



BOOK OF ABSTRACT ON ADVANCES IN ENVIRONMENT MANAGEMENT FOR SUSTAINABLE FISHERIES & LIVESTOCK PRODUCTION

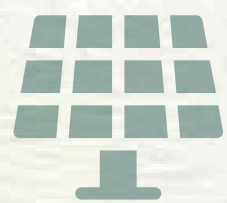
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Editors

V. P. Saini
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Book of Abstracts
On
**Advances in Environment Management for Sustainable
Fisheries & livestock production**

Editors

**V. P. Saini
Chandrahas
Ashutosh Kumar Singh
Tapas Paul
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National Bank for Agriculture and Rural Development

Book of Abstracts on Advances in Environment Management for Sustainable Fisheries & livestock production

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Cover Design: Mr. Tushar Kumar

Published By: Dean, College of Fisheries, Kishanganj
Bihar Animal Sciences University, Patna

Year of Publication: 2024

ISBN No. 978-81-963832-4-4

Citation: Saini, V. P., Chandrabhas, Singh, A. K., Paul, T., Thakur, A., Kumari, M., Dar, S. A., (Eds.). 2024. Book of Abstracts on Advances in Environment Management for Sustainable Fisheries & livestock production. College of Fisheries, Kishanganj, Bihar Animal Sciences University, India. pp. 94. ISBN 978-81-963832-4-4

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Printer: Anant Printing Press, Kishanganj, Bihar, India

पत्रांक : 1130/FIN

दिनांक : 15-11-2024

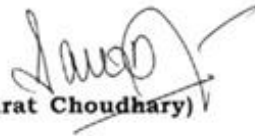


Message

It is quite gratifying to note that Department of Aquatic Environment Management, College of Fisheries, Kishanganj is organizing **National Seminar on "Advances in Environment Management for Sustainable Fisheries and Livestock Production (AEMS-2024)"** at College of Fisheries (BASU), Kishanganj from 18-19th November, 2024.

The theme of this year's Seminar will focus on sustainable environment management for fisheries and livestock production. I'm aware that this Seminar is full with eminent speakers, a presentation of an innovative research study, and invited speeches. This will undoubtedly contribute to enhancing the knowledge of the participants in environmental sciences. Such a large meeting cannot be arranged without total dedication and assistance, participation of numerous individuals, including faculty, students, and sponsors.

I send my hearty wishes on the successful organization of the Seminar. I strongly believe that this Seminar will aid future research initiatives and become the impetus for the interchange of research concepts.



(Samrat Choudhary)

Renu Devi

Minister

Animal & Fisheries Resources Department

Government of Bihar



Govt. of Bihar



Message

I am delighted to learn that Department of Aquatic Environment Management, College of Fisheries, Kishanganj is organizing **National Seminar on “Advances in Environment Management for Sustainable Fisheries and Livestock Production (AEMS-2024)”** at College of Fisheries (BASU), Kishanganj from 18-19st November, 2024.

I believe that the seminar would definitely be a forerunner towards reorienting our approach to sustain production without any harm to environment. I hope the seminar will identify and bring out new strategies and path ways to develop eco-friendly fisheries and livestock production technologies for attaining food and nutritional security.

My hearty wishes for the organizers for a great success of the seminar and congratulations to the College of Fisheries, Kishanganj for hosting the seminar, discussing the contemporary issues involved in Indian aquaculture and livestock sector.

Smt. Renu Devi)

Dr. N. Vijaya Lakshmi, I.A.S., Ph.D

डा० एन० विजयलक्ष्मी, भा.प्र.से., पी.एच.डी.

Principal Secretary

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Message

I am happy to note that a **National Seminar on "Advances in Environment Management for Sustainable Fisheries and Livestock Production (AEMS-2024)"** is scheduled to be held at College of Fisheries (BASU), Kishanganj from 18-19th November, 2024. Keeping in view the state of food and nutrition security in the country and the UN Agenda 2030, the theme of the Seminar is very timely and relevant.

The prospects for increasing the standard of living and achieving comprehensive food and nutritional security will rely on sustainable environmental management. It calls for a focussed approach on innovations, technology and planning in transformation of our social, economic, and environmental settings. A substantial part of our fisheries and animal husbandary growth thus must come through the application of innovative technologies at different segments of value chain to promote both food security and nutritional security. I believe that the Seminar will discuss these aspects in detail and come up with effective action plans for alleviating poverty and hunger through eco-friendly fisheries and livestock production.

I appreciate the efforts of the organizing committee, and all other stake holders involved in organizing this Seminar.

I wish the Seminar a great success.

(Dr. N. Vijaya Lakshmi)



डॉ० डी०आर० सिंह
कुलपति
Dr. D.R. Singh
Vice-Chancellor

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Message

It gives me a great sense of pride to mention that the **National Seminar on “Advances in Environment Management for Sustainable Fisheries and Livestock Production (AEMS-2024)”** is being organized by the Department of Aquatic Environment management, College of Fisheries Kishanganj from 18-19th November, 2024.

Fisheries science sector is one of the principal sources of livelihood for a large section of the economically underprivileged population of the country. This sector has grown up tremendously since last decade and are supporting economic growth & prosperity of the country. However, with the increase in urbanization and population this sector is facing new challenges including environmental aspects in terms of pollution, climate change, antimicrobial resistance etc. It is the need of the hour to focus on environmentally sound aquaculture and fish production keeping in focus to emerging environmental issues.

I believe that the seminar would definitely be a forerunner towards reorienting our approach to sustain production without any harm to environment. I hope the seminar will identify and bring out new strategies and path ways to develop eco-friendly fisheries production technologies for attaining food and nutritional security.

I sincerely appreciate the academics and scientists from different regions of the nation and the dedicated organizing committee for organizing this conference for the benefit of all and the generations to come.


(D. R. Singh)



Message

I am highly pleased to know that the **National Seminar on "Advances in Environment Management for Sustainable Fisheries and Livestock Production (AEMS-2024)"** is being organized by the Department of Aquatic environment Management, College of Fisheries, Kishanganj from 18-19th November, 2024.

I am glad that the College of Fisheries, Kishanganj is planning to discuss on the diversified issues, inviting experts and students to discuss the merits and relevance of the issues on environment management for sustainable fisheries and livestock production. I look forward for the effective knowledge sharing which will help making major reforms in fisheries and livestock sectors and in the production of nutritious and energy rich food to all sections of the people.

I anticipate this conference to discuss the eco-friendly innovations in aquaculture and livestock sector for uplifting economically underprivileged population of the country. As India is a fast developing country, no future generation should be malnourished. I believe that the National Seminar would pave a path for it.

I convey my best wishes to the organizers and congratulate College of Fisheries, Kishanganj for organizing a wonderful Seminar.

(Dr. Dilip Kumar)
Chief Technical Advisor at FAO-Myanmar
& Former Director & Vice-Chancellor, ICAR-
CIFE



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Date: 04.11.2024

MESSAGE

It gives me immense pleasure to know that Department of Aquatic Environment Management of College of Fisheries, Kishanganj, Behar, India is going to organize a 2-day National Seminar on "Advances in Environment Management for Sustainable Fisheries & Livestock Production" during 18-19th November, 2024.

The United Nations has established 17 Sustainable Development Goals, also known as SDGs, with the aim of ensuring that everyone lives well in a healthy world by 2047. Aquatic resources have directly helped nine to ten goals out of seventeen SDGs. According to World Bank projections, there will be nine billion people on Earth by the year 2050 (FAO, 2010). It shouldn't be easy to meet the demands for fisheries, crops, fuel, fiber, food, and cattle. In the near future, there will be a lot of obstacles to overcome, like starvation, malnutrition, poor health, and biodiversity loss. These difficulties also serve as roadblocks to human advancement.

The Fisheries and Livestock sector, crucial for underprivileged populations, faces environmental challenges like pollution and climate change. This seminar aims to provide a national platform for researchers to discuss "Advances in Environment Management for Sustainable Fisheries and Livestock Production (AEMS-2024)" focusing on environmental biotechnology, eco-friendly food production, health, and biodiversity conservation.

I congratulate Dr. V. P. Saini, Chairperson and Dean College of Fisheries, Kishanganj India and other members of the entire team for taking up this difficult and significant assignment. I thus have great expectations that the two days of the conference will be filled with stimulating discussion and debate that will lead to the development of preliminary answers to the issues that are now being considered.

Lastly, I hope the conference achieves its goals and fulfills its mission with great success.

(Prof. Dr. Binay Kumar Chakraborty)

Preface

It is with immense pleasure and gratitude that we present this Book of Abstracts as a part of National Seminar on “Advances in Environment Management for Sustainable Fisheries and Livestock Production (AEMS-2024)” is being organized by the Department of Aquatic Environment Management, College of Fisheries, Kishanganj from 18-19th November, 2024. Since its establishment, the College of Fisheries, Kishanganj has been at the forefront of promoting awareness and tirelessly working towards the sustainable development of fisheries in Bihar. This seminar serves as a platform for discussing crucial issues related to the advancement of the fields, with a particular focus on eco-friendly sustainable fish and livestock production. By exploring transformative technologies, we aim to address the challenges posed by climate change and ensure food security. We envision that this seminar will attract substantial investment and inspire technological innovations, including start-ups, to generate employment opportunities and enhance sustainable production in the face of a growing population. By improving incomes and livelihoods in the fisheries and livestock sector, we can elevate the quality of employment and living standards, thereby contributing significantly to its overall development within a limited timeframe. We extend our heartfelt appreciation to all the participants, organizers, and sponsors who have contributed their valuable insights, suggestions, and unwavering support in organizing this remarkable event. **The financial assistance received from Research and Development Fund of National Bank for Agriculture and Rural Development (NABARD) towards printing of the proceedings of the seminar is gratefully acknowledged.** We anticipate an extraordinary Seminar and wish the AEMS-2024 great success.

Editors

Theme I: Eco-friendly Sustainable Fish and Livestock Production

ECO/AEMS/01

Downstream Processing of *Spirulina platensis* Biomass for Sustainable Vegan Protein Hydrolysates: Process Optimization and Evaluation in Microbiological Media

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Abstract

The aim of the present study was to mass cultivate the protein-rich microalgae, *Spirulina platensis* in a low-cost medium in a newly designed Photobioreactor for extraction of protein hydrolysate and to evaluate its performance in microbiological media. The specific growth rate of spirulina platensis in CIFE medium was .304 day⁻¹ and doubling time 2.803 days. The protein content of *Spirulina platensis* was estimated to be 66.754 % (per dry weight). The study also focussed on the optimisation of process parameters for enzymatic hydrolysis of *Spirulina platensis* by papain enzyme. The influence of three process parameters, including temperature, pH and enzyme-substrate ratio, on the degree of hydrolysis was examined. The optimum temperature was 58.208 °C, pH 6.7829 and enzyme-substrate ratio 4.878% obtaining a degree of hydrolysis of 37.05%. A study was conducted by comparing the performance of a spirulina protein hydrolysate and commercial peptone in microbiological media. Spirulina peptone (SP) based broth and agar media showed better growth for both Gram-positive and negative bacteria. All bacterial species exhibited better growth in terms of specific growth and productivity of media. *Escherichia coli*, *Staphylococcus aureus*, and *Bacillus subtilis*. exhibited 52.6%, 10.15%, 27.94% higher growth when compared with commercial peptone-based media. The growth curve also analysis indicated a higher rate of growth on SP compared to the commercial peptone. The productivity of SP-based media was greater than 1 for all bacterial strains. The biological reactivity of media was also confirmed by biochemical tests. SP-based alkaline peptone water (APW) enrichment broth and thiosulphate citrate bile salts sucrose (TCBS) agar were used for the selective enrichment and isolation of *Vibrio* spp. from marine environmental samples. Isolation rates of *Vibrio* spp. on SP-containing media were similar and comparable with commercial peptone-containing media. Using peptone from spirulina not only addresses the issue of safety concerns but also environmental issues.

Keywords: *Spirulina platensis*, Photobioreactor, CIFE medium, Protein Hydrolysate, Response surface methodology, Papain, Productivity

Dietary Supplementation of Formulated Fish Specific Mineral Mixture Improved Growth, Nutrient Composition and Haematological Parameters of *Cyprinus carpio* Fingerlings

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Abstract

The present study was undertaken to study the effect of formulated fish specific mineral mixture on growth, nutrient composition and haematological parameters of *Cyprinus carpio*. The experiment consists of five treatments (T1-T5, in triplicate), basal diet consisted of rice bran (49-50%), mustard oil (48.5-49%), mineral mixture (0-2%) and salt (0.5%), positive control with commercially available mineral mixture (T1) and negative control without any mineral mixture (T2) and three (T3-T5) treatments supplemented with formulated mineral mixture (as per ICAR, 2013 recommendations) at three inclusion levels 1%, 1.5% and 2% respectively. Formulated mineral supplementation have significantly improved ($P<0.05$) the growth performance such as final weight, weight gain, specific growth rate of *C. carpio* fingerlings as compared to the non-supplemented group (T2). Besides, the protein efficiency ratio and feed conversion ratio was found to be significantly better ($P<0.05$) in the T4 group. Additionally, mineral mixture significantly ($P<0.05$) improved flesh quality in terms of total protein and lipid content. Moreover, the haematological parameters including hemoglobin, hematocrit, total erythrocyte Count, total leucocyte count, mean corpuscular volume, mean corpuscular haemoglobin and mean cell hemoglobin concentration were also significantly ($P<0.05$) improved and recorded best @ 1.5% (T4) of total fish feed over non supplemented group. The data obtained in the present study will be helpful in increasing the fish production and productivity in sustainable way and helpful for various stakeholders including fish farmers, entrepreneurs and feed industry.

Keywords: Mineral Mixture, *Cyprinus carpio*, Growth, Health, Nutrient Composition

ECO/AEMS/03

Comprehensive Economic Assessment of Oil and Bypass Fat Supplementation in Goat Kid Nutrition

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Abstract

An experiment was conducted to study the effect of dietary fat supplementation on growth performance and economics in goats. A total of 30 goat kids for a period of 90 days were used in this study. Goat kids were randomly divided into five groups having 6 animal in each i.e. T, (Basal ration), Tz (Basal ration + 20g linseed oil/animal/day), T, (Basal ration + 20g linseed oil bypass fat/animal/day), T4 (Basal ration + 20g rice bran oil/animal/day) and Ts (Basal ration + 20g rice bran oil bypass fat/animal/day). The basal ration was formulated as per ICAR (2013). Average body weight gain in kg and average daily gain (g/d) were significantly ($p < 0.05$) higher for supplemented groups than control group. The cost of feed per kilogram of body weight gain was lowest in Ts, followed by T3, and Ti, while it was found highest in the oil supplemented groups (T4 and 12). The cost of feeding (Rs/day) of oil supplemented group was 7.13% higher than control group, and cost of feeding (Rs/day) in bypass fat supplemented group was 19.64% higher than the control group.

Keywords: Goat, Bypass Fat, Economics, Linseed, Rice bran oil

BCD AI / ML May Tell That All Rising Temperature Leads to Total Dissolved Solids TDS, Digital Cation Exchange Capacity Result Non-Migration, Non-Growth, Diseases, Non-Maturity and Every Hazards Alternative Path is Digital Hydroponic

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&DBT, Chandigarh University, Chandigarh, India

Abstract

Water has got many important qualities and parameters have roles in Fisheries. This AI/ML measures digitally most important water quality parameters digital CEC Cation Exchange capacity and TDS i.e. Total Dissolved Solids in water can be sensed digitally either TDS meter, osmometer, optical density with spectrophotometer, Satellite imagery or by visual means having huge negative impacts in every Biology. Lowering digital TDS of water research studies often found higher growth, fecundity etc. Study in fresh water finds that TDS values may ranging 0 ppm to 550 ppm. Lower TDS values help in congenial Fisheries. Rising water temperature helps TDS value of water to rise low to higher and thus resulting stresses among the species in Ecology owing to rising TDS. Automation in Fisheries can change TDS value of water and sustainances in Fisheries can be maintained. Research study found that no Inland Fish species other than Anabas and Tilapia can breed naturally beyond the TDS 195 ppm. All fish prefer to migrate in Fresh water having least digital TDS and fish breeds. Any ypong fish may remigrate to higher TDS waters. In first instances how faster a fish can migrates $Y = -5X + 475.8$, $R^2 = 0.9$, This linear formula can be applicable to any Fish species. Y 100 denotes the fullest or maximum agility, gradual change in agility of fish species depending on changes of TDS being x ppm in any fresh water. We maintain optimum TDS depending on species can be reared, cultured or bred based on digital Environment Editing Model of EEM on TDS. Finally we say Fish just an experimental species this phenomena is applicable to all animals, and every mankind. Apart from very crucial digital CEC Cation exchange capacity, we have all digital DISPER EEM program disease percentage zero with Environment Editing Program in achieving zero diseases, globally. Here a rising TDS in aquatics actually in all inclusive metals, heavy metals undesired elements that inhibit every anabolic reactions and in by inhibiting every Biology to remain inactive. Latest Beyond Central Dogma Model BCD suggests digital Hydroponic in low TDS too preferred to avoid most Metal elements to Animals and Human.

Keywords: Digital Inland Fisheries, Digital DISEPER EEM program

P-lined Biofloc System: An Advanced Aquaculture System for Quality Seed Rearing in Bihar

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Abstract

The rise of sustainable aquaculture is significantly shaping global fisheries development by enhancing production, conservation, and resource augmentation. A shift towards resource-specific aquaculture practices is being observed, characterized by the adoption of diverse species, processes, and cultural systems. In Bihar, India, biofloc coupled with P-lined pond based culture system has shown remarkable potential for optimizing water resource utilization. The technology is ushering in a new era in aquaculture by enabling higher production densities within limited space, while mitigating risks associated with water quality management, environmental stress and frequent occurrence of diseases. This method has proven to be highly effective for seed rearing and growth phase development, particularly for species like Indian Major Carps, Silver Carp, Grass Carp, Common Carp, Roopchanda, and Koi Carp. Rearing spawn, fry, and fingerlings in these biofloc systems has resulted in minimal mortality rates and significantly enhanced productivity, achieving yields 5 to 6 times higher than conventional aquaculture methods. The system also shortens the culture window, making it a time-efficient approach. Furthermore, the feed conversion ratio (FCR) of biofloc-cultured organisms is notably improved, ranging from 1.2 to 1.4, compared to 1.7 to 2.0 in traditional systems. This enhanced FCR not only reduces feed costs but also supports more sustainable resource use. The superior performance of biofloc-reared seeds in growout systems further emphasizes the system's efficacy. This biofloc-based technique not only optimizes the rearing of commercially important species but also offers a climate-resilient approach to aquaculture. Given its promising results in terms of both productivity and resource efficiency, P-lined biofloc pond systems hold significant potential for advancing sustainable aquaculture in Bihar and similar regions. This approach provides a viable pathway to support both ecological balance and economic growth in the aquaculture sector.

Keywords: Seed rearing, Outdoor Biofloc Technology, Sustainable aquaculture, P-lined system

Evaluation of the Properties of Freeze-dried Visceral Protein Hydrolysate from *Pangasianodon hypophthalmus* (Sauvag, 1978) Extracted by Enzymatic and Chemical Methods

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Abstract

Protein hydrolysate prepared from visceral part of *Pangasianodon hypophthalmus* processing waste. Fish processing waste contain high amount peptides which have better nutritional and functional properties. Freeze dried visceral protein hydrolysate extracted from *Pangasianodon hypophthalmus* processing waste using enzyme such pepsin, papain and hydrochloric acid and sodium hydroxide used as chemical treatments. In this studied shown different treatment effects on yield, chemical composition, colour and functional properties. It was observed that the treatment with the pepsin demonstrated significantly ($p < 0.05$) had better degree of hydrolysis (64.08 ± 0.073), protein percentage (75.06 ± 0.89), L^* value (68.39 ± 0.39). Functional properties of alkali extracted freeze dried visceral protein hydrolysate has better than among the other treatments. The colour of hydrolysate varied from lighter to dark with better emulsification properties depend on the treatments. Freeze dried of acid extracted visceral protein hydrolysate had lower turbidity with increasing the pH. Enzyme and chemical extract hydrolysate observed lowest solubility at 5 pH, whereas lowest foaming capacity and stability of papain, pepsin and alkali extracted freeze dried hydrolysates observed at 5 pH and acid extracted fish protein hydrolysate observed at 3 pH. This study indicated that the possibility of extracting peptides with good functional properties higher in enzyme in comparison to chemical. The content of bioactive peptides could make the *Pangasius* visceral protein hydrolysate prepared with enzyme and chemical both are suitable for protein extraction and use for incorporation in food for increasing its functional properties.

Keywords: Fish Viscera, Protein Hydrolysate, Freeze Dryer, Degree of Hydrolysis

Wound Management in Catfishes and its Healing Mechanism

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and Rajesh Kumar**

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Abstract

Catfishes are considered medicinal fish, traditionally used to treat many human diseases. From times, its consumption is prescribed prophylactically to anaemic and malnourished patients due to its nutritional superiority. Wounds on fish skin occur frequently in aquaculture, particularly in catfishes; moreover, in intensified aquaculture production systems, these injuries create a higher chance of mortality. Any interruptions in the skin, such as removal of mucus, scale or deeper incisions, are negatively correlated with barrier functions and disease resistance. Wounds are invincible events in catfish, and they remain a challenging clinical problem that requires superior management practices. The present review emphasises the microarchitecture of the fish skin, particularly in regenerative processes and healing cascades of mechanical-induced wounds in fish, skin resilience and barrier function. The current knowledge on wound healing mechanisms in fish is summarized in five focus areas: the Anatomy and functions of fish skin, techniques to wreak mechanical skin damage in fish during experiments, mechanisms for healing deep wounds in fishes, *in-vitro* models for wound healing studies and wound care and management with a focus on different factors that may cause delays these regenerative processes.

Keywords: Wounds, Healing, Catfish, Skin, Medicinal

Do Fisheries of Rudrasagar Lake in North-Eastern India Boom or Bust? A fish Stock Assessment-Based Introspection

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Abstract

Rudrasagar Lake in North-eastern India has been identified as one of the wetlands of National Importance of conservation and a Ramsar site of international importance. The Lake is recorded to have high fish diversity and is subjected to commercial fish harvesting regularly. However, whether the fisheries in the lake is done in sustainable way or whether some species already over-exploited and urgently need were not been investigated yet. Under this background, two species of different taxonomic families viz., *Anabas testudineus* and *Mystus bleekeri* were selected for detailed stock assessment studies using FiSAT software (version 1.2.2) in the Lake from June 2021 to May 2022. Various population dynamic parameters and VPA and Thompson and Bell Models were elucidated. The growth parameters ' L_{∞} ' and ' K ', mortality rate ' Z ', the natural mortality coefficient ' M ' and the Fishing mortality coefficient (F) were analyzed for the respective fish species. Based on the above results, the exploitation ratio (E), exploitation rate (U) and the MSY were also worked out. Values for ' E ' and ' U ' were higher (>0.5) for the species studied indicating the possibilities of over exploitation. This finding is further supported by a higher fishing mortality than Natural Mortality. Since the fishing level (F factor = 1) was higher than the estimated $fMSY$, for sustainable fishery, it is suggested to reduce the fishing effort by 10-20% for the different fish species in the Lake. The results of the study would be helpful for sustaining capture fisheries production of commercially important fishes in the Lake through scientific intervention and monitor the status of their stocks for timely advising the fishermen who directly depend on the Lake recourses for their livelihood.

Keywords: Population parameters, Stock assessment, Fisheries sustainability, Rudrasagar Lake.

**Seasonal Dynamics of Reproductive Performance in
Amblypharyngodon mola in Tripura**

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College of Fisheries, Lembucherra

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Abstract

This study investigates the reproductive cycle of *Amblypharyngodon mola* (Mola Carplet) over the first six months of the year, focusing on key maturation parameters such as fecundity, gonad weight, Gonado-Somatic Index (GSI), ova diameter, and histological changes in the ovaries and testes. Data were collected monthly and analyzed to observe seasonal variations in reproductive readiness. Fecundity, GSI, gonad weight, and ova diameter all showed a significant increase from January to June, peaking during the pre-spawning and spawning season (May and June). The lowest fecundity was recorded in January (976 ± 26.7), rising to the highest in June (3420 ± 49.1). Similarly, the GSI and ova diameter were lowest in January ($81.3 \pm 1.31 \mu\text{m}$) and highest in June ($153 \pm 3.48 \mu\text{m}$). A statistically significant difference ($p < 0.05$) was observed in all parameters across months, reflecting the reproductive cycle's progression. Histological analysis of gonads further supported these findings. During January and February the ovaries were dominated by perinuclear and alveolar oocytes, representing the pre-spawning phase. By March and April, early and mid-vitellogenic oocytes were observed, marking the start of maturation. In May, both mid and late vitellogenic oocytes were noted, indicating the peak of spawning readiness. By June the ovaries contained late vitellogenic and spawning oocytes, signaling the culmination of the reproductive cycle. This research highlights the reproductive dynamics of *A. mola*, with a clear seasonal peak in late spring, providing valuable insights into its breeding biology. Understanding these reproductive patterns is critical for optimizing captive breeding programs and conservation strategies aimed at sustaining the species.

Keywords: *Amblypharyngodon mola*, Reproductive cycle, Histological analysis, Seasonal dynamics, Breeding biology

Transforming Fish Processing Waste into Functional Food Ingredients and Nutraceuticals

Hanjabam Mandakini Devi*

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Abstract

Fish processing waste is defined as fish material left over after primary processing during the fish manufacturing process. The wastes in the form of scales, skin, head, viscera, bones, frames etc. comprised of around 50-80 % of the whole fish. Such fish wastes is a great source of minerals, proteins and fat. Therefore, fishery waste is commonly utilized for the production of fish meal or fish oil, fish silage and manure. However, other possible utilization of processing waste would be manufacturing of valuable biomolecules such as collagen and gelatin. About 30% of the wastes consists of skin and bone with a high collagen content. Collagen and gelatin are widely used as functional food ingredients and nutraceuticals. Pink perch refiner discard composed of 28.70 % scale and 7.91 % bones. Tilapia waste composition consists of 6.78 % skin, 12.64 % frame and 26.01 % head. Leather jacket waste composed of 26.90 % head, 17.21 % frame and fins, 5.11 % skins, and 8.84 % viscera. The yield of gelatin from the pink perch refiner discard is 15.60 % while that of leather jacket skin is 10.56 %. The gel strength of gelatin from pink perch refiner discard and leather jacket fish skin were 143.97 g and 165.7g respectively. Tilapia skin gelatin was hydrolyzed to produced gelatin hydrolysate. The molecular weight of the obtained hydrolysate is in the range of 5.0-25 kDa and found to have higher DPPH activity than parent gelatin (25 % DPPH). Therefore, fish processing waste can be transformed onto compounds having potential functional food ingredients and nutraceuticals.

Keywords: Waste, Transformation, Gelatin, Hydrolysate

Spatial Variations of Water Fertility in Relation to Primary Productivity in Short Seasonal Irrigation Tanks: The Example of Thanjavur, Tamil Nadu, India

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Abstract

In the current study, three short seasonal irrigation tanks (two experiments and one control) from Thanjavur was undertaken, to correlate the water fertility in short seasonal irrigation tanks with primary productivity during 2024. During the study period Allur Eri, Panavelli Eri, and Valambakudi Eri (short seasonal irrigation tanks) were explored so as to study the spatial variation in Gross Primary Productivity (GPP), Net Primary Productivity (NPP) and Community respiration (CR). The study revealed that GPP, NPP and CR were optimum during monsoon season while lower during inter-monsoon period. Primary productivity is an important biological phenomenon in directly or indirectly. The importance of primary productivity in an aquatic ecosystem is realized for estimating the productive capacity. It shows nature of ecosystem, its tropic level and availability of energy for secondary and tertiary producers. Primary productivity is the major component for the fish production and the potential of fish production can be estimated by primary production. Primary production is influenced by biotic as well as abiotic interactions. During study period it has also been observed that the GPP, NPP and CR values varied from site to site but the fluctuation is negligible. The results showed that temperature, nutrients, precipitation and sunshine percentage contributed significantly to spatial variations of GPP, NPP and CR in the study areas.

Keywords: Primary Productivity; Fertility; Short Seasonal Irrigation tanks; Fish Production

Assessment of Water Quality in Relation to Culture Fisheries in Long Seasonal Irrigation Tanks: A Study in Trichy District, Tamil Nadu, India (Cauvery Delta)

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Abstract

In the present study, four long seasonal irrigation tanks (three experiments and one control) from Trichy District, Tamil Nadu, India (Cauvery Delta) was undertaken, to correlate the water quality in irrigation tanks with fish production. Studies have revealed that the irrigation tanks are in good trophic status. The water colour, temperature, pH, alkalinity, light penetration, electrical conductivity, nitrates, TDS, TSS, total hardness, biochemical oxygen demand, phosphates, primary productivity, and ammonia levels were optimum whereas dissolved oxygen and fish growth/yield was high in experimental tanks in comparison to control ponds. This may be due to different fish species stocking density and good managed conditions of the irrigation tanks. The direct stocking of fish seeds (>8 cms in length and > 8 grams in weight) was done in the identified irrigation tanks. Stocking density was done in six species combination of 1:1:1:1:1:1 of Catla, Rohu, Mrigal, Common Carp, GIFT and Grass Carp in the recommended stocking rate of 2000 nos/ha in the selected long seasonal (3 Nos.) seasonal irrigation tanks in Trichy district. On the other hand, grazing pressure might have decreased the Net Primary Productivity but resulted in the high fish biomass. Thus, fish production appear to depend to lesser degree on the magnitude of primary production and therefore, collective relation between primary productivity and fish production could be established and a varieties of factors like organic load, ammonia production, nature/quantity of fertilizers influence such correlations. Management of water quality by managing the optimization of waste input in long seasonal irrigation tanks may help in enhancing the fish production through culture based capture fisheries in the long seasonal irrigation tanks for sustainable environmental management and fish production.

Keywords: Water Quality; Carps; Fish Production Model; Environment, Stocking Density

Effect of Coconut Husk Extracts on the Microbial Quality of Ice Stored *Labeo rohita*

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Abstract

Coconut husk is a rich source of phytochemicals with potential functional applications. The study extracted phenolic compounds from green coconut husk using ethanol, hot water, and a combination of ethanol and hot water as solvents. The study then investigated the antimicrobial activity of the coconut husk extracts against selected pathogenic and spoilage causing bacteria, as well as impact of coconut husk extract on the total plate count during ice storage of *Labeo rohita*. The antibacterial activity was evaluated using the agar well diffusion method, and the bacterial count in ice-stored *Labeo rohita* was determined by total plate count (TPC). The results showed that total phenolic content (TPC) was highest in ethanolic extract (331.44±0.26mg GAE/g), followed by mixture of ethanol and hot water (300.35±0.23mg GAE/g) and hot water extract (269.76±0.25mg GAE/g). The coconut husk extracts demonstrated potent antimicrobial properties against *Bacillus cereus*, methicillin-resistant *Staphylococcus aureus*, *E. coli*, *Morganella morganii*, and *Klebsiella pneumoniae*. All three extracts (ethanolic, ethanol-water, and hot water) exhibited inhibitory effects on these pathogens. The initial bacterial count was similar across all treated and conventionally ice stored samples. However, the treated samples showed a slower increase in total plate count (TPC) compared to the traditionally stored sample. The control sample had an 18-day shelf life, while the ethanolic extract and ethanol-water mixture treated samples had a 24-day shelf life, and the hot water extract-treated sample reached the limit on day 21. All treated samples exhibited a slower bacterial growth rate compared to the control sample. This could be attributed to the significant antimicrobial properties of green coconut husk extract, which effectively reduces spoilage-causing bacteria during ice storage.

Keywords: Antimicrobial, Coconut husk, Phenolic compounds, Pathogenic, Spoilage

Assessment of Fertility and Hatchability in Eggs from Red Cornish and Kadaknath Crossbred Chicken

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Abstract

India has a total poultry population of 851.81 million, with Bihar contributing 16.52 million (20th Livestock Census, 2019). The total poultry meat production in Bihar is 100.79 thousand tones, accounting for 25.43% of the meat produced from all sources in the state. The indigenous Kadaknath breed is known for its unique, black-colored meat, which is high in protein and low in fat and cholesterol. Its adaptability to a wide range of environmental conditions makes it ideal for backyard poultry farming in rural areas. The Red Cornish breed, originating from England, is renowned for its superior meat production characteristics, including tenderness and rich flavor. To combine the desirable traits of both breeds, Red Cornish males were crossed with Kadaknath females maintained at the Poultry Research and Training Centre, Bihar Animal Sciences University, Patna. A total of 500 chicks obtained from five hatchings were analyzed, with the first three occurring in September and the remaining two in October 2023. Fertility percentages for the five hatches were as follows: hatch 1—91.47%, hatch 2—92.11%, hatch 3—87.43%, hatch 4—85.46%, and hatch 5—87.66%, resulting in an average fertility percentage of 89.02%. Hatchability percentages (based on the Fertile Egg Set) for the same hatches were 85.29%, 91.82%, 89.37%, 90.72%, and 89.94%, yielding an average hatchability of 89.54%. Additionally, the hatchability percentages (based on the Total Egg Set) were 78.02%, 84.58%, 78.14%, 77.53%, and 78.85%, with an average of 79.71%.

Keywords : Kadaknath, Red Cornish, Fertility, Hatchability

Dietary Intervention for the Reduction of Dissolved Wastes in the Recirculatory Aquaculture System of Genetically Improved Farmed Tilapia, *Oreochromis niloticus*

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Abstract

Recirculatory Aquaculture System (RAS) is an emerging intensive type of aquaculture system that achieves high rates of water re-use with reliably effective use of land. In built mechanical and biological filtration helps to maintain the water quality in RAS. But the high stocking density in RAS results in higher ammonia release and accumulation in the culture water, which affects the growth and health of fish by causing stress to them. To combat this issue, a 6-week feeding trial was conducted by stocking GIFT at different stocking densities in a recirculating aquaculture system (RAS). The GIFT tilapia fingerlings with an average weight of 15.34g $\pm$ 0.59 were stocked at different stocking densities as T1 (3833g/m³ , 250 fishes/m³), T2 (5500g/m³ , 366 fishes/m³) and T3 (7166g/m³ , 466 fishes/ m³). Significantly (p<0.05) higher weight gain and specific growth rate (SGR) was found in T1, followed by T2 & T3. Based on this stocking density (3833g/m³) another experiment was conducted to investigate the effect of protein: lipid ratio diets on dissolved wastes production of GIFT fingerlings reared in RAS. Sixty fingerlings of initial size 5.05 $\pm$ 0.1 g were stocked into each experimental tank of 50 L capacity. Six practical diets were formulated with varying protein levels (40% to 30%) and lipid levels (7% to 12%) for six different treatment groups viz. P₄₀L₇, P₃₈L₈, P₃₆L₉, P₃₄L₁₀, P₃₂L₁₁ and P₃₀L₁₂. The NH₃-N, NO₂-N and NO₃-N levels of culture water varied significantly (p<0.05) with varying levels of dietary protein and lipid. The NH₃-N level decreased from T1 (0.22 ppm) to T6 (0.08 ppm) with decreasing dietary protein and increasing dietary lipid levels. The highest levels of NH₃-N and NO₂-N were observed in the T1 group as the fish of that group were fed with higher dietary protein. The similar trend was also observed in the results of NO₂-N (0.29 to 0.13 ppm) and NO₃-N levels (1.08 to 0.7 ppm). As the highest growth is observed in the fish fed with dietary protein and lipid level of 34% and 10% respectively, with significantly lower levels of NH₃-N and NO₂-N excretion into the culture water, it is recommendable to use 34% dietary protein and 10% dietary lipid for the culture GIFT fingerlings in RAS.

Keywords: Dietary intervention, GIFT, Low-protein high-lipid diet, ammonia-N, Nitrogenous waste

Evaluation of Carcass Traits in Red Cornish With Plymouth Rock Black Cross Chickens

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Abstract

The per capita meat availability in Bihar is only 3.17 kg/year, significantly lower than the national average of 7.1 kg/year, indicating that Bihar's availability is roughly half that of the country. According to the Bihar Animal Husbandry Statistics (BAHS) 2023, poultry meat production in Bihar stands at 100.79 thousand tonnes. Chicken is consumed more frequently than chevon or pork, largely due to its lower fat content and higher protein content compared to other animal proteins. The Red Cornish, an English poultry breed, is widely recognized for its excellent meat production traits. Meanwhile, the Plymouth Rock Black, an American breed, is a dual-purpose bird valued for both egg and meat production. In an effort to combine these desirable traits, a crossbreeding experiment was conducted at the Poultry Research and Training Centre, Bihar Animal Sciences University, Patna. Red Cornish males were crossed with Plymouth Rock Black females to produce birds with both egg-laying and meat-producing qualities. A total of eight birds at twelve weeks of age were slaughtered to collect data on carcass traits. The mean $\pm$ SE (in grams) for various parameters was as follows: live weight 1020.75 ± 27.06 , bled weight 965.37 ± 26.97 , defeathered weight 885.00 ± 26.63 , deskinning weight 779.87 ± 23.60 , and eviscerated weight 613.00 ± 21.44 . The mean $\pm$ SE for shank and head weights were 45.87 ± 2.06 and 36.57 ± 1.47 , respectively. Further, the mean $\pm$ SE for neck weight was 42.03 ± 1.38 , wing weight 88.28 ± 4.28 , thigh weight 106.41 ± 3.42 , drumstick weight 100.67 ± 3.68 , breast weight 162.16 ± 7.84 , and back weight 108.20 ± 4.44 . The mean $\pm$ SE for internal organs was as follows: spleen weight 1.31 ± 0.09 , liver weight 24.00 ± 1.24 , heart weight 5.77 ± 0.21 , and gizzard weight 25.86 ± 1.44 .

Keywords: Red Cornish, Plymouth Rock Black, Crossbreeding, Carcass traits

Algal oil: A sustainable alternative of fish oil in aquafeed

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Abstract

With the rapid rise in global population, the demand for finite natural resources is increasing which cause a great challenge to global nutritional security. Aquaculture, as the most efficient producer of edible protein, holds immense potential to meet the rising demand for fish and seafood. However, the intensification of aquaculture relies heavily on feed inputs, which account for 40–75% of production costs. By 2025, compound feed production is expected to reach 73.15 million tonnes, intensifying the need for sustainable alternatives to traditional feed ingredients, such as fishmeal and fish oil. Declining fishmeal availability due to reduced capture fisheries and frequent price fluctuations has spurred the search for alternative protein and lipid sources, including plant-based and animal-based ingredients. Marine algae, recognized for their rich nutritional profile, are increasingly viewed as a sustainable ingredient for aquafeeds. Algal oil, derived from marine algae, is emerging as a promising alternative to fish oil, providing essential fatty acids like eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), which are crucial for the growth, development, and health of aquatic species. Products like Veramaris, Algaprime™ DHA, and Almega PL have demonstrated significant results when used in commercially important species like Salmonids and Gilthead Seabream. Despite these advantages, the high production costs, complex extraction processes, and susceptibility of long-chain polyunsaturated fatty acids (LC-PUFAs) to oxidation present challenges to widespread adoption. Nevertheless, with further research and trials, algal oil has the potential to become a viable, sustainable alternative for the aquafeed industry, contributing to both nutritional security and environmental sustainability.

Keywords: Algal Oil, Sustainable Aquafeed, Essential Fatty Acid, Aquaculture

Evaluating the Effect of Insulin Supplementation on Carbohydrate Metabolism in *Labeo rohita*

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Abstract

As insulin plays a crucial role in glucose regulation and carbohydrate utilization in vertebrates, understanding its effects on fish could offer insights into optimizing feed efficiency and improving fish health. In this study evaluates the effects of insulin supplementation on glucose metabolism in *Labeo rohita* (Rohu), a species of freshwater fish known for its high commercial value in aquaculture. In the present study, Rohu fish were intraperitoneally injected with insulin @ 0.5 ml, 1.0 ml, 1.5 ml and 2.0 ml per kg body weight to evaluate the ability of fish to utilize carbohydrates. Insulin supplementation was observed to lower blood glucose levels significantly in treated groups compared to the control, suggesting enhanced glucose clearance from the bloodstream. Hepatic glycogen content increased markedly, indicating improved glycogen synthesis. Additionally, enzymes involved in glucose metabolism, such as glucokinase and glycogen synthase, exhibited higher activity levels in insulin-supplemented fish, highlighting increased glucose utilization and storage capacity. Growth parameters, including weight gain and specific growth rate (SGR), showed a positive correlation with insulin supplementation, with fish in the highest insulin group demonstrating the most substantial growth. These findings suggest that insulin supplementation can improve glucose metabolism efficiency and promote growth in *Labeo rohita*. Enhanced glucose utilization may lead to improved energy allocation, supporting better growth performance, which is beneficial in aquaculture. This research opens avenues for further investigation into insulin use in aquafeeds, aiming to enhance sustainable production and optimize metabolic health in cultured fish.

Keywords: Insulin, Glucose, Metabolism, Glycogen, growth

Impact of Inland Low-Saline Shrimp Culture in Andhra Pradesh
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Abstract

Shrimp culture has emerged as a highly commercial enterprise from a traditional coastal farming to the inland low saline shrimp farming with the introduction of *L. vanammei*. The West Godavari district of Andhra Pradesh is the leading producer of farmed shrimp (1.35 lakh tonnes) in 2022-23. Many agricultural farmers converted agricultural land into shrimp farms due to its fascinating profits. However, the unrestrained use of chemicals and high stocking densities has led to notable challenges. To assess the impact of low-saline shrimp farming on local paddy farmers, a study was carried out involving interviews with 60 farmers, utilizing tools such as the Likert scale, rank order of perceived issues, and Principal Component Analysis (PCA). The findings revealed that the primary concerns reported were decreased land fertility (58.34%) and lower production rates compared to peers (48.33%). Other issues, such as changes in water quality (53.33%), severe fluctuations in paddy yields (63.34%), seepage (58.34%), and a rise in fertilizer usage (45%), were regarded as moderate problems. PCA identified five components that accounted for 76.48% of the observed variability. Since there were no appropriate guidelines for inland low saline shrimp culture, the study highlights the need for intervention of the Department of Fisheries (DoF), Andhra Pradesh (AP) to establish distinct agricultural zones in upland areas and aquaculture zones in delta regions. Recommendations include limiting the conversion of agricultural land and tightening regulations on license issuance to foster sustainable farming practices. To enhance crop yields for paddy farmers, the study advocates for crop diversification and the adoption of high-yield varieties. Furthermore, maintaining optimal stocking densities and adhering to scientifically backed chemical use can help mitigate the negative effects associated with low-salinity shrimp farming.

Keywords: Inland low saline shrimp farming, Paddy farmers, Perceived responses, Factor Analysis, Salinity

Study of Fisheries Co-operative Societies in Gorakhpur District of Uttar Pradesh

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Abstract

The present study is on the fisheries co-operative societies of Gorakhpur district of Uttar Pradesh. Gorakhpur district was purposively selected for study because of the highest number (45) of active fisheries co-operative societies. Further out of 45 fisheries co-operative societies 13 co-operative societies and 5 members form each society, altogether 65 respondents were selected by following simple random sampling. Study revealed that out of 13 co-operative societies 7 were formed before year 1984. “Matsya Jivi Shkaari Samiti Lit. Ramgarh Taal” was the oldest fisheries co-operative society which was formed in 1959 and “Matsya Jivi Shkaari Samiti Lit. Taramandal” had largest area of allocated water body which was 1691.16 ha. All 13 co-operative societies were doing composite fish farming and IMC and EMC were the major cultured species. Cast net (Jaali), Drag net, digging tools and boat were the gears and crafts commonly used by the cooperative societies. Further no cooperative society was practicing fish breeding. Most of the respondents (70.77%) belonged to middle and old age groups and majority were educated, most of the respondents (61.54%) belonged to OBC category as in U.P. majority of the fishing community comes under the OBC category. One of the major outcomes of the study was, either most of the respondents were from fishing community, majority (93.85%) of them did not had pond and this could be the reason to join the fisheries co-operative society. More than half of the respondents had fisheries as primary occupation and almost same number of respondents attended training on various topics of fish farming. Study showed that more than half of the respondents had medium level of extension agency contact, mass media participation, economic motivation, risk orientation and innovativeness. Organizational atmosphere and organization commitment was also studied and found of medium level by more than half of the respondents. Further almost half (53.85%) of respondents had medium level of knowledge regarding scientific fish farming practices. The study will help the policy makers to formulated the location specific policies for the growth and betterment of members of fisheries co-operative society.

Keywords: Fisheries co-operative society, Uttar Pradesh, Gorakhpur, Knowledge Test.

Development of Carrot Powder Fortified Burger Patty Premix Incorporated with Fish Surimi Powder

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Abstract

The objective of this study was to develop novel gluten-free patty premix incorporating Rohu fish surimi powder fortified with carrot powder. Formulation with quinoa flour, almond flour, soy flour, oat flour, and flaxseed powder were optimized. Surimi powder incorporated patty premix powder was incorporated with varying levels (0.5, 1, 1.5, and 2 %) of carrot powder. The WAC (136.16 to 121.17 %), OAC (66.39 to 48.52 %), and pH (6.20 to 5.89) decreased as the level of carrot powder in the patty premix increased. The addition of carrot powder resulted in a decrease in the textural parameters. The sensory results revealed that the 1.5 % carrot powder incorporation scored the highest in all sensory attributes.

Keywords: Rohu, Surimi Powder, Carrot Powder, Patty Premix, Gluten-Free

Utilization of Derelict Water Bodies through Lotus-Fish Farming as a Sustainable Climate Resilient Practice in Tripura

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Abstract

This present study aims at addressing the environmental deterioration of derelict/used water bodies located in the Tripura region. The proposed strategy involves simultaneous cultivation of lotus plants and suitable fish species, capitalizing on their complementary ecological requirements which appears to be a climate resilient aquatic crop with high local demand. Lotus plants serve as natural biofilters, enhancing water quality through nutrient absorption, while also providing shade and a habitat for many aquatic organisms contribute to nutrient cycling by utilizing available trophic and ecological niches, fostering a harmonious ecosystem.

Keywords: Derelict Water Bodies, Lotus-Fish Farming, Climate Resilient, Tripura

Effects of De-oiled Rice Bran (DORB) on Growth Performance, Digestion and Oxidative Stress in *Labeo rohita* Fingerlings

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Abstract

A 60-day feeding trial was conducted to evaluate the effect of de-oiled rice bran (DORB) on the growth performance, digestion and oxidative stress of *Labeo rohita* fingerlings. Six iso-nitrogenous (30%), Iso-lipidic (6%) and Iso-energetic (1.8MJ/100g) diets were prepared with different inclusion level of DORB viz, C (control, 0% DORB), T20 (20% DORB), T30 (30% DORB), T40 (40% DORB), T50 (50% DORB) and T60 (60% DORB). In addition, one commercial diet with 29.88±0.30% CP and energy (1.82MJ/100g). Three hundred and fifteen (315) fingerlings with 15 fish per tank having an average weight 8.0±0.5g were randomly distributed in seven treatments in triplicates following a completely randomized design. At the end of the experiment, growth and nutrient utilization were evaluated in terms of weight gain (%), SGR (Specific Growth Rate), FCR (Feed Conversion Ratio), and PER (Protein efficiency Ratio). The weight gain % and SGR were similar in 30, 40, 50 and 60% DORB fed groups, but higher ($P<0.05$) than the control and commercial diet fed groups. The highest FCR values were observed in the control and commercial feed fed group. Maximum weight gain was recorded in 40% DORB fed group based on the polynomial regression equation ($y = -0.0044x^2 + 0.3362x + 34.76$, $R^2 = 0.85$). The digestive enzyme, protease and amylase activities were higher in 20, 30 and 40% DORB fed groups, whereas, oxidative stress enzyme catalase activity was significantly lower ($p<0.05$) in the same groups. The GST (Glutathione S-transferase) and SOD (Super oxide dismutase) activities were significantly ($p<0.05$) higher in the T50 and T60 groups. The GST activity was significantly ($p<0.05$) lower than the control group, which was not different from T20 and T30 groups. From the study, it can be concluded that 40% DORB fed group showed maximum growth and causes stress to fish when fed at higher inclusion level (50 & 60%).

Keywords: De-oiled Rice Bran, Catalase, Digestive enzyme, Weight gain

Effect of Organic Manures on Growth of Ornamental Aquatic Plant Water Primrose, *Ludwigia repens*

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Abstract

Biodiversity of aquatic and semi-aquatic plants constitutes an integral component of any aquatic ecosystem. They serve as a source of food and shelter for the aquatic fauna, thus forming the base of aquatic wildlife conservation practices. Ornamental aquatic plants have great potential in the aquarium fish industry as a secondary source of income besides the ornamental fish trade. Thus, for the sustainable growth of this trade, it is necessary to strengthen the culture and propagation techniques for commercially important species. Among the commercially important varieties of aquatic plants, water primrose, *Ludwigia repens* is one of the fast-growing amphibious plants that produces both submersed and emergent growth and can grow terrestrially. Submersed growth is typically upright within the water column, and nodal rooting is common; this adds aesthetic value to the aquarium outlook. The experiment was performed to evaluate the growth of *L.repens* under different organic manure, viz., vermicompost, poultry manure, cattle manure, and goat manure in mud pots of 3.5-liter capacity for 5 months under controlled environmental conditions. Results revealed that maximum biomass, plant length, and number of leaves were observed in the treatments with high available nitrogen, i.e., cattle manure. It can be concluded that the application of cattle manure at the rate of 2% with soil/sand (2:1) mixture is good for the culture and propagation of ornamental aquatic plants, water primrose as it is readily available at a cheaper price in local market compared to other manures.

Keywords: Aquatic Plant, Water Primrose, Morphological, Organic Substrate, Red Ludwigia

Nutritional Efficiency through Microencapsulation: Boosting IMC Larval Growth and Survival

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Abstract

Microencapsulated feed is increasingly recognized as a valuable advancement in aquaculture nutrition, particularly for IMC larvae, which requires nutrient dense feeds to support their rapid growth and development. The encapsulation process, which involves coating feed particles with a protective layer, offers several benefits that address the limitations of traditional feeds and has significant implications for growth, survival, and overall health in fry. One of the primary advantages of microencapsulation is the improved stability of essential nutrients such as proteins, lipids, vitamins, and minerals. In aquatic environments, nutrients in conventional feed can quickly leach out, reducing the effective nutritional value available to fish. Microencapsulated feeds allow for controlled nutrient release, ensuring a steady supply of nutrients over extended periods. This characteristic is crucial for young fry, as it can help to meet their high metabolic demands throughout the day. Additionally, encapsulation can improve the digestibility of feed ingredients, allowing fry to assimilate nutrients more efficiently, which enhances specific growth rate (SGR) and improves feed conversion ratios (FCR). By minimizing nutrient leaching, microencapsulated feeds help reduce water pollution caused by nutrient runoff. This feature is particularly valuable in aquaculture systems where water quality directly influences the health and survival of fish stocks. In IMC culture, maintaining clean water conditions is essential for optimal growth and reducing disease risk, particularly during the sensitive fry stage. The application of microencapsulated feeds for IMC fry represents a significant advancement in aquaculture, offering targeted nutrition that supports optimal growth, enhances survival rates, and promotes sustainable aquaculture practices. Through better nutrient stability, controlled release, and reduced environmental impact, microencapsulated feed is proving to be a vital tool in the advancement of efficient and responsible fish farming practices.

Keywords: Microencapsulated, feed, Larva, fry, IMC, Growth

Sustainable Fish Farming: Opportunities and Challenges**Rajesh Kumar*, Dhirendra Kumar, Shashi Pal and TKS Rao**

COVAS, Kishanganj

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Sustainable fish farming (SFF) is one of a critical component of sustainable food production system. SFF contributes to sustainable food systems by adopting good fish farming practices. It is estimated that the global population projected to reach 9.7 billion by 2050 and the demand for protein-rich foods will be continue to grow worldwide including India. Sustainable fish farming offers an applicable solution to meet this demand without depleting wild fish populations. Overfishing remains a significant threat to marine biodiversity and the sustainability of global fish stocks. By providing an alternative source of fish, sustainable aquaculture reduces the pressure on wild fisheries, allowing overfished populations to recover and ecosystems to regenerate. Sustainable fish farming contributes to food security by providing a reliable source of food that is less vulnerable to the fluctuations and challenges faced by wild fisheries, such as climate change, pollution, and overfishing. By employing eco-friendly practices, sustainable fish farming helps to protect water quality, conserve natural habitats and reduce greenhouse gas emissions. Sustainable fish farming production faces some crucial challenges like negative environmental impacts if it is not properly managed. There might be water pollution from excess feed and waste, the spread of diseases to wild fish populations. Some other challenges are as to develop alternative feed sources such as plant-based or insect-based feeds. It is essential for reducing the environmental impact of fish farming and to reduce cost of farming as it is more expensive than conventional practices. Sustainable fish farming is essential for meeting the growing demand for seafood while preserving the health of oceans, rivers and waterbodies. By adopting eco-friendly practices of fish farming and innovation the aquaculture sector can play a pivotal role in sustainable fish farming.

Keywords: Sustainable fish farming, food security, eco-friendly practices

**Theme II: Environmental
Biotechnology in Fisheries &
Veterinary Science**

Complete Sequence and Characterization of the *Cyprinion semiplotum* Mitochondrial Genome and its Phylogenetic Implications

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Abstract

The mitochondrial genome (mitogenome) can provide useful information for analysing phylogeny and molecular evolution. However, the complete mitogenomes from the order Cypriniformes are limited to representatives of the subfamily Barbinae. Therefore, in the present study, we sequenced the mitochondrial genome of Assamese kingfish (*Cyprinion semiplotum*), a species encompassing edible, nutritional and medicinal value. The genome structure, gene order and codon usage were typical among other cyprinid mitochondrial genomes. The mitogenome is circular and 16,671 bp in length with 13 protein coding genes (PCGs), 22 transfer RNA genes (tRNAs), two ribosomal RNA genes (rRNAs) and a control region (CR). The nucleotide composition of the genome is highly A + T biased, accounting for 55.10%, with a slightly positive AT skewness (0.024), indicating the occurrence of more adenine than thymine, as found in other Cyprinid fishes. All protein-coding genes (PCGs) initiate by an authoritative ATN codon, except for *cox1* being CGA. Regarding the stop codon, six PCGs utilize the canonical termination codon (TAA and TAG), whereas the others end with the truncated stop codon (TA and T). All tRNA genes show a typical secondary cloverleaf structure, except for tRNA^{ser} (GCT) lacking the dihydrouridine arm. The phylogenetic position of *C. semiplotum* indicates that subfamily Barbinae is sister to subfamily Spinibarbinae. More molecular data from different taxonomic groups, especially from the kingfishes of the Eastern Himalaya is needed to understand the phylogeny and evolution of the kingfishes of the Eastern Himalaya. The mitogenome reported in this study will facilitate the study of population genetics and conservation of *Cyprinion semiplotum*.

Keywords: Mitogenome, Assamese kingfish, Population genetics, Conservation, Phylogeny

Relative Abundance of Fertility-Related Transcripts is Affected by FMD Vaccination in Differentially Fertile Sahiwal Bulls

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Abstract

Vaccination of breeding bulls has been evident that it has an adverse effect on semen quality parameters for a particular period, but the molecular mechanism is still unexplored. Hence, a study was planned in Sahiwal bulls to understand the molecular mechanism of transient vaccination stress (FMD vaccine) on the relative abundance of fertility transcripts in Sahiwal bulls. Eight (8) healthy sexually matured Sahiwal breeding bulls are classified into two groups, high fertile (HF, 45 to 52%) and low fertile (LF, 26 to 43%) based on conception rate. Sperm RNA was isolated from fresh semen samples for the differential abundance of fertility-related gene transcripts such as CRISP2, AQP7, PRM1, CCT5 and CCT8. The results revealed that the most affected period for all the parameters was found within 15 days post-vaccination, and restoration was observed at 60 days post-vaccination in high and low-fertile bulls. The relative expression of positive fertility transcripts of CRISP2, AQP7 and PRM1 gene was found to be decreased up to 30 days post-vaccination and gradually returned to normal at the 60th day in both high and low-fertile Sahiwal bulls; whereas, the expression of the negative fertility-related transcript of CCT5 and CCT8 gene was found to be significantly ($p \leq 0.05$) up-regulated during the post-vaccination period on 15th day and gradually decreased in both high and low fertile bulls. The study concluded that the expression of positive fertility-related genes was found to be decreased in the post-vaccination period in both high and low-fertile bulls and the expression of negative fertility genes was found to be increased in post-vaccination period than pre-vaccination in low fertile as compared to high fertile Sahiwal bulls.

Keywords: Bull fertility, Sahiwal, Sperm transcripts, Vaccination

Toxicological Impact of Blue Dyes on Zebrafish Embryos: A Multi-Biomarker Study**Harshavarthini M^{1*}, Yuvasree K¹, Shubra Singh¹, Satya Prakash Shukla³, Naresh S. Nagpure¹, Dhanalakshmi M² and Savaliya Bhautik Dilipbhai ³**¹*Fish Genetics and Biotechnology Division, ICAR- CIFE Mumbai.*²*Fisheries Resources Management, and Post-Harvest Technology, ICAR- Central Institute of Fisheries Education, Mumbai.*³*Aquatic Environment & Health Management Division, ICAR- Central Institute of Fisheries Education, Mumbai.***Abstract**

Dyes are organic compounds or mixtures used to add color to the final products of different industries, such as tanneries, food, cosmetic, textile, and medicinal sectors. Dye pollution arising from various industrial processes has become a significant environmental concern due to its adverse impacts on aquatic ecosystems. As such, systematic studies on the adverse effects of these dyes on aquatic organisms are scarce. Therefore, a comparative toxicity analysis was conducted to assess the ecotoxicological potential of three distinct dyes: Brilliant Blue (BB), Remazol Brilliant Blue R (RBBR), and C- Phycocyanin (C-PC) in zebrafish embryos using the endpoints of embryotoxicity, teratogenicity, genotoxicity, and histopathology. BB and RBBR represent synthetic organic dyes commonly used in industries, whereas C-PC is a natural pigment used as a food colorant. C-PC was extracted from *Spirulina platensis* and purified using standard chemicals to obtain pigment with high purity value of 2.08. A zebrafish embryo toxicity test (ZFET) was performed with eight different concentrations of the dyes and, the 96 h LC₅₀ values were estimated as 136.64 mg/l (71.82-501.13 mg/l) for BB, 2.55 mg/l (0.84-4.57 mg/l) for RBBR and 53.327 mg/l (25.20-709.93 mg/l) for C-PC. The comet assay or single-cell gel electrophoresis was used to assess DNA damage in embryos after 96 h of exposure to LC₂₀ concentration. The DNA damage was estimated in terms of Olive Tail Moment (OTM) as 1.802±0.41 for BB, 3.05±0.81 for RBBR, and 1.252±0.08 for C-PC. Teratogenicity and histological investigation revealed morphological alterations such as egg coagulation, yolk sac edema, pericardial edema, tail bend, body curve, abnormal notochord development and yolk sac burst following exposure to the selected blue dyes at LC₂₀ concentration. The analysis using multiple biomarkers revealed that RBBR induced significantly higher toxicity, whereas comparatively lesser DNA damage was induced by the other two dyes used in this study.

Keywords: Comet assay; C- Phycocyanin; Dye pollution; Histology; Teratogenicity

Acute Heat Stress Weakens Immune System in Catfish *Clarias magur* Revealed by Comparative Gill Transcriptome Analysis

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Abstract

Rising temperatures significantly impact aquatic ecosystems, causing substantial losses in aquaculture. This study examined the transcriptomic responses of freshwater catfish *Clarias magur* to acute heat stress. Fish were exposed at two different temperatures i.e. 26°C (control) and 34°C (heat stress) to assess tolerance and adaptation to acute heat stress. The Transcriptomic profiling of gills identified significant changes in immune-related gene expression, including BOLA class I, MHC class I, MHC Class II and GTPase IMAF family member 8 molecules, indicating impaired immune function. Altered expression of important immune response genes contributed to immune dysfunction in the studied species which was further supported by the histopathological alteration of vital organs like gills, liver, kidney, spleen, and skin tissues of heat-exposed fishes. The macrophage infiltration, congestion of blood sinusoids, apoptosis, and hypertrophic degeneration were observed in liver tissues which indicates a compromised immune system. The skin cuticle disruption and pathogen invasion were observed in the skin tissue and melanomacrophage centers and granulomas were observed in the spleen tissues of heat-exposed fishes which is an indicator of weakened immunity. This study underscores the harmful effects of heat stress on the physiological health and immune function of *C. magur*. It provides crucial insights into the molecular mechanisms behind thermal stress responses, highlighting the need for adaptive aquaculture strategies. As climate change drives temperature fluctuations, these findings are vital for developing interventions to enhance the resilience and sustainability of economically significant aquatic species.

Keywords: Heat stress, *Clarias magur*, transcriptomics, DEGs.

Gonadal Stem Cell: A Possible Solution of Continuous Seed Production and Futuristic Aquaculture

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Abstract

Aquaculture sustainability is crucial for future nutritional security. However, existing reproductive knowledge and seed production system might become a bottleneck in future. Notably, germ cells store and carry the parental genetic information to progeny and therefore are regarded as the building blocks for future generation. Any discrepancy in germ cell physiology directly affects reproductive performances. Recently, germ cells, especially gonadal stem cells (GSC) are being increasingly used for surrogacy and reproductive enhancement. To explore the possible utilization of GSC for reproductive security in aquaculture, using two different marine fish, i.e., Japanese anchovy (*Engraulis japonicus*) and Chub mackerel (*Scomber japonicus*), analysed the existence of GSCs, characterised their cellular biology, explore the possibility of *in vitro* long term culture and preservation and examined their potential in *in vivo* gamete production. Briefly, we have isolated fish GSC from various fish gonad (both from male and female) and established a serum and feeder free long term culture methodology. Our data shows that, even after 9 months (70 passage) of continuous culture, the GSC retains their stemness *in vitro*. Simultaneously, we have prepared germ-cell deficient chub mackerel and when transplanted with cultured GSC, we observed differentiation into later stage germ cell and able to produced next generation within 3 months after transplantation. Though extensive research is necessary, our work so far suggests that gonadal stem cell will be a potential “One for all” solution to reproductive security, bioresource conservation and intellectual proper right management in future aquaculture.

Keywords: Stem cell, Fish, Reproduction, surrogacy, cell culture

Evaluation of the Performance of Fertility and Hatchability in Eggs from a Cross Between Kadaknath and Rhode Island Red (RIR) Chickens

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Abstract

According to the 20th Livestock Census (2019), India has a total poultry population of 851.81 million, with Bihar contributing 16.52 million, accounting for 1.9% of the national poultry population. The egg production in Bihar stands at 2.8 billion, with a per capita availability of 26 eggs, significantly lower than the national average of 101 eggs (BAHS, 2023). The indigenous Kadaknath breed, known for its adaptability to diverse environmental conditions, is ideal for backyard poultry farming in rural areas. The Rhode Island Red, an American poultry breed, is recognized for its exceptional egg production. To develop chicks with both high egg production and adaptability, Kadaknath males were crossed with Rhode Island Red females. Data on the eggs produced from this crossbreeding were collected from the incubation chart register at the hatchery unit of the Poultry Research and Training Centre, Bihar Animal Sciences University, Patna. A total of 500 chicks from six hatchings were analyzed, with the first three occurring in September and the rest three in October 2023. Fertility percentages for hatch 1, hatch 2, hatch 3, hatch 4, hatch 5 and hatch 6 were 81.59%, 82.41%, 76.19%, 87.58%, 75.86% and 85.71%, respectively, with an average fertility percentage of 81.89%. Hatchability percentages (based on Fertile Egg Set) for the same hatches were 87.96%, 82.66%, 83.75%, 74.01%, 87.50% and 92.70%, respectively, with an average hatchability of 84.27%. Additionally, the hatchability percentages (based on Total Egg Set) for the hatches were 71.77%, 68.13%, 63.80%, 64.82%, 66.37% and 79.46%, respectively with an average of 69.01%.

Keywords: Kadaknath, Rhode Island Red, Fertility, Hatchability

Standardization of Blood Anti-Mullerian Hormone (AMH) Levels as a Fertility Biomarker in Indigenous Cows

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Abstract

Anti-Mullerian hormone (AMH) is emerging as a reliable endocrine marker for assessing fertility potential in bovines. Unlike other markers, AMH levels remain unaffected by gonadotropins, making it a consistent predictor of ovarian reserve. In cows, AMH concentration correlates with the number of ova, fertilized embryos and transferable embryos. However, there is a lack of data on AMH profiles in indigenous cow breeds. This study aims to standardize age-specific AMH levels in *Bos indicus* cows using immunoassays. Blood samples were collected from Sahiwal and Tharparkar cows ranging from 0 to 10 years old, and AMH levels were measured. Results indicate that AMH concentration varies significantly with age in both breeds ($p < 0.001$), though no significant difference was observed between breeds. The lowest AMH levels were observed in calves aged 0-6 months (199.07 ± 44.89 pg/ml in Sahiwal, 180.87 ± 32.76 pg/ml in Tharparkar, and 189.97 ± 26.64 pg/ml combined). AMH levels then increased significantly ($p < 0.05$), peaking at 1.5-2.0 years in Sahiwal (1497.71 ± 77.18 pg/ml), 2.0-2.5 years in Tharparkar (1725.14 ± 114.81 pg/ml), and 2.0-2.5 years when combined (1763.08 ± 70.01 pg/ml). These findings will aid in assessing reproductive lifespan in Sahiwal, Tharparkar, and potentially other cattle breeds based on AMH levels.

Keywords: Anti-Mullerian Hormone, Bovine, Fertility, Sahiwal, Tharparkar

Molecular Insights into ISKNV Prevalence in Susceptible Fishes: A Case Study from Maharashtra, India

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Abstract

Infectious spleen and kidney necrosis virus (ISKNV), primarily affecting the spleen and kidneys, poses a significant threat to aquaculture and has been identified in over 50 species of both wild and cultured fish. A total of 410 fish specimens from nine species were selected for this study, employing a two-stage random sampling method for collection. This study reports outbreaks of ISKNV in Zebrafish (*Danio rerio*), Angelfish (*Pterophyllum scalare*), and koi carp (*Cyprinus carpio koi*) in Maharashtra. The outbreaks were characterized by clinical signs such as exophthalmia, fin rot, splenomegaly, and skin hemorrhages. The presence of ISKNV in the samples was validated using polymerase chain reaction (PCR) at the AAHM Laboratory, ICAR-CIFE, Mumbai, and reconfirmed through sequencing. Initial PCR screening using WOA-recommended primers (Kurita et al., 1998) yielded inconsistent results, failing to achieve definitive amplification of the virus. However, optimization of MCP primers (Wang et al., 2007) resulted in effective amplification of the virus, producing a specific product length of 562 bp. The optimized MCP primers exhibited a detection limit of 10 viral copies per assay using conventional PCR. Species-specific prevalence was highest in Angelfish (*Pterophyllum scalare*) at 31.81%, followed by Zebrafish (*Danio rerio*) at 28.57%, and koi carp (*Cyprinus carpio koi*) at 18.46%. Additionally, food fishes such as tilapia (*Oreochromis niloticus*) and Asian seabass (*Lates calcarifer*) were also tested for the presence of ISKNV, but no positive cases were found in these species in Maharashtra. This study expands the known host range of ISKNV and underscores the need to prevent its spread across species. Further research is essential to clarify the virus's pathogenicity, transmission routes, and epidemiology, and to develop effective strategies to mitigate disease outbreaks.

Keywords: Infectious spleen and kidney necrosis virus (ISKNV), Aquaculture, Ornamental fish, Prevalence, Aquatic viral diseases

Effect of Resveratrol on Reproductive Genes in *Systomus sarana*

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Abstract

Resveratrol (3,5,4'-trihydroxy-trans-stilbene) is a stilbenoid, a type of natural polyphenol, and phytoalexin produced by several plants. Resveratrol has several properties such as cardio-protective effects, antioxidants, anti-inflammatory, antidiabetic, neuroprotective and anti-aging. In order to study the effect of resveratrol on reproduction in *Systomus sarana*. The fishes were collected and randomly allocated into six groups and fed diets with (T1 = sunflower oil, T2 = cod liver oil, T3 = sunflower oil + cod liver oil, T4 = sunflower oil + resveratrol, T5 = cod liver oil + resveratrol, T6 = sunflower oil + cod liver oil + resveratrol) for 60 days and T4, T5, and T6 are 0.3% resveratrol added diet. Resveratrol significantly increased the reproductive performance and expression of genes related to reproduction in both the ovary and testis. There was an upregulation of reproduction-related genes *ARs*, *Cyp17a1*, *ERs*, *FSHR* and *vtg* in resveratrol-treated fish, suggesting the positive impact on the reproduction of fishes. Among all the groups, T5 (cod liver oil + resveratrol) is having the highest reproductive gene expression.

Keywords: Expression, Reproduction, Resveratrol, *Systomus sarana*

Decoding the Gut Microbiome Profile in *Oreochromis niloticus* Raised in Cage Culture of a Heavy Metal-Polluted Coal Mining Reservoir of Jharkhand

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Abstract

Coal mining activity leads to significant and severe environmental impacts as it involves removal of massive amounts of top soil, prominent soil erosion, habitat destruction and aquatic pollution. Coal mining causes influx of heavy metals that are dissolved and seep into ground and surface water. Due to heavy metals toxicity and their bio-accumulation in the aquatic animals including fishes, physiological performance as well as the associated gut microbiota is drastically affected that leads to immunosuppression and mortality. The research efforts on the profiling of immune biomarkers and gut metagenomics profiling of fish are still in infancy stage. In this context, a comparative study was performed to gain insight on the modulation of immune biomarkers and gut microbial community present of Nile tilapia fish (*Oreochromis niloticus*) from two sites namely Ramgarh coal void area (test) and Urban reservoir (control). ICP-MS analysis revealed higher concentration of heavy metals in muscle tissue of tilapia reared in the coal void. The results of shot gun metagenome sequencing study performed via Illumina next seq platform revealed most dominant domain as bacteria followed by viruses in gut of tilapia collected from both sites. *PVC bacteria* were recognised as the dominating superphylum followed by *Proteobacteria* and *Terrabacteria*. The most dominant phylum in the virus domain was *Duplodnaviridae*, in both groups, while the domain *eukaryota* consisted of *Sar*, *Opisthokonta* and *Viridiplantae* as the major clades. Significantly enhanced serum immune biomarkers as well as upregulated expression levels of pro-inflammatory cytokine and down regulated expression of anti-inflammatory genes in different lymphoid organs were deciphered.

Keywords: Sequencing, coal void area, tilapia, immunity, microbial diversity, cytokine, heavy metals

Expression & Association Studies of Egg Production Related Candidate Genes In Aseel

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Abstract

Aseel, a popular game bird is well known for its hostility, high stamina, majestic gait and fighting qualities. Aseel is also one of the most reared birds in backyard poultry farming. The annual egg production however, needs to be improved to make it economically viable. Various candidate genes have been identified which are specific to egg production and their level of expression in tissues of birds belonging to different egg production groups can be used as early selection criteria for further breeding and flock improvement. Present investigation on expression of *CRBP IV* gene in tissues like kidney, liver and oviduct of Aseel birds is one of the first studies of this kind in India. The egg production up to 40 weeks were recorded in 180 pedigreed Aseel birds kept at Desi fowl unit of ICAR-CARI, Izatnagar, Bareilly. The birds were grouped in two groups i.e. high egg producing and low egg producing. Top 4 and bottom 4 birds were slaughtered from respective groups and tissues were collected. Quantitative Real Time- Polymerase Chain Reaction (qRT-PCR) was used to study the mRNA expression of *CRBP IV* gene in three tissues viz., kidney, liver and oviduct of the two egg production groups. The data retrieved was analyzed using JMP-SAS (2010). It was found that the mRNA expression of *CRBP IV* gene differ significantly among the two egg production groups in liver at 15% level of significance. Fold expression of *CRBP IV* gene studied via $2^{(-\Delta\Delta Ct)}$ method revealed that *CRBP IV* gene was expressed 1.59, 1.2 and 1.17 folds more in kidney, liver and oviduct, respectively of high egg producing group compared to low egg producing group. The level of expression of *CRBP IV* gene (two levels based on deviation from average $40-\Delta Ct$ values) in liver ($P < 0.05$) of Aseel chicken had significant effect on egg production up to 40 weeks. Full sib selection for improvement in egg production up to 40 weeks can be done on the basis of level of expression of *CRBP IV* in liver of Aseel native chicken.

Keywords: Aseel, Expression, *CRBP IV*, qRT-PCR, Kidney, Liver, Oviduct

Reproductive Success and Sexual Characteristics of Mascara barb (*Dawkinsia assimilis*) in Captivity Without Hormones

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Abstract

The gorgeous hill stream fish Mascara barb (*Dawkinsia assimilis*) is indigenous to the swift-moving streams of its environment. Because of its vivid colors and unique patterns, it has gained popularity among aquarists. Mascara barbs exhibited distinct physical variations from females during breeding seasons, such as brighter colors and tubercles on their snouts, enlarged dorsal fins present in males. By maintaining regulated water quality, successful breeding had been accomplished in 2021 and further onwards. The detailed stages of embryonic development offered information about the reproductive biology of this species. It has been found that, the semi-adhesive, demersal eggs attached to the substrate. The eggs were appropriate for more observation because of their spherical shape and milky white color, which suggested health and vitality. In summary, this research shows that it is possible to breed Mascara barb without the use of hormones, and it also emphasizes how crucial it is to comprehend sexual dimorphism and reproductive behavior in ornamental fish. The results of this study can help aquarists and breeders promote the health and conservation of this amazing species as the need for sustainable fishkeeping methods increases.

Keywords: Mascara barb, Morphology, captive breeding, embryonic development

Assessment of Genotoxicity Induced by Microplastics along the Maharashtra Coast, Northwest India, using Marine Clam Species as Bioindicators

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Abstract

Plastic pollution in aquatic environments has posed a critical social and scientific concern for over 60 years. Global plastic production continues to increase, reaching an estimated 400.3 million tonnes in 2022, with approximately 4.8 to 12.7 million tonnes of plastics entering ocean ecosystems each year. While plastic waste is non-biodegradable, it undergoes photodegradation into microplastics (MPs) and nanoplastics (NPs). Due to their persistence and toxicity, MPs are now classified as "Contaminants of Emerging Concern" (CEC), and are considered the second most serious threat to aquatic organisms. The present study examined the spatial distribution of microplastics and their genotoxic effects on clams using DNA-based biomarkers across various sites along the Maharashtra coast, including Aksa, Alibagh, Bandra, Ratnagiri, and Srivardhan, with Ratnagiri serving as a reference site. Across all locations, microplastic bioavailability was found to be higher in sediment than in water. DNA alterations serve as early-stage biomarkers that can predict long-term negative impacts on aquatic organisms. In this study, comet assay results revealed significant DNA damage in clams from polluted sites compared to the reference site. Additionally, the micronucleus cytome assay was used to assess various cellular abnormalities, including cell death (e.g., pyknosis, karyolysis, karyorrhexis, condensed chromatin), DNA damage (e.g., micronuclei, nuclear buds, nucleoplasmic bridges, fragmented nuclei), and cytokinetic defects (e.g., binucleated cells). Among these abnormalities, the presence of micronuclei, fragmented nuclei, and karyolysis emerged as effective biomarkers, showing significant differences among sites. These findings suggest that the Maharashtra coast, particularly the Mumbai region, is highly contaminated with microplastics capable of inducing genotoxic effects in marine clams. Continuous monitoring of water quality in these regions, along with immediate mitigation efforts, is essential to address and control plastic pollution's adverse effects on marine ecosystems.

Keywords: Biomarker, Comet assay, Clams, Genotoxicity, Microplastics, Micronucleus cytome assay

**A Standardized Protocol for In Vitro Propagation of Endanger
Plant *Bryophyllum pinnatum***

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Abstract

To establish a standardized protocol for in vitro propagation of endangered plant *Bryophyllum pinnatum* using leaf explants, The highest rate of shoot proliferation (85%) and number of shoots per explant 10 was obtained on media BAP 2.5mg/l + Kn0.5mg/l with average shoot length 2.0 ± 0.66 . The maximum shoot regeneration showed 80 ± 1.45 in BAP 1.5mg/l + NAA 0.5mg/l + IBA 0.5mg/l. The largest effect on root formation occurred in BAP 0.5mg/l + IBA 0.5mg/l + NAA 2.0 mg/l and 45 ± 0.0 percentage of rooted explants with 9 ± 11.5 number of roots produced. The plants were maintained at about 70% relative humidity in the greenhouse with 75% shading with 98% of survival rate was achieved after 6 weeks.

Keywords: Regeneration, *Bryophyllum pinnatum*, survival rate

**Isolation and Molecular Characterization of
Mycoplasma gallisepticum from Field Isolates of chickens**

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Abstract

Total of 428 dead birds were necropsied under present study over the period of two years, out of which 198 were suspected for *Mycoplasma gallisepticum* (MG) infection. The cases were suspected based on gross lesions like air sacculitis, tracheitis deposition of cheesy exudate inside trachea and air sacs, pericarditis, pneumonia etc. Swab samples were collected from the respiratory organs of chickens which were further subjected for culture of the organism using PPLO agar and enrichment supplement. The inoculated agar plates were placed into incubator for at least seven days in the presence of 5% Carbon dioxide. The typical fried egg or nipple shaped colonies were developed over agar plate after 4-5 days of incubation which is a characteristics of *mycoplasma spp.* Suggestive colonies were confirmed by PCR. Representative PCR positive samples were further subjected for molecular characterization. Partial genome sequence of 16S rRNA from MG isolate showed 99% similarity with other gene sequences available in NCBI GenBank.

Keywords: Mycoplasma spp., Gene, Lesions, Colonies

Biofilm-Based Adsorbent for the Removal of Triclosan

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Abstract

Triclosan (TCS), a common antimicrobial agent in personal care and pharmaceutical products, is an emerging pollutant linked to adverse effects on animals, including allergic responses, antibiotic resistance, and endocrine disruption. When it reacts with chlorinated water, TCS can produce toxic by-products like chloroform, posing severe health risks to humans. Thus, effective remediation strategies are essential to mitigate TCS contamination. This study investigates the bioremediation of TCS using microbial biofilms developed on a ceramic adsorbent using bacterial consortia present in wastewater from the Mogra Nalla in the Lokhandwala Complex. In a microcosm experiment, graded concentrations of TCS (5, 10, 20 & 40 mg L⁻¹) were used to study removal efficiency. TCS concentrations in water samples were quantified using reverse-phase High-Performance Liquid Chromatography (RP-HPLC) at 3-hour intervals over 24 hours. Results showed TCS reduction percentages of 94.19%, 70.20%, 63.16%, and 29.45% for initial concentrations of 5, 10, 20 & 40 mg L⁻¹, respectively, after 3 hours. After 6 hours, reductions increased to 100%, 97.15%, 85.59%, and 42.94%, respectively. Control groups, consisting of ceramic adsorbents without biofilms, showed minimal reduction, with TCS decreasing to 6.03%, 5.87%, 8.66%, and 4.79% at the 3-hour for the same concentrations. The results indicate that bacteria in wastewater can effectively form biofilms on ceramic adsorbent, significantly enhancing TCS removal. The biofilm-based treatment systems can be a promising and sustainable solution for mitigating triclosan contamination in aquatic environments.

Keywords: Triclosan, contamination, bioremediation

Estimation of α -Melanocyte stimulating hormone (α -MSH) and Melanin Concentrating Hormone (MCH) in the skin of *Cyprinus carpio* and *Ctenopharyngodon idella* after subjected to Pyrene

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Abstract

Pyrene (four ring), a higher molecular weight polycyclic aromatic hydrocarbons (PAHs) compound commonly known as marker of PAHs contamination in the monitoring of the wastes. Any types of wastes are ultimately dumped in to aquatic bodies where it lead to severe health impacts in aquatic flora and fauna including fish. In fish, skin and gills are the external organs that are continuously in direct contact with the ambient surroundings via which harmful chemicals gets penetrated inside their body leading to various behavioral, physiological and reproductive ailments. Any stress in fish leads to the activation of the hypothalamic-pituitary-interrenal (HPI) axis which stimulates the pituitary corticotropes in pars distalis and the pars intermedia to synthesize and secrete pro-opiomelanocortin (POMC)-derived peptides involved in the mediation and regulation of the stress response. Mainly two hormones α -Melanocyte stimulating hormone (α -MSH) and Melanin Concentrating Hormone (MCH) have been implicated is a key regulator of pigment dispersion and aggregation in fish skin in any stress conditions. In present investigation, these two hormones were estimated in two Indian major carps (*Cyprinus carpio* and *Ctenopharyngodon idella*) and found that the changes in melanophores structures corresponds to elevated level of α MSH as concentration (0.1mg/L, 0.2mg/L 0.5mg/L and 1.0mg/L) dependent manner of Pyrene. On contrary, MCH level remain constant in the fish skin exposed to 0.2mg/L, 0.5mg/L and 1.0mg/L of pyrene. However in *C. idella*, the changes in melanophores structures were relatively less prominent than *C. carpio* while MCH level more or less similar to unexposed group.

Keywords: Pyrene, *C. carpio*, *C. idella*, α MSH, MCH

Caffeine as an Emerging Aquatic Contaminant: Degradation and Acute Toxicological Effects on *Oreochromis niloticus*

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Abstract

Rapid population growth, urbanization, and industrialization have continually released emerging contaminants, including food preservatives, pharmaceuticals and personal care products, into the environment. Among these, caffeine is a notable contaminant due to its widespread uses and presence in aquatic systems and biological activity, largely stemming from high global coffee consumption. These contaminants, comprising complex organic compounds, persist in water and pose potential risks to ecosystems and human health. The present study aims to evaluate the fate (Particularly degradation rate) and toxicity in *Oreochromis niloticus*. The stability of caffeine was estimated under in vitro conditions at three different concentrations, viz. 1, 5 and 10 ppm. The concentrations of caffeine in milli-Q water were measured by High-Performance Liquid Chromatography (HPLC). The mean temperature, pH, and TDS were $24 \pm 2^\circ\text{C}$, 7.1 - 7.2, and $0.5 \pm 0.2 \text{ mg L}^{-1}$, respectively. The half-life for caffeine degradation ranged from 4–21 days in light and >28 days in dark conditions. The static non-renewal acute bioassay test was performed to estimate the 96 h LC_{50} caffeine value for *Oreochromis niloticus* at different concentrations (110, 120, 130, 140, 150, 160, 170 and 180 ppm). A range finding and definite test were performed, and a 96-hour LC_{50} was calculated using the probit analysis method. The 96-hour LC_{50} of caffeine for *Oreochromis niloticus* was calculated as 128.82 mg L^{-1} . During acute exposure, the fishes exhibited behavioural changes like surfacing, erratic and uncoordinated swimming, sluggish movement, respiratory distress, chromo-shifting phenomenon and overproduction of mucus on the surface of the body with varying degrees depending upon the concentration of caffeine. Additionally, a decrease in the Hepatosomatic Index (HSI) and Intestinal Somatic Index (ISI) was noted, suggesting that caffeine exposure disrupts critical physiological functions in *O. niloticus*, potentially affecting liver and intestinal health. Acute caffeine exposure at median-lethal concentrations induced significant cytotoxic and genotoxic abnormalities in *O. niloticus* erythrocytes, including various nuclear deformities indicative of DNA damage and cellular structural alterations. The biomarkers used in the present study can be useful tools for assessing and evaluating the acute toxicity of emerging contaminants on the stress and health of aquatic organisms.

Keywords: Caffeine, Bioassay test, Chromo-shifting phenomenon, Hepatosomatic Index, Intestinal Somatic Index,

Genetic Diversity Analysis of Different Stocks of *Labeo rohita* (Rohu) of Mithila Region of Bihar and its Correlation with Sensory Attributes of Culinary Preparation

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Abstract

Rohu (*Labeo rohita*) fish of the Mithila region, especially in the Darbhanga and Madhubani districts is well known for its taste as compared to rohu found in other regions. To validate the same, a pilot survey of Darbhanga, Madhubani, Supaul, Araria, and Kishanganj districts was conducted to identify the different locations for the collection of live rohu specimens. The fish (avg. weight 1.21 Kg) were collected from selected aquatic resources of Darbhanga, Madhubani, Supaul, Araria, and Kishanganj districts. The fish were brought to the college laboratory in ice and processed for further study. The muscle tissue (50-100 mg) was collected from all the collected fish specimens and preserved in 90% ethanol for genotyping. The partial region of mitochondrial gene cytochrome b (1141 bp) was amplified and nucleotide sequencing. Sensory evaluation of rohu culinary preparations i.e. fried fish and fish curry was done for all the collected samples. The sensory attributes used to evaluate culinary preparations were appearance, texture, odour, flavour, colour, and overall acceptability. The overall acceptability decreased from Darbhanga to Kishanganj and was found lowest for Kishanganj i.e. 6.55 (± 0.58) for fried fish and 6.28 (± 1.44) for fish curry. No correlation was observed between the identified haplotypes/nucleotide composition of the cytochrome b gene with sensory attributes of any of the culinary preparations. This finding suggests that the distinct taste of Mithila rohu is not due to a different genetic stock but may be associated with habitat variability.

Keywords: *Labeo rohita*, Mithila rohu, Cytochrome b, Sensory attributes

**Theme III: One Health for
Ecosystem Wealth**

Enhancement of Mucosal Immune Response Employing Bacterial Biofilms

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Abstract

Vaccines are regarded as the safest and most cost-effective strategy to prevent infectious diseases. For some diseases, vaccine improvements are required as protection levels are still inadequate. The key to solving this challenge might lie in the development of more efficacious vaccine delivery systems. In the present study, the principal properties of biofilm have been demonstrated to include their capacity to induce strong mucosal response. The mucosal membranes are the gateway to systemic distribution for many pathogens. Stimulation of immunity in the mucosa with the purpose of halting an infection at an early stage has therefore been a sought-after strategy. Mucosal immunity in mammals is based upon IgA antibodies. Mucosal vaccines may be more desirable in fish as they allow large-scale application and are less labour-intensive compared with injection application. Moreover, mucosal application is a relatively stress-free method that could be used even on young fish that are too small to inject.

Key words: Bacteria, Mucosal, Immunity, Antibodies, Vaccine

In-feed Oxolinic Acid-Induced Histopathological Alterations in Nile Tilapia *Oreochromis niloticus* Juveniles

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Abstract

Aquaculture urgently requires effective bacterial disease management, necessitating improved regulation of antibiotic application. This study investigated the effects of oral oxolinic acid (OA) administration on *Oreochromis niloticus* at the dose of 12 (1×) and 36 mg (3×)/kg biomass/day for 7 consecutive days, relative to a control group. The 1× and 3× groups experienced dose-dependent mortalities ranging from 3.33% to 8.33%. The concentrations of OA residues peaked in the plasma, liver, and kidney on day 7 with the muscle tissues showing the greatest amounts. In both groups, the residues persisted even on day 35 post-dosing. Elevated concentrations of malondialdehyde and total nitric oxide were noted, signifying oxidative stress responses, which correlated with the tissue level changes in various organs. Nevertheless, the cohort administered the recommended dose (1×) exhibited recovery following OA discontinuation. Histologically, the kidney had hydropic oedema, degradation of renal epithelium, nephrocalcinosis, vacuolation, and necrosis. Glycogen-type vacuolation, cellular hypertrophy, and cytoplasmic vacuolation were observed in the liver. Gills exhibited epithelial hyperplasia, thinning, curling, thickening of secondary lamellae, and erosion. Intestinal tissues exhibited a depletion of absorptive vacuoles, degradation of the epithelial layer, mucinous degeneration, and necrotic regions. Splenic alterations were confined to necrosis and a slight increase in sinusoidal space. Recovery was noted in the 1× group. However, none of the assessed parameters normalized in the 3× group even after 35 days of dose suspension. The results, thus, indicated that *O. niloticus* can able to adapt and tolerate OA safely. However, the recommended dose of OA (12 mg/kg biomass/day for 7 days) elicited reversible biological reactions in tilapia and can be utilized in aquaculture with due caution following regulations.

Keywords: Aquaculture, Antibiotic-feed, Histopathology, Oral administration, Oxidative stress

Effect of Area Specific Mineral Mixture on Performance in Animal Health at Different Agroclimatic Zone

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Abstract

An experiment was conducted to study the effects of area specific mineral mixture on performance of non-descript indigenous cow at Hill, Plateau and Plain zones of Chhattisgarh and the experiment was lasted for 90 days. Forty five cows (1-2 Lactation) were selected at random on body weight basis and divided into three groups consisting of 15 cows in each agro-climatic zone. Each group was further subdivided into three groups i.e. negative, control and treatment containing 5 cowseach. Cows of all the groups were allowed for grazing in their natural feed resources available in their respective zones, however control group was supplemented with common mineral mixture and treatment group was supplemented with area specific mineral mixture evolved in RKVY project. The Zn, Co, and Mn values were significantly higher on 90 days at all agro climatic zones in control and treatment groups. On 45 days Zn was significantly higher in control and treatment group at hill and plain zone whereas Co was significantly higher on 45 day at hill zone only. The Mo was significantly higher on 45 day in control and treatment groups at plateau zone of study. The supplementation of area specific mineral mixture and common mineral mixture showed significant difference during the experimental period at different agro climatic zones.

Keywords: Mineral Mixture, Environment, Cattle, Mineral

Effect of *Aeromonas hydrophila* Challenge on the Serum Biochemical Parameters of *Labeo rohita*

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Abstract

Fish serum biochemistry is an important indicator of any abnormalities including the disease. It is important to detect the diseases early as the establishment of bacterial infection occurs without any external signs at the sub-lethal carrier stage. In this study, changes in serum biochemical parameters such as glucose, cortisol, creatinine, alanine aminotransferase, aspartate aminotransferase and C-reactive protein were assessed in *Labeo rohita* fingerlings challenged with *Aeromonas hydrophila* N₁₀P at a sub-lethal dose of 2.40×10^7 cells/fish. When challenged, this moderately virulent strain established its pathogenic potential to cause infection without any external signs. The levels of serum biochemical parameters increased significantly on the first day of post-injection (dpi) and regained normalcy after 15 dpi. The increased levels of the measured parameters suggested that *A. hydrophila* infection can cause stress and affect the vital organs functioning. The variations in these serum parameters could serve as pointers for early recognition of *Aeromonas* infection.

Keywords: *Labeo rohita*, *Aeromonas hydrophila*, Bacterial challenge, Serum biochemistry, Stress

Role of Lactic Acid Bacteria (*Lactobacillus plantarum*) as an Immunomodulator in Koi Carp

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Abstract

In the time of intensive fish rearing, bacterial diseases are becoming a serious problem in the aquaculture sector, particularly when complicated by increasing bacterial antibiotic resistance. The widespread use of antibiotics to control fish diseases has led to the development of antibiotic-resistant bacterial strains and has caused water pollution in the aquatic environment. Also, there is a risk associated with the transmission of resistant bacteria from aquatic environments to humans, and risk associated with the introduction of nonpathogenic bacteria in the human environment, containing antimicrobial resistance genes, and the subsequent transfer of such genes to human pathogens. This resulted in a new trend in aquaculture that paved a way towards use of probiotics in aquaculture which exert a beneficial effect via a wide array of actions which includes competition for adhesion sites and resistance to colonization, competition for essential nutrients, production of antagonistic compounds against pathogens, enhancement of the immune response and diseases resistance. In the present study, *Lactobacillus plantarum*, a probiotic was evaluated for its effect in bringing about immunomodulation in Koi carp. The results clearly indicated its effect as an immunomodulator in koi carp in terms of antibody response which was found employing ELISA. There was clear difference between antibody titre in fishes fed with control diet and diets having probiotic.

Keywords: Lactobacillus, Immunomodulation, Antimicrobial, pathogens, ELISA

Pathology of Fatal Multiple Organ Failure in a Dog

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Abstract

The dog with a history of respiratory distress passed away soon after being admitted into veterinary hospital. Pale mucous membranes and subcutaneous oedema were found in the neck and abdomen upon external examination. On gross examination, trachea of the dog was found filled with frothy exudate while lungs of were showing progressive pneumonia. Plural cavity was filled with copious amount of serosanguinous fluid indicative severe respiratory infection. Both right ventricular dilatation and left ventricular hypertrophy were seen. The animal had moderate enteritis. The cortices of both kidneys were greyish discoloured upon evisceration, and the liver was enlarged along with having significant necrotic foci on its parietal surface. Splenomegaly was also reported as significant lesion. In addition to the prostate gland growing, the bladder wall thickened. Based on gross necropsy findings, multiple organ failure is thought to be the cause of death in the presented animal.

Keywords: Ventricular, Kidney, Liver, Organ

Antiparasitic Efficacy of Biogenic Silver Nanoparticles Against *Ichthyophthirius multifiliis*, A Protozoan Parasite of Fish

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Abstract

White spot disease, caused by the ciliated protozoan parasite *Ichthyophthirius multifiliis*, commonly called “Ich”, affects majority of ornamental fish species including goldfish (*Carassius auratus*). This study aimed to evaluate the *in vitro* antiparasitic efficacy (AE%) of biogenic silver nanoparticles (AgNPs), synthesized from *Bauhinia variegata* (Kachnar) leaf extract, against *Ich* parasite. The AgNPs, characterized using UV-Visible spectroscopy, exhibited a surface plasmon resonance peak at 424 nm and a zeta potential of -45.7 mV. TEM analysis confirmed that the nanoparticles were spherical, ranging from 20 to 50 nm in size, with phytochemical compounds acting as capping agents, as identified by FTIR. Treatment of the *Ich* parasite with biogenic AgNPs resulted in AE rates of 100, 85, and 76% at concentrations of 10, 7.5, and 5 ppm, respectively, within 60 minutes. The estimated median effective concentration (EC₅₀) of the biogenic AgNPs was 4.30 ppm at 30 min and 2.62 ppm at 60 min. Further, the microscopic observations revealed various morphological changes indicative of parasite mortality, such as loss or wrinkling of cilia, cell rupture with leakage of cellular contents, and alterations in the macronucleus. No mortality was observed in the control groups or those treated with the leaf extract or AgNO₃. Hence, the current study suggest that biogenic AgNPs have potential as antiprotozoal agents for managing ichthyophthiriosis, although further *in vivo* studies and field evaluations are needed.

Keywords: *Ichthyophthirius multifiliis*, biogenic AgNPs, TEM, FTIR, antiprotozoal efficacy,

Occurrence of Microplastics in Fish from Upper and Lower Stretches of River Brahmaputra- A Comparative Study

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Abstract

River Brahmaputra, a major river of Central and South Asia flows through Southwestern China, Northeastern India and Bangladesh. During its course of 2900 km from its origin in the Himalayas it is joined by many tributaries in India, eventually draining into the Bay of Bengal after a confluence with the River Ganga. The river traverses a distance of approximately 900 km in India after entering the country at Upper Siang district, Arunachal Pradesh, and departing at Dhubri district of Assam, India before flowing into Bangladesh as River Jamuna. The river supports a rich diversity of aquatic life and sustains innumerable communities along its course. In recent years, microplastics have emerged as an alarming contaminant, wreaking havoc on the aquatic ecosystem. But, information on microplastics contamination in aquatic organisms of River Brahmaputra is scanty. The current study aims to isolate, quantify, and characterize microplastics in fishes from upper and lower stretches of River Brahmaputra. Fish species were collected from upper stretches of Brahmaputra River at Tuting, Upper Siang district, Arunachal Pradesh (Elevation 1240 m above msl) and lower stretches at Dhubri, Assam, India (Elevation 30 m above msl). The gills and guts of the collected fish species were examined for microplastic contamination. Fish species from the lower stretch had a significantly ($P<0.05$) higher occurrence of microplastics than the fish from upper stretch of the River Brahmaputra. The results of this study will be helpful in formulation of policies pertaining to the health of aquatic organisms of Brahmaputra river and millions of people dependent on fish, as food from the river.

Keywords: Microplastics, Brahmaputra, Fish, Aquatic ecosystem

ONH/AEMS/09

Impact of *Aeromonas hydrophila* Infection and Enrofloxacin Therapy on the Haemato-biochemistry, Erythromorphology, and Histopathology of *Oreochromis niloticus*

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Abstract

Infections caused by *Aeromonas hydrophila* are a major barrier to tilapia production. Antibiotics are essential for effective disease management for prophylactic and therapeutic purposes. This study assessed the efficacy of oral enrofloxacin (ENF) at the recommended dose of 10 mg/kg biomass/day for five days in combating *A. hydrophila* infection in *Oreochromis niloticus*. The evaluation focused on assessing the survival, haemato-biochemical changes, erythrocyte morphology, and histopathological alterations in the vital organs. *A. hydrophila* was sensitive to ENF, with a minimum inhibitory concentration of 0.20 µg/mL. The bacterium exhibited moderate virulence, with an LD₅₀ of 1.15×10⁷ cells/fish. Infected fish developed systemic infections, displaying lethargy, dark pigmentation, erratic swimming, and vertical orientation. ENF treatment significantly reduced mortality and physiological stress, as evidenced by improved haemato-biochemical profiles. Histopathological analysis revealed kidney and liver tissue damage in infected fish, which showed signs of faster recovery following ENF therapy. Erythrocyte abnormalities in the challenged fish included elongation, irregular and teardrop shapes, crenation, hypochromia, cytoplasmic membrane damage, vacuolation, hypertrophic nuclei, and eccentric nuclei. These erythro-morphological disruptions were alleviated with ENF treatment. ENF therapy restored haemato-biochemical parameters, accelerated wound healing, and enhanced recovery from infection compared to the untreated control. The findings indicated that ENF is effective in mitigating *A. hydrophila* infection in *O. niloticus* at the recommended dose. However, its responsible use in aquaculture is essential to prevent potential adverse effects on fish health, the environment, and consumers.

Keywords: Nile tilapia, Bacterial diseases, Antibiotic feed, Plasma biochemistry, Histoarchitecture, Erythrocytes

**Phenotypic and Molecular Characterization of Biofilm
Producing MRSA resistant *S. aureus* from Apparently Healthy
and Mastitic Cows**

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Abstract

The present study aims for phenotypic and molecular characterization of biofilm forming methicillin resistant *S. aureus* from raw milk collected from both mastitic as well as apparently healthy cows. Out of 257 samples, 33 samples were found to be mastitic when subjected to California mastitis test. The characterization were confirmed by biochemical (traditional) and molecular methods (PCR). Out of 257 samples, 46 isolates were confirmed to be *S. aureus* by PCR among which 16 (34.78%) isolates were found to be MRSA positive and further out of 16 isolates, 10 isolates were found to be positive for *mecA* gene and 2 for *femA* gene. Among 33 mastitic samples, 10 samples showed growth in MSA and rest were found negative in molecular and biochemical screening. The confirmed *S. aureus* isolates (n=46) were further subjected to antibiotic sensitivity testing by Kirby-Bauer disc diffusion test. Results of ABST revealed that the overall resistance (resistance + intermediate) was maximum against amoxycylav (95.9%) followed by methicillin (93.47%), streptomycin (86.96%), erythromycin (86.94%), penicillin (76%), oxacillin (56.52%), ciprofloxacin (52.16%), cefoxitin (36.95%). Maximum sensitivity was observed against Meropenem (100%) followed by methicillin (93.47%), co-trimoxazole (86.97%), vancomycin (86.90%), chloramphenicol (84.80%), azithromycin (52.17) and cefoperazone (50%). Out of total, multi drug resistance (80.43%) isolates were found maximum in number. Phenotypic detection of all 46 isolates were performed for biofilm formation by CRA and MTP methods, which revealed 75% MRSA, 23.9% MSSA and 81.25% MRSA, 30.43% respectively. Results shows that crystal violet microtitre plate assay is more sensitive ($P<0.0001$) than CRA assay. Genotypic detection of biofilm (*icaA*, *icaD* and *bap*) revealed that out of 30 MSSA isolates, *icaA* and *icaD* could be detected independently in 1/30 (3.3%) and 6/30 (20%) isolates, respectively. However, 14/30 (46.6%) isolates were found to be positive for both the *icaA* and *icaD* genes. It was also found that only 1/30 (3.3%)

could be tested positive for *bap* and 1/30 (3.3%) tested positive for both *icaA* and *Bap* genes. Studies also revealed that out of 16 MRSA isolates, 1/16 tested positive for *icaA*, 3 for *icaD*, 6 for both *icaA* and *icaD*, 1 for *Bap* and 1 for both *icaA* and *Bap* gene. These findings suggest that regulation of biofilm formation is primarily mediated by PIA dependent genes. Thus, further study must be undertaken to explore the possible mechanisms through which bacteria develop resistance to the present day therapeutics.

Key word: MARSA, MSSA, Biofilm, ABST

**Temperature-Dependent Growth Kinetics and Virulence
Determinants in *Aeromonas salmonicida* subsp. *salmonicida*
COFCAU_AS: Implications for Pathogenicity**

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Abstract

This study aimed to comprehensively examine the growth kinetics and phenotypic and genotypic virulence characteristics of *Aeromonas salmonicida* subsp. *salmonicida* COFCAU_AS across a range of temperatures: 20°C, 25°C, 30°C, and 35°C. Growth rates were determined using both spectrophotometric and hemocytometric direct count methods. Results indicated that bacteria cultured at 20°C exhibited the highest growth rate, while those cultured at 35°C demonstrated the lowest. Phenotypic virulence assays revealed maximum activity in hemolysis, amylase, gelatinase, and casein hydrolysis tests at 35 °C. In contrast, lipase activity peaked at 25°C, and DNase activity was highest at 30°C. Genotypic analysis further revealed that the expression of *aerA*, *hlyA*, and *vapA* genes was highest at 35°C, with the lowest expression for *aerA* and *hlyA* at 20°C and for *vapA* at 25°C. These findings underscore the significant impact of temperature on the growth and virulence of *A. salmonicida* subsp. *salmonicida*. The study reveals that the bacterium's virulence potential is enhanced at higher temperatures due to increased enzymatic activities and elevated gene expression levels. This finding has significant implications for understanding its behavior and pathogenicity under varying environmental conditions. The observation that bacterial growth rates are higher at lower temperatures, while virulence properties intensify at higher temperatures, suggests that the stress experienced by the bacteria at elevated temperatures may trigger an increase in virulence factor expression. Although these findings provide valuable insights, further transcriptome analysis is necessary for a more comprehensive understanding of the underlying mechanisms. The comprehensive data provided by this study offer valuable insights for future research and potential strategies for managing infections caused by this pathogen.

Keywords: Growth kinetics, Phenotypic, Virulence, Temperature, Genotypic expression, *Aeromonas salmonicida* subsp. *salmonicida*

A Review on Studies on Combined Exposure of Triclosan and Microplastic in Aquatic Environment

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Abstract

Plastic pollution has become a significant global concern due to its persistent presence in aquatic environments and its resistance to degradation. Plastics are fragmented into microplastics (MPs) smaller than 5 mm, which accumulate and exert toxic effects on various aquatic organisms. MPs not only pose direct toxicity but also act as carriers for other contaminants, such as triclosan (TCS), increasing its toxicity through combined exposures. The hydrophobic nature of TCS enhances its adsorption onto MPs, leading to altered toxicity compared to individual exposures. Studies have shown that combined exposure to MPs and TCS can result in either synergistic or antagonistic effects, depending on various factors such as MP type, size, and exposure duration. For instance, co-exposure to TCS and polystyrene (PS) MPs has been found to increase TCS bioaccumulation and oxidative stress in aquatic organisms, whereas other studies suggest no significant changes or even reduced toxicity. These discrepancies highlight the complexity of interactions between MPs and TCS and the need to consider multiple factors when assessing their combined effects on aquatic life. Future studies should focus on the long-term and chronic effects of combined exposure to microplastics (MPs) and triclosan (TCS) on aquatic organisms. Investigating the underlying molecular mechanisms and biochemical pathways, along with realistic environmental scenarios and complex contaminant mixtures, will provide deeper insights. Additionally, assessing the broader ecological impacts and developing effective mitigation strategies will be crucial for addressing the combined toxicity of MPs and TCS in aquatic ecosystems.

Keywords: Plastic pollution, Microplastic, Triclosan, Aquatic Environment

Antibiotic Resistance *Salmonella enteric* Associated with Seafood

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Abstract

The consumption of seafood has risen across the world. The incidence of seafood-associated bacterial infections also rose, with *Salmonella* sp. being of significant concern. There are various *Salmonella* serotypes exist; *Salmonella enterica* serovar Typhimurium and Enteritidis have garnered major attention as seafood-borne pathogens. The disease-causing capacity of *Salmonella* is attributed to its ability to express a wide assemblage of virulence factors that help the bacterium invade, colonize, and survive in seafood environments and in the gastrointestinal tracts of humans. More than this, the emergence of antimicrobial resistance in *Salmonella* detected from seafood is a significant task for the seafood industry in safeguarding the health of humans worldwide. Implementation of comprehensive surveillance programs, good aquaculture practices, proper handling, processing, and adherence to strict food safety regulations and food safety management are needed to minimize the *Salmonella* contamination in seafood. This study is focused on the antimicrobial resistance in *Salmonella* involved in different types of seafood.

Keywords: *Salmonella*, Seafood, Antimicrobial Resistance, Pathogen, Public Health

**Phytotherapeutic Use of Papaya Leaf Extract Against
Aeromonas veronii Infection in Indian Major Carp, Rohu (*Labeo rohita*)**

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Abstract

Indian major carps, crucial to Indian aquaculture, are increasingly vulnerable to bacterial infections like *Aeromonas veronii*, leading to greater use of antibiotics. This study evaluated the antibacterial potential of *Carica papaya* leaf extract (CPE) as a phytotherapeutic alternative against *A. veronii*. The methanolic extract showed significant in vitro activity against *A. veronii* at 12.5 mg/mL, while aqueous and ethanolic extracts were ineffective. Acute toxicity tests in *Labeorohita* fingerlings established a 96-hour LC50 of 160.69 mg/L, establishing the safety margin of CPE. In the in vivo trial, *Labeo rohita* fingerlings were divided into six groups, including controls, and fed diets with varying CPE concentrations (25–100 mg/g) for 12 days, followed by another 12 days of a basal diet to monitor recovery and mortality. The results demonstrated significant improvements ($p < 0.05$) in hematological, serum biochemical, and immunological parameters in fish fed CPE-supplemented diets. Lower-dose groups (T1 and T2) showed better recovery in RBC count and hemoglobin levels by the 12th day post-challenge. Elevated WBC counts, along with stress markers such as ALP, SGOT, and SGPT, were observed in infected fish. Immunological responses, indicated by increased CRP, total protein, and globulin levels, were also noted. The study concludes that lower concentrations of CPE (25 mg/g and 50 mg/g) yielded better recovery, suggesting its potential as an effective, dosage-dependent phytotherapeutic agent for managing bacterial infections in aquaculture.

Keywords: Rohu, *Aeromonas veronii*, *Carica papaya*, Acute toxicity, Immunity

Antimicrobial Resistance (AMR) Pathogen in Fish and Fishery Products

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Abstract

Antimicrobial resistance (AMR) pathogens are an emerging problem that may affect the health of humans as well as animals. There are many major concerns with the use of antibiotics in fish produced for food, including the possible effects on the emergence of infections resistant to antibiotics in fish and the aquatic environment. Antibiotic-resistant bacteria grow if antibiotics are frequently used to treat bacterial infections in fish. The AMR found in aquaculture were classified into 17 drug classes. Aminoglycosides, beta-lactams, tetracyclines, (fluoro) quinolones, sulpha groups, and multi-drugs are the most frequently observed AMRs. In aquaculture, *Escherichia coli*, *Aeromonas*, and *Vibrio* are the most reported antibiotic-resistant bacteria (ARBs). Due to the development of resistant bacteria, some antimicrobial drugs that are often used in aquaculture are currently only partially effective against some fish infections. Although a healthy population depends on the production of food, however antibiotic resistance is becoming an increasing risk to human health worldwide. Bacteria can acquire antimicrobial resistance through horizontal gene transfer in the environment, via natural transformation, transduction, or conjugation. Once bacteria have acquired AMR genes, they may exist in the environment for a long time. Prolonged use antimicrobial leads to serious health hazards by producing antimicrobial-resistant pathogens in aquaculture. Good aquaculture practices help to lower the risk of disease and reducing the need for antibiotics and antimicrobials.

Keywords: Antimicrobial resistance bacteria, antibiotic resistance, horizontal gene transfer

Development of a Holistic Approach for Disease Management in Prawn Aquaculture

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Abstract

Freshwater prawn (*Macrobrachium rosenbergii*) hatcheries continue to experience significant losses due to bacterial diseases such as shell diseases, necrosis, etc. In many cases, bacteria cause disease when the host is immuno-suppressed or physiologically stressed. Due to limitations on the use of antibiotic in aquaculture, there is an urgent need for alternative anti-infective strategies to control bacterial diseases and support the growing demand for sustainable aquaculture. One promising approach could be to target bacterial quorum sensing, a cell-density dependent communication system that regulates virulence factor expression. Disrupting this system can significantly reduce bacterial pathogenicity. Additionally, organic acids, such as β -hydroxybutyrate, may have potential to enhance gut health, modulate immune responses, and inhibit bacterial growth. Another strategy could focus on strengthening the host's innate immune system. Heat shock proteins, such as Hsp70, play a crucial role in cellular stress responses and can be induced to enhance immune function. Furthermore, gnotobiotic models could be developed to study host-microbe interactions in a controlled environment. By eliminating confounding factors from the microbial community, researchers can closely examine the effects of anti-infective agents on the host immune response and bacterial virulence. Overall, we would be able to explore the combined application of quorum sensing inhibitors, organic acids, and immunomodulators to develop a comprehensive strategy to combat bacterial diseases in prawn aquaculture. A deeper understanding of the underlying mechanisms and optimization of these approaches can significantly enhance prawn health and productivity.

Keywords: Quorum sensing, β -hydroxybutyrate, HSP70, *Macrobrachium rosenbergii*

Co-Infection in Fish: An Overview

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Abstract

During a disease outbreak, the potential of pathogenic effects is greatly amplified by the fundamental effects of co-infection. Co-infection are the most prevalent infection in the nature, when a susceptible host is infected by two or more different pathogens, simultaneously or as secondary infections and alters the severity and course of a disease. Such mixed infections can be due to homologous or heterologous pathogens, comprising bacterial, viral, fungal or parasitic co-interactions. Among the bacterial interactions mostly opportunistic pathogens are responsible such as *Aeromonas* spp., *Flavobacterium columnare*, *Pseudomonas* spp., etc. Viral and parasitic co-infections show cytopathic and severe necrotic alterations in the tissues respectively. The effect of co-infection is very detrimental to the affected host as they enhance the likelihood and occurrence of the disease outbreak. Co-infection ultimately alters the dynamics of the infection and impacts on the fish immune system and its survival. Other than an immunocompromised fish, other environmental factors are the other parameters which quantifies the prevalence of co-infections. Due to less data and information known, the disease manifestation of these secondary pathogens remains unnoticed and unchecked which not only adds to the severity and occurrence of the disease but also its transmission to other susceptible hosts. Therefore, it becomes crucial to understand its mechanism and control remedies, to prevent such disease outbreak and reduced productivity as a whole.

Key words: Fish; Co-infection; Opportunistic pathogens; Bacterial; Mixed infections

**Isolation and Identification of *Flavobacterium tilapia*
Associated with Diseased goldfish, *Carassius auratus***

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Abstract

The present study reports the isolation of *Flavobacterium tilapia* and co-infection with *Shewanella putrefaciens* in goldfish, *Carassius auratus*. The diseased goldfish was collected from Jafarpur, 24 Parganas South, West Bengal, India during the month of December. The diseased goldfish had skin lesions, scale loss and body discolouration. Yellow-pigmented colonies obtained from cutaneous lesions of *C. auratus* on Cytophaga/Shie agar were identified as *F. tilapia* SLG3 and *S. putrefaciens* SLG1, SLG2. *F. tilapia* was a Gram-negative, rod-shaped bacterium. The Vitek-2 Compact system identified the SLG2 strain as *Spingomonas paucimobilis*. However, the molecular characterization confirmed it as *S. putrefaciens*. Other two isolates, SLG3 and SLG1 were identified and submitted as *F. tilapia* (KP997190) and *S. putrefaciens* (KP997189) to the NCBI. *F. tilapia* SLG3 formed a monophyletic group with other strains of *F. tilapia* and showed high DNA homology with *Flavobacterium* spp. based on evolutionary phylogenetic analyses. Most likely, this is a rare finding regarding isolation and association of *F. tilapia* and *S. putrefaciens* in diseased *C. auratus*. Flavobacteriosis is a well-known but scientifically less explored disease of freshwater fish species. It is caused by several bacterial species within the family Flavobacteriaceae. *F. tilapia* is one of them. Likewise in the present report, phenotypic and molecular characterization confirmed the disease condition as flavobacteriosis with mixed bacterial infection. Further investigations on *F. tilapia* as an opportunistic pathogen in ornamental fish are necessary, which would help manage the disease condition.

Keywords: *Flavobacterium tilapia*; *Shewanella putrefaciens*; Flavobacteriosis; *Carassius auratus*

Effects of Nano Urea on Haemato-Physiological parameters of *L. rohita*

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Abstract

The present study is to evaluate the 96-hour median lethal concentration (LC₅₀) of nano urea and to assess the long-term effects of sub-lethal exposure on haematological, biochemical, histological, and genotoxic parameters in *L. rohita* which has been developed as more efficient alternatives to conventional fertilizers in agricultural systems. The results from the acute test revealed that the 96-hour LC₅₀ for nano urea was 9.77 ppm. Severe behavioural alterations, such as hyperactivity, restlessness, erratic swimming, air gulping, increased opercular movements, loss of equilibrium, and frequent surfacing, were observed in fishes exposed to higher concentrations, all indicative of stress due to toxic exposure. For chronic study, *L. rohita* were exposed to 1/5th, 1/10th, and 1/20th of the determined LC₅₀ values for nano urea including a control over 45 days. The study observed a marked decrease in haemoglobin (Hb), red blood cell count (RBC), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC), and hematocrit (HCT), while there was an increase in white blood cell (WBC) count and mean corpuscular volume (MCV). And the biochemical analysis revealed elevated glucose, urea, creatinine, and liver enzymes (SGPT, SGOT, LDH, ALP), signifying liver and kidney damage in fish exposed to the highest concentrations of nano urea. Additionally, genotoxicity tests were performed using comet assays and micronuclei formation tests on liver and blood cells to assess DNA damage caused by long-term exposure to nano urea. The presence of micronuclei in blood cells further confirmed genotoxicity, highlighting the harmful impact of the fertilizer. These results suggest application of nano urea in aquaculture requires careful consideration and regulation to prevent potential harm to aquatic life. Further studies are needed to explore the full scope of toxicity mechanisms, assess the impact of nano-fertilizers across different trophic levels, and develop strategies for aquatic environments.

Keywords: Nano Urea, LC₅₀, Toxicity, Haematological Parameters, Genotoxicity

Identification, Environmental Adaptability, and Antifungal Susceptibility of Emerging Fungal Pathogens in Freshwater Aquaculture

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Abstract

The increasing occurrence of fungal pathogens in aquaculture systems presents a significant challenge to global food security and health of aquatic ecosystem. This study identifies novel fungal pathogens from *Labeo rohita* and *Ompok bimaculatus* in Tripura, specifically *Fusarium oxysporum*, *Saprolegnia parasitica*, and *Phoma* sp. which have been associated with tissue necrosis in infected fishes, exhibiting clinical signs such as caudal fin erosion and ventral body surface hemorrhage and emerged as critical threat in freshwater aquaculture system of this region. Morphological identification through microscopic observation of all cultures revealed the presence of septate and aseptate hyphae. Environmental adaptability experiments showed that these fungal pathogens has adaptability to thrive at different environmental conditions and its optimum salinity, temperature and pH were 0.0-0.5 ‰, 25-30 °C and 5.5-6.0, respectively. In vitro studies exhibited its nature to produce extracellular enzymes like caseinase, lipase, gelatinase, starch hydrolase and DNase which contribute to its pathogenicity. Antifungal susceptibility results revealed that *F. oxysporum* was sensitive to miconazole and mebendazole (up to 4 µg mL⁻¹) and resistant to fluconazole (500 µg mL⁻¹) whereas *S. parasitica* and *Phoma* sp. was not resistant to these drugs. Fungal pathogens from aquatic environments exhibit varying degrees of zoonotic potential, raising significant public health concerns. *Fusarium oxysporum* demonstrates high zoonotic capabilities, whereas *Saprolegnia* and *Phoma* have been rarely reported to cause opportunistic infections in humans. This research contributes to our understanding of emerging fungal diseases in aquaculture and provides a framework for developing effective, environmentally conscious control strategies.

Keywords: Aquaculture, Fungal Pathogens, Extracellular Enzymes, Antifungal Resistance

**Theme IV: Technological
Innovations for Biodiversity
Conservation**

Occurrence of Triclosan in the Aquatic Environment and its Impact on Biotic Communities

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Abstract

Triclosan (TCS) is a synthetic biocide used in a wide range of personal care and pharmaceutical products. Due to extensive use and subsequent disposal, TCS is widely detected in different aquatic environment posing a severe ecotoxicological threat. The current study was designed to assess the occurrence of TCS in Versova creek and Mithi river of Mumbai, India and its toxicity on aquatic organisms. The mean concentration of TCS was found in the Versova creek and Mithi river was 0.0145 ± 0.0005 mg L⁻¹ and 0.48 ± 0.143 mg L⁻¹ respectively. The results of the toxicity study revealed that TCS has dose dependent effect on various aquatic organism. Median lethal concentration (LC₅₀) was found against *Clarias magur* (1.123 mg L⁻¹), *Pangasianodon hypophthalmus* (1.17 mg L⁻¹) and *Labeo rohita* (0.645 mg L⁻¹). Similarly half maximum effective concentration (EC₅₀) was calculated against *Chlorella vulgaris* (1.493 mg L⁻¹), *Spirulina platensis* (1.035 mg L⁻¹) and *Lemna minor* (4.813 mg L⁻¹). A 45-day study exposing bottom-dwelling catfish (*Clarias magur*) to sediment spiked with TCS showed organ-level bioaccumulation, primarily in the liver, followed by the gills, kidneys, and brain. In addition, Oxidative stress enzymes, liver enzymes and serum biochemical markers exhibited a time-dependent increase in activity, while brain acetylcholinesterase (AChE) and gill sodium-potassium ATPase enzyme activity decreased in TCS-exposed fish. The effects of TCS on aquatic primary producers were also estimated and it exhibited a significant impact on the growth, pigment and protein content of the microalgae. During a 28-day microcosm study, sediment exposed to TCS concentrations of 3 mg L⁻¹ and 6 mg L⁻¹ was evaluated for Total Plate Count (TPC). A maximum inhibition of 83.62% was observed in the 6 mg L⁻¹ treatment compared to the control. In addition, Enzyme activities were estimated using the spectrophotometric method in which acid phosphatase (ACP), B-glucosidase (BG), fluorescein di acetate (FDA) and dehydrogenase (DHA) activity were found to be decreased, whereas alkaline phosphatase (ALP), urease (UA) and aryl sulfatase (ARS) activity were observed to be increased with the exposure of TCS which indicated that TCS can effectively alter the nutrient dynamics of the ecosystem. In the ongoing microbial and phytoremediation study, several TCS-tolerant bacteria, microalgae and plant species that may be able to break down TCS were isolated from the water.

Keywords: Triclosan, Median Lethal Concentration, Microalgae, Microbial Enzymes

Biometric Characterization and Stock Status of *Lamellidens marginalis* from Kanwar Lake – The Ramsar Site, Begusarai, Bihar, India

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Abstract

The study, conducted at Kanwar Lake from September 2022 to August 2023, aimed to assess the biometric characteristics and stock status of the freshwater mussel *Lamellidens marginalis*. The biometric measurements of *Lamellidens marginalis* specimens from Kanwar Lake revealed the mean values for shell length (SL) of 71.73 ± 12.36 mm, shell width (SW) of 32.61 ± 5.26 mm, shell height (SH) of 35.66 ± 6.50 mm, and shell weight (SW) of 32.61 ± 5.26 g. Mortality analysis revealed a natural mortality (M) rate of 1.07 yr^{-1} , Fishing mortality (F) of 0.78 yr^{-1} , Total mortality (Z) of 0.29 yr^{-1} , and Exploitation level (E) of 2.68 yr^{-1} . The over-exploitation level indicates that the *Lamellidens marginalis* population in Kanwar Lake is currently unsustainable, suggesting very high fishing pressure. This study provides crucial baseline data on the growth patterns, mortality rates, and exploitation levels of *Lamellidens marginalis* in Kanwar Lake. These findings are essential for effective resource management and conservation strategies, particularly for species in ecologically significant areas like Ramsar sites.

Keywords: *Lamellidens marginalis*, Kanwar Lake, Ramsar site, Exploitation level

Microplastics in Indian Major Rivers: Occurrence, Effects and Potential Solutions

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Abstract

At present, concerns have surfaced over the presence of plastic pollution in river ecosystems. Plastic is widely used in various industries, including packaging, sports, construction, automobiles, agriculture, and personal cosmetics, due to its lightweight, flexible, long-lasting, and affordable properties. Nowadays, the widespread use and increasing dependence on plastic have made plastic pollution a severe problem. Due to poor management, plastic waste enters aquatic, terrestrial, and inland surroundings and degrades into tiny microplastic MPs (<5 mm) particles through photochemical and mechanical processes. Several studies have found that about 14 million metric tons of plastic annually enter the ocean. This pollution has a substantial impact on the day-to-day lives of one billion people living in the Indian subcontinent, either directly or indirectly. According to several studies, the Ganges River is the second most polluted river in the world. It releases 1.05×10^5 tons of plastic and 1 to 3 billion Mps particles into the Indian Ocean annually. The Brahmaputra and Indus rivers have concentrations of 531-3485 and 525-1752 MPs per kilogram of sediment, respectively. The average concentration of Mps in two rivers in Chennai, Tamil Nadu, is 0.4 MPs per litre. Furthermore, the Adyar River (Chennai) is anticipated to discharge 11.6 trillion MPs annually into the Bay of Bengal. Due to their small size and large surface area, MPs are more harmful than traditional plastics because they can easily pass through biological membranes and accumulate heavy metals, toxic chemicals, and waterborne pollutants on their surfaces, increasing their toxicity. Therefore, there is an urgent need for the effective management of Mps, which includes prohibiting plastics, employing bioplastics, promoting microbial decomposition of plastics, and enhancing research into alternative materials to plastics.

Keywords: Microplastics, River, Ecosystems, Pollution, Management

Spatio-Temporal Variability of Marine Litter along the

Thoothukudi Coast: Patterns and Implications

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Abstract

Marine litter is widely distributed in marine environments and has been a severe concern worldwide, due to the disposal of waste from diverse sources. The severity of this threat has garnered increasing attention in India over the last decade, but the full consequences of this pollution are yet to be quantified. To estimate the spatiotemporal distribution and composition of marine litter pollution, three beaches along the Thoothukudi district was studied. Marine litter was collected from 100 m long transects during two seasons (monsoon and post-monsoon). The OSPAR monitoring standard was applied to the 12,507 litter items collected, then grouped under 9 types and 44 categories. In terms of number, litter abundance was higher during monsoon (1.11 ± 0.42 items/m²) than that of post-monsoon (0.76 ± 0.22 items/ m²). Single use plastic comprises of 99% in all the beaches studied. The litter flux decreases with an increase in distance from the shore, and act as a sink to the sea-floor. The results denote that the distribution and typology of marine litter were representatives of household, tourism and fishing, which in turn highlights the need for better regional litter management measures. Suggested management practices include source reduction, mitigation, management of beach environment and change in littering behaviour through environmental education.

Keywords: Beach Litter, Pollution, Management, Monsoon

Filtration Capacity of Selected Bivalve Species Potential for Integrated Multi-Trophic Aquaculture (IMTA) System

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Abstract

The intensification of aquaculture continues to generate waste in the form of uneaten feed and bio-deposits, both within the system and in the environment, upon discharge. These waste products release nitrogen and phosphorus, enhancing productivity and often resulting in eutrophication. Integrated multi-trophic aquaculture (IMTA) is an emerging technology that can mitigate these problems through the use of extractive species. Bivalves are crucial filter feeding extractive organisms in IMTA systems, filtering plankton and algae to reduce eutrophication. However, the relative performance of major bivalve species such as oysters, clams, mussels, and scallops remain unclear. This study aimed to identify the most effective bivalve species for waste remediation in IMTA based on their plankton filtration capacity. Three indigenous bivalve species from the Kakinada coast, Andhra Pradesh, India, were selected for this study: blood clams, oysters, and green mussels. Two experiments were conducted for 5 days each in the laboratory condition (microcosms) in 2 L containers with plankton (*Thalassiosira* @ 2×10^6 cells ml^{-1}) and the mesocosm experiment in 300 L containing 50 L of shrimp aquaculture waste. There was no significant difference in the filtration rate and clearance rate of plankton and chlorophyll-a; however, plankton filtering rate of 94%, 87.1%, and 77.0% were observed in clam, oyster, and green mussel treatments, respectively. In the mesocosm experiment, the clearance rates for ammonia, nitrite, phosphate, biological oxygen demand (BOD), and total dissolved solids (TDS) showed no significant differences. However, oysters demonstrated significantly higher clearance rates for chemical oxygen demand (COD) and total suspended solids (TSS) compared to blood clams and green mussels. The total plate count was significantly lower in green mussels than that in oysters and clams. All the bivalve species exhibited the ability to decrease plankton levels and improve physico-chemical water parameters. Nevertheless, factors such as economic importance, availability, and species suitability should be considered during the selection process.

Keywords: Integrated multi-trophic aquaculture, Bivalve species, Filtration capacity

Mitigating Triclosan Induced Toxicity in *Labeo rohita* Using Microalgae *Spirulina*

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Abstract

Triclosan (TCS), a widely used antimicrobial agent, is prevalent in aquatic environment, posing significant risks to aquatic organisms. Conversely, the microalga *Spirulina platensis* is recognized for its rich composition of micronutrients, macronutrients, antioxidants and diverse bioactive compounds, making it an appropriate option as a functional feed in the aquaculture sector. This study aims to find out the potential use of *Spirulina platensis* dietary supplement to mitigate toxicity induced by TCS in *Labeo rohita*. A 96-hour median lethal concentration of TCS for *L. rohita* was determined to be 0.401 mg/L. A chronic exposure study was conducted with *L. rohita* at 0.0802 mg/L TCS (1/5th LC₅₀), while being fed diets supplemented with 0%, 1%, 2%, 4%, and 8% *Spirulina* for 60 days. Groups fed with 4% and 8% *Spirulina* in diet showed improved serum protein levels and reduced markers of hepatic and renal injury. It regulated various antioxidant enzyme activity in tissues. It significantly reduced MNI frequency and % tail DNA moment in blood, liver and gill. The current study suggests that, the optimum inclusion of *Spirulina* as a functional feed could be between 4% to 8% owing to its ability for protecting *L. rohita* against TCS induced toxicity. This research lays the groundwork for developing functional aquafeeds with microalgae like *S. platensis*, which may enhance antioxidative properties. This approach could alleviate stress from pollutants like TCS in aquatic animals, contributing to environmental conservation.

Keywords: Toxicity, Microalgae, Functional Feed, Antioxidant

Population Characteristics of Snow Trout *Schizothorax richardsonii* in Teesta River Sikkim

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Abstract

The present work was carried out during the period of 2022 (November) to 2024 (April) to get knowledge on the population characteristics of the *Schizothorax richardsonii* (J.E.Gray, 1832) of the Teesta River, Sikkim, North-East India. Where under population parameters studied growth, mortality, recruitment, and exploitation rates of the species. *S.richardsonii* found across the Himalayan and sub-Himalayan regions of the Indian subcontinent and belongs to the family Cyprinidae, subfamily Schizothoracinae. The length-at-first maturity of the fish during the study period was estimated to be 24.64 cm. 411 nos of fish specimens were examined where weight varies from 4gm to 482gm and length ranges from 5.2cm to 33 cm. L_{∞} (mm) noted 369.6 and K (yr⁻¹) observed 0.58. The estimated values for L₂₅, L₅₀, and L₇₅ are 3.62cm, 7.44cm, and 11.27cm, respectively. As a result, 7.44cm was the length at first capture (L₅₀). Applying the formula $L_m = L_{\infty} * 2/3$, the length-at-first maturity of *S.richardsonii* during the study period was estimated to be 24.64 cm. The instantaneous total mortality coefficient (Z) was predicted to be 4.28 year⁻¹ by using the growth parameters. The natural mortality coefficient (M) for *S.richardsonii* was determined to be 1.01 by using Pauly's empirical formula (1980). Fishery mortality (F) coefficients were calculated using the formula $F = Z - M$, and the results showed that they were 3.28. The current exploitation rate was estimated as $E=0.77$. Peak recruitment occurs twice a year. The peak recruitment was observed in May (14.38%) and October (15.91%). The natural fish population in the Teesta river and hill streams is declining both in terms of quantity and quality. Such as pollution from overfishing, damming streams, introduction of exotic fish and climate change.

Key words: Snow Trout, Growth, Mortality, Recruitment, Teesta River, Sikkim

Application of GIS and Remote Sensing for Biodiversity Conservation

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Abstract

Geographic Information Systems (GIS) and Remote Sensing (RS) are pivotal technologies in the field of biodiversity conservation. These tools provide powerful means to collect, analyze, and interpret spatial data related to ecosystems and species. Their applications are diverse and include habitat mapping, monitoring environmental changes, and aiding in conservation planning. A Geographic Information System (GIS) is a computer system that analyzes and displays geographically referenced information. It uses data that is attached to a unique location. The geographic location of farms using a specific fertilizer, GIS analysis of farm locations, stream locations, elevations, and rainfall will show which streams are likely to carry that fertilizer downstream. the many uses of GIS in earth sciences, biology, resource management, and many other fields. Remote sensing is the process of detecting and monitoring the physical characteristics of an area by measuring its reflected and emitted radiation at a distance (typically from satellite or aircraft). GIS and RS are used to create detailed maps of habitats. These maps help in identifying different vegetation types, land cover classes, and critical habitats for various species. GIS and Remote Sensing are indispensable in biodiversity conservation, offering tools to map, monitor, and manage natural resources effectively. Their continued development and integration into conservation strategies will enhance our ability to protect and sustain biodiversity in the face of ongoing environmental challenges.

Keywords: GIS, Remote sensing, Biodiversity, Conservation

Effects of Triclosan on Sediment Microbial Enzyme Activity in a Microcosm Investigation

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Abstract

Triclosan (TCS), a broad-spectrum biocide, is gaining attention due to its toxic effects on biotic communities and associated ecosystems. The omnipresence of TCS arouses growing concern about its potential ecological effect on microbes and microbial enzymes responsible for sustaining biogeochemical processes. The present study was formulated to investigate the effects of triclosan on microbial enzyme activity in a microcosm setup. The sediment sample for the microcosm study was collected from Versova Creek, Mumbai. In that experiment, graded concentrations of triclosan (0, 3 and 6 mg kg⁻¹) were added and incubated in the dark for 28 days. The quantification of TCS level was performed in High-Performance Liquid Chromatography. Various microbial enzyme activities were estimated using the spectrophotometric method in which acid phosphatase (ACP), β -glucosidase (BG), fluorescein di acetate (FDA) and dehydrogenase (DHA) activity were found to be decreased, whereas alkaline phosphatase (ALP), urease (UA) and aryl sulfatase (ARS) activity were observed to be increased with the exposure of TCS. The maximum inhibition (68%) was observed in FDA activity, followed by 63% suppression found in DHA activity, and the least (27%) affected enzyme activity was recorded in ACP activity after 28-day incubation period in 6 mg kg⁻¹ TCS concentration. The rise in UA and ARS activity was observed in the case of 3 mg kg⁻¹ TCS level. After 28 day trial period, the degradation in TCS levels of 3 mg kg⁻¹ and 6 mg kg⁻¹ was estimated to be 89% and 72%, respectively. The heterotrophic count of the microcosm sample was also reduced during the experiment. The findings of this study demonstrated dose-dependent TCS impacts on microbial enzyme activity in sediment. This alteration in enzyme activity could potentially disrupt the biogeochemical cycle and harm the overall functioning of the ecosystem.

Keywords: Triclosan, Microcosm, Microbial Enzyme Activity, Biogeochemical Cycle

River Dolphin Management Using GIS

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Abstract

Along with Coelacanth, Horse shoe shrimps, and a few different species of sharks, the Ganges river dolphin (*Platanista gangetica gangetica*) is one of the oldest animals on the planet. It was designated as the National Aquatic Animal of India on 5 October 2009. This species is now extinct in most of the areas where it once existed, due to serious threats from habitat fragmentation, pollution, poaching, and deaths from accidental entanglement in fishing gear. The Ganges river dolphin comes under Schedule I of the Wildlife Protection Act (1972), classified as Endangered in the IUCN Red List and included in CITES Appendix I. As it is a keystone species and comes in top predators help maintain the balance of food web, their extinction would represent a loss of genetic diversity potentially impacting the overall health and resilience of aquatic ecosystem, Lack of technology is a major reason why many organizations and government fail their projects because cannot collect accurate data, were not well planned. GIS makes it easier for organizations to plan and manage projects concerning the river dolphin environment and their management. GIS technology helped gather the data needed to make these decisions. They used the available map data to collect information about the available resources and decide where these river dolphins taking shelter, they provide us the data how can we make management strategies etc. They then used the data to renew the most strategic locations by monitoring the environment using satellite images. GIS helps in tracking the current state of an area as well as predicting or planning future requirements.

Keywords: River dolphin, GIS, Keystone, Habitat fragmentation, Pollution

Evaluation of Concentrations of Heavy Metal in the Sediment of Ranjit Sagar Reservoir, Punjab, India

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Abstract

Ranjit Sagar is a man-made reservoir or dam situated in district Pathankot, 24 Km upstream of Madhopur Headworks. Since 2017, its 87.60 km² has been a Conservation Reserve. It was constructed in the year 1981 in the form of tallest earth core with gravel shell dam in India. It is the habitat of numerous bird species, water birds, and fish species including other fauna and flora. Heavy metal concentration in the sediment of RanjitSagar reservoir were examined for various element like arsenic, cadmium, nickel, lead, zinc, chromium and copper. The sediment of RanjitSagar reservoir showed various concentration range of these metals. The study reveals that arsenic values ranged from 0.25 to 8.2 µg g⁻¹, with the highest concentration (6.58 µg g⁻¹) observed in January and lowest (2.65 µg g⁻¹) in July. Seasonally, arsenic level was maximum in winter, followed by post-monsoon and monsoon. Cadmium concentrations varied from 0.10 to 0.60 µg g⁻¹, with the highest concentrations (0.45 µg g⁻¹) in August and lowest (0.20 µg g⁻¹) in July. It was observed in the post-monsoon season, followed by winter and monsoon. Nickel concentrations were highest in October and lowest in July, with the highest concentrations in post-monsoon and winter. Lead concentrations were highest in November and lowest in July, with the highest concentrations in the post-monsoon season. Zinc concentrations were highest in November and lowest in July, with the highest levels in the post-monsoon season. Chromium levels varied from 0.4 to 37.45 µg g⁻¹, with October having the highest concentration, whereas lowest in July. Seasonally, it was highest levels in post-monsoon. Copper concentrations ranged from 2.5 to 34.05, with the highest concentrations in September and lowest in July. The study highlights to understand the environmental impact of these places by the presence of heavy metal concentrations in sediment samples.

Keywords: Evaluation, Heavy metals, Sediment, RanjitSagar Reservoir, Punjab

Assessment of the Zooplankton Community in Ranjit Sagar Reservoir in Punjab (India)

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Abstract

Ranjit Sagar is a man-made reservoir or dam located in the Pathankot district, 24 Km upstream from Madhopur Headworks. Since 2017, its 87.60 Km² have been designated as a Conservation Reserve. It was built in 1981 as India's tallest earth core dam with a gravel shell. Zooplanktons are crucial fish food organisms for growth and survival in aquatic biota. They are found in lentic water systems and are essential for various fish species. To understand seasonal fluctuations, zooplankton populations were collected through a bolting silk plankton net and analyzed by using Sedgewick Rafter Cell for qualitative and quantitative purposes. The study of zooplankton examined rotifers, cladoceras, copepods, ostracods, oligochaete, and dipteran populations in Ranjit Sagar reservoir. Rotifer populations varied between 4.0 to 26.0 no. l⁻¹, with the highest recorded population (24.0 no. l⁻¹) during December and lowest (5.0 no. l⁻¹) in September. The population of cladocera varied from 4.0 to 19.0 no. l⁻¹, with December having the highest mean population (17.0 no. l⁻¹) and September & January having the lowest (6.0 no. l⁻¹). Seasonally, cladoceran was recorded to be maximum (11.33 no. l⁻¹) in post-monsoon, followed by winter (11.11 no. l⁻¹) and monsoon (10.0 no. l⁻¹). Copepod populations ranged from 2.0 to 10.0 no. l⁻¹, with the highest (8.0 no. l⁻¹) in October and lowest (3.0 no. l⁻¹) in December & January, whereas, seasonally, it was maximum (5.83 no. l⁻¹) in monsoon followed by post-monsoon (5.66) and winter (4.0). Ostracod populations ranged from 0.0 to 2.0 no. l⁻¹, with the highest (1.67 no. l⁻¹) in July, whereas, lowest (0.33) in December & January. Oligochaete populations varied from 0.0 to 6.0 no. l⁻¹, with the highest (5.33 no. l⁻¹) in July and lowest (1.0 no. l⁻¹) in January. Dipteran populations varied from 0.0 to 2.0 individuals per liter, with the highest population density (1.33 no. l⁻¹) in December and lowest as 0.33 no. l⁻¹ in January & August in Ranjit Sagar reservoir. The overall abundance trend of zooplankton in RanjitSagar reservoir was recorded in the order of rotifera> cladocera> copepoda> oligochaeta> diptera> ostracoda. The results showed that aquatic life thrives well in reservoir water.

Keywords: Assessment, Zooplankton Population, Ranjit Sagar Reservoir, Punjab

Marine Debris in Coastal Ecosystems: A Study from Mangroves to the Seafloor

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Abstract

Marine debris, particularly plastics, poses a significant threat to coastal ecosystems, yet its distribution across both mangroves and seafloors remains under-researched. This study aims to assess the abundance, composition, and sources of marine debris in two distinct environments: the seafloor of the North-Eastern Arabian Sea and mangrove ecosystems. The pollution caused by marine debris is a serious environmental threat in many parts of the world. Using a trawl-based swept method, experimental fishing was conducted fortnightly from September 2017 to March 2018, resulting in the collection of 1,077 debris pieces weighing 11.7 kg (dry weight) from 25 hauls. The average density of debris was 943 items/km², with an average weight of 10.2 kg/km², leading to an estimated total of 379 tonnes (dry weight) of marine debris along the coast. Plastic-based debris comprised 87.1% of the total items, with plastic bags and food wrappers being the most common types. Shoreline and recreational activities were identified as the major sources of debris, contributing 88.6% of the total load. Simultaneously, an assessment of mangrove debris conducted from September 2019 to March 2020, utilizing belt transect methods, revealed 3,526 debris items weighing 367.9 kg, averaging 176.45 items (18.40 kg) per transect, with plastics averaging 110.15 items per transect and a weight of 7,924 grams. Analysis of debris trapped in mangrove trees found 1,224 items weighing 88 kg, indicating the critical role of mangroves in trapping and retaining debris. The study highlights the effective use of available fishing trawlers and co-management practices ("Make fishers friend") as viable methods to remove seabed debris. This comprehensive study provides vital data for understanding the prevalence and impact of marine debris across coastal ecosystems, facilitating region-based effective control and management of plastic debris pollution.

Keywords: Marine debris; Coastal water; Mangrove ecosystems; Plastic pollution

Artificial Reefs, as a Solution for Restoration of Marine Ecosystem – A Review

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Abstract

Pollution and global warming has become a threat to the environment and sustenance of the life existing on the planet. It has led to climate change causing a shift in habitat and ecology of species residing over. The effect of climate change is immense on the marine life and it has affected the aquatic flora and faunas, adversely. Henceforth, there has been increasing interest in marine restoration. Artificial reefs implementation is one approach being used as a measure for restoration of marine ecosystem that has been damaged due to coral reefs destruction due to anthropogenic activities like pollution, overfishing, destructive fishing practices using cyanide or dynamite, collecting live corals for the aquarium market, etc. Artificial reefs are modeled by sinking oil rigs, scuttling ships, or shipwrecks that help in preservation of the ocean floor by mimicking with natural reefs. They may be built of polyvinyl chloride or concrete to provide substratum for attachment of algae and invertebrates such as barnacles, corals, and oysters which in turn provides intricate structures and food for assemblages of fish. In addition, they provide livelihoods to millions of people and serve as barrier against the worst impact of cyclones, protecting the coastal communities. These reefs also cater to the needs of recreational fishermen and tourists so that the natural reefs can be completely conserved and relieved of fishing pressure. Henceforth, this comprehensive literature review focusing on artificial reefs is carried out to understand its role in marine ecosystem restoration and fisheries management, alongwith the study of its design, material characteristics, application, effectiveness and management.

Keywords: Artificial Reefs, Fisheries, Ecosystem, Coral, Biodiversity, Coastal, Protection

Current Status of Fish Diversity in the River Bagmati, A Tributary of the Ganga

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Abstract

The present study on ichthyofaunal diversity in river Bagmati was conducted from October 2023 to September 2024. A total of 42 fish species belonging to 10 orders, 16 families, and 31 genera were recorded. The dominant order, *Cypriniformes*, comprised 21 species, followed by *Siluriformes* and *Anabantiformes*, each with 6 species, and *Perciformes* with 3 species. The remaining orders represented only one species each. Among 42 species, 35 species comes under Least concern (LC), 3 species Vulnerable (VU), 2 species Not evaluated (NE), 1 species Near threatened and 1 species Critically endangered category in IUCN redlist. Among them, *Wallago attu*, *Channa orientalis* and *Ailia coila* comes under the vulnerable and near threatened category respectively. In terms of conservation status, most species (35) were classified as Least Concern (LC) according to the IUCN Red List, while 3 species were categorized as Vulnerable (VU), 2 as Not Evaluated (NE), 1 as Near Threatened (NT), and 1 as Critically Endangered (CR) category. *Wallago attu*, *Channa orientalis*, and *Ailia coila* fall under the vulnerable and near-threatened categories respectively, signaling the need for targeted conservation efforts for these species. Different diversity indices were calculated and the Shannon-Weiner diversity index value ranging from 1.569 to 1.571. The Pielou's Evenness (J') value, ranging from 0.985 to 0.987 and Species richness (d) value ranged from 5.669 to 5.851, reflecting a diverse fish community. The Bray-curtis similarity index showed highest similarity between Muzaffarpur and Darbhanga sampling site (98%) and lowest similarity with Sheohar site (87%). The result also showed the high fish diversity in Muzaffarpur district site followed by Darbhanga and Sheohar district site, indicating a possible difference in environmental conditions and habitat quality that could influence fish diversity. This study emphasize the importance of preserving the fish diversity in the Bagmati River, highlighting the urgency of focused research on vulnerable species and habitat protection. The findings will contribute to future conservation planning, management, and ecological assessments of freshwater fish species in the region. Further, monitoring and conservation efforts are needed to ensure the sustainability of fish populations, particularly for species at risk of decline.

Keywords: Fish diversity, Conservation strategies, River Bagmati

Study on Performance of Biochar Bed Column Device for Removal of Triclosan from Aqueous Solution Containing Humic Acid

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Abstract

Triclosan (TCS), an emerging pollutant emerges as a notable contributor to adverse impacts on aquatic organisms owing to its widespread use during COVID-19. The current study aims to investigate the efficiency of sugarcane bagasse biochar (SBB) for removal of triclosan (TCS) in presence of humic acid from aqueous solution through batch and column studies. In batch study, SBB was prepared for TCS removal. Langmuir isotherm model showed highest adsorption. A 90% reduction in TCS was accomplished with 0.625 g L⁻¹ of SBB-400°C. Adsorption kinetic modelling was well fitted to pseudo-second order model. TCS removal was not significantly inhibited in presence of 5, 10 and 25 mg. L⁻¹ humic acid concentrations. Column experiments of continuous flow biochar-bed column with the aqueous solution spiked with TCS (100 mg L⁻¹) at a flow rate of 50 mL min⁻¹ showed 99% removal efficiency. Thomas model and Yoon-Nelson model signified the breakthrough behaviour of TCS adsorption on the column. Bioassay studies on *Chlorella vulgaris* revealed that the designed column is highly efficient, effective and eco-friendly approach for TCS removal.

Keywords: Biochar; Bioassay; Column bed device; Humic acid; Triclosan

Biometric Characterization and Stock Status of *Lamellidens marginalis* from Kanwar Lake – The Ramsar site, Begusarai, Bihar, India

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Abstract

The study, conducted at Kanwar Lake from September 2022 to August 2023, aimed to assess the biometric characteristics and stock status of the freshwater mussel *Lamellidens marginalis*. The biometric measurements of *Lamellidens marginalis* specimens from Kanwar Lake revealed the mean values for shell length (SL) of 71.73 ± 12.36 mm, shell width (SW) of 32.61 ± 5.26 mm, shell height (SH) of 35.66 ± 6.50 mm, and shell weight (SW) of 32.61 ± 5.26 g. Mortality analysis revealed a natural mortality (M) rate of 1.07 yr^{-1} , Fishing mortality (F) of 0.78 yr^{-1} , Total mortality (Z) of 0.29 yr^{-1} , and Exploitation level (E) of 2.68 yr^{-1} . The over-exploitation level indicates that the *Lamellidens marginalis* population in Kanwar Lake is currently unsustainable, suggesting very high fishing pressure. This study provides crucial baseline data on the growth patterns, mortality rates, and exploitation levels of *Lamellidens marginalis* in Kanwar Lake. These findings are essential for effective resource management and conservation strategies, particularly for species in ecologically significant areas like Ramsar sites.

Keywords: *L. marginalis*, Kanwar Lake, Ramsar site, Exploitation level, Conservation.

Drone Technology in Fisheries and Aquaculture: Opportunities and Challenges

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Abstract

The biggest challenge is to provide adequate and nutritious food to the world population expanding at an alarming rate. As capture fisheries continue to decline, aquaculture becomes increasingly essential, especially in developing countries, where it serves as a crucial source of protein-rich food. However, aquaculture is still facing operational challenges such as accessibility, improper monitoring and management, unavailability of skilled labor, high labor demand etc. Overcoming these challenges requires advanced technologies that are ecologically friendly, productive and innovative, contributing to the evolution of smart aquaculture practices. In recent years, drone technology (also known as unmanned aerial vehicles) has been widely used in various sectors including agriculture, military surveillance, commercial sectors, disaster monitoring, traffic control, etc. However, its potential remains untapped in the field of fisheries and aquaculture. Here, we explored the potential and challenges of using drones for effective management, monitoring and surveillance operation in fisheries and aquaculture. Drones may assist in various day to day tasks in both remote and nearby locations, such as arial monitoring of aquaculture farms, high-resolution aerial imaging, health assessment, real-time data collection related to water quality, dissolved oxygen and pollutants, monitoring of fish behaviors, fish feeding, counting fish seed and even transporting fresh and live fishes. Their application in fishery resource management is equally transformative which may support in stock assessments and tracking fish migrations. Despite these advantages, several challenges may persist, such as operational difficulties for less-educated or less-skilled farmers, regulatory restrictions, implementation costs and potential impacts on fish behavior due to the humming noise of the drones. Overall, this comprehensive overview highlights the use of drone technology and its potential to create a sustainable future for fisheries and aquaculture.

Keywords: Drone, Fisheries, Aquaculture, Sustainability

Morphological, Distributional, and Molecular Characteristics of *Puntius terio* (Hamilton, 1822) in Eastern India: Insights from Genetic Variation and Phylogenetic Analysis

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Abstract

This study investigates the morphological, distributional, and molecular characteristics of *Puntius terio* (Hamilton, 1822) in India, with a focus on three states: Assam, Bihar, and Odisha. Morphological analysis of 67 specimens revealed a standard-length range of 23.41-45.64 mm (mean 36.83 ± 6.76 mm). Key diagnostic features include a golden-edged black spot above the anal fin, an incomplete lateral line with 22-24 scales, and III+8 dorsal fin rays. The body is deep and laterally compressed, with morphometric variations noted in body depth (31.82-46.18% SL) and head length (26.78-31.59% SL). Analysis of 273 COI sequences from 6 *Puntius* species revealed 283 variable sites in a 606 bp consensus. Average nucleotide frequencies were T=28.87%, A=26.95%, G=17.58%, C=26.61%, with 44.19% GC content. Intraspecific K2P distances: 0.1-1.3%; interspecific: 0.3-18.7%. Phylogenetic analysis showed *Puntius* sensu stricto as a distinct clade. Species delimitation mostly matched morphological identifications, with some exceptions. This study provides insights into *P. terio* diversity, distribution, and genetics, aiding taxonomy and conservation efforts in India.

Keywords: *Puntius terio*, Morphometry, Meristics, Distribution, Genetic Variation, Phylogenetic Analysis, Species Delimitation, India

First Report on the Occurrence of Invasive Exotic Sucker Mouth Catfish, *Pterygoplichthys disjunctivus* from Deepor Beel, A Ramsar Site of International Importance, Assam, India

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Abstract

India's wetlands, covering an estimated 1-5% of the country's total land area, support roughly one-fifth of the nation's biological diversity. Among these wetlands, floodplain wetlands, particularly in the Ganga-Brahmaputra basin, are significant for their ecological richness and fisheries potential. However, these ecosystems face rapid degradation due to anthropogenic disturbances and natural factors. Introduction of non-indigenous invasive species is one of the major factors endangering these environments. This study documents the first record of invasive *Pterygoplichthys disjunctivus* from Deepor Beel ecosystem, Assam. The collected specimen was identified, and characterized using morphological measurements. The study highlights the potential routes of introduction, likely through the aquarium trade or river connectivity, and underscores the significant threat posed by *P. disjunctivus* to native biodiversity. This species, known for its adaptability, fecundity, and ability to disrupt local ecosystems, is expanding its range in India, raising concerns over its impact on freshwater biodiversity and the associated socio-economic consequences.

Keywords: Floodplain Wetland, Invasive Species, Ecosystem Degradation

Management of Emerging Pollutants in Aquatic Ecosystem for Improving Water Quality using Mathematical Model

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Abstract

The mushrooming of industries and increase in population lead to the emergence of new chemical compounds used for different commercial and domestic purposes. These compounds are released in the aquatic systems either directly after use or indirectly through wastewater treatment plants (WWTPs), biosolids and are therefore, referred to as emerging pollutants (EPs). Water quality monitoring is a major challenge in present era due to continuous release of EPs from multiple sources and posing threat to aquatic biodiversity as well as human health globally. United Nations Sustainable Development Goals (SDG)-2030 stressed upon serious concern on water quality management by preventing the abrupt release of EPs and wastewater. However, many EPs and their metabolites remain undetected in wastewater treatment plant effluents (WWTPs) and shows differential fate and behavior in sediment-water matrix. Despite of increase in ecotoxicological risk, a clear knowledge about fate and transformation of these EPs in the aquatic system is still scarce. Therefore, there is a clear need to strengthen the current state of knowledge concerning the fate and transformation of EPs on aquatic environment and identify potent EPs. Over the years, many researchers have attempted to develop several water quality models for elucidating the pathways of fate and transformation of different EPs in the aquatic environment. The water quality model includes several physical mechanisms that determine fate and transformation of pollutants in a water body. Some of the models are used to elucidate fate of pollutants are mass balance models, steady-state model, unsteady-state data modelling, novel dynamic QWASI models, multimedia models, SPARROW Models, SWAT.

Keywords: Emerging Pollutants, Water Quality, Mathematical Model, Fate

Theme V: Climate Change in Fisheries and Livestock System

Impact of Climate Change on Plankton Diversity

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Abstract

Planktons are microscopic entities constituting the sustaining base of food chains in the ocean or other water bodies. They are the primary food source for fish and other aquatic organisms. They enhance the immunity of the aquatic organisms. Climate change is expected to warm up the ocean surface where majority of life inhabits. Ocean warming influences vertical mixing and stratification patterns, which alter nutrient cycle, plankton production, and aquatic food web. Plankton serves as the first food source for all larval organisms and the base of aquatic ecosystem. Zooplankton contributes as food source to economically valuable fishes, primary production grazers, and carbon and nutrient cycle drivers. Climate change is altering plankton diversity in riverine systems, with far-reaching consequences for food webs, fisheries and ecosystems. Rising temperatures, changing water chemistry and altered river flows are disrupting plankton communities leading to - increased frequency and severity of harmful algal blooms, Changes in plankton abundance, Shifts in disease dynamics and parasite-host interactions, Invasion of non-native species. These changes have cascading impacts on food webs, threatening the stability and resilience of riverine ecosystems. Fisheries are also affected, as plankton are a crucial food source for many commercially important species.

Keywords: Climate Change, Phytoplankton, Zooplankton, Food Web

The Potential of Coral Farming to Restore Degraded Reefs and Enhance Carbon Sequestration

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Abstract

The increasing concentration of greenhouse gases, primarily carbon dioxide (CO₂), in the atmosphere is driving unprecedented changes to our planet. These changes include rising temperatures, extreme weather events, ocean acidification, and sea-level rise which leads to several uneven phenomenon in aquaculture like coral bleaching and habitat destruction ,etc. To mitigate these impacts and ensure a sustainable future, it is imperative to reduce greenhouse gas emissions, reduce overfishing and implement effective carbon sequestration strategies. Coral farming, also known as coral aquaculture, is a promising technique for restoring degraded coral reefs and enhancing their ability to sequester carbon. By cultivating corals in controlled environments and then transplanting them onto damaged reefs, coral farming can help to revitalize these vital ecosystems. Coral reefs are important carbon sinks, capturing and storing carbon dioxide from the atmosphere. Healthy coral reefs act as natural barriers, protecting coastlines from erosion and storms and also act as shelter homes for many species. In conclusion, coral farming offers a promising approach to restoring degraded reefs and enhancing their carbon sequestration capabilities. By addressing the challenges and leveraging technological advancements, we can contribute to the long-term sustainability of these vital ecosystems and their invaluable services.

Keywords: Corals, Carbon Dioxide, Coastlines, Barriers, Sustainability, Ocean Acidification

Impact of Climate Change on the Persistence, Environmental Partitioning and Toxic Effect of an Emerging Pollutant, Triclosan, in the Oceanic Compartments of the Southwest Coast of India

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Abstract

In recent years, increased urbanization, population expansion, and the outbreak of the COVID-19 pandemic have significantly contributed to the release of Emerging Contaminants (ECs) into aquatic systems. Among these contaminants, triclosan (TCS), a widely used antimicrobial agent in pharmaceuticals and personal care products, has been detected in the sediment-water matrices across global environments at concentrations ranging from nanogram to microgram levels. This widespread presence of TCS poses substantial risks to ecosystems and human health. Concurrently, anthropogenic emissions of greenhouse gases (GHGs) are driving climate change, resulting in long-lasting shifts in all components of the climate system. These climatic changes are expected to have profound consequences for aquatic ecosystems, particularly in coastal regions, by altering water and sediment quality parameters that govern pollutant dynamics. In this study, the occurrence of the emerging contaminant triclosan was quantified in water, sediment, and fish samples from coastal areas (water: Mean 2.43 ng/L; sediment: Mean 0.61 ng/g; fish: Mean 54.5 ng/g), physicochemical parameters of water and sediment was estimated. A principal component analysis (PCA) biplot was used to predict the correlations between TCS concentrations and environmental variables. Analysis results revealed a positive correlation with pH, salinity, temperature, and total organic carbon (TOC). Climate modeling and Regional Risk Assessment methodologies were used to further investigate the potential impacts of climate change-induced alterations in water and sediment quality on TCS dynamics. Our results indicated that salinity, temperature and TOC will be the primary drivers influencing TCS persistence, partitioning, and toxicity in marine environments.

Keywords: Principal Component Analysis, Physicochemical Parameters, Water, Sediment

Sponge City: A sustainable Use of Water Resources in Aquaculture

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Abstract

Our country has been facing a nasty flood situation for many years. Urban flooding has become an increasingly frequent and destructive issue in cities due to rapid urbanisation of the stormwater management system. Minimising the impact of flood required an adaptation plan, especially in the community. Traditional drainage infrastructures often fail to handle heavy rainfall, leading to significant economic and environmental impacts. The concept of a sponge city emerges as a sustainable solution to mitigate urban flooding by enhancing the city's ability to absorb, store, and reuse. Sponge city also promotes Integrated fish farming, natural breeding ground, natural live feed resources for aquaculture and disease resistance water. Future prospects of sponge city are water harvesting and reuse, pollution control and resilience for drought and aquaculture. It increases sustainability goals, production, feed resources management, water quality management.

Keywords: Breeding Ground, Integrated Fish Farming, Sustainable, Disease Resistance.

Plastic and Microplastic Pollution in the Fisheries Supply Chain: A Gender-Based Preliminary Study of Awareness, Perceptions and Attitude at Ferry Wharf, Mumbai

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Abstract

Awareness of environmental hazards posed by plastic pollution, and subsequently by microplastics, is crucial for mitigating plastic litter accumulation in ecosystems. This study, conducted at New Ferry Wharf (NFW), a major landing centre in Mumbai, Maharashtra, aimed to evaluate the awareness, perceptions, and attitudes of the fishing community regarding plastic pollution while examining how these factors vary across demographic categories such as gender and occupation. Utilising a descriptive survey design with a structured interview schedule, the study used 60 purposively selected respondents. To gauge gender-based awareness regarding plastic use and its impact on marine environments, ten key statements were assessed using a five-point Likert scale, which were subsequently normalized. Statements were framed both positively and negatively to counteract response bias. The findings revealed considerable awareness regarding plastic use; however, understanding of microplastics remained limited. Respondents perceived government and academic institutions as pivotal in raising awareness and regulating plastic consumption, advocating for proactive measures such as banning production and shutting down manufacturing facilities to nip the evil in the bud. They emphasized the importance of environmental education initiatives, particularly the role of social media and sensitization campaigns in reducing plastic consumption. A positive attitude toward continued learning, willingness to reduce plastic use, and support for government initiatives through volunteer clean-ups were evident among participants. The Mann-Whitney test indicated that both men and women held similar views on plastic use, while the Kruskal-Wallis test revealed significant differences among supply chain actors, necessitating a Dunn's post hoc test for specific group discrepancies. In light of these insights, it is evident that government agencies must intensify public education on the origins and consequences of plastic pollution. Through comprehensive campaigns, this study advocates for a collaborative approach that bridges policy, education, and community engagement to mitigate plastic waste and its pernicious impacts on marine ecosystems.

Keywords: Plastics, Microplastics, Perception, Awareness, Mumbai, Likert scale

Toxicological Effects of Textile Dyes on Aquatic Organisms

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Abstract

Textile dyes, widely used by the textile industry, pose significant environmental challenges, especially to aquatic organisms. These dyes, which comprise a broad spectrum of chemical classes such as various types of dyes, leach into water bodies through industrial effluents. Discharge of untreated or inadequately treated textile wastewater causes severe contamination, adversely affecting water quality and aquatic life. Textile dyes are often resistant to biodegradation due to their complex molecular structures, resulting in persistent environmental pollutants. These pollutants impede the penetration of light into water, hindering photosynthetic aquatic plants and plankton in their food production. The dyes release toxic compounds that can lead to bioaccumulation of hazardous substances in aquatic organisms, causing long-term ecological damage. Studies have explored toxic effects on various aquatic species, highlighting the potential for disruption of reproductive and developmental processes in fish, alteration of microbial communities, and carcinogenic and mutagenic effects in both aquatic and terrestrial organisms. The findings underscore the urgent need for improved treatment methods and sustainable practices to protect aquatic life. We focused on addressing the critical issue of textile dye contamination in aquatic ecosystems. The study discusses the environmental impact of these dyes in depth, exploring both chemical and biological consequences on aquatic life. this topic focused on addressing the critical issue of textile dye contamination in aquatic ecosystems. The study delves into the environmental impact of these dyes, exploring both the chemical and biological consequences on aquatic life.

Keywords: Bioaccumulation Photosynthetic, Contamination, Carcinogenic

Seasonal Variations in Nutrient Content in the Epilimnion Zone of Ranjit Sagar Reservoir, Punjab, India

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Abstract

Ranjit Sagar reservoir is located in the Pathankot district covering 87.60 km² and it has been officially designated as a Conservation Reserve since 2017. Reservoir standing crop and yield are influenced by water inflow and outflow, irrigation fluctuations, and rapid water level changes. Nutrient concentration varies by reservoir type, with older waterbodies being more fertile. Monthly analyses of water samples from Ranjit Sagar reservoir were conducted for nutrient parameters. The nitrite-nitrogen (NO₂-N) concentrations at Ranjit Sagar reservoir ranged from 0.005 to 0.04 mg l⁻¹, with the highest in December and lowest in October. Seasonally, the highest values were observed in winter and the lowest in postmonsoon. The mean values of nitrate-nitrogen (NO₃-N) in water were 0.1 to 2.1 mg l⁻¹, with the highest in August and lowest in December. Seasonally, the highest values were observed in monsoon and the lowest in post-monsoon. Ammonical nitrogen (NH₃-N) values ranged from 0.01 to 0.8 mg l⁻¹, with the highest values in January and lowest in July. Seasonally, NH₃-N was maximum in winter, whereas minimum in monsoon. The mean values of phosphate-phosphorous (PO₄-P) in the water varied from 0.1 to 0.9 mg l⁻¹, with the highest values occurring in October and December. The monsoon season had the highest PO₄-P, followed by the post-monsoon and winter seasons. The mean sodium (Na⁺) values ranged from 4.6 to 11.8 mg l⁻¹, with August having the highest mean and February having the lowest. The monsoon season had the highest Na⁺ values, while the winter season had the lowest. The mean potassium (K⁺) values ranged from 10.3 to 18.9 mg l⁻¹. Calcium content varied across different sites ranged from 10.5 to 23.0 mg l⁻¹, with the highest in January and lowest in August. The maximum calcium content was observed in winter, followed by post-monsoon and monsoon in the trophogenic layer of Ranjit Sagar reservoir. Nutrient features in Ranjit Sagar reservoir vary monthly and seasonally, influenced by hydrological cycles. Nutrients significantly influence biogenic productivity, suggesting fertilizers can enhance the reservoir's nutritional status and productivity.

Keywords: Seasonality, Nutrient status, Epilimnion zone, Ranjit Sagar Reservoir, Punjab,

Assessment of the Phytoplankton Community in Punjab's Ranjit Sagar Reservoir, India

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Abstract

Since plankton initiate energy transfer in aquatic ecosystems, the stability of the system depends on their well-being. In the aquatic food chain, phytoplanktons are an essential link that nourish zooplankton. Fish and other aquatic animals' breathe the oxygen that algae produce when they photosynthesise. A man-made reservoir or dam called Ranjit Sagar is located 24 Km upstream of Madhopur Headworks in the Pathankot district. Its 87.60 km² has been formally designated as a Conservation Reserve since 2017. It was built in 1981 and stands as the tallest earth core dam with a gravel shell dam in India. The study examined the phytoplankton, chlorophyceae, bacillariophyceae, cyanophyceae and euglenophyceae populations in Ranjit Sagar reservoir. Chlorophyceae population ranged from 8.0 to 34.0 × 10⁶ no. l⁻¹, with the highest population (32.33 × 10⁶ no. l⁻¹) in December and lowest (10.0 × 10⁶ no. l⁻¹) in August. Seasonally, average population of chlorophyceae was maximum in winter (23.11 × 10⁶ no. l⁻¹), while minimum in monsoon (16.5 × 10⁶ no. l⁻¹). The bacillariophyceae population ranged from 12.0 to 28.0 × 10⁶ no. l⁻¹, however, its population was highest (26.33 × 10⁶ no. l⁻¹) in October and lowest (14.0 × 10⁶ no. l⁻¹) in July, with the maximum seasonal population in winter (22.88 × 10⁶ no. l⁻¹) and minimum in monsoon (20.0 × 10⁶ no. l⁻¹). The range of cyanophyceae population varied from 6.0 to 22.0 × 10⁶ no. l⁻¹ with highest population (18.66 × 10⁶ no. l⁻¹) in February and lowest (7.33 × 10⁶ no. l⁻¹) in July. The euglenophyceae population was not encountered during microscopic analysis of phytoplankton throughout the study period. Overall, the water quality and flora and fauna of Ranjit Sagar reservoir are diverse and varied. The abundance of phytoplankton in Ranjit Sagar reservoir was recorded in the order of Bacillariophyceae & Cyanophyceae > Chlorophyceae. The findings revealed that reservoir water is favourable for aquatic life.

Keywords: Evaluation, Phytoplankton population, Ranjit Sagar Reservoir, Punjab

Climate-Driven Eutrophication and Cyanobacteria Proliferation in Deepor Beel: A Seasonal Perspective

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Abstract

Deepor Beel, a Ramsar-designated freshwater lake in Assam, India, is a vital wetland ecosystem, providing habitat for diverse wildlife, supporting fisheries, and serving as a source of livelihood for surrounding communities. However, the wetland faces mounting ecological pressure due to increasing eutrophication, primarily fueled by nutrient-rich runoff from agricultural lands and urban waste. This study focuses on the seasonal abundance of *Microcystis*, a cyanobacteria responsible for harmful algal blooms (HABs), and examines how climate variability exacerbates this problem. Through seasonal sampling we analyze the impact of temperature shifts, and other environmental parameters on the proliferation of *Microcystis* blooms in Deepor Beel. The findings reveal that *Microcystis* blooms show a marked seasonal pattern, peaking during warmer months and post periods of heavy rainfall that wash nutrients into the ecosystem. This seasonal abundance is strongly correlated with rising water temperatures and increased nutrient concentrations, both of which create optimal conditions for *Microcystis* growth. Climate change, in the form of intensifying seasonal temperature fluctuations and altering rainfall patterns, is likely to further exacerbate these blooms, resulting in a feedback loop that degrades water quality, depletes dissolved oxygen, and disrupts aquatic biodiversity. The study underscores the urgent need for adaptive management strategies that incorporate climate projections and focus on nutrient management, habitat restoration, and sustainable land use around Deepor Beel. Such interventions are essential to reduce the frequency and severity of *Microcystis* blooms, protect the lake's biodiversity, and sustain the ecosystem services it provides. This research contributes to a better understanding of climate-driven eutrophication in freshwater ecosystems and highlights the critical role of climate adaptation in wetland conservation.

Keywords: Climate change, Temperature, *Microcystis*, Harmful Algal Blooms (HABs).

Artificial Intelligence in Aquaculture & Fisheries: Current Breakthrough and Future Horizon

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Abstract

Global fisheries production is steadily rising due to the aquaculture industry. For food and nutrition security in our nation and around the world, fish is essential. For this reason, it becomes imperative to boost fish output. However, it is dwindling as a result of several illnesses that could harm the country's economy. Early detection of illness-affected fish can assist us in taking the appropriate action to stop the sickness from spreading. The integration of Artificial Intelligence with Aquaculture has emerged as a transformative force. Manual identification of fish disease is not an error-free task by amateur farmers. Therefore, a computer vision-based automated approach can be a considerable solution for the reduction of disease. The necessity of computer vision-based fish disease recognition has investigated. Recognition of disease-attacked fish at an early stage can help us take necessary steps to prevent from spreading of the disease. In this work, we have performed an in-depth analysis of expert systems that can continue with an image captured with the help of smartphones and identify the disease. Two set of features is selected then a segmentation algorithm is employed to detect the disease attacked portion from the disease-free portion.

Keywords: Fish, Aquaculture, Data, Disease, Detection.

Assessment of Comparative Feeding Practices in Cotton-Wheat Growing Zone of Haryana

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Abstract

In the Cotton-Wheat growing region of Haryana, a thorough survey was conducted to evaluate feeding practices, status of macro and microminerals in feed, fodder, blood, milk, and hair as well as to determine the correlation between intake of minerals and their status in blood, milk and hair of cattle and buffalo. Total 504 dairy farmers were selected for conducting survey and collection of samples, which was performed from June to November 2021 (Kharif season). Sorghum was the most preferred green fodder used by 76.58% of farmers followed by bajra 23.41% and grasses 19%, Wheat straw was the preferred dry roughage used by 90 % of the farmers followed by paddy straw 11.9%. Wheat grain (Dalia) was the common energy source fed by the farmers 48.41% followed by multi grains 19.24%. Pelleted concentrate feed was used by 15.07% farmers. Cotton seed cake, Gram churi and mustard cake were the main source of dietary protein used by 64.28%, 28.17% and 23.81% farmers, respectively. Mineral mixture was supplemented by 23.61% of the farmers; whereas 81.15% farmers included common salt in the ration of their animals.

Keywords: Animal Nutrition, Farmer Haryana, Livestock Status

Age and Season Related Changes in White Blood Cells of Black Bengal Goats During Prepubertal Growth Period

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Abstract

The present study was conducted to find out the effect of changed climate on white blood cells count of black Bengal goats during prepubertal growth period. The neutrophil content was increased significantly ($P \leq 0.01$) from day 15 to 180 days and reached maximum at 180 day ($39.83 \pm 0.84\%$). The eosinophil content increased significantly ($P \leq 0.01$) from day 15 to 180 days with maximum value at 150 days age ($5.50 \pm 0.26\%$). The basophil content did not differ significantly between age and season. The monocytes content was increased significantly ($P \leq 0.01$) from day 15 to 180 days with maximum value at 180 days age ($2.83 \pm 0.32\%$). The lymphocytes content differs significantly ($P \leq 0.01$) with age, where higher lymphocyte content was existed at first two months (i.e. upto 60 days) followed by gradual declining with the advancement of age. The lymphocyte was significantly ($P \leq 0.01$) more in the kids born in winter ($59.91 \pm 0.53\%$) than summer ($57.17 \pm 0.63\%$). Neutrophil was higher in the kids born in winter compared to summer born kids. It was observed that the predominant leukocytes were lymphocyte (59%) followed by neutrophil (35%), eosinophil (4%), monocyte (2%) and basophil (negligible).

Keywords: Prepubertal, Growth, Neutrophil, Eosinophil, Lymphocytes, Basophil, Monocytes

Harnessing Constructed Wetlands to Minimize Pollution Risk and Protect Aquatic Ecosystems

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Abstract

Sewage, urban runoff, and industrial waste degrade water quality in aquatic environments by introducing harmful chemicals, heavy metals, and excess nutrients. These pollutants cause eutrophication, triggering algal blooms that deplete oxygen and create hypoxic conditions harmful to fish. Toxic compounds accumulate in aquatic organisms, posing health risks up the food chain, and disrupt aquaculture by increasing disease incidence and affecting fish growth. Furthermore, polluted water often flows into rivers, damaging riverine ecosystems and endangering aquatic species within them. To mitigate aquatic pollution and promote a healthy environment, it is essential to reduce harmful compounds, heavy metals, and toxins. A constructed wetland is an artificial wetland to treat sewage, Urban runoff and industrial discharge. They are engineered systems that use the natural functions of vegetation, soil and organisms to provide secondary treatment to wastewater. The plants and microorganisms in these wetlands absorb heavy metals, excess nutrients, and organic pollutants, improving overall water quality. These systems support the restoration of aquatic ecosystems, enhance biodiversity, and offer a sustainable approach to managing aquatic pollution. In conclusion, constructed wetlands represent a sustainable and effective solution for tackling aquatic pollution while promoting biodiversity. As the challenges of water pollution and environmental degradation continue to grow, the implementation of constructed wetlands stands out as an innovative approach to that integrates aquatic health with waste water management solutions.

Keywords: Constructed wetlands, Aquatic pollution, Water quality, Biodiversity

Behavioural Changes, Genotoxicity and Cytotoxicity during Acute Ammonia exposure on *Oreochromis niloticus* under Controlled Environmental Conditions

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Abstract

Ammonia is a common aquatic pollutant with detrimental effects on fish. Understanding its toxicity is crucial for effective water quality management. The present study examined the 96h median lethal ammonia concentration using probit analysis to various concentrations (1, 3, 6, 9, 12, 15 and 18 ppm of 96 h LC₅₀) on *Oreochromis niloticus*. The concentrations of total ammonia in water were measured using the spectrophotometric method. The mean temperature, dissolved oxygen, pH, and total hardness were $26 \pm 1^\circ\text{C}$, 6.5 ± 0.6 mg/L, 7.1 - 7.4, and 150 ± 5 mg/L, respectively. A range finding and definite test were performed, and a 96-hour LC₅₀ was calculated using the probit analysis method. The 96-hour LC₅₀ of ammonia for *Oreochromis niloticus* was calculated 7.07 mg/L. During acute exposure, the fishes exhibited behavioural changes like surfacing, erratic and uncoordinated swimming, sluggish movement, respiratory distress and overproduction of mucus on the surface of the body with varying degrees depending upon the concentration of ammonia. A genotoxicity study revealed a significant % of tail DNA in liver and gill cells. The acute ammonia exposure at median-lethal concentrations also identified remarkable cytotoxic and genotoxic abnormalities among the peripheral erythrocytes of *Oreochromis niloticus*. These genotoxic effects showed notched, clubbed, elongated, binucleated, degenerated, distorted, webbed, bean-shaped, lobed, multilobed, and peripheral fragmented nuclei that expressed DNA damage and nuclear abnormalities from ammonia toxicity. The cytotoxic anomalies in blood cells included cytokaryotic fusion, cytoplasmic degeneration, and ruptured, diffused, distorted and fused cells, indicating severe structural changes. Therefore, the present study revealed the toxic potential at median-lethal concentration of ammonia, which could impair physiological functions and induce severe genetic damage in *Oreochromis niloticus* at median-lethal concentrations.

Keywords: Ammonia Toxicity, Median-lethal Concentration, Genotoxicity, Cytotoxicity

Impact of Climate and Economic Factors on Fish Production in India: A Transfer Function Model Approach

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Abstract

This study utilizes a Transfer Function Model (TFM) to analyze the influence of climate and economic factors on fish production in India. The focus is on climate variables, specifically temperature and precipitation, and economic indicators, including the Indian Fisheries GDP and marine exports. The TFM, an extension of the ARIMAX model, examines the dynamic relationships between fish production (measured in lakh tonnes) and the identified predictors. Stationarity was ensured by differencing the climate variables. The results revealed a significant negative impact of temperature on fish production, further modulated by an autoregressive effect, while precipitation was positively associated with production. Economic variables, particularly GDP and marine exports, showed minimal influence on fish production. Model diagnostics confirmed a good fit with low prediction error (MAPE = 1.83%) and a reasonable residual variance ($\sigma^2 = 3.146$). This study underscores the critical role of climate variables in shaping fish production. It provides valuable insights for policy development, particularly in the face of climate variability and its impacts on the fisheries sector.

Keywords: Transfer Function Model (TFM), Climate Variability, Fish Production



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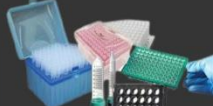












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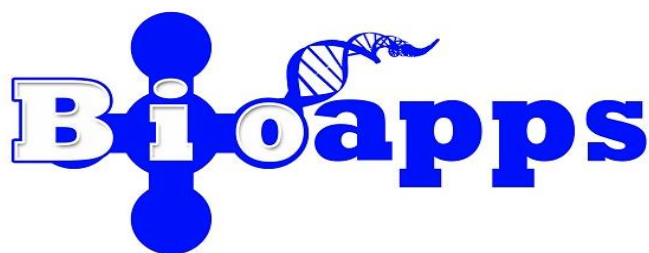

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