metabolic capacity of a variety of environmental microbial communities within a short period. Japan's Exclusive Economic Zone (EEZ) possesses one of the highest biodiversity in the world. This high level of diversity provides a source of abundant biological resources, and Japan, as an oceanic nation, has enjoyed its benefits since ancient times. Under such circumstances, Japan has developed the marine biotechnology field from the 1980s ahead of the rest of the world, and has been pioneering the active use of marine bioresources, as well as understanding the diversity of marine organisms together with physicochemical marine environment research. Similar studies conducted on urban rivers in Japan has also led to an understanding of the taxonomic profiles of bacterial consortia that are important ecologically as well as economically. The ultimate focus is on environmental conservation and resource security by utilizing biotechnological application for human welfare.

Keywords: environment, shotgun metagenome, aquatic resource utilization

FSB2019-PHF-01

Quality assessment of ethnic fermented product Nga-pi, traditionally prepared at Cox's Bazar region

Fatema Hoque Shikha, Md. Ismail Hossain, Qamruzzaman Howlader

Department of Fisheries Technology, Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Correspondence: Md. Ismail Hossain (ihossain.ft@bau.edu.bd)

Nga-pi, an ethnic fermented product traditionally prepared at Cox's Bazar region by Rakhine people is one of the popular food items of that area. To assess the quality of traditionally prepared Nga-pi, raw shrimp used for Nga-pi preparation and final product were collected from producers, whole sellers and retailers of two different areas, Chaowfalldandi and Nazirartak, Cox's Bazar, Bangladesh. The collected samples were brought to the Fish Processing Laboratory, Department of Fisheries Technology, Bangladesh Agricultural University, Mymensingh for performing different analysis. Some amount of the collected Nga-pi sample (from producer) was stored at refrigeration temperature (5 to 8°C) for 90 days to observe the changes in nutritive values during the storage. Assessment of sensory and biochemical parameters were done following the standard procedures. A comparative study was carried out among the samples collected from two different areas. Comparative study result showed no big difference in nutritive and other values among these two areas. The sensory analysis result of traditionally prepared Nga-pi showed better grade point for the sample collected from producers than whole sellers or retailers. The results of proximate composition analysis for the samples of three different sources-producer, whole seller and retailer showed that the moisture content ranged of 53.29% to 58.66%, the crude protein content ranged from 49.71% to 53.31%, the crude lipid content ranged from 3.59% to 12.10% and ash content ranged from 14.38% to 40.78% with the lowest values for the sample collected from producer and the highest value for the sample collected from retailer, respectively. On the other hand the TVB-N value was found 25.06 mg/100g and APC value 2.01×10^5 CFU/g in Nga-pi collected from producer which values were lesser than the values found for other two samples. The result of the Nga-pi sample stored refrigeration temperature (5 to 8°C) for 90 days showed that- the percent moisture content, percent ash content, TVB-N value and APC value increased but the percent protein and lipid content decreased with the progress of storage time.

Keywords: fermented product, Nga-pi, traditional preparation, quality assessment, Cox's Bazar

FSB2019-PHF-02

Comparative quality analysis of dried fish (*Harpadon nehereus*): Traditional vs. Improved (UC Davis Chimney Dryer Produced)

Md. Sazedul Hoque¹, Biplob Dey Mithun¹, Md. Mahmudul Hasan¹, Martin L. van Brakel²

¹*Department of Fisheries Technology, Faculty of Fisheries, Patuakhali Science and Technology University, Dumki, Patuakhali-8602, Bangladesh;* ²*Scientist ECOFISH^{BD}, WorldFish Bangladesh and South Asia Office, Banani, Dhaka-1213, Bangladesh.*

Correspondence: Md. Sazedul Hoque (sazedul.fst@pstu.ac.bd)

Fish drying is a traditional method of fish preservation that provides cheap dietary sources of animal protein in Bangladesh. However, different problem associated in traditional method produced low-quality dried fish. The aim of the present study was to produce improved quality dried fish using UC Davis chimney solar dryer. The study also compared the changes of sensory, microbial and biochemical quality of Bombay duck (*Harpadon nehereus*) dried fish produced

from improved method vs. collected traditional method. The sensory, microbial and bio-chemical quality of dried fish was evaluated by Quality index method, standard plate count and AOAC method, respectively. The results revealed excellent and highly acceptable organoleptic characteristics of dried fish produced from improved method. The APC, TEC, TViC and TSC of improved dried fish was 4.32×10^4 CFU/g, 4.8×10^5 CFU/g, 1.3×10^2 CFU/g and absent (all values within the permissible limit), comparing with the traditionally produced dried fish samples found to be 7.72×10^7 CFU/g, 2.6×10^2 CFU/g, 3.9×10^5 CFU/g and 5.0×10^4 CFU/g, respectively (all values exceeded the permissible limit). The protein, lipid, ash and moisture content of improved dried fish was 48.98%, 6%, 20.95% and 23.97%, while the traditional dried fish was 44.46%, 5.86%, 21.29% and 28.29%, respectively. The TVB-N content of improved and traditional dried fish was at 0.040 mgN/100g and 0.135 mgN/100g in sterile packed, and 0.162 mgN/100g and 0.149 mgN/100g in polyethylene packed sample, respectively. The above results confirm that UC Davis chimney dryer produced superior quality of dried fish compared to traditional one both in initial and storage time, while shelf life of both dried fish is extended under sterile packed conditions.

Keywords: UC Davis chimney dryer, improved dried fish, control dried fish, Bombay duck, quality analysis

FSB2019-PHF-03

Simultaneous and faster method for determination of antibiotics as nitrofurans metabolites in fish and shrimp muscle using enzyme-linked immunosorbent assay

Md. Mezanur Rahman¹, K.M. Golzar Hossain¹, Md. Golam Mostofa¹, Salma Begum¹, Shamshad B. Quraishi²

¹Quality Control Laboratory, Chattogram, Department of Fisheries, Bangladesh; ²Analytical Chemistry Laboratory, Chemistry Division, Atomic Energy Centre, Dhaka, Bangladesh

Correspondence: Md. Mezanur Rahman (mezanur.ict94@gmail.com)

A simultaneous and faster analytical method was developed for the extraction of four nitrofurans metabolites from the fish and shrimp samples. Homogenized samples were hydrolyzed and derivatized with 4-nitrobenzaldehyde. Subsequently, extracted with ethyl acetate, evaporated to dryness and the residue was re-dissolved in Hexane. Commercial enzyme-linked immunosorbent assay (ELISA) method has been applied for the analysis of nitrofurans metabolites. The method was validated in shrimp and fish matrix according to the criteria defined in Commission Decision 2002/657/EC for qualitative screening method following the guidelines set by the community reference laboratories residues (CRLs) 2010. Characteristic's parameters as detection capability (CC β), specificity/selectivity, stability, recovery and precision were determined. Detection capability (CC β) for nitrofurans metabolites (AMOZ, AOZ, AHD and SEM) in Fish and shrimp matrix was in the range of 0.5- 0.75 μ g/kg, which were less than the Maximum Required Performance Limit (MRPL) of 1 μ g/kg set by European Union. The proposed method is suitable for semi-quantitative screening analysis of antibiotics in the fish and shrimp muscle in conformity with the current EU performance requirements before exporting to EU and other countries. Results from analysis of unknown samples by the developed ELISA method were comparable to those obtained by a liquid chromatography-tandem mass spectrometry (LC-MS/MS) method. Accuracy and precision of the method had also been checked through participation of International Proficiency Testing (PT) having a very satisfactory performance score.

Keywords: nitrofurans metabolites, method validation, fish and Shrimp, CC β .

FSB2019-PHF-04

Shelf-life of ready-to-cook (RTC) hilsa fish ball under modified atmosphere packaging at refrigerated (4°C) storage condition

Razia Sultana¹, Md. Monjurul Hasan², Fawzia Adib Flowra¹, Md. Abul Bashar², Md. Tariqul Islam¹

¹*Department of Fisheries, University of Rajshahi, Rajshahi-6205, Bangladesh;* ²*Bangladesh Fisheries Research Institute, Riverine Station, Chandpur, Bangladesh*

Correspondence: Md. Tariqul Islam (tariqrubd@gmail.com)

Modified atmosphere packaging (MAP) is a widely used packaging technique for displaying chilled fish and its products in developed countries. In view of this, the quality and shelf-life of ready-to-cook (RTC) hilsa fish ball was evaluated by biochemical and microbiological analysis under not sealed pack (control), MAP-1 (50% CO₂& 50% N₂) and MAP-2 (40% CO₂ & 30 N₂ & 30% O₂) pack at 5 days interval during 20 days of storage at 4°C. The pH value of hilsa fish ball was in the range of 5.85 to 6.28. The total volatile base nitrogen (TVB-N) value gradually increased with the storage time. However, there were no significant (p<0.05) differences in pH and TVBN values among the three packaging conditions at each of the storage days. Thiobarbituric acid reactive substances (TBARS) fluctuated between 1.13 to 4.84 mg malonaldehyde/Kg during the storage period. Significantly (p<0.05) lower TBARS values were observed in MAP-1 sample on 10th, 15th and 20th day of storage compared to that of control and MAP-2 sample. The pH and TVB-N values of the samples under all packaging conditions were within the acceptable limit during the storage period. The aerobic plate count (APC) gradually increased from the initial value of 4.08log CFU/g with time in all packaging conditions. However, significantly (p<0.05) lower APC were observed on the 10th, 15th and 20th day of storage in all samples compared to that of the control sample. Considering the bacterial counts, the shelf-life was determined at approximately 10 days for not sealed pack, 17 days for MAP-1, and 15 days for MAP-2 sample, based on the 6 logs CFU/g, which is considered as the acceptable limit for ready-to-eat fishery products. Therefore, the MAP-1 (50%CO₂ and 50%N₂) is the best packaging, which can be utilized by the superstores to display hilsa fish ball with extended shelf life.

Keywords: hilsa fish, fish ball, MAP, shelf-life

FSB2019-PHF-06

Seaweed-based functional food attributes: Effects of edible brown seaweed *Undaria pinnatifida* in improving memory functions to prevent age-related neurodegeneration

Md. Mohibullah^{1,2}, Yong-Ki Hong²

¹*Department of Fishing and Post Harvest Technology, Sher-e-Bangla Agricultural University, Dhaka, Bangladesh;* ²*Department of Biotechnology, Pukyong National University, Busan, Republic of Korea.*

Correspondence: Yong-Ki Hong (ykhong@pknu.ac.kr)

Neuroprotective and neurotrophic supports are critical for neuronal survival, outgrowth, and functional activity in the degenerating brain where oxidative stress is a leading cause of neurological disorders. An ethanol extract of the phaeophyte *Undaria pinnatifida* (UPE) concentration dependently increased the viability of rat hippocampal neurons in both hypoxia induced oxidative stress and normoxic conditions. UPE, at an optimal 15 µg/mL, significantly reduced reactive oxygen species formation, DNA fragmentation, early and late apoptosis rates,

and mitochondrial membrane dysfunction against hypoxia. Learning and memory are closely related to synaptic plasticity in neurons, associated with robust spine density and classical morphological patterns. Here, we further investigated the effects of UPE on learning and spatial memory in mice. For behavioral studies, the passive avoidance test and radial-arm maze paradigm were used. With oral administration of UPE at an optimal concentration of 2mg/g body weight, the latency time in the passive avoidance test was increased significantly versus the scopolamine induced memory impairment group. The working errors and latency time in the radial-arm maze decreased compared with scopolamine-administered mice. Dendritic spine morphology of hippocampal neurons in the UPE-administered group (2 mg/g body weight) was analyzed using Golgi-impregnated tissue sections; the number of dendritic spines increased significantly. Numbers of large mushroom and stubby spines also increased. In addition, the most active neuroprotectant from UPE was identified as fucoxanthin (Fx) by reverse-phase high-pressure liquid chromatography (RP-HPLC) and ¹H NMR. Fucoxanthinol (FxOH), a metabolite after enzymatic hydrolysis of Fx, significantly provided protection from neurite breakage and also enhanced the length of neurites in hypoxia cultures. The findings suggest that UPE and its active component Fx as well as FxOH have the ability to protect central nervous system neurons, and thus can be used as dietary supplements for the prevention and treatment of memory-related neurological disorders.

Keywords: *Undaria pinnatifida*, fucoxanthin, fucoxanthinol, neuroprotection and memory formation, functional food, neurodegeneration

FSB2019-PHF-08

Biochemical and microbiological perspectives of semi-fermented fish products of Bangladesh

Muhammad Mehedi Hasan

Department of Fisheries Technology, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Correspondence: Muhammad Mehedi Hasan (mehedihasan@bau.edu.bd)

Indigenous semi-fermented fish product *shidal* is consumed either as main dish or condiment in Bangladesh. The primary *shidal* producing sites in Bangladesh were surveyed through personal interview and on the spot observation to record preparation techniques and species used. Common preparation method by combined activity of drying and semi-fermentation in earthen vats was noticed with exception for a particular species. Apart from spot-fin swamp barb *Puntius sophore*, several marine and freshwater fish species, namely, anchovy *Setipinna* spp., Indian pellona herring *Pellona ditchela*, croaker *Johnius* spp, smooth-back herring *Raconda russeliana*, Indo-Pacific king mackerel *Scomberomarus guttatus*, bronze featherback *Notopterus notopterus* and Gangetic leaffish *Nandus nandus* were documented as raw material of *shidal*. Spot-fin swamp barb and Indian pellona herring *shidal* carried better sensory attributes than the other counterparts. The market share of at one time exclusive species spot-fin swamp barb is challenged by several marine species. Proximate analyses of afore mentioned samples revealed the highest crude protein but lowest lipid in bronze featherback (55.23±1.11% and 2.86±0.25%, respectively), whereas lowest crude protein but highest lipid in Indo-Pacific king mackerel (20.86±1.43% and 5.4±0.98%, respectively). The protein breakdown products like total volatile bases and trimethylamine showed highest protein degradation in Gangetic leaffish (283.2±3.27 and 68.2±0.71, respectively) and minimal degradation in smooth-back herring (113.9±0.09 and 47.4±0.36, respectively). Peroxide value showed highest lipid oxidation in croaker (64±0.15) and lowest in bronze featherback (28.2 ±0.57). The pH showed highest value in smooth-back herring

(7.7±0.9) and lowest in Indo-Pacific king mackerel (6.6±0.01). Total plate count (log cfu/g) was highest in smooth-back herring (5.43±0.53) and lowest in bronze featherback (4.72±0.28), whereas total fungal count (log cfu/g) was highest in bronze featherback (5.97±0.7) and lowest in Indo-Pacific king mackerel (3.1±0.17). Future investigations on antioxidative potential, fatty acid and protein profile might disclose the undiscovered features of semi-fermented fish products of Bangladesh.

Keywords: semi-fermented fish, *shidal*, sensory attributes, biochemical, microbiological

FSB2019-PHF-09

Characterization of *Escherichia coli* and *Staphylococcus aureus* isolated from shrimp farm areas of Satkhira district, Bangladesh

Md. Ariful Islam, Md. Muket Mahmud, Ajran Kabir, Md. Ahsanul Haque Shahid, KHM Nazmul Hussain Nazir

Department of Microbiology and Hygiene, Faculty of Veterinary Science, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh.

Correspondence: KHM Nazmul Hussain Nazir (nazir@bau.edu.bd)

At present contamination of shrimp is one of the important issue for the farms and exporters in Bangladesh. The present study was conducted to isolate and identify shigatoxin producing *Escherichiacoli* and pathogenic strains of *Staphylococcus aureus* from shrimp farming areas of Satkhira district. A total of 180 samples comprising of shrimp (n=80), water (n=50 and mud (n=50) were collected and subjected for total viable count determination; isolation and identification of *E. coli* and *S. aureus* on the basis of cultural, morphological and biochemical properties. Confirmatory diagnosis of *E. coli* and *S. aureus* were performed by Polymerase Chain Reaction (PCR) using strain-specific primers *stx-1* & *stx-2*; and *nuc* gene, respectively. Antibiotic sensitivity pattern of the selected isolates were assured by using levofloxacin, azithromycin, ciprofloxacin, moxifloxacin, gentamicin, ceftriaxone, amoxicillin and ertapenam. The mean TVC was found higher in mud (5.03±1.012) followed by shrimp (4.68±0.947) and water (4.495±0.965). Out of 180 samples, 37 (20.5%) samples were found positive for *E. coli* and 90 (50%) samples were found positive for *S. aureus*. A total of 18 (48.6%) isolates of *E. coli* and 25 (27.7%) isolates of *S. aureus* were found positive for *stx-1* and *nuc* gene, respectively. None of the *E. coli* isolates were found positive to *stx-2* gene. Overall prevalence of pathogenic strains of *E. coli* and *S. aureus* were 10% and 13.8%, respectively. Both *E. coli* and *S. aureus* were found resistant to ertapenam, amoxicillin and sensitive to azithromycin, ciprofloxacin, moxifloxacin, gentamycin and levofloxacin. It may be concluded that presence of pathogenic strains of *E. coli* and *S. aureus* are not only a threat for the shrimp farms but also a big threat to human health.

Keywords: shrimp, *Escherichia coli*, *Staphylococcus aureus*, PCR, *stx-1* gene, *stx-2* gene, *nuc* gene, Multidrug resistance.

FSB2019-PHF-11

Health benefits of bioactive peptides produced from silver jewfish (*Johnius argentatus*)

Jasmin Akter Jarin, Muhammad Mehedi Hasan, Md. Shaheed Reza, Md. Kamal

Department of Fisheries Technology, Bangladesh Agricultural University-2202, Bangladesh

Correspondence: Md. Kamal (mkamal772011@gmail.com)

Studies were conducted to determine health benefits of bioactive peptides produced from washed and unwashed mince of silver jewfish (*Johnius argentatus*) using 0.020% (w/w) papain at pH 6.5. Peptides contained 1.3% moisture, 94% protein, 3% total fat, 1.5% ash and 200mg/100g sodium and possessed amino acid profile of 6.47% arginine, 10% lysine, 2.21% histidine, 3.55% phenylalanine, 3.76% tyrosine, 8.16% leucine, 4.48% isoleucine, 3.31% methionine, 4.91% valine, 5.71% alanine, 3.51% glycine, 3.01% proline, 16.90% glutamate, 4.40% serine, 4.56% threonine, 10.20% aspartate, 1.13% tryptophan and 1.00% cysteine. No harmful elements including Pb, viable cell counts, coliform bacteria, mold and *Staphylococcus aureus*, were found in peptides produced. Daily 9 peptide tablets containing 3 g protein were tested among 14 respondents for 3 months. After 90 days of taking peptides tablets, all hypertension patients attained normal blood pressure (120/80 mmHg) along with satisfactory CK-MB levels while 85% respondents' blood glucose level lowered to normal range. Different kinds of body pain including leg pain, joint pain, muscle pain, back pain and knee pain at pre-trial period were reduced from 70%, 50%, 40%, 55% and 60% to 20%, 20%, 10%, 5% and 13% respectively at post-trial. The peptides were also found effective for those who were suffering from sleeping problem and gastric problems. All the respondents were interested to buy fish peptides tables if it is produced commercially and available in the market. Majority (92%) of the respondents opined that the price between 1,000 to 1,500 BDT would be reasonable for them for 100 tablets while 74% of the respondents opined that tablet size was adequate although the number of tablets consumed per day were too many. The results of this pilot survey provided evidence for usefulness of fish peptides in patients struggling with hypertension, diabetes and some other health problems.

Keywords: bioactive peptide, marine fish, papain, protein tablet, human health

FSB2019-PHF-10

Study on TVB-N Curve and TMA-N curve of two carp species available in the fish market of Bangladesh

M. A. Mansur, M. N. Uddin, M. N. Haider, Hamima-E-Noor, Mahfuja Akter
Department of Fisheries Technology, Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh
Correspondence: Mohammad Abul Mansur (mansurft63@gmail.com; mansurft63@bau.edu.bd)

This research was conducted for determining TVB-N curve, TMA-N curve of two carp species *Labeo rohita* and *Catla catla* in winter and rainy season in Bangladesh. TVB-N and TMA-N values of fishes were estimated immediately after receiving in the laboratory and at every two hours interval until 10 hours chilled storage. In winter TVB-N of *Labeo rohita* was 15.52 mg/100g at the beginning and it was increased to 18.62 mg/100g, 20.57 mg/100g, 23.09 mg/100g and 27.39 mg/100g at every two hours interval. TMA-N value was 3.36 mg/100g at the beginning and it was increased to 4.92 mg/100g, 5.81 mg/100g, 6.42 mg/100g and 9.35 mg/100g at every two hours interval. In case of *Catla catla* the TVB-N value was 16.10 mg/100g and it was increased to 18.12 mg/100g, 20.30 mg/100g, 21.98 mg/100g and 25.73 mg/100g at every two hours interval. In rainy season TVB-N value of *Labeo rohita* was 18.00 mg/100g at the beginning and it was increased to 20.30 mg/100g, 22.40 mg/100g, 24.04 mg/100g and 29.26 mg/100g at every two hours interval. TMA-N value was 2.39 mg/100g at the beginning and it was increased to 3.10 mg/100g, 4.30 mg/100g, 5.75 mg/100g and 6.90 mg/100g at every two hours interval. In winter season TVB-N value of *Catla catla* was 18.20 mg/100g at the beginning and it was increased to 21.00 mg/100g, 22.96 mg/100g, 24.70 mg/100g and 26.93 mg/100g at every two hours interval. The TMA-N value of *Catla catla* in winter season was 2.10 mg/100g at the beginning and it was increased to 2.88 mg/100g, 4.00 mg/100g, 5.30 mg/100g and 7.10 mg/100g at every two hours interval. In both seasons pattern in the TVB-N curve and TMA-N curve was

that the value gradually increased with storage time but remained below the maximum allowable limit of TVB-N and TMA-N.

Keywords: TVB-N curve, TMA-N curve, carp

FSB2019-PHF-12

Shrimp: An important source of multidrug resistant *Vibrio* species in Bangladesh

Ripon Sarker, KHM Nazmul Hussain Nazir, Muhammad Tofazzal Hossain
Department of Microbiology and Hygiene, Faculty of Veterinary Science, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh
Correspondence: Muhammad Tofazzal Hossain (tofazzalmh@yahoo.com)

Among more than 70 identified *Vibrio* species, *V. parahaemolyticus*, *V. cholerae*, *V. alginolyticus* and *V. vulnificus* are of major concern as they are pathogenic to human and fish as including shrimps. Vibriosis is important concern due to huge loss of shrimp industries throughout the world. The present research work was conducted for the detection and differentiation of *Vibrio* species with their prevalence in shrimp farm areas of Satkhira, Khulna, and Bagerhat districts. A total of 146 samples (Shrimp=100, Water=23 and Mud=23) were collected and subjected to bacterial isolation and identification by using cultural, morphological and biochemical properties. Confirmatory diagnosis was performed by multiplex PCR using species-specific primers designed from *groEL* gene. Antibiotic sensitivity test of selected isolates were also performed using 17 commercially available antibiotics. Among 146 samples, 128 were suspected for the presence of *Vibrio* spp. on the basis of culture and finally 122 isolates were confirmed as *Vibrio* by PCR using genus specific *groEL* gene primers which produced a positive band at 1117 bp. Out of 122 PCR positive isolates, 88 were confirmed as *V. parahaemolyticus* (60.3%), 7 were as *V. cholerae* (4.8%), 13 were as *V. alginolyticus* (9%) and 6 were as *V. vulnificus* (4%) by multiplex PCR. All the tested isolates of *V. Parahaemolyticus*, *V. cholerae*, *V. alginolyticus* and *V. vulnificus* were found sensitive to Levofloxacin and Norfloxacin; and found resistant to Amoxicillin, Cefixime, Moxifloxacin, Lincomycin and Cefuroxime which is the indication of presence of multidrug resistant *Vibrio* spp. in shrimp farm areas. It might be concluded that multidrug resistant *Vibrio* species is not only a threat for the shrimp farms but also a big threat to human health.

Keywords: shrimp, *V. Parahaemolyticus*, *V. cholerae*, *V. alginolyticus*, *V. vulnificus*

FSB2019-PHF-13

Development of ready-to-cook (RTC) tilapia fish (*Oreochromis niloticus*) curry and extension of shelf-life by vacuum and modified atmosphere packaging at refrigerated storage

Taposhi Mariam Begum^{1,2}, Razia Sultana¹, Md. Abdur Rahim¹, Fawzia Adib Flowra¹, Md. Tariqul Islam¹

¹Department of Fisheries, University of Rajshahi, Rajshahi-6205, Bangladesh; ²Department of Fisheries, Dhaka, Bangladesh

Correspondence: Md. Tariqul Islam (tariqrubd@gmail.com)

Modified atmosphere packaging (MAP) is a widely used packaging technique used for displaying chilled fish and its products in developed countries. For this purpose, the quality and shelf-life of ready-to-cook (RTC) tilapia fish (*Oreochromis niloticus*) curry using different ingredients and spices was evaluated by biochemical and microbiological analysis under not sealed pack (control), vacuum pack and MAP-1 (50% CO₂ & 50% N₂) and MAP-2 (50% CO₂ & 50% O₂) at 4 days interval during 20 days of storage at 4°C. The pH value of tilapia fish curry was in the range of

5.97 to 6.52. The total volatile base nitrogen (TVB-N) value in fish curry gradually increased with the storage period. However, there were no significant ($p < 0.05$) differences in pH and TVBN values among treatments during the storage period. Thiobarbituric acid reactive substances (TBARS) fluctuated between 0.07 to 1.28 mg malonaldehyde/Kg during the storage period. The pH, TVB-N and TBARS values of the samples under all packaging conditions were within the acceptable limit during the storage period. On the other hand, total viable count (TVC) gradually increased from the initial value of 4.22 log CFU/g with time in all packaging conditions. However, significantly ($p < 0.05$) lower TVC were observed on the 12th and 16th day of storage in all samples compared to that of the control sample. Considering the bacterial counts, the shelf-life was determined at approximately 11 days for not sealed pack, 14 days for vacuum pack, 16 days for MAP-2, and 19 days for MAP-1 sample, based on the 7 logs CFU/g, which is considered as the upper acceptable limit for fresh and frozen fish. Therefore, the MAP-1 (50% CO₂ & 50% N₂) is the best packaging, which can be utilized by the superstores to display their products with extended shelf life.

Keywords: tilapia, fish curry, vacuum, MAP, shelf-life

FSB2019-PHF-14

Post-mortem changes in three fresh water eels, *Mastacembelus armatus*, *Macrognathus aculeatus* and *Mastacembelus pancalus* during ice storage

Fatema Hoque Shikha, Md. Ismail Hossain, Mahmudul Hasan

Department of Fisheries Technology, Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Correspondence: Md. Ismail Hossain (ihossain.ft@bau.edu.bd)

Studies were conducted on the progress of rigor-mortis and the post-mortem changes in three species of freshwater eels during storage at room temperature (30 to 35°C) and ice (0°C). Rigor-mortis in fish sample at room temperature, started 1hr after spiking and it reached to a maximum of 76%, 57.14% and 100% within 4 hrs after death in *Mastacembelus armatus* (Baim), *Macrognathus aculeatus* (Tara baim) and in *Mastacembelus pancalus* (Guchi baim), respectively. In ice stored eels also rigor started within one hour of spiking and gradually reached to a maximum of 88.89% within 3 hrs in Baim and 85.71%, 100% in Tara baim and in Guchi baim within 2 hrs, respectively. At that level, rigor continued for 17, 14 and 18 hrs in Baim, Tara baim and Guchi baim, respectively and then started to relax. The rigor relaxed up to 22.22, 21.43 and 16.67% within 34, 32 and 36 hrs in Baim, Tara baim and in Guchi baim, respectively without emitting any objectionable odor. The pH of the muscle was 6.84, 6.80 and 6.92 immediately after catch in Baim, Tara baim and in Guchi baim, respectively which decreased gradually with the lapse of storage period regardless of the storage temperature but the decrease in pH was much rapid in samples stored at room temperature then those of stored in ice. The organoleptic quality of eels during ice storage was assessed on the basis of the sensory parameters. On the basis of the score, Baim was found in acceptable conditions for 24 days whereas Tara baim and Guchi baim were acceptable condition for 28 days in ice storage. Moisture, protein, lipid and ash contents in muscles immediately after death were 79.20±1.77, 15.40±1.10, 4.47±0.72 and 1.77±0.15% in Baim; 78.54±1.7, 14.68±0.57, 5.52±1.11 and 1.62±0.09% Tara baim and 78.50±1.34, 15.34±1.23, 4.77±0.70 and 1.72±0.06 % in Guchi baim. The TVB-N, peroxide and NPN value remained within the recommended value up to 24 days in Baim and 28 days in Tara baim and Guchi baim. The initial bacterial loads were 6.5×10³, 6.2×10³ And 6.3 ×10³ CFU/g in Baim, Tara baim and in Guchi baim, respectively. At the end of the 24 days of ice storage, bacterial load increased up to 4.3 ×10⁶ CFU/g in Baim, 3.9×10⁶ CFU/g in Tara baim and 4.5×10⁶ CFU/g in Guchi baim at the end of 28 days of storage in ice.

Keywords: post mortem changes, rigor, fresh water eel, ice storage

FSB2019-PHF-15

Effects of salt and other preservatives on the quality and insect infestation of dried silver jewfish (*Johnius argentatus*)

Nadia Nusrat, Md. Shaheed Reza, Md. Kamal

Department of Fisheries Technology, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh.

Correspondence: Md. Kamal (mkamal772011@gmail.com)

Studies were conducted to determine the effects of salt and other preservatives on blowfly infestation of silver jewfish (*Johnius argentatus*) during drying and storage period. Fresh jewfish collected from Teknaf Fish Market, Cox's Bazar were subjected to drying on platform type open dryer for 4-6 days. After 4 days of drying, large number insect larvae were found in control treatment, whereas relatively small number were observed in treated samples, except 25% salt treatment where no insect larvae were found. Study was also conducted on the optimization of salt concentrations in preventing blowfly infestation of silver jewfish during drying. No insect larvae were found in treatments containing salts concentrations from 15% to 25%. During storage, the dried products kept in polythene bag but the mouth was open was acceptable conditions for 45 days, while the products kept in polythene bag but the mouth was closed was acceptable condition up to 60 days of storage. In order to reduce the salt concentration in product, attempt was made to see the influence of Niseen S and common salt on the quality of the dried fish products as well as preventing insect infestation in various treatments but there was no larval development in any treatments even in control was observed during drying and during pre-storage. Rehydration properties of dried silver jewfish produced with different concentration of Niseen S and common salts showed that uptakes of water by the samples ranged from 69-89% which indicates good quality of the products produced with or without NiseenS, while organoleptic properties of the dried fish products revealed that mean scores for colour, flavor, texture and odour ranged from 7-9, indicating good quality of all the products.

Keywords: jewfish, salt, infestation, blowfly, Niseen S, storage

FSB2019-PHF-16

Comparison on fatty acid profile in the different body parts of freshwater crab (*Paratelphusa lamellifrons*)

Md. Badrul Islam¹, Md. Moniruzzaman Sarker², Md. Redwanur Rahman³, Mala Khan⁴, Md. Juwel Hosen⁴, Md. Abu Hasan⁴, M. A. A. Shofi Uddin Sarkar⁴, Mirola Afroze⁴

¹Drugs & Toxins Research Division, BCSIR Laboratories, Rajshahi, Bangladesh; ²Department of Zoology, University of Rajshahi, Rajshahi, Bangladesh; ³Institute of Environmental Science, University of Rajshahi, Rajshahi, Bangladesh; ⁴Designated Reference Institute for Chemical Measurements, BCSIR, Dhaka, Bangladesh

Correspondence: Md. Badrul Islam (badol02@yahoo.com)

Different body parts of freshwater crab *Paratelphusa lamellifrons* from Padma river were screened for profiling their fatty acid composition. Gas chromatographic studies revealed the presence 12 varieties of fatty acids of which three are SFA, 9 are UFA of which 5 were monounsaturated fatty acids (MUFA) constitute on average 35.70% of the total lipid and 4 were highly unsaturated fatty acids (PUFA). Amount of SFA, MUFA and PUFA and their concentrations in cephalothorax, cheliped and legs ranges between (24.45-26.77)%, (35.50-36.31)% and (16.90-17.76) % respectively. MUFAs were observed as the dominated one among the investigated fatty acids in all the body parts of *P. lamellifrons*. Except SFAs both cheliped and legs contained maximum amount of MUFAs (36.30% and 36.31%) and PUFAs (17.76% and 17.67%) compared to cephalothorax (34.50% and

16.90%). Palmitic (18.87-19.91) %, oleic (20.87-21.97)% and linoleic (13.62- 14.87)% was observed predominant fatty acids among the recorded SFAs, MUFAs and PUFAs in the present study. Omega-3 fatty acids were found maximum in cephalothorax (3.28%) compared to cheliped (2.89%) and legs (2.85)% whereas omega-6 fatty acids in cheliped (14.87%) and legs (14.82%) of *P. lamellifrons* than that of cephalothorax (13.62%). The present study findings indicate that all the body parts of freshwater crab (*P. lamellifrons*) are rich in essential fatty acids omega-3 and omega-6.

Keywords: fatty acid profile, different body parts, freshwater crab, essential fatty acid, Padma River

FSB2019-PHF-17

Investigation of shrimp/prawn farming status in south-west region of Bangladesh in context with its quality control and food safety issues

Mst. Subrina Khatun, M. Ariful Islum, K. K. U. Ahmed

Shrimp Research Station, Bangladesh Fisheries Research Institute, Bagerhat-9300, Bangladesh

Correspondence: Mst. Subrina Khatun (subrinskhatun@gmail.com)

To determine hazardous antibiotics/chemicals and pesticides residues in GAP and non-GAP farms and exploring the post-harvest management techniques of shrimp/ prawn for ensuring its food safety issues, a study was conducted from July 2016 to June 2019 in three upazilas viz. Bagerhat Sadar, Rampal and Kachua of Bagerhat district. A total of 550 shrimp/prawn farms were randomly questionnaire surveyed GAP criteria viz. good practice status in site selection, good practice status in farming, good practice status in water use, good practice status in surrounding environment and pest control of farm, good practice status in feed management, good practice status in disease management, good practice status in harvesting and post harvesting management were maintained for this survey. On the basis of surveyed data, the farms were categorized into three categories viz. Category-A, Category-B and Category-C where Category-A indicates the farms which comply 90-100% GAP criteria; Category-B indicates the farms which comply 70-< 90% GAP criteria and Category-C indicates the farms which comply 50-<70% GAP criteria. From the study it was found that only 1-2% farms were in category A, 30-43% farms were in category B, 50-60% farms were in category C and 6-9% farms did not follow any GAP criteria. From the surveyed farms, 10% farms were selected as sampling sites. When the culture period of shrimp/prawn exceeded three months then sampling was done in each farm. Multisampling was done when necessary. A total of 108 shrimp/prawn samples were collected in which 30% samples were from GAP farms and 70% samples were from non-GAP farms. Collected samples were analyzed for hazardous antibiotics/chemicals and pesticides residues (Heptachlor, Endrin, Dieldrin and DDT) using LC-MS and GC-MS machine. No hazardous Nitrofurantoin and Chloramphenicol metabolites were found from the samples collected from sampling farms. Analyzed report from ECD detector of Gas Chromatography shows that no residual concentrations of Heptachlor, Endrin, Dieldrin and DDT were found from GAP samples. In non-GAP samples, 14.8% samples comprising some residues of Heptachlor, Endrin and Dieldrin in which 10.2% samples residues were lower than the Maximum Residual Limit (MRL) which is not harmful for human health. Only 4.6% samples had residues which were slightly higher than the MRL. Exploration of post-harvest management techniques of shrimp/prawn were done observing the icing system quality and transportation system from farms to market/depot. It was found that 5% farmer used proper icing and transportation system as well, 20% farmers used moderate icing and transportation system and 80% farmers used poor icing and transportation system. It was also observed that pathogenic bacterial load was higher in poor icing and transportation system as well than the proper icing and transportation system. From the study it can be concluded that, if farmers follow at least 50% of the GAP criteria then the foods (shrimp/prawn) will be safer for human consumption.

Keywords: GAP, antibiotics, pesticides, post-harvest management, food safety

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**Technical Session 9:
Water Quality & Aquatic Pollution**

KEYNOTE PAPER

Development of national ecological stream health assessment model using fish indicators in Korea and the integrative stream health diagnosis

Prof. Dr. Kwang-Guk An

Chungnam National University, Daejeon, South Korea

Correspondence: Kwang-Guk An (kgan@cnu.ac.kr)

Biography:

Dr. Kwang-Guk An is serving as a Full Professor at the Department of Bioscience and Biotechnology, Chungnam National University, South Korea. His primary focus in research deals in Environmental Ecology, Limnology, River/Lake Ecology, Freshwater Biology, Ecological Health assessment and risk assessment of invasive fish species in Korea. He received his PhD degree in Aquatic Ecology from the University of Missouri, Columbia, USA in 1998. After his Ph.D., he worked as Post-Doc at the same institution and then moved to Ehwa Woman's University, South Korea. He then joined Gwangju Institute of Science and Technology (GIST) before joining Chungnam National University, where is he serving since 2004. He also served as a visiting professor in University of Michigan, Ann Arbor, USA during 2010-2011. He was the Vice President of Korean Society of Limnology during 2013-2014 and acted as an Editor-In-Chief of Korean Journal of Limnology in 2007-2009. Also, He served as a Vice-Dean at the College of Bioscience and Biotechnology in Chungnam National University, South Korea during 2014-2016. His current research projects explore the stream health using fish communities, water chemistry, nutrient dynamics and reservoirs eutrophication, ecological modelling and risk assessments and invasive fish species risk assessment. He has richly contributed to the scientific community by publishing research in various national and international research journals (approximately 260 research articles published till date).

Abstract:

The development of the national stream health assessment model in Korea was initiated by the Ministry of Environment, Korea in 2004 for the conservation and management for the disturbed and polluted streams and rivers ecosystems. I participated in the “National Aquatic Ecosystem Health Assessment Project” as a key project investigator for a multi-metric model development using fish taxa, and developed the national model and health criteria in 2007 using fish indicators. The national model is based on multi-metric fish model based on the fish community-level. I demonstrate the model development and the application to the model to Korean streams. In addition, I also describe some more low-level approaches to stream health assessments in the only presentation. Thus, the methodology was based on levels of fish community, but this presentation goes further extending up to physiological assays and the DNA levels of fish for the evaluations of stream ecosystem health. This is so-called “Integrative Approach for Ecological Stream Health Assessments (IAESHAs)”. The method of IAESHAs was applied to a stream ecosystem using multi-level organisations from a molecular-level of biomarkers to community-levels of bioindicators along with analysis of physical and chemical stressors. Water quality parameters of BOD, COD, TN, and TP were measured and the physical habitat health, based on Qualitative Habitat Evaluation Index (QHEI) model was analyzed. Biomarkers of comet assay, blood chemistry, physiological parameters, and bioindicators such as organismal, population, community-level parameters were evaluated along with eco-toxicity tests. The assessment approach of integrative ecological stream health would be used as a key tool for ecological restorations and species conservations in the degraded stream ecosystems. Ultimately, these approaches provide us an effective management strategy of stream ecosystems through establishments of ecological networks in various watersheds.

FSB2019-WQP-01

A study on heavy metal pollution in freshwater fish and marine fish of Bangladesh

Mohammad Abul Mansur

Department of Fisheries Technology, Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh.

Correspondence: Mohammad Abul Mansur (mansurft63@gmail.com; mansurft63@bau.edu.bd)

This research was conducted to detect and quantify five common heavy metal e.g. Chromium (Cr), Cadmium (Cd), Lead (Pb), Zinc (Zn) and Copper (Cu) in six freshwater fish and six marine fish species of Bangladesh. Freshwater fishes (*Hilsa ilisha*, *Clarias batrachus*, *Heteropneustes fossilis*, *Anabas testudineus*, *Oreochromis niloticus*, *Mystus corsula*) were collected from Mymensingh district of Bangladesh. Marine fishes (*Stromateus cinereus*, *Lates calcarifer*, *Trichiurus haumela*, *Johnius argentatus*, *Cybium guttatum*, *Harpodon nehereus*) were collected from Cox's Bazar district of Bangladesh. Heavy metal analysis by Atomic Absorption Spectrophotometer indicated that almost all species of this research study contained the stated five heavy metals (Cr, Cd, Pb, Zn and Cu) in their muscle. Cr was above maximum allowable limit (Cr = 0.0 to 8.14 ppm) in the freshwater fishes as well as in the marine fishes except *Stromateus cinereus*. Pb content was also above maximum allowable limit (Pb = 1.62 to 16.04 ppm) in the freshwater fishes and marine fishes. Maximum allowable limit of Cr and Pb is Cr= 0.05 ppm; Pb =2.0 ppm as recommended by WHO/FAO. However, Cd, Cu, Zn content was below the maximum allowable limit in the freshwater fishes as well as marine fishes. Maximum allowable limit of Cd, Cu, Zn is Cd = 1.0 ppm, Cu = 10.0 ppm, Zn = 100 ppm. Heavy metal was detected in the twelve species of fishes irrespective of origin i.e. freshwater fish or marine fish. From the result of this research it may be concluded that the freshwater fishes and marine fishes contain heavy metal. Some heavy metal eg. Pb and Cr was above maximum allowable limit. More study is necessary on heavy metal content of fishes because all heavy metals are dangerous for consumers' health.

Keywords: fish, heavy-metal, Cr, Cd, Pb, Cu, Zn

FSB2019-WQP-02

Assessment of heavy metal contamination in the sediment and bivalves from the coast of Bay of Bengal, Bangladesh

Sanjida Afreen Semme¹, A.S. Shafiuddin Ahmed², Md. Kamal Hossain³, Afroza Parvin³,
Mohammad Moniruzzaman⁴ and Md. Jasim Uddin¹

¹*Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh,* ²*Department of Fisheries and Marine Science, Noakhali Science and Technology University, Noakhali, Bangladesh,* ³*Soil and Environment Laboratory, Bangladesh Council of Scientific and Industrial Research, Dhaka, Bangladesh,* ⁴*Freshwater Station, Bangladesh Fisheries Research Institute, Mymensingh-2202, Bangladesh*

Correspondence: Md. Jasim Uddin(jasimfm@bau.edu.bd)

Heavy metal pollution has been a burning issue in marine environmental studies for many years. As metals are non-biodegradable, rapidly assimilate in the environment, extend to toxic levels within a short period of time, and bioaccumulation, followed by bio-magnification, it hazards for both human health and the ecosystem. Marine organisms, especially gastropods, bivalves, sponges and sea cucumbers can assimilate heavy metals from their living environments and widely used as indicator species of the specific ecosystem. Current study aimed to quantify the heavy metals contamination in inter-tidal sediments and edible bivalve species from 5 distinct

industrial and tourist locations of Bay of Bengal coast of Bangladesh namely, Saint Martin, Cox's Bazar, Moheshkhali, Chattogram and Khulna coastal areas well-known for an accumulation of heavy metals. Five heavy metals (Zn, Ni, Cr, Pb, Cd) were analyzed with Atomic Absorption Spectrophotometry (AAS) to assess the degree of metals in the sediments and 3 bivalve species viz., *Crassostrea cuttackensis*, *Anadara granosa* and *Meretrix meretrix*. The heavy metals concentration showed the following order ($\mu\text{g g}^{-1}$) in sediments as Zn (10.51-63.63) >Ni (7.433-27.54) >Cr (1.4-52.37) >Pb (1.69-13.28) >Cd (0.02-3.41) and in bivalves Zn (56.35-808.22) >Cd (1.097-86.91) >Pb (0.1-1.69) >Ni (0.09-0.35) >Cr (0.07-0.46). The study shows that metals in sediments and bivalves are below the limit proposed by the World Health Organization except for Zn and Cd in the bivalves exceeding the upper limit. Therefore, the study suggests that the level of toxic metals in sediments and bivalves should be continuously monitored to assess the fate and effect of these metals in the fragile ecosystem.

Keywords: marine pollution, heavy metals, sediments, bivalves, Bay of Bengal

FSB2019-WQP-04

Acute toxicity of chromium to striped catfish *Pangasianodon hypophthalmus*

Md. Fazle Rohani, SM Majharul Islam, Md. Shahjahan

Laboratory of Fish Ecophysiology, Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Correspondence: Md. Shahjahan (mdshahjahan@bau.edu.bd)

Chromium is considered the most detrimental pollutant to the aquatic organisms. Hence, an experiment was conducted to determine the acute toxicity of chromium in view of its effects on hemato-biochemical parameters and structure of erythrocytes in striped catfish, *Pangasianodon hypophthalmus*. Fish were exposed to seven different concentrations (0, 10, 20, 30, 40, 50 and 60 mg/L) of chromium, each with three replications for 96h. After 96h of exposure the survived fish were sacrificed to measure hemato-biochemical (hemoglobin, Hb; red blood cell, RBC; white blood cell, WBC and blood glucose) parameters. In addition, erythrocytic cellular abnormalities (ECA) and erythrocytic nuclear abnormalities (ENA) of peripheral erythrocytes were assayed. No mortality was observed up to 10 mg/L, but 90% and 100% mortality was observed at 50 mg/L and 60 mg/L, respectively after a 96h exposure period. The 96h LC50 value through probit analysis was 32.47 mg/L. Hb and RBC significantly decreased at 20, 30 and 40 mg/L of chromium, whereas WBC showed opposite scenario. Blood glucose levels significantly increased at 10, 20, 30 and 40 mg/L of chromium compared to 0 mg/L. Frequencies of ECA and ENA significantly increased with increasing chromium concentrations. This study indicates that chromium is highly toxic to striped catfish.

Keywords: toxicity, chromium, haematological parameters, erythrocytes, Thai pangas

FSB2019-WQP-06

Profenofos, an organophosphate insecticide alters the haematological parameters of Nile Tilapia (*Oreochromis niloticus*)

Md. Polash Khan, Md. Al-Emran, S. M. Majharul Islam, Md. Shahjahan, Kizar Ahmed Sumon
Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Correspondence: Kizar Ahmed Sumon (kizar@bau.edu.bd)

Profenofos is an organophosphate insecticide, which is widely used in crop protection purposes in Bangladesh and can contaminate the surrounding aquatic environment through multiple routes.

The present study aimed at assessing the sub-lethal effects of profenofos on haematological parameters and the alteration of structures of peripheral erythrocytes of Nile tilapia (*Oreochromis niloticus*). The 96-h LC₅₀ value of profenofos for Nile tilapia was calculated by using probit analysis, which was found to be 1693.6 µg/L. Semi-adult fish were exposed to five sub-lethal concentrations of profenofos (0, 212, 423, 847 and 1270 µg/L) in 15 PVC tanks for 28 days. Each of the control and treatments were executed in three replicates. Fish were sacrificed at 7, 14, 21, and 28 days of profenofos exposure and blood samples were collected to study hemato-biochemical (Hemoglobin, Hb; Red blood cell, RBC; White blood cell, WBC and blood glucose) parameters and the formation of micronucleus (MN) in the blood erythrocytes. The blood glucose levels were significantly increased with increasing concentrations of profenofos. Blood haemoglobin level was decreased initially but increased in the highest and second highest treatments compared to the control. RBC and WBCs values were decreased significantly with increasing concentrations of profenofos and exposure days. Various erythrocytic nuclear abnormalities (ENA) including binucleated, notched nuclei, blebbed, nuclear bridge, and nuclear bud and erythrocytic cellular abnormalities (ECA) such as echinocytic, fusion, elongated shaped, tear-drop shaped, and twin were found in giemsa stained blood smears of fish treated with different concentrations. Statistically significant increase in the frequencies of formation of MN with the increase in toxicity and exposure days were found compared to the control. The present study revealed that profenofos alters the haematological parameters of Nile tilapia, thus, the use of profenofos in agriculture must be carefully evaluated.

Keywords: heamatological parameters, Nile tilapia, organophosphate pesticide

FSB2019-WQP-07

Acute toxicity of thiamethoxam insecticides on banded gourami (*Trichogaster fasciata*)

Md. Mahmudul Hasan¹, Md. Mohibul Hasan¹, Shema Biswas¹, Kizar Ahmed Sumon¹, Ramji Kumar Bhandari², Harunur Rashid¹

¹Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh; ²Department of Biology, University of North Carolina Greensboro, Greensboro, NC, USA

Correspondence: Harunur Rashid (rashid@bau.edu.bd)

To meet the growing demand of food under the harsh conditions farmers are using a variety of Organophosphate pesticides. Residues of this pesticides applied on agricultural land may enter into the aquatic environment through drain, runoff and spray drift, which may lead to the contamination of this environment. Thiamethoxam (Trade name Virtako) is a neonicotinoid insecticide used widely in Bangladesh to control a broad spectrum of chewing and sucking insect pests on major agricultural crops. This widely used insecticide also causes toxic effects to non-target aquatic organisms, especially fishes. In this study experiments were made in the laboratory to determine median lethal concentration (LC₅₀) of thiamethoxam to Banded Gourami (*Tricogaster fasciata*) and behavioral effects of this neonicotinoid insecticide on the fish. The 96 hour LC₅₀ value of thiamethoxam, determined from the mortality data using Probit analysis, was found as 161.065 ppm for the Banded Gourami. The fish exhibited respiratory distress such as gasping in air, loss of balance, discoloration of body and erratic swimming. The results indicate that thiamethoxam has effects on Banded Gourami. According to survey result, it was found that most frequently used insecticide is thiamethoxam (Trade name Virtako). For this reason it should be used with caution during agricultural activity. In addition, chronic effects of this insecticide on fish reproduction and bioaccumulation are still under investigation.

Keywords: thiomethoxam, banded gourami, behaviour, LC₅₀

FSB2019-WQP-08

Maintaining C/N ratio for optimum water quality and increase growth performance of tilapia in a biofloc culture system

Shompa Sarker¹, Md. Amzad Hossain¹, AQM Robiul Kawser¹, Mst. Rubia Banu²

¹Department of Aquaculture, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur-1706, Bangladesh; ²Department of Fisheries Management, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur-1706, Bangladesh

Correspondence: Md. Amzad Hossain (amzad@bsmrau.edu.bd)

Tilapia (*Oreochromis niloticus*) is an aquaculture species that is intensively produced worldwide. It has shorter life cycle, hardy and survive in adverse environmental condition. According to these characteristics this fish is suitable for the culture with limited water exchange. The main objectives of the present study were to evaluate the effects of carbon/nitrogen ratio on growth performance and utilization of biofloc as feed in tilapia and observe the bacterial community under biofloc technology. Therefore, an experiment was conducted to evaluate the effects of optimum of carbon/nitrogen ratio on growth performance, survival, physico-chemical parameters, microbial dynamics and feed utilization of tilapia fingerlings in a biofloc system. The carbon/nitrogen ratio (C/N ratio) was manipulated by addition of a low-cost carbohydrate source (molasses) to the rearing water. The experiment was comprised of five biofloc treatment groups (with varying C:N ratio, i.e., 12:1, 15:1, 18:1, 21:1) and a control (no molasses). Each treatment was triplicated and tilapia was reared at a density of 50 individual/ 250 L water. Molasses was added to the tank every 3 days. The tanks were aerated and agitated continuously by using an air pump and the fish was reared for 90 days. The C/N ratio affected the water quality, microbial dynamics and growth performance of tilapia. It was concluded that maintaining optimum C/N ratio is important to maintain optimum water quality and maximize growth of tilapia.

Keywords: tilapia, C/N ratio, biofloc technology, water quality, growth

FSB2019-WQP-10

Comparative study on proximate composition and heavy metal concentration of mola carplet (*Amblypharyngodon mola*) and spotted snakehead (*Channa punctatus*) collected from pond water and open water

Fatema Hoque Shikha, Md. Ismail Hossain, Md. Abul Mansur, Nazbun Nahar

Department of Fisheries Technology, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Correspondence: Md. Ismail Hossain (ihossain.ft@bau.edu.bd)

The study was conducted on the proximate composition and heavy metal concentration of *Amblypharyngodon mola* and *Channa punctatus* collected from pond water and open water in Mymensingh. As the fishes were freshly caught from both sources so organoleptically they were excellent in quality. The proximate composition analysis result showed -protein, lipid, moisture and ash content (%) of pond water *A. mola* were 20.26±0.63, 6.70±0.17, 66.40±1.51 and 2.55±0.58 respectively and for the fish caught from open water the values were 19.66±0.75, 5.81±0.18, 63.03±0.82 and 2.92±0.15 respectively. On the other hand, protein, lipid, moisture and ash content (%) of pond water *C. punctatus* found 23.83±1.07, 5.91±0.11, 64.44±1.87 and 3.23±0.11 respectively whereas the values for the fish caught from open water were 22.21±0.66, 5.43±0.19, 62.73±1.65 and 3.67±0.47 respectively. Arsenic (As) concentration of *A. mola* was higher in open water fishes (0.23±0.05 µg g⁻¹) than the fishes of pond water (0.14±0.03 µg g⁻¹).

In the case of *C. punctatus* As concentration found Nil both in pond water and open water fishes. Cadmium (Cd) concentration of pond water and open water *A. mola* was 0.19 ± 0.04 $\mu\text{g g}^{-1}$ and 0.27 ± 0.05 $\mu\text{g g}^{-1}$ respectively. Cd concentration of pond water *C. punctatus* was found 0.21 ± 0.04 $\mu\text{g g}^{-1}$ whereas open water fishes contained 0.28 ± 0.06 $\mu\text{g g}^{-1}$ in the muscle. Copper (Cu) concentration of pond water and open water *A. mola* was 0.27 ± 0.07 $\mu\text{g g}^{-1}$ and 0.32 ± 0.04 $\mu\text{g g}^{-1}$ respectively. Cu concentration of pond water *C. punctatus* was 0.25 ± 0.05 $\mu\text{g g}^{-1}$ but open water fishes contained 0.29 ± 0.07 $\mu\text{g g}^{-1}$ in the muscle. Heavy metal concentration of *A. mola* and *C. punctatus* was within permissible limits except Cd. The result revealed that open water fishes had higher concentration of heavy metals in their muscle than the fishes of pond water.

Keywords: comparative study, proximate composition, heavy metal concentration, *A. mola*, *C. punctatus*

FSB2019-WQP-11

Heavy metals accumulation in striped catfish *Pangasianodon hypophthalmus* (Sauvage, 1878) cultured in Mymensingh region of Bangladesh and human health risk assessment

Md. Abdulla-hil Maruf¹, Badhan Saha², Nusrat Jahan Punom¹, Mohammad Moniruzzaman², Priyanka Dey Suchi², Mst Khadiza Begum¹, Md Mostavi Enan Eshik¹, Mohammad Shamsur Rahman¹

¹Aquatic Animal Health Group, Department of Fisheries, Faculty of Biological Sciences, University of Dhaka, Dhaka-1000, Bangladesh; ²Biological Research Division, Bangladesh Council for Scientific and Industrial Research (BCSIR), Dhaka-1000, Bangladesh
Correspondence: Mohammad Shamsur Rahman (shamsur@du.ac.bd)

Pangas (*Pangasianodon hypophthalmus*) is one of the fastest growing aquaculture species in Bangladesh. Pollution of aquatic environment with heavy metals has become a worldwide problem due to their toxic effects on organisms. Aim of this study was to measure the level of metal contents (Cd, Pb, Ni, Cu and Cr) in Pangas organs and their feed, which caught from farms of Muktagacha, Trishal and Bhaluka of Mymensingh district. Flame Atomic Absorption Spectrophotometer was used to determine concentrations of selected metals. Large variations were observed in metal concentrations stuck between different tissues in each fish. In pre-monsoon, concentration of Cd, Cr and Pb remain safe. But both feed and fish samples of Muktagacha contained highest amount of Ni (684.3 mg/kg in feed sample, 62.3717 mg/kg in Pangas). The highest Cu values recorded from feed and Pangas of Bhaluka where liver of them contained significantly more Cu than gill and muscle. During post-monsoon, concentration of Pb and Cr found below the detection limit, Cu was under safe limit but Cd and Ni was higher than the maximum limit of FAO, WHO and EU. Except Cd, pre-monsoon Pangas samples, carried more Pb, Ni, Cu, and Cr than post-monsoon. It also determined that studied metal accumulation of liver remained greater than gill and muscle. Human health hazard related with this metal absorption were assessed by target hazard quotients (THQs) and carcinogenic risk (CR). The THQ estimations of Ni in pre- and Cd in post-monsoon were upper than 1, recommending that individuals would encounter non-carcinogenic risks. Pre-monsoon carcinogenic risk (CR) values of Pb were evaluated between 10^{-4} to 10^{-6} that in acceptable limit but still in hazard risk. This experiment warned the safety issues regarding consumption of Pangas, contaminated with heavy metals. Government should take necessary steps to control the heavy metal pollution in fish farming areas.

Keywords: *Pangasianodon hypophthalmus*, heavy metals, fish feed, health hazard

FSB2019-WQP-12

Abundance of noxious *Anabaena crassa* in pangasiid catfish (*Pangasianodon hypophthalmus*) ponds

Zinia Rahman¹, Mohammad Mahfuzul Haque², Saleha Khan²

¹Department of Genetics and Fish Breeding, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur-1706, Bangladesh; ²Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Correspondence: Saleha Khan (khansaleha64@gmail.com)

An investigation was carried out to see the composition and succession of noxious blue-green algae in pangasiid catfish (*Pangasianodon hypophthalmus*) ponds as microalgal blooms are very common and making serious problems in waterbodies throughout Bangladesh. In the natural assemblage of pangasiid catfish (*P. hypophthalmus*) farming ponds, the microalgal population was identified and found to be composed of 36 phytoplankton genera belonging to four major groups. During the course of study, 20 species of Cyanophyceae were recorded, among them significant occurrence of *Anabaena crassa* was observed and found to create bloom in ponds of monoculture as high nutrient contents and other favourable environmental conditions seriously enhanced the growth with a peak in the summer months. Efforts were made to study certain physico-chemical factors and their influence on the composition and seasonal abundance of this species. Moderately higher water temperature, lower rainfall and NO₃-PO₄ enrichment increased the biomass of *A. crassa* (35 × 10³ cells/L) in the experimental ponds. Higher feeding rate in monoculture of pangasiid catfish (*P. hypophthalmus*) made the ponds hypernutrified by unutilized feed and fish excreta that supported the higher abundance of *A. crassa*. In composite culture ponds, silver carp (*Hypophthalmichthys molitrix*) effectively grazed down the microalgae, as a result algal bloom was not noticed. Aquatic environmental monitoring in pangasiid catfish (*P. hypophthalmus*) ponds with special emphasis on microalgal species composition and their dynamics in different regions and different seasons are suggested for better management practices.

Keywords: algal bloom, cyanophyceae, *Anabaena crassa*, Pangasiid catfish (*Pangasianodon hypophthalmus*)

FSB2019-WQP-13

Biocontrol of mosquito larvae using larvivorous fishes

Chhimi Lhamo¹, Harunur Rashid²

¹Commercial Agriculture and Resilient Livelihoods Enhancement Programme (CARLEP), Ministry of Agriculture and Forests, Thimphu, Bhutan; ²Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Email: Harunur Rashid (rashid@bau.edu.bd)

Mosquito control, in both urban and rural environments, is one of the main public health concerns in Bangladesh and many other countries of the world. Use of larvivorous fish as biological control agent for urban and rural mosquito control. This study investigates suitability and performance of some indigenous fish species in comparison with some exotic fish species. A series of laboratory experiments were designed to compare predation rates of three native fish species (banded gourami *Trichogaster fasciata*, slender rasbora *Rasbora daniconius* and zebrafish *Danio rerio*) with two exotic fishes (mosquito fish *Gambusia affinis* and guppy *Poecilia reticulata*) due to their mosquito-larvivorous feeding habit. All five fish species preyed on

significant numbers of mosquito larvae when exposed in different water for 12 hours. Of the five fishes, mosquito fish showed a highest consumption of mosquito larvae within 1 hour (gorge period), followed by Guppy and Slender rasbora ranging from 9.00 ± 1 , 6.67 ± 5.77 , 7.33 ± 2.52 larvae per fish in tap water. Within the 5 hours (background period), Banded gourami showed the highest larval consumption counts from 9.67 ± 6.03 larvae per fish. Guppy and mosquito fish showed consistent eating behavior throughout the experiments. Slender rasbora showed the highest consumptions of mosquito larvae ranging from 18.22 ± 0.58 larvae per fish. Banded gourami showed a gradual increase in consumption of larvae after the gorge period, thus resulting in the highest consumption of larvae ranging from 48.33 ± 38.63 per fish while guppy, mosquito fish and zebrafish showed a comparatively less consumptions of larvae in pond water with 1.33 ± 2.31 , 2.33 ± 0.58 , 3 ± 1.73 larvae per fish. All showed a similar pattern of gradual increase or decrease in consumption of larvae over time especially in tap water and pond water. Of the five fish species, banded gourami showed the highest predation of larvae ranging from 35.00 ± 7.55 per fish in drain water followed by Srasbora ranging from 29.33 ± 6.66 larvae per fish. Mosquito fish also showed a good feeding behavior on the larvae within the ranges of 22.33 ± 15.89 per fish compared to other exotic fish guppy with 17 ± 5.57 larvae per fish. Zebrafish showed the least consumption of mosquito larvae with 12.67 ± 5.86 per fish in drain water. The weight of the fish and the larvae consumptions correlations were revealed to be statistically significant and there was enough evidence to suggest that the correlation observed for this experiment does exist in the population. In this study, larval consumption by all the fish species were significantly reduced in simulated night experiments compared to daytime experiment in tap water and pond water. Native species Banded gourami (locally called 'kholisha') showed the greatest potential as a mosquito control agent, having higher consumption of mosquito larvae comparable to that of exotic Guppy and Mosquito fish.

Keywords: biocontrol, mosquito larvae, banded gourami, mosquito fish, guppy

FSB2019-WQP-14

Community structure assessment of phytoplankton and ecological pollution in Payra River, Bangladesh

Md. Arifur Rahman¹, Maria Binta Safa², Nitai Roy³

¹Department of Fish Biology and Genetics, Faculty of Fisheries, Patuakhali Science and Technology University, Dumki, Patuakhali- 8602; ²Faculty of Fisheries, Patuakhali Science and Technology University, Dumki, Patuakhali- 8602; ³Department of Biochemistry and Food Analysis, Faculty of Nutrition and Food Science, Patuakhali Science and Technology University, Dumki, Patuakhali-8602, Bangladesh

Correspondence: Md. Arifur Rahman (marahman@pstu.ac.bd)

Phytoplankton plays a central role in the structure and functioning of freshwater ecosystems. For this reason, one year study was conducted from July 2018 to June 2019 in the Payra River, Patuakhali, Bangladesh. Exactly 32 phytoplankton species were detected during study period belonging to 5 families. Study reveals that, higher Shannon-Weaver diversity index (H') estimated in winter (1.72) and lowest in summer (1.26), maximum species richness observed in rainy season (2.28) and minimum in spring (1.82). Greater mean evenness value was seen in late autumn (0.52) and tiniest evenness index in summer (0.36) and the lowest mean dominance value (0.72) observed in late autumn and uppermost dominancy values in autumn (0.56). Evenness value close to 1 is more uniform when dominance index shows the alternative. Maximum species richness was recorded in September. Among the phytoplankton groups Chlorophyceae group showed the highest monthly average abundance in Payra River. In monthly average abundance

Navicula distans showed maximum presence per liter among the entire species composition Cyanophyceae group found to be dominant and contribute about 37.18% in primary total production in Payra River. Canonical correspondence analysis (CCA) coordination plot revealed that, rainfall and photoperiod were the most influential meteorological parameters and NH₃, water temperature; EC and CO₂ had great influence in shaping species diversity in Payra River among the hydrological factors. The cluster analysis showed that, autumn season formed a separate cluster based on Bray-Curtis similarity matrix. The ecological condition of the river was found moderately polluted based on Shannon Weaver diversity index (Staub et al 1970) and serious to moderate pollution according to Margalef richness value (Lad, 2015). Pollution tolerant genera of algae showed the probable high organic pollution in the Payra according to Palmer's pollution index. The present findings will help researchers for further analysis on phytoplankton and conservation of aquatic biota in Payra River from pollution.

Keywords: phytoplankton, species richness, seasonal involvement, pollution level, environmental factors

FSB2019-WQP-16

Peripheral erythrocytes and histological responses of silver barb and their recovery patterns to varying concentrations of profenofos

Md. Moniruzzaman¹, Jyotika Roy¹, Maharin Rashid Chowdhury Pinky¹, Md. Shahjahan², Md. Sadiqul Islam¹

¹Department of Fisheries Biology and Genetics, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh; ²Department of Fisheries Biology and Genetics, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh
Correspondence: Md. Sadiqul Islam (sadiqul1973@yahoo.com)

An experiment was conducted to evaluate the effects and recovery responses of an organophosphorus, profenofos (trade name celecron 50 EC) on peripheral erythrocytes and some organs (liver and kidney) of the silver barb, *Barbonymus gonionotus*. To observe the peripheral erythrocytes, blood was collected from the gill and kidney. A static bioassay was conducted to determine the acute toxicity (LC₅₀ value) of profenofos. The LC₅₀ (96 h) value of profenofos on silver barb was 0.1 ppm. Fish were exposed to profenofos at two different concentrations 0.01 (10% of 96 h LC₅₀) and 0.05 (50% of 96 h LC₅₀) for 1, 7, 15 and 30 days to assess the effects of pesticide on peripheral erythrocytes and some organs of the fish. Another 30 days were required for the observation of recovery responses on these parameters. The results indicated that the acute exposure of both concentrations of profenofos significantly altered the nuclear and morphology of peripheral erythrocytes. Peripheral erythrocytes were significantly different between the blood of gill and kidney, and also different in recovery responses. Histological changes of liver and kidney were observed after exposure to profenofos. Significant changes in the hepatocytes, mild to severe necrosis, and vacuolation were observed in the liver of treated fish. Highly degenerated kidney tubules and hematopoietic tissues, degeneration of renal corpuscles, vacuolization, and necrosis were evident in the kidney of treated fishes. Although some of the changes were reversible, the rest were less pronounced after a recovery period. The present investigation sufficiently emphasized that profenofos has an adverse effects on fish. So, the use of profenofos in agriculture and aquaculture must be carefully evaluated.

Keywords: *Barbonymus gonionotus*, profenofos, organophosphorus, erythrocytes

FSB2019-WQP-17

Isolation and molecular detection of pathogenic bacteria from freshwater mussels (*Lamellidens marginalis* and *L. corrianus*) of Old Brahmaputra River

Md. Abdullah Al Mamun¹, Md. Firoz Shah¹, Ripon Sarker², Muhammad Tofazzal Hossain², Mohammad Moniruzzaman³, Md. Jasim Uddin¹

¹Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh; ²Department of Microbiology and Hygiene, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh; ³Freshwater Station, Bangladesh Fisheries Research Institute, Mymensingh-2201, Bangladesh

Correspondence: Md. Jasim Uddin(jasimfm@bau.edu.bd)

Mussels and water might harbor different pathogenic bacteria in relation to public health importance. Poor management of wastewater treatment effluent discharged into waterway may contain numerous pathogenic microorganisms. The study was undertaken to detect pathogenic strains of *Escherichia coli*, *Salmonella* spp., *Staphylococcus* spp. and *Vibrio* spp. from Mud, River water and Mussels of Old Brahmaputra River. A total of 27 samples were collected from three locations of Old Brahmaputra river of Mymensingh town. All samples were processed and streaked on EMB, SS, MS and TCBS agar media. The selective colonies were purified, chromosomal DNA was extracted from each isolate and polymerase chain reaction (PCR) was done to determine the genus or species by using specific primers. At last, antibiotic sensitivity pattern of selected isolates was studied against 17 commonly used antibiotics. Among the 27 samples, all were suspected as *E. coli*, whereas 10 as *Salmonella* spp., 10 as *Staphylococcus* spp. and 18 as *Vibrio* spp. on the basis of culture properties. A total of 18 isolates were confirmed as *E. coli* (585 bp) by amplifying genus specific *16S rRNA* primers. Among them no positive isolates were found to *stx-1*, *stx-2* and *rfb* gene. Similarly, 3 isolates were confirmed as *Salmonella* spp. by amplifying genus specific *inv-A* primers; 3 isolates were confirmed as *Staphylococcus* spp. by amplifying genus specific *nuc* primers and 4 isolates were confirmed as *Vibrio cholerae* by amplifying species specific *groEL* gene primers. Antibiotic sensitivity results indicated that most of the antibiotics were found to be non-effective against *E. coli*, *Salmonella* spp. and *Staphylococcus* spp., where as few antibiotics were found to be non-effective against *Vibrio cholerae*. It can be concluded that both species of mussels (*Lamellidens marginalis* and *L. corrianus*) can harbor pathogenic species of enteric bacteria which are resistant to most of the antibiotics.

Keywords: freshwater mussel, Old Brahmaputra River, isolation, pathogenic bacteria, antibiotic sensitivity

Poster Abstracts

Poster Abstracts

Theme: Marine Fishery Resources as a Part of Blue Economy

FSB2019-Pst-03

Breeding biology, domestication & seed production of chaka chingri (*Peneaus indicus*)

Md. Motiur Rahman, Md. Amirul Islam, A.F.M Shofiquzoha

Shrimp Research Station, Bagerhat-9300, Bangladesh.

Correspondence: Md Motiur Rahman & matiur.bfri@gmail.com

Peneaus indicus, also known as the Indian white prawn inhabits the coasts of Africa, China, Australia, Indonesia, India and Bangladesh. *P. indicus* is non-burrowing, active at both day and night, and prefers a sandy mud bottom. Adults are normally found at depths less than 30 m. The shrimp mature and breed mostly in marine habitats and spend the juvenile and sub-adult stages of 30 to 120 mm (TL) in coastal estuaries, backwaters or lagoons. In Bangladesh the traditional shrimp farming is practiced with one crop of salt tolerant paddy during the rainy season (June to September) and one crop of shrimp during the summer season (November to April). These ghers are tidal; auto-stocking of mixed varieties of shrimp and fin fish's takes place during high tide. Average total production is 650 kg/ha/yr, the proportion of shrimp being 71% in which (*P. indicus*) constituted 5-10 percent. Harvesting is periodical during full and new moon. An experiment was conducted to know the breeding biology, domestication performances of (*Peneaus indicus*) in the earthen ponds of fourteen decimal in the Shrimp Research Station Bagerhat from July 2018 to June 2019. The initial weight and density of stocked PL was 0.0123 mg and 2200/decimal. After culturing 140 days the final weight was (17.83±1.22 gm). Gross yield and survivality of shrimp was (988 kg/ha) and 10% at harvesting time. Higher water temperature (37°C) and poor salinity level was recorded (4.0±1.84 ppt). Water pH (8.00±0.5), DO (5.46±1.6 ppm), conc. of iron (0.4±0.2 mg/l), alkalinity (124.0±17.68 mg/l) and Ammonia (0.03±0.04 mg/l) was also determined. Rearing of stock and intensive observation is going on for brood development. The obtained results showed that *Peneaus indicus* could survive in low salinity level and wide range of temperature variation. Problem and Challenges were to keep the stock stress free in against of climate change and pollution issues. Being native species, with its fastest growing rate at a high stocking density, (*P. indicus*) could be a potential indigenous species for native and export market.

Keywords: breeding biology, *Peneaus indicus*, domestication

FSB2019-Pst-06

Market status and supply chain of marine fish species at different fish landing center in coastal district of Bangladesh

Md. Mahmudul Hasan¹, Md. Sazedul Hoque¹, Syed Istiak²

¹Department of Fisheries Technology, Faculty of Fisheries, Patuakhali Science and Technology University, Bangladesh; ²ASAP Healthy Food Limited/Deep Sea Fisheries Ltd., Dhaka, Bangladesh

Correspondence: Md. Sazedul Hoque (sazedul.fst@pstu.ac.bd)

Bangladesh is rich in marine fish biodiversity and this marine captured fishes are landed at marine fish landing centers mainly at four coastal districts namely Patuakhali, Barguna,

Chattogram and Cox's Bazar. The objective of this study was to assess the fish species availability, seasonal price variation and supply chain of marine fish at four fish landing centers in coastal districts of Bangladesh. The study was conducted for 1 year (12 months) from June 2018 to May 2019. Data was collected based on semi-formal questionnaire through face to face interview method in three times of a season. The study found that there were about 52, 49, 56 and 54 marine fish species available at Mahipur, Pathorghata, Chattogram and Cox's Bazar marine fish landing centers, respectively. The present study identified highest number 42, 41, 46 and 45 of marine fish species and lowest number 32, 33, 36 and 37 of fish species during pre-monsoon period at Mahipur, Pathorghata, Chattogram and Cox's Bazar fish landing centers, respectively. Higher fish price was found during pre-monsoon period and lowest price was during post-monsoon period. Different private channel controls the supply chain of marine fish at the study area. There is about seven (7) marketing channel have been identified at Mahipur and Pathorghata, and six (6) marketing channel have been identified at Chattogram and Cox's Bazar fish landing centers. The present study revealed that higher number of fish availability and lower in price during post monsoon period which was vice-versa during pre-monsoon period. Supply of marine fish fully control by different middlemen that significantly reduces the laborious fishermen's benefits. Improved handling and proper icing practices at landing centers could ensure the availability premium quality of marine fish in Bangladesh.

Keywords: marine fish; fish landing center; fish availability, fish price variation, fish supply chain

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Species biodiversity of seaweeds in the coastal water of the BOB, Bangladesh

Avijit Talukder, Fahmida Sultana, Purna Chakraborty
Chattogram Veterinary and Animal Sciences University, Bangladesh.
Correspondence: Avijit Talukder (avijitocan@cvasu.ac.bd)

Seaweeds have been considered as one of the important marine resources and component of blue economy which has profound influence in ocean biogeochemical processes. In the coastal waters of Bangladesh, seaweeds are found mainly in the St. Martin's island and in the mangrove forest region of Chittagong coast. Total 193 species of seaweed were recorded from the Bangladesh coast along the Bay of Bengal. Three research locations named south-western coast of St. Martin's, Innani and Fauzderhat coast were designed to conduct this research using random sampling methods. Seasonal seaweeds samples were collected from intertidal sampling locations at low tide spanning 2015-2016 hydrological year. On an average 25-30 species diversity were recorded from St. Martin's south-western coast; 3 species reported from Fauzderhat coast and no species diversity found in Innani coast. Turbidity, salinity, water temperature, pH, meteorological properties have effect on seaweeds diversity. In addition, ocean acidification, mangrove destruction and coastal pollution greatly hamper the habitat of seaweed communities. This study attempted to introduce species biodiversity and dominant species of seaweeds available in the coastal waters of St. Martin Island, Inani and Fauzderhat coast along the Bay of Bengal. This research will work as a useful guideline as well as the reference material for the upcoming researchers and entrepreneurs who will deal with seaweed culture.

Keywords: Bay of Bengal, biodiversity, coastal waters, seaweed

FSB2019-Pst-24

Diversity assessment of marine crabs including seven new records from coastal regions of Bangladesh through morphological and molecular approaches

Shilpi Sarkar^{1,2}, Kazi Ahsan Habib¹, Sharmin Akter^{1,2}, Amit Kumer Neogi¹, Najmun Nahar¹, Md. Jayedul Islam^{1,3}

¹Aquatic Bioresource Research Lab (ABR Lab.), Department of Fisheries Biology and Genetics, Sher-e-Bangla Agricultural University, Dhaka-1207, Bangladesh; ²Department of Zoology, Jahangirnagar University, Dhaka-1342, Bangladesh; ³Department of Zoology, Jagannath University, Dhaka-1100, Bangladesh.

Correspondence: Kazi Ahsan Habib (ahsan.sau@gmail.com)

Crabs are decapod crustaceans of the infraorder Brachyura. Among benthic communities, crustaceans are important members because many species are used for human consumption and a tremendous variety of small species contribute to the complexity and functioning of tropical ecosystems. Crabs are one of the many creatures that help to keep the sea clean. Sometimes identification of crab is confusing due to change of their body coloration with environmental condition. In recent years, the use of molecular methods for specimen identification and classification has become quite popular. A study has been conducted at ABR Lab in Sher-e-Bangla Agricultural University based on both morphological and molecular methods to assess the diversity of marine crabs from the coastal regions of Bangladesh. Species level identification of the collected crab samples were first carried out using morphological analysis and then DNA barcoding with mitochondrial COI and/or 16s rRNA gene regions. In the present study, a total of 30 species under 19 genera and 13 families have been identified. These identified species are *Charybdis feriata*, *Charybdis affinis*, *Charybdis hellerii*, *Charybdis natator*, *Charybdis lucifera*, *Portunus pelagicus*, *Portunus sanguinolentus*, *Portunus reticulatus*, *Scylla olivacea*, *Scylla serrata*, *Mutata lunaris*, *Mutata planipes*, *Calappa lophos*, *Gelasimus vocans*, *Ocypode ceratophthalma*, *Ocypode macrocera*, *Tubuca dussumieri*, *Tubuca rosea*, *Episesarma mederi*, *Episesarma versicolor*, *Varuna litterata*, *Carcinoscorpius rotundicauda*, *Atergatis integerrimus*, *Daldorfia horrida*, *Doclea ovis*, *Phalangipus longipes*, *Arcania gracilis*, *Ixa cylindrus*, *Cyclodius obscures* and *Ethusa sp.* Among them *Doclea ovis* (Fabricius, 1787), *Phalangipus longipes* (Linnaeus, 1758), *Ixa cylindrus* (Fabricius, 1777), *Arcania gracilis* (Henderson, 1893), *Portunus reticulatus* (Herbst, 1799), *Cyclodius obscures* (Hombron and Jacquinot, 1846) and *Ethusa sp.* have been recorded for the first time in Bangladesh. Results of this study endows the remarkable addition of new records to the country's crab inventory and boost the total number of known marine species in Bangladesh.

Keywords: crab, diversity, new record, DNA barcoding

FSB2019-Pst-26

Study on species diversity and distribution of marine bivalves in the East coast of Bangladesh

Parsha Shanjana Brishti, Sonia Sultana, Md Jayedul Islam, Kazi Ahsan Habib
Aquatic Bioresource Research Lab (ABR Lab), Department of Fisheries Biology and Genetics, Faculty of Fisheries, Aquaculture and Marine Science, Sher-e-Bangla Agricultural University, Dhaka-1207, Bangladesh

Correspondence: Kazi Ahsan Habib (ahsan.sau@gmail.com)

Bivalvia is the second largest taxonomic class of Mollusca. Their ecological and economical value play crucial roles in coastal ecosystem. In the present study, a survey of marine bivalves for species diversity and distribution was done from two regions; Sonadia Island and Saint Martin's Island of Bangladesh. Marine bivalves were collected during low tides from intertidal regions and shallow coastal waters monthly from July 2018 to June 2019. A total of 76 bivalve samples was collected and laboratory study showed 27 bivalve species belonging to 27 genera under 11 families and 6 orders. Number of species of bivalves distributed in each family revealed that 10 species belongs to the family Veneridae, 3 species to Mactridae and Donacidae of each, 2 species for each of the family of Tellinidae, Pectinidae and Cardiidae. One species each were reported from Pholadidae, Psammobiidae, Carditidae, Spondylidae and Arcidae. Among the identified bivalves 9 species under 5 families were newly recorded in Bangladesh, viz. *Lioconcha castrensis*, *Lioconcha ornata*, *Maetra abbreviata*, *Mimachlamys sanguinea*, *Leporimetis ephippium*, *Tellinides timorensis*, *Macridiscus aequilatera*, *Maetra maculata*, *Spondylus squamosus*. Among these new records, only *Spondylus squamosus* was found from Saint Martin's Island. More species diversity of bivalves was recorded from Sonadia Island than Saint Martin's Island. Species diversity also showed that veneridae is the most diverse and abundant family in both of the islands. The low diversity and abundance of bivalves at Saint Martin's Island might have resulted from anthropogenic activities like indiscriminate collection, disposal of domestic sewage, habitat loss and tourism. This study will boost Molluscan checklist of Bangladesh.

Keywords: diversity, marine bivalves, Bangladesh

FSB2019-Pst-27

Diversity study and DNA barcoding of marine crabs of Bangladesh with new records of seven species

Kazi Ahsan Habib, Shilpi Sarkar, Sharmin Akter, Najmun Nahar, Md. Jayedul Islam, Amit Kumer Neioji

Aquatic Bioresource Research Lab (ABR Lab), Department of Fisheries Biology and Genetics, Faculty of Fisheries, Aquaculture and Marine Science, Sher-e-Bangla Agricultural University, Dhaka-1207, Bangladesh

Correspondence: Kazi Ahsan Habib (ahsan.sau@gmail.com)

Crabs are the members of decapod crustaceans of the infraorder Brachyura. Among benthic communities, crustaceans are important members because many species are used for human consumption and a tremendous variety of small species contribute to the complexity and functioning of tropical ecosystems. Crabs are one of the many creatures that help to keep the sea clean. Sometimes identification of crab is confusing due to change of their body coloration with environmental condition. In recent years, the use of molecular methods for species identification and classification have become quite popular. A study on diversity of marine crabs of Bangladesh has been conducted at ABR Lab in Sher-e-Bangla Agricultural University based on both morphological and molecular methods. Species level identification of the collected crab samples were first carried out by morphological analysis and then DNA barcoding with mitochondrial COI gene and/or 16s rRNA gene regions. In the present study, a total of 30 species under 19 genera and 13 families have been identified. These identified species are *Charybdis feriata*, *Charybdis affinis*, *Charybdis hellerii*, *Charybdis natator*, *Charybdis lucifera*, *Portunus pelagicus*, *Portunus sanguinolentus*, *Scylla olivacea*, *Scylla serrata*, *Mutata lunaris*, *Mutata planipes*, *Calappa lophos*, , *Gelasimus vocans*, *Ocypode ceratophthalma*, *Ocypode macrocera*, *Tubuca dussumieri*, *Tubuca rosea*, *Episesarma mederi*, *Episesarma versicolor*, *Varuna litterata*, *Carcinoscorpius rotundicauda*, *Atergatis integerrimus*, *Daldorfia horrida*, *Doclea ovis*,

Phalangipus longipes., *Ixa cylindrus*, *Arcania gracilis* , *Portunus reticulatus*, *Cyclodius obscures* and *Ethusa sp.* Among these last seven species mentioned in the above list have been recorded for the first time in Bangladesh. Results of this study endows the remarkable addition of new records to the country's crab inventory and boost the total number of known marine species in Bangladesh.

Keywords: diversity, marine crabs, DNA barcoding, new records

FSB2019-Pst-30

New geographical record of the Fossil shark, *Hemipristis elongata* (Klunzinger, 1871) from the Bay of Bangle, Bangladesh coast

Jakia Hasan¹, Mohidul Islam¹, Zulfikar Ali¹, Enamul Hoq², Yahia Mahmud²

¹*Marine Fisheries and Technology Station, Bangladesh Fisheries Research Institute Cox's Bazar 4700, Bangladesh;* ²*Bangladesh Fisheries Research Institute, Mymensingh 2201, Bangladesh*
Correspondence: *Jakia Hasan (jakiabfri@gmail.com)*

Shark and ray landings have declined globally by at least 20% since last 15 years, but in the Indo-Pacific regions this decline has been more severe. Although, the fossil shark (snaggletooth shark, *Hemipristis elongata*) is landed in tropical Indo-West Pacific region, this species has not been previously reported in Bangladesh coast. In January 2019, one male species of *H. elongata* was recorded to landed in the Cox's Bazar, Bangladesh coast. Generally fossil shark occurs on the continental shelf and this species is uncommon in areas where it occurs and has a relatively unproductive life-history. The shark species is considered of very high quality flesh, fins and liver oil. The recorded species was 2.13 kg weight and taxonomically identified by the morphometric approach. The shark species showed relatively longer, broadly rounded snout and long gill opening, more than 33% of eye length and 5.8% of total length. The key characteristics of this species are teeth in lower jaw, long, hooked, erect to oblique cusps that prominently protrude from closed mouth, white tips of second dorsal fin, pectoral, pelvic, anal and second dorsal fin is strongly falcate. The fossil shark was catch by set bag net from Swatch of No Ground adjacent to Sundarbans mangrove from about 20 meter depth. This specimens represent the first record of *H. elongata* in Bangladesh waters. As per IUCN (2016) the species is listed as vulnerable.

Keywords

fossil shark, *Hemipristis elongata*, Bay of Bengal

FSB2019-Pst-60

Assessing fish diversity in Meghna river estuary through morphological analysis and DNA barcoding

Tania Siddiqueki, Najmun Nahar, Md Jayedul Islam, A H M Safiullah Habib, Kazi Ahsan Habib
Aquatic Bioresource and Research Lab, Department of Fisheries Biology and Genetics, Faculty of Fisheries, Aquaculture and Marine Science, Sher-e-Bangla Agricultural University, Dhaka-1207, Bangladesh

Correspondence: *Kazi Ahsan Habib (ahsan.sau@gmail.com)*

Meghna Estuary is the largest coastal plain estuarine ecosystem and a transitional zone between freshwater of Meghna river system and saline water of the Bay of Bengal, Bangladesh and support diverse fish ecosystem. The estuary acts as feeding and breeding ground for a wide

variety of fishes. DNA barcoding appears to be an advance approach for taxonomic identification, characterization, and discovery of newer species, facilitating biodiversity studies. With the aim to build comprehensive DNA barcode library, a study has been conducted to assess the diversity of fish species found in Meghna river estuary of Bangladesh. Species level identification was carried out using morphological analysis and DNA barcoding with mitochondrial COI and/or 16S rRNA gene regions of the collected fish samples. From August 2018 to till date a total 54 species under 8 orders and 17 families were documented from the 4 sampling station and all are successfully barcoded. Among them one species *Psammogobius biocellatus*, Valenciennes 1837 (Sleepy goby) species belongs to the family Gobiidae is first time recorded in Bangladesh.

Keywords: fish diversity, Meghna river estuary, DNA barcoding

FSB2019-Pst-61

Shell morphological variations in three size groups of Asiatic hard clam, *Meretrix meretrix* and blood cockle, *Anadara granosa* off the coast of Moheshkhali Island, Cox's Bazar, Bangladesh

Md. Asaduzzaman¹, Saleha Khan¹, Mohammad Moniruzzaman², Md. Jasim Uddin¹

¹Department of Fisheries Management Bangladesh Agricultural University, Mymensingh-2202, Bangladesh, ²Freshwater Station, Bangladesh Fisheries Research Institute, Mymensingh-2201, Bangladesh

Correspondence: Md. Jasim Uddin (jasimfm@bau.edu.bd)

The present study was focused on assessment of intra-species morphological variations among three different size groups of Asiatic hard clam (*Meretrix meretrix*: Veneridae) and blood cockle (*Anadara granosa*: Arcidae) populations collected from the west coast of Moheshkhali Island, Cox's Bazar, Bangladesh. Both *M. meretrix* and *A. granosa* are edible coastal bivalves having commercial importance. A total 30 individuals for each respective species were studied and 14 measurements were taken for *M. meretrix* and 15 characteristics were chosen for *A. granosa*. Results on morphometric comparison of different measurements of three size groups of *M. meretrix* from the Maheshkhali coast using one way ANOVA showed that thirteen characteristics out of fourteen were significantly different ($p < 0.05$) among the size groups: shell length, shell width, height of left valve, height of right valve, posterior shell length, hinge or ligament length, distance between adductor muscle scars, umbo height, upper shell height, shell length between umbo and shell margin, thickness of shell margin, wet tissue weight, shell weight; but condition index has not showed significant variation ($p > 0.05$) among the groups. In contrast, *A. granosa* showed significant variations ($p < 0.05$) in thirteen characteristics out of fifteen among the size groups which includes shell length, shell depth, height of left valve, height of right valve, ligament length, umbo height of Left valve, umbo height of right valve, symmetry of left valve, symmetry of right valve, distance between adductor muscle scars, shell length between umbo and shell margin, wet tissue weight, dry shell weight whereas no significant difference was found in case of ridge number and condition index among different size groups ($p > 0.05$). Current findings on the basic morphological variation analyses of the two highly commercial species may be useful to understand their biological characteristics for management of natural bivalve populations and their farming in coastal waters of Bangladesh.

Keywords: marine bivalve, *Meretri meretrix*, *Anadara granosa*, shell morphology, Moheshkhali

FSB2019-Pst-62

Testicular cycle of Asiatic hard clam (*Meretrix meretrix* L, 1758) collected from the west coast of Moheshkhali Island, Cox's Bazar, Bangladesh

Md. Sujon Mia¹, Sharmin Afroj¹, Gias Uddin Ahmed², Mohammad Moniruzzaman³, Md. Jasim Uddin¹

¹Department of Fisheries Management, ²Department of Aquaculture, Bangladesh Agricultural University, Mymensingh-2202, ³Freshwater Station, Bangladesh Fisheries Research Institute, Mymensingh-2202, Bangladesh

Correspondence: Md. Jasim Uddin (jasimfm@bau.edu.bd)

Bivalve mollusks mainly clams, oysters, mussels, cockles and scallops constitute the second largest group in global fish production just next to finfish. Current study aimed to describe the annual testicular cycle of Asiatic hard clam, *Meretrix meretrix* collected from the west coast of Moheshkhali Island, Cox's Bazar, Bangladesh using biometry and histology. Samples were collected monthly over a year during July 2018 to June 2019 from the inter-tidal region during low tide. The samples were transported to the Aquatic Ecology Laboratory of Bangladesh Agricultural University in ice box. After washing the clams, biometric measurements such as, shell length, shell width, shell height was measured using digital calipers. After dissection, soft tissue wet weight was taken and a transverse section of 2-3 mm was cut for routine histology. Condition index (CI), a ratio of tissue wet weight (g) to shell length (cm) calculated for males was the highest in July (1.86 ± 0.53) and the lowest in May (0.88 ± 0.16) by mean. Histology revealed 5 testicular stages (early developing, late developing, ripe, spawning and spent) and undifferentiated clams under microscope. Histology revealed that spermatogenesis of *M. meretrix* initiated in June and December. Ripe females occurred from January to May and July. Two distinct spawning pulses were noted over an annual cycle. First spawning event occurred during February to May and another spawning pulse was noted during August to November ascertained from the presence of spawning individuals in the histological preparations. The undifferentiated stage as a preparatory step for next spermatogenesis extended from June to August and November to December. Water quality parameters such as, Water quality parameters such as water temperature, salinity, dissolved oxygen (DO) and pH were monitored monthly to correlate them with male gametogenic phenology of *M. meretrix* in that habitat. The dynamics of testicular development of clams was in consistent with the CIs of the males. The preliminary data provided here could be useful for collecting spats from natural habitat for commercial farming and for the development of artificial propagation of *M. meretrix* in laboratory condition.

Keywords: Asiatic hard clam, *Meretrix meretrix*, histology, testicular cycle, condition index

Poster Abstracts

Theme: Climate Change & Fisheries

FSB2019-Pst-09

Comparison of broccoli (*Brassica oleracea* var. *italica*) production in hydroponic and aquaponic systems in captive condition

Zubyda Mushtari Nadia^{1,2}, Prosun Roy¹, Md. Abdus Salam¹

¹Department of Aquaculture, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh; ²Department of Aquatic Animal Health Management, Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka-1207, Bangladesh.

Correspondence: Zubyda Mushtari Nadia (zubyda.nadia@sau.edu.bd)

An experiment was carried out in “BAU Aquaponics Oasis” Laboratory, Bangladesh Agricultural University (BAU), Mymensingh from 19th February, 2018 to 4th June 2018 to compare the effects of organic hydroponics, inorganic hydroponics and aquaponics on broccoli production. Media based hydroponic and aquaponic system was selected where three treatments such as- T₁, organic hydroponic; T₂, inorganic hydroponic and T₃, aquaponic systems were used with three replications. Initially in T₁, 3 kg vermicompost was added in 90 L water and after 10 days 1 kg vermicompost was added weekly discarding the old vermicompost. In case of T₂, at first 28.5 g mixed fertilizer composed of TSP, urea, DAP, MOP, dolomite, boron and iron was added in 90 L water which was then further treated fortnightly with 22.8 g fertilizer mixture. While in T₃, 10 tilapia was released in 90 L of water with no external organic or inorganic fertilizer. Tilapia was fed commercial feed and the growth of tilapia was measured at 15 days interval. The highest average production of broccoli was 11.79 ±0.51 tons/ha/106 days in T₂ followed by 4.77 ±0.85 and 4.77 ±0.85 tons/ha/106 days in T₃ and T₁ respectively. Most of the nutritional components of broccoli were highest in T₂, such as- protein 4.54 ±0.52%, lipid 0.45 ±0.07%, fiber 6.47 ±0.01% and NFE 1.29 ±0.22%. Tilapia production was 21.55 ±3.36 tons/ha/106 days. The physico-chemical water quality parameters were in acceptable range except nitrite level in T₃. Thus, present study figured that inorganic hydroponics had high potential than organic hydroponics and aquaponics for producing broccoli.

Keywords: aquaponics, hydroponics, broccoli, mixed fertilizer, vermicompost

FSB2019-Pst-34

Role of the Sundarbans mangrove blue carbon for climate change mitigation: A review

Sabrina Jannat Mitu, Abu Faisal Ahamad, Md. Mostafa Shamsuzzaman, Mohammad Mahmudul Islam

Department of Coastal and Marine Fisheries, Faculty of Fisheries, Sylhet Agricultural University, Sylhet-3100, Bangladesh

Correspondence: Md. Mostafa Shamsuzzaman (shamsuzzamanmm.cmf@sau.ac.bd)

Blue carbon is a recent concept that has received international attention as a climate change tool. Carbon stored, sequestered or released from coastal ecosystems such as tidal marshes, mangroves, sea grass meadows and kelp forests, especially in their soils and sediments known as blue carbon. Mangrove forests are highly productive carbon sinks that absorb and store more carbon than they release. In addition to its function as blue carbon stock, the mangrove area also serves as a protective barrier against coastal erosion, soil fertility maintenance, in the protection of the coast

from the natural disasters and saving lives and property from tsunamis, floods and cyclones. The study aimed to synthesize and describe the role of mangrove blue carbon for global climate change mitigation and also to assess the potentiality of blue carbon in Bangladesh. A review of literature related to the Sundarbans mangrove and blue carbon was conducted to exemplify the mechanism of C storage, production and assimilation. The findings of this study indicates the role of mangroves in mitigating climate change, CO₂ production and absorption in the mangrove area, carbon trading and its future perspectives in international markets. The findings also suggest that blue carbon has become a new option for Bangladesh's economic development by reducing the impact of climate change. Now a days the mangrove area are experiencing a steep global decline and therefore, conservation and rehabilitation of mangrove ecosystem is needed to sustain the blue carbon absorption and storage. Considering the recent scenario of global economy, thrust should be given to expand the horizon of blue carbon sector through afforestation, scientific soil management, protected area development and conservation measures, rather than investing in costly technology to sequester carbon. Finally, this study offers the conceptual clarity and perspectives necessary to meet the challenge of mitigating climate change more effectively bringing blue carbon to market, thereby supporting the health and resilience of oceanic ecosystems, the sustainable prosperity of communities that depend on them.

Keywords: carbon sequestration; REDD+; carbon trading, blue carbon; climate change

FSB2019-Pst-47

Effects of photoperiod on reproductive biology of Rohu, *Labeo rohita*

Md. Shahjahan, Md. Al-Emran, SM Majharul Islam, SM Abdul Baten, Harunur Rashid, Md. Mahfuzul Haque

Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh 2202, Bangladesh

Correspondence: Md. Shahjahan (mdshahjahan@bau.edu.bd)

Among the environmental factors, photoperiod plays an important role in growth and reproduction of fish. This study was conducted to assess the effects of photoperiod on reproductive biology of rohu, *Labeo rohita*. The experiment was conducted with three different photoperiod treatments, such as 6 hours of light and 18 hours of dark (06L:18D), 12 hours of light and 12 hours of dark (12L:12D), and 18 hours of light and 6 hours of dark (18L:06D). In the experiment, sexually matured females were exposed in the three photoperiod conditions for 30 days and the sampled fishes were sacrificed on 0, 15 and 30 days of exposure to know GSI and gonadal histology. The mean GSI values, oocyte diameter and proportions of vitellogenic oocyte were maximum in the fishes of 06L:18D treatment indicating stimulation of vitellogenesis. On the other hand, the same parameters were minimum in the fishes of 18L:06D, revealing the inhibition of vitellogenesis. This study indicates that prolonged photoperiod negatively affects growth and reproductive performances of rohu.

Keywords: rohu; light; vitellogenesis; photoperiod; reproduction

Poster Abstracts

Theme: Hilsa Fisheries – Aspects & Prospects

FSB2019-Pst-29

Assessment on feasibility of cage culture of *Tenualosa ilisha* (Hamilton, 1822) in Andharmanik River, Khepupara, Patuakhali

A S M Tanbirul Haque, Md. Amirul Islam, Ahmed Fazley Rabbi, M A Bashar, Yahia Mahmud
Bangladesh Fisheries Research Institute, Mymensingh-2201, Bangladesh
Correspondence: A S M Tanbirul Haque (tanbirulhaque@yahoo.com)

In this experiment Jatka was collected from near Payra port, Baliatoli, Moudobi, Ramnabad channel. After collection jatka was stocked in the pond of BFRI, Riverine Sub-station near Andharmanik river for conditioning. Jatka were prepared for rearing in cage through conditioning/ regular netting. Domesticated jatka (about 12 cm) were stocked in cages at two different densities (2/25ft³, 2/50ft³). Growth rate comparatively higher in circular cage than rectangular cage. Highest growth was found 24.5±0.832 cm in circular cage and highest weight gain was found 144±12.59 g also in circular cage. These results were found in one year (May 2018 to May 2019). Growth performance was not significant. Mortality rate were also so high (about 80%).

Keywords: hilsa, cage culture, feasibility

FSB2019-Pst-59

Justification of 22 days hilsa fishing banned period in Bangladesh

Biplob Kumer Sarker¹, Md. Yeamin Hossain¹, Md. Ashekur Rahman¹, Md. Ataur Rahman¹, Md. Akhtarul Islam¹, Md. Rabiul Hasan¹, Md. Abul bashar², Yahia Mahmud³

¹Department of Fisheries, Faculty of Agriculture, University of Rajshahi, Rajshahi-6205, Bangladesh; ²Bangladesh Fisheries Research Institute, Riverine Station, Chandpur-3602, Bangladesh; ³Bangladesh Fisheries Research Institute, Headquarter, Mymensingh -2202, Bangladesh

Correspondence: Md. Yeamin Hossain (hossainyamin@gmail.com)

Tenulosa ilisha (Hilsa) is the most important fish species of Bangladesh and it is a blessing from the Almighty GOD, however indiscriminately harvesting may hamper its future production. Additionally, banned period is greatly requisite to assure sustainable survival and production of Hilsa. Although the government of Bangladesh has imposed a 22-days ban in October on catching, selling and transporting Hilsa every year to ensure safe spawning of this fish during its peak spawning season based on full-moon. If it can be possible to set up appropriate banned period, then it would be leading achievement to ensure sustainable production. This study justifies the 22-days Hilsa fishing banned period in Bangladesh. Data were collected through direct field observation and monitoring in the Bay of Bengal and main rivers. Additionally, surveyed were done on fishers and other related personnel. Furthermore, commercial fishing catch data from the BFDC fish landing center during 2007 to 2019 were analyzed. Our observations found that the 80% individuals were in mature and ripe conditions in the rivers and coastal waters of Bangladesh after the end of banned period (until next 7-10 days). In contrast, our results on marine catch indicated that around 80% individuals were in spent stage after end of the banned period (7-10 days). Finally, this

study indicated that the mature (*Ma*) hilsa fishing banned period would be re-fixed to ensure its future sustainability.

Keywords: hilsa, fishing ban, production

FSB2019-Pst-63

Temporal variations of growth pattern, condition, prey-predator status and physiological condition for Hilsa shad, *Tenualosa ilisha* (Hamilton, 1822) in the Meghna River, Southeastern Bangladesh

Akhery Nima^{1,2}, Md. Ashekur Rahman¹, Md. Ataur Rahman¹, Md. Akhtarul Islam¹, Md. Abul Bashar², Yahia Mahmud³, Md. Yeamin Hossain^{1*}

¹Department of Fisheries, Faculty of Agriculture, University of Rajshahi, Rajshahi-6205, Bangladesh; ²Bangladesh Fisheries Research Institute, Riverine Station, Chandpur-3602, Bangladesh; ³Bangladesh Fisheries Research Institute, Headquarter, Mymensingh -2202, Bangladesh

Correspondence: Md. Yeamin Hossain (hossainyamin@gmail.com)

Growth pattern and condition factors are the most useful parameters to estimate fish health in aquatic habitat which is the efficient tools for natural population management and conservation by assessing the well-being of fish and predicts its future population success. The current study focuses on the temporal (monthly) variations of growth pattern, condition (Fulton's, K_F ; relative, K_R), prey-predator status and physiological condition for *Tenualosa ilisha* (Hamilton, 1822) from the Meghna River, Southeastern Bangladesh during July 2018 to June 2019. This study evaluated the effect of temperature and rainfall on monthly K_F for *T. ilisha* in the Meghna River. Total length (TL) and body weight (BW) were measured nearest to the 0.01 g and 0.01 cm accuracy, respectively for each individual. The growth pattern was estimated using: $W=a \times L^b$ and condition factors as (K_F): $K_F = 100 \times (W/L^3)$; (K_R): $K_R = W/(a \times L^b)$ where W is BW, L is TL, a and b was the parameters of regression analysis. Prey-predator relationship were determined using relative weight (W_R) as $W_R = (W/W_S) \times 100$, where W is BW and W_S is the predicted standard weight for the same individual as $W_S = a \times L^b$. The physiological condition was assessed as: $\bar{a} = W/L^b$. The smallest individual was 15.3 cm in TL while the largest one 57.8 cm in TL. Growth pattern variation was monthly observed though the overall length weight relationship indicates positive allometric growth. K_F was very highly correlated with TL and BW (Spearman rank test, $p < 0.0001$) indicating that K_F is the best condition factor for evaluating the well-being of this species in the Meghna River. Additionally, W_R was close to 100 which indicate the balance habitat for *T. ilisha* with the presence of prey and predator. However, in August and January individuals fed less. The highest percentage of fatty fish was found in the month December while the lean was in February. Finally, the study will be helpful to suggest sound policy for Hilsa fishery management in the Meghna River considering the growth pattern, conditions and prey-predator & physiological status.

Keywords: hilsa, growth pattern, variation

FSB2019-Pst-88

Impact assessment of twenty-two days hilsa *Tenualosa ilisha* (Hamilton, 1822) fishing ban in Bangladesh

Mohammad Ashraful Alam¹, Flura¹, Md Mehedi Hasan Pramanik¹, Md. Abul Bashar¹, Md Anisur Rahman¹, Yahia Mahmud²

¹Bangladesh Fisheries Research Institute, Riverine Station, Chandpur, Bangladesh; ²Bangladesh Fisheries Research Institute, Head Quarter, Mymensingh-2201, Bangladesh

Correspondence: Mohammad Ashraful Alam (ashraf_bfri@yahoo.com)

The entire study was conducted to evaluate the impact of twenty-two days fishing ban from 9-28 October 2018 on the basis of lunar periodicity and Gonado-Somatic Index (GSI) study. The major spawning grounds of hilsa as well as other common hilsa landing sites in Bangladesh were selected for the study. From the selected locations comprehensive data were collected before the ban, during the ban and after the ban period. The percentage of male hilsa ranged from 4-35% in different sampling locations before the ban period whereas after the ban period the percentage of male hilsa ranged from 2-12%. The percentage of male was 20% before the ban period that declined to 6% after the ban period. On the other hand, the percentage of female hilsa ranged from 62-96% in different sampling locations before the ban period whereas after the ban period it ranged from 88-100% in the selected sampling locations. In general, the percentage of female hilsa increased from 73% (before the ban) to 93% (after the ban). Overall, the percentage of female was higher than the male. In the year 2018 percentage of spent hilsa was 3% before the ban period that increased substantially up to 47.74% after the ban period and calculated egg production was 728338.97 Kg and the estimated *Jatka* production was 36417 crore of hilsa juvenile will be added to the hilsa population. Experimental larvae collection with glass nylon fiber net (mouth diameter 15', length from mouth to cod end 25', mesh size-0 and approximate time of operation is 30 minutes) was conducted in the spawning ground during the low and high tides. Overall, 82.6% hilsa larvae were found (high and low tide combined) during the experimental larvae collection. Besides *Jatka*, spawn and fries of other fish species were also found in higher quantity in and around the spawning areas of Hilsa than previous years which indicates fishing ban might have positive impacts on successful breeding and maintenance of biodiversity of other fish species.

Keywords: assessment, hilsa, fishing ban, Bangladesh

FSB2019-Pst-89

Semi-natural breeding trial of hilsa shad, *Tenulosa ilisha* in the Meghna River Estuary

Md. Anisur Rahman¹, Md. Mehedi Hasan Pramanik¹, Flura¹, Md. Abul Bashar¹, Md. Monjurul Hasan¹, Yahia Mahmud²

¹Bangladesh Fisheries Research Institute, Riverine Station, Chandpur, Bangladesh; ²Bangladesh Fisheries Research Institute, Headquarter, Mymensingh-2201, Bangladesh

Correspondence: mhshihab.hasan@gmail.com

The Hilsa shad, *Tenulosa ilisha* is one of the most commercially important fish species in South Asian countries. For the better conservation of Hilsa it is necessary to establish a standard breeding and culture protocol along with the present Hilsa management activities. The semi-natural breeding trial was conducted in the major breeding ground during 06 to 28 October 2018 which was the peak breeding time of Hilsa for the year 2018. The male and female Hilsa broods were collected from the River Meghna using BFRI experimental net during afternoon and late evening of full moon and new moon time. A total of seven breeding trials were conducted in which selected Hilsa broods were used. For the breeding trial, both eggs and milt were collected through stripping and then the eggs were mixed with the milt immediately. The fertilized eggs were transferred to a plastic hatching jar for incubation providing mild water circulation, aeration and shade to protect penetration of direct sunlight for controlling temperature i.e., to maintain congenial environment. During the incubation period, the eggs were observed for 24 hrs. to study the embryonic and larval development stages of Hilsa. After 4.2-4.6 hrs. of fertilization *morula* stage i.e., fifth stage of embryonic development was identified. After that, no embryonic development of egg was observed up to 12 hrs. of fertilization and the fertilized eggs were found to be dead filled with fungus at the end. In our previous research funded by ECOFISH-BD project (2015-2017), 18-*myotome* stage i.e., ninth stage of embryonic development was identified after 8-8.5 hrs. of fertilization. The water quality parameters were found in good range during the breeding trial though the temperature was found to be fluctuated from the optimum ranges needed for the incubation of fertilized eggs. Although it was not possible to be succeeded completely in semi-natural breeding trial in the major breeding ground of River Meghna, the experience will give the necessary insight for future research works.

Keywords: breeding, semi-natural, hilsa

Poster Abstracts

Theme: Biotechnology in Fisheries & Aquaculture

FSB2019-Pst-25

Assessment fish diversity in Meghna river estuary through morphological analysis and DNA barcoding

Tania Siddiqueki^{1,2}, Najmun Nahar¹, Md Jayedul Islam^{1,2}, Kazi Ahsan Habib¹, A H M Safiullah Habib¹

¹Aquatic Bioresource and Research Lab, Department of fisheries Biology and Genetics, Sher-e-Bangla Agricultural University, Dhaka1209; ²Department of Zoology, Jagannath University, Dhaka-1100, Bangladesh

Correspondence: Kazi Ahsan Habib (ahsan.sau@gmail.com)

DNA barcoding appears to be an advance approach for taxonomic identification, characterization, and discovery of newer species, facilitating biodiversity studies. With the aim to build comprehensive DNA barcode library, a study has been conducted to assess the diversity of fish species found in Meghna river estuary of Bangladesh. Species level identification was carried out using morphological analysis and DNA barcoding with mitochondrial COI and/or 16S rRNA gene regions of the collected fish samples. Meghna Estuary is the largest coastal plain estuarine ecosystem and a transitional zone between freshwater of Meghna river system and saline water of the Bay of Bengal, Bangladesh and support diverse fish ecosystem. The estuary acts as feeding and breeding ground for a wide variety of fishes. From August 2018 to pill date a total 54 species under 8 orders and 17 families were documented from the 4 sampling station and all are successfully barcoded. Among them one species *Psammogobius biocellatus*, Valenciennes 1837 (Sleepy goby) species belongs to the family Gobiidae is first time recorded in Bangladesh.

Keywords: Meghna River estuary, DNA barcoding, fish diversity, new record

FSB2019-Pst-31

Seasonal prevalence of *Salmonella* spp. isolated from the Old Brahmaputra River

Fouzia Siddiqua Ema, Md. Nurul Haider, Md. Kamal, Md. Shaheed Reza

Department of Fisheries Technology, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Correspondence: Md. Shaheed Reza (msreza@bau.edu.bd)

Seasonal prevalence of one of the most important waterborne pathogenic bacteria, *Salmonella* in the water and sediment of the old Brahmaputra River during autumn and winter was studied using PCR-based method. Water and sediment samples were collected in November and March from three (3) sampling stations of the river located at Sadar Upazilla, Mymensingh. Changes in physico-chemical parameters of water, dissolved oxygen (DO) and pH were monitored that ranged between 22.95 to 25.25°C and 27.70 to 28.25°C; 1.40 to 3.25 mg/L and 5.15 to 5.45 mg/L, and 8.03 to 9.02 and 7.97 to 8.50 during winter and autumn respectively. During winter and autumn seasons 24 isolates each were collected from water samples and 18 isolates were collected from sediment samples and subjected to bacteriological examination. PCR amplification targeting *invA* and *SPAB_01124* genes using previously reported primers confirmed the overall prevalence of pathogenic *Salmonella* spp. in the Old Brahmaputra River to be 21.05% (n = 4/19) in winter and 21.73% (n = 5/23) in autumn, indicating more or similar prevalence during the two seasons studied. There was station-wise difference observed among three stations studied where

prevalence was highest in St.1 (Morakhola Rail Bridge) that might be related to higher level of contamination of water and sediment in that area. For sediment samples in winter and autumn seasons, the percentages of prevalence were nil for all three stations. Our results show that *Salmonella* spp. is ubiquitous in natural waters and their concentrations fluctuated very little during winter and autumn.

Keywords: *Salmonella*, seasonal prevalence, PCR

FSB2019-Pst-42

Comparative breeding performances of indigenous climbing perch (*Anabas testudineus*) population in a semi-artificial condition

Shamima Yeasmin Dipu¹, Md. Mahamudul Hassan¹, Nayan Chandra Mondal¹, Nargis sultana², Mohammad Shafiqul Alam¹

¹Department of Genetics and Fish Breeding, Faculty of Fisheries, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur; ²Department of Fisheries Biology and Aquatic Environment, Faculty of Fisheries, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur-1706, Bangladesh

Correspondence: Mohammad Shafiqul Alam (msalamjp@gmail.com, msalambd@bsmrau.edu.bd)

The climbing perch (*Anabas testudineus*) locally known as 'koi' is found in the wetland ecosystem in Bangladesh and this indigenous koi is not yet commercially cultured in our countries. However, the objective of the present study was to compare breeding performances of two populations and develop a semi artificial breeding technique for *A. testudineus* in captive condition. The experiment was set with four treatments T₁- Netrokona ♀ × Netrokona ♂, T₂- Sylhet ♀ × Sylhet ♂, T₃-Sylhet ♀ × Netrokona ♂, T₄-Netrokona ♀ × Sylhet ♂ with three replications. The induced breeding was performed in 500 L plastic drum with modified inlet and outlet system. Synthetic hormone was used at the dose of 0.2 ml/kg for female and 0.1 ml/kg for male fishes at the base of the pectoral fin. It took around 8 to 12 hours for ovulation and egg release. The eggs were very minute and floating on the surface of water. The fertilized eggs were bright clear and transparent while unfertilized eggs appeared milky and opaque. The ovulation rate, fertilization rate, hatching rate, latency period and survival rate were recorded in each set of treatment and compared. The ovulation rate (egg/gram) was higher in Sylhet population (444). The fecundity of Sylhet female was 24000-30000 and the fecundity of Netrokona female was 15000-20000. The highest fecundity was found in T₃ (29444) and the lowest was found in T₁ (15667). The highest fertilization rate found 89.59% in T₄ and 88.22% in T₂ whereas the lowest fertilization rate found 84.54% in T₁. The highest hatching rate was 76.79% in T₂ and the lowest hatching rate was 42.31% in treatment T₃. Moreover, the higher survivality rate show after 14 days in T₂. The present study indicated that the breeding performances were better in Sylhet population than Netrokona population in the semi-artificial condition.

Keywords: climbing perch, indigenous fish, breeding performances, plastic drum

FSB2019-Pst-64

Effects of salt and other preservatives on the quality and insect infestation of dried silver jewfish (*Johnius argentatus*)

Nadia Nusrat, Md. Shaheed Reza, Md. Kamal

Department of Fisheries Technology, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh.

Correspondence: Md. Kamal (mkamal772011@gmail.com)

Studies were conducted to determine the effects of salt and other preservatives on blowfly infestation of silver jewfish (*Johnius argentatus*) during drying and storage period. Fresh jewfish collected from Teknaf Fish Market, Cox's Bazar were subjected to drying on platform type open dryer for 4-6 days. After 4 days of drying, large number insect larvae were found in control treatment, whereas relatively small number were observed in treated samples, except 25% salt treatment where no insect larvae were found. Study was also conducted on the optimization of salt concentrations in preventing blowfly infestation of silver jewfish during drying. No insect larvae were found in treatments containing salts concentrations from 15% to 25%. During storage, the dried products kept in polythene bag but the mouth was open was acceptable conditions for 45 days, while the products kept in polythene bag but the mouth was closed was acceptable condition up to 60 days of storage. In order to reduce the salt concentration in product, attempt was made to see the influence of Niseen S and common salt on the quality of the dried fish products as well as preventing insect infestation in various treatments but there was no larval development in any treatments even in control was observed during drying and during pre-storage. Rehydration properties of dried silver jewfish produced with different concentration of Niseen S and common salts showed that uptakes of water by the samples ranged from 69-89% which indicates good quality of the products produced with or without Niseen S, while organoleptic properties of the dried fish products revealed that mean scores for colour, flavor, texture and odour ranged from 7-9, indicating good quality of all the products.

Keywords: jewfish, salt, infestation, blowfly, Niseen S, storage

FSB2019-Pst-65

Frozen storage stability of tilapia (*Oreochromis niloticus*) meat paste and effect of heating time on it's gel forming ability

Fatema Hoque Shikha, Md. Ismail Hossain, Mashrufa Tanzila
Department of Fisheries Technology, Bangladesh Agricultural University, Mymensingh, Bangladesh

Correspondence: Md. Ismail Hossain (ihossain.ft@bau.edu.bd)

In order to ensure appropriate and profitable utilization of tilapia the suitability of this species and its potentiality in the manufacture of surimi was investigated. This study was conducted to evaluate the frozen storage stability of mince and surimi made from washed and unwashed muscle of tilapia (*Oreochromis niloticus*) and to study the effect of heating time on gel formation and gel disintegration of tilapia meat paste. Frozen storage ability was tested by analyzing freeze-thaw cycle of both mince and surimi made from washed and unwashed muscle. Freeze-thaw cycle was analyzed by drip-loss study. Study revealed that with the addition of cryoprotectants (4% sucrose, 4% sorbitol and 0.2% polyphosphate) surimi frozen at -25°C for five weeks had good frozen storage stability without losing much of its textural and sensory qualities. Thaw-drip decreased significantly ($p < 0.05$) in surimi with cryoprotectants prepared from both unwashed and washed minces compared to the minces without cryoprotectants. Then to study the effect of heating time on gel formation and gel degradation, salt-ground (3% NaCl) paste in tubes was incubated in water baths for 1 hour, 2 hrs, 3hrs, 4 hrs and 5 hrs. Gel formation and gel degradation was studied at 50°C and 60°C, respectively. The results obtained from the study clearly indicated that the gel formation increased with increasing heating time at 50°C and gel degradation increased with increasing heating time at 60°C.

Keywords: frozen storage stability, tilapia, mince, surimi, heating time

FSB2019-Pst-93

Study of growth hormone gene polymorphisms in tilapia (*Oreochromis niloticus*) for Marker Assisted Selection

Mst. Sadia Zafrin, Md. Samsul Alam

Department of Fisheries Biology and Genetics, Bangladesh Agricultural University,
Mymensingh-2202, Bangladesh

Correspondence: Md. Samsul Alam (samsul.alam@bau.edu.bd)

Polymorphisms in growth hormone genes have been found to cause variation in growth performance of fish. The objective of the study was to detect polymorphisms in microsatellite loci located in the growth hormone genes in Nile tilapia (*Oreochromis niloticus*). Five microsatellite loci namely GH-MS01, IGFII, IGFII-MS01, IGFII-MS03, and STR were analyzed to study the genetic variation in selected populations of *O. niloticus*. Fin samples of a total 43 fish from four different sources were collected and genomic DNA was isolated by SDS-Proteinase-K digestion, phenol: chloroform: isoamyl alcohol extraction and alcohol precipitation methods. The five microsatellite markers were amplified by polymerase chain reaction, separated by polyacrylamide gel electrophoresis and visualized by ethidium bromide staining. All the five loci were found to be polymorphic. The average number of alleles of FM-Mini hatchery population (3.8) was found to be highest and that of the FBG-Mini hatchery and Eon Aquaculture population was found to be lowest. The average observed heterozygosity (H_o) value of the FM-Mini hatchery population was the highest (0.140) and that of FBG-Mini hatchery population was the lowest (0.040). On the other hand, the average expected heterozygosity (H_e) was highest in the BFRI population (0.660) and lowest in the FM-Mini hatchery and FBG-Mini hatchery population (0.432). The fixation index ($1 - (H_o / H_e)$) values were positive in all the loci (except locus GH-MS01 in Eon Aquaculture population), which means these populations (*O. niloticus*) were deficient in heterozygosity. Deviation from Hardy-Weinberg expectation at STR locus in FBG-Mini hatchery and Eon Aquaculture population were not significant but in all other cases the deviations were found to be significant. The Nei's (1972) genetic distance between FBG-Mini hatchery and Eon Aquaculture population was the highest (0.972) while that between the Eon Aquaculture and BFRI population was the lowest (0.332). The population differentiation (F_{ST}) value between FBG-mini hatchery and Eon Aquaculture populations was the highest (0.279) and that between FM-Mini hatchery and BFRI population was the lowest (0.095). The UPGMA dendrogram based on Nei's (1972) genetic distance resulted in two clusters. The FBG-Mini hatchery and FM-Mini hatchery constituted one cluster whereas the BFRI and Eon Aquaculture population constituted the second cluster. The results provide evidence that genetic variation exists within the growth hormone genes in all four populations of *O. niloticus*. The polymorphisms that have been detected in the present study can be used to study association with growth and thus selection of fast growing Nile tilapia in Bangladesh.

Keywords: growth hormone, polymorphism, microsatellite, selection, *Oreochromis niloticus*

Poster Abstracts

Theme: Emerging Fish Diseases

FSB2019-Pst-41

Performance of a herbal product in fish disease recovery

Md. Farid Uz Zaman, Gias Uddin Ahmed, Mohammad Nurul Alam, Md. Mamunur Rahman
*Department of Aquaculture, Faculty of Fisheries, Bangladesh Agricultural University,
Mymensingh-2202, Bangladesh.*

Correspondence: Md. Farid Uz Zaman (farid100422@gmail.com)

An experiment was conducted for a period of three months to observe the performance of a herbal product, “herbicon”, in recovery of fish disease. The experiment was conducted with Thai sarpunti (*Barbonymus gonionotus*) in a mini pond (1.75 decimal) behind the Fisheries Faculty, BAU, Mymensingh. A comparative sensitivity test was conducted with bacteria, *Aeromonas* sp. against herbicon and 11 other antibiotics. *Aeromonas* sp. was found to be very sensitive to ciprofloxacin, chloramphenicol and herbicon. Moderate sensitivity was observed to azithromycin, doxycycline, erythromycin, tetracycline, streptomycin, cefotaxime, gentamycin and kanamycin. The pathogen was found to be resistant to ampicillin. By experimental infection with *Aeromonas* sp. Thai sarpunti developed deep ulcers, hemorrhagic lesions and loss of scales. Histopathologically, hepatocytes were severely necrotic, hemorrhaged and missing in many places resulting wide vacuums in liver structure. Severe necrosis, tubular degeneration and vacuums were found in kidney. After treatment with herbicon, clinically, it was found that, ulcers were healed up to almost normal appearance and most of the clinical signs had disappeared and treated fish looked apparently healthy. Histologically, affected liver and kidney had almost recovered to normal at the end of the experiment. Among the four treatments, the highest recovery (95-100%) was obtained in treatment 3 (8ml/kg of feed) within 14 days. In treatment 1 there were 70-75%, and in treatment 2, 80-85% clinical and pathological recoveries were observed. The present study revealed that herbicon, would be an effective, alternative, risk-free and eco-friendly treatment measure against *Aeromonas* like infections in aquaculture fishes of Bangladesh.

Keywords: herbal product, fish disease, disease recovery

FSB2019-Pst-57

Quantification of major aquaculture medicinal products (AMPs) used in Mymensingh district of Bangladesh

Noor Rahman, Kamru Naher Azad, Md. Ali Reza Faruk

Department of Aquaculture, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Correspondence: Kamrun Naher Azad (kamrunnaherkeya003@gmail.com)

With the rapid expansion and commercialization of aquaculture in Bangladesh, there has been an increasing trend of using aquaculture medicinal products (AMPs). The present study quantified the amount of three AMPs including antibiotics, probiotics and disinfectant used in aquaculture in Mymensingh district. Data were collected through questionnaire interview with different representatives of pharmaceutical companies, drug retailers, drug depots and by personal contact. Seventeen pharmaceutical companies were found to provide these three AMPs with different trade names to meet the farmers' demand. Among these AMPs, selling of probiotics in solid form was the highest (42.2 tons) followed by antibiotics (19.8 tons) and disinfectants (11.7 tons). On

the other hand, in liquid form the selling of disinfectants was the highest (17.9 tons) followed by antibiotics (10.4 tons) and probiotics (2.5 tons). It was calculated that, the total price of antibiotics, probiotics and disinfectants used in Mymensingh district per year were Tk. 5.41 crores, Tk. 4.24 crores and Tk. 5.97 crores respectively. Six groups of antibiotics having seventeen different active compounds with 53 trade names were found to be provided by pharmaceutical companies. The groups included β -Lactams, macrolides, quinolones, tetracyclines, sulfonamides and fluoroquinolones. The highest amount of AMPs were sold by Green Dale (16.68 tons) followed by EON group and Elanco group, Popular, ACME, Reneta and Square. Most of the AMPs were prepared by the companies either for use in veterinary or poultry but were being used indiscriminately in aquaculture. It is thus important to produce and use appropriate labeled AMPs in aquaculture for safe fish production. More in-depth studies are needed to understand the impact of AMPs on fish, aquatic ecosystem and human health. To have a clear picture of total amount of such products used in aquaculture, a comprehensive study needs to be conducted in all districts of the country.

Keywords: aquaculture medicinal products, quantification, probiotics, antibiotics, disinfectants

FSB2019-Pst-66

Application of molecular methods facilitate detection of common and new emerging fish pathogens in Bangladesh

Md. Mahbubur Rahman, Tasmina Akter, Md. Javed Foysal

¹*Fisheries Biotechnology Discipline, Institute of Biotechnology and Genetic Engineering, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur-1706, Bangladesh*
Md. Mahbubur Rahman (mahbub-biotech@bsmrau.edu.bd)

Fish diseases is considered as one of the major constrains for sustainable aquaculture of Bangladesh. Every year substantial losses occur in different aquaculture facilities due to outbreak of various diseases. Proper diagnosis of a disease is very crucial for prevention and control of the disease. But, in Bangladesh, fish disease diagnosis is mostly based on traditional methods which are time consuming and often misleads or fails to identify the disease. However, application of several molecular methods facilitate us to identify major bacterial pathogens affecting fishes of the country. By analyzing 16S rRNA gene sequence homology, we identified *Aeromonas hydrophila*, *A. veronii*, *A. bivalbium*, *Pseudomonas fluorescens*, *Stenotrophomonas maltophilia*, *Camamonas testosteronii*, *Edwardsiella tarda*, *Streptococcus agalactiae*, *S. iniae*, *Enterococcus faecalis*, *E. faecium* and *E. hirae* as the potential fish pathogens of the county. Among these, *S. maltophilia*, *C. testosteronii*, *A. bivalbium*, *Enterococcus faecalis*, *E. faecium* and *E. hirae* are the first time report as fish pathogen in Bangladesh. We developed specific PCR methods for rapid and reliable identification of *Aeromonas* spp., *P. fluorescens*, *S. agalactiae*, *S. iniae* and *E. faecalis*, we also developed PCR-RFLP methods for successful identification of different species of *Aeromonas* viz., *A. veronii*, *A. hydrophila* and *A. bivalbium* and two species of *Pseudomonas* viz., *P. fluorescens* and *P. putida* and simultaneous PCR method for identification of *Aeromonas* sp. and *Edwardsiella* sp. simultaneously. In addition, we established a multiplex-PCR method to identify most virulent fish pathogenic *A. veronii* strains. Recently, we confirmed *Enterococcus* as an important causative agent of streptococcosis disease in tilapia through metagenomics analysis of diseased fish. Whole genome sequences of *A. veronii* and *E. faecalis* enable us to understand the major virulence associated genes involved in the pathogenesis of motile *Aeromonas* septicaemia and streptococcosis in fishes in Bangladesh.

Keywords: motile *Aeromonas* septicaemia, *Aeromonas veronii*, aerolysin, hemolysin, bio-control

FSB2019-Pst-67

Molecular detection of mosquitofish (*Gambusia affinis*) in the south-western region of Bangladesh

Md. Mer Mosharraf Hossain¹, Md. Imtiaz Uddin², Md. Ariful Haque Rupom¹, Jannatul Ferdoush¹, Md. Monjur Hossain², Subrata Mondal¹, Al-Amin¹, Md. Anisur Rahman¹

¹Department of Fisheries and Marine Bioscience, Jashore University of Science and Technology, Jashore-7408, Bangladesh; ²Biotechnology Division, Bangladesh Institute of Nuclear Agriculture, Mymensingh-2202, Bangladesh.

Correspondence: Md. Mer Mosharraf Hossain (mmm.hossain@just.edu.bd)

To improve the sustainable management and control of North American, western mosquitofish (*Gambusia affinis*) in freshwater of Bangladesh, the most invasive to indigenous species, caused severe infestation to all carps, genetic diversity of the species were studied using DNA sequences of nucleotides first time in Bangladesh for the construction of a genetic baseline for *G. affinis*. This study consisted of six microsatellites nuclear DNA loci that were used for the construction of a genetic baseline used a gene-specific marker (CytB). A total of 6 fish for 6 sites were used for DNA extraction, then genotyped and analyzed to examine genetic diversity to assess the persistence of a species in the environment. Genetic diversity was inferred as some polymorphism and monomorphism with minimal genetic distance, in which a UPGMA dendrogram showed the same cluster. MEGA X [3] computes pairwise distance (0.01) and overall mean distance (0.01) of substitution type is nucleotides between a query and the database sequences were constructed. The optimal tree with the sum of branch length = 0.036 showed a homogenous pattern among lineages. This study confirms the limited genetic diversity of *G. affinis*, across six sampling sites which might be used in the future to control mosquitofish (*G. affinis*) and the propagation of its parasitic *Lernaea* sp.

Keywords: mosquitofish, *Gambusia affinis*, PCR, DNA sequencing, identification, genetic diversity

FSB2019-Pst-68

Molecular identification, putative virulence gene detection and antibiogram profile of the pathogens causing Streptococcosis in *Barbodes gonionotus*

Rakib Ehsan, Md. Mahbubur Rahman

Fisheries Institute of Biotechnology and Genetic Engineering (IBGE), Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur-1706, Bangladesh.

Correspondence: Md. Mahbubur Rahman (mahbub-biotech@bsmrau.edu.bd)

Streptococcosis is one of the most prominent diseases that cause severe economic losses in freshwater and marine fishes all over the world. In Bangladesh, the disease is suspected to be present in *Barbodes gonionotus* along with Tilapia. But, no studies have yet been reported regarding its existence in the country. Bacteria belong to the genera *Streptococcus*, *Enterococcus*, *Lactococcus*, etc. are reported as the causative agents of the disease. From culturing the suspected sample in KF media, a total of 47 isolates were randomly selected for initial phenotypic identification, where 17 isolates were identified as *Enterococcus* sp. To confirm the pathogenic potential of the isolates, three randomly selected isolates (PS-1, PS-3, PS-6) and three laboratory isolates (S-20, S-22, S-38) of *Enterococcus* sp. were used for artificial infection challenge test in *B. gonionotus* and *Oreochromis niloticus* where, all but one isolate exhibited moderate to high virulence in fish. Based on 16S rRNA gene sequence analysis five out of six isolates exhibited 99~100% sequence homology with *Enterococcus faecalis*. The other isolate was identified as *E.*

hirae. PCR amplification was done by using specific primers for detection of five virulence genes viz., *esp*, *cyl*, *agg*, *hyl* and *gel*, where the *esp* gene was found in all of *E. faecalis* isolates. Eleven commercial antibiotic discs were used to determine the antibiogram profile of *E. faecalis* by disk diffusion assay where all of *E. faecalis* isolates were found resistant to multiple antibiotics specifically, amoxicillin, ampicillin, cefradine, cefuroxime, erythromycin, and penicillin-G. These results provide information for understanding the mechanism of the pathogenicity and treatment measure against the disease.

Keywords: Streptococcosis, *Enterococcus faecalis*, *E. hirae*, antibiogram profile, *ESP* gene

FSB2019-Pst-87

Health status of cultured shrimp (*Penaeus monodon*) in Cox's Bazar region

Md. Asek Uddin¹, Gias Uddin Ahmed¹, Mt. Nur-A-Sharmin Aktar¹, Moin Uddin Ahmad²

¹Department of Aquaculture, Bangladesh Agricultural University, Mymensingh 2202, Bangladesh;

²Department of Fisheries, Khagrachari, Bangladesh

Correspondence: Gias Uddin Ahmed (giasa50@gmail.com)

Health management is the crucial factor for the development of coastal shrimp farms in Bangladesh. A study was carried out for a period 8 months from March 2018 to October 2018 to observe the health status of shrimp (*Penaeus monodon*) in three upazilas viz., Cox's Bazar Sadar, Teknaf and Maheshkhali of Cox's Bazar district through clinical and histological procedures. Data were collected through personal contact, questionnaire interview and discussion with key informants. As per clinical observation, shrimp from Beximco shrimp farm and Aquaculture Farm Limited at Cox's Bazar Sadar upazila, Unique Aquaculture at Teknaf upazila were healthy during summer. During rainy season, shrimps of Teknaf upazila were affected with early mortality syndrome (EMS) within 30 days of stocking where symptoms were lethargy, darkened shells and moulting of the carapace were present. White spot disease (WSD) affected shrimp were collected from Teknaf upazila having loose cuticle and the presence of white spots inside the carapace and appendages. From histological observation the structure of shrimp muscle and hepatopancreas from Aquaculture Farm Limited, Beximco shrimp farm of Cox's Bazar Sadar upazila and Unique Aquaculture of Teknaf upazila were almost normal. During rainy season there were some remarkable pathological changes like parasitic cyst, vacuum, pyknotic cell, acanthocephalan parasite, hemorrhage and necrosis. Cultured shrimps in rainy season were more affected than those of summer season. However, shrimp of summer season had reduced pathological changes in hepatopancreas than those of rainy season. From clinical, histological and pathological point of view healthy shrimp were noticed in summer and moderately infected in rainy season. From field and laboratory observations it was revealed that the study area had potentiality for shrimp culture, although necessary measures need to be taken especially during rainy season.

Keywords: *Penaeus monodon*, health status, disease, farm, gher, Cox's Bazar.

Poster Abstracts

Theme: Advances in Aquaculture

FSB2019-Pst-04

Growth, yield and economic returns of striped catfish (*Pangasianodon hypophthalmus*) at different stocking densities under floodplain cage culture system

Md. Atick Chowdhury, Nirmal Chandra Roy, Angkur Chowdhury

Department of Fish Biology and Genetics, Sylhet Agricultural University, Sylhet-3100, Bangladesh.

Correspondence: Nirmal Chandra Roy (ncroy.say@gmail.com); Angkur Chowdhury (chowdhuryangkur@gmail.com)

The influence of stocking density plays one of the major role in the final production for profitable aquaculture practices. This study was conducted to investigate the effect of stocking density on growth performance, yield and economic return of striped catfish (*Pangasianodon hypophthalmus* Sauvage, 1878). The fish were reared at three different stocking densities in rectangular cages (submerged volume 32 m³) suspended in a *haor* floodplain from August to November 2018. *P. hypophthalmus* (mean initial weight 50.53±0.08 g) were stocked at densities of 19, 22 and 25 fish/m³ indicated in three treatments (T₁, T₂ and T₃). After 90 days of the experimental period, growth and yield parameters were studied and an economic analysis regarding farm profitability was carried out. Fish growth performance significantly decreased with increasing stocking density. The mean yields were 12.27±0.08, 14.00±0.14 and 15.01±0.20 kg/m³ in T₁, T₂ and T₃, respectively and showed significant variations ($P<0.05$) with increasing stocking density. Relative growth rate, specific growth rate, protein efficiency ratio between 19 and 22 fish/m³ were not significantly different, but they were significantly higher in 25 fish/m³. The feed conversion ratio was significantly lower in 19 and 22 fish/m³ than the 25 fish/m³ stocked cages. Environmental parameters were within the acceptable range and not significantly different between the treatments during the study period. Gross return was significantly high in higher stocking densities. However, net return (profit) was significantly lower in the 19 fish/m³ stocked fish than other two densities. The benefit-cost analysis revealed significantly high benefit-cost ratios in 19 and 22 fish/m³ than the 25 fish/m³. Overall, best farm profitability was achieved from the stocking density of 22 fish/m³ among three stocking densities experimented in the study.

Keywords: *Pangasianodon hypophthalmus*, cage culture, floodplain, growth, profitability

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Role of social media in advancement of aquaculture in Bangladesh: Potentials and challenges

Md. Rajibul Islam, Iftekhar Ahmed Fagun, Sakib Tahmid Rishan

Faculty of Fisheries, Sylhet Agricultural University, Sylhet-3100, Bangladesh;

Correspondence: Md. Rajibul Islam (rajib.islam2005@gmail.com)

Aquaculture production contributes 56.24 percent of the total fish production in Bangladesh. The study was conducted to explore the role and feasibility of social media in advancement of aquaculture in Bangladesh and its potentiality and challenges. Nowadays internet is used by 57.2% of total population in Bangladesh. Social media has become ubiquitous and social capital

allows a person to draw on resources from other members of the networks to which he or she belongs. To collect empirical data a number of qualitative and quantitative tools such as questionnaire interviews, focus group discussion and oral history from different stakeholders were employed. The study identified 40 communities about aquaculture techniques, systems and information sharing on Facebook, the most popular social media in Bangladesh. Bangladesh is a country consisting in different remote areas such as Haor regions, hilly regions are not easily accessible for physical extension work of fisheries and aquaculture. Establishing the social media as a bridge between extension organization and fish farmers can contribute to make more profitable and sustainable aquaculture sector. On the other way, social media can play important role in fisheries and aquaculture research field. Based on literature review, interview from different stakeholders the research analysis has proposed a conceptual frame work for potentiality of social media in advancement of aquaculture in Bangladesh. The study has also identified the challenges of establishment of social media as a tool for aquaculture extension service and prepared some recommendations. The study has found, Social media can be used to spread new techniques and culture practices to the field level. Building community network, developing community infrastructure and community based fisheries management will be also easy to implement through the utilization of social media.

Keywords: social media, aquaculture advancement, Bangladesh

FSB2019-Pst-10

Effect of low cost fermented carbohydrate source on the diversity of live food and growth performance of shrimp (*Penaeus monodon*) in semi-intensive pond

Md Shoebul Islam, S.M. Rafiquzzaman

Department of Fisheries Biology & Aquatic Environment, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur-1706, Bangladesh

Correspondence: S.M. Rafiquzzaman (rafiquzzaman@bsmrau.edu.bd)

Though shrimp is the second largest exportable product in our country, the rising graph of shrimp production has been severely punctuated by disease. Recently researchers found that using of fermented carbohydrate in aquaculture is the most effective means to prevent diseases. It also strives to simulate natural estuarine conditions by creating zooplankton as supplemental nutrition to the shrimp and the beneficial bacteria helps to maintain water quality. So, this study has designed to see the effect of using fermented carbohydrate for producing live food, ensuring disease free pond environment and good growth performance of shrimp in semi-intensive culture system. The experiment was carried out in the ponds situated Shyamnagar, Satkhira with 3 treatments (Control: 100% commercial feed; T₁: 90% CF + 10% LFRB and T₂: 70% CF + 30% LFRB respectively) with two replications. The plankton density was checked using SR- cells. Husk free rice bran was grinded and sieved into smaller fine pieces and probiotics (*Bacillus* and *Lactobacillus*) were used for fermentation. Over the study period, the water quality parameters were at optimum level in the treatment pond compared to control. The pH was higher (8.1±0.14) in control ponds than treatment ponds (7.8±0.07). In early period, the average growth rate in T₁ was 0.20 g/day & in T₂ was 0.22 g/day, which is better than control ponds (T₀) 0.05g/day. In control ponds (T₀); there was no shrimp after 30 days of stocking. The transparency level of the ponds of T₁ and T₂ were comparatively less (45±3 cm) than the control ponds (around 60 cm). The density of plankton was higher in treatment ponds. Hence, it can be concluded that fermented carbohydrate is a low cost source which can play important role on the live food production and good growth performance of shrimp in semi intensive pond.

Keywords: zooplankton, probiotics, fermentation, live food

FSB2019-Pst-11

Cellulase producing bacteria in aquafeed for sustainable aquaculture in Bangladesh

Mauching Marma, S.M. Rafiquzzaman

Department of Fisheries Biology and Aquatic Environment, Faculty of Fisheries, Bangabandhu Sheikh Muibur Rahaman Agricultural University, Salna Gazipur -1706, Bangladesh

Correspondence: S. M. Rafiquzzaman (rafiquzzaman@bsmrau.edu.bd)

Bangladesh is one of the tropical countries, where ruminants are fed on lignocelluloses agricultural-products (such as cereal straw, grass, and tree foliage). Ruminant stomach contains crude fiber such as cellulose, starch, and xylem as the basal feed for ruminants. These materials are fermented in the rumen by microbial community including bacteria, fungi, and protozoa. Furthermore, the community has an essential role in rumen to degrade feed and supplies nutrients to host, predominantly in the form of volatile fatty acids and microbial protein. Recently, the increasing cost of animal source feed ingredients has encouraged the feed manufacturers to search for cheaper alternative sources of carbohydrate and protein such as plant source. In that context, Cellulose is one of the most important polysaccharides and the major component of plant cell walls. Due to its particular properties, the use of bacterial cellulose is required for different applications. Cellulose is very difficult to degrade as it has homopolymer consisting of glucose units joined by β 1-4 bond. Cellulose has a crystalline structure, and it is surrounded by a tough lignin layer. With the help of cellulase enzyme producing microbes, cellulose can be converted to glucose which is a multiutility product, in a much cheaper and biologically favorable process. Rumen microbes that have been known for the production of cellulases that can degrade cellulose include bacteria, some fungi, and actinomycetes. Several cellulase producing bacteria such as *Bacillus*, *Lactococcus*, *Enterobacter*, *Cellulomonas*, *Thermomonospora*, *Ruminococcus*, *Bacteroides*, *Erwinia*, *Gluconacetobacter*, and *Rhodobacter* species have also been identified. Research on isolation and identification of novel cellulases producing enzymes from bacteria are still wide. And specially in Bangladesh this research concept is going to be very unique as it will improve the quality of nutrients and digestibility of plant feed ingredients at a cheaper price than the use of commercial cellulase enzymes.

Keywords: cellulase, cellulose, rumen fluid, aquafeed

FSB2019-Pst-12

Microbial exogenous enzymes for sustainability of aquafeeds: A review on Bangladesh perspective

Koushik Chakroborty, S. M. Rafiquzzaman

Department of Fisheries Biology and Aquatic Environment, Faculty of Fisheries, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur-1706, Bangladesh.

Correspondence: S. M. Rafiquzzaman (rafiquzzaman@bsmrau.edu.bd)

The growth of Bangladesh's aquaculture sector has been facilitated by the use of hatchery-bred seed and the application of prepared feeds. But unfortunately, the quality of both inputs (seed and feed) specially aquafeed has been a problem that is generally expressed at the farm level as poor yield performance and higher cost of production. Moreover, the increasing cost of animal source feed ingredients has encouraged the feed manufacturers to search for cheaper alternative sources of protein such as plant proteins. Though the palatability of many plant materials has demerits but the more concerned problem with the plant source feed ingredients is the presence of Anti-nutritional factors (ANF) in it as it reduces the bioavailability of various nutrients and have adverse effects on the digestion of feed and its efficiency. ANFs include, but are not limited to, phytases, Protease Inhibitors (PIs), Non-Starch Polysaccharides (NSPs) (cellulose and

hemicellulose), saponins, tannins, haemagglutinins or lectins, gossypols and cyanogenic glycosides. In this context, exogenous enzymes are, one of the many types of protein in biological systems, now extensively used throughout the world as additives in aquafeeds because supplementation with enzymes can help to eliminate the effects of antinutritional factors and improve the utilization of dietary energy and amino acids, resulting in improved performance of fish/shrimps. Therefore, there is an ongoing interest in screening microorganisms, including bacteria for novel exogenous enzymes which plays significant role in improving the nutritive quality of food and feed that contain ANF. Moreover, these enzymes have a great industrial significance also. But in Bangladesh there is no research till date regarding the isolation and screening of microorganisms from native sources that have potential exoenzymes. So, researches on microbiological potentiality of producing exogenous enzymes are of prime importance in Bangladesh.

Keywords: anti-nutritional factors, exogenous enzymes, aquafeed

FSB2019-Pst-13

Effects of dietary seaweed supplementation on growth performance, immunity and stress responsiveness in Thai sharputi (*Barbonymus gonionotus*)

Afroza Azad Katha, S.M. Rafiquzzaman

Department of Fisheries Biology and Aquatic Environment, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur -1706, Bangladesh

Correspondence: S. M. Rafiquzzaman (rafiquzzaman@bsmrau.edu.bd)

Bangladesh is highly vulnerable to the effect of climate change in fisheries because of its economics, social dependence on fisheries sector. Climate change effects on fresh water culture fisheries in Bangladesh through temperature oscillations and salinity intrusion. For this, in intensive aquaculture, fish are exposed to several stress factors of biological, chemical or physical origin, that can affect fish immune status and also the rising cost of imported fish feed ingredients have called for an intensive research towards the production of high nutritional fish feed using cheap and natural nutrient sources. In this study, seaweed was used as alternative protein ingredients in fish feed and the enrichment of its nutritional value. This work aimed to appraise growth performance, digestibility and stress responsive-ness in Thai sharputi (*Barbonymus gonionotus*) when fed diets supplemented with seaweeds. A control diet was tested against 3 practical diets supplemented with *Gracilaria tenuistipitata* at 5%, 10%, 15% levels. Thai sharputi fingerlings (10.0 ± 4.98 g) were fed the experimental diets for 9 weeks. Results found that, average weight gain (WG) of Thai sharputi (*Barbonymus gonionotus*) increased up to 10% supplement of *Gracilariatenuistipitata* showed WG 8.67g/week, 11.56 g/week, 9.05g/week respectively that are higher than the control (6.48g/week). Others parameters such as specific growth rate (SGR), feed conversion ratio (FCR) showed highest results in seaweed treated fish than the control. The innate immune system and apparent digestibility of dry matter was also evaluated and showed best result in 10% seaweed supplementation. Stress factors were also evaluated on different temperatures and salinity which show higher survivability than control diet. To reduce economic losses caused by immunosuppression in intensive aquaculture, it is necessary to develop strategies that account for environmental stressors for farmed fish. Overall, our results indicate that the use of dietary seaweed supplementation improves growth, digestibility, immunity and stress responsive-ness in Thai sharputi.

Keywords: seaweeds, dietary supplementation, immunostimulants, Thai sharputi, growth, environmental stressors, immune response

FSB2019-Pst-28

Ecofriendly shrimp farming using aquamimicry (pellet free) technique in Bangladesh

Md. Motiur Rahman, A.F.M. Shofiquzzoha, Khan Kamal Uddin Ahmed

Bangladesh Fisheries Research Institute, Shrimp Research Station Bagerhat-9300, Bangladesh

Correspondence: Md. Motiur Rahman (matiur.bfri@gmail.com)

The horizontal expansion of shrimp farming is not an option to increase production in future, rather intensification is. The most obvious curse of intensification is generation of wastes of equal proportions which needs to be treated either in-situ or ex-situ. The purchase capacity of commercially aqua feed is already out of reach for many small scale farmers in Bangladesh. Several drawback of common practice is inefficient use of feeds, leading to water quality deterioration, variable ingredient quality and potential introduction of pathogens which lowers the carrying capacity of our ghers. In this situation, Aquamimicry may be potentially better approach for Shrimp farming. Aquamimicry is in –situ waste assimilation within shrimp ponds where copepods production is stimulated by using FRB/FSY/FWB. FRB/FSY/FWB is made by adding water and probiotics and hydrolyzing enzymes to finely grounded rice/soyabean/wheat bran powder allowed to soak overnight, and is applied at a rate 1000 kg/ha in ponds 24 hours after the fermentation process is over. After application of FRB, as soon as the copepod, bloom is ready, the PL was stocked at a 19 individuals/m² in 13 decimal ponds 3 feet water depth in 18 July 2018 of SRS. The stocked ponds were routinely seeded with FRB at a rate 20 kg/ha/daily. In addition to creating the copefloc it also provides supplementary nutrition to the shrimps as they feed on the particles of FRB/FSY/FWB very easily. Water temperature 28-30 C, pH 8.5 and DO > 5ppm, Zero NH₃ was maintained accurately in 24 hours. The average weight and yield was 19.5 gm and 2111.85 kg/ha after culturing 90 days. The initial weight and survivality of PL was 0.00958gm and 57%. The biggest advantage is that this can partially/totally negate the use of commercial feed which accounts for~60-70% of total cost. FSY/FRB makes the shrimps healthy, improve appetite, obliterate the production of black soil and subsequent deterioration in water quality due to build up toxic metabolites. Also, there is no need to provide aeration unlike biofloc as the target organism is not bacteria but the copepods

Keywords: aquamimicry, copepods, FRB, FSY, probiotic

FSB2019-Pst-33

Growth performance of pabda (*Ompok pabda*) in net cage at different stocking density at baor environment in Jashore, Bangladesh

Md. RobiulAwal Hossain, Maliha Hossain Mou, Md. Shariful Islam, Shishir Kumar

Dey

Bangladesh Fisheries Research Institute (BFRI), Freshwater Sub-Station, Chanchra, Jashore-7402, Bangladesh

Correspondence: Md. Shariful Islam (sharif.bfri@gmail.com)

The study was conducted in two sites namely Mosshimnagar and Per Khajura villages adjacent to a fisher community of the Jhapa baor of Monirampur Upazilla under Jashore district of Bangladesh. The Pabda fingerlings were stocked in net cages at the stocking densities (fish/m³) of 300, 350 and 400 in treatments I (T₁), II (T₂) and III (T₃) respectively in each site. The culture period was 109 days. Water quality parameters such as water temperature, transparency, pH, dissolved oxygen, ammonia, total alkalinity and hardness were observed fortnightly and was found in a suitable range for fish culture. The Initial average weight of Pabda were 5.40±1.15g, 5.40±1.23g and 5.40±1.00g in T₁, T₂, T₃ respectively at Mosshimnagar site and 5.40±1.16g,

5.40±1.21g and 5.40±1.02 g in T₁, T₂, T₃ respectively at Per Khajura site. The fishes in cage attained the average final weight (g) of 27.35±1.15, 26.4±1.00 and 21.65±1.23; SGR (%/day) were estimated 1.49, 1.46 and 1.51; survivals (%) were recorded 69.20, 87.4 and 90.74; FCR were estimated 2.31, 2.38 and 2.43; productions (kg/m³) were estimated 6.50, 7.35 and 6.50 and BCR were 1.39, 1.31, 1.10 in T₁, T₂ and T₃, respectively in Mosshimnagar site. In Per Khajura site, the fishes attained the average final weight (g) of 28.9±1.11, 26.7±1.15 and 25.3 ±1.05; SGR (%/day) were estimated 1.54, 1.47 and 1.42; survivals (%) were recorded 29, 80, and 72.3; FCR were estimated 2.14, 2.43 and 2.55; productions (kg/m³) were estimated 7.05, 7.45 and 7.96 and BCR were 1.49, 1.30, 1.20 in T₁, T₂ and T₃ respectively. The stocking density of 300/m³ was found better performance in both the site in relation to growth, survivals and BCR.

Keywords: baor, growth, stocking density, Jashore

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Sprouted green wheatgrass: A potential source of fish meal supplement for aqua-feed

Al Minan Noor, Md. Abdus Salam

Department of Aquaculture, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh.

Correspondence: Al-Minan Noor (minannoor80@gmail.com)

Aquaculture is the fastest growing sector worldwide. The growing demand for fish feed ingredients create pressure on fishmeal and fish oil which destroy the aquatic biodiversity. Wheatgrass is the newly sprouted nutritious young green grass with a good source of amino acids like lysine and methionine that can be used as aqua-feed supplement for boost up fish production, minimizing feed adulteration and reduce feed cost. The scientists are relentlessly working to discover potential feed supplement to reduce dependency on fish meal and fish oil which are the sole protein sources of fish feed. This paper highlights an absolutely unexplored and virgin sources of fish feed ingredients to replace fish meal as dietary inclusion the wheat grass meal to support the fish the growth and production in the country. The wheatgrass content vitamins A, C and E, as well as various minerals like iron, magnesium, calcium and divers amino acids. It is an inexpensive source of aqua-feed ingredients, can grow at home round the year in soil as well as hydroponically. It is not only eco-friendly; it can reduce pressure on conventional fish feed constituents. This review will focus on sprouted wheatgrass meal preparation, its nutrients constituents, proximate composition and fish farming with formulated aqua-feed by wheatgrass meal for sustainable and profitable fish farming.

Keywords: wheatgrass, sprout, fishmeal, protein, vitamins, minerals

FSB2019-Pst-56

Fish Producer Organization: A Better Market Access and Supply Chain in the Marketing Distribution Channel

Md. Shamim Parvez¹, S.M. Moniruzzaman², Mohammad Mahshin², A.K.M. Aminullah Bhuiah², Farhana Ahmed², Md. Forhadur Reza³, Ashim Gosh³, M. Aminur Rahman⁴

¹Market Access and Supply Chain Provider Project, Kranti Associates Ltd. Adabor, Dhaka, Bangladesh;

²Project Implementation Unit, National Agricultural Technology Program-2, Department of Fisheries, Matshya Bhaban, Ramna, Dhaka, Bangladesh;

³Department of Fisheries, Bangladesh; ⁴Department of Fisheries and Marine Bioscience, Jashore University of Science and Technology, Jashore-7408, Bangladesh

Correspondence: Md. Shamim Parvez (parvezmdshamim@gmail.com)

Owing to the increasing fish production and rapid expansion of inland aquaculture, Bangladesh has become one of the leading aquaculture producing countries and secured 5th position in the world aquaculture production. A large number of people, many of whom living below the poverty line, find employment in the domestic fish marketing chain in the form of farmers, processors, traders, intermediaries, laborers and transporters. In the local level of distribution channel of fish marketing in Bangladesh, the products move from farmers to consumers through market intermediaries such as paikers, aratdars, depot owners, processing plants and retailers. Fish farmers are the first link in the fish marketing distribution channels. Informer is a middleman, who wants to take ownership of the product but establishes a hidden bridge between seller and buyers for receiving some commissions from the farmers. In backward linkage of fish producer organization, the quality of fish seed, fertilizer, feeds and other inputs are required to produce safe fish. On the other hand, in the forward linkage of market access of fish, there need to improve post-harvest management, cool chain maintenance, and new products development as per market demand to earn maximum benefit. But during the post-harvest handling and grading/sorting, farmers are usually practiced to put their harvested fish on the open lands, date mats, hogla mats, polythene and banana leaves. With rough handling and are not practiced the proper cleaning of fish and floor, washing utensils, use of hygienic water etc. The same condition occurs concerning the handling of fish in the marketing distribution channels among aratdar, supplier, and retailer. And even, no cool chain is maintained from producer to consumer via aratdar, paiker, wholesalers, retailer, traders, etc. These are the common problems for which no published documents are available. Under such circumstances, deficiency of knowledge in proper handling, maintaining cool chain, value addition, post-harvest management services of fish, they damage the quality of fish, i.e. impaired fins, scales falling, body injure etc. Sometimes the normal appearance of fish is changed due to lacking of proper handling in the forward linkage of marketing. Understanding the current traditional supply chain in use for years and trying to improve it in order to establish producer organization from relevant to the present situation for economically and quality in more benefited of the commodity by the active participation in both backward and forward legs of a Producer organization to complete a supply chain of fish farmer to market.

Keywords: fish, producing organization, market access, supply chain, distribution channel

FSB2019-Pst-69

Quantification of major aquaculture medicinal products (AMPs) used in Mymensingh district of Bangladesh

Noor Rahman, Kamru Naher Azad, Md. Ali Reza Faruk

Department of Aquaculture, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Correspondence: Kamrun Naher Azad (kamrunnaherkeya003@gmail.com)

With the rapid expansion and commercialization of aquaculture in Bangladesh, there has been an increasing trend of using aquaculture medicinal products (AMPs). The present study quantified the amount of three AMPs including antibiotics, probiotics and disinfectant used in aquaculture in Mymensingh district. Data were collected through questionnaire interview with different representatives of pharmaceutical companies, drug retailers, drug depots and by personal contact. Seventeen pharmaceutical companies were found to provide these three AMPs with different trade names to meet the farmers' demand. Among these AMPs, selling of probiotics in solid form was the highest (42.2 tons) followed by antibiotics (19.8 tons) and disinfectants (11.7 tons). On the other hand, in liquid form the selling of disinfectants was the highest (17.9 tons) followed by antibiotics (10.4 tons) and probiotics (2.5 tons). It was calculated that, the total price of antibiotics,

probiotics and disinfectants used in Mymensingh district per year were Tk. 5.41 crores, Tk. 4.24 crores and Tk. 5.97 crores respectively. Six groups of antibiotics having seventeen different active compounds with 53 trade names were found to be provided by pharmaceutical companies. The groups included β -Lactams, macrolides, quinolones, tetracyclines, sulfonamides and fluoroquinolones. The highest amount of AMPs were sold by Green Dale (16.68 tons) followed by EON group and Elanco group, Popular, ACME, Reneta and Square. Most of the AMPs were prepared by the companies either for use in veterinary or poultry but were being used indiscriminately in aquaculture. It is thus important to produce and use appropriate labeled AMPs in aquaculture for safe fish production. More in-depth studies are needed to understand the impact of AMPs on fish, aquatic ecosystem and human health. To have a clear picture of total amount of such products used in aquaculture, a comprehensive study needs to be conducted in all districts of the country.

Keywords: aquaculture medicinal products, quantification, probiotics, antibiotics, disinfectants

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Dietary manganese requirement of stinging catfish *Heteropneustes fossilis*

Md. Nur Amin Mukul¹, Md. Amzad Hossain¹, Taslima Akter¹, Md. Mahbubur Rahman²

¹Department of Aquaculture, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur, Bangladesh; ²Institute of Biotechnology and Genetic Engineering, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur-1706, Bangladesh

Correspondence: Md. Amzad Hossain (amzad@bsmrau.edu.bd)

The present research was conducted to determine the dietary Manganese (Mn) requirement of the stinging catfish, *Heteropneustes fossilis*. Isonitrogenous purified diets containing five graded levels of supplemental manganese (0, 5, 10, 15 and 20 mg kg⁻¹) were formulated and fed to triplicate groups of fish for a period of 10 weeks. MnSO₄·H₂O was used as the dietary manganese source. Water temperature, dissolved oxygen, pH and ammonia were within suitable ranges for *H. fossilis* culture. Results indicated that the highest (p < 0.05) weight gain and specific growth rate were for the fish fed the diet supplemented with 10 mg Mn kg⁻¹, followed by fish fed the diets with 20, 15 and 5 mg Mn kg⁻¹, and the lowest in fish fed the Mn unsupplemented control diet. Supplementation of dietary Mn also lowered FCR value. Whole body protein content was found to improve with increasing dietary manganese level up to 10 mg kg⁻¹ followed by no change on further increase in dietary manganese. On the other hand, whole body fat reduced with increasing dietary manganese level up to 10 mg kg⁻¹ and then stabilized. Mn contents in muscle and bone were linearly increased up to the 10 mg kg⁻¹ dietary Mn and then remained stable beyond this level. Survival of fish fed the control diet and Zn supplemented diet was 95% and 99-100%, respectively. Muscle and bone iron found to be decreased with the increasing of graded levels of Mn in the diet. Blood parameters were affected by dietary manganese supplementation. Red blood cell and white blood cell were increased with the increasing dietary manganese levels upto 10 mg kg⁻¹, while haemoglobin and haematocrit decreased with the increasing dietary manganese levels. It was concluded that a dietary supplementation of 10 mg Mn kg⁻¹ is suitable for growth, feed utilization and maintaining bone Mn level in *H. fossilis*.

Keywords: *Heteropneustes fossilis*, manganese requirement, growth performance, body composition, mineralization

FSB2019-Pst-72

Feasibility of jute (*Corchorus olitorius*) leaf powder based fish feed in the growth performances of mrigal fingerlings (*Cirrhinus cirrhosus*) in laboratory

Papri Biswas, Prosun Roy, Md. Abdus Salam

Department of Aquaculture, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Correspondence: Md. Abdus Salam (masalambau@gmail.com)

An experiment was carried out in the “BAU Aquaponics Oasis” Laboratory, Department of Aquaculture, Bangladesh Agricultural University, Mymensingh for 60 days from 20th September to 20th November, 2018 to evaluate the feasibility of jute leaf powder based fish feed for growth performances of mrigal fingerlings (*Cirrhinus cirrhosus*) in laboratory condition. Three treatments were considered as T₁ (cont.), T₂ and T₃ with three replications each. Three experimental diets were formulated to replace fish meal using processed jute leaf meal (JLM) at the rate of 0% (T₁-con.), 10% (T₂-JLP₁₀) and 20% (T₃-JLP₂₀). Nine plastic half drums were used for fish culture containing 10 fingerlings/90 L water and oxygenated with aerators. The jute leaves were processed in laboratory for making jute leaf powder. Fishes were fed with experimental diets twice daily at the rate of 10% of their body weight. Fish sampling was done at 15 days interval. Water quality tests were done weekly and to estimate tolerance against low pH stress was done. The proximate composition determination of mrigal fingerlings was done. The highest mean length gain, mean weight gain, SGR, FCR and production were 1.51 ±0.18 cm, 2.96 ±0.13 g, 0.53 ±0.03 %, 2.81±0.71 and 4084.00 ±50.67 kg/ha/60 days in T₂. The fish survival rate was 100% in all the treatments. The highest tolerance against low pH stress was 16 min in T₂. The higher values of moisture, crude protein, crude lipids, ash, crude fiber and carbohydrate contents were 75.81 ±0.82, 14.10 ±0.21, 5.13 ±0.32, 3.79 ±0.52, 1.24 ±0.11 and 0.82 ±0.28 % in T₂. The highest cost of fish feed was 50.35 tk in T₁. Therefore, the present experiment exposed that JLP₁₀ based fish feed might be given the higher fish production and proximate composition also was higher than T₃-JLP₂₀ and control.

Keywords: jute leaf, fish feed, mrigal fingerlings, growth performances

FSB2019-Pst-73

Fish density-dependent bush bean production in media-based aquaponics system

Prosun Roy, Md. Abdus Salam

Department of Aquaculture, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Correspondence: Md. Abdus Salam (masalambau@gmail.com)

Aquaponics is one of the most effective technology for organic food production and solution of environmental problems as aquaponics mimics the natural ecosystem. The present experiment was carried out to prove this truth in “BAU Aquaponics Oasis” Laboratory, Department of Aquaculture, BAU, Mymensingh for 93 days in 2018 in tilapia based bush bean (*Vigna unguiculata*) production system. The fish reared at the density of 30, 40, 50 and 60 fish/300L tank that was designated as T₁, T₂, T₃ and T₄ treatments, respectively. All the experiments were conducted in triplicates. Six bush bean saplings were transplanted in gravel media in 12 plastic half drums (99.5×57×21cm³). The ammonia laden fish tank wastewater was irrigated into the vegetable beds twice daily at 9 AM and 5 PM with an 18-watt submersible water pump and tank water oxygenated with a 35-watt air pump. The fish was fed at 5% body weight with commercial floating feed. The fish was sampled and water quality measured fortnightly and plant height, leaf length-width, flower and fruit

numbers counted and finally, feeding rate adjusted accordingly. The data interpretation showed that the bush bean production was 42.76 ± 11.72 to 25.00 ± 7.07 tons/ha/93 days, where the highest production was in T₃. While, the highest fish production was 282.40 ± 25.73 tons/ha/93 days in T₄. The highest moisture, crude protein and ash content of bush bean was (84.50 ± 0.95 , 2.17 ± 0.07 and $2.56 \pm 0.06\%$) in T₁ and the highest crude lipid and crude fiber was in T₄. The bush bean fruiting period, total production and fish production was significantly higher than the reported data in present media-based aquaponics system. There was no water exchange except adding evaporated water only. Moreover, the most of the water quality parameters were within the acceptable range for fish welfare. Considering fish and bush bean production, 50 fish/300L was the best aquaponics combination. Therefore, it is proved that media-based soil less aquaponics performed well in Bangladesh climatic condition which can be replicated in adverse climatic situation in the country with any crops.

Keywords: aquaponics, bush bean, climatic condition, tilapia, water quality

FSB2019-Pst-95

Culture and growth performance of *Spirulina platensis* in the media prepared from supernatant of digested biscuit factory waste

Md. Abdul Baten, Zannatul Ferdous, Md. Ahsan Bin Habib

Department of Aquaculture, Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Correspondence: Md. Ahsan Bin Habib (ahsanmphd@yahoo.com)

An experiment was conducted to evaluate the culture and growth performance of spirulina (*Spirulina platensis*) in supernatant of three different concentrations of digested biscuit factory waste (DBFW), and Kosaric medium (KM) as control. Biscuit factory waste was allowed to digest under aeration in 5 L glass jar. After 30 days, the yellowish white coloured supernatant was screened and taken in 1.0 L conical flask with three replications. Then, spirulina was inoculated to grow in supernatant of these three digested biscuit factory waste (DBFW) (treatments) with the addition of 9.0 g/L NaHCO₃ and micronutrients, and in KM. It was cultured in supernatant of three concentrations viz., 20, 40 and 60% BFW and Kosaric medium (KM) with three replications under fluorescent light in light: dark (12 hr:12 hr) condition for a period of 14 days. The growth rates in terms of optical density, dry cell weight and chlorophyll *a* of spirulina cultured in these media were varied from each other. The cell weight of spirulina was attained a maximum of 12.43 ± 0.21 mg/L (dry wt. basis) in KM followed by 6.42 ± 0.002 , 11.81 ± 0.001 and 10.22 ± 0.001 mg/L in supernatant of 20, 40 and 60% DBFWM, respectively on the 10th day of culture. Similar trend was also observed in the cases of optical density of the media contained spirulina, chlorophyll *a* content (mg/L), total biomass (mg/L), specific growth rates (on the basis of cell weight and chlorophyll *a*) and total biomass of spirulina. Cell weight of spirulina grown in these media had highly significant ($P < 0.01$) correlation with chlorophyll *a* content ($r = 0.993$) and total biomass ($r = 0.925$) of spirulina. The results showed that the growth performance of spirulina grown in supernatant of 40% DBFWM was significantly ($P < 0.01$) higher than that of spirulina grown in supernatant of 20 and 60% DBFWM. The percentage of crude protein (64.50%) of spirulina cultured in 40% DBFWM was higher than that of spirulina cultured in 20 and 60% DBFW, and KM. The physico-chemical parameters were within the optimum ranges for the culture of spirulina. So mass culture of *S. platensis* may be done in supernatant of 40% DBFW.

Keywords: *Spirulina*, digestion, supernatant, biscuit factory waste

FSB2019-Pst-96**Culture and growth performances of spirulina (*Spirulina platensis*) in supernatant of digested rotten wax gourd (*Benincasa hispida*)**

Sonet Ranjan Sarker, Kamrun Nahar Azad, Md. Ahsan Bin Habib

Department of Aquaculture, Bangladesh Agricultural University, Mymensingh 2202, Bangladesh

Correspondence: Md. Ahsan Bin Habib (ahsanmphd@yahoo.com)

An experiment was conducted to evaluate the culture and growth performance of spirulina (*Spirulina platensis*) in supernatant of three different concentrations of digested rotten wax gourd (*Benincasa hispida*), and Kosaric Medium (KM) as control. Rotten wax gourd allowed to digest under aeration in 5 L glass jar. After 30 days, the yellowish white coloured supernatant was screened and taken in 1.0 L conical flask with three replications. Then, spirulina was inoculated to grow in supernatant of these three digested rotten wax gourd (DRWG) (treatments) with the addition of 9.0 g/L NaHCO₃ and micronutrients, and in KM. It was cultured in supernatant of three concentrations viz., 25, 50 and 75% RWG and Kosaric medium (KM) with three replications under fluorescent light in light: dark (12 hr:12 hr) condition for a period of 14 days. The growth rates in terms of optical density, dry cell weight and chlorophyll *a* of spirulina cultured in these media were varied from each other. The cell weight of spirulina was attained a maximum of 11.88 ± 0.25 mg/L (dry wt. basis) in KM followed by 7.002 ± 0.0012, 10.809 ± 0.0011 and 11.215 ± 0.0013 mg/L in supernatant of 25, 50 and 75% RWGM, respectively on the 10th day of culture. Similar trend was also observed in the cases of optical density of the media contained spirulina, chlorophyll *a* content (mg/L), total biomass (mg/L), specific growth rates (on the basis of cell weight and chlorophyll *a*) and total biomass of spirulina. Cell weight of spirulina grown in these media had highly significant (P < 0.01) correlation with chlorophyll *a* content (r = 0.993) and total biomass (r = 0.925) of spirulina. The results showed that the growth performance of spirulina grown in supernatant of 50% RWGM was significantly (P < 0.01) higher than that of spirulina grown in supernatant of 25 and 75% RWGM. The percentage of crude protein (64.50%) of spirulina cultured in 50% RWGM was higher than that of spirulina cultured in 25 and 75% RWG, and KM. The physico-chemical parameters were within the optimum ranges for the culture of spirulina. So mass culture of *S. platensis* may be done in supernatant of 50% RWG.

Keywords: *Spirulina*, culture, supernatant, rotten wax gourd

Poster Abstracts

Theme: Management of Critical Aquatic Resources

FSB2019-Pst-07

Observations of fish production and availability of aquatic inhabitants under pen culture in Chatol Beel floodplain

Monayem Hussain, Md. Atick Chowdhury, Chironjib Singha Samanta Chandan, Nirmal Chandra Roy

Department of Fish Biology and Genetics, Faculty of Fisheries, Sylhet Agricultural University, Sylhet-3100, Bangladesh.

Correspondence: Nirmal Chandra Roy (ncroy.sau@gmail.com)

Present study concerned about the growth and production of fishes and availability of aquatic inhabitants in Chatol beel floodplain under pen culture technology for a period of 135 days. The pen enclosure was made by bamboo-split fence which covering an area about 2.43 ha. A combination of seven fish species—*Labeo rohita*, *Catla*, *Cirrhinus cirrhosus*, *Ctenopharyngodonidella*, *Puntius gonionotus*, *Aristichthys nobilis* and *Labeo gonius* were stocked in the pen at theratio of 30:20:25:5:10:5:5 with the stocking density of 6250 fingerings/ha. The gross fish production of pen was 5282.9 kg, which included 4684.9 kg from stocked fish and 598 kg from non-stocked fish. The small indigenous species of fish (SIS) was dominant in the catches of non-stocked fish and total 20 different SIS species belonged to 12 families were being found with varying abundance. A total 9 species of phytoplankton, 5 species of zooplankton, 21 aquatic weeds and 9 taxa of benthic fauna were observed during study period. The net profit was US \$3532 and cost- benefit ratio was 1:1.8, which delineate that composite fish culture through pen culture technology in floodplain area has immense possibilities for increasing fish production and financial gains.

Keywords: floodplain, pen, SIS

FSB2019-Pst-08

Exploration of fishing gears and availability of fish species at Shibsra River of Paikgachha Upazila, Bangladesh

Prosun Roy¹, Suprakash Chakma², Zubyda Mushtari Nadia^{1,3}

¹*Department of Aquaculture, Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh;* ²*Department of Fisheries Technology, Faculty of Fisheries, Patuakhali Science and Technology University, Dumki, Patuakhali-8602, Bangladesh;*

³*Department of Aquatic Animal Health Management, Faculty of Fisheries and Aquaculture, Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka-1207, Bangladesh*

Correspondence: Prosun Roy (prosunroy555@gmail.com)

The present study was undertaken to ascertain fishing gear and crafts uses, fish catch composition of the particular gear along with the identification of available fish species of Shibsra River, South-Western Bangladesh for a period of 12 months from January to December, 2018. From the present study, 15 distinct fishing gears were listed under 8 major groups. On the basis of the use, the ber jal was the most dominant gear used by the fishermen constituting 26.67% (Fig. 1). The highest catch composition was found for ber jal (50 kg/day). Precisely 60 fish species (55 finfish and 5 shellfish) were listed covering 28 families of which Cyprinidae was found as most

dominant having 13 species followed by Bagridae (4 species having 2 genera), Clupeidae (4 species having 3 genera), Channidae (4 species having 1 genera), Siluridae (3 species having 2 genera), Gobiidae (3 species having 3 different genera), Palaemonidae (3 species having 1 genera), Ambassidae, Notopteridae, Schilbeidae (2 species having 2 different genera), Cichlidae, Mastacembelidae (2 specie having 1 genera), and the rest of the families having only one single species under a single genera for each. This study also depicted 8 endangered (14%), 5 vulnerable (8%), 33 least concern (55%), 8 near threatened (13%) and 6 not evaluated (10%) species out of 55 finfish and 5 shellfish species (Fig. 2). Due to incognizance and over exploitation on fish with small mesh size net, species diversity of this river is under threat. So, public awareness and compatible knowledge on use of suitable fishing gears with suitable mesh size could contribute to sustainable fisheries in this river and betterment in livelihood of the fishermen in the surrounding area.

Keywords: fishing gears, fishing crafts, fish species, Shibs River

FSB2019-Pst-16

Long-term fish fauna and community structure analysis in one monitoring site of a temperate river along with chemical water quality

Mu-Sung Sung, Ji Yoon Kim, Kwang-Guk An

Department of Bioscience and Biotechnology, Chungnam National University, Daejeon 34134, South Korea

Correspondence: Kwang-Guk An (kgan@cnu.ac.kr)

Long-term monitoring surveys were conducted, on monthly basis, during eight-years duration (2010–2017) in Seom River, South Korea. This river is an important tributary of Han-River Watershed used for muliti-purpose in water resource. We analyzed fish trophic and tolerance guilds, fish community structure as well as ecological stream health, based on the multi-metric fish model. In total, 56 fish species were collected and the dominant species were *Zacco platypus* and *Gobiobotia macrocephala* that have riffle species characteristics. We also found three endangered fish of *Rhodeus pseudosericeus*, *Gobiobotia macrocephala*, and *Gobiobotia brevibarba*. The community structure analyses showed that the insectivore fish were dominated the trophic guilds, indicating a low potential pollution. Fish community showed seasonal and inter-annual fluctuations and these were mainly influenced by flow regimes rather than the chemical water quality and habitat modifications. In fact, annual water quality (total phosphorus, total nitrogen, electrical conductivity, total suspended solids) had no significant variations over the eight years. Also ecological stream health based on the IBI fish model, had little changed over the study year.

Keywords: Seom River, fishcommunity, endangered species, water quality

FSB2019-Pst-17

The influence of the weir constructions in a large river on water quality and fish fauna

Hye-Jin Kim, Yeo-Rip Shin, Ji Yoon Kim, Kwang-Guk An

Department of Bioscience and Biotechnology, Chungnam National University, Daejeon 34134, South Korea

Correspondence: Kwang-Guk An (kgan@cnu.ac.kr)

The purpose of this study is to analyze the physicochemical water quality and fish fauna before and after the construction of two weirs in a large river, Korea. Long-term water quality was analyzed during the last 10 years. After the weir constructions, significant changes occurred in nutrient (TP) and suspended solids (TSS), which showed sharp decreases in the river. In contrast, algal biomass, measured as chlorophyll-a, and mass ratios of TN:TP increased. Thus, the ratios of CHL:TP had large increases after the weir constructions, resulting in massive algal blooms. This significant change of the water quality were mainly attributed to increased water residence time (WRT). Also, the weir constructions resulted in changes of fish compositions, based on the trophic fish guild and tolerant fish guilds. The tolerant fish with lentic-type dominated the fish community and exotic species of bluegill (*Lepomis macrochirus*) abruptly increased in the river, thus the construction had positive effects on the reproduction and growth of bluegill population. Overall our data suggest that the weirs changed the water quality and fish compositions, resulting in modifications of primary production and the food chains in the river ecosystem

Keywords: invasive species, fresh water, artificial structure, weir, stream health

FSB2019-Pst-18

Long-term distribution patterns of largemouth bass as an invasive species in Korean watersheds, and the risk screening assessments using two different models

Jeong-Eun Kim, Md Mamun, Kwang-Guk An

Department of Bioscience and Biotechnology, Chungnam National University, Daejeon 34134, South Korea

Correspondence: Kwang-Guk An (kgan@cnu.ac.kr)

Largemouth bass (*Micropterus salmoides*), as an ecological disturbing species designated by the Ministry of Environment, Korea (MOE) and the invasive exotic species, is widely known to have a negative effect on biodiversity in aquatic ecosystems in Korea. The objectives of this study were to analyze the distribution and expansion patterns of the species and assess the invasiveness risk in Korean watersheds during the past 10 years (1997 – 2017). The species distribution/expansion were analyzed by ArcGIS (v.10.2.1). Invasiveness risks of the bass was performed by comparing the FISK model (Fish Invasiveness Screening Kit) and the K-IRA model (Korean Invasiveness Risk Assessment). According to the long-term distribution/expansion analysis, the bass tended to increase continuously in Korea, and the “Hot Spot” analysis showed highest spreading in the Nakdong-River of the four major river watersheds. The value of the FISK model was 31, which indicates a "High Risk" species, while the value of the K-IRA model was 65, evaluated as “potential risk species”. Thus, two models had some differences in the risk. We believe that this approach may be used as a key tool for the future predictions on the distribution/expansion and the invasiveness risk of exotic species.

Keywords: invasive species, spatial distribution, largemouth bass, risk screening

FSB2019-Pst-19

Key factors influencing the distribution of invasive fish species (*Micropterus salmoides*) and ecological impact on native fish communities in Korean lotic ecosystems

Jung Jae Kim, Seok Cheol Kwon, Kwang Guk An

Department of Bioscience and Biotechnology, Chungnam National University, Daejeon-34134, South Korea

Correspondence: Kwang-Guk An (kgan@cnu.ac.kr)

Largemouth bass is one of the widely dispersed invasive fish species in the world. The negative effects of this species have been reported from many countries in the world. In Korea, largemouth bass introduced in 1970s to 1980s, and their negative impact on native fish communities and river ecosystem have been reported. We studied ecological impact of the largemouth bass and key factor regulating bass in six different regions in Korea. In order to analyze ecological impact, we used the combined approach of index of biotic integrity (IBI) and some of approaches based on the fish community guild. We used fish assemblage data and water quality data of two years before and after weir construction on mainstream of Young-san River. The model value of IBI score decreased in response to the bass abundance. In the meantime, when the IBI value were less than 15, abundance of bass decreased, indicating low abundance of the bass in the poor health condition based on IBI. Proportion of sensitive species highly decrease in sites where the bass present. Some water quality parameters influenced the distribution of bass. Stream order is the one of the key limiting factor for distribution of largemouth bass.

Keywords: invasive species, largemouth bass, river ecosystem, fish community

FSB2019-Pst-20

Stream health assessments using a combined approach of chemical and biological multi-metric models and their relations with fish trophic and tolerance guilds

Md Mamun, Kwang-Guk An

Department of Bioscience and Biotechnology, Chungnam National University, Daejeon 34134, South Korea

Correspondence: Kwang-Guk An (kgan@cnu.ac.kr)

Nonsan stream is a tributary of Geum River that is largely affected by urbanization and agricultural activities in the watershed area. The aim of the present study was to diagnose the chemical and biological health of the stream using the multi-metric water pollution index (WPI) and the index of biotic integrity (IBI_{KR}) model, respectively, during 2010-2016. The monthly and annual variations of water chemistry were directly influenced by the monsoon season in the stream. The inflow of total phosphorus, suspended solids, ionic contents, and dilution of total nitrogen happened during July-August. The chlorophyll growth is largely influenced by the total phosphorus ($R^2=0.43$, $p < 0.01$), TN:TP ratios ($R^2=0.54$, $p < 0.01$) and electrical conductivity ($R^2=0.81$, $p < 0.01$). Principal component analysis (PCA) showed that the abundance of omnivore and tolerant species were higher than insectivore and sensitive species, respectively due to excessive nutrient pollution and organic matters in the stream. Fish composition analysis presented that *Zacco Platypus* (Pale chub, Cyprinidae) was the most dominant in the stream and the sensitive fish species showed disappeared. Analysis of Pearson correlation network estimation revealed that the water quality parameters are negatively correlated with trophic and tolerance guilds. Average multi-metric values of WPI during 2010-2016 ranged from 15 to 19 in the stream, indicating a fair to poor chemical health. The model values of the biological multi-metric index based on biological integrity matched with the chemical model. Also, the trophic and tolerance guild analysis matched with chemical conditions. This outcome suggested that biological health was directly influenced by chemical pollutions.

Keywords: stream health, nutrients and organic matters, water pollution index (WPI) model, index of biotic integrity (IBI) model, trophic and tolerance guilds

FSB2019-Pst-21

Spatial and temporal patterns of chemical water quality using statistical approaches in the mainstreams of Geum River

Seokcheol Kwon, Md Mamun, Kwang-Guk An

Department of Bioscience and Biotechnology, Chugnam National University, Daejeon 34134, South Korea

Correspondence: Kwang-Guk An (kgan@cnu.ac.kr)

Long-term water quality patterns were analyzed in 12 mainstream sites of Geum River. The chemical parameters measured were several types of dissolved oxygen (DO), nutrients (TN, TP, TDN, NH₄-N, NO₃-N, TDP, PO₄-P), ionic contents (electrical conductivity, EC), water temperature (WT), total suspended solids (TSS), chlorophyll (CHL), and so on. Statistical approach of multi-collinearity was verified using the Variance Inflation Factor (VIF) for selected water quality variables and the principle component analysis (PCA) was performed using the remaining 17 water quality variables that were removed from the TDN due to high inter-correlation between TN and TDN values. In the analysis, we classified key factors into five main components. Factors (I) included DO, TN, WT, EC, NH₄-N, and NO₃-N, which are likely to be related to the characteristics of the river bottom condition (oxic vs. anoxic) and inflow regime (dilution by rainfall) of nitrogen-based contaminants. Factors (II) included BOD, COD, TOC, EC and CHL, which were related to the organic matter pollution indicators and ions in the polluted waters. Factor (III) included TSS, TDP, and PO₄-P. Factors (IV) included TC and FC, which were associated with the E. coli group, and Factor (V) included pH, NH₄-N, and CHL. Based on the factor analysis, we determined the spatial and temporal variations of water quality.

Keywords: principal component analysis, water quality analysis, Geum River in Korea

FSB2019-Pst-22

Preliminary studies on chemical water quality and fish fauna in an urban stream and the efficiency analysis on the fish passing in the fishways

Yeo-Rip Shin¹, Md Mamun¹, Kwang-Guk An¹

¹Department of Bioscience and Biotechnology, Chugnam National University, Daejeon 34134, South Korea

Correspondence: Kwang-Guk An (kgan@cnu.ac.kr)

The main objective of the study was to evaluate chemical water quality and fish fauna in an urban stream along with the effect of barriers for fish passing in the fishways. This is preliminary research for the better project in the urban aquatic ecosystem. We analysed water quality parameters such as nutrients (TP, TN), organic matters (BOD, COD), and algal biomass as chlorophyll-a. Also, we collected fish for the evaluations of ecological stream health, based on the multi-metric models (based on the IBI metrics), which is officially used in National Fish Assessment Model. Also we developed the efficiency model of fishway, based on structural parameters, biological parameters (fish), and hydrological parameters. For the study, we conducted on six sections of the weirs in Daejeon Stream. We compared the water quality and fish guilds of trophic and tolerance compositions between the sampling sites. In addition, we compared the fish ways using the fishway model. We are analyzing the data now and will add more valuable information in the future.

Keywords: fishway, urban stream, weir

FSB2019-Pst-35

Fish species availability and socio-economic condition of fishermen of the Bergobindopur baor of Chaugachha upazilla in Jashore district of Bangladesh

Kamrun Naher Azad¹, Sharmin Akter², Khairun Naher Azad³

¹*Dept. of Aquaculture, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh;*

²*Dept. of Fisheries and Marine Bioscience, Jashore University of Science and Technology, Jashore-7408, Bangladesh;* ³*Fisheries and Marine Resource Technology Discipline, Khulna University, Khulna-9208, Bangladesh*

Correspondence: Kamrun Naher Azad (kamrunnaherkeya003@gmail.com)

A study was conducted to investigate fish species availability and socio-economic conditions of fishermen of the Bergobindopur baor of Chaugachha upazilla in Jashore district of Bangladesh. Data were collected from 31 fishermen of the baor through questionnaire interviews and focus group discussion. The data analysis revealed that twelve indigenous fish like puti, tengra, shol, gazzar, ayre, koira, maya, chanda and a few exotic fish like silver carp, common carp, grass carp were available in Bergobindopur baor. Prices of fishes varied from species to species but high priced fish were Rui, Catla, Mrigal. Fish were transported by different vehicles like van, nosimon, korimon, truck. Various nets were used for capturing fish like- kochal jal, net jal, thela jal etc. The study also showed that a large portion of fishermen (70%) were Hindu, almost all were male except 4%, majority were married (91%) and middle aged (55%). Both of joint and nuclear families were occupied by the fishermen at almost equal percentages. Monthly average income was around Tk. 3500-4000 per fishermen and Most of the fishermen's (60%) yearly income was between Tk. 30000-50000. Non-constructed houses were more abundant (88%) and majority (61%) had electricity facilities. All fishermen used tubewell water for drinking, multiplicity used sanitary latrines and almost all fishermen took allopathic (80%) and homeopathic (17%) treatment which indicated positive signs for health condition of fishermen. Through fishing, their socio-economic condition became more improved than earlier. About 60% fishers opened bank accounts and all sent their children to school as well as farmed cattle. However, the fishers faced some problems like lack of sufficient boats and gears, transportation problems, inadequate training facilities, lack of financial supports, lack of awareness etc. Therefore, more institutional, organizational, technical and credit supports are required to minimize their difficulties and ensure their socio-economic betterment and sustainable livelihoods.

Keywords: fish species availability, socio-economic condition, fishermen, Bergobindopur baor

FSB2019-Pst-36

Life-history traits of the spotted snakehead *Channa punctata* (Bloch, 1793) in the wetland ecosystem (Gajner beel) from northwestern Bangladesh

Md. Yeamin Hossain¹, Asma Afroz Chowdhury¹, Redwanul Haque Khonok¹, Md. Ashekur Rahman¹, Sumaya Tanjin¹, Farzana Akter Rima¹, Md. Rabiul Hasan¹, Zannatul Mawa¹, Zoarder Faruque Ahmed²

¹*Department of Fisheries, Faculty of Agriculture, University of Rajshahi, Rajshahi-6205, Bangladesh;*

²*Department of Fisheries Management, Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh*

Correspondence: Md. Yeamin Hossain (hossainyamin@gmail.com)

The spotted snakehead *Channa punctata* (Bloch, 1793) is an important small indigenous food fish in Asian countries which has high nutritional and commercial value. Though severe work have been

done, this is the first work on life-history traits including growth pattern, condition factors (Fulton's, K_F ; Allometric, K_A ; Relative condition, K_R ; Relative weight, W_R), form factor ($a_{3.0}$), size at first sexual maturity (L_m) and natural mortality (M_w) of *C. punctata* in the Gajner beel, northwestern Bangladesh during July to December 2018. Traditional fishing gears including *fash jal* (Gill net) and *thela jal* (Push net) were used for sampling. Different lengths (i.e., total length, TL; standard length, SL) and body weight (BW) of each individual were taken by using digital slide calipers and an electronic balance to the nearest 0.01 cm and 0.01 g, respectively. In total, 583 individuals ranging from 5.8-22.8 cm TL and 1.96-115.08 g BW were collected in this study. On the basis of b value, the growth pattern of *C. punctata* was isometric ($b=3.0$) with r^2 values ≥ 0.979 in all the LWRs. Also, all LWRs as well as LLR were highly significant ($p<0.001$). From four types of condition factor, K_F showed highly significant relationship ($p<0.001$) with TL and BW. Therefore, K_F was the best for assessing the overall health of this species in the Gajner beel, NW Bangladesh. Wilcoxon Signed rank test showed that, W_R was not significantly differ from 100 ($p=37235$). Also, the calculated $a_{3.0}$ was 0.0111 indicating the fish was fusiform in shape. Moreover, the L_m and M_w were 12.67 cm TL and 0.96 year⁻¹, respectively. Therefore, the findings of this study would be very helpful for stock assessment and management of *C. punctata* in Gajner beel and adjoining ecosystems.

Keywords: growth pattern, *Channa punctata*, size at sexual maturity, natural mortality, Gajner beel

FSB2019-Pst-37

Population biology of green mullet, *Planiliza subviridis* (Valenciennes, 1836) in the Shibs River, southern Bangladesh

Zannatul Mawa, Md. Tariqul Islam, Sumaya Tanjin, Md Rabiul Hasan, Md Akhtarul Islam, Asma Afroz Chowdhury, Md Ashekur Rahman, Md. Yeamin Hossain
 Department of Fisheries, Faculty of Agriculture, University of Rajshahi, Rajshahi 6205, Bangladesh

Correspondence: Md. Yeamin Hossain (hossainyeamin@gmail.com)

The present study illustrates the population biology of *Planiliza subviridis* (Valenciennes, 1836) with emphasizing on growth pattern, conditions factors (K_A , K_F , K_R), relative weight (W_R), form factor ($a_{3.0}$), size at first sexual maturity (L_m) of *P. subviridis* in the Shibs River, Southern Bangladesh. A sum of 317 individuals of *P. subviridis* was sampled during July to December 2018 using traditional fishing gears like set bag net (mesh size ranges: 1.0-1.5 cm). For each individual, total length (TL) was measured by slide calipers and whole body weight (BW) was taken on an electric balance with 0.01 g accuracy. The LWRs was calculated using the expression: $W = aL^b$, where the W is the body weight (BW in g), L the total length (TL in cm), a and b are the regression parameters. Fulton's condition factor (K_F) was calculated using the equation: $K_F = 100 \times (W/L^3)$, where W is the total body weight (BW, g) and L is the total length (TL, cm). A total of 317 specimens from the Shibs River, ranging from 6.50-19.70 cm (total length) and 2.90- 93.20 g. BW (body weight) were analyzed in this study. The LLRs were highly significant with all r^2 is ≥ 0.995 . Also, the LWRs were highly significant with all r^2 values is ≥ 0.992 . The allometric coefficient ' b ' of LWRs relationship indicated positive allometric growth of the species as ' b ' value was higher than 3.0. The Fulton's condition factor (K_F) showed no significant variations for this populations (Spearman correlation test, $P = 0.2582$ for TL vs. K_F), also the relative weight (W_R) showed no significant variations ($P = 0.6317$ for BW vs. W_R) during the study. The calculated form factor ($a_{3.0}$) was 0.0116 in the Shibs River for *P. subviridis* suggesting that, this fish can be classified as elongated which is characteristic of many riverine

fishes. In the present study the first sexual was 11.65 cm in TL. The size at first sexual maturity (L_m) of this species in the Shibsra river was calculated using the equation, $\log(L_m) = -0.1189 + 0.9157 * \log(L_{max})$. Therefore, these results of this study would be very effective for wild stock management of *P. subviridis* in coastal Shibsra River and adjoining ecosystems of Bangladesh.

Keywords: growth pattern, sexual maturity, condition factor, *Planiliza subviridis* and Shibsra River

FSB2019-Pst-38

Comparative study of fish species diversity in the Padma river and its two tributaries

Mst. Tasnima Khatun, Md. Rashedul Kabir Mondol

Department of Fisheries, University of Rajshahi, Rajshahi-6205, Bangladesh

Correspondence: Md. Rashedul Kabir Mondol (rashedul.kabir@ru.ac.bd)

The present investigation was carried out from January to December, 2017 in the main channel of the Padma River and its two major tributaries the Mahananda and the Baral River to compare the fish species biodiversity and to identify factors that act as drivers for the potential differences among them. Samplings were carried out by using a traditional fishing gear seine net with the help of professional fishermen at six different sites. It was found 66 species in the Padma River; 53 and 57 species found in the Mahananda River and the Baral River, respectively. Cypriniformes (31%, 43% and 35%) and Cyprinidae (27.27% 39.62% and 31.58%) were the most dominant order and family in the river Padma, Mahananda and Baral River, respectively. Based on national conservation status highest percentage threatened fish species was found in the Padma River (27%), followed by 19 % in the Baral River and 17% in the Mahananda River. According to Margalef's index expressed that the Padma River contains more fish diversity than its tributaries and Evenness index expressed that the Mahananda River was less diversified area. By using different type of biodiversity indices, it was observed that main channel is more abundant with fish than its tributaries. It could be concluded that the main channel of the Padma River is more diversified area for having available fishes. Dissolved oxygen was the main drivers of species richness across the river network. Also carbon-di-oxide (Padma and Mahananda River), water transparency (Mahananda and Baral River) and pH (Baral River) was found as drivers for species richness. We should manage and conserve this population for protecting fish species diversity as well as for sustainable fisheries management.

Keywords: species diversity, Padma River, biodiversity index

FSB2019-Pst-45

Stock assessment of commercially important mussels from different habitats through maximum length-based models

Md. Yeamin Hossain¹, Md. Akhtarul Islam¹, Md. Aatur Rahman¹, Md. Rabiul Hasan¹, Zannatul Mawa¹, Md. Ashekur Rahman¹, Sumaya Tanjin¹, Mohammad Moniruzzaman² and Yahia Mahmud³

¹*Department of Fisheries, University of Rajshahi, Rajshahi-6205, Bangladesh;* ²*Bangladesh Fisheries Research Institute, Freshwater Station, Mymensingh-2202, Bangladesh;* ³*Bangladesh Fisheries Research Institute, Headquarter, Mymensingh-2201, Bangladesh*

Correspondence: Md. Yeamin Hossain (hossainyamin@gmail.com)

The *Perreysia currugata*, *Lamellidens marginalis* and *Anadara granosa* are commercially important mussels in the Indian Sub-continent. These mussels are used as food items by some ethnic groups in Bangladesh, Bhutan, India, Nepal and Sri-Lanka. Our study is aiming to estimate the stock status including the growth pattern, form factor (a_{30}), growth parameters (asymptotic length (L_{∞}), asymptotic weight (W_{∞}), growth co-efficient (k), age at zero length (t_0), growth performance index (ϕ), longevity (t_{max}), size at first sexual maturity (L_m), age at sexual maturity (t_m) and mortality (fishing mortality, F ; natural mortality, M ; total mortality, Z), exploitation rate (E), maximum sustainable yield (MSY) of *P. currugata*, *L. marginalis*, *A. granosa* in Bangladesh based on monthly sampling of 1850 individuals of each species from three different habitats (Padma, Barnoi and the Mangrove Rivers of Bangladesh) from July 2018 to June 2019. Shell length (SL) and whole body weight (BW) was measured by the digital slide calipers and electronic balance with 0.01cm and 0.01 g respectively. The smallest and largest specimens of the three species were 4.56-7.13, 4.51-14.3, 2.37- 6.80 cm. The growth pattern was negative allometric for Padma, Barnoi and Mangrove Rivers. The a_{30} was 0.0002 for PR, 0.0593 for BR and 0.1714 for the MR. The calculated L_{∞} , W_{∞} , L_m (cm), t_m (year), k (year⁻¹), and ϕ were as 7.65, 64.95, 4.59, 0.92, 0.55, 1.51 for *P. currugata*; 15.17, 191.8, 8.69, 0.85, 0.62, 2.15 for *L. marginalis* and 7.30, 129.02, 4.40, 0.92, 0.56, 1.47 for *A. granosa*. The estimated t_{max} (year), t_0 (year), M , F , and Z were 3.27, 0.062, 1.07, 1.12 and 2.19 for the population of Padma River; 3.03, 0.044, 1.10, 0.84, 1.94 for the population Barnoi River and 2.27, 0.062, 1.44, 2.24 for the population in mangrove Rivers. The exploitation rate (E) was 51%; 43% and 56% in the Padma, Barnoi and Mangrove Rivers, respectively. The results of this study would be very effective for proper management of Mussel stocks from three different habitats in Bangladesh.

Keywords: *Perreysia currugata*, *Lamellidens marginalis*, *Anadara granosa*, mussel stock, exploitation

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Does landmark-based truss morphometrics delineate intraspecific phenotypic variation of Annandale loach, *Lepidocephalichthys annandalei*, in three natural freshwaters?

Md. Sarower-E-Mahfuj, Shaid-ur-Rahman, Md. Abdus Samad

Department of Fisheries and Marine Bioscience, Jashore University of Science and Technology, Jashore-7408, Bangladesh

Correspondence: Md. Sarower-E-Mahfuj (sa.mahfuz@gmail.com)

The present study was undertaken with the objective to investigate the intraspecific variation of *Lepidocephalichthys annandalei* on the basis of morphometric characters using the truss network system that was constructed over the fish body. Fish samples were collected from three natural freshwater sources of South-Western Bangladesh viz., the Nabaganga river (n = 58); the Bhairab river (n = 46); and the Dhakuria *beel* (n = 21). Data were analysed to principal component (PC) analysis, discriminant function (DF) analysis and univariate analysis of variance. The first principal component (PC 1) accounted for 27.68%, the second principal component (PC 2) accounted for 11.54%, the third principal component (PC 3) accounted for 6.85% and the fourth principal component (PC 4) accounted for 5.84% of the total variation. For morphometric measurements the first DF accounted for 71.1% and the second DF accounted for 28.9% among group variability, explaining 100% of the total among groups variability. Plotting DFs revealed that the stocks were not clearly separated from each other in the discriminant space with virtually overlapping in varying degrees. The information derived from dendrogram based on morphometric and truss distances data, that the Nabaganga river, and the Bhairab river formed two separate clusters. On the other hand, Dhakuria *beel*, formed a sub-cluster. The aforementioned compilations of results are suggested that the presence of phenotypic variations

of *L. annandalei* among 3 freshwaters. The baseline information of the study will be helped in their biological status, further conservation as well as protect them from extinction.

Keywords: Annandale loach, morphometrics, intraspecific, truss networks

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Differentiation of intraspecific phenotypes in congaturi halfbeak, *Hyporhamphus limbatus*: evidence from landmark-based truss network analyses

Md. Sarower-E-Mahfuj¹, Sharmin Sultana Jinia¹, Md. Abdus Samad¹, Kamrunnaher Azad²

¹ Department of Fisheries and Marine Bioscience, Jashore University of Science and Technology, Jashore-7408, Bangladesh; ² Department of Aquaculture, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Correspondence: Md. Sarower-E-Mahfuj (sa.mahfuz@gmail.com)

In the present study the interspecific disparity of congaturi halfbeak, *Hyporhamphus limbatus* was examined on the basis of morphometric and meristic characteristics used by landmark-based truss network system that was developed from the external phenotype of fish body. Total 174 fish samples were collected from Bhairab River (n=38), Kopotakkho River (n=40) and Baluhar *Baor* (n=96). Meristic counts were compared among three population and no significant differences were observed in non-parametric Kruskal-Wallis test. Univariate statistics (ANOVA) showed that 2 [standard length (SL) and Eye length (EL)] of seven morphometric characters and 7 (3-4, 5-6, 6-7, 7-3, 3-6, 4-6 and 2-6) of the 16 truss measurements significantly differed to varying degrees ($p < 0.05$, $p < 0.01$, $p < 0.001$) among samples. Data were subjected to principal component analysis (PCA) and discriminant function analysis (DFA). The first principal component analysis (PC I) examined 24.81% of the total variation while second (PC II) and third (PC III) showed accordingly 14.38% and 8.89%. Using these variables 85.6% of original grouped cases correctly classified into their correct samples and 77.6% of cross-validated grouped cases correctly classified. A dendrogram based on the morphometric and landmark distances was shown for the three stocks where two clusters were formed in which Kopotakkho River and Baluhar *Baor* formed one cluster and Bhairab River formed a separate sub-cluster. The information derived from the present study may be helpful to learn their biology, management and conservation of *H. limbatus* population in these three aforementioned ecological areas.

Keywords: phenotypes, congaturi halfbeak, morphometric, meristic, truss network

FSB2019-Pst-58

Diatom assemblages and ecosystem shift; A 50-year record engraved in a Seaport sediment core of Osaka Bay, Japan

Md. Jahangir Sarker¹, Tamiji Yamamoto²

¹ Department of Fisheries and Marine Science, Noakhali Science and Technology University, Noakhali, Bangladesh; ² Graduate School of Biosphere Science, Hiroshima University

Correspondence: Md. Jahangir Sarker (mjsarker@nstu.edu.bd)

Sediment samples (Core-1; core-2 each were 60 cm deep) were collected from 10 m depths from Amagasaki Seaport, Osaka, Japan using a single core sampler (acrylic tube 5.0 cm in diameter, 100 cm long) on November 14, 2006 to assess long term ecosystem changes with human perturbation. The sediment core samples were sliced in every 2 cm, and diatom assemblage,

sediment aging (^{210}Pb and ^{137}Cs radio isotope) and long term changes in carbon and nitrogen (^{13}C and nitrogen ^{15}N stable isotopic signatures) were performed according to Yasuhara and Yamazaki (2005). Abundance and diversity of diatom assemblages have been decreased sharply from ca. 1960 to 1990. Among 69 species identified, 14 were fresh water species with high abundance during about 1957 to 1976, suggesting terrestrial influences was quite high to the Amagasaki ecosystem. Stable isotope signatures of the sediment $\delta^{13}\text{C}$ (-22.95- -22.35‰ < -22.18- -21.61‰) from 1957 to 1990 in our study were little higher than in the ranges of terrestrial origin (-30.0- -23.0‰) and a little lower than the ranges of marine derived matters (-18- -24‰). However, the values of measured sediment $\delta^{13}\text{C}$ content being increased gradually from 1957 likely signaling a shift from fresh water influenced ecosystems state to marine derived organic matter with the highest values in 2006 ($\delta^{13}\text{C}$ -21.5- -20.5 ‰). Since by the last 50 years, about 40% of diatom species was disappeared, which may be due to human impact (excess amount of nutrients; N, P).

Keywords: diatom assemblage, ^{13}C , ^{15}N isotope signature, sediment dating, ecosystem shift

FSB2019-Pst-77

Estimation of sexual maturity, spawning and peak spawning season of Asian stinging catfish, *Heteropneustes fossilis* (Bloch, 1794) in wetland ecosystem (Gajner Beel/NW) Bangladesh through multimodel inferences

Md. Rabiul Hasan, Md. Yeamin Hossain, Saleha Jasmine, Zannatul Mawa, Md. Akhtarul Islam, Asma Afroz Chowdhury, Md. Ashekur Rahman, Sumaya Tanjin and Farzana Akter Rima
Department of Fisheries, Faculty of Agriculture, University of Rajshahi, Rajshahi 6205, Bangladesh

Correspondence: Md. Yeamin Hossain (hossainyamin@gmail.com)

The stinging catfish, *Heteropneustes fossilis* (Bloch, 1974) is a commercially important indigenous fish species in the Gajner Beel Wetland Ecosystem, northwestern (NW) Bangladesh. Our study highlighting on reproduction of *H. fossilis* containing size at sexual maturity, spawning and peak spawning season based on systematic monthly sampling of 427 female individuals via cast net, gill net and conical trap in the Gajner Beel through January to December 2018. Also, we study on environmental parameters (hydrological) and the special effects of climate variation comprising temperature and rainfall on reproduction of *H. fossilis* in the Gajner Beel. For each individual, total length (TL) was taken using a digital slide calipers and body weight (BW) was measured by digital balance to the nearest 0.01 cm and 0.01 g accuracy. TL was varied from 6.30 – 24.10 cm and BW was ranged from 1.20 - 83.94 g. Gonads (ovaries) were occupied prudently by ventral dissection from female specimens and weighed to the closest 0.01 g precision. To assess the size at sexual maturity and spawning season the gonadosomatic index (GSI (%)) = $(\text{GW}/\text{BW}) \times 100$, modified gonadosomatic index (MGSI (%)) = $(\text{GW}/\text{BW}) \times 100$, and Dobriyal index ($\text{DI} = \sqrt[3]{\text{GW}}$) were estimated. Focused on GSI, MGSI; TL was calculated as 12.9 cm and DI also was 12.9 cm for female. The TL_{50} means the TL where 50% of individuals attain maturity, was predicted by logistic equation as 14.2 cm. According to the higher values of GSI, MGSI, and DI, spawning season was April to August, and peak spawning season was in May for *H. fossilis*. Hydrological parameters (temperature, rainfall, DO, and total alkalinity) were highly correlated with GSI. Additionally, water temperature during the spawning period ranged from 28 to 34 °C, with an average of 30.8 °C and average rainfall was 238.14 mm. Finally, the findings of the current study would be very effective to undertake specific management for *H. fossilis* in the wetland and adjoining ecosystems.

Keywords: *Heteropneustes fossilis*, spawning season, sexual maturity, catfish

FSB2019-Pst-78

Occurrence, abundance and seasonal dynamics of benthic invertebrates in a fish pond

Md Abdullah An Nur¹, Md. Mahfuzul Haque¹, Md. Ahsan Bin Habib², Saleha Khan¹

¹Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh; ²Department of Aquaculture, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Correspondence: Saleha Khan (khansaleha64@gmail.com)

The benthic invertebrates are important in an aquatic ecosystem and they are used as food of some fishes and other aquatic organisms. The occurrence, abundance and seasonal dynamics of benthic invertebrates in a fish pond and their relation with some soil and water quality parameters were studied for a period of one year from October 2018 to September 2019. Samples were collected at fortnightly interval from three stations of different depth of the pond. A total twenty two genera under four different groups of benthic invertebrates were identified. The mean abundance of each benthos group during the study period was in the following order: Oligochaeta (12 genera)>Chironomidae (5 genera)> Mollusca (3 genera)>Ceratopogonidae (2 genera). Among the genera, *Culicoides*, *Tubifex* and *Pelopia* were most abundant and they occurred in all months. Chemical properties of bottom soil had significant combined effect on the abundance and growth of *Chironomus*, *Pelopia*, *Branchiura*, *Aeolosoma*. The organic matter of the bottom soil of the pond influenced the production of benthic invertebrates. The abundance of benthic invertebrates per unit area of the bottom indicates that the pond is productive. The taxonomy of the benthic invertebrates as well as their abundance is important to know the environmental status of a water body and for successful aquaculture.

Keywords: benthos, oligochaeta, Chironomidae, mollusca

FSB2019-Pst-79

Reproductive biology of *Anabas testudineus* (Bloch, 1792) in wetland Ecosystem (Gajner Beel, NW Bangladesh) in relation to climate change in Bangladesh

Zannatul Mawa, Md. Yeamin Hossain, Md Rabiul Hasan, Md Akhtarul Islam, Asma Afroz Chowdhury, Md Ashekur Rahman and Sumaya Tanjin
Department of Fisheries, Faculty of Agriculture, University of Rajshahi, Rajshahi-6205, Bangladesh

Correspondence: Md. Yeamin Hossain (hossainyamin@gmail.com)

The freshwater climbing perch, *Anabas testudineus* (Bloch, 1792), is an economically important, and nutritionally valuable food fish in south Asia. Our study highlighting on reproduction of *A. testudineus* containing size at sexual maturity, spawning and peak spawning season based on monthly sampling of 371 female individuals via cast net, gill net, seine net and square lift net in the Gajner Beel through January to December 2018. Also, we study on environmental parameters (hydrological) and the special effects of climate variation comprising temperature and rainfall on reproduction of *A. testudineus* in the Gajner Beel. Lengths (TL, SL) and body weight (BW) of each individual were taken by measuring broad and digital balance, respectively. Gonads (ovaries) were dissecting from female specimens and weighed to the closest 0.01 g accuracy. To consider the size at sexual maturity and spawning season the gonadosomatic index (GSI (%)), modified gonado somatic index MGSI (%), and Dobriyal index DI were estimated. Based on GSI, MGSI, DI; TL was calculated as 10.4 cm for female. The TL₅₀ means the TL where 50% of individuals achieve maturity, was predicted by logistic equation as 9.42 cm. Also, focus on higher

values of GSI, MGSI, and DI, spawning season was extended from March to August, through the peak in May-July, for *A. testudineus*. Among five important hydrological parameters, temperature, DO, pH and total alkalinity were highly correlated with GSI, while the TDS did not show any correlation with GSI. Additionally, water temperature during the spawning period ranged from 28 to 34 °C, with an average of 30.5 °C and there was significant relationship between temperature and GSI. And also rainfall during spawning season is 31 mm to 389 mm, with average 204.85 mm which showed notable relation with GSI. Finally, the significances of present study would be effective to undertake specific management for *A testudineus* in the Gajner *Beeland* surrounding ecosystem.

Keywords: GSI, *Anabas testudineus*, wetland ecosystem, climate change

FSB2019-Pst-81

Reproductive biology of walking snakehead *Channa orientalis* (Bloch & Schneider, 1801) in the wetland ecosystem (Gajner *beel*) from Northwestern Bangladesh: Recommendation for sustainable management considering emerging climate change

Md. Yeamin Hossain¹, Asma Afroz Chowdhury¹, Md. Ashekur Rahman¹, Sumaya Tanjin¹, Farzana Akter Rima¹, Md. Rabiul Hasan¹, Zannatul Mawa¹, Zoarder Faruque Ahmed²
¹Department of Fisheries, Faculty of Agriculture, University of Rajshahi, Rajshahi-6205, Bangladesh; ²Department of Fisheries Management, Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh
Correspondence: Md. Yeamin Hossain (hossainyeamin@gmail.com)

The walking snakehead *Channa orientalis* (Bloch & Schneider, 1801) is an important small indigenous food fish in Asian countries which has high nutritional and commercial value under the family Channidae of Perciformes order. This study is conducted on reproductive biology containing size at sexual maturity (L_m) and spawning season of *C. orientalis* in the Gajner *beel*, northwestern Bangladesh through monthly Gonadosomatic index (GSI), Magnified gonadosomatic index (MGSI) and Dobryial index (DI). Monthly sampling was done during January to December, 2018 using different traditional fishing gears including *flash jal* (Gill net), *thela jal* (Push net). Different lengths (i.e., total length, TL; standard length, SL) and body weight (BW) of each individual were taken by using digital slide calipers and an electronic balance to the nearest 0.01 cm and 0.01 g accuracy, respectively. Also gonad was collected after dissecting from each female fish and weighed by electronic balance to the nearest 0.01g accuracy. Size at sexual maturity, spawning- and peak- spawning season were estimated by length based GSI, MGSI, DI. In total, 282 female individuals ranging from 8.1-17.7 cm TL and 5.72-72.51 g BW were collected in this study. Based on L_{max} the L_m was calculated as 10.11 cm TL (95% CL = 7.24 to 14.11). Additionally, based GSI, MGSI and DI, the L_{50} is 12.4 cm. On the basis of GSI index and MGSI index spawning season is from April to June and peak spawning season in April and June. There is a significant relationship between GSI vs. Temperature, DO, TDS but no significant relationship between GSI vs. Rainfall, p^H , Alkalinity. Finally, the findings of this study would be very helpful for conservation of *C. orientalis* in Gajner *beel* and adjoining ecosystem.

Keywords: reproductive biology, *Channa orientalis*, sustainable management

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Co-management of open waterbodies for increasing fish production: A study in Chalan Beel Areas of Bangladesh

Macksood Alam Khan, Md. Khalid Aurangozeb
Rural Development Academy (RDA), Bogura, Bangladesh
Correspondence: porag_rda@yahoo.com

The objectives of this study were to explore the formation and nature of CBO involved in management of fish sanctuary; assess the responsibilities and decision making process of CBOs in management of fish sanctuary; know the level of co-operation between the stakeholders of community based organization; document the process and problems of fish sanctuary management by CBOs; know the pattern of fish biodiversity conservation by the community based organization. Data were collected from Kurulia beel, Ruhul beel, Isamoti-Kup Nodi and Dikshi beel under Chatmohor and Vangura Upazila of Panba district for this study where large numbers of sanctuaries are run under active community based organization (CBO). Both qualitative and quantitative data were collected to address the research objectives. Qualitative data were collected through focus groups, unstructured interviews, use of PRA tools and personal observations; and the quantitative data were collected through a structured questionnaire. Fish production from the year 2013 to 2015 was observed also through recall method. A total of 120 respondents (30 respondents /sanctuary) were selected by purposive sampling for data collection of the study during January 2016 to July 2016. Government has established sanctuary at the deepest part of these waterbodies and formed a new CBO in each area as the prescription of Department of Fisheries for the co-management of the sanctuary based waterbody. Co-management was exist for several years and then was handed over the sanctuary based waterbody to the CBO by lease agreement (co-management period and leasing period varied from project to project). Results showed that sanctuary establishment has a substantial impact on fish production and biodiversity conservation. Fish production both in quality and quantity was found increased significantly after the establishment of sanctuary. Therefore, the income, fish consumption, sell etc of the fishers have also increased. Socioeconomic conditions of the fishers have been improved in the studied areas. In case of Ruhul and Kurulia beel, leaders of the CBO's were elected through a democratic process, but leaders were selected through a non-democratic process in case of two other waterbodies. For this reason, active members were seen increasing in case of, but members were decreasing in case of two other beels. In Ruhul and Kurulia beel the decision making process was found through democratic discussion, whereas nondemocratic were found in case of two other beels. In Dikshi beel, only the six executive members were found active and active 20-40 members were found in three other beels. Democratic decision making process of the CBO's might be the main reason behind active membership and such average production of fish from the waterbodies. All the four CBO took various steps for increasing the fish production. Another main factor might be the time of left leasing period. The CBO of Dikshi beel knows that the leasing period will be terminated this year, so they started over exploitation rather than conservation. Other major problems of these sanctuary based waterbodies management were - inadequate monitoring by Department of fisheries, lack of financial support by the government, lack of fish sanctuary equipments in the waterbody, no re-excavation and renovation of sanctuaries etc. Fishers of the waterbodies are dissatisfied with several issues with the independent management of these sanctuary based waterbodies by the local CBO. The most common dissatisfaction is about the 'distribution of benefit'. Finally, the study identified several factors that influence the management success of fish sanctuary by the CBO like, i) Government project and incentives, ii) Selection of leader for CBO management by democratic system, iii) Transparent management, regular meeting, democratic practice in meeting, iv) Good relationship among members of the managing CBO, v) Area of sanctuary and the water body, vi) Monitoring

by the Department of Fisheries. Sanctuary is now a proven model for biodiversity conservation and increased fish production. Lesson learnt from the study is that if the community people participation in a democratic way in the CBO and monitoring of lead agency that are the key factors for the management of common properties like sanctuary based water body in Bangladesh.

Keywords: co-management, Chalan beel, fish production

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Life-history traits of three Ambassid fishes (*Chanda nama*, *Parambassis lala* and *Parambassis ranga*) from Bangladesh

Farzana Akter Rima, Sumaya Tanjin, Md. Ashekur Rahman Md. Akhtarul Islam, Md. Ataur Rahman, Md. Rabiul Hassan, Asma Afrose Chowdhury, Zannatul Mawa, Md. Yeamin Hossain
Department of Fisheries, University of Rajshahi, Rajshahi-6205, Bangladesh
Correspondence: Farzana Akter Rima(farzanarima19@gmail.com)

This study describes the life-history traits including meristic counts, population structure (LFD), growth pattern (LWR), condition factor, form-factor ($a_{3,0}$), size at first sexual maturity (L_m) and natural mortality (M_w) of three Ambassid (*Chanda nama*, *Parambassis lala* and *Parambassis ranga*) fishes from the Mathabhanga River, southwestern Bangladesh. Total 370 individuals were occasionally collected using cast net, gill net, square lift net, conical- and box- trap from July 2017 to June 2018. Total length (TL) was ranged from 2.4 to 7.5 cm, 1.9 to 3.8 cm and 1.8 to 6.5 cm for three species. The fin formula is: dorsal, D. 21–22 (VIII/13–14); pectoral, P₁. 8–10 (2/6–8); pelvic, P₂. 6 (I/5); anal, A. 17–18 (III/14–15); and caudal, C. 20–22 (4/16–18) for *C. nama*; D. 20–21 (VIII/12–13); P₁. 8–9 (1-2/7); P₂. 6 (I/5); A. 16–18 (III/13–15); C. 18–20 (4-6/14) for *P. lala* and D. 20–21 (VIII/12–13); P₁. 9–10 (2/7–8); P₂. 6 (I/5); A. 18–20 (III/15–17); C. 22–24 (4-6/18) for *P. ranga*. The LFDs showed that, 4.0 -5.0 cm TL size group for *C. nama* and 3.0-4.0 cm TL size group for *P. lala* and *P. ranga* were numerically dominant. The LWRs indicated isometric growth for *C. nama*, and positive allometric growth for *P. lala* and *P. ranga*. Body weight (BW) vs. Fulton's-condition (K_F) was extremely correlated ($P < 0.001$), it might be considered that the K_F is the best for wellbeing of these species. The $a_{3,0}$ was 0.0082, 0.0138 and 0.0104 for above three species, respectively. Also L_m was 4.4 cm TL, 2.5 cm TL and 4.0 cm TL for these species, respectively. Furthermore, M_w was 2.2, 3.3 and 2.7 year⁻¹ for three species respectively. These findings would be very effective for identification, sustainable management and conservation of these species level in the Mathabhanga River or any other waterbodies in Bangladesh and adjacent countries.

Keywords: Ambassid, meristic counts, condition factor, mortality, Mathabhanga River

Poster Abstracts

Theme: Post-Harvest Fisheries & Food Safety

FSB2019-Pst-02

Upstream migration of hilsa towards Hakaluki Haor: A case study

Iftekhar Ahmed Fagun, Sakib Tahmid Rishan, Natasa Tasnia

Faculty of Fisheries, Sylhet Agricultural University, Sylhet-3100, Bangladesh.

Correspondence: Iftekhar Ahmed Fagun (iftekharfagun@gmail.com)

Based on a fieldwork the study explored the underlying causes and pathways of Hilsa migration towards Hakaluki Haor and status of Hilsa fishing. To collect empirical data a number of qualitative tools such as interviews, focus group discussion and oral history from different stakeholders were employed. The study identified, though unusual fishermen have been netting Hilsa abundantly on early monsoon in Hakaluki haor since 2016. Due to flash flood in the Hakaluki Haor and storm water flows down to the Meghna River through Kushiya River, Hilsa swims against the tide and enters into Hakaluki Haor from upper Meghna river system. The major causes of migration towards Hakaluki Haor are found early flash flood, storm water flows and government's initiative of imposing ban on Hilsa fishing during spawning season in upper Meghna sanctuary. As impose of ban on fishing of Hilsa increased the total production, abundance of Hilsa in Hakaluki Haor act as an indicator of total inland Hilsa production in Bangladesh. The weight of Hilsa species caught from Hakaluki are varied from 200 gm to 900 gm and rarely found 1 kg. The length ranges varied between 10 cm to 30 cm. The average price was found 300-500 Tk/Kg. A well-structured marketing channel of Hilsa was also identified. Construction of buri keari dam in Fenchuganj, siltation in riverbeds, habitat modification and fragmentation, overfishing and increased fishing efforts, environmental pollution, navigability crisis, decreased water carrying capacity of Hakaluki, establishment of brick field and other illegal structures on haor are major threats found to hilsa population in Hakaluki Haor during different interviews and group discussions. The research analysis has identified some recommendations to ensure safe migration and conserve migratory Hilsa population in Hakaluki Haor.

Keywords: Hakaluki Haor, upstream migration, hilsa, *Tenualosa ilisha*

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Assessment of quality status of dried tengra (*Mystus vittatus*) in Sylhet Sadar of Bangladesh

Md. Mehedy Hasan¹, Md. Jakiul Islam¹, Md. Abu Sayeed¹, Mohammad Abu Jafor Bapary¹, Shakil Akhtar¹, Ariful Islam²

¹*Department of Fisheries Technology and Quality Control, Sylhet Agricultural University, Sylhet-3100, Bangladesh;* ²*Department of Fisheries, International Institute of Applied Science and Technology, Rangpur, Bangladesh.*

Correspondence: Md. Mehedy Hasan (mehedy.sau@gmail.com)

Dried fish- a very popular and demandable fish food item in Bangladesh which is thought to be the most low-cost dietary protein source playing a vital role in solving malnutrition problem throughout the country especially for the economically disadvantaged people. A pre-surveyed study revealed that there are frequent complaints of consumers on the quality of sun-dried fish available in the market, especially on the physical, visual and organoleptic qualities. Considering the above context, a study was carried out on organoleptic, nutritional and microbiological quality of dried Tengra, one of the most consumed and available dried fish items in North-Eastern part (Sylhet) of Bangladesh. The samples were collected over a period of five months from November

2016 to March 2017 from local retail markets and drying yards. In addition, experimental sample was also prepared in laboratory condition maintaining maximum hygiene and sanitation to point out the quality differences among the samples. Organoleptic analysis revealed that experimental samples demonstrated highest characteristics score than those of others. Mean lipid, protein, crude fiber and nitrogen-free-extract (NFE) showed higher values in the experimental sample except moisture and ash content (Table1). The mean total plate count (TPC) of dried Tengra from experiment, drying yard and market samples were 4.51 ± 0.11 , 5.33 ± 0.25 and 6.39 ± 0.18 log cfu g⁻¹, respectively. The analyses of pathogenic *E. coli* and *Salmonella sp* in fifteen samples from each source showed the presence of *E. coli* in all the samples collected from retail market and drying yards while the percentage of *Salmonella* in the retail market and drying yards were 60% and 40%, respectively. On the contrary, the experimentally produced samples were found free from both the investigated pathogenic microbes. The findings of the present study indicate the poor organoleptic, nutritional and microbiological quality in commercially produced dried Tengra in compare to the experimental samples. It can be concluded that commercially produced dried fish needs better hygiene and good manufacturing practices to ensure the safety and healthy aspects of consumers.

Keywords: dried fish, nutritional quality, microbiological quality, pathogenic microbes

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Study on shelf life of solar tunnel dried product prepared from Nile tilapia (*Oreochromis niloticus*) under different storage conditions

Tanushree Gain, Md. Nurul Haider, Md. Kamal, Md. Shaheed Reza

Department of Fisheries Technology, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Correspondence: Md. Shaheed Reza (msreza@bau.edu.bd; rezams@gmail.com)

In an effort to develop a new value-added product with extended shelf life from Nile tilapia (*Oreochromis niloticus*), dried product was processed by three (3) different treatments viz., control (T1), 10% salt treatment (T2), 10% salt with 0.02% butylated hydroxytoluene (T3) in a Hohenheim-type solar tunnel dryer. Investigation of their shelf life under different packaging conditions was also done. It was revealed that the moisture content of dried tilapia in T1, T2 and T3 treatments declined rapidly during the 5th, 3rd and 2nd day of drying respectively but moderately declined in 1st to 4th day of T1 that reached a value of 12.40 ± 0.20 , 21.30 ± 2.41 and $16.80 \pm 2.16\%$ in the end products of T1, T2 and T3 respectively. Protein content were more or less similar in all three treatments with a highest ($40.24 \pm 0.87\%$) in T3 on wet weight basis. Overall organoleptic quality of the dried fish products in all packaging conditions were excellent to good except in T2 and T3 packed in gunny bag while dehydration ability was found to be significantly higher for T1 compared to the other two treatments at 40°C. Chemical analyses were also conducted to investigate shelf life of solar tunnel dried products packed in gunny bag, polyethylene bag and vacuum pack for up to 150 days. The values of total volatile base nitrogen (TVB-N), trimethylamine nitrogen (TMA-N) and peroxide value (PV) were determined where results for T1, T2 and T3 treated dried products stored in gunny bag, polyethylene bag and vacuum packet were within acceptable limit which coincided well with the findings obtained in the organoleptic study. It was concluded that packaging system using vacuum pack significantly extended the shelf life of the product up to 150 days compared to 120 days for polyethylene bag and gunny bag at ambient condition.

Keywords: shelf life, vacuum pack, dehydration

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Consumer preference and economic study of solar tunnel dried Nile tilapia (*Oreochromis niloticus*)

Md. Abdul Monnaf, Md. Kamal, Md. Shaheed Reza

Department of Fisheries Technology, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Correspondence: Md. Shaheed Reza (msreza@bau.edu.bd; rezams@gmail.com)

Nile tilapia (*Oreochromis niloticus*) is an important aquaculture species in Bangladesh and is regarded a popular species. In addition to the conventional wet fish market, efforts were made to prepare quality dried Nile tilapia in a Hohenheim-type solar tunnel dryer. Cost-benefit and consumer preference towards the product were assessed. It was observed that drying completed in 5 days where moisture was reduced from an initial value of $71.53 \pm 0.95\%$ to a final value of $16.00 \pm 0.11\%$. Protein, lipid and ash content was 40.24 ± 2 , 13.7 ± 1.13 and $12.5 \pm 0.5\%$ respectively. Investigation on the cost-benefit of dried Nile tilapia revealed that net profit for per kg dried fish was 36.65 BDT while the return on investment was 1.21. Studies conducted to examine consumer preference on dried Nile tilapia revealed that 60% respondents liked the color very much while, 26% and 14% respondents 'liked it extremely' and 'moderately' respectively. More or less similar likeliness was observed for flavor, chewiness and taste of the product. These results suggest that dried Nile tilapia would be good product with moderate to good market demand. In case of market price of the product, respondent's data showed that 44% respondents were willing to pay 400 - 450 BDT for 1 kg dried Nile tilapia, while 32% and 4% respondents were willing to pay 450 - 500 and 550 - 600 BDT for 1 kg fish respectively. For increasing the consumption of dried tilapia, 60% respondents suggested on publicity while others emphasized on quality and sanitary level of the product to enhance demand for the product in the market.

Keywords: consumer preference, cost-benefit, solar tunnel, dried Nile tilapia

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Status of farming and marketing of live pangas (*Pangasiushypophthalmus*) from Trishal upazila to different areas of Bangladesh

Md. Ismail Hossain, Fatema Hoque Shikha, Faroque Ahmmed

Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh, Bangladesh

Correspondence: Fatema Hoque Shikha (shikhafh@bau.edu.bd)

The research was conducted to collect information on the status of farming and marketing of live pangas (*Pangasius hypophthalmus*) from Trishal region to different areas of Bangladesh by interviewing stakeholder and secondary sources. The survey was carried out for seven months from May to November, 2016. Pangas farmers, arotdar, commission agents, wholesaler and retailers were interviewed in accordance with participatory rural methods. The results showed that the best harvesting season were found to be June to July and November to January. It was also found that 90% farmers harvested their fish completely and only 10% of farmers harvested partially, The survey result also indicated that fish marketing history in Trishal upazila under Mymensingh district was contradictory. It was found that marketing first started at Karwan bazar of Dhaka before 1999-2000. The transportation system involved a number of intermediaries. The daily supply of pangas from five farms of Trishal upazila was estimated to be 1.38 tons by truck to different areas. Virtually most of the fish (95%) was transported live from Trishalupazila to different areas, where as 5% fish was locally supplied from different farms. In addition to pangas, there are some fish species available in different markets, such as Indian major carps and tilapia. Among these species pangas was the dominating species throughout the markets. The price of

pangas depends on market structure, quality, size, distance, weight, seasonal variation and regional perception. The prices of pangas were found to be highest of 130tk/kg and the lowest of 85tk/kg but sometimes 60 to 70tk/kg when the fish are dead in different districts. On the other hand significant quantity loss was observed in fish 8%, 10%, 15%, 18%, and 19% after reaching to Savar, Manikgonj, Maowa, Sylhet, and Barisal from Trishal. Therefore, it was strongly recommended that proper handling of live fish must be ensured during transportation to attain quality pangas at consumer level.

Keywords: live pangas, status, farming, marketing, Trishal

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Heavy metal dynamics in commercially important marine fishes from the Bay of Bengal coast of Bangladesh

Md. Sirajul Islam, Md. Humayun Kabir

Department of Environmental Science and Resource Management, Mawlana Bhashani Science and Technology University, Tangail-1902, Bangladesh

Correspondence: Md. Sirajul Islam (islamstazu@yahoo.com)

The study was conducted to investigate the heavy metal contamination in common marine fishes from the Cox's Bazar, Pathorghata (Barguna) and Chattogram coastal region of Bangladesh. The fishes sample were collected from fish landing station during the pre-monsoon, monsoon and post-monsoon seasons from December 2017 to November 2018. The fish samples were. The collected fish samples such as Churi (*Trichiurushaumela*), Surma (*Euthynnusaffinis*), Loittyia (*Harpodonnehereus*), Poa (*Otolithoidespama*) and Ilish (*Tenualosailisha*) were processed, preserved and analyzed for heavy metals concentration such as Cu, Zn, Cr, Pb, Cd and Hg in the laboratory using AOAC 19TH Edition (2012) By ICP-OES method. In the Cox's Bazar, Zn was detected in pre-monsoon, monsoon and post-monsoon season, while Cu was detected only post-monsoon season and other heavy metals (Cr, Pb, Cd, Hg) were not detected in all season. The result showed Zn was ranged from 4.02 to 6.23, 4.02 to 12.46, 2.64 to 4.50 and 4.73 to 11.10 mg/kg respectively and Copper (Cu) showed 0.66, 1.36, 4.01 and 1.38 mg/kg respectively during study period which were within the acceptable range. In the Pathorghata, Cd, Pb and Hg were not found in any species of fish samples, on the other hand, concentration of Zn (6.24, 6.48 and 6.61 mg/kg) and Cr (0.56, 0.77 and 0.48 mg/kg) were higher in Loittyia, Poa and Ilish during post monsoon, monsoon and pre monsoon season, respectively, whereas, Cu (1.20, 1.27 and 1.22 mg/kg) was higher in the Loittyia and Ilish during post monsoon, monsoon and pre monsoon season, respectively. In case of Chattogram, the concentration range of Zn was 4.94-6.94 in mg/kg in Ilish, 2.81-3.21 mg/kg in Loittyia and 5.42-6.10 mg/kg in Churi, respectively, whereas rest of the metals were not detected. The fish species showed a great capacity to accumulate metals, with highest bioaccumulation for the essential element Zn. From this study, concentration of Zn and Cu were well below thresholds of concern, whereas for Cr it was slightly above the acceptable limits for human consumption. These marine fishes are not mostly hazardous for human health but have a little health risk. In view of these findings strict method of waste disposal control should be adopted to ensure the safety of the environment and safeguard our marine life.

Keywords: heavy metals, marine fish, bioaccumulation, Bengal coast, food safety

Poster Abstracts

Theme: Water Quality & Aquatic Pollution

FSB2019-Pst-46

Assessment of heavy metals in sediment, water, feed and fish at post-larval stage of tilapia in Trishal, Mymensingh

Md. Sazzad Hossain, Md. Hamidur Rahman, Md. Fazle Rohani

Department of Aquaculture, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh;

Correspondence: Md. Sazzad Hossain (sazzadbau@gmail.com)

The present study was conducted to determine different viz. heavy metals lead (Pb), Zinc (Zn), Arsenic (As), Chromium (Cr), and Cadmium (Cd) concentration in sediment, water, feed and fish at post larval stage of tilapia in trishal, Mymensingh. Sample preparation, grinding, acid mixing, electro-thermal heater digestion were carried out in the Fish Nutrition Laboratory of the Department of Aquaculture, faculty of Fisheries, Bangladesh Agricultural University, Mymensingh. Finally, heavy metals concentrations were determined by Graphite furnace Atomic Absorption Spectrometer (GFAAS) in the Interdisciplinary Institute for Food Security (IIFS) Laboratory, Bangladesh Agricultural University, Mymensingh. The average Zn, Cd, Cr Pb, and As concentration (ppm) in the examined soil were 6.5852, 0.1236, 0.4733, 0.6744 and 1.3464, respectively. The average Zn, Cd, Cr Pb, and As concentration (ppm) in the examined feed were 6.9683, 0.0001, 0.5338, 0.0 and 0.0 respectively. The average Zn concentration (ppm) in the fish was 7.8505 but others metals Cd, Cr, Pb, As were not found. The average Zn, Cd, Cr, Pb, and As concentration (ppm) in the experiment water were 0.0, 0.0, 0.0284, 0.0656 and 0.0, respectively. The study revealed that average Zn, Cd and Pb concentration in sediment sample were far below than the maximum allowed concentrations but Cr and As were above than the maximum allowable limit of World Health Organization (WHO) and Food and Agricultural Organization (FAO). Only Cr was above the recommendation limit but in fish and water samples were below the allowable limit. So the result showed that in post-larval stage fish was safe but soil and feed are contaminated by few metals. The result will help the tilapia farmers to know the main sources of heavy metals in fish. That result will help to produce safe tilapia production.

Keywords: heavy metals, tilapia, soil, water, feed.

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Microplastic pollution from coastal waters and beach sediments in Cox's Bazar, Bangladesh

Sumaya Mahjabin Moon¹, Kaniz Fatema¹, Md. Ashraful Islam Sarker¹, Turabur Rahman¹, Shanur Jahedul Hasan², Kizar Ahmed Sumon¹, Hisayuki Arakawa³, Ramji Kumar Bhandari⁴, Harunur Rashid¹

¹*Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh, Bangladesh;* ²*Marine Fisheries and Technology Station, Bangladesh Fisheries Research Institute, Cox's Bazar, Bangladesh;* ³*Department of Ocean Sciences, Tokyo University of Marine Science & Technology, Tokyo, Japan;* ⁴*Department of Biology, University of North Carolina Greensboro, Greensboro, NC, USA*

Correspondence: Harunur Rashid (rashid@bau.edu.bd)

There is no doubt that plastics have made our daily life easier but it has turned into a matter of concern that plastic materials are making environmental pollution. The abundance of

microplastics in surface water and beach sediment in northern coast of the Bay of Bengal near Cox's Bazar, Bangladesh were reported. Two beaches named Laboni Point beach and Crab beach for beach sand analysis and three sites of water for surface water analysis were selected. Two transects along the high tide line were selected per beach and five replicate samples of sand were collected from each transect. Plastic particles <5 mm size was considered as microplastics whether 5 to 25 mm as mesoplastics and >25 mm as macroplastics. In the present study, particle sizes varied between 0.7 mm–8.4 mm and 1.0 mm–10.0 cm in case of surface water and beach sediment, respectively. Highest number of microplastics was found in Moheshkhali estuary (23333/km²) and lowest near Sonadia Island (11667/km²). In case of Laboni Point beach microplastics were found 22.4/m² and 26.4/m² in dry and rainy season respectively. However, in case of Crab beach, more microplastics were found in dry season (51.2/m²) than rainy season (30.0/m²). According to the findings of this study, Crab beach faced more microplastics contamination than Laboni Point beach in both dry and rainy season. Basically, Crab beach is created through siltation by the 'River Reju'. High plastic pollution might have been due to transportation of plastic particles by the River in addition to those coming from the sea.

Keywords: plastic, microplastic, coastal pollution, marine environment, human health

FSB2019-Pst-51

Distribution of microplastic pollutants in lower stretches of the River Karnaphuli – a coastal tidal river in the south-east Bangladesh

Turabur Rahman¹, Kaniz Fatema¹, Kazi Shahrukh Elahi¹, Md. Ashraful Islam Sarker¹, Shanur Jahedul Hasan², Md. Helal Uddin¹, Md. Mahfuzul Haque¹, Hisayuki Arakawa³, Ramji Kumar Bhandari⁴, Harunur Rashid¹

¹Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh, Bangladesh; ²Marine Fisheries and Technology Station, Bangladesh Fisheries Research Institute, Cox's Bazar, Bangladesh; ³Department of Ocean Sciences, Tokyo University of Marine Science & Technology, Tokyo, Japan; ⁴Department of Biology, University of North Carolina Greensboro, Greensboro, NC, USA

Correspondence: Harunur Rashid (rashid@bau.edu.bd)

River Karnaphuli, one of the country's lifelines, is being polluted rapidly due to unabated dumping of toxic chemicals and solid wastes into the water from the riverside industrial units in Chattogram. Plastic pollution has become a great concern in recent time and this study is conducted to ascertain the plastic pollution in the water and sediment of Karnaphuli River. A 300 µm mesh sized Manta net and Ekman dredge were used to collect the surface water and sediment samples respectively from the upper stretch of Halda-Karnaphuli river junction to Natun bridge (Karnaphuli bridge). Surface water and sediment samples were collected from five sites with three replications for each site. Collected samples were further processed to isolate macro- & microplastics and result showed about 98-99% of plastics were micro sized. Fragments and threads (filament) were the most abundant microplastics with the range of 140,000-238,334 particles/km² in the water samples along with films, foams and micro-beads. Sediment of Karnaphuli River contained threads, fragments, films and foams whether threads were the most abundant type. In addition, 75-225 microplastics/kg sediment sample were recorded. The result showed variation on distribution in the plastic particles number which was used to be higher in number in the downstream of River Karnaphuli rather than the upstream. These findings demonstrate high plastic pollution in the Karnaphuli River which resulting high life risks for aquatic fauna and human being and requires further attention.

Keywords: Karnaphuli River, microplastic, water, sediment.

FSB2019-Pst-52

Acute toxicity of frequently used organophosphate pesticides on freshwater zooplankton in Bangladesh

Sabikunnahar Kaspia¹, Solaiman Bin Habib¹, Md. Mohibul Hasan¹, Kizar Ahmed Sumon¹, Ramji Kumar Bhandari², Harunur Rashid¹

¹Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh; ²Department of Biology, University of North Carolina Greensboro, Greensboro, NC, USA

Correspondence: Harunur Rashid (rashid@bau.edu.bd)

Freshwater zooplankton are small planktonic crustacean used in ecotoxicological acute tests and chronic reproduction studies. Because they are very sensitive to toxicants and very low concentrations may affect their survival. The objective of this study was to investigate the acute toxicity of zooplankton (*Diatomus* and *Diaphanosoma* Sp.) exposed to different concentrations of agro-pesticides in Bangladesh. Four days of exposure was conducted with 30 *Diatomus* and *Diaphanosoma* species held individually in each treatment and control to know the effects of insecticide, fungicide and herbicide. To identify 96hr LC₅₀ value, Insecticide (Thiamethoxam), fungicide (Tricyclazole) and herbicide (Penexsulam) were exposed to 0, 6.25, 12.5, 25, 37.5, 50, 75 µg/L and 0, 1.88, 3.76, 5.64, 7.52, 9.4, 11.28 mg/L and 0, 1.56, 2.34, 3.12, 3.9, 4.68, 6.24 mg/L accordingly to the treatment. For *Diatomus* species, the lethal concentrations (LC₅₀) of insecticide (Thiamethoxam), fungicide (Tricyclazole) and herbicide (Penexsulam) were found 12.95µg/L, 4.27mg/L and 2.56mg/L respectively after probit analysis. On the other hand, for *Diaphanosoma* the values were 19.14 µg/L, 5.01 mg/L, 2.82 mg/L accordingly. During experiment, deformities were observed under light microscope after certain time interval (24, 48, 72 and 96 hour). In addition, water quality parameter (DO, P^H, Temperature and Alkalinity) were also tested before and after experiment. However, it is found that active ingredient of insecticide thiamethoxam is more harmful for both zooplankton species compare to other fungicides (Tricyclazole) and herbicides (Penexsulam).

Keywords: zooplankton, acute toxicity, agro-pesticides

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Acute toxicity of thiamethoxam insecticides on banded gourami (*Trichogaster fasciata*)

Md. Mahmudul Hasan¹, Md. Mohibul Hasan¹, Shema Biswas¹, Kizar Ahmed Sumon¹, Ramji Kumar Bhandari², Harunur Rashid¹

¹Department of Fisheries Management, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh; ²Department of Biology, University of North Carolina Greensboro, Greensboro, NC, USA

Correspondence: Harunur Rashid (rashid@bau.edu.bd)

To meet the growing demand of food under the harsh conditions farmers are using a variety of Organophosphate pesticides. Residues of this pesticides applied on agricultural land may enter into the aquatic environment through drain, runoff and spray drift, which may lead to the contamination of this environment. Thiamethoxam (Trade name Virtako) is a neonicotinoid insecticide used widely in Bangladesh to control a broad spectrum of chewing and sucking insect pests on major agricultural crops. This widely used insecticide also causes toxic effects to non-target aquatic organisms, especially fishes. In this study experiments were made in the laboratory to determine median lethal concentration (LC₅₀) of thiamethoxam to Banded Gourami

(*Tricogaster fasciata*) and behavioral effects of this neonicotinoid insecticide on the fish. The 96 hour LC₅₀ value of thiamethoxam, determined from the mortality data using Probit analysis, was found as 161.065 ppm for the Banded Gourami. The fish exhibited respiratory distress such as gasping in air, loss of balance, discoloration of body and erratic swimming. The results indicate that thiamethoxam has effects on Banded Gourami. According to survey result, it was found that most frequently used insecticide is thiamethoxam (Trade name Virtako). For this reason, it should be used with caution during agricultural activity. In addition, chronic effects of this insecticide on fish reproduction and bioaccumulation are still under investigation.

Keywords: thiomethoxam, banded gourami, behaviour, LC₅₀

FSB2019-Pst-75

Concentration and bioaccumulation of heavy metal in the coastal region of Bangladesh

Nahida Islam¹, Shaida Akter¹, Dinesh Chandra Shaha²

¹Department of Fisheries Management, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur-1706, Bangladesh; ²Department of Fisheries Management, Bangabandhu Sheikh Mujibur Rahman Agricultural University Gazipur-1706, Bangladesh

Correspondence: Dinesh Chandra Shaha (shaha.dinesh@gmail.com)

Heavy metal contamination becomes a major problem in coastal area of Bangladesh. The most common heavy metals such as Pb, Cr, As, Cd and Hg are found in the coastal area. The average concentration of heavy metals in water and sediment of Pasur river following a increasing order of Cr> Pb>As > Cd. And the average concentration of heavy metals in water and sediment of the Karnaphuli river followed the increasing order of Cr> As>Pb>Cd and Cr>Pb> As>Cd respectively and higher concentration was observed in winter. There is absence of Hg and As in water in Rupsha river. Higher concentration of metals was observed in fish between water and fish due to bioaccumulation of metals. Some treatment scheme should be formulated and implemented by the researchers and related organization to overcome this problem.

Keywords: heavy metals, water, sediment, fish, bioaccumulation

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Growth pattern inference based on length-weight relationships of Bombay duck *Harpadon nehereus* in the Bay of Bengal

Md. Abdullah Al-Mamun¹, Rokeya Sultana²

¹Laboratory of Fish Population Dynamics, College of Marine Fisheries, Ocean University of China, Qingdao, Shandong, China; ²Department of Statistics, Chattogram Government College, Chattogram, Bangladesh

Correspondence: Md. Abdullah Al-Mamun (mamunbau09@yahoo.com)

The Bombay duck, *Harpadon nehereus* (Hamilton 1822) under the class Aulopiformes and family Synodontidae locally known as loitta, is one of the most commercially important fish species in the Bay of Bengal, Bangladesh. The study was undertaken to estimate the length-weight relationships, and to determine the growth pattern of the species. Length-weight data were directly taken during catch inspection of commercial fishing vessels at fish landing port in Chittagong from January to December 2018. Growth pattern was assigned basing on parameter 'b' in length-weight relationship equation $W=aL^b$. The parameters 'a' and 'b' of above equation varied

monthly, and they ranged from 0.0023 to 0.0132 and 2.65 to 3.29 respectively. The highest value of 'a' was obtained in September, and the lowest value was in March. The highest value of 'b' was obtained in March, and the lowest value was in December. The generalized length-weight relationship was fitted to the pooled data of all monthly samples, and the fitted equation was $BW=0.004TL^{3.02}$. The values of coefficient of determination (r^2) among all log-log linear regression analyses ranged from 0.749 to 0.954, the highest r^2 was estimated in July, and the lowest was in November. High values of coefficient of determination exhibited high degree of changes in logarithm weight due to changes of logarithm length. Growth pattern of both monthly samples and populations was investigated. Analysis revealed that growth patterns of all monthly samples were allometric. Isometric growth pattern were found for monthly populations in April, August and November, whereas, allometric growth patterns were apparent in other months. The growth pattern of pooled data of all monthly samples was positive allometric. The results of present study might be incorporated in sustainable management and conservation plan of *H. nehereus* population in the Bay of Bengal, Bangladesh.

Keywords: Bombay duck, *Harpadon nehereus*, growth pattern, length-weight relationships, Bay of Bengal

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