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MATSYA JAGAT

DIVISION OF FISHERIES SCIENCES

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Contents

Foreword

It is a great pleasure for me to write this foreword for the second issue of this year's e-magazine, **"Matsya Jagat,"** published by the Division of Fisheries Science at our university. This e-magazine will certainly provide students, faculty members, and other readers with the latest information and activities related to the fisheries and aquaculture sectors.

Our Fisheries Science division offers a wide range of activities to benefit students, fish farmers, and entrepreneurs. Obtaining up-to-date reading materials for classes and information on aquaculture from the available literature is challenging. Hopefully, this magazine will meet the readers' demands, especially those interested in recent advancements in aquaculture and fisheries sciences. It is expected to become an important medium for disseminating knowledge about the latest infrastructure developments and emerging technologies enhancing fish production, marketing, and preservation.

I would like to congratulate the fisheries science faculty of our university for their efforts in developing our fisheries division. However, more efforts are required in translating knowledge through outreach activities and connecting fish farmers, entrepreneurs, and marketing professionals. This integration is essential for developing the economy, ecology, and empowerment of those living in rural and remote areas of the country.

Dr. Biswajit Ghosh
Hon'ble Vice Chancellor
The Neotia University

The Editor-in-Chief **Message**

It is my pleasure to introduce the 2nd Issue of volume – II of e-Magazine **"Matsya Jagat"** published by Division of Fisheries Science, The Neotia University, started with the objective to propagate the latest divisional activities, and initiatives of the division and impact thereof among the students and readers.

Dissemination of technological information, particularly latest advancements and developments in the area is the need of the hour. **"Matsya Jagat"** showcases the progress of the activities carried out under Division of Fisheries Science and I strongly believe that this magazine would serve as a great platform for promoting diversified fisheries activities, ideas and experiences and will further welfare of fisher, fish farmers, students and other readers in addition to the dissemination of information on the various aspects. I would like to place on record my appreciation for the consistent efforts put in by the editorial team towards making of this magazine.

Prof (Dr.) H Shivananda Murthy
Chair Professor
Division of Fisheries Science
The Neotia University

From the Editorial Desk

Welcome to the second issue of Matsya Jagat, the e-magazine from the Division of Fisheries Sciences, TNU. This edition proudly features the scholarly work of our Bachelor of Fisheries Science (BFSc) students across various semesters. Each article, crafted under the mentorship of our dedicated faculty, showcases their academic rigor and spirit of inquiry.

The vibrant cover, designed by our talented BFSc student, emerged as the winner of an inter-semester poster competition, reflecting the artistic flair within our student community.

This issue highlights our students' research and insights, offering a glimpse into their innovative aquaculture practices and advancements in fisheries sciences. Their passion and dedication are evident in every piece.

At the Division of Fisheries Sciences, our goal is to nurture skilled professionals ready to contribute meaningfully to the field. Through a blend of rigorous training, practical experience, and mentorship, we aim to empower our students to become leaders in fisheries science.

As you explore this issue of Matsya Jagat, we invite you to engage with our students' work and join us in our pursuit of excellence and innovation.

We hope you find this issue enlightening and inspiring.

Dr. Hakim Mudasir Maqsood,
Assistant Professor (Fish Genetics and Breeding)
Head, Department of Aquaculture
Div. Of Fisheries Sciences, TNU

Foreword from **Faculty Head**

With immense pleasure and heartfelt enthusiasm, I welcome you to the latest edition of Matsay Jagat, Issue II Vol.2. In the dynamic and ever-evolving field of Fisheries Science, Matsay Jagat stands as a beacon of knowledge and insight, serving the curiosity and intellect of both enthusiasts and professionals. As the Assistant Professor and Faculty Head of the Division of Fisheries Science at The Neotia University, I am profoundly aware of the significance of sharing valuable information and fostering a community dedicated to learning and collaboration. This issue promises to deliver a treasure trove of thought-provoking content, meticulously crafted to offer a comprehensive understanding of a diverse range of topics within Fisheries Science. Every article in this issue is designed with great care to provide both depth and breadth, ensuring a rich and enlightening experience for our readers.

As a researcher and educator deeply committed to this field, I commend the editorial team for their dedication and vision in curating such an enriching publication. Matsay Jagat continues to be an indispensable platform for sharing knowledge, fostering dialogue, and shaping the future of Fisheries Science. I extend my heartfelt gratitude to all contributors whose expertise and passion light up the pages of this issue. May their insights inspire and empower you to explore the boundless possibilities within the realm of Fisheries Science.

With best wishes for a captivating and enlightening read.

Dr. Neeraj Pathak
Assistant Professor and Faculty Head
Division of Fisheries Science
The Neotia University

Faculty of **Fisheries Sciences** at a Glance

Faculty

Prof. (Dr.) H. Shivananda Murthy

MFSc, PhD, PDF (USA, UK and Spain)
Chair Professor (with powers and position of Dean), Division of Fisheries Sciences, Division of Fisheires Sciences

Department of Aquaculture

Dr. Hakim Mudasir Maqsood

Assistant Professor (Fish Genetics and Breeding)
Head, Department of Aquaculture

Key Research Area:
Nutrigenomics, Genome Editing, One Health Aquaculture

Ms. Puja Chakraborty

Asst. Prof (Adhoc Grade-I) Aquaculture

Key Research Area:
Nanotechnology, Environmental remediation, Aquatic toxicology

Department of Fisheries Engineering

Ms. Aditi Banasure

Assistant Professor (Fisheries Engineering)

Key Research Area:
Traditional fish traps, TKs, Collapsible trap, Destructive fishing practices.

Department of Fish Processing Technology

Dr. Neeraj Pathak

Assistant Professor and Head,
Fish Processing and Technology

Key Research Areas:
Emerging Fish Quality and Safety, Thermal Processing

Department of Aquatic Animal Health Management

Dr. Avishek Bardhan

Assistant Professor and Head (AAHM)

Key Research Area:
Antimicrobial resistance, Aquatic Health, Antibiotic Safety, Drug toxicity

Department of Aquatic Environment Management

Dr. Suman Karmakar

Assistant Professor & Head,
Aquatic Environment Management

Key research area:
Aquatic Toxicology

Department of Fisheries Resources Management

Dr. Vikas Pathak

Assistant Professor and Head (FRM)

Key Research Area:
Fish diversity, Biology and Ecological studies

Department of Fisheries Economics, Extension and Statistics

Mr. Khemraj Bunkar

Assistant Professor and Head (FEES)

Key Research Area:
Supply/Value chain analysis and Economic analysis

Ms. Camelia Chattopadhyay

Assistant Professor (Ad hoc grade-II), FEES

Key research areas:
Fisheries Extension and Aquaculture

Technical Staff

Laboratory Technician: 01

Mr. Rohit Khatua (MSc Marine Biology)

Field Staff: 02

Activities at Division of Fisheries Sciences

National Seminar

The Departments of Aquaculture and Aquatic Animal Health Management, Division of Fisheries Sciences, jointly organized a National Seminar on Recent Advances in Aquaculture and Fish Health Management on May 13, 2024. The seminar aimed to share the latest research and advancements in aquaculture and fish health management with undergraduates, postgraduates, researchers, and scientists from across India. The event was graced by Prof. Biswajit Ghosh, HVC TNU, and the Registrar, TNU. Mr. Amit Saraogi, MD of Nouriture-Anmol Feeds, attended as the chief guest. Invited speakers were given a tour of TNU's facilities for BFSc, MFSc, and PhD programs. A campus placement drive for final year BFSc students was held after the valedictory function.

The seminar featured lead lectures by renowned experts, including Prof. (Dr.) Uttam Kumar Sarkar, Director of NBFGR, Dr. Baidya Nath Paul, Principal Scientist at ICAR-CIFA Rahara Research Station, and Dr. Swagata Ghosh, Principal Scientist at KVK Sonarpur. These lectures covered a wide range of topics, offering valuable insights into recent advancements in aquaculture techniques and fish health management strategies.

MoU Signing

Our **Division of Fisheries Science** is Pleased to Have Signed **Two Memorandums of Understanding** on the occasion of **National Seminar** on **'Recent Advances** in Sustainable **Aquaculture and Fish Health'** on 13th May, 2024.

- **ICAR-National Bureau of Fish Genetic Resources, Lucknow.**
- **ICAR-Central Institute of Brackish water Aquaculture, Chennai,**

The Neotia University Organised International Conference at Kathmandu, Nepal:

Three days 7th International Conference on “Global Approaches in Agricultural, Biological, Environment and Life Sciences for Sustainable Future (GABELS - 2024)” was organised by The Neotia University in association with Agricultural Technology Development Society (ATDS) Ghaziabad, UP; D. A. V. College, Tribhuvan University, Kathmandu, Nepal; and other organizations during June 08-10, 2024 at D. A. V. College, Kathmandu, Nepal. More than 600 delegates and participants attended the conference. Prof (Dr) H Shivananda Murthy, the Chair Professor, was nominated as Organizing Director of the Conference by the Organising Committee and he was the Guest of Honor in the Valedictory Function of the International Conference.

Prof (Dr) H Shivananda Murthy, Delivered Keynote address and Chaired Technical Session in the International Conference:

Prof (Dr) H Shivananda Murthy, delivered the keynote address in the International Conference, GABELS-2024, held at Tribhuvan University, Kathmandu, Nepal, held during 8th to 10th, 2024. Prof H S Murthy was the only chosen Keynote Speaker from India. Prof Murthy Chaired the Technical Session in ‘Animal and Fisheries Science’ and was also the Guest of Honor in the Valedictory Function of the conference.

Lecture Series

Prof. (Dr.) Uttam K. Sarkar

Director ICAR-NBFGR delivered key note speech on the occasion of National Seminar on Transformative Excellence in Fish Genetics and Conservation: A Comprehensive Approach to Sustainable Fisheries and Biodiversity Management in India in Changing Climate.

Dr. B. Paul (Principal Scientiest) ICAR-CIFA Rahara Research Station and **Dr. Swagata Ghosh** (SMS, RKMVERI-KVK Sonarpur) were invited guest speakers. Their talks were focused on advances in aquaculture, fish nutrition and Ornamental fish production, respectively.

Facilitation Event (Prize distribution after Poster and Oral presentations)

Visit of Director ICAR-NBFGR Prof. (Dr.) Uttam K Sarkar to various facilities at Div. Of Fisheries Sciences, TNU

Exposure visit of BFSc students to Dept. Of Marine Engineering, School of Maritime Studies under the mentorship of Miss Aditi Banasure.

Coursework project on development of innovative cage designs and evaluation of efficiency thereof
Project completed by BFSc I – Year students under the mentorship of
Dr. Hakim Mudasir Maqsood

The Economic Landscape of **Indian Fisheries**

Khemraj Bunkar*[1], Aditi Banasure[2] and Camelia Chattopadhyay[1]

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Introduction

India, endowed with an extensive coastline of 8,118 kilometers and a vast network of rivers, lakes, and reservoirs, has a rich heritage of fishing and aquaculture. India's fish production achieved a record high of 16.24 million tonnes (DoF, 2022). India is one of the world's largest producers of fish, accounting for an outstanding double-digit average annual growth rate of 10.87 percent since 2015-16 (DEA, 2022). The fisheries sector plays a pivotal role in the Indian economy, contributing significantly to food security, employment, and export earnings. This article delves into the multifaceted aspects of Indian fisheries economics, examining its contributions, challenges, and the potential for sustainable growth.

Economic Contribution

- **Employment and Livelihood**

The fisheries sector is a critical source of livelihood for millions of Indians. Inland fishing in rivers, reservoirs, wetlands, and estuaries is crucial for the livelihoods of nearly 82% of India's 28.06 million fisherfolk including fishermen, fish farmers, and those engaged in ancillary activities such as processing, packaging, and transportation (DoF, 2022). Additionally, millions more are indirectly dependent on the sector, including those involved in the supply of fishing equipment, feed, and other related services.

- **Contribution to GDP**

This remarkable output contributed 1.1% to the nation's overall GDP and 7% to the agricultural GDP. (DoF, 2022). This significant contribution underscores the sector's importance in the broader agricultural and rural economy of India.

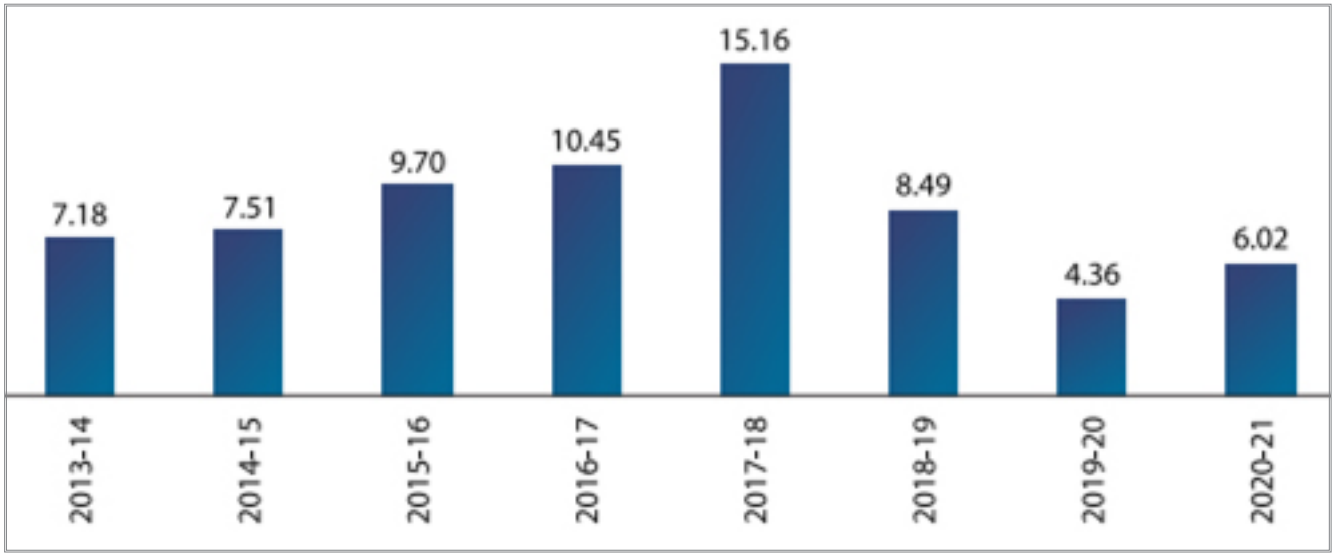

Fig 1: Trend of Percentage Growth of GVA of Fisheries in India (Constant Prices: 2011-12) (Source: DoF, 2022)

- **Export Earnings**

India is one of the largest exporters of fish and fish products in the world. In the fiscal year 2021-22, the country exported over 1.36 million tons of seafood, earning approximately USD 7.7 billion. Major export destinations include the USA, China, Japan, Southeast Asia, and the European Union. Frozen shrimp (74%) and frozen fish (6.02%) are the top export items, accounting for a substantial share of the total export earnings.

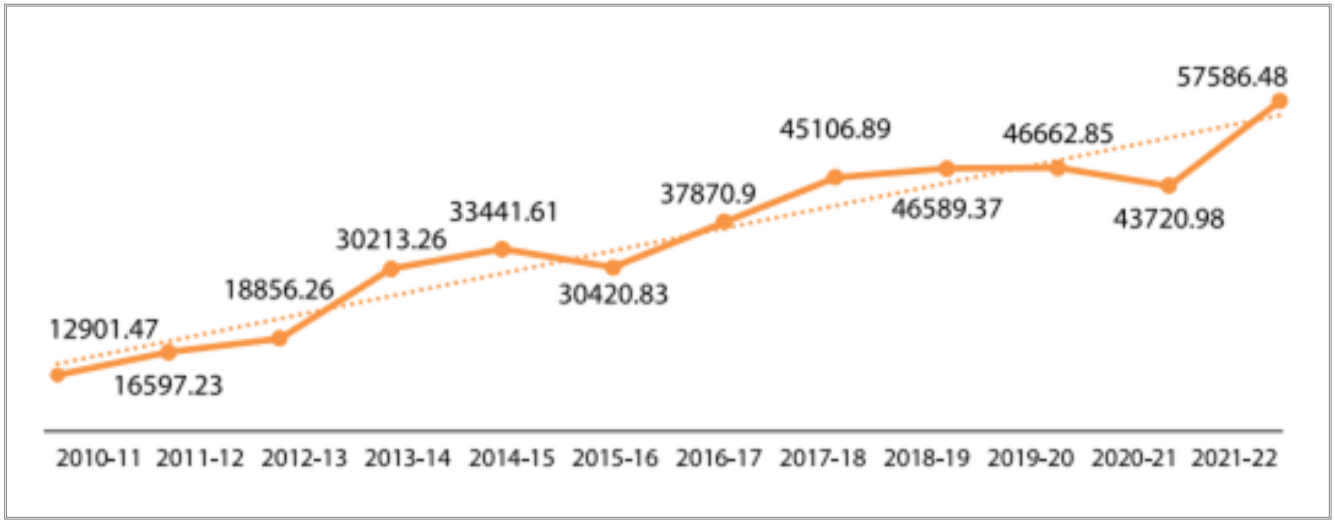

Fig 2: Trend of Export of Fish and Fish Products in Value (Rs. Crore) (Source: DoF, 2022)

Challenges Facing the Sector

Despite its significant contributions, the Indian fisheries sector faces several challenges that hinder its full potential. These include:

- **Overfishing and Resource Depletion**

Overfishing, especially in coastal waters, has led to the depletion of fish stocks. This is exacerbated by illegal, unreported, and unregulated (IUU) fishing practices, which pose a severe threat to the sustainability of marine resources.

- **Infrastructure Deficiencies**

Inadequate infrastructure for fish landing, storage, processing, and transportation leads to significant post-harvest losses, estimated to be around 20-25%. This not only reduces the income of fishermen but also affects the quality and safety of fish products.

- **Market Access and Value Chain Inefficiencies**

Small-scale fishers often face challenges in accessing lucrative markets due to middlemen dominance, poor bargaining power, and lack of market information. Value chain inefficiencies result in reduced profit margins for primary producers.

- **Infrastructure and Technology**

Investing in modern infrastructure for fish landing, storage, processing, and transportation is necessary to reduce post-harvest losses. Additionally, leveraging technology for market information, traceability, and efficient supply chain management can improve market access and profitability for fishers.

- **Policy Support and Institutional Strengthening**

Strengthening policy frameworks and institutions to support the fisheries sector is imperative. This includes ensuring effective implementation of policies, providing financial and technical support to fishers, and fostering public-private partnerships for sectoral development.

Conclusion

The fisheries sector is a cornerstone of the Indian economy, with vast potential for growth and development. Addressing the challenges and harnessing the opportunities in a sustainable manner will not only enhance the sector's economic contributions but also ensure the livelihoods of millions and the health of aquatic ecosystems. Through a combination of sustainable practices, technological advancements, and robust policy support, India can chart a path towards a vibrant and resilient fisheries economy.

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Use of **Bioinformatics, AI, and ML in Fisheries and Aquaculture**

Hakim Mudasir Maqsood[1]*, Dip S[2], Shoaib K[2] Subrata H[2], Tridisha H[2], Katherine[3], Elvonu Toso[3]

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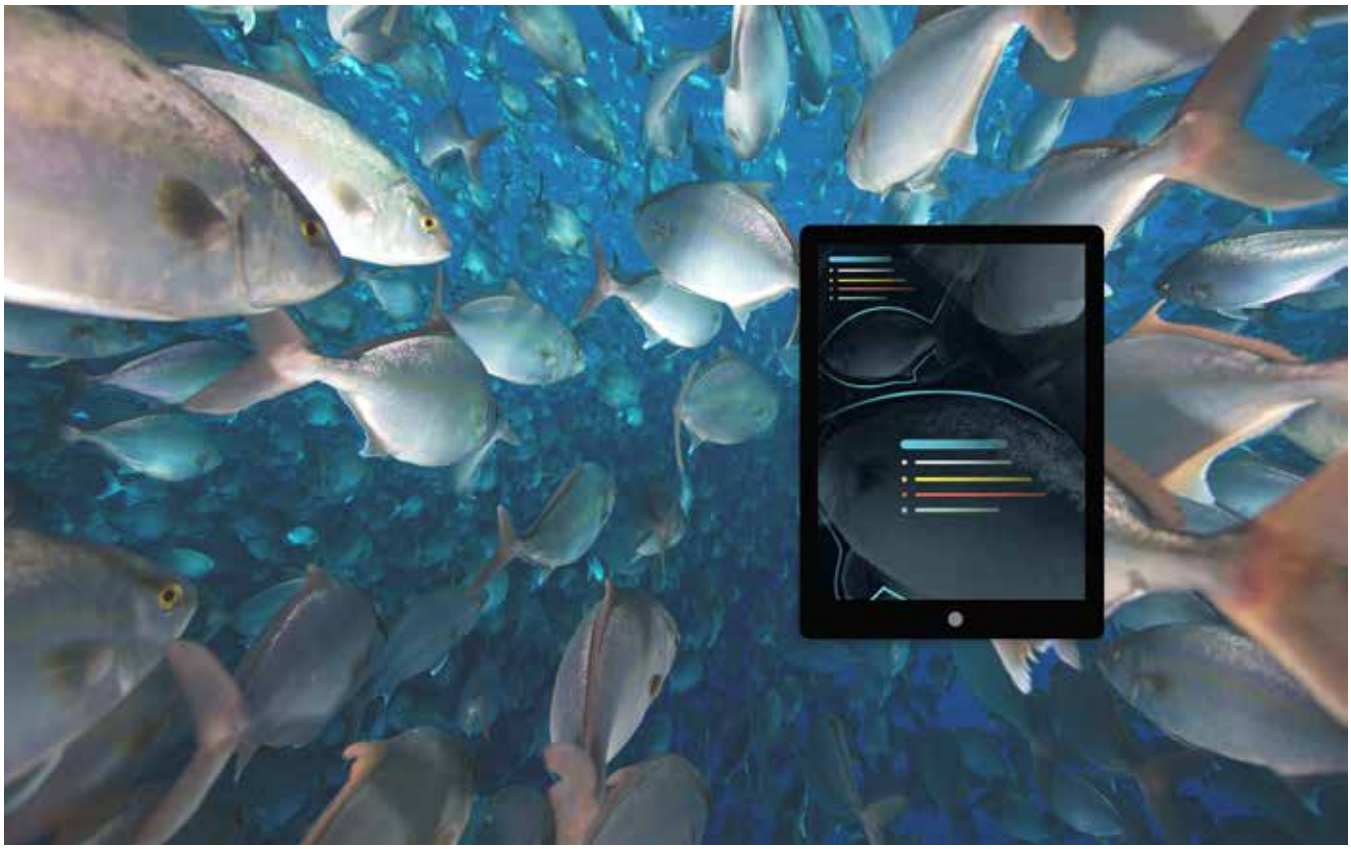

The integration of bioinformatics, artificial intelligence (AI), and machine learning (ML) in fisheries and aquaculture is revolutionizing the industry, offering advanced solutions for enhancing productivity, sustainability, and fish health management. These technologies are instrumental in addressing some of the critical challenges faced by aquaculture, including disease control, feed optimization, and environmental impact.

Bioinformatics in Aquaculture

Bioinformatics plays a crucial role in managing and analyzing biological data, which is essential for genetic research, breeding programs, and disease management in aquaculture. The application of bioinformatics allows for the characterization and mapping of genes, aiding in the study of population genetics, genomic evaluation, and marker-assisted selection. This genomic information is vital for enhancing selective breeding programs, improving disease resistance, and optimizing growth rates in farmed fish populations.

AI and ML Applications

1. Disease Detection and Management:

AI and ML technologies are being used to monitor and predict disease outbreaks in fish farms. By analyzing data from various sensors and imaging technologies, AI can detect early signs of disease and recommend timely interventions. For instance, hydroacoustic sensors and underwater cameras equipped with AI can monitor fish behavior and health indicators, reducing the need for stressful manual inspections.

2. Feed Optimization:

Feeding is a significant cost in aquaculture, and optimizing feed efficiency is critical for profitability and sustainability. AI-driven systems, such as those developed by companies like ReelData AI and Umitron, use real-time data to adjust feeding schedules and quantities. These systems analyze fish behavior and environmental conditions to optimize feed delivery, thus reducing waste and improving growth rates.

3. Environmental Monitoring:

AI and ML are also used for environmental monitoring, helping to maintain optimal conditions for fish farming. These technologies can analyze data from temperature, oxygen, and pH sensors to ensure that water quality remains within suitable parameters. Real-time monitoring helps in making informed decisions to mitigate the impacts of adverse environmental conditions on fish health and growth.

Precision Aquaculture

Precision aquaculture leverages data-driven insights to improve the management and productivity of aquaculture operations. This approach involves the use of sensors, automated systems, and AI to monitor and control various aspects of fish farming, such as feeding, health monitoring, and environmental management. For example, the CageEye system uses hydroacoustic sensors to provide real-time data on fish distribution and behavior within cages, enabling farmers to optimize feeding practices and monitor fish welfare without invasive techniques.

Challenges and Future Directions

Despite the significant advancements, the adoption of AI and ML in fisheries and aquaculture faces several challenges. These include high initial costs, lack of expertise, and industry reluctance due to the perceived complexity of these technologies. Moreover, there is a need for regulatory frameworks to ensure the ethical and effective use of AI in aquaculture.public-private partnerships for sectoral development.

To overcome these challenges, it is essential to promote interdisciplinary collaboration and training, integrate AI into existing management practices, and develop standardized protocols for AI applications. Additionally, fostering industry trust through transparent and validated AI solutions will be crucial for widespread adoption.

In conclusion, the integration of bioinformatics, AI, and ML in fisheries and aquaculture holds great promise for enhancing productivity, sustainability, and fish health management. Continued research, technological development, and industry collaboration will be key to unlocking the full potential of these advanced technologies in aquaculture.

Further reading

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Rising Tide of Microplastics: India's Coastal and Marine Ecosystems at Risk

Neeraj Pathak[1], H. Shivananada Murthy[1], Hakim Mudasir Maqsood[1], Faisal Rashid Sofi[2], Archit Shukla[3], Kawkabul Saba[2]*

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Introduction

Plastics, synthetic organic polymers derived from petrochemical processes, have become ubiquitous due to their durability, versatility, and low cost. However, their resilience poses severe environmental challenges, particularly in marine ecosystems. Microplastics, defined as plastic particles less than 5 millimeters in diameter, are of growing concern due to their persistence, pervasive distribution, and potential toxicological effects. They originate from a variety of sources, including the fragmentation of larger plastic debris, synthetic fibers from textiles, and microbeads from personal care products. India, with its extensive 7,500 km coastline, is particularly vulnerable to microplastic pollution. The confluence of high population density, rapid industrialization, and inadequate waste management systems exacerbates the issue. Coastal and marine ecosystems in India, ranging from mangroves and coral reefs to sandy beaches and estuaries, provide critical habitats for diverse marine species and support the livelihoods of millions. The intrusion of microplastics

into these environments disrupts ecological balance, threatens marine biodiversity, and poses risks to human health through the food chain. This review focuses on the properties, sources, distribution, and impacts of microplastics in India's coastal and marine environments. By highlighting recent research findings and employing advanced detection methodologies, we aim to underscore the urgency of addressing microplastic pollution. Furthermore, this review suggests future research directions, emphasizing the need for comprehensive monitoring programs, improved waste management practices, and policy interventions to mitigate the detrimental effects of microplastics on marine ecosystems.

Properties and Sources of Microplastics

- **Primary Microplastics**

Primary microplastics are manufactured to be microscopic and are commonly used in cosmetic products and industrial applications. Recent studies indicate that personal care products contribute significantly to microplastic pollution in Indian coastal waters (Jambeck et al., 2015).

Table 1 highlights the various types and sources of primary microplastics found in India. These microplastics, such as microbeads in exfoliating products and plastic pellets used in manufacturing, directly enter the marine environment through wastewater discharge.

Type	Source	Description
Primary	Cosmetics	Microbeads from exfoliating products
Primary	Industrial	Plastic pellets and resin from manufacturing
Secondary	Urban Runoff	Degradation of larger plastics from urban areas
Secondary	Fishing Gear	Breakdown of lost or discarded fishing gear

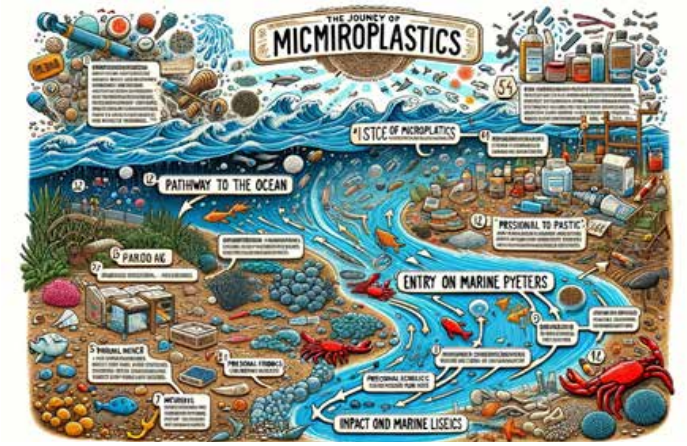

Figure 1: The Journey of Microplastics: From Land to Marine Ecosystems in India

- **Secondary Microplastics**

Secondary microplastics result from the breakdown of larger plastic debris due to physical, chemical, and biological processes. The intense sunlight and high temperatures in India accelerate the degradation of macroplastics, leading to an increased presence of secondary microplastics in the environment (Andrady, 2017). Urban runoff, as depicted in Table 1, significantly contributes to the degradation of larger plastics into microplastic fragments.

Routes of Entry into Marine Environment

- **Terrestrial Sources**

Approximately 80% of marine plastic debris originates from land-based sources. Major contributors include improper waste management, industrial discharge, and riverine transport (Lebreton et al., 2017). In India, major rivers like the Ganges and Brahmaputra act as conduits for plastic waste to the Bay of Bengal and Arabian Sea (Sarkar et al., 2019).

- **Maritime Sources**

Fishing activities, shipping operations, and tourism also contribute significantly to marine plastic pollution. Lost fishing gear, plastic packaging, and discarded waste from vessels are common sources of marine debris (Richardson et al., 2019).

Detection and Quantification

- **Beach Combing and Sediment Sampling**

Beach combing and sediment sampling are primary methods for detecting macro and microplastics. Studies along the Indian coastline have revealed high concentrations of microplastics in beach sediments, with polyethylene and polypropylene being the most prevalent (Kumar et al., 2020).

- **Water Column Sampling**

Surface water sampling using trawl nets has identified significant microplastic contamination in coastal waters. Recent surveys report microplastic densities of up to 60 particles/m³ in the Bay of Bengal (Chatterjee & Sharma, 2019).

Spatial and Temporal Trends

- **Coastal Accumulation**

Microplastics are most concentrated along densely populated and industrialized coastal areas. For example, Mumbai's coastal waters show high levels of microplastic pollution correlating with population density and industrial activity (Napper et al., 2020). Figure 1

illustrates the journey of microplastics from land-based sources to marine environments, highlighting areas of significant accumulation.

- **Temporal Changes**

Long-term data indicate an increasing trend in microplastic pollution over the past two decades. Seasonal variations also affect microplastic distribution, with monsoon rains exacerbating the influx of terrestrial plastics into marine environments (Sundaramanickam et al., 2016).

Environmental and Biological Impacts

- **Ingestion by Marine Organisms**

Ingestion of microplastics by marine organisms, including fish, crustaceans, and mollusks, has been well-documented. This ingestion can lead to physical blockages, reduced feeding, and potential transfer of toxic chemicals (Browne et al., 2015).

- **Chemical Contaminants**

Microplastics can adsorb and transport harmful pollutants, including PCBs and PAHs, posing additional risks to marine life and human health (Rochman et al., 2013).

Future Directions and Recommendations

- **Research Needs**

Future research should focus on the long-term ecological impacts of microplastics, effective mitigation strategies, and the development of biodegradable alternatives (Thompson et al., 2019).

- **Policy and Management**

Effective waste management practices, stringent regulations on plastic production and disposal, and public awareness campaigns are crucial to mitigating the microplastic pollution crisis in India (UNEP, 2018).

Conclusions

Microplastic pollution represents a growing threat to India's marine ecosystems. Addressing this issue requires a multidisciplinary approach, combining scientific research, policy intervention, and public engagement. By understanding the sources, impacts, and trends of microplastics, we can develop targeted strategies to protect marine biodiversity and ensure the health of coastal environments.

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GIS and its Application in Fisheries Management

Subhadip Bar, B.F.Sc. III Year

Introduction

The world's seas, lakes, and streams are tremendous biological systems abounding with life and assets. Dealing with these oceanic conditions really requires shrewd gadgets that can gather, dissect, and envision spatial information. The standards of GIS incorporate the utilization of geographic data to more readily comprehend and oversee assets that can be utilized actually for fisheries the executives.

Standards of GIS

At its center, GIS consolidates five key parts - equipment, programming, information, individuals and strategies. A system for capturing, storing, analyzing, managing, and presenting spatial or geographic data is known as a GIS. It permits clients to see, comprehend, decipher, and envision information in different organizations like guides, outlines, and diagrams. The rule of GIS is the capacity to gather various kinds of information from various sources and overlay them into a typical geographic structure. GIS deals with the standard of spatial examination, which includes analyzing examples, connections, and patterns in topographical information. This investigation can uncover important data about the appropriation, overflow, and conduct of marine creatures, as well as the natural circumstances that influence their environment.

Application in Fisheries the board

GIS standards concern the joining of various fisheries related spatial information, including natural information, (for example, fish stocks), ecological information, (for example, oceanography, water quality), and financial information (like fisheries, monetary necessities). Joining of these information takes into consideration a superior comprehension of fisheries biological system.

Fishery Arranging and Site Choice:

GIS helps in recognizing appropriate areas for fishing exercises in view of elements like water profundity, temperature, saltiness, and vicinity to fish territories. It helps maximize fishing efforts while minimizing impact on the environment.

Stock Evaluation:

GIS is utilized to incorporate information on fish gets, ecological circumstances, and environment attributes. This permits wellbeing authorities to survey the wellbeing and wealth of fish, which is significant deciding fishing limitations.

Natural Checking:

GIS can be utilized to screen natural factors that influence fisheries, like water temperature, saltiness, and sea ebb and flow. This data helps in comprehend the impact of environmental change and other ecological changes on fish territories.

Natural surroundings Examination:

GIS devices can be distinguish and portray significant fish living spaces, for example, producing grounds, nurseries, and taking care of grounds. This data is significant for carrying out preservation estimates that safeguard these regions.

Risk Appraisal: GIS can be utilized to recognize regions where there is overfishing or natural surroundings obliteration. By dissecting verifiable information and displaying future situations, fisheries chiefs can survey the dangers related with various administration systems.

Conclusions

Geographic Information Structures (GIS) are fundamental in fisheries the executives, supporting spatial examination, route, and arranging. By utilizing GIS standards, administrators improve environment understanding, streamline asset use, and advance reasonable practices. It is possible to advance global fisheries management and conservation efforts by combining GIS with technological advancements like AI and remote sensing.

Further reading

Meaden, G. (2009). Geographical Information Systems (GIS) in fisheries management and research. In Computers in fisheries research (pp. 93-120). Dordrecht: Springer Netherlands.

Eder, B. L., & Neely, B. C. (2013). Use of geographic information systems by fisheries management agencies. Fisheries, 38(11), 491-496.

The power of blood analysis in fish health

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The Importance of Blood Analysis in Fish Welfare

Blood analysis provides valuable information about fish health, including their neuroendocrine and immune systems, the effects of stress, diseases, and genetic traits (Esmaeili, 2021; Seibel et al., 2021). Despite its potential, it is not commonly used in fish research or farming. Modern techniques have moved beyond traditional methods like using antibodies or PCR (a method to amplify DNA). Now, scientists use advanced methods such as studying RNA (transcriptomics), small molecules in cells (metabolomics), and proteins (proteomics). These new techniques can give a detailed and comprehensive view of how fish's endocrine, immune, reproductive, and genetic systems function in different environments.

Hematological Indicators of Fish Welfare

Hematological indicators are vital tools for assessing the physiological state and overall welfare of fish (Seibel et al., 2021). These indicators include various blood parameters that can reflect the health status, stress

levels, and immune responses of fish (Esmaeili, 2021). Here, we delve into the key hematological indicators commonly used to evaluate fish welfare:

Cortisol:

Cortisol is a primary stress hormone in fish, released by the adrenal gland in response to stressors. Elevated cortisol levels indicate acute or chronic stress, which can result from poor water quality, overcrowding, handling, or disease. Measuring cortisol provides insight into the fish's endocrine stress response and overall welfare.

Glucose:

Blood glucose levels rise in response to stress as part of the secondary stress response, providing the energy needed to cope with adverse conditions. High glucose levels can indicate stress or metabolic disturbances, while persistently elevated levels may suggest chronic stress or disease.

Lactate:

Lactate is produced during anaerobic metabolism, typically increasing under stress or intense physical activity. Elevated lactate levels can signal hypoxia, poor water quality, or excessive handling, offering another measure of stress and physiological strain in fish.

Hematocrit (Packed Cell Volume):

Hematocrit measures the proportion of red blood cells (RBCs) in the blood, reflecting oxygen-carrying capacity. Changes in hematocrit can indicate anemia, dehydration, or hypoxia. High hematocrit levels may result from dehydration or stress-induced splenic contraction, while low levels can suggest anemia or blood loss (Chen and Luo, 2023).

Red Blood Cell (RBC) Count and Hemoglobin Concentration:

RBC count and hemoglobin concentration are critical for evaluating the oxygen transport capacity of the blood. Variations in these parameters can indicate anemia, hypoxia, or other health issues. These metrics are particularly important in assessing the fish's ability to cope with environmental challenges.

White Blood Cell (WBC) Count:

WBCs are integral to the immune response. Elevated WBC counts can indicate infection or inflammation, while low counts may suggest immunosuppression. Differential WBC counts, including lymphocytes, neutrophils, eosinophils, and monocytes, provide detailed information about immune system status and responses to stress or disease.

Electrolyte Balance:

Electrolytes such as sodium, potassium, and chloride are essential for maintaining osmotic balance and cellular function. Stress and poor water quality can disrupt electrolyte balance, leading to physiological disturbances. Monitoring electrolyte levels helps assess the impact of environmental and husbandry conditions on fish health.

Total Protein and Albumin/Globulin Ratio:

Total protein levels, along with the albumin/globulin (A/G) ratio, provide insights into nutritional status, liver function, and immune health. Changes in these parameters can indicate malnutrition, liver dysfunction, or immune responses (Chen and Luo, 2023).

Plasma Enzyme Activities:

Enzymes such as alanine aminotransferase (ALT), aspartate aminotransferase (AST), and alkaline phosphatase (ALP) are markers of liver and muscle health. Elevated enzyme activities can signal tissue damage, liver stress, or metabolic disturbances.

Oxidative Stress Markers:

Oxidative stress markers, including malondialdehyde (MDA) and superoxide dismutase (SOD), indicate the balance between reactive oxygen species (ROS) production and antioxidant defenses. High levels of oxidative stress markers suggest cellular damage and can be linked to poor water quality, toxins, or nutritional deficiencies (Chen and Luo, 2023).

Challenges and Considerations

Despite the utility of hematological indicators, several challenges exist in their application:

- **Standardization:**

There is a need for standardized protocols to ensure consistency in sampling, handling, and analysis.

- **Species-Specific Baselines:**

Different fish species have varying baseline hematological values, requiring species-specific reference ranges.

- **Environmental and Seasonal Variations:**

Environmental conditions and seasonal changes can influence hematological parameters, complicating the interpretation of results.

- **Integrated Approaches:**

Combining hematological data with other physiological and behavioral assessments can provide a more holistic view of fish welfare.

Conclusions

Blood analysis is a powerful tool for assessing fish welfare, providing detailed information on physiological responses to environmental and husbandry conditions. The adoption of advanced techniques and standardized protocols can improve welfare monitoring and support the development of welfare-friendly aquaculture practices. Continued research and innovation in this field are essential for sustainable aquaculture and the well-being of farmed fish.

Further reading

Chen, H., & Luo, D. (2023). Application of haematology parameters for health management in fish farms. Reviews in Aquaculture, 15(2), 704-737.

Esmaeili, N. (2021). Blood performance: a new formula for fish growth and health. Biology, 10(12), 1236.

Seibel, H., Baßmann, B., & Rebl, A. (2021). Blood will tell: what hematological analyses can reveal about fish welfare. Frontiers in Veterinary Science, 8, 616955.

Insights from the **World of Fisheries and Aquaculture**

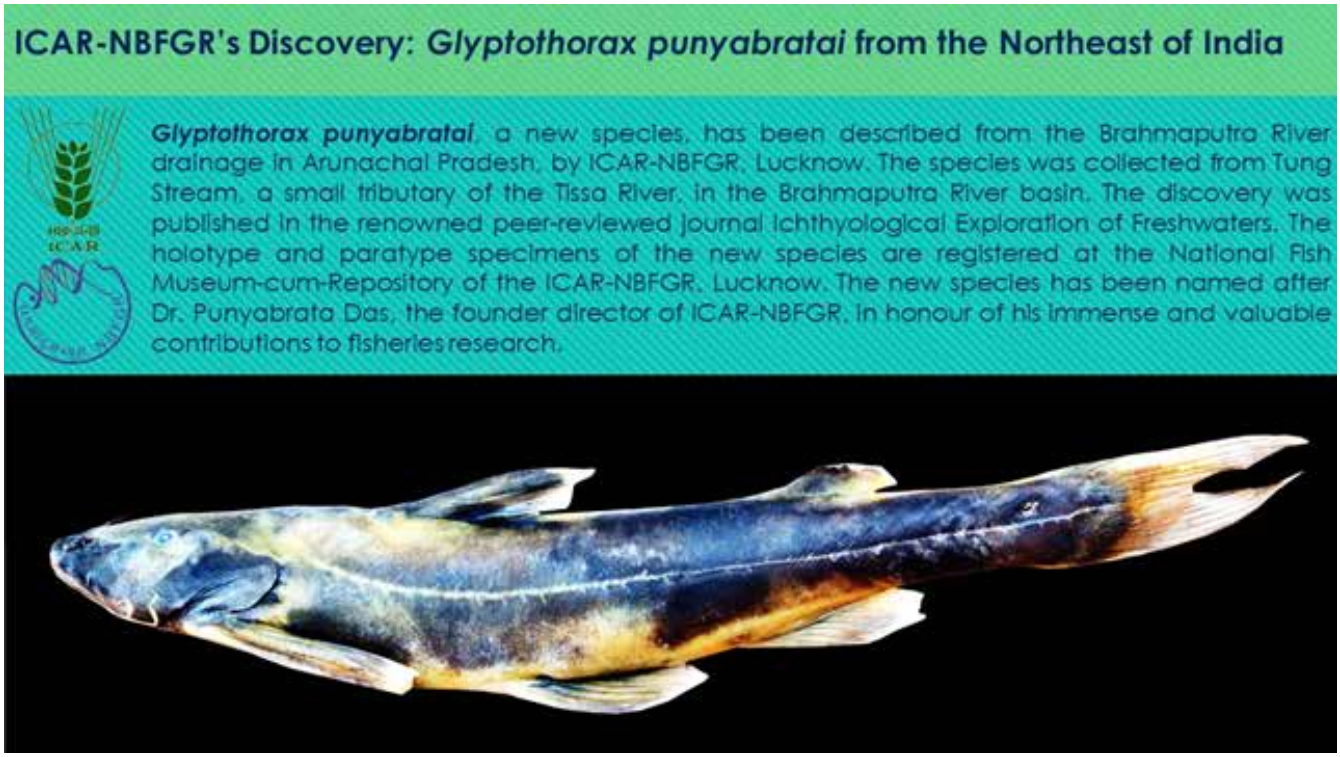
Global Record:

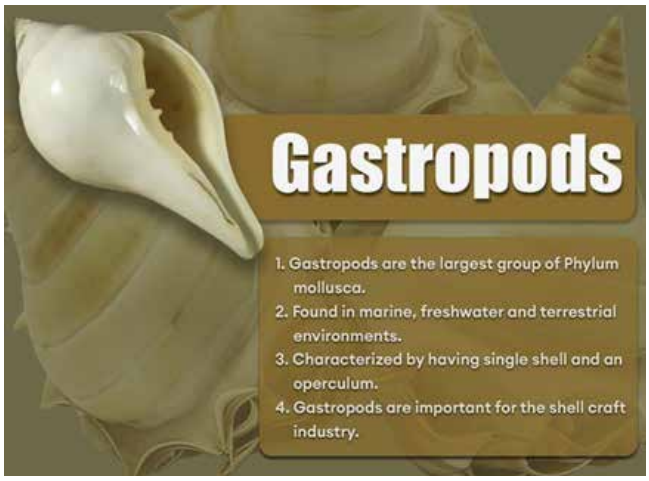
Total world fisheries production hit an all-time high of 186.6 million tons in 2023.

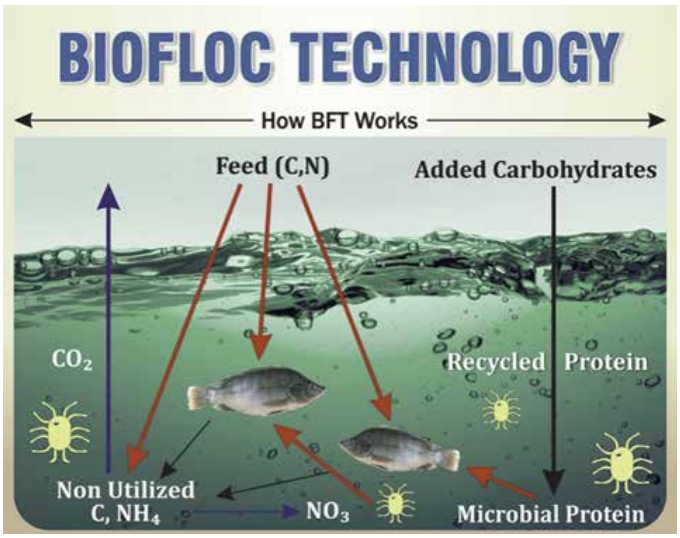
Indian Scenario

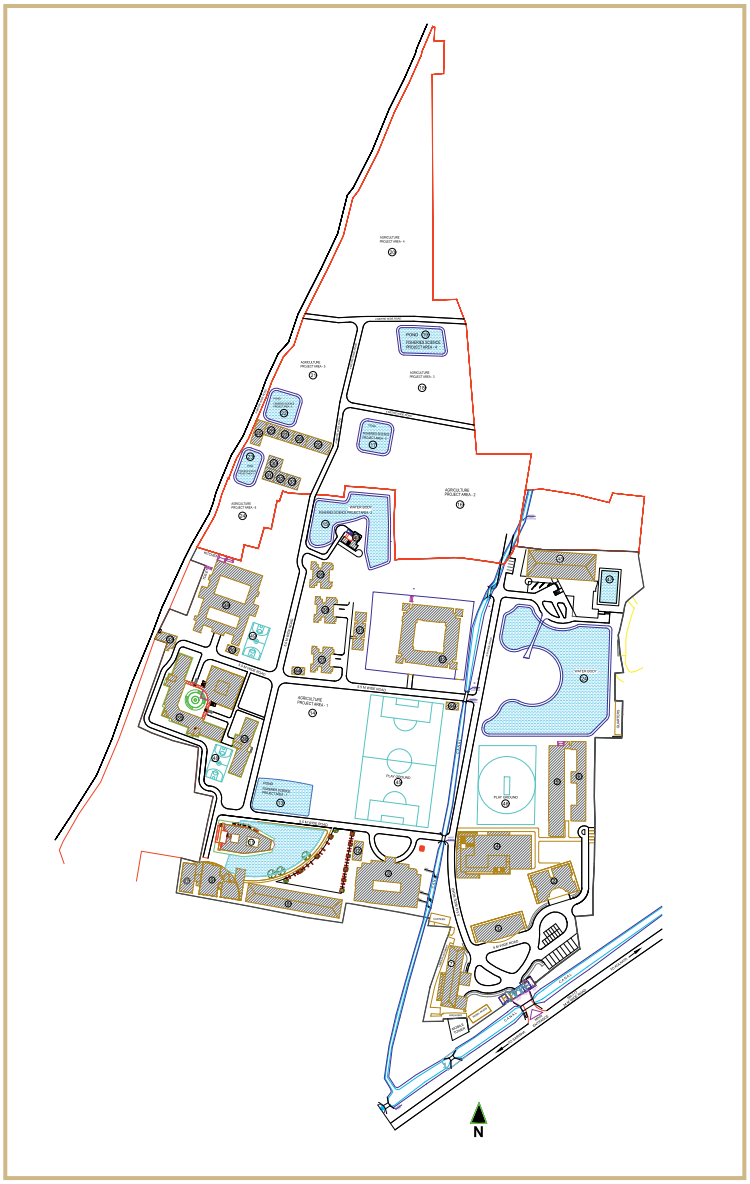
Indian Fish Production touched all time high of 175.45 Lakh Tonnes*

Courtesy: DoF, 2023 2024*


ICAR-NBFGR's Discovery: Glyptothorax punyabratai from the Northeast of India
Glyptothorax punyabratai, a new species, has been described from the Brahmaputra River drainage in Arunachal Pradesh, by ICAR-NBFGR, Lucknow. The species was collected from Tung Stream, a small tributary of the Tissa River, in the Brahmaputra River basin. The discovery was published in the renowned peer-reviewed journal Ichthyological Exploration of Freshwaters. The holotype and paratype specimens of the new species are registered at the National Fish Museum-cum-Repository of the ICAR-NBFGR, Lucknow. The new species has been named after Dr. Punyabrata Das, the founder director of ICAR-NBFGR, in honour of his immense and valuable contributions to fisheries research.


Gastropods
1. Gastropods are the largest group of Phylum mollusca.
2. Found in marine, freshwater and terrestrial environments.
3. Characterized by having single shell and an operculum.
4. Gastropods are important for the shell craft industry.


BIOFLOC TECHNOLOGY
How BFT Works
Feed (C,N)
Added Carbohydrates
CO_2
Recycled Protein
Non Utilized
C, NH_4
NO_3
Microbial Protein



LEGEND- BUILDING

A. ADMINISTRATIVE BLOCK

1. ADMINISTRATIVE BUILDING (G + V)

B. ACADEMICS BLOCK

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

C. AGRICULTURE & FISHERY SCIENCE BLOCK

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

D. RESIDENTIAL BLOCK

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

E. UTILITY & SERVICES BLOCK

43. ELECTRICAL ROOM
44. PUMP ROOM

F. RECREATIONAL BLOCK

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

G. HEALTH BLOCK

50. MEDICAL UNIT

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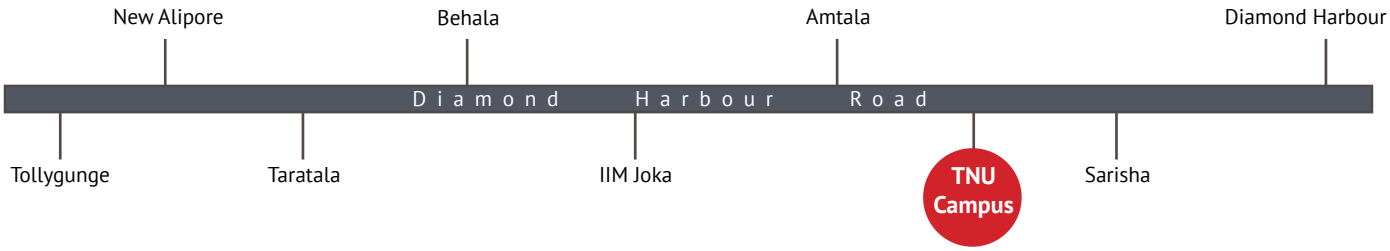

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