INTERNATIONAL SYMPOSIUM ON SUSTAINABLE FISHERIES: REVOLUTION IN BLUE ECONOMY (ISSF-2021)

ON THE OCCASION OF

WORLD FISHERIES DAY 2021

NOVEMBER 20-21,2021 /VIRTUAL PLATFORM

AMITY UNIVERSITY

BOOK OF ABSTRACTS

Editors

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AMITY INSTITUTE OF MARINE SCIENCE AND TECHNOLOGY

IN COLLABORATION WITH

AMITY INSTITUTE OF BIOTECHNOLOGY

AMITY UNIVERSITY UTTAR PRADESH, NOIDA

International Symposium on

Sustainable Fisheries: Revolution in Blue Economy (ISSF - 2021)

On the occasion of

World Fisheries Day 2021

Organized by

Amity Institute of Marine Science and Technology

In Collaboration with

Amity Institute of Biotechnology

November 20th -21st.2021/ Virtual Platform

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Book of Abstracts

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The information contained in this abstract book has been taken from various researchers. Respective affiliations are mentioned in the content.

Preface

Local and worldwide aquatic food systems rely heavily on fisheries. The enormous range of aquatic foods harvested from fisheries, from seaweeds and sea cucumbers to crustaceans and fish, contributes to robust, sustainable, and diverse diets, as well as income streams from the value chain's associated trade and processing operations. The industry employs 120 million people worldwide. Ninety-seven percent of them reside in developing nations and engage in small-scale fishing.

However, evaluating their contributions is challenging due to the diversified, dispersed, and generally informal nature of their labour. We must ensure that fishermen's voices are heard and appreciated.

The Amity Institute of Marine Science and Technology (AIMST) is located in Noida and is part of Amity University Uttar Pradesh. AIMST aids graduate and postgraduate students in building transdisciplinary and professional skills, as well as instilling ethical and moral principles in them, and in developing a core competency that allows individuals to flourish personally and professionally.

With over 100 publications, the Institute has a broad mandate of research, teaching, and extension in areas such as aquaculture nutrition, aquaculture toxicology, marine pharmacology, bioremediation, ornamental fish breeding and rearing, marine biotechnology, transgenic fish technology, and others.

In the midst of the COVID-19 pandemic AIMST hosted an international symposium on 'Sustainable Fisheries: Revolution in Blue Economy - 2021,' which facilitated brainstorming sessions for scientific debates and deals, as well as served as a catalyst for collaborative research and capacity building in the field of fisheries. The day establishes the trade's future objectives and milestones. It brings together not only the fishing department, but also a number of associated fisheries units under one roof.

Our keynote speakers talked during the first session held on 20th of November, followed by the participants' brief oral presentations. Various poster presentations were conducted during the second session on November 21st.

Dr. Ashutosh Srivastava
Chair-ISSF-2021
Head of the Institute- AIMST

Message

It gave me great pleasure to announce that the Amity Institute of Marine Science and Technology (AIMST), in collaboration with the Amity Institute of Biotechnology, hosted an online symposium on "Sustainable Fisheries: Revolution in Blue Economy" (ISSF-2021) at Amity University Uttar Pradesh, Noida, India on November 20th and 21st, 2021.

Along with the students, this symposium brought together scientists from all around the world who offered intriguing talks and posters.

Each participant and speaker, who participated in this conference, shared fascinating knowledge and ideas. The symposium was a huge success and we hope to organize more such events in the future.

Dr. Sofia Priyadarsani Das
Convener-ISSF-2021
Asst-Professor-II
AIMST

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Speakers

1) Dr. J. K. Jena : Chief Guest :
   Deputy Director General (Fisheries Science), Indian Council of Agricultural Research, Krishi Anusandhan Bhawan-II, Pusa, New Delhi-110 012, India

2) Dr. Subha Bhassu : Keynote Speaker :
   Professor- HOD, Institute of Biological Sciences, University of Malaya, Kuala Lumpur, Malaysia

3) Dr. Manoj Sharma : Keynote Speaker :
   Director, Mayank Aquaculture Private Limited

4) Dr. P. Mukhopadhyay : Keynote Speaker :
   National and State (WB) Awardee, Ex-Principal Scientist ICAR-CIFA,
   Former FAO Consultant (Aquaculture Nutrition) in Kenya and Uganda

5) Dr. P. Das : Invited Speaker :
   Principal Scientist, Fish Genetics and Biotechnology Division, ICAR-CIFA, Bhubaneswar.

6) Dr. M. Karthikeyan : Invited Speaker :
   Director, Marine Products Export Development Authority
   Kochi, India

7) Dr. N. Inayathullah Nayasudeen : Invited Speaker :
   Founder and Managing Director, Shrimp Care Solution, International Aquaculture Consultant at NFDB, Hyderabad

8) Dr. Koffi Charles Boussou : Invited Speaker :
   Lecturer, Ecology and Aquatic Ecosystem Management, Jean Lorougnon Guede University, Daloa, Cote d'lvoire

9) Dr. Afzal Khan : Invited Speaker :
   Professor of Zoology, Aligarh Muslim University (AMU), Aligarh

10) Mr. Debtanu Barman : Invited Speaker :
    Founder and CEO-Aqua doctor Solution, Kolkata, West Bengal

11) Dr. Mahua Saha : Keynote Speaker :
    Principal Scientist, CSIR - National Institute of Oceanography, Ministry of Science and Technology, Govt. of India

12) Dr. Senthil Kumar : Invited Speaker :
    Professor, University of Technology and Applied Science, Sur-Oman, Muscat

Content

Abstracts

ADVANCES IN AQUACULTURE TECHNOLOGIES & HOW FULL FILL HUMAN NEEDS

N. Inayathullah* (Invited Speaker)

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Application of scientific knowledge and technology always helped mankind to transform life at ease and paved way for a better future. Technologies applied in aquaculture are also not an exception to it. Rapid developments are implemented for the last few decades in aquaculture industry that satisfies the protein requirement of human across the globe; besides ensuring employment opportunities and foreign exchange for many underdeveloped and developing countries. Many old techniques are modified as well as several new methodologies such as Bio floc, Re-circulating Aquaculture Systems (RAS), Aquaponics etc. has been developed aimed at increasing the productivity and betterment of farmers' economy. Innovations related to reproduction, application of biotechnological and genetic tools for the production of hybrids so also genetically improved stocks, transgenic, mass scale production of quality fish seeds; application of probiotics etc. resulted in increased productivity and enhances the sustainability of the ecosystem. Recent innovations of advanced technologies in aquaculture are very much helpful in reducing the fishing pressure exerted on edible species from the wild thereby safeguarding the sustenance of aquatic biodiversity. These technologies paved way to greater contributions such as enhancement of growth rates to a marketable size, better feed conversion ratios, disease resistance, improvement of stress tolerance against extreme environmental conditions and improvement of sterility issues. Last but not the least, employment opportunities available in private and government bodies in India and overseas are also detailed.

Keywords: Technology, Aquaculture System, Economy, Innovation.

BIODIVERSITY CONSERVATION

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Overfishing has long been recognized as leading causes that have reduced aquatic biodiversity, along with other causes such as pollution, habitat destruction, fragmentation, non-native species invasions and climate change. The FAO Code of Conduct for Responsible Fisheries and the international instruments pertaining to fisheries and biodiversity conservation stress the need for developing selective and eco-friendly fishing gears in order to conserve resources, protect non-targeted resources and endangered species like sea turtles and minimize environmental impacts of fishing. Various types of bycatch reduction technologies have been developed in the fishing industry around the world, in order to minimize the impact of fishing on non-target resources. These devices have been developed taking into consideration upon variation in the size, and differential behaviour pattern of shrimp and other animals inside the net. Semi-pelagic trawl system has been developed as an alternative to shrimp trawling in the small-scale mechanized trawlers operating in the tropical waters. Sources of pollution from fishing operations which affect fisheries environment include emissions of greenhouse gases (GHGs) and plastic debris originating from abandoned and lost fishing gears. Enforcement of bycatch reduction technologies, promotion of low impact and fuel-efficient fishing systems and smart trawling techniques, along with regulation on total fishing effort at sustainable levels and maintenance of Marine Protected Areas will facilitate protection and restoration of biodiversity and enhance the resilience of the fish stocks to fishing pressure.

Keywords: Biodiversity Conservation Technology, Bycatch Reduction, Semi-Pelagic Trawl System, Smart Trawling, Climate Change

RECENT ADVANCEMENTS IN FISHERIES TITLE: 12s FISH METABARCODING FROM eDNA.

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Recent years have seen a lot of progress in the fisheries sector. I would like to draw your attention to the most advanced technology that can identify several different fish species. The technology has advanced so much that in contrast to the conventional method where a specialist is needed to identify a species, we can identify a fish's quality with even a small amount of DNA. Environmental DNA (eDNA) is defined here as the extra organismal genetic materials suspended in environmental samples, such as water and sediment. EDNA is shed from macro-organisms through faeces, body mucus, blood, and shed tissue or scales, and it is emerging as an alternative data source for biodiversity monitoring. The method uses a universal PCR primer pair MiFish to amplify a short fragment of fish DNA (approximately 170 bp from the mitochondrial 12S rRNA gene) simultaneously across a large variety of taxa. In combination with next-generation sequencing technologies, this method has been mostly used as a means of monitoring biodiversity using environmental DNA (eDNA) shed from fishes. Importance of deep-sea metabarcoding is that it is a vast part of ocean which is untouched and undisturbed and have very less information about the species present over there unlikely any other ecosystem it isn't easy to retrieve an sample because due to several factor such as depth, pressure, temperature, salinity as well as various other physical, biological, chemical and geological factor which are unknown to us, mainly as these areas fall under restricted area which is managed by international seabed authority which is followed by 167 countries. Understanding the advantages of 12s fish metabarcoding using the universal mifish primer.

Keywords: Mifish, eDNA, 12S Metabarcoding

THE BIO-XENOGRAFT-A TORTUOUS STUDY ON UNDERSTANDING THE MEDICAL IMPLICATIONS OF FISH SKIN

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The non-contagious nature of Tilapia skin with high quantities of type 1 collagen and being structurally analogous to human skin with a healthy microbiota has been suggested as a implicit xenograft for the treatment of burn injuries. Nile Tilapia fish skin (NTFS)has been suggested as an option of biological material for the management of burns. The colony forming units (CFU) found in samples of the Nile Tilapia fish skin before the process of chemical sterilization indicated the presence of non-infectious microbiota. Studies conducted on the course of action of Tilapia skin towards gunpowder burn injuries showed an impressive lineage towards a positive result. Tilapia skin when applied on the gunpowder injuries of 23-year-old case in Brazil showed a visible signs of recovery within the first 20 days with a complete reepithelialisation within 12 and 17 days of treatment independently with no side effects and do dressing change, Tilapia skin showed us the implicit towards an innovative approach in tissue xenografting, being highly available with over 6 million tonnes being artificially bread on an annual basis and increasing, and is easy to apply, with such an advancement in something so simple this can easily become the first nationally studied animal skin registered by the National Sanitary Surveillance Agency for use in treatment of burns. Additionally, fish skin grafts show promising results in treating diabetic foot ulcers (DFUs), venous leg ulcers (VLUs) and some evidence worthy of further exploration in treating a host of other acute and chronic wounds Tilapia skin can be the new revolution in the phenomenon knowns as The Blue Revolution.

Keywords: Burn injuries, Nile Tilapia, Treatment.

IMPLICATIONS OF EUPHOTIC DEPTH IN RELATION TO AVAILABILITY OF MARINE FISHERY RESOURCES FOR UPWELLING REGIONS OF COASTAL WATERS

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The optical assessment of euphotic zone for coastal and inland waterbodies has major implications in understanding the depth of distribution, abundance, and availability of marine fisheries resources in the upper surface of the mixed layer of water column. The photic depth is essentially characterised by the presence of sufficiently well-lit surface light penetration zone, wherein primary productivity and nutrient concentration attracts schools of fish stocks. The optical characterization for productive turbid inland and coastal waters based on ocean color scheme play a vital role in quantifying the long- term variability in phytoplankton and primary productivity. The presence of chlorophyll concentration in productive and nutrient rich waters can be accurately predicted by adopting blue-green band ratioing scheme which potentially represents the proxy of algal biomass. However, optical information pertaining to depth at which productivity occurs is essentially governed by euphotic depth that provides a meaningful information on growing trends of seaweeds and fishery yield. Thus, present study intends to reveal a biological link-pin between remotely sensed euphotic depth and coastal upwelling zone that remains poorly confounded in terms of identifying the depths of fishery yields on spatio-temporal scales. Seasonal variability in the thickness of euphotic layer are potential indicators of weak and strong upwelling zones which accrues sharp fluctuations in swarm of pelagic fishes and culture yield of marine species namely, sardines and anchovies that mainly relies on planktonic food chain. The estimation of euphotic depth would also assist in limnological studies that focuses on fishery management and understanding the seasonal trends in distribution depth of fishery resources.

Keywords: Euphotic Depth, Chlorophyll Concentration, Coastal Waters, Upwelling Zones, Fishery Management

CONSERVATION AND BIODIVERSITY OF FRESHWATER FISHES

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Massive diversity exists in our biosphere, not just at the species level, but at all levels of biological organization, from macromolecules within cells to biomes. We have accumulated this vast diversity in nature over millions of years of evolution, but if current rates of species loss continue, we could lose all of it in less than two centuries. As more people throughout the world recognize the fundamental significance of biodiversity for human survival and well-being on this planet, biodiversity and its conservation have become important environmental concerns of international concern.

Fishes are a huge and diverse group of Chordata, with over 33,500 species, which is more than all non-fish vertebrates combined. Freshwater fishes are found all over the world and number over 16,000 species. They are one of the most threatened vertebrate groups, particularly sensitive to human-caused changes like species introduction, overexploitation, fragmentation, deterioration of continental waterways, and climate change.

This highlights the urgent need to begin the study and implementation of alternative management strategies to protect these aquatic ecosystems. The development of freshwater aquatic sanctuary (FAS) inside the protected area network is one solution that can preserve freshwater ecosystems from a variety of challenges. Even though similar conservation strategies are well established in the terrestrial and marine ecosystems, progress on freshwater systems has been slow and insignificant.

Keywords**: Freshwater fishes, FAS (freshwater aquatic sanctuary), Conservation, Biodiversity**

AN OVERVIEW ON FISHERIES AS A SIGNIFICANT BRANCH OF AGRICULTURE

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Capture fisheries has been carried out from centuries, but the ratio now has increased. This is carried out in the sea, rivers and reservoirs etc. Capture fisheries exploit the aquatic organisms which also disturbs the food cycle. This overfishing destroys the fish stocks. In Capture fisheries both desirable and undesirable varieties are caught. Culture fisheries is commercial ways of farming fishes in confined areas where particular breeds of fishes are farmed to get maximum yield. Culture takes place in ponds, which are fertilised, and supplementary feeds are provided to the fish to get maximum yield. Culture fisheries is conducted in freshwater, brackish water and sea water. The new advancement and expansion in culture fisheries has encouraged farmers to farm wide varieties of aquatic organisms like prawn, crabs, and so on which has now been included under culture fisheries. Culture fisheries is also now called as aquaculture due to culture of variety of aquatic organisms. Fishes like salmon, Tunas, cod, Trout, Carp are some popular fishes taken for food and are harvested in bulk loads. They are great source of protein as well as they taste good. ICTs in fisheries are used to promote the agricultural production by providing scientific information to the farmers. It has its part from resource assessment, capture or culture to processing and commercialization. The advancement in biotechnology has allowed the scientists to identify and combine traits in fish and shellfish to increase productivity and improve quality. With the help of genetic study, scientists are investigating ways to increase production of natural fish growth factors. Biotechnologies and genomic tools are applied to use against aquatic pathogens to improve production. Now biotechnologies and concepts are taken in measure to improve ways in fisheries. New data processing technologies in fisheries include big data, block chain, smart weighing at sea, Radio-frequency identification (RFID), AI technological, smartphones for monitoring, drones, advancements in equipment can be seen now a days. The fishing industry should be properly inspected that the fishing practices are in consistent manner but not disproportionate. Fishes are integral part of sea and are related to other organisms. So, imbalance in the population in varieties of the sea can threat the sea ecosystem also affecting other aquatic lives so, the fisheries management should be accurate, and it should not include any other random undesirable varieties. In a way fisheries if done accurately with all data and acquistics , it also promotes conservation of other species and biodiversity in aquatic life as more population of a certain breed is also not good for the marine ecosystem.

Keywords: Fisheries, Conservation, AI Technology, Capture, Culture, Marine Ecosystem

BOND OF PLANKTONS WITH FISHERIES AND THEIR ROLE IN REVOLUTIONIZING BLUE ECONOMY

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Phytoplanktons and Zooplanktons are the Primary producers and consumers in the aquatic food web. They are an important food source for the fishes throughout the oceanic ecosystem. To estimate the major component of fish diets, various fishes' guts have been analysed for the type of planktons and copepods were found to be the dominant biomass in their guts. Phytoplanktons and Zooplanktons play an important role in the transfer of energy from lower trophic levels to higher levels in the food pyramid. Phytoplankton fixes the atmospheric carbon dioxide photosynthetically and incorporates it into the water, which can be taken up by various types of marine organisms through food. Several studies have been conducted to study this carbon uptake and two of them have been conducted in the Southern Ocean. Planktons such as fungi and bacteria can also act as decomposers and detritivores. They break down the dead or decaying plant and animal organic and inorganic matter, which eventually falls through the water column down on the seafloor. This falling matter (including faecal matter, sand and soot) is called Marine Snow. Phytoplankton is rich in various minerals and trace elements that are necessary for a balanced diet. Hence, the industrial use of Phytoplanktons as a supplement of magnesium, phosphorus, potassium, calcium, iron and zinc in diet is increasing and is becoming an upcoming source of growth nutrients and omega-3 fatty acids. This nutrient-rich food for fishes can help in better growth which in turn adds value to the fish market with more sales and demand contributing to the objectives of blue economy.

Keywords: Phytoplanktons, Zooplanktons, Fish, Food, Carbon

FISH AS FOOD

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'Matsya' or the 'Fish' as known in ancient Indian scriptures was the first incarnation of Lord Vishnu on Earth and the purpose of this incarnation was to save the 'first human' on Earth from a devastating flood and this story clearly indicates the belief the age-old relationship between human and fish. Since ancient times, in our country protection of fish in community fish sanctuaries near temples have been in practice and speaks about the awareness of our ancestors about the symbiotic relationship, we share with our marine friend. In many parts of our country and the world, fish forms a staple part of diet but still the use and benefits of fish food remains underrated. Of over 32,000 species of fish only a small number of species are consumed as food. The preparation of fish varies from cooked, uncooked, pickling, smoked, marinated, drying etc. Fish and seafood qualify as very important contributors to the food supply chain globally being available source of high quality, easily digestible protein and contains many vitamins like vitamin D and B2, is a great source of minerals like iron, zinc, iodine, magnesium and potassium along with essential fatty acids such as omega 3 fatty acids, with innumerable health benefits specially lowering risk of cardiovascular diseases. Fish consumption comes with a few hazards to watch out too, which includes choking, allergies, bio toxins, mercury and other toxic metal poisoning, parasites etc. The ecological and economic impact of fish consumption is varied and demands debate and so to conclude our focus at this point should be sustainable fishery which promotes both conservation and utilisation of our marine resources.

Keywords: History, Sustainable Fishery, Nutrition

PROXIMATE, PHYTOCHEMICAL, FTIR AND GC-MS ANALYSIS IN THE CHLOROFORM EXTRACT OF HALYMENIA CEYLANICA HARVEY EX KUTZING

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Marine macro algae produce the wide range of chemical compounds that can help to protect against the infectious disease. The present investigation was carried out in the chloroform extract of *Halymenia ceylanica* Harvey ex Kutzing, an important red algal species. The proximate analysis includes the content of the total carbohydrates, total proteins, total lipids, moisture and ash showed 40.21%, 7.53%, 3.38%, 8.92% and 38.35% respectively. The preliminary phytochemical analysis showed the presence of anthraquinone, anthocyanin, cardiac glycosides, catechin, coumarin, emodins, flavonoids, glycosides, phytosteroids, saponins, tannins and terpenoids. The presence of the functional groups was confirmed by FTIR analysis, which revealed 13 peaks that showed the presence of alkenes, alkyl halides, aliphatic amines, alkanes, aromatics, amines, alkynes and carboxylic acids. The GC-MS analysis revealed the four biological active compounds such as n-Hexadecanoic acid (12.16%), Oxalic acid (5.88%), 1,2- Benzenedicarboxylic acid, Mono(2-Ethylhexyl) Ester (78.37%) and Phenytoin (3.57%). The presence of the chemical compounds in the *Halymenia ceylanica* Harvey ex Kutzing is responsible for the biological activities in therapeutic effects.

Keywords: *Halymenia ceylanica*, Proximate, Phytochemical, FTIR, GC-MS

FISH AS FOOD

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Billions of people rely on fish for protein, and fishing is the principal livelihood for millions of people around the world. Average fish consumption in the 1960s was 9.9 kilograms, by 2010 annual per-capita consumption had risen to 18.6 kilograms. But fish consumption varies massively from country to country depending on local traditions and supplies. Fish as a food source, globally high in demand, rich in essential amino acids, essential n-3 fatty acids, vitamins and minerals. To meet up the demand of increasing population in term of fish consumption, overexploitation is taking place which causes instability in aquatic biodiversity.

Overfishing is the rate of capturing of fishes is high as compared to rate of reproduction and capture of unwanted sea life while fishing for a different species. This, too, is a serious aquatic threat that causes the needless loss of billions of fishes along with thousands of sea turtles and cetaceans etc. The damage done by overfishing goes beyond the aquatic environment.

Many people who make a living catching, selling, and buying fish are working to improve how the world manages and conserves ocean resources. If overfishing a continues, more species will be driven to extinction and aquatic ecosystems will collapse. Organizations like WWF work with a cross-section of stakeholders to reform fisheries management globally, focusing on sustainable practices that not only conserve ecosystems, but also sustain livelihoods and ensure food security.

Keywords: Overfishing, Biodiversity, Fish Consumption, Aquatic Ecosystem.

IMPACT OF POLLUTION IN MARINE ECOSYSTEM AND THEIR MANAGEMENT

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Coastal and marine environment can begin up to 100 kilometres inland, extend to the continental shelf, and include ocean systems with water up to 50 meters in depth. It includes estuarine and coastal wetlands, such as marshes and mangroves, sand beaches and dunes, seagrass beds, and coral and oyster reefs. The capacity of human activities to have significant impact on marine environment was not regarded as a serious issue until the middle of the 20th century. It is now regarded as a matter of increasing urgency, but the evolution of appropriate management measures presents several challenges. Pollution is recognized as a severe anthropogenic issue in the coastal and marine ecosystems across the world. Unprecedented and continuous accumulation of growing plastic contaminants into any respective aquatic ecosystem by the anthropogenic sources causes direct or indirect interruption to ecosystem structure, functions, and consequently, services and values. Land-based and sea-based sources are the primary sources of these contaminants in various modes that enter the ocean. Entanglement, toxicological effects via ingestion of plastics, suffocation, starvation, dispersal, and rafting of organisms, and introduction of invasive species are significant ecological effects with growing threats to biodiversity and trophic relationships. Degradation and modifications of marine systems are associated with loss of ecosystem services and values. Consequently, this emerging contaminant affects the socio-economic aspects through negative impacts on tourism, fishery, shipping, and aquatic animal's health. Preventing accumulation sources of plastic pollutants, 3R's (Reduce-Recycle-Reuse), awareness & capacity building, and producer/manufacturer responsibility are practical approaches toward addressing the issue of plastic pollution. Development of proposals/solutions on key research gaps can open a novel pathway to address this environmental issue in an effective scientific manner. In conclusion, the current status of plastic pollution in the marine ecosystem to make aware people of a plastic-free, healthy blue ocean in the near future.

Keywords: Coastal and Marine environment, Pollution, Plastics, Pollution, Marine Ecosystem

POPULATION GENETICS OF THE DECCAN MAHSEER USING MICROSATELLITE MARKERS

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A microsatellite marker is a versatile genetic marker system for the field of population genetics and genomics. Here, in this study 11,4392 microsatellites have been mined using Illumina Next Seq 500 paired end (2X150) data generated from the Deccan mahseer, Tor khudree (Sykes 1839), belonging to family Cyprinidae which is an important food fish as well as a game fish distributed in peninsular India. Due to overfishing and habitat destruction, the species is declared endangered and placed on the IUCN red list. Fourteen polymorphic loci were used to genotype 152 khudree individuals representing four wild populations (River Tungabhadra, River Tunga, River Periyar and River Cauvery) of India to see the utility of the nuclear marker in determining the genetic structure of this species. A total of 178 alleles were observed across 14 loci and for each locus, the number of alleles ranged from 7-18 with an average of 12.714 alleles per locus. All the loci were found to be in Hardy-Weinberg equilibrium except for three loci; TK_CIFA_05, TK_CIFA_08 and TK_CIFA_26. Negative FIS values were observed both locus- wise and in populations indicating the presence of high heterozygosity. All the loci deviated significantly from the linkage disequilibrium. With mean allelic richness (9.29) and observed heterozygosity (0.88-1.00) across all the loci, SSR markers demonstrated high genetic variability. However, genetic differentiation was observed to be low but significant, with Fst values ranging from 0.017 to 0.052 with highest was found to be between Cauvery and Tunga population. Within population, variation was found to be high (96.01%) as compared to within population. The population structure showed the presence of two gene pools; one is the Cauvery population and the other three populations (Tunga, Tungabhadra, and Periyar) as the other gene pool. The results of the present study along with the highly polymorphic markers developed would serve as a useful resource for further research on population genetics and conservation programs of the species.

Keywords: Microsatellites, *Tor Khudree*, Population Genetics

FISH AS FOOD IN INDIA

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Food in India portrays the ethnicity, culture, heritage, class, lifestyle, and religiosity of indo people as a link to acknowledge the Indian social landscape. According to Hindu culture, fish belongs to a portion of good Rajasic food that stimulates passion and movement. On average North-western India, consumption is less than 1 kg fish whereas its counterpart North-eastern India consumes more than 12 Kg fish per capita. The other States, Union territories, and coastal regions contribute to maximum fish consumption in India. According to 2019-20 survey Keralites eat 19.59 kg of fish a year on the other hand Lakshadweep people eat 105.6 Kg fish per person in a year. Being rich in HUFA, PUFA, Omega 3, vitamins, and minerals accommodating valuable white meat constitutes a healthy diet. In humans a study of coastal South India shows that fish-eating consumers have better cardiovascular risk than non-fish consumers in a daily diet. The iron-enriched fish powder is highly effective in controlling iron deficiency and anemia among adolescent girls in Meghalaya. In India fish along with a meal, fish by-products are also being used in food processing industries and dairy industries such as liver oil for its high medical value, fish flour, and fish silage. As a developing country white meal act as an economic booster especially due to aquaculture sectors and fishing communities. According to ICMR Indian adults require 0.9 to 1 g per Kg body weight protein however the average intake is 0.6 g only. Reasonable and cheaper sources of protein from fish such as rohu, Catla, bangda, rawas, and pomfret may lead to a way for fulfilling a protein diet in average Indians.

KEYWORDS: Fish, Malnutrition, HUFA, PUFA, Healthy Food

CONSERVATION AND BIODIVERSITY

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It can be conserved in the following ways: In-situ Conservation, Ex-situ Conservation. In-situ conservation of biodiversity is the conservation of species within their natural habitat. Biodiversity conservation means protection, conservation and management of biodiversity in order to obtain sustainable benefits for future generations. Biodiversity conservation is important because biodiversity provides certain services and resources that are essential for life on earth. What is Biodiversity Conservation? The protection, management and preservation of genetic diversity, species and ecosystems are important and are also called biodiversity conservation. We must protect flora and fauna for the sustainable growth of individual species and of all types of ecosystems. Public awareness should be created regarding biodiversity conservation and its importance. Biodiversity conservation is the protection and management of biodiversity to obtain resources for sustainable development. the important advantages of in-situ conservation: It is a cost- effective and convenient method of conserving biodiversity. Ex-situ conservation: This method refers to the conservation of biodiversity in the areas outside their natural habitat such as zoos and botanical gardens. The in-situ conservation has several advantages.

Ex-situ Conservation Ex-situ conservation of biodiversity involves the breeding and maintenance of endangered species in artificial ecosystems such as zoos, nurseries, botanical gardens, gene banks, etc. Biodiversity and its Conservation Methods Biodiversity refers to the variability of life on earth. Biodiversity conservation has three main objectives: To preserve the diversity of species. Also Read: All the varieties of food, timber plants, livestock, microbes, and agricultural animals should be conserved.

Keywords: Ex-Situ Conservation, In-Situ Conservation, Biodiversity, Endangered Species.

EXTRACTION AND CHARACTERIZATION OF EDIBLE GELATIN FROM PINK PERCH SKIN AND BONES, SURIMI INDUSTRY WASTE, USING RSM MODEL.

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Rapid growth of fish processing has resulted in increasing quantities of waste. It is estimated that fish processing waste after filleting accounts for approximately 75% of the total fish weight. Global fish waste is estimated to be approximately 100 mMT, and more than 4 mMT in India. These wastes are dumped, buried, used for landfilling, or incinerated, increasing environmental hazards, pollution, and threat to public health and increasing greenhouse gas emissions. These wastes are inexpensive sources of amino acids and protein, underlining their potential to be used as food, animal feed and fertilizer. The utilization of waste from fish processing industry for production of value-added products has attracted substantial attention. The objective of this work was to extract gelatin from from industrial sample of Pink Perch skin and bones, and further, optimize of gelatin extraction process by Response Surface Methodology (RSM) to maximize yield along with quality. A Box-Behnken design was used to study the combined effects of three independent variables pH of the treatment solution (X1), acid treatment time (min, X2) and treatment temperature (°C, X3) on different responses like yield of gelatin (%) and L-hydroxyproline content (mg/g). Yield and L-hydroxyproline content obtained at optimal conditions were pH 3, time 30 min, temperature 75 (°C) were 16.2% and 41.62 mg/g respectively. The gelatin exhibited thermo- reversible properties, with gel strength of 793.01±0.99 g. The produced gelatin was compared with commercial bovine gelatin with regard to some rheological and physico-chemical properties. Gelatin characterization showed acceptable rheological and functional properties compared to the commercial bovine gelatin. These results imply that the gelatin with good interfacial properties could potentially be used as a novel ingredient in food systems.

Keywords: Pink Perch, Gelatin. Bovine Gelatin, RSM, Rheological Properties

DEVELOPMENT OF COMPREHENSIVE TRANSCRIPTOME RESOURCES IN INDIAN MAJOR CARP ,*Labeo rohita*

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The monsoon carp, Labeo rohita, (rohu), is a popular table fish in Indian subcontinent and widely cultured in monoculture and poly-culture systems. Though genomic resources such as molecular markers and marker maps, QTLs, mtgenome, ESTs and draft genome are available, comprehensive transcriptome resources are scanty. Development of RNA sequencing (RNA-Seq) technology through utilization of high throughput sequencing technology facilitate transcriptome analysis in several model and non-model species in a cost effective manner. Transcriptome analysis allows cataloguing of all types of transcriptomes, investigation of transcriptional structure of genes, splicing patterns, and gene isoforms, studying post transcriptional modifications and gene expression quantification and genome annotation. In the present investigation we developed comprehensive transcriptome resources in Indian major carp, Labeo rohita using Illumina sequencing. In total 57.4 Gb of raw data were obtained from 20 RNA-seq libraries from 10 tissues i.e muscle, liver, kidney, testes, ovary, skin, gill, brain and intestine. The raw reads were QC checked using the program FASTQC and pre-processed. After filtration and trimming 54.6 Gb of high quality data were obtained. The raw reads were assembled using the program Trinity v2.8.6. Trinity resulted in 678160 transcripts with N50 value of 1254 bp and average transcript length of 735 bp. The transcripts were clustered using program cd-hit-est resulting in 639799 transcripts with N50 value 1045 bp and average transcript length of 680 bp. The final transcripts were annotated using the program Blast2GO. Gene ontology (GO) and KEGG pathway mapping analysis revealed various functional genes related to various processes such as biological process, molecular function and cellular components. The present study exhibited the power of next generation sequencing technology for rapid development of EST resources in non-model fish species. Further, it would facilitate genome annotation of this important aquaculture species with more accuracy.

Keywords: RNA-Seq, Carp, EST, NGS, Annotation, Blast2GO

VIBRIO CHOLERA AS FISH PATHOGEN: MOLECULAR IDENTIFICATION AND PATHOGENICITY OF A STRAIN CAUSING MORTALITY OF *Labeo rohita*

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Vibrio cholerae is a gram-negative bacteria known for causing epidemics and pandemics comprised both non-pathogenic and pathogenic strain. The present study isolated and identified a non-choleragenic, non- O1, non-O139 V. cholerae (EMM1) from diseased L. *rohita* cultured in wetland system at Purba Medinipur district, West Bengal, India. Identification of the isolate was done by Biochemical test, 16s rRNA gene sequencing and phylogenetic analysis. Challenge experiment revealed 100% mortality of L. *rohita* within 84h while injecting intraperitoneally with V. *cholerae* (EMM1) at a dose of 1.04× 107 CFU/ml. Histopathological changes in L. *rohita* includes degenerated hepatocytes in Liver, shrunken glomeruli in kidney, necrosis of the Intestinal villi epithelium, degeneration of muscle bundle, etc. The study proves that the identified strain is a potent pathogen and draws the attention for proper management of culture system to prevent possible occurrence of disease in culture fish.

Keywords: *Vibrio cholerae*,16S Rrna Gene, Biochemical Characteristics, *Labeo rohita*

CAPTURE FISHERIES AND ITS POTENTIAL DECLINE

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Capture fisheries involves catching and harvesting naturally available species. Capture fisheries is free for all, provided one has the time and resources. The capture fishery sector does not support nor control the wild population; they do not aid in the increasing of the population. Overfishing can deplete the population of a species, even resulting in the collapse of an ecosystem. Several major wild populations around the globe have met this fate. Strict control and regulation need to be enforced to maintain the population. It is advised to not catch beyond 30% of the wild population. This is called as the maximum sustainable yield (MSY), it could potentially prevent overexploitation and allows the population to recover over time. Captured fisheries is prominent in marine waters. There is a high demand for marine fish amongst consumers, rearing marine species can be a bit of a challenge and it requires a larger capital, thus there has not been a lot of interest amongst fish farmers or fisherman to begin rearing marine species outside of the wild population. Since the 1990 the global harvest from capture fisheries has stabilized, unlike culture fisheries which has been on an upward trajectory. There is a possibility of the capture fisheries to show decline as culture fisheries gain popularity and is able to successfully manage the consumer demand.

Keywords: Capture Fisheries, Overfishing, Maximum Sustainable Yield (MSY)

RECENT ADVANCEMENT IN FISHERIES

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Technologies or digital advances now days allows us to monitor and get the internal knowledge in detail about the specific organism or the environment inside the ocean. New technologies can provide data that are reliable and useful for further and advanced research. Facing tremendous increase of data for fisheries monitoring, control and surveillance, the Big Data can help in sorting out data coming from new technological tools.

MCS (Monitoring, Control and Surveillance) monitoring is the collection and analysis of fishing activity or catch, species composition. Control includes the terms and conditions under which resources are harvested. Surveillance includes the regulation of fishing activity to ensure that national legislation and terms, conditions of access and management measures are observed. MCS is now an important part of fishing operation and fisheries management. To understand the action motives of MCS a distinction will be drawn between collaborative and non-collaborative tools. The main collaborative tools are VMS and AIS, which were first built on existing satellite and radio frequency technologies and electronic recording. Non-collaborative surveillance systems are increasingly used by national and regional fisheries management authorities to monitor fishing activities in their costal zones and wider EEZ.

The growing use of drones is one of the prominent fields of application of new technology for sustainable fisheries. Drones can be used for fish stock assessments, therefore providing cheaper services than oceanographic vessels.

Keywords: Surveillance Collaborative Tools, Non-Collaborative Tools

EXTENT OF ABILITY AND USE OF ICT ON FISH PRODUCTION

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Information and Communication Technology (ICT) offers a lot of benefits such as socio-economic development ease the communication process and enhance the safety aspects of the fisherman when they are on the sea. It has a huge potential for providing appropriate knowledge and skills for the fisherman community. It is a phenomenal growth in creating knowledge-based society with more conscious human and better-informed community. Realising the importance of ICT, Govt of India has implemented number of ICT projects, programmes, agendas, strategies and initiatives for the purpose of assisting and strengthening for the development of farming community including fish farming. Information and communication technology centres are also established near to the fisherman community settlement. Information and communication technology therefore boosts information supply on improved farm technologies for increasing productivity and income of the farmers. But the great challenge is that most of the fish farmers including women have comparatively low level of education for which they do not have adequate knowledge and skill, efficiency in use of various ICT tools. The researcher therefore put another objective in the study to assess the extent of ability and use of ICT by the respondents on various aspects of fish production. Knowledge about ICT, skill in using ICT, preference towards service providers, purpose and extent of ICT use as well as reception of information through ICTs were selected as the variables for the study.

Keywords: - Communication, Information and Technology.

TRANSCRIPTOME ANALYSIS IDENTIFIED GENES ASSOCIATED WITH BODY GROWTH TRAIT IN IMPROVED FARMED CARP, *Labeo rohita* (HAMILTON 1822)

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Harvest body weight is an important performance trait in commercially important aquaculture species. Molecular underplay of genes associated with growth rate is not fully elucidated in major carp species of India. The genetically improved rohu, JayantiTM with its 18% average genetic gain is a promising candidate for studying genes associated with performance traits. With this aim, a total of 70 gb of data was generated from RNAseq (PE 2x150 bp) of 6 low breeding value (LBV) and 6 high breeding value (HBV) Jayanti rohu individuals belonging to 10th generation. A total of 178 million reads using Illumina Hiseq 2500 platform were obtained, out of which 173 million reads were retained after quality control and trimming using afterqc. De novo transcriptome assembly was performed using trinity v2.11.0 resulting in 14,02,926 transcripts with avg. length of 525 bp. Identification of 3816 upregulated and 4184 downregulated genes (DEGs) between high and low breeding value individuals was performed using DESeq in Bioconductor package. Functional annotation of differentially expressed transcripts (above log2fold change) using Blast2Go revealed that transcripts belonged to GO terms such as Binding and catalytic activity of 'molecular processes', Protein containing complex of GO term 'Cellular component' and regulation of gene expression under GO term 'Biological process'. In total, 2,14,655 high quality cSNPs were identified and annotated using VCFtools and SNPeff package. The results indicated 1,30,214 transitions, 84,441 transversions and the Ts/Tv ratio was observed to be 1.542. This study will provide pivotal molecular information for developing genomic selection program in genetically improved rohu as well as other carp species.

Keywords: Growth Rate, RNA seq, cSNPs, DEGs, Breeding value, *Labeo rohita*, Jayanti^{TM}

ROLE OF TACHYKININ GENE AND ITS RECEPTORS IN REGULATION OF CATFISH REPRODUCTION

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Tachykinins (TKS) are family of peptides which are distributed in central and peripheral nervous system. NKB is a functional hormone or peptide that belongs to the family of tachykinins, which is comprised of 10–11 amino acid residues in length that share a common carboxy-terminal amino acid sequence (Phe-X-Gly-Leu-Met-NH2. Till date various researchers have reported reproductive roles of tachykinin related genes and its receptors number of teleost species including eel, zebrafish, medaka, goldfish, etc. It was recently identified as a key regulator of reproduction in mammals and fish. Mutations in the genes encoding Neurokinin B (TAC3) or its receptor NK3R (TACR3) leads to hypogonadotropic hypogonadism, a disease characterized by the failure of sexual maturation, impaired gametogenesis and infertility, indicating that the NKB/NK3R system is indispensable for vertebrate reproduction. Recently, most studies with mammalian and non- mammalian vertebrates demonstrated that NKB stimulated gonadotropin-releasing hormone (GnRH)/gonadotropin release. Recently, our laboratory has cloned and characterized tac3 and tac3r gene from the brain of catfish *Heteropneustes fossilis*, an Indian stinging catfish. It showed differential, season dependent distribution in brain, gonad, pituitary, muscle, intestine, spleen and heart suggesting its putative role. Further, research work is in progress to determine its specific role in regulation of reproduction.

Keywords: Tachykinin, Catfish, Reproduction

AQUACULTURE DISEASE DETECTION BY ARTIFICIAL INTELLIGENCE TECHNIQUES

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Aquaculture, especially shrimp farming is classified as “High Risk – High Reward” Business. In recent context, the risks in aquaculture are mainly due to disease outbreaks. Once disease outbreak occurred, the delayed harvesting decision made the situation further complex. In order to facilitate early detection of disease and early harvesting decision for farmers, the Artificial Intelligence techniques in aquaculture industry is need of hour. In this technique, the miniature model of check-trays which are commercially used by farmers in shrimp farms, are developed along with high resolution camera system. The device is deployed in the pond and the shrimp occurs frequently in trays. The camera mounted on top of the device takes the image of the shrimps at frequent intervals and send the same to Cloud-based systems. There, the algorithm will process the image and extract the shrimp features for analysis. The major features include presence of white spots on the body and carapace, presence of black spots, presence of size variation, extend of hepatopancreatic damage, conditions of gut, presence of external parasites etc. Once features are observed and if found any abnormality, it will immediately be communicated to farmer via mobile application. Farmer can also be able to access the images/data for his reference and further necessary action. In addition to disease diagnosis, the shrimps are measured for Total Length (TL) (cm) which is then converted to Average Body Weight (ABW) (g) via machine learning algorithm employing regression models. This will help the farmers in better understandings of daily growth pattern of shrimps. Such technologies will be helpful in making aquaculture smart, scalable and sustainable.

Keywords: Disease Diagnosis, Artificial Intelligence, Real-Time Information, Prediction of ABW, Early Disease Diagnosis, Cloud, Farmer Alert, Mobile Application and Smart Aquaculture

EFFECT OF COVID-19 PANDEMIC ON FISHERIES MARKET IN INDIA

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Fish and other aquatic foods are playing a key part of our global food systems and it's a highly nutritious food group of major social, cultural and economic significance. India is the second largest aquaculture producer in the world after China. Due to Covid-19 pandemic India shuts all its boundaries from all other countries as well as within the country. Also, India is facing a fish scarcity, with prices rising in several states due to worldwide lockdown. Livelihood of many small and marginal fishermen at the coastal region have also impacted because of this lockdown. From fishing industries to seafood markets as well as local vendors to big brands of marine exporters facing hitch due to disruptions in transportation, trade and labour.

As the country is dealing with a pandemic, fisheries sector also shows hitches in this period. There are 30% catch reductions as reported from Mangalore coast due to the labourer were gone to the native. So, as we anticipated, the sea food market experiences a great fall because of its perishable nature. In conclusion, there is a need of restructuring of market and exports for a stable the economy driven by sea food industry.

Keywords: Pandemic, Fisheries, Sea Food, Covid-19

DETERMINATION OF OPTIMUM DIETARY CARBOHYDRATE LEVEL OF LONG WHISKERS CATFISH, *Mystus gulio* FRY

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Five iso-proteinous (400 g/kg diet) and iso-lipidic (120 g/kg diet) semi-purified diets with different levels of carbohydrate (100, 150, 200, 250 and 300 g/kg diet) were fed ad libitum to *Mystus gulio* fry (0.33±0.004 g) in triplicates (10 fish/replicate) for 90 days. Fifteen fibre-reinforced plastic tanks (50 L) with flow through system (water flow rate of 0.5 L/min) were used for rearing the fish. At the end of the feeding period, the effect of dietary carbohydrate on weight gain, Specific Growth Rate (SGR), Protein Efficiency Ratio (PER), Protein Productive Value (PPV), Lipid Productive Value (LPV), Energy Productive Value (EPV), Food Conversion Ratio (FCR) and whole-body composition of fish were evaluated. Among all the dietary treatment groups, the fish fed diet containing 200 g carbohydrate/kg diet had significantly higher ($P<0.05$) weight gain (8.39 g), SGR (3.62 %/day), PER (1.52), PPV (24.08%), LPV (27.13%), EPV (66.89%) and lower FCR (1.65). The whole-body protein (15.79%) and lipid contents (5.77%) were significantly higher ($P<0.05$) in the fish fed diet containing 200 g carbohydrate/kg diet and 300 g carbohydrate/kg diet, respectively. From the present study it is concluded that the optimum dietary carbohydrate requirement of M. *gulio* fry is 200 g/kg diet, respectively. The study results would be helpful for formulating the nutritionally balanced cost-effective nursey diets for M. *gulio* fry.

Keywords: Carbohydrate, Diet, Nutrient, Growth, Catfish, *Mystus gulio*

TRAINING NEEDS OF FISHERS OF RATNAGIRI THAILAND, MAHARASHTRA, INDIA: AN ASSESSMENT AND PRIORITIZATION

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Fishers operating gill net, trawler and purse-seiner in Ratnagiri tahsil of Maharashtra, India were interviewed to assess and prioritize their training needs. Socio-personal profile of fishers were also studied to know the age, educational status, fishing experience, membership of co- operatives, primary and secondary occupation of gill net, trawler and purse-seine operators. Training need quotients of gill net, trawler and purse-seine operators for various aspects were calculated and training needs were prioritized. The most needed trainings among all the subjects to the purse -seine operators were government schemes, role of financing institutes and concept of eco-labelling. While the gill net operators were very much interested to undergo training on maintenance of inboard and outboard engines. Fishers operating gill net and trawlers were curious to learn about the use of Potential Fishing Zone data disseminated by INCOIS, Hyderabad. It is suggested that training programmes should be organized on the prioritized training needs with appropriate training modules in simple local language by the concern governmental and non-governmental organizations for skill development of fishers.

Keywords: Fishers, Training Needs Assessment, Prioritization, Technology Transfer, Ratnagiri, Maharashtra.

IDENTIFICATION OF BACTERIOPHAGES AGAINST ANTIMICROBIAL-RESISTANT PATHOGENIC STRAINS AGAINST *A. veroni* AND *B. cereus* FROM THE GANGA RIVER

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In 1896 Study shows by Ernst Hanbury Hankins that the river Ganga is the primary source of bacteriophage. In recent times antimicrobial disease resistance pathogenic strain become a major constraint in the aquaculture sector due to overuse of antibiotics. To tackle the problem, solutions are required for the microorganisms that are resistant to antibiotics. As a result, bacteriophage might be a viable alternative to investigate. Therefore, in the present study, we have collected the water sample from 21 different locations along the Ganga River to find out specific bacteriophages against the fish pathogenic strain viz A. *veroni* and B. *cereus*, A. *hydrophylla*, *Vibrio cholera*. From which phase against A. *veroni* and B. *cereus* was found. Bacteriophage against these two bacterial strains is identified by the double agar diffusion method and the pure culture is stored in SM buffer for further use. Sample from Koteswar, Bageswar, Bagwan shows the presence of bacteriophage for A. *veroni* strain whereas sample from Koteswar, Jamuna expressway, Bageswar and sample near Bhagalpur and Barrackpore shows the presence of bacteriophages against B. Cereus. Furthermore, characterization of bacteriophages against those bacteria will be done to find the novelty of these bacteriophages and to develop a potential phage therapy to tackle the rising population of the antimicrobial-resistant bacterial strain in the aquaculture sector.

Keywords: Antibiotics, Microorganisms, Antimicrobial Disease.

FISH FOOD: KEY TO SUCCESSFUL AQUACULTURE

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Fish food are an essential part of commercial and personal aquaculture which consists of a balanced diet and nutrition for farmed fishes. Cultivated fish are taken care of diets uniquely intended for their nourishing requirements. Their feed contains every one of the fundamental supplements expected to keep them healthy and growing. The aquaculture feed is basically in pellets or granules, in this way it gives the fishes a wholesome nourishment in a concentrated and steady shape, permitting the fishes to nourish well and develop to greatest potential. Aquaculture feed should contain the following nutrients Lipids, fats, carbohydrates, minerals, vitamins, and protein. When choosing a feed for aquaculture species, one of the most important aspects to consider is protein consumption. The protein content of typical aquaculture diets varies per species. Fish that are smaller and younger require more protein than fish that are larger and older. The amount of protein required is also affected by the breeding habitat, water temperature, and water quality. Protein levels in feed must be higher in cold, filthy conditions. Extruded bits or pressure- pelleted feed are two types of aquaculture feed. Pressure-pelleted aquaculture feed floats on the surface of the water, whereas extruded aquaculture feed sink. Extruded feeds are more expensive due to production costs, but they also have the advantage of allowing a producer to see the fish's feeding habits up close. Both floating and sinking feeds are consumed by a wide range of marine organisms. Others, like shrimp, only eat sinking feeds. Aquaculture feed comes in a variety of sizes. It is generally recommended that you just feed your fish the biggest attainable feed size. The fish will starve if the feed pellets are too small.

Keywords: Fish, Food, Cultivated Fish, Nutrients, Protein

THE CULTURE OF *L. vannamei* AND THE ECONOMIC FACTORS IN SHRIMP AQUACULTURE DEVELOPMENT

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These previous few years have been a tremendous accomplishment for shrimp farming in India. Earlier, the nation was for the most part dependent on Black Tiger Shrimp (P. monodon). Afterward, the appearance of the WSSV put a genuine impact on the development of the species. However, introduction to *L. vannamei* in India, has been proven quite successful over the years as the species has successfully driven the Indian seafood market growth.

The study was carried out at Mayank Aquaculture Pvt Ltd, which is an aquaculture farm in Surat, district of Gujarat. The production of *L. vannamei* in Gujarat is applaudable. In 2017, the production capacity at the industry was 1200 tons of shrimp. According to farmers, the production yield of Shrimp mainly depends on factors like water quality, stocking densities, feed requirements and shrimp size. India can be expected to meet the surplus demand of shrimps in the market around the world. The introduction of Multi Phase Indoor System in Shrimp farming has been a colossal accomplishment in ensuring the quality of shrimps just as doubling the benefit of farmers via completing two harvests every year. In this study, we will further understanding of the farming practices adopted by the Aquaculture farm in Surat, Gujarat.

Also, the various economic factors in the aquaculture development such as seed cost, medicine cost, farm management and Export and Domestic market. We will further understand the profitability of Shrimp farming so far.

Keywords : Shrimp Farming, Vannamei, WSSV, Aquaculture, Tiger Shrimp.

IN VITRO CONTROL OF FISH PATHOGENIC BACTERIA PSEDUOMONAS AERUGINOSA PKB 113 BY THE EXTRACTS OF LOCALLY AVAILABLE PLANTS IN WEST BENGAL

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Bacteria are one of the major factors causing haemorrhagic septicemia to the edible fishes and create a growing threat to aquaculture. Thus, necessity of use of chemical compounds with antibacterial activities has increased to protect the fishes against the bacteria. Nowadays, use of commercial antibiotics is no longer effective in aquaculture, due to increased incidence of appearance of antibiotic resistant strains. The uses of medicinal plants as therapeutics have much lower side effects than the antibacterial drugs. In the present study, antimicrobial activity of locally available plants like *Piper betel* (Paan) and *Syzigium aromaticum* (Labanga) were tested against *Pseudomonas aeruginosa* strain PKB113 (accession number JX426137 in the GenBank database) which was isolated from the septicemic lesions of the freshwater edible fishes. The antibacterial activity test of both the plants was done by means of disc diffusion method as well as bacterial growth curve analysis. The present study also showed that methanolic extracts of both *Piper betel* (Paan) and *Syzigium aromaticum* (Labanga) have significant antibacterial effect against the test bacterium *Pseudomonas* PKB 113 but *Syzigium aromaticum* (Labanga) was more effective than *Piper betel* (Paan).

Keywords: Pseudomonas, Medicinal Plants, Antibacterial Effect, Disc Diffusion, Growth Curve.

FEEDING PRACTICES OF *Litopenaeus vannamei*

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Shrimp culture has taken a major turn in the seafood industry and has made a high impact over a small period. Shrimp being highly nutritious and easy to harvest makes it easier for the aquaculture farm owners to quickly grow hundreds of shrimps in one season and gain high profit margin from it. Shrimp is known to be of high value for many commercial fisheries areas around the world. Shrimp aquaculture has grown exponentially all around the world and it has been recorded in the recent decades due to the high demand for shrimps. To have a good profit margin, some basic measures must be taken under consideration as only healthy harvest counts, these aspects are as follows: (i) Pond design and construction, (ii) Pond water quality and soil management, (iii) Feed and feeding management, (iv) Biosecurity and disease prevention, and (v) Harvesting. All these aspects are highly important and are necessary for a good harvest to take place without any failure. This study was carried out at Mayank Aquaculture Private Limited, which is an aquaculture farm in Surat, district of Gujarat. Shrimp farming of *Litopenaeus vannamei* also known as the White-legged Shrimp in India has shown promising growth rate for the past decade. In this present study, major focus is on feed and feeding management practises of White-legged Shrimp (*Litopenaeus vannamei*), initially the variation in shrimp growth upon change feed composition is studied. Subsequently, different calculation methodologies were used to understand the feeding management practices. Concluding with a data submission where comparison of initial and final feed accumulation of two ponds is obtained with initial and final shrimp growth rate. Resulting in reasonable observations with improved feed conversion ratio and management practises of L. *vannamei* at Mayank Aquaculture Private Limited.

Keyword: Aquaculture, Feed Composition, Feed Conversion Ratio (FCR), Feed Distribution, Shrimp Farming, White-Legged Shrimp

DECIPHERING THE ROLE OF FISH SKIN MUCUS UNDER ALTERED AQUATIC ENVIRONMENT

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Fishes are evolved to thrive in an aqueous environment rich in a plethora of pathogenic micro-organism and a wide variety of pollutants. The fish skin along with its mucous secretions forms the first biological barrier providing protection from various environmental stresses and hazards to which it is exposed and to preserve the constancy of the milieu interieur. Fish skin mucus provides a medium in which antibacterial mechanism may act and thus serves as a repository of several innate immune components. Being a component of innate immunity, mucus plays a frontier role in protecting the fish from infections. The composition and characteristics of skin mucus is very important for the maintenance of its immune functions. Several innate immune components which includes enzymes e.g. proteases, phosphatases, catalase, peroxidase and many non-enzymatic substances with biostatic and biocidal activity (e.g., complement, C-reactive proteins, agglutinin, antimicrobial peptides, immunoglobulins) are present and have been identified in the skin mucus. Any change in the property of the ambient water disturbs the equilibrium and is reflected by changes in the physiology of the skin and its mucus composition. The altered response of skin and its mucosal secretion would help in understanding the adaptive changes that contribute to the plasticity of barrier function under different environmental conditions.

Keywords: Innate Immunity, Mucus, Fish Skin.

ENVIRONMENTAL PERTURBATIONS IN THE CONTEXT OF THE RIVER GANGES

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Despite the fact that the country only accounts for around 2.4 percent of the world's total land mass. India is home to 8% of all known species of animals and plants, and it ranks eighth in terms of the number of species that contribute to agriculture. The river Ganga is one of the largest and most diverse freshwater ecosystems in the world, with a wide range of species. The environmental issues surrounding the river Ganga were investigated, and it was discovered that the majority of untreated sewage created in high- income towns was entering the river. Other important sources of contamination included the discharge of untreated industrial effluents, the disposal of dead corpses, cadavers, carcasses, human and animal wastes, as well as siltation along the river's bank. Several portions of the Ganga's flow were found to be heavily polluted, with changes in species diversity and fish output. River Ganga requires continuous monitoring and conservation due to different point and non-point sources of pollution, as well as other anthropogenic and developmental activities, all of which pose a threat to the biota and, as a result, human health. There is a need to raise awareness about population dynamics, advancements in environmentally friendly technology, socio-economic development, and the harnessing of natural resources, as well as possible preventive measures taken with caution to ensure that the environment's quality does not deteriorate.

Keywords: Perturbations, River Ganga, Freshwater Ecosystem, Biodiversity, Conservation

GEOSPATIAL DISTRIBUTION, CONTAMINATION LEVELS OF HEAVY METALS IN THE SEDIMENT OF EAST KOLKATA WETLAND, INDIA

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East Kolkata Wetland (EKW) is one of the largest sewages fed aquaculture in the world. There is unapproved discharge of toxic metal waste into EKW due to unloading of metropolitan (garbage damp in Dhappa), agricultural chemicals, sewage fed fisheries (bheries), manufacturing units waste etc. Sediment act as a sink of heavy metals due to their complex physical chemical mechanism. In this study, total 45 sediment samples from 15 sampling station were collected from Sardar Bherry situated at EKW to characterise spatial distribution, potential risk and potential sources of heavy metals by means of inductively coupled plasma mass spectrometry. The geostatistical prediction map showed the range of Fe, Zn, Mn, Cu, Cr, Ni, Pb, Cd and Co in sampling stations were 6725-30193 µg/g, 104.7- 776.9 µg/g, 174.2-448.5 µg/g, 46.7-229.7 µg/g, 17.3- 134.1µg/g, 21.9-55.7µg/g, 9.61-59.6µg/g, 4.43-15.3 µg/g respectively. The results of the risk assessment of different hazard index (Geo-accumulation index, Contamination Factor, Ecological Risk Index) showed that sediment samples were severely polluted by Cd followed by Zn. The multivariate analysis showed that enrichment of Cu, Zn, Pb and Fe was primarily due to sediment properties (pH) followed by different anthropogenic wastes. Cd is the most enriched and abundant contaminated element chiefly from anthropogenic activities i.e., sewage sludge, chemical fertilizers, untreated wastewater from industrial and agricultural drains along the studied area. The findings of this study provide detailed information about level of contamination of heavy metals in sediments that could help in establishing rational ecological protection measures.

Keywords: EKW, Heavy Metal, Geo-Accumulation Index, Anthropogenic Waste

FISH, FOOD AND ECOSYSTEM

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Food fish is a powerful concept for understanding and responding to nutrition and sustainability challenges. Food systems integrate social, economic, environmental and health aspects of food production through nutritional consumption. Global food fish demand is rising, and serious questions remain about whether supply can increase sustainably. Due to the particular nutritional characteristics of fish, fisheries represent far more than a source of protein. They provide essential micronutrients like vitamins, minerals and omega-3 fatty acids which are necessary to end malnutrition and reduce the burden of communicable and noncommunicable disease around the world. Historically, the oceans were considered limitless and thought to harbour enough fish to feed an ever-increasing human population. However, the demands of a growing population, particularly in poorer countries, now far outstrip the sustainable yield of the seas. At the same time as fishing has become more industrialized and wild fish stocks depleted, aquaculture production, fish and shellfish farming has grown rapidly to address the shortfalls in capture fisheries. But aquaculture has come under intense scrutiny and criticism as environmentalists fear that it could cause significant environmental problems and further impact wild species that are already threatened. Indeed, both capture fisheries and aquaculture must repay to environment, but all human activities of significant scale do, and it is necessary to fairly evaluate and compare the ecological and economic impact of both. In fact, a thorough analysis shows that the ecological threat of aquaculture is much lower than continuing to supply the majority of fish protein from wild capture to enhance blue economy through sustainable fish production

Keywords: Economic, Environmental And Health Aspect

ROLE OF GENETICS AND BIOTECHNOLOGY IN FISHES

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Biotechnology provides powerful tools for sustainable development in aquaculture, fisheries, and the food industry. The growing public demand for seafood and the depletion of marine ecosystems have encouraged scientists to study how biotechnology can increase the production of seafood products, making aquaculture a growing field for animal research. Scientists are investigating genes that will increase the production of organic fish and the natural compounds used by marine organisms to fight bacterial infections. Modern biotechnology has already made a significant contribution and poses significant challenges to aquaculture and fisheries development. It recognizes that modern technology for biotechnologies should be used as a supplement and not as a substitute for conventional technology in problem solving, and that their use should be driven by necessity rather than by technology. The use of modern biotechnology to improve aquaculture production has great potential not only to meet demand but also to improve aquaculture. Genetic modification and biotechnology also have the potential to improve the quality and quantity of aquatic fish. Like all improved biotechnologically enhanced diets, aquaculture will be strictly controlled before marketing is approved. Properly integrated with other technologies for food production, agricultural products and services, biotechnology can be a significant help in meeting the needs of the growing and growing population in cities over the next millennium. Successful development and application of biotechnology is possible only if the foundation of research and extensive knowledge of biology, diversity, breeding, agronomy, physiology, pathology, biochemistry and genetic material is applied.

Keywords: Polyploid Breeding, Germline Stem Cell, Supplement.

MOLECULAR IDENTIFICATION KEY FOR AQUATIC SPECIES: A TOOL FOR CONSERVATION & MANAGEMENT

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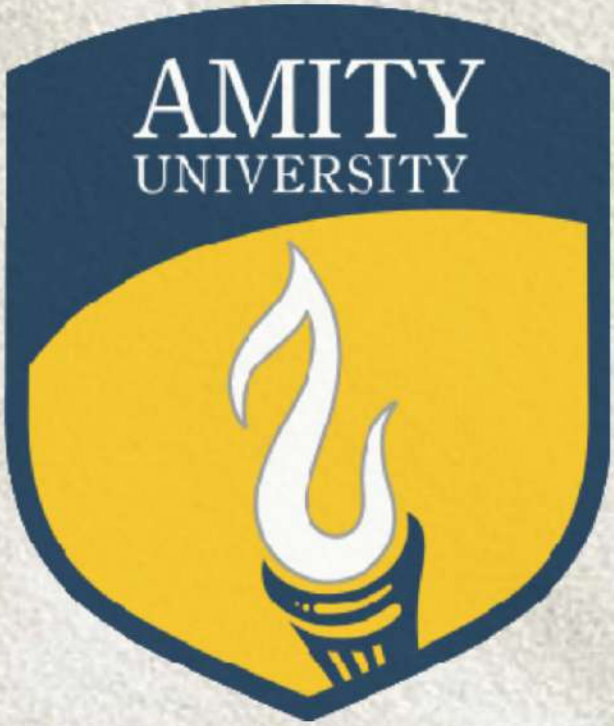
Sometimes in nature animals work together for their mutual benefit which is known as symbiotic relationship which exist in between fishes and turtles. The Red-crowned Roofed Turtle (*Batagur kachuga*), which is one of the endangered species found in Chambal riverine area. Nowadays turtle's population are going under intense pressure from anthropogenic activities and by change in the surrounding environments, which affects the fish and other aquatic population immensely. This kind of risk to the aquatic fauna can be addressed through molecular conservation. In the early 1990s, technologies such as polymerase chain reaction (PCR) and automated DNA sequencing spearheaded a boom in molecular ecology. Microsatellite and mitochondrial DNA haplotype markers became the methods of choice for many turtle studies. Today, the rate of research continues unabated. The emergence of new methods, approaches and ideas means exciting prospects for the molecular ecology of freshwater turtles. Due to lack of genetic resources for this species, the complete mitogenome of other *Batagur* species are taken into consideration for primer designing. For the first time MT-ND1 & MT-ND2 gene has been sequenced and submitted in the GenBank (Accession no. MZ156023, MZ156024) for *Batagur kachuga*. Phylogenetic analysis has been done on the basis of mitochondrial gene sequences of 11 turtle species along with one outgroup. The phylogenetic tree depicts a single branch for the family Geoemydidae in both the gene. The present investigation is the first report of the endangered species *Batagur kachuga* mitochondrial ND1 and ND2, furthermore molecular studies needed with more number of samples to resolve the species ambiguity. Further, the present investigation will be helpful for the scientific community for conserving the mutually benefiting aquatic species for sustainable growth.

Keywords: Molecular Conservation, Molecular Analysis, Mitochondrial Genes, Symbiotic Relationship.



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