English Monthly from Hyderabad, India

RNI Regn. No. 52899/93

Aqua International

Estd. 1993

Health • Nutrition • Management • Processing

March 2021

Annual Subscription: Rs 800 Foreign $ 100

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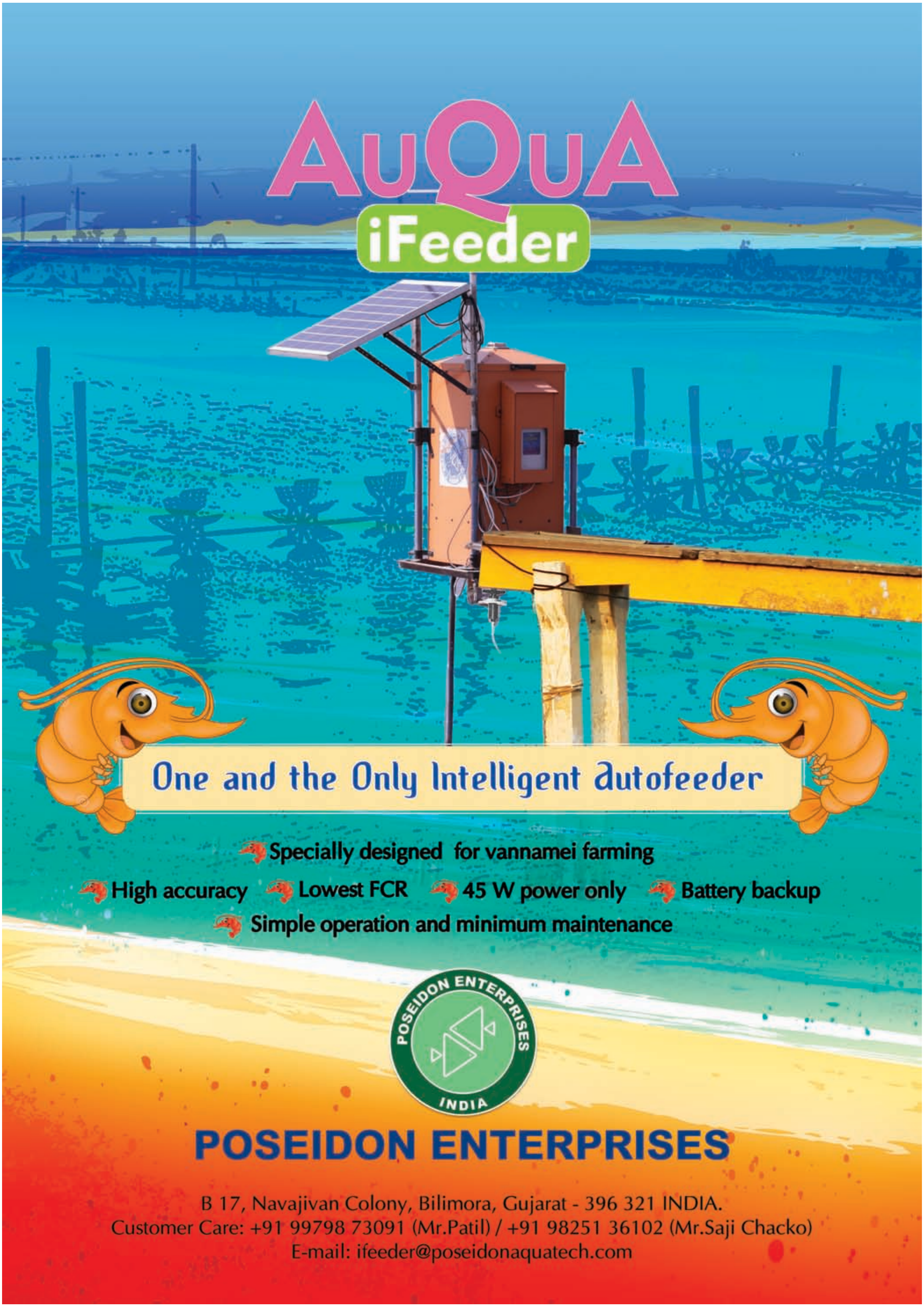
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Aqua International

English Monthly Magazine
(Established in May 1993)

Volume 28 Number 11 March 2021

Editor & Publisher
M. A. Nazeer

Editorial & Business Office:
AQUA INTERNATIONAL
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E-mail: info@aquainternational.in
Website: www.aquainternational.com

Annual Subscription
India : Rs. 800
Foreign Countries : US $ 100
or its equivalent.

Aqua International will be sent to the subscribers in India by Book Post and to the foreign subscribers by AirMail.

Edited, printed, published and owned by M. A. Nazeer and published from BG-4, Venkataramana Apts., 11-4-634, A.C.Guards, Hyderabad - 500 004, India. Printed at Srinivasa Lithographics.
Registered with Registrar of Newspapers for India with Regn. No. 52899/93. Postal Regn. No. L II/ RNP/HD/1068/2021-2023.
Views and opinions expressed in the technical and non-technical articles/ news are of the authors and not of Aqua International. Hence, we cannot accept any liability for any loss or damage arising from the use of the information / matter contained in this magazine.
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Five major fishing harbours will get substantial investments for modernisation and development in India

High stocking density of fish or shrimp in ponds usually exacerbates problems with water quality and sediment deterioration. Water quality parameters play an important role in Vannamei shrimp culture. Poor water quality is the leading cause of disease, stop feeding, high FCR, retardation of growth, mortality, crop failure and economic losses. The maintenance of good water quality is essential for both survival and optimum growth of culture organisms.

Dear Readers,

The March 2021 issue of ***Aqua International*** is in your hands.

In the News section you may find news about -- Five major fishing harbours will see substantial investments for modernisation and development in India, according to Union Finance Minister Nirmala Sitharaman's budget speech on 1 February 2021. To start with, five major fishing harbours — Kochi, Chennai, Visakhapatnam, Paradip and Petuaghat — will be developed as hubs of economic activity. Government will also develop inland fishing harbours and fish-landing centres along the banks of rivers and waterways.

Finance Minister in her Budget speech also announced a new policy for central public sector enterprises (CPSEs), which she said will serve as a clear roadmap for disinvestment of government-owned firms across sectors. She said, the Government has kept four areas that are strategic where bare minimum CPSEs will be maintained and rest privatized. In the remaining sectors, all CPSEs will be privatized.

The Online Training-cum-Awareness Programme entitled *'Diversification in Aquaculture'* was organized by Kolkata Centre of ICAR-Central Institute of Fisheries Education on 30 January 2021 in Hindi language. Dr S. N. Ojha, Principal Scientist (PS), ICAR-CIFE, Mumbai in his spoke about importance of learning new technologies and techniques, regarded his senior colleague Dr A. K. Reddy as Guru from whom he sought for knowledge and got his doubts clarified; discussed about *'Extension of organizational skills'* as 4 chapters in addition to research, training and extension of technical skills, an initiative to take FPOs forward; finfish / shellfish farmers must be organized as FPOs since places from where they procure fish seeds and sell their harvested produce are both organized sectors.

The ICAR - National Bureau of Fish Genetic Resources (NBFGR), Lucknow has organised a training programme on *"Clownfish Aquaculture"* at the ICAR-NBFGR & Mangrove Foundation marine ornamental fish hatchery at the coastal and marine biodiversity Centre, Airoli, Thane, Maharashtra. The programme was held during 27 to 29 January 2021. NBFGR has established a marine ornamental fish breeding and rearing facility, particularly for clownfishes.

Eminent marine biologist Prof Amalesh Choudhury passed away on 30 December 2020 at Kolkata due to COVID-19 at 89 years of age. He was internationally-renowned marine biologist from West Bengal, 'Professor of Professors' and Founder Head of Dept of Marine Science, University of Calcutta. Prof Amalesh was founder of MS-related academic course and research in eastern India and main architect in establishing the Department at CU during 1987-88 from where he retired as Professor and Emeritus Professor in 1991 and 1996 respectively.

New team of Managing Committee for CLFMA OF INDIA 2020 – 2022 was elected / selected with Mr Neeraj Kumar Srivastava as the President. The 54-year-old industry association is recognized as one among the reputed livestock industry bodies in India. CLFMA of India is well recognized by livestock farmers, Central and State Governments, government departments, Agricultural Universities, Veterinary Colleges and also National Research Institutes in India as well as outside the country.

In the Articles section -- article titled ***INTEGRATED TAXONOMY – New Dimension to Explore the Fish Diversity*** written by M. Kishore Kumar and other authors highlighted that the population discrimination and species identification are essential in the conservation

Contd on next page

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Our Mission

Aqua International will strive to be the reliable source of information to aquaculture industry in India.

AI will give its opinion and suggest the industry what is needed in the interest of the stakeholders of the industry.

AI will strive to be The Forum to the Stakeholders of the industry for development and self-regulation.

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of biodiversity, natural resources and fisheries management. Traditionally, identification of species has relied on morphological and meristics characteristics, but these methods often encounter problems with reliability as some of the fish species are cryptic. More recently, fish otolith, scale and bone also used by fish taxonomist as one of the taxonomic tools to delineate the species. There are so many biochemical and molecular methods too available for the identification of fish species. This article discusses the merits of employing various taxonomic tools to study the fish taxon, collectively known as "Integrated taxonomy".

Another article titled ***Empowerment of Rural Women through Income-generating Fish culture Practices*** written by Subrato Ghosh highlighted that participation of women in finfish farming activities, both edible and non-edible (ornamental) ones, will improve economy of rural families and enhance their nutritional status via partial use of pond-reared fishes for household consumption. Economic and livelihood security of rural women can be assured. Propagation of familiar and less-familiar aquarium fishes is less capital-intensive and less labour-intensive affair, can be adopted by women in semi-urban and rural areas. An idea is presented here on different facets of women-friendly pisciculture activities with emphasis on ornamental fish farming involving women groups in South 24 Pgs, West Bengal.

Article titled ***Ocean Acidification and its Impact on Marine Ecosystem*** written by K. Abarna highlighted that Ocean acidification a serious thread for all the marine organisms and their ecosystem for over three to four decades. Increasing acidification of an ocean leads to a dwindle in the production of shellfish resources such as oyster culture and also in lobster fattening. Coral reefs are already showing a decreasing sign of growth in response to the increasing rate of ocean acidity. Moreover, this threat plays a vital role in the reduction of marine fisheries ultimately lessening the economic status of the fishermen and stakeholders up to global. Hence it is mandatory to mitigate increasing acidification in Ocean.

Another article titled ***Importance of "pH" as a Major Water Parameter and Its Impact on Growth & Survivals in Vannamei Shrimp Culture*** written by Dr P. C. Behera highlighted that the maintenance of good water quality is essential for both survival and optimum growth of culture organisms. Poor water chemistry leads to deteriorate water quality, which causes stress to the culture animals. Growth and survival, which together determine the ultimate yield, are influenced by a number of ecological parameters and managerial practices. High stocking density of fish or shrimp in ponds usually exacerbates problems with water quality and sediment deterioration. Water quality parameters plays an important role in vannamei shrimp culture. The poor water quality is the leading cause of disease, stop feeding, high FCR, retardation of growth, mortality, crop failure & economic losses. The maintenance of good water quality is essential for both survival and optimum growth of culture organisms.

M.A.Nazeer
Editor & Publisher
Aqua International

ICAR-NBFGR takes initiatives for Capacity building on **"Clownfish Aquaculture"** as a part of **"Establishing Marine Ornamental Fish village in coastal Maharashtra"**

Dr J. K. Jena, DDG, Fisheries Science, ICAR is addressing to the participants

Lucknow: The ICAR - National Bureau of Fish Genetic Resources (NBFGR), Lucknow has organised a training programme on "Clownfish Aquaculture" at the ICAR-NBFGR & Mangrove Foundation marine ornamental fish hatchery at the coastal and marine biodiversity Centre, Airoli, Thane, Maharashtra. The programme was held during 27 to 29 January 2021.

ICAR - National Bureau of Fish Genetic Resources (NBFGR) has established a marine ornamental fish breeding and rearing facility, particularly for clownfishes at the premises of the coastal and marine biodiversity centre of the Mangrove foundation, Dept. of Forest, Govt of Maharashtra, who has funded and partner of this programme. The functional hatchery comes in operation during 2019. Ten different clownfishes from Indian coral reef regions were collected and stocked in the facility. Broodstock has been developed and captive propagation achieved for seven species. Following, based on trade value, upscaled the production of two species, Amphiprion percula and A. ocellaris. Water quality was standardized and presently, the facility is in operation with indigenous RAS system with zero percentage water exchange. Low-cost biological filtration setup was developed, which has given promising result in water quality maintenance and the technology

Participants during demo session on water quality

is being extended to the beneficiaries of Maharashtra.

The mangrove foundation has identified 500 beneficiaries from five different coastal districts of Maharashtra and NBFGR has conducted four hands on trainings and disseminated the simplified clownfish rearing package to 150 beneficiaries from three districts, Thane, Palghar and Raighat of Maharashtra (2019 - 2020).

Two cluster mode clownfish rearing units (with the participation of five to seven families) were established in Thane (Dive Kevani Village) and Sindhudurg (Ganthi Nagar, Vengurla) districts, stocked the clown juveniles produced in NBFGR facility (1.5 months old), reared further (2 months) and also launched the retail sale at Thane unit. One individual, two-month reared clown by a beneficiary was sold as Rs 280. Once after the corona virus catastrophic situation comes recuperate, arrangements will be made for bulk purchase.

As a part of capacity building to beneficiaries, Eighteen beneficiaries from seven different villages of Sindhudurg district and two Project Associates attached with mangrove foundation were attended the fifth training scheduled during 27 to 29 January. During the inauguration, Mr Siddhesh Surve, Assistant Director - Capacity Building, Mangrove Foundation has given welcome address.

Neenu Somraj, I. F. S., distributing certificate to the participant

Followed, Dr Kuldeep Kumar Lal, Director, ICAR-NBFR has delivered the inaugural address in virtual mode and briefed about the importance of the training and role of the institute in biodiversity conservation and livelihood promotion. Mr Nathuram Kokare, Range Forest Officer, Airoli, Mangrove Foundation has felicitated the event. Dr T. T. Ajith

Participants with NBFGR team

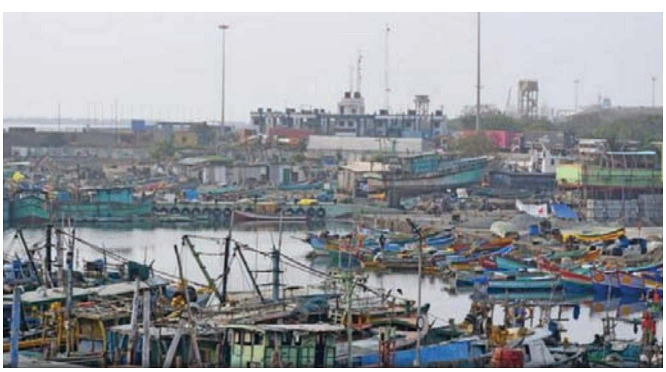
Dr. K. K. Lal addressing to the participants

Kumar, Principal Scientist, ICAR-NBFGR, who is the Organising Secretary of this programme delivered vote of thanks. Further, technical sessions about clownfish rearing (theory and demonstrations) were handled by different resource persons. Various topics on clownfish culture, including identification of different clownfishes, rearing techniques and trade perspectives, water quality management, feeding strategies, equipment's & accessories, disease diagnosis & remedies and marketing linkages were addressed. Besides, a separate session on Pradhan Mantri Matsya Sampada Yojana (PMMSY) was organised and various components of the scheme was explained to the beneficiaries.

During the closing ceremony and certificate distribution, Dr Kuldeep Kumar Lal, Director, ICAR-NBFGR and HOD's of different divisions of NBFGR were attended in virtual mode.

Dr J. K. Jena, Deputy Director General (Fisheries Science), ICAR has been joined virtually as Chief Guest and addressed the gathering. He emphasised, Honourable Prime Minister is very much keen in promoting ornamental aquaculture in India, so the ICAR can extend all possible support to the beneficiaries. He also mentioned that this programme helps to generate self-employments and promoting livelihood to the coastal community of the country. He appreciated the efforts taken by the NBFGR and extended his gratitude to the Mangrove foundation. Ms Neenu Somraj, I. F. S., Deputy Conservator of Forests, Mangrove Foundation, given felicitation and distributed the certificates to all the beneficiaries. Programme ended with the feedback of participants, followed, vote of thanks delivered by Dr N. B. Dhayanithi, Research Associate of the programme. During the programme, Covid - 19 protocols were strictly followed.

5 fishing harbours to be modernised



1 February 2021, New Delhi: Finance Minister also announces measures to promote seaweed cultivation

Five major fishing harbours will see substantial investments for modernisation and development, according to Finance Minister Nirmala Sitharaman's budget speech on 1 February 2021.

"To start with, five major fishing harbours — Kochi, Chennai, Visakhapatnam, Paradip and Petuaghat — will be developed as hubs of economic activity," she said. "We will also develop inland fishing harbours and fish-landing centres along the banks of rivers and waterways," she added.

Emerging sector

Ms Sitharaman announced measures to promote seaweed cultivation. "Seaweed farming is an emerging sector with potential to transform the lives of coastal communities. It will provide large scale employment and additional incomes," she said. "To promote seaweed cultivation, I propose a Multipurpose Seaweed Park to be established in Tamil Nadu," she added.

Overall, the Fisheries department saw an increase in budget allocations from Rs 825 crore in 2020 - 2021 to Rs 1,220 crore in 2021 - 2022. The Blue Revolution centrally sponsored schemes saw their budget allocation double, with the new Pradhan Mantri Matsya Samada Yojana alone getting a Rs 1,000 crore allocation.

Courtesy: *The Hindu*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Online Programme on Diversification in Aquaculture

Catfish Ompak pabo

Pond-cultured freshwater prawn

30 January 2021, Kolkata: The Online Training-cum-Awareness Programme entitled 'Diversification in Aquaculture' was organized by Kolkata Centre of ICAR-Central Institute of Fisheries Education on 30 January 2021 in Hindi language. Dr S. N. Ojha, Principal Scientist (PS), ICAR-CIFE, Mumbai in his introductory speech spoke about importance of learning new technologies and techniques, regarded his senior colleague Dr A. K. Reddy as Guru from whom he sought for knowledge and got his doubts clarified; discussed about 'Extension of organizational skills' as 4 chapters in addition to research, training and extension of technical skills, an initiative to take FPOs forward; finfish / shellfish farmers must be organized as FPOs since places from where they procure fish seeds and sell their harvested produce are both organized sectors.

Dr Ojha lucidly informed participants online about eight important objectives of PMMSY scheme; need for utilization of most potential of available water resource for aquaculture; sustainable, responsible, inclusive and equitable fish production; discussed salient aspects of fish production and productivity in India, economic value addition, enhancing income and employment generation; 13 categories of intended beneficiaries under PMMSY who can submit projects; Central sector schemes and Centrally-sponsored schemes (beneficiary-oriented and non-beneficiary-oriented activities); Online field school to FPOs as our scientific road forward; typical range of services provided by FPOs (input supply, financial & technical, marketing linkages, training & networking); unit cost and Government assistance involved in PMMSY schemes viz., nursery, grow-out and inputs for pond aquaculture (3 categories), stocking of fingerlings in reservoirs, fish feed mills, ornamental fish farming unit, aquatic referral labs for quality testing & disease diagnosis - farmers/fishers can bring such 'diversifications' if desired.

Dr A. K. Reddy, Former PS, ICAR-CIFE, Mumbai spoke on 'Freshwater prawn farming as diversification in aquaculture'. Emphasizing this sector as 'sleeping giant', Dr Reddy spoke about origin of prawn farming in India in sewage-fed wetlands of Kolkata, natural seed collection and culture, steady growth in India during 2000-2004 and earlier and declining trend since 2005 due to accidental entry of Nodavirus along with giant prawn seeds imported from Thailand. *M. rosenbergii* accepts pelleted formulated feed in monoculture and composite fish culture systems. In grow-outs, 1.0-1.5 inch seeds (5-10gm) collected from river Narmada had good growth and survival but 8-10mm hatchery seeds must be stocked in nursery ponds first, till it attains 2-5gm. Cloth hapa enclosures in grow-out ponds may serve as nurseries. Bottom must be clean in earthen nurseries, vermicompost or GNOC used a week before stocking PL 5-10 (20-30mg, shining/glassy appearance) to enhance zooplankton production. Organic manures not preferred, shelters arranged with palm leaves/coconut/bamboo branches in ponds to avoid cannibalism.

He discussed about Scampi seed quality testing in circular tubs; very low pH variation must exist between hatchery and nursery pond water; PL attain juvenile stage in 45-60 days; grow-out pond preparation with composted cattle manure, bleaching powder and lime, their dosage and preparation of fermented organic slurry for zooplankton growth; tamarind leaves and branches used in Narmada for prawn seed collection; commercial feed in grow-outs beginning with 6% of body weight daily and 2% before harvesting; M. rosenbergii polyculture in Maharashtra and Gujarat with riverine seeds; male population segregated after nursery phase for stocking in grow-outs in Andhra Pradesh; cull harvest among marketable-sized prawns, females and blue-clawed males harvested and orange-clawed males left for further growth; broodstock exchange with natural stock needed to avoid inbreeding and low quality seed production; pond transparency shouldn't be more than 30-40cm, sunlight penetration upto pond bottom undesirable (facilitates unwanted algal growth and hampers moulting); Scampi requires 25% protein in diet (lesser than brackishwater shrimps) and lesser feed in major carp ponds. Dr Reddy nicely explained these particulars of giant prawn management practices.

Mr Milon Sinha, Director (Fisheries Division), Nature, Environment and Wildlife Society, Kolkata and expert Magur breeder spoke on 'Freshwater catfishes as available candidates for aquaculture diversification'. Mr Sinha explained why fish farmers are interested in catfishes and essential reasons for diversification; which are high consumer demand, good taste, realization of higher profit than carps, medical diet value due to having easily digestible protein, availability of hatchery-bred seeds, short culture period, less disease proneness, culturable in seasonal low-depth

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ponds, long transportation time for marketing in live condition, purer genetic quality resulting in better growth. As dominant candidate species, farmers are interested in monoculture of Magur *Clarias magur, Singhi Heteropneustes fossilis and Pabda Ompak pabo/O. pabda*. He discussed about the comparative data on culture details (stocking density, size, weight of seeds at stocking, culture period, feeding rate with pelleted feed having 38-32% protein, expected yield, av weight attained) and economics {total sale price in West Bengal markets, cost for culture (pond lease, seed, feed, pond preparation, harvesting, others) and gross profit} in monoculture of these three catfishes individually in 1 ha pond.

Mr Sinha mentioned that formulated farm-made feed, if used, will be 1-1.5% higher in quantity compared to commercial feeds. Speaking on importance of pond water parameters and health management of fishes, he stated since these fishes require high-protein diet, there is possibility of degradation of water quality via fish faeces, which must be taken care of. If water quality parameters are under control, chances of disease occurrence will be lower. Exchange of pond water needed @ 20% once in two months, 25 % of pond surface should be covered with water hyacinth creating shade, where insects harbour and fed upon by these fishes. Overall the programme was very informative with practical knowledge, News communicator and registered participant Subrato Ghosh could learn a lot.

Eminent marine biologist Prof. Amalesh Choudhury passes away

30 December 2020, Kolkatta: Internationally-renowned marine biologist from West Bengal, 'Professor of Professors' and Founder Head of Dept of Marine Science (MS), University of Calcutta (CU) Prof. Amalesh Choudhury, DSc, FNASc died on 30 December 2020 at Kolkata due to COVID-19 at 89 years of age. He was founder of MS-related academic course and research in eastern India and main architect in establishing the Department at CU during 1987-88 from where he retired as Professor and Emeritus Professor in 1991 and 1996 respectively. He used to engage himself in his dream research works in Sundarbans after retirement with sincerity, dedication and tireless effort as usual. A self-taught marine biologist and world-class naturalist, Prof. Choudhury was associated with teaching and research in Zoology (Parasitology, Embryology), Fisheries Science and Marine and Estuarine Biology for nearly fifty years. He was the PI of 26nos Research Projects funded by ICAR, CSIR and other Govt agencies. Retired Vice Chancellors of UGC Universities in WB respected Prof. C. S. Chakraborty, Prof. S. K. Ghosh, Prof. D. R. Mondal (and probably Prof. N. C. Saha); Retd. Director, ZSI Late Dr A. K. Ghosh and many Professors/Scientists in India and USA (both in-service and retired) had been once Prof. Choudhury's students.

He was born on 11/6/1931 in Malda district, WB; had schooling in Katihar in eastern Bihar; completed MSc in Zoology in 1952 from CU with 1st position in 1st class and Ph.D in 1962. Before joining CU as Lecturer in Zoology in 1969, Prof. Choudhury worked at three UG colleges and Bengal Veterinary College as Lecturer and established SD Marine Biological Research Institute at Sagar Islands, WB in 1966 in memory of his mother and also laboratory at his residence at Sodepur, Kolkata. His scientific

Amalesh Choudhury

contributions on macro-zoobenthos, analysis of soil and water chemistry, plankton ecology, molluscan and crustacean aquaculture, assessment and management of diverse crustacean, piscine and molluscan communities, their population structure and biology in different coastal wetlands of WB, lower stretch of Hooghly estuary in South 24 Parganas and Purba Medinipur districts, lower Gangetic delta and mangrove waters of Indian Sundarbans, research and management of *Hilsa ilisha* fishery in Hooghly-Matla estuarine system, impacts of overfishing of important marine fishes have been widely acclaimed.

News communicator Subrato Ghosh humbly had intimate conversation with revered Sir at his residence on two occasions and in Seminar/Conference more than once since 2001, could obtain his blessings and inspiration, learnt about his greatness from Dr S. K. Chakraborty, Retd. Principal Scientist (PS), ICAR-CIFE, Mumbai and Dr Joe K. Kizhakudan, PS, ICAR-CMFRI in personal conversations. At 85 years of age and above, Prof. Choudhury was still enthusiastic on going to field with students for research studies, specimen collection and/or meticulous observations; his works in Gangetic delta and on Sundarbans ecology is unique. Marine biology fraternity in India lost a great personality. A man of towering intellect and profound knowledge, Prof. Amalesh Choudhury's legacy will live on for long and will always be remembered as influential teacher and dedicated researcher by many many students, researchers and followers.

New Leadership Team at CLFMA OF INDIA for 2020-2022

Mumbai, 1 February 2021: CLFMA of India is the apex organization and the voice of the country's dynamic livestock sector. The 54-year-old industry association is recognized as one among the highly reputed in India. CLFMA of India is well recognized by livestock farmers, Central and State Governments, government departments, Agricultural Universities, Veterinary Colleges and also National Research Institutes in India as well as outside the country.

On 1st February 2021, CLFMA's Extra Ordinary General Meeting was held and the new leadership team took charge for the period 2020-2022. The outgoing Chairman Mr S. V. Bhave expressed his appreciation and conveyed best wishes to the new team led by Mr Neeraj Kumar Srivastava, World Area Director - SCA of Novus Animal Nutrition (India) Pvt Ltd, who got elected as the new Chairman.

Mr Bhave in his tenure was instrumental in developing a strong network with the Government especially with the Animal Husbandry Ministry and its departments. During the 52nd AcM » 61st Symposium held at Le Meridien, New Delhi, he was able to get Mr Giriraj Singh, Hon'ble Union Minister of Fisheries, Animal Husbandry and Dairying as our Chief Guest and otherwell -

Chairman
Neeraj Kumar Srivastava, Novus Animal Nutrition (India) Pvt Ltd

known speakers viz. Mr Atul Chaturvedi, Hon'ble Secretary, Department of Animal Husbandry and Dairying, GOI., Mr Pawan Agarwal, CEO, Food Safety and Standards Authority of India (FSSAI), Government of India, to quote a few. During his period, the 5th Combined Feed Additive List was approved by GOI. He conducted around 14 successful Events (Seminars & Webinars) at pan India locations which was well appreciated.

Mr S. V. Bhave outgoing Chairman said that, it was indeed a great pleasure to work with CLFMA as a Chairman and after 2 years and 4 months extra responsibility due to COVID 19 pandemic, CLFMA has decided to appoint Mr Neeraj Kumar Srivastava, who is an accomplished, talented business leader having a proven record of successfully managing the businesses in Animal Health and Nutrition Industry. He has a great networking with all the industry stake holders including government authorities of the Animal Health and Nutrition sector - domestic and worldwide especially South Asia. As he is a Strong leader and talented professional with a Master of Science (M.Sc.) & MBA Marketing his experience and vision will be of great asset to CLFMA and under his Stewardship, we anticipate CLFMA would continue to grow to greater heights.

Mr Neeraj Kumar Srivastava, newly elected Chairman thanked Mr S. V. Bhave and said that, it was a great honour to be nominated as CLFMA Chairman, as CLFMA is a single leading voice of the Animal Husbandry Industry and promised to do his level best to help CLFMA work for the benefit of its members and the industry at large. He added that, he was truly honoured and thrilled to carry the great legacy of many distinguished leaders and which is more than 5 decades for serving our Industry. He promised to build and add to the best of his capacity towards the visibility of CLFMA, its image & reputation and working towards betterment of the livestock industry.

He also said that, Mr Bhave's team has done a great job especially with regard to government engagements and conducting relevant seminars during his tenure.

CLFMA of India has over 230 members representing diverse subsectors of animal protein value chain including feed manufacturing, poultry, dairy and aquaculture business, animal nutrition and health, veterinary services, machinery and equipment, processing, distribution and retailing of meat and ancillary services such as banking.

Following Office Bearers were elected for the period 2020 – 2022 :

Deputy Chairman
Divya Kumar Gulati, Nurture Aqua Technology Pvt Ltd

Deputy Chairman
Sumit Sureka, Shivshakti Agro (India) Ltd

Secretary
Suresh Deora, S. A. Pharmachem Pvt Ltd

Treasurer
Naveen Pasuparthy, Nanda Feeds Pvt Ltd

Immediate Past Chairman
S. V. Bhave, Berg and Schmidt India Pvt Ltd

Executive Director
Ms Chandrika Venkatesh

The other members of the Managing Committee 2020 - 2022 comprises of:

Mr Vijay Bhandare, Bhavani Agrovet Pvt Ltd
Mr Selvan Kannan, Noveltech Feeds Pvt Ltd
Dr Prashant Shinde, Cargill India Pvt Ltd
Mr Anil M, KSE Limited
Mr Sujit Komarla, Komarla Feeds
Mr Lakshmanan, Shanthi Poultry Farm Pvt Ltd
Mr Ramakanth V. Akula, The Waterbase Limited
Mr Sandeep Kumar Singh, Godrej Agrovet Ltd
Dr Sujit Kulkarni, Trouw Nutrition India Pvt Ltd
Mr Balaram Bhattacharya, Indian Herbs Specialities Pvt Ltd
Mr R. Ramkutty, Niswin Enterprises
Dr Devender Hooda Huvepharma SEA (Pune) Pvt Ltd
Mr Abhay Shah, Spectoms Engineering Pvt Ltd
Mr Prashant Vatkar, Godrej Tyson Foods Ltd
Mr Nissar Mohammed Coastal Exports, Corporation (Co-opted)
Dr Saikat Saha Evonik, India Pvt Ltd (Co-opted)
Dr Vijay Makhija, Intervet India Pvt Ltd (Co-opted)

Mr Suresh Deora, the New Secretary, CLFMA gave the vote of thanks and said that “The new team of CLFMA has an apt mix of experienced professionals which will strive to uphold the reputation and the legacy of CLFMA and work with commitment towards its growth in the years to come. He concluded saying that the government engagements of CLFMA would be strengthened further and the new team will certainly work towards the overall development of the Animal Industry at large.

RR Animal Health Care develops Cyromazine Active Pharmaceutical Ingredients

Wants to work as import substitution for Indian market

February 15, 2021, Hyderabad: RR Animal Health Care Ltd is excited to share the news of development of our first Animal Pharma Active Pharmaceutical Ingredient (API) for poultry segment. With the development of Cyromazine 99.5% through an in-house developed route of synthesis, we became one of the first Animal Health Care company from India to develop this molecule with complete backward integration using a Green Chemistry route without the use of solvents.

Cyromazine, which is used as a Larvicide in Animal Health Care Industry, presently been imported mainly from China and most domestic suppliers were blending it with carrier material to prepare 1% or 2% formulated product. Many users and suppliers import the blended 2% product for their cost optimization.

This product shall work as an import substitution for Indian market. Presently with 3000 kg production capacity at a GMP certified facility in Hyderabad, India, which will be equivalent to nearly 150 tons of 2% formulation product, we are optimistic to supply to a large domestic customer base & export client. We promise to deliver a global standard product, readily availability in India across the year at an economical rate.

Our one small step towards Aatmanirbhar Bharat!!

About RR Animal Health Care Ltd.

RR Animal Health Care Ltd is a company with diversified interested in Animal and Human Health & Nutrition segment. With over 12 years of legacy, this company has established itself with unique solutions for Human, Poultry, Aqua and Livestock management in India. With 3 manufacturing facilities in India, the company is committed to deliver value to its customers across diversified species & segments. Pioneer in farm biosecurity segment with new concepts, the company is well recognized as a ‘Unique Solution Provider’ across industries. For more info: www.rrahc.in.


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Profile of Aquaculture in Andhra Pradesh

Sl No.	Dist	Licensed Reservoirs			Reservoirs under Lease			MI Tanks			GP Tanks			Total		
		No of Lece-nses	TWSA (Ha)	EWSA (Ha)	No	TWSA (Ha)	EWSA (Ha)	No	TWSA (Ha)	EWSA (Ha)	No	TWSA (Ha)	EWSA (Ha)	No. of water bodies	TWSA	EWSA
1	Srikakulam	0	0	0	1	944	708	252	2535	1268	3783	19483	5845	4036	22018	7112
2	Vizianagaram	2	2990	2243	5	928	696	436	5249	2625	2217	11655	3497	2660	16904	6121
3	Visakhapatnam	2	2900	2175	18	2325	1744	221	4169	2085	1052	8649	2595	1293	12818	4679
4	East Godavari	2	34936	26202	16	1535	1151	177	3504	1752	1594	5484	1645	1789	8988	3397
5	West Godavari	3	10480	7860	3	1120	840	101	2552	1276	587	7885	2366	694	10437	3641
6	Krishna	1	3600	2700	0	0	0	227	4363	2181	2716	10291	3087	2944	14654	5269
7	Guntur	3	55483	41612	1	1243	932	85	4651	2326	152	3333	1000	241	7984	3325
8	Prakasam	1	2570	1928	9	1985	1489	273	12439	6220	629	16951	5085	912	29390	11305
9	Nellore	3	2270	1703	4	12815	9611	419	3047	1524	1285	5657	1697	1711	8704	3220
10	Chittoor	1	1404	1053	7	921	691	687	35214	17607	7374	39112	11734	8069	74326	29341
11	Kadapa	5	18389	13792	10	4457	3343	239	31309	15655	1542	16106	4832	1796	47415	20486
12	Ananthapur	3	4468	3351	8	10875	8156	320	51385	25693	1084	7357	2207	1415	58742	27900
13	Kurnool	3	35040	26280	8	7110	5333	167	9512	4756	479	7316	2195	657	16828	6951
Total		**29**	**174530**	**130898**	**90**	**46258**	**34693**	**3604**	**169929**	**84965**	**24494**	**159278**	**47783**	**28217**	**329208**	**132748**

2018-19 DISTRICT WISE INDICATOR WISE FISH & PRAWN TARGET, ACHIEVEMENT & GVA

Prod. in M.Tonnes

Sl.No.	District	Production					
		Marine fish	Inland Fish	Marine Shrimp	Brackish Water Shrimp	Fresh Water Prawn	Total
1	Srikakulam	37703	70400	9443	9639	434	127619
2	Vizianagaram	12001	35777	2639	358	63	50838
3	Visakhapatnam	104005	50252	28802	6577	82	189718
4	East Godavari	93616	165385	23878	72165	43192	398236
5	West Godavari	902	898886	265	24852	227296	1152201
6	Krishna	39585	799201	10891	229618	151321	1230616
7	Guntur	43487	78066	12230	59839	1863	195485
8	Prakasam	52092	32033	14041	39817	491	138474
9	Nellore	91701	210980	23136	86118	30423	442358
10	Kurnool	0	47839	0	0	136	47975
11	Kadapa	0	5330	0	0	6	5336
12	Anantapur	0	9115	0	0	32	9147
13	Chittor	0	4353	0	0	2	4355
	Total	475092	2407617	125325	528983	455341	3992358

SIGNIFICANCE OF FISHERIES SECTOR IN AP STATE

Natural resources:

- Coastline : 974 Kms
- Brackish water (Saline) : 1.74 lakh ha
- Inland Water : 8.00 Lakh ha
- Mangrove Area : 352 Sq Kms

Aquaculture Extent : 1.96 lakh Ha

- Shrimp Culture : 0.83 Lakh Ha
- Fish Culture : 1.04 Lakh Ha
- Mud crab culture : 0.07 Lakh Ha
- Sea bass Culture : 0.016 Lakh Ha

Total Fish Production:

- India (2017-18) :125.90 LMT
- Andhra Pradesh (2017-18) : 34.49 LMT
  (27% share in country production)
- Andhra Pradesh (2018-19) : 39.92 LMT
- GVA – (2018-19 – Constant Price) : Rs. 48,222 crore
- GSDP Contribution (2017-18) : 7.4% (India – 0.96%)
- Direct/ Indirect Employment : 26.50 lakhs

Source: MPEDA


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The Road Map for Reducing Public Sector Role

How will the new disinvestment policy oversee the future of all central public sector enterprises?

21 February 2021: The story so far: Finance Minister Nirmala Sitharaman, in her Budget speech for 2021-22, announced a new policy for central public sector enterprises (CPSEs), which she said will serve as a clear roadmap for disinvestment of government-owned firms across sectors. "We have kept four areas that are strategic where bare minimum CPSEs will be maintained and rest privatized. In the remaining sectors, all CPSEs will be privatized," the Minister said.

What goes outside government control?

The government had revealed the broad contours of the policy in May 2020 as part of the Atmanirbhar Bharat package unveiled in the initial stages of the COVID-19 pandemic. The strategic sectors identified at the time for retaining certain public sector entities within the government's control remain the same in the final policy approved by the Cabinet. These are atomic energy, space and defence, transport and telecommunications, power, petroleum, coal and other minerals, and lastly, banking, insurance and financial services. While the initial plan was to retain one to four public sector firms in these sectors, this has now been replaced by the phrase "bare minimum presence".

Once the government decides what is the bare minimum number of firms it wants to retain, the rest of the firms will be privatized, merged or subsidiarised with other CPSEs, or closed. For all firms in sectors considered non-strategic, privatization or closure are the only two options being considered. The policy's objective is to minimise the public sector's role and create new investment space for the private sector, in the hope that the infusion of private capital, technology and management practices will contribute to growth and new jobs. The proceeds from the sale of these firms would finance various government-run social sector and developmental programmes.

A disinvestment bid for Air India under the Vajpayee government had got stalled amidst a political outcry.

A disinvestment bid for Air India under the Vajpayee government had got stalled amidst a political outcry.

In her Budget speech, Finance Minister Nirmala Sitharaman promised the sale of two more public sector banks and a general insurance player, along with plans to list the Life Insurance Corporation of India on the stock markets

Why is this significant?

A bold push for disinvestment of the public sector was expected soon after Prime Minister Narendra Modi assumed office in May 2014 and announced that the government had "no business to be in business". This was seen as a clear intent to privatize a huge chunk of India's large public sector, a legacy from post-Independence policies that placed government firms at the 'commanding heights' of the economy.

However, the first term saw little activity by the government on this front, barring an aborted attempt to sell 76% of its stake in the loss-ridden national carrier Air India. A few public sector enterprises were merged with other PSEs and the proceeds from the transactions counted as disinvestment proceeds in the government's accounts.

In its second innings, however, there has been some enthusiasm to privatise, with a fresh push to sell Air India (lock stock and barrel, with 100% stake sale), followed by Maharatna oil PSU Bharat Petroleum Corporation Ltd (BPCL), and the likes of Shipping Corporation of India, Container Corporation of India and Pawan Hans. The process for those sales is under way, although timelines and investor interest were affected by the pandemic. However, the process indicated a piecemeal approach to privatisation and created uncertainty.

The new policy is significant as it goes beyond such an approach and lays down a rationale for deciding the future ownership pattern of 439 CPSEs, including their subsidiaries. For instance, it is now clear that 151 public sector firms in non-strategic sectors (including 83 holding companies and 68 subsidiaries) will either be closed or sold. The policy also brings public sector banks and insurance entities into the disinvestment ambit for the first time.

In her Budget speech, Finance Minister Nirmala Sitharaman promised the sale of two more public sector banks and a general insurance player, along with plans to list the Life Insurance Corporation of India on the stock markets


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How is this different from policies in the past?

This is the first time since 2004 that India is working on a slew of privatisation deals. Earlier, the Atal Bihari Vajpayee government between 1999 and 2004 had managed to sell off majority stakes in a dozen-odd public sector enterprises, including Modern Foods, Balco, Hindustan Zinc, VSNL and a few hotels. A separate Ministry had been formed just for disinvestment, led initially by the late Arun Jaitley and then by Arun Shourie, who drove the process.

An attempt to sell Air India at the time had, however, got stalled in the face of a political outcry. Prior to that, the early 1990s saw the stock market listing of minority stakes in a bunch of public sector firms, a policy that was replayed when the UPA government was in office from 2004 to 2014. The new policy goes beyond the Vajpayee-era privatisation drive, which was limited to a 'case-by-case' sale of entities in non-strategic sectors, by stressing that even strategic sectors will have a 'bare minimum' presence of government-owned firms.

What is likely to be sold?

The government hopes to conclude the sale of Air India, BPCL and some other entities, where some progress has already been made over the past year. Ms Sitharaman also promised the sale of two more public sector banks and a general insurance player in her Budget speech, along with plans to list the Life Insurance Corporation (LIC) of India on the stock markets.

The Union Budget has estimated ₹1.75 lakh crore as receipts from PSU stake sales in the year, compared to its target of ₹2.10 lakh crore for 2020-21, of which just about ₹20,000 crore has been raised so far. However, the Finance Ministry mandarins are confident of achieving next year's target.

What is the proposed process for selecting the CPSEs to be sold or retained?

The NITI Aayog has been entrusted with suggesting which public sector firms in strategic sectors should be retained, considered for privatisation or merger or 'subsidiarisation' with another public sector firm, or simply closed. A core group of secretaries on disinvestment will consider the NITI Aayog's suggestions and forward its views to a ministerial group. Apart from the Finance Minister, the group will include Road Transport and Highways Minister Nitin Gadkari and the minister in charge of the administrative ministry of the public sector enterprise concerned. After the ministerial group's nod, the Department of Investment and Public Asset Management in the Finance Ministry will move a proposal to the Cabinet Committee on Economic Affairs for an 'in-principle' nod to sell specific CPSEs. The NITI Aayog is expected to soon formalise its recommendations on which of the 77 public sector companies in strategic sectors should remain with the government.

Public sector firms and corporations engaged in activities allied to the farm sector, such as providing seeds to farmers, or the procurement and distribution of food for public distribution, will not be privatised. Similarly, the policy excludes departments with commercial operations like Railways and Posts, firms making appliances for the physically challenged, and those providing support to vulnerable groups through financing of SCs, STs, minorities and backward classes. CPSES "maintaining critical data having a bearing on national security", security printing and minting companies, will also be retained in the public sector.

What are the risk factors?

The turmoil in the global economy could impact the valuations of firms being privatised, as many potential investors may not have the appetite for bidding in these times. The prospect of post-deal scrutiny by audit and investigating agencies, like the CAG (Comptroller and Auditor General of India) and the CBI, will be a source of worry for officials, with similar cases pertaining to the Vajpayee-era transactions still cropping up in courts.

Lastly, as economist Pronab Sen has warned, privatisation is a good idea, but doing it during a recession may dampen economic recovery as investors will end up buying existing capacities instead of embarking on fresh investments.

Courtesy: *The Hindu*


35th Edition
Aquaculture Expo 2021
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LAYOUT OF STALLS

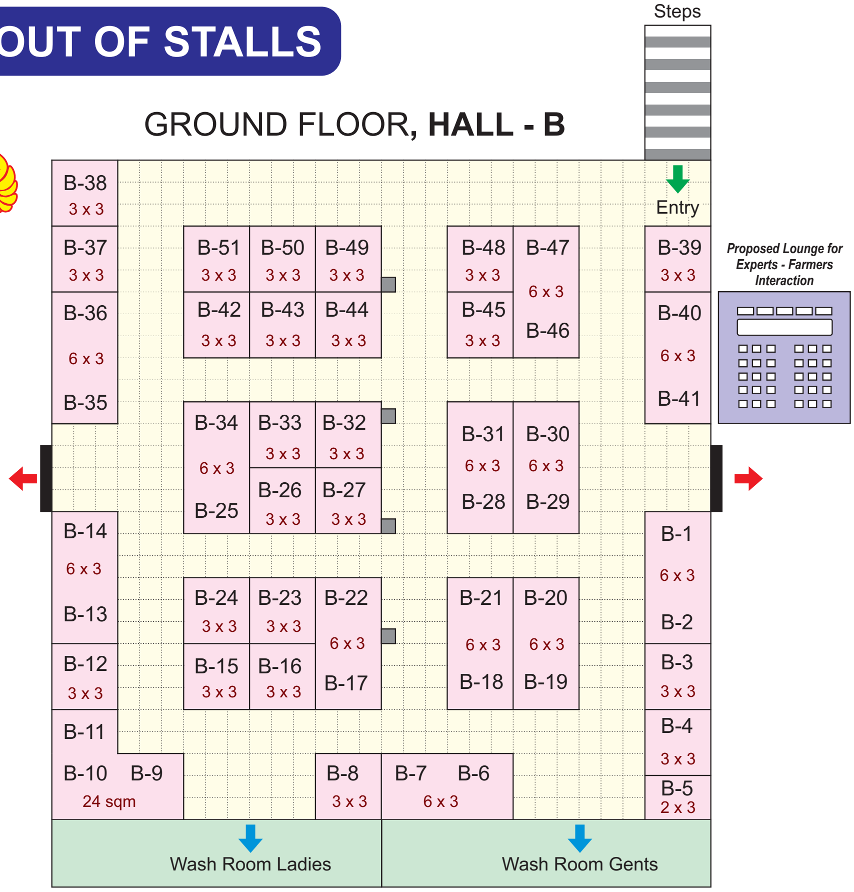
35th Edition

Aquaculture Expo 2021

9 & 10 March 2021
Nellore, A.P, India

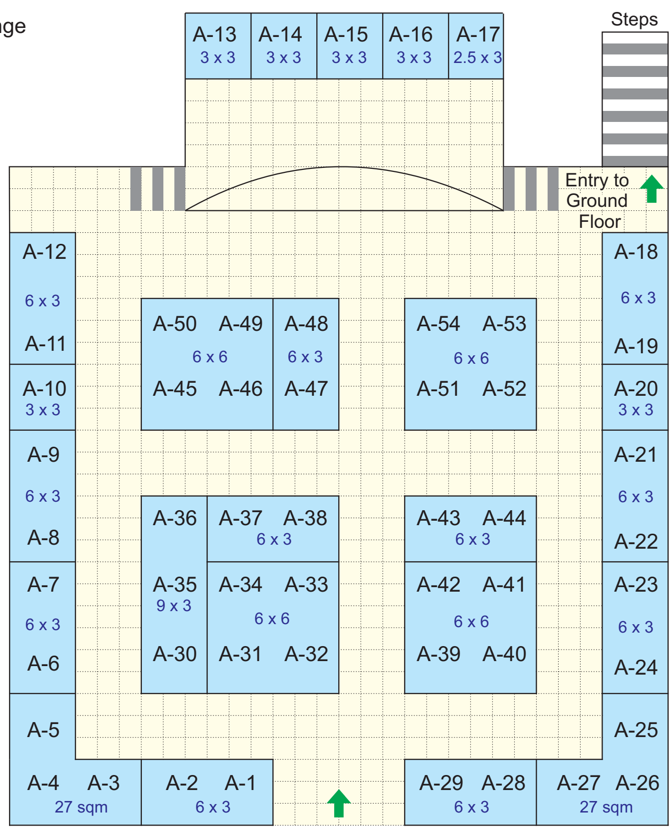
3x3 meter,
Single Model booth

GROUND FLOOR, **HALL - B**



Pillar

Experts - Farmers Interaction Lounge



Main Entry

UPSTAIRS, **HALL - A**

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Irregular water exchange, excess and leftout feed, dead algae, fecal matter, increases the organic load at the pond bottom. Accumulation of such waste absorbs available oxygen, creating anaerobic condition which leads to pollution of pond bottom. Polluted pond bottom and unhealthy environmental conditions triggers the release of toxic gasses like Ammonia, H_2S, Methane, etc, The toxicity of Ammonia, Hydrogen Sulphide, Methane attributed mainly due to unionized form. As the concentration in water increases, ammonia excretion by aquatic organism diminishes and the level of ammonia in blood and in other tissues increases. Ammonia increases oxygen consumption by tissues, damage gills and reduces the ability of blood to transport oxygen, and increases the disease susceptibility. To eliminate / overcome the above problems 'GASSEN PLUS' Yucca Schidigera, it contains Steroidal"Saponin" which help to reduce ammonia and other noxious gasses such as H_2S, Methane, etc., Microbial enzyme "Urease' Production inhibited by Saponin which leads to an increases D.O. and reduction of BODand COD levels.

Bacterial strains such as Bacillus Subtilis, Nitrobactor, Nitrasomonas, rapidly converts ammonia into Nitrates, Nitrites and finally non-toxic Nitrogen. Hydrogen Sulphide converts into Sulphates, Sulphites and finally non-toxic Sulphur, Methane into Non-toxic carbon. This conversion reduces the obnoxious gasses in the pond bottom. Reduction of this gasses improve the D.O. level in the water and bottom.

COMPOSITION:
YUCCA SCHIDIGERA
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Subrato Ghosh

Fishery Extension Officer, Government of West Bengal

Highlight Points

Participation of women in finfish farming activities, both edible and non-edible (ornamental) ones, will improve economy of rural families and enhance their nutritional status via partial use of pond-reared fishes for household consumption. Economic and livelihood security of rural women can be assured. Propagation of familiar and less-familiar aquarium fishes is less capital-intensive and less labour-intensive affair, can be adopted by women in semi-urban and rural areas. An idea is presented here on different facets of women-friendly pisciculture activities with emphasis on ornamental fish farming involving women groups in South 24 Pgs, West Bengal.

Introduction

Freshwater and brackishwater pisciculture, *i.e.,* farming of economically-important foodfishes in controlled systems under confined pond conditions have been playing important role in addressing nutritional and livelihood security of poor sustainably in developing countries. Farming of finfishes and shellfishes, *i.e.,* aquaculture has received much attention of Central and State Governments, farming community, scientists and others in recent years. This vocation has emerged as the key viable income-generating option for poor in rural India. Rural womenfolk, especially those from marginalized section of the community, have always played important role in livelihood generating activities and traditionally women in India contributed generously in fishery and homestead pisciculture sectors.

Women-friendly freshwater pisciculture technologies like ornamental/aquarium fish breeding and rearing in rectangular cemented cisterns in home land and backyard ponds, farming of economically-important nutritious catfishes *Clarius batrachus* and *Heteropneustes fossilis* in cemented cisterns, controlled breeding and seed production of exotic carp *Cyprinus carpio* in cloth enclosures in ponds during winter, formulated farm-made (pellet-type) feed preparation for edible and ornamental fishes, seed production of major carps in FRP portable hatchery - these can be easily implemented by rural women utilizing locally-available resources and can be adopted on small- to medium-scale for income and employment generation (individually or in form of SHGs) without jeopardizing their household activities. As for instance, according to officers of Freshwater Fisheries Research and Training Centre (FFRTC), Government of West Bengal (WB), a minimum net profit of Rs 27,850/- can be obtained in a year (Rs 2,500-4,500/- / month) from farming of familiar ornamental fishes guppy, molly, swordtail and platy. Common interest group of fisherwomen in a village can work together by shouldering the responsibilities equally and jointly.

A report of WorldFish, Malaysia states that in 2012, female fish farmer Shahnaz Dewan at Adabari village in Tangail District, Bangladesh stocked 5500nos of large-sized fish fingerlings in 24dec pond and followed proper fish pond management practices. After 105-110 days, in early September, she harvested total 1020kg of *Tilapia nilotica* and 40kg of major carps, which she sold for BDT 140,180 (1 BDT = 0.012US$). She then stocked carp fingerlings and harvested again in early February 2013, this time obtained 350kg adult fishes and earned BDT 42,000. Her overall total production during 2012-2013 was 1410kg, yielding a gross profit of BDT 97,930. She served as a demonstration farmer, educating and influencing her neighbours. Likewise, quite a few noteworthy instances and success stories can be discussed about in context of eastern and north-eastern states of India, namely Odisha, WB, Assam and Tripura.

Spawn rearing and fry-staged fish production

In rural WB, most houses have a small backyard pond 100-800sqmt in area. It lies fallow, semi-clean and weed-infested, can be renovated and converted into a fish pond. These are ideally suited for rearing/nursing spawn-stage seed of *Labeo rohita*, *Catla catla*, *Cirrhinus mrigala* and exotic major carps by women of the family. In a study on involvement of womenfolk in aquaculture in rural Odisha, it was found that a backyard pond 200sqmt in area could

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produce as much as 19,000nos fry and 3,000nos fingerlings, yielding a total income of Rs 1,700/- in a period of 4 months. Resources around the home of resource-poor women can be used in such homestead fish seed rearing units, who can easily attend household works like cooking, taking care of their children and domestic animals.

Rearing of hatchery-produced spawn (3-days old) of economically-important cultivable freshwater fishes upto fry (22-25mm) stage is a preferred package of practices for resource-poor fisher-womenfolk, where 1,50,000nos fry of Indian major carps can be produced in 25dec pond in 15-18 days period and sold to grow-out fish farmers, giving an income of Rs 5,000-6,000/-. Smaller and seasonal backyard ponds 0.02-0.05 hectares in area having water depth 0.6-1.0mt are preferred for fry rearing. In this way, unutilized water resources of villages can be used productively. Rural women can adopt it as an income-generating activity; fry stages can be sold and supplied to fish growers in same village who will get healthy and quality major carp fry for stocking in larger ponds without bothering for transportation and mortality.

Rearing indigenous magur *Clarius batrachus* in cemented cisterns

The magur fish *C. batrachus* is air-breathing, nutritious, has medicinal properties, high-priced and has good demand in WB. Many unemployed youths have become interested in culture of *C. batrachus* in cement cisterns in their backyard. Its advanced fry (8-10gm) grows upto marketable size in 4 months in rectangular cement cisterns if fed fish-meal based farm-made supplementary feed. Entire water can be drained off from cisterns and fishes can be harvested easily. Presently 58 private hatcheries in WB produce induced-bred healthy seeds of indigenous magur, which can be procured for culture. Important features of this activity are: 1) Tank size: 8feet x 4feet x 3feet, two inch slope on one side and overhead shade; 2) Indigenous Magur seeds 8-10gm size stocked @ 8-10nos / sqfoot; 3) Seeds treated with 1ppm Potassium permanganate soln. for 5 minutes before stocking; 4) Mixture of fish meal, ground nut oil cake and rice bran in equal proportions fed to growing fishes 2 times a day @ 20% of bw; 5) Water replenishment done 50 - 60% two times a week; 6) At end of 3-4 months, 12-16 kg marketable-sized Magur (50-60gm) obtained from tank; 7) Smaller-sized seeds (35-40 days old, 2.0-2.5 inch) can be stocked, price Rs 4 - 6/ - / piece.

Ornamental/aquarium fish farming

Breeding and propagation of freshwater exotic ornamental (aquarium/coloured) fishes has proved to be an important avenue for increasing employment opportunities for rural women through small- to medium-scale farming units. It is an income-generating activity and priority sector where women can be gainfully involved, either individually or as SHGs. Basic requirements for setting up a backyard ornamental fish rearing unit are: 300-400sq feet or 25-27 sqmt land area; 5-6nos rectangular cement cisterns (2000-3000lit capacity), water depth 2 feet; overhead shade; portable water source (submersible pump, tube well or well water); few glass aquaria (150lit capacity); adult fishes or brood fishes brought from market; small feed pelletizer and raw feed ingredients; live food; medicines (Malachite green, Methylene blue, Potassium permanganate); portable aerators or air blower; bio-filter; fish sampling nets; immersion heater; fish packing polythene packets; oxygen cylinder.

This sector provides huge possibilities for empowering women economically and is a flourishing avenue of self-employment generation. State of WB has substantial involvement of women in propagation of aquarium fishes and an established avenue of women entrepreneurship. It is easy to start with live bearers; once women get acquainted with the care of brooder fishes, fry handling - slowly the unit will expand.

Features in succession in breeding and rearing of goldfish *Carassius auratus* are: 1) Adhesive eggs, thickly planted aquarium needed; 2) Spawning grids 6mm x 6mm placed in glass tank; 3) Frame/grid placed in bottom of tank, height 5cm from bottom; 4) Male and female broodstock maintained separately for a month on balanced feed; 5) Male : Female in 1:1 or 2:1 ratio released in spawning tank; 6) Within 12-20 hours, females release eggs; broodstock taken out after spawning; 7) Golden coloured fertilized eggs visible at tank bottom, may remain attached to plants; 8) After 48 hours, eggs hatch and larvae are produced; 9) From 72^{nd} hour, goldfish larvae fed with small rotifers (zooplankton) for further development for one week; 10) Feed on zooplankton Daphnia and Moina and powdered feed (pulverized fish meal) for next 15 days; 11) Shifted to cemented rectangular tanks (5x3) or (6x3) sq.feet; 12) Within 100-120 days, it reaches to marketable size; 13) Feed preparation with mustard oil cake, rice polish, soyabean meal, pulverized fish meal and shrimp head waste/trash shrimp meal (powdered) may be used for goldfish.

Features in breeding and rearing of live bearing fishes (guppy *Poecilia reticulata*, molly *Poecilia sphenops*, sword tail *Xiphophorus hellerii*)

It includes: 1) Time required to attain maturity by adults: a) For platy, swordtail, guppy: 6-8 weeks; b) molly: 12-16 weeks; 2) Eggs develop inside the body of adult mother, young ones born with or without yolk sac; 3) Spermatozoa of male retained within body of females; 4) Gestation period: 1 month, 50-70 young ones take birth in single time; 5) Males and females kept separately, introduced into breeding tank just prior to breeding; 6) Pregnant females should be handled cautiously; 7) Diffused illumination required, young ones reared on zooplankton; 8) Box-type perforated cylindrical container can be kept fitted into wall of cement tank for 2-4 gravid females, so that newborns can drop through mesh into tank water; 9) Breeding tank must have thick plantation (Hydrilla); 10) For swordtail, it takes 24-36 hours for all young ones to have birth (about 30-80nos every time); 11) After 5 weeks, it again gives birth to young ones; 12) For guppy and molly, 1 tablespoon common salt may be added into tanks where young ones remain; 13) Three-day old young ones may be stocked @

4000-4500nos. / tank; 14) For red molly, on 6th month, those are stocked in spawning chambers as large earthen bowls 1.5-2.0 feet diameter in ratio 5:1 (Female : Male); 15) Gravid females move along the sides in upper water column; 16) Those are carefully collected in released in *maateer maalsa* or earthen bowl 6 inch diameter, one female in each container; 17) In 24 hours, a female gives birth to 150 fully-formed young ones.

Women-led Uttar Jafarpur ornamental fish co-operative society and SHGs

According to scientists of ICAR-CIFA, Bhubaneswar, an investment of Rs 75,000/- (capital and recurring investment of Rs 50,000/- and Rs 25,000/- respectively) gives a return of Rs 50,000/- / year from a livebearer backyard small-scale ornamental fish culture unit, where village women can have active involvement. Both live bearers and egg layers can be bred and reared for commercial purpose, hormonal injection is not required. Backyard units (cement cisterns) can be established in 500-1000sq.feet area with investment ranging upto Rs 80,000/-. A single guppy, molly, angel fish and goldfish are rated within Rs 5-20/- / piece in ornamental fish wholesale markets in WB.

Such an enterprise generates income for the unemployed youth to women homemakers. Members of the prominent Uttar Jafarpur Women Ornamental Fish Cooperative Society in Falta CD Block, Dist. South 24 Pgs, WB (where author has visited) aspire to stick to this occupation for long. This Mohila Rangin Maachh Samabay Samity (recipient of award from Hon'ble Chief Minister of WB) was established in 2003 and started with 15 women, begun with breeding and propagation of mollies - white, black and red in large earthen bowls/vessels. Thereafter cement cisterns 6feet x 2feet size were purposefully constructed. Currently, this actively-functioning registered Coop Society in ornamental fishery sector, run by women, has 36 core members (Rita Gure, Sujata Gure, Sunita Guchhait and others) engaged in daily nurture of the young ones (bought @ Rs 1.00-2.00/-/piece) and adults of 20 species of high-valued ornamental fishes. Many of these women practice aquarium fish farming at home in addition to working for the Cooperative. They have cement tanks in their backyards for maintaining brooders or curing infected ornamental fishes, and have family-owned or shared or taken-on-lease ponds where such fishes are propagated in inverted mosquito net-type enclosures fixed in ponds, with about 50000nos of growing aquarium fishes in 8dec pond (2000-2500nos / enclosure). Marketable-sized fishes have assured supply to wholesalers in Howrah district; husbands of women members go to markets to sale the produce, profit obtained as expected by dint of honesty, hard work and self-taught skills and experience. Home-made dry food fed to growing fishes. On an average, ornamental fish farming brings Rs 7,000-14,000/- / month for each woman in Uttar Jafarpur Ornamental Fish Cooperative Society; it has brought marked change in quality of life in this village in South 24 Parganas and led to increase in their family income.

The hub of ornamental fish farming in South 24 Parganas district includes Falta Block that consist more than 50 women-led SHGs; other adjacent Blocks where women-led SHGs are working exclusively and successfully on backyard ornamental fish farming include Budge Budge-II (with 8 SHGs), Bishnupur-II (5 SHGs), Mograhat-I (3 SHGs) and Mograhat-II (2 SHGs). These women have advanced their skills and knowledge through training programmes conducted by WB University of Animal and Fishery Sciences, Kolkata and Department of Fisheries, Government of WB (both at FFRTC and Block-level). Swapna Majhi, member of WB Government-instituted Swarnali Women Cooperative in Nandabhanga village in Bishnupur-II Block breeds and propagates ornamental fish in 15 tanks at her house. At more than Rs 5,000/- per month, she has almost tripled her income. Likewise, Meen Kanya Rangin Maachh Mahila Samabay Samity Ltd., Nadia; Surya Kiran Rangin Maachh Mahila Samabay Samity Ltd., Kaliaganj Block, Uttar Dinajpur; Swapna Rangin Maachh SHG, Budge Budge-II Block to name a few, have grown up in WB, all run by women.

Epilogue

Women SHGs or Primary Cooperative Societies may be organized with common interest and similarity in economic status, especially from the poorer section of society. Many technology options have been identified through participatory approach by scientific personnel of Krishi Vigyan Kendras established in different states at district level. In view of multiple options of available fish farming technologies, labour efficiency and self-employment potential for rural women, such women-friendly technologies will be expanded widely in days to come, which will be highly rewarding in economic terms. Three quarters of the SHGs in Western Odisha Rural Livelihoods Project conducting aquaculture are women groups. Under this Project, with regards to aquaculture, women participate in auctions for the lease of water bodies, obtaining loans from banks, gaining credit worthiness, gaining technical skills and expertise to help them conduct fish culture.

Women SHGs can serve as means of generating much needed resources and family income, as an avenue for increasing women's agency and well-being and for addressing wider needs of the communities in which women live. Government Extension staff study the condition of women in a village and sensitize them to join together and form groups. Need-based training programmes and problems of women are identified. If women may show interest in ornamental fish farming, training programmes should be conducted and imparted. Women participate in it and form SHGs. After pooling fund from the group and other sources, they form a cooperative and start small business. Women fishery cooperative steadily earns money, maintain bank accounts, bring upliftment in socio-economic status of the family. In South 24 Parganas district, women are very recently coming up in preparing value-added food products from small indigenous local freshwater fishes and from those left unsold in registered and non-registered fish retail markets.

In rural Bangladesh, many women are involved in inland fishery and pisciculture activities. Year after year, they continue to be essential in improving nutrition, increasing production and distribution of food and enhancing living conditions of their families. Under the Community-Based Fisheries Management Project of WorldFish Center, many self-sustaining independent women could be created in 22 districts of Bangladesh, who manage their own fish ponds, eventually take the lead in breaking rural poverty cycle. In WB, there is ample scope of empowering rural women through integrated fish farming with poultry and duckery components in addition to those discussed above. In India, under different projects funded by Central and State Government, efforts have been made to develop skill and empower rural women in fish farming technology; different packages of practices introduced through demonstrations and participatory trials in many parts of the country. With research and extension programmes, it is expected that aquaculture vocation will be made more attractive to women. During 2006-2009, author had worked with members of Maa Biswamata SHG at Kendrapara district of Odisha and disseminated technologies like fish seed production in portable FRP hatchery, raising fry and fingerlings of major carps. It led to capacity building of the SHG women members to a considerable extent and the activities have become a sustainable source of livelihood for them.

OCEAN ACIDIFICATION AND ITS IMPACT ON MARINE ECOSYSTEM

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Highlight Points

- Ocean acidification a serious thread for all the marine organisms and their ecosystem for over three to four decades.
- Increasing acidification of an ocean leads to a dwindle in the production of shellfish resources such as oyster culture and also in lobster fattening.
- Coral reefs are already showing a decreasing sign of growth in response to the increasing rate of ocean acidity.
- Moreover, this threat plays a vital role in the reduction of marine fisheries ultimately lessening the economic status of the fishermen and stakeholders up to global. Hence it is mandatory to mitigate increasing acidification in Ocean.

Introduction

Due to deforestation, fossil fuel combustion and many other anthropogenic activities the CO_2 concentration in the atmosphere get increases which resulted in more CO_2uptake by the ocean (Fabry et al. 2008). Out of the total CO_2 emitted by human activity 1/3rd of gets absorbed by the ocean which leads to changes in the chemical balance of seawater ie. pH reduction and this process was named ocean acidification (Doney et al. 2009). pH reduction occurs due to the release of hydrogen ions. In comparison with pre-industrial times, the pH of surface water of the ocean was dropped by 0.1 units which is approximately 26% and by 2100 it is estimated to drop by 0.3 units which are 170% higher acidity in comparison with preindustrial times (Orr et al. 2005; Bopp et al. 2013; Gattuso and Hansson, 2011). The ocean is considered to be the largest reservoir of carbon because of its daily CO_2 uptake of 22 million metric tons (Feely et al. 2008).

Chemistry behind ocean acidification

The difference in partial pressure between the ocean surface and atmosphere gases gets easily exchanged and hence the ocean gets its significant part in the carbon cycle. The chemistry of seawater gets altered when CO_2 dissolves in seawater. The dissolved CO_2 either remains as the gas that can be exchanged with the atmosphere or it will be utilised by phytoplankton and marine plants. This portion is referred to as the aqueous CO_2 and expressed as the partial pressure of CO_2.

The CO_2 molecules dissolved in seawater gets combined with the water molecules (H_2O) and it forms carbonic acid (H_2CO3), which is a weak acid.

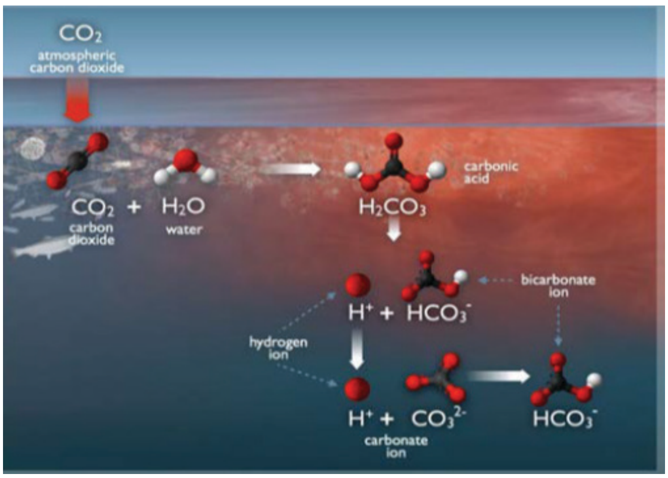
$CO_2 \longleftrightarrow H_2O + H2CO_3$
(Carbondioxide) (Water) (Carbonic acid)

The carbonic acid formed gets dissociate or break apart to their constituent ions ie., hydrogen ions (H+) and bicarbonate ions (HCO_3-)

$H2CO_3 \longleftrightarrow H^+ + HCO_3^-$
(Carbonic acid) (Hydrogen ion) (Bicarbonate ion)

The hydrogen ion formed will either remain as such, thereby causing a reduction in pH of seawater otherwise it will combine with carbonate ions to form bicarbonate ions.

$H+ + CO_3^{2+} \longleftrightarrow HCO_3^-$
(Hydrogen ion) (Carbonate ion) (Bicarbonate ion)



Impacts on marine ecosystem

Pacific Oyster Farms Fail

Since 2005, shellfish farmers along the U.S. Pacific Coast are facing difficulties in raising oyster larvae due to more acidic conditions caused by the devastating impacts of ocean acidification (Hauri et al. 2009). Hence it leads to a drastic loss for the 111 million dollar oyster industry of the West Coast (The Seattle Times online article).

Molluscs such as mussels, clams and scallops are known to be vulnerable to the increasing acidity of the ocean. They are vulnerable because these animals create their shells out of calcium carbonate to protect their soft body from predators, disease and harsh ocean conditions. But the high acid condition makes calcium carbonate not available for their shell growth to take place (Gazeau et al. 2007). Ability to survive by mollusc decrease due to the slower shell growth leading to a negative impact on commercial fisheries. A study suggests that if this slowed growth occurred in 2006 continues and predicted for 2100, there would be a loss of 75-187 million dollars of mollusc fisheries (Cooley and Doney, 2009). But this prediction is considered to be an underestimate because only acidity impact is taken into account neglecting other impacts such as reduced reproductive success and larval survival.

Decreased growth rate in corals

Coral reefs are a major contributor to the national economy also started showing signs of decline due to the impact of ocean acidification. Great Barrier Reef, the largest reef-building corals are also showing more than fourteen percent reduction in skeletal growth since 1990, which is noted to be the largest decrease in growth rate in the last 400 years (De'ath et al. 2009). This growth rate decline will ultimately end in the mass die-off of tropical coral reefs by the end of this century.

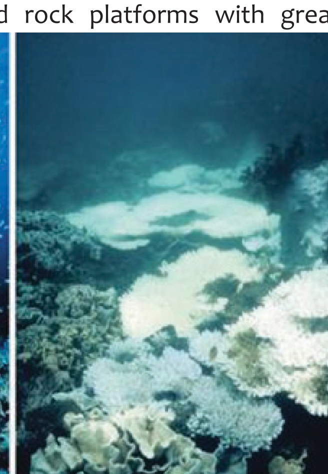
Nearly 500 million people around the world rely on reefs for coastal protection, food and income (Wilkinson, 2008). Economists estimated the reef values as 30 to 172 billion dollars per year (TEEB, 2010). Healthy reefs provide goods and services to society, including tourism, coastal protection, fisheries, education and aesthetic values. In Hawaii, coral reefs through tourism annually generate around 364 million dollars (U.S. EPA). If reefs collapse due to ocean acidification or some other threats the estimated 30 million people who completely depend on reef ecosystems for protein and protection will face serious health consequences. This loss will cause an impact starting from small coastal communities to the global economy.

Coral reef habitat loss

Coral Reefs

Coral reefs serve as a home to nearly a quarter of the entire biological diversity of the oceans providing habitat for a number of species and one of the most beautiful habitats in the world. Although they just cover a percent of the world's continental shelves, they serve as significant habitat to as many as one to three million species, which includes nearly twenty-five percent of the marine fish species (Bryant et al. 1998). This three-dimensional framework offers feed, space toreproduce, shelter larvae and hide from predators for those millions of species (Knowlton et al. 2010).

If CO_2 emissions doesn't get reduced and the current situation continues then by the middle of this century, the eroding rate of coral will be faster than the skeleton growing rate due to the combined pressures of ocean acidification and global warming (Silverman et al. 2009). Reefs may become eroded rock platforms with great



changes in structure (Hoegh-Guldberg et al. 2007). This will decline reefs, in turn, will threaten the reef-dependent species survival (Veron et al. 2009).

Fish

For habitat, four thousand fish species depend on the reef ecosystem. The reef dependent species such as butterflyfish completely depend on coral for feed. Other fish species also depend on the reef for food, shelter and nurseries (Munday et al. 2008). Due to bleaching events, there are extensive die-offs of coral which shows the interrelation of reef fish with the coral habitat. In Papua New Guinea, after an event, about 75 percent of the reef fish species declined in abundance and several species became extinct (Jones et al. 2004). This example gives us an idea about the great impact of rising ocean acidity on coral reefs in the near future.

Sea turtle

Sea turtles are considered as the most endangered marine animal which is often found to rest and feed on the reefs. They prefer to feed on sponges, algae, soft corals and molluscs that live on the reef. A decline in coral growth will cause a great impact on the feeding behaviour of turtles and could change their food source to a less nutritious one or they even go hungry. Even the breeding nature of turtles will be affected as they dig and lay an egg on sandy beaches which has a connection with the coral reef ecosystem. Because the type and amount of sand on nesting beaches are mostly made up of the skeletal remains of plants and animals that habitat on the reef, including parts of the reefs themselves. Due to the decline in the abundance of reef-dependent species, the type of sand will get altered leading to a negative impact on turtle's reproduction ability and this ultimately results in population size reduction of the endangered species (Fuentes et al. 2010).

Food web disruption

a) Pteropods

Pteropods are tiny and abundant swimming sea snails which are referred to as the "potato chips of the sea" due to their importance as being a food source for so many species. They can even reach a density of a thousand individuals per cubic meter and are considered very important in the polar as well as sub-polar food webs and serve as an important diet of the zooplankton, herring, salmon, and baleen whales. Since Pteropods build their shell out of calcium carbonate they are more vulnerable to the increasing acidity of the ocean. As they cannot survive in more acidic waters, their populations may plummet and cause a rippling effect throughout the food webs that depend on them (Doney et al. 2009).

Actively swimming pteropod in seawater with low surface CO_2 conditions that preserve the shell with no dissolution

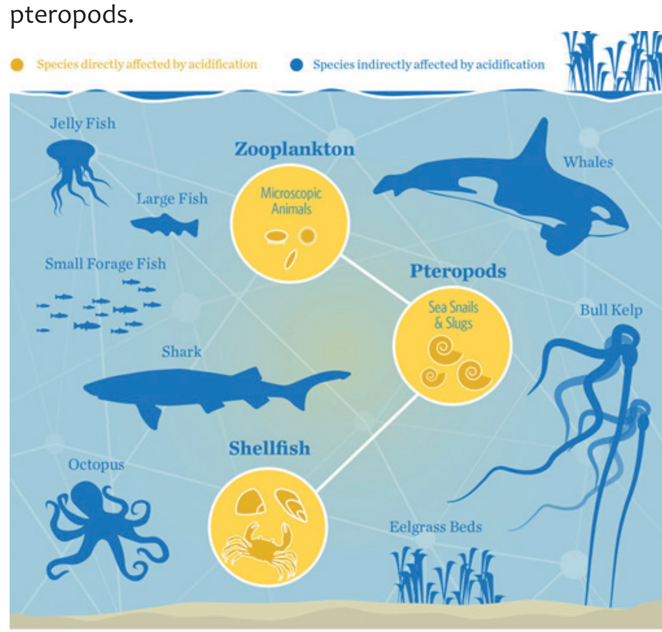
Pteropod showing swimming difficulties and partially dissolved shell after exposure to elevated CO_2 conditions (1600 ppm) for 2 weeks

b) Salmon

North Pacific salmon population gets affected as they heavily depend on pteropods for food. Pteropods contribute 45 percent of the diet of pink salmon juveniles. The North Pacific salmon fisheries provide three billion dollars' worth of personal income for fishermen in 2007, supported 35000 jobs in just the harvesting and processing field. Other commercially important fish species that depend on pteropods for food include cod, herring and mackerel whose population may also collapse due to the decline of the pteropod population (Aydin et al. 2005).

c) Killer whale

Killer whales of the North Pacific ocean prefer to eat salmon, about 96% of the killer whales diet is dependent on salmon. When the base of the food web (pteropods) disappears, there is a direct effect on the top predators. If those predators cannot supplement their diets with other food sources then there will be a collapse in the entire food web food webs. Top predators like the emblematic killer whale may suffer and have further implications. These iconic species serve as an important tourist attractionmay be threatened by the cascading impacts due to the loss of pteropods.

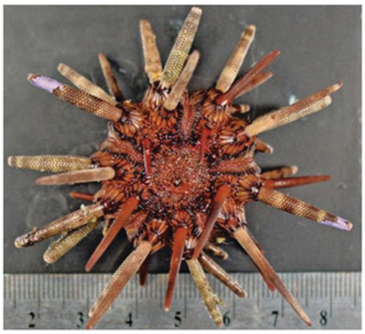


Impacts on shell fishes

a) Sea urchin

Sea urchins reproduce by directly releasing their eggs and sperm into the surrounding seawater. Under acidified conditions, the sperm's mobility gets reduced, which lowers the chances of egg fertilization, embryo formation and larvae development. Even under normal conditions, only a few percentages of sperm locates and fertilizes the eggs because a majority of sea urchin embryos and larvae will be fed by fish and only some survivors mature into adults. To compensate for this low success rate, sea urchins usually release millions of eggs and sperm. However, the predicted

more acidic conditions for the end of this century may reduce the size of the next generation of sea urchins. Like many other calcifiers, sea urchins make up their skeleton using calcium carbonate. Ocean acidification may slow the growth rate and deformed shells may leave them more vulnerable to predators and decrease their surviving ability.



Pencil urchin under normal CO2

Pencil urchin under high CO2 (2850 ppm) showing dissolution of spines

b) Lobster

Under more acidic conditions, the lobster larvae had lighter and less dense shells, which could make them more susceptible to predation and less able to survive. Increasing ocean acidity may drive some lobsters to create larger shells but the exact reason for this is unknown. However, it may have a negative impact as most of its energy will be diverted away from other activities that are vital to survival (Ries et al. 2009).

c) Sea Stars

Sea stars are important predators in the coral reef ecosystem, keeping the populations of other species in check. Sea stars have hundreds of tiny calcium carbonate plates embedded within their tissue rather than the continuous skeleton. Hence they differently respond to increasing ocean acidity than other marine calcifiers that have continuous calcium carbonate shells. Studies on purple sea stars response to increased acidity have shown a decrease in calcification but an increase in overall growth (Dupont et al. 2008). This increase in growth rate may lead to an increased feeding rate creating more pressure on their preferred food sources like mussels and therefore causing population declines of the prey species.

Response of lobster larvae to ocean acidification and warming (NOAA's Ocean Acidification Program and Sea Grant)

d) Squids

Squid are the fastest moving marine invertebrates, which propels at a speed of 25 miles an hour. This form of jet propulsion movement requires large amounts of oxygen which are sentthrough the blood to the tissues. Ocean acidification may inhibit the squid's ability to transport required amounts of oxygen, resulting in the inhibition of important activities like hunting and avoiding predators. This would affect a squid's ability to survive. While another study suggested that cuttlefishshows resilience to changes in metabolism from high levels of carbon dioxide (Gutowska et al. 2008), another study on jumbo squidmentioned the significant drops in metabolic rates and activity level (Rosa and Seibel, 2008). More research is necessaryfor abetter understanding of the impacts of acidification on these species.

Ecological winners

Most of the marine species get negatively impacted due to the increased acidity of the ocean whereas there are some species that benefit from ocean acidification. This may be due to the high CO_2 levels which benefit them or because their competitors are directly harmed by it.

a) Jelly fish

Jellyfish are one of the "winners" of the more acidic ocean. The fact of whether increasing acidity is directly related to the recent increases in jellyfish population is not clear, but it is clear that ocean acidification does not affect the reproduction of jellyfish or their internal structure formation. Even if acidification is not directly responsible for their increased prevalence, it may be creating ocean conditions that are ripe to flourish (Richardson and Gibbons, 2008).

b) Algae and sea grasses

Algae and seagrasses are likely to do well in the increased acidity of the ocean. These species utilize CO_2 and sometimes it directly competes with calcifiers. When acidity increases, conditions may favour these organisms and they may be able to move into areas where they have not previously flourished.

Group			Main response
Algae		Fleshy algae	+22% growth
		Diatoms	+17% growth
		Calcifying algae	-80% abundance
Molluscs		Clams, scallops, mussels, oysters, pteropods, abalone, conchs and cephalopods (squid, cuttlefish and octopuses)	-34% survival -40% calcification
Echinoderms		Sea urchins, sea cucumbers, starfish	-10% growth -11% development
Corals		Warm and cold water coral	-32% calcification -47% abundance
Crustaceans		Shrimps, prawns, crabs, lobsters, copepods, and their relatives contributing to zooplankton	This group is relatively resistant to changes in ocean pH
Finfish		Small (herrings, sardines, anchovies), large (tuna, bonitos, billfishes), demersal (flounders, halibut, cod, haddock), etc.	Loss of habitat and food supply. Possibly some effects on behavior, fitness and larval survival

Recommendations for overcoming ocean acidification

a) Adopt a Policy of Stabilizing Atmospheric Carbon

Dioxide at 350 ppm or below

To protect and revive the ocean and its services, it is a must to bring down the level of carbon dioxide level in the atmosphere to 350 ppm from the current level of 390 ppm. This will be a monumental and necessary task that will require emissions to peak and begin to be drastically controlled and reduced within the decade. Industrialized nations will have to reduce their emission 25 to 40 percent below 1990 levels by 2020 and 80 to 95 percent by 2050, and global emissions will need to be reduced at least 85 percent below 2000 levels by 2050.

b) Conserve Energy and Shift to Alternative Energy Sources

Widespread energy efficiency standards should be adopted for energy conservation at every opportunity at homes, businesses and transportation. Alternative energy sources, such as offshore wind can be used for meeting the energy needs that remain. Governments should also implement some programs that fund alternative energy production by curtailing subsidies to fossil fuel production. Alternative energy can be viable and effective in comparison with fossil fuels, alternative energy sources are not only safer and cleaner but also more cost-effective.

c) Stop Offshore Drilling

To combat problems like ocean acidification and climate change, damaging practices such as offshore drilling should be prohibited. Not only oil pollution causes a threat to marine life and ecosystems, but the emissions from continuous oil use are driving acidification and climate change. To ensure the safety of our oceans and to control carbon dioxide emissions, new offshore drilling should be banned, and we must shift from oil use to alternative energy use.

d) Promote Offshore Wind Energy

A better way to transition to clean energy is to promote offshore wind development. It is very better than offshore drilling because offshore wind utilizes the oceans in a cleaner and safer way. In order to facilitate and encourage the growth of wind energy, federal subsidies for fossil fuels should be redirected towards renewable energies. Tax credits for investment in wind technology should be extended, and policy mechanisms that increase the long-term demand and supply of renewable energies should be developed. For the maximal use of this new technology, the electrification of the transportation fleet must be accelerated and infrastructure should be established.

Conclusion

Human-caused threats, such as offshore drilling and overfishing should be curtailed to maintain the natural resilience of marine ecosystems because these threats decrease the ability of the oceans to cope with rising acidity. Both ocean acidification and climate change act in concert with each other and cause major impact on marine life. Ocean ecosystems will have the best chance of overcoming the ocean acidification pressure if they are not simultaneously struggling to overcome other threats.

Reference:

Aydin, K.Y., et al. (2005) Linking ocean food webs to coastal production and growth rates of Pacific Salmon (Oncorhynchus spp.), using models on three scales. Deep Sea Research Part II: tropical studies in Oceanography, 52(5-6):757-780.

Bopp L, Resplandy L, Orr JC, Doney SC, Dunne JP, et al. (2013) Multiple stressors of ocean ecosystems in the 21st century: projections with CMIP5 models. Biogeosciences 10: 6225-6245.

Bryant, D., L. Burke, J. McManus, and M. Spalding (1998) Reefs at Risk: A Map Based Indicator of Threats to the World's Coral Reefs. World Resources Institute, Washington D.C.

Cooley, S.R. and S.C. Doney (2009) Anticipating ocean acidification's economic consequences for commercial fisheries. Environmental Research Letters, 4024007

De'ath, G., J.M. Lough, and K.E. Fabricius, K.E. (2009) Declining Coral Calcification on the Great Barrier Reef. Science, 323:116-119

Dixson, D.L., Munday, P.L., Jones, G.P. (2010) Ocean acidification disrupts the innate ability of fish to detect predator olfactory cues. Ecology Letters, 13:68-75

Doney, S. C., Fabry, V. J., Feely, R. A., Kleypas, J. A. (2009). Ocean Acidi cation: ¬ e Other CO2 problem. Annu. Rev. Mar. Sci. 1:169–192.

Dupont, S., B. Lundve and M. Thorndyke (2010) Near Future Ocean Acidification Increases Growth Rate of the Lecithotrophic Larvae and Juveniles of the Sea Star Crossasterpapposus. Journal of Experimental Zoology (Mol. Dev. Evol.), 314B

Dupont, S., Havenhand, J., Thorndyke, W., Peck, L., and Thorndyke, M. (2008) Nearfuture level of CO2-driven ocean acidification radically affects larval survival and development in brittlestarOphiothrix fragilis. Mar. Ecol. Prog. Ser., 373:285-294.

Faby, V. J., Seibel, B. A., Feely, R. A., Orr, J. C. (2008). Impacts of ocean acidi cation on marine fauna and ecosystem processes. ICES Journal of Marine Science, 65:414–432.

Feely, R. A., Sabine, C. L., Hernandez-Ayon, J. M., Lanson, D., Hales, B. (2008). Evidence for Upwelling of Corrosive "Acidi ed" Water onto the Continental Shelf. Science, Vol320:1490 -1492.

Fuentes, M.M.P.B., J.L. Dawson, S.G. Smithers, M. Hamann and C.J. Limpus (2010) Sedimentological characteristics of key sea turtle rookeries: potential implications under projected climate change. Marine and Freshwater Research, 61:464-473

Gagliano, M., M. Depczynski, S.D. Simpson, and J.A.Y. Moore (2008) Dispersal without errors: symmetrical ears tune into the right frequency for survival. Proceedings of the Royal Society; Biological Sciences, 275:527-534

Gattuso JP, Hansson L (eds) (2011) Ocean Acidification. Oxford: Oxford University Press. 326 p

***More reference can be provided on request.**

Importance of "pH" as a Major Water Parameter and Its Impact on Growth & Survivals in Vannamei Shrimp Culture

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Introduction:

The maintenance of good water quality is essential for both survival and optimum growth of culture organisms. Poor water chemistry leads to deteriorate water quality, which causes stress to the culture animals. Growth and survival, which together determine the ultimate yield, are influenced by a number of ecological parameters and managerial practices. High stocking density of fish or shrimp in ponds usually exacerbates problems with water quality and sediment deterioration.

Water quality parameters plays an important role in vannamei shrimp culture. The poor water quality is the leading cause of disease, stop feeding, high FCR, retardation of growth, mortality, crop failure &economiclosses. The maintenance of good water quality is essential for both survival and optimum growth of culture organisms.

The following water quality parameters are considered to be the most important in shrimp culture.

• Dissolved oxygen • pH • Ammonia • Temperature • Alkalinity • Hardness • Hydrogen sulfide• Salinity & • Turbidity.

Aquaculture Pond Dynamics

Aquaculture ponds are a living dynamic systems they exhibits continuous and constant fluctuations. The pond undergoes a vast collection of both chemical reactions and physical changes. Changes in the volume of a pond are very important as they affect the concentration of dissolved substances and correspondingly requirements for treatment. Hence, the pond dynamics not only depend on its own characters and conditions but also on the surrounding atmospheric weather conditions.

Aside from temperature and dissolved oxygen, pH is likely the most commonly measured water quality variable in aquaculture. One of the most disconcerting aspects of pH in aquaculture systems is its propensity to change rapidly.

Importance of pH in Aquaculture

The pH is having greater effect to growth and survivals of shrimp as well as shrimp culture pond environment.Carbon dioxide, pH, alkalinity and hardness are interrelated and can have profound effects on pond productivity .The level of stress and shrimp health depend on oxygen availability and the toxicity of ammonia as well as that of certain metals. Carbon dioxide and pH concentrations fluctuate or cycle daily. Alkalinity and hardness are relatively stable but can change over time, usually weeks to months, depending on the pH or mineral content of watershed and bottom soils.

As water pH is one of the most critical chemical parameters for shrimp farming. pH is the measure of hydrogen ion (acidity) concentration. The optimum water pH range in the shrimp pond is 7.5 - 8.5. It is essential to stabilize the pH with in this range. The pH value in the water is normally lowest in the early morning and highest in the afternoon. For the best water quality, the maximum diurnal pH fluctuation should not exceed 0.5. It is important to maintain a stable pH at a safe range because it affects the metabolism and other physiological processes of culture organisms.

All living organisms have optimal ranges of pH where growth is best. Soil and water pH is easily tested and low pH is regulated by the addition of limestone.

Daily Fluctuation in pH of Pond Water

The consumption of carbon dioxide causes pH to naturally fluctuate during the day. It is generally lowest at sunrise (due to accumulation of carbon dioxide during the night) and highest at afternoon when algae consumption of carbon dioxide is at its greatest. Waters of moderate alkalinity are more buffered and the degree of pH fluctuation is lower.

Impact of pH in shrimp Culture Pond

The ideal pH for most aquaculture species is between 7.5 and 8.5. Lower pH values may result in slower growth, poorer survival and greater susceptibility to disease in aquaculture species. Brief daily excursions of pH above 8.5 are common in ponds and apparently do not harm aquaculture species. However, long-term exposure to pH of 9.0 or above will have effects similar to those of suboptimal pH. The acid and death points for most species are pH 4 and pH 10, respectively.

Effect of Sub-optimal pH in Shrimp Health

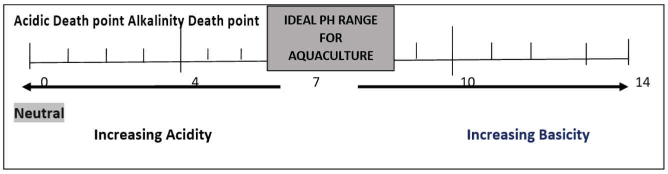
Sub-optimal pH has a number of adverse effects on culture aquatic animals. It can cause stress, increase susceptibility to disease, low production levels and poor growth. Signs of sub-optimal pH include increase mucus on the gill surfaces of fish, damage to the eye lens, abnormal swimming behavior, fin fray, poor phytoplankton and zooplankton growth and can even cause death.

Sub-optimal pH has a number of adverse effects on vannamei shrimps. If pH changes significantly, it can make shrimp shocked, weakened and stop eating. In high or low pH extends for a long time, it will make shrimp grow slowly, stunting growth and susceptible to diseases. It can cause stress, less survivals, low production and leads to poor growth.

Signs of sub-optimal pH include increase mucus on the gill surfaces, black gill disease, damage to the eye lens, abnormal swimming behavior, loose shell, soft shell, irregularity in moult , poor phytoplankton and zooplankton growth . The mortality may occurs for culture shrimps in below pH 4 and above pH 10 range respectively.The low pH levels will cause the shell of shrimp to become soft. This is due to the shell of the shrimp being composed of calcium carbonate which reacts with acid.

High pH may also increase the toxicity of other substances. The toxicity of ammonia is ten times more severe at a pH of 8 than it is at pH 7. It is directly toxic to aquatic life when it appears in alkaline conditions. Low concentrations of ammonia are generally permitted for discharge.

(Ideal pH for most aquaculture species.)



Impact of pH in Aquaculture Pond Environment

The pH of pond water ecosystems can fluctuate considerably within daily and seasonal timeframes. The most of aquatic animals have evolved to tolerate a relatively wide environmental pH range. Animals become stressed or die when exposed to pH extremes or when pH changes rapidly even change occurs within a pH range that is normally tolerated. In addition to the direct effects of pH on aquatic animals, the hydrogen ion concentration affects aqueous equilibrium involving ammonia, hydrogen sulfide, chlorine and dissolved metals. The interactions of pH with these variables are often more important than the direct effects of pH on aquatic animals. Direct "pH toxicity" is relatively rare in aquaculture ponds because farm sites and water supplies are selected to provide a desirable environment for culture, which should include a pH of approximately 6 to 9. However, certain conditions may cause pH to rise or fall outside the tolerable range, killing the animals being cultured.

Treatment for Low pH & High pH

Treatment methods will depend on whether there is a high pH problem or a low pH problem. To treat a pond with low pH, a pond can be limed with agricultural limestone or fertilized to promote plant growth. To decrease a high pH, the pond can be flushed with fresh water, feeding rates can be reduced to decrease nutrient input into the pond, gypsum ($CaSO_4$) can be added to increase the calcium concentration, or alum ($AlSO_4$) can be added in extreme cases.

Treatment the pond bottom soil.

- pH > 6: use 300 - 600 kg of lime/ha
- pH< 5: use 1500 - 2000 kg of lime/ha.

Treatment to Pond water:

Low pH:

- **Below 7.5 pH:** lime or slaked lime 100 - 200 kg/ha.
- **pH in the morning is from 7.5 to 7.8, and the difference in the afternoon exceeds 0.3:**

  200 – 300 kg dolomite lime/Ha in the afternoon continuously in 2-3 days.
- **For pH in the morning is from 7.5 to 7.8, and the differences in the afternoon is 0.5:** If the water color is normal, use $CaCO_3$ clime of 180-300 kg/ha every afternoon until the pH stop fluctuate too much during the day.

High pH: Following management and treatment measures can be undertaken to reduce high pH in pond water.

- If pH > 8.3 in the morning: use sugar with a dose of 10-30 kg/Ha or use appropriate probiotics to stimulate the development of microbial decomposition. These microorganisms decompose organic detritus in the pond. CO_2 will be produced and pH will be reduced.
- pH can be reduced by replacing less water..
- If pH fluctuation is large during the day (> 0.5), hardness (the amount of $CaCO_3$) in ponds is low, algae grows and develop quickly causing algal blooms, organic detritus increases in ponds, use dolomite lime with a dose of 100-200 kg/ha to increase water hardness and buffering agent. Water should also be changed to stabilize the growth of algae.
- Flush the pond , reduce feeding rates to lower nutrient input and plant growth , ponds built in acid sulphate soils should be refilled immediately to prevent drying
- Built no deeper than necessary , grassed on the walls, limed on the walls
- Add gypsum ($CaSO_4$) to increase the calcium concentration, add alum ($AlSO_4$) for immediate reduction of pH to avert imminent shrimp mortality.

Conclusion: High density systems and systems with a high degree of pH variability should be monitored daily and occasionally twice a day. The daily measurement should be made at the time of day when the pH is likely to be most critical. In systems with algae blooms, pH should be measured late in the afternoon to determine the maximum daily pH, and occasionally early in the morning to determine minimum daily pH. Usually the maximum daily pH is the more critical measurement because ammonia toxicity is highest when the pH is at its highest point. Ideally, pH and temperature should be measured whenever total ammonia nitrogen is measured so that the concentration of unionized ammonia can be calculated pH in water quality is of utmost importance in fish and shrimp farming. Regardless of the particular aquaculture system used, maintaining balanced levels of water quality parameters is fundamental for both the health and growth of farmed aquatic species.

INTEGRATED TAXONOMY – New Dimension to Explore the Fish Diversity

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Highlight Points

1. Recent taxonomist for identification of species, use of fish otolith, fish scale, fish bone and molecular methods as one of the taxonomic tool to identify the species.
2. Integrative taxonomy is described as a comprehensive approach to naming a species.
3. The geometric morphometric analysis methods were used to determine if scale morphology can discriminate between genera, species, geographic variants, and fish stocks.
4. The morphometric analysis of fish otolith is difficult because of the concave form of otoliths and overall variability of shape Knowledge of the concepts of morphometric analysis is needed in order to utilize this method.
5. The accuracy of fish scale identification usually exceeds 70 percent and the resolution is high, identifiying upto population level.

Abstract

The population discrimination and species identification are essential in the conservation of biodiversity, natural resources and fisheries management. Traditionally, identification of species has relied on morphological and meristics characteristics, but these methods often encounter problems with reliability as some of the fish species are cryptic. More recently, fish otolith, scale and bone also used by fish taxonomist as one of the taxonomic tools to delineate the species. There are so many biochemical and molecular methods too available for the identification of fish species. This article discusses the merits of employing various taxonomic tools to study the fish taxon, collectively known as "Integrated taxonomy".

Integrated taxonomy

The term "integrative taxonomy" was coined by Dayrat (2005) to describe a comprehensive approach to naming species.DNA sequencing technologies, access to museum collections, information about phylogenetics and phylogeography, advances in evolutionary studies and computer tomography have revolutionized conventional taxonomy in such a way that conventional taxonomy could be supplemented and complemented with information generated from all the above approaches. Species delimitation and a scientific consensus on naming could be achieved now by using a combination of different methods along with traditional taxonomy tools and this is the objective of integrative taxonomy. In other words, it brings together all available knowledge regarding many aspects of a single group of species so as to form a comprehensive picture of the degree and kind of similarities and differences that are to be found within such a group.

INTEGRATED TAXONOMIC TOOLS

Fish scale

The fish scales are used as an identification tool for differentiation among fish species. The geometric morphometric analysis methods were used to determine if scale morphology can discriminate between genera, species, geographic variants, and fish stocks. This method is used because it allows standard multivariate analyses while preserving information about scale shape, which is important in making biological interpretation of results. This method was tested on ctenoid scales from mullets collected from different areas of the Gulf of Mexico and Aegean Sea by Ibanez et al. (2009). This method is non-destructive, quick and less costly than genetic analysis, thus allowing many individuals to be screened. The genus Mugil was even better segregated as *Mugilcephalus*was well separated from other species. *Mugilcurema* more closely resembled to *Chelonlabrosus*and *Liza saliens*. These results agree with genetic studies of the mugilidae that indicate remarkable genetic divergence in *Mugilcephalus*


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and *Mugilcurema* compared with other family (Caldara *et al.*, 1996).

Otolith

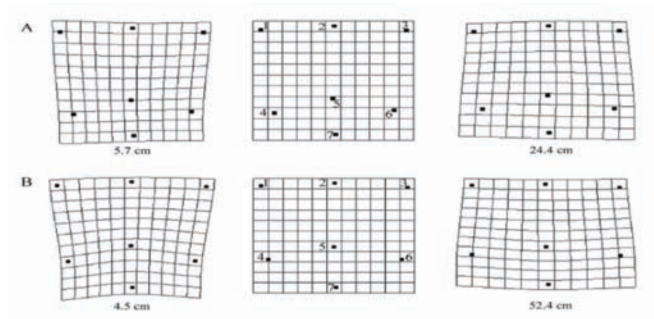
This method is more laborious than the use of fish scales and also requires more knowledge and training, due to its superior accuracy (exceeding 80 percent for congeneric species). The main limitation of this identification tool consists in its destructiveness (the extraction of otoliths kills the fish) and in the fragility of the otoliths, as they easily break during extraction and manipulation. In addition, the morphometric analysis is difficult because of the concave form of otoliths and overall variability of shape Knowledge of the concepts of morphometric analysis is needed in order to utilize this method.

(Adapted from V´ıctor M. Tuset a, *et al.,)*

The development of digital techniques using shape analysis have offered fishery biology new possibilities of research to identify stocks by means of morphometric characters of fish or otoliths (Campana and Casselman, 1993; Bolles and Begg, 2000; Begg*et al*., 2001)Recently, new analysis based on outlines using bending energy, waveletsand curvature scale space analysis were tested on otolith shape identification (Parisi-Baradad*et al*., 2005; Piera*et al*., 2005). With the development of different shape analyses, otolith shape analysis has also been used in the identification of fish species (Lombarte*et al*., 1991; L'Abee-Lund and Jensen, 1993; Tuset*et al*., 2003). Shape descriptors of saccularotoliths (sagittae) obtained by image analysis were investigated for the identification of three species of genus Serranus inhabiting the Canary Islands by (Victor M. Tuset*et al*., 2006). The study of morphological characteristics of fish otoliths has been considered to be important in recent years to identify fishes in palaeoichthyology (Gaemers, 1984; Nolf, 1985, 1995) and trophic ecology (Durr and Gonzalez, 2002; Moreno ´ Lopez *et al*., 2002). Generally, the sagittal otoliths are the most widely used in comparative taxonomy works because of their large size, degree of inter-specific variation and relative ease by which the structures can be accessed (Nolf, 1985)The otolith morphology in Aphanius is known to represent a valuable tool for the taxonomy, and is also indicative for the genetic diversity of a particular population revealed by (Bettina Reichenbacher, 2009).

Fish Scales

Fish scales have been extensively used in fish species identification since the early 1900s. Not only is their count important in key classification; also descriptions of their shape and particular features have been used in keys to recognize families or distinguish between close species. The accuracy of this identification tool usually exceeds 70 percent and the resolution is high, allowing identification at population level. In addition, the method is appealing as scales offer a cheap, rapid and reliable identification of fish using easily extractible body parts (scales) in a non-destructive manner (thus allowing rare and endangered species to be returned to the water). Research and development of the method should be improved as a baseline is needed for many species, including many that are commercially exploited.



(adapted from Ana L. Ibánez*et al.)*,

Molecular methods:

Several molecular genetic methods have been applied to fisheries-related taxonomic problems to identify and distinguish closely related species. Barcoding is defined as the use of a standardized short region of DNA to verify species identity, which typically for fish is the CO1 region of mitochondrial DNA, with the generation of publicly accessible and highly comparable data. All publicly accessible data are available from one website (Barcode of Life Database), and information on specimen vouchers, photographs and other biological information is available from the same site. Currently, the practice relies on high throughput DNA sequencing, which is typically undertaken by commercial sequencing centres. More sophisticated and expensive molecular methods, based on DNA extraction, followed by sequencing or restriction enzyme digestion, are increasingly used for similar identification problems (Bartlett and Davidson 1992), including shark species (Martin, 1993; Heist and Gold, 1998). Unlike other biochemical techniques, such as allozyme and DNA markers, the protein fingerprints revealed by IEF show little intraspecific variation (Lundstrom, 1981). Most individuals from the same species have identical protein fingerprints. When protein fingerprints vary among individuals from the same species, the differences are restricted to the presence or absence of one or a few of the protein bands; the majority of bands are shared among all individuals..

An increasing number of studies and techniques have become available to identify different animal species . Histological analysis of tissues, fatty acids composition, antigen–antibody gel diffusion (Kangethe, Gathuma, & Lindqvist, 1986), SDS-PAGE (Zerifi, Labie, & Bernard, 1991), ELISA-assays (Andrews, Berger, Mageau, Schwab, & Johnston, 1992; Martin, Wardale, Jones, Hernandez, & Patterson, 1991) and Isoelectric focusing (IEF) (King, 1984; Renon, Colombo, Colombo, Biondi, & Malandra, 2001) are only some of the numerous techniques available for the species identification. Recently, molecular methods based on nucleic acids amplification (PCR) have been developed and employed to reach the goal of the species differentiation. Usually PCR is coupled with other techniques able to detect differences in the sequence of the products obtained by PCR amplification. So far restriction fragment length polymorphism (RFLP) (Meyer, Hofelein, Luthy, &Candrian, 1995) and single strand conformation polymorphism (SSCP) (Rehbein, Kress, & Schmidt, 1997) have been the techniques most frequently used for this purpose. Regarding fish-species identification, methods such as IEF (AOAC, 1998), liquid chromatography (Osman, Asoor, & Marsh, 1987), immuno-diffusion (Carrera et al., 1996) and molecular methods (Barlet & Davidson, 1991; Cespedes et al., 1998; Cocolin, D'Agaro, Manzano, Lanari, &Comi, 2000; O'Reilly& Wright, 1995) have been used.

Osteology:

The osteological identification of fish species includes the collection of paired head bones for premaxilla, maxilla, lower Jaw and opercular were taken for identification and the results will show the significant differences among bones of species which were described and compared in both intergeneric and interspecific relationship of species. Morphometric and meristic characteristics which are affected by external ambient; however the osteological traits enhance the other characters, since these features are useful to make identification keys for their distinction (Nasri et al., 2013; Mafakheri et al., 2014). The jaw bones are considered to be important characteristics to separate the groups of symmetric species in teleostean fishes Osteological studies provide additional information for a better understanding of the phylogeny of cyprinid fishes (Alkahem*et al*., 1990). Several studies were focused on fish taxonomy based on fish bones such as Takahashi (1962), which identification species using vertebral column, Qasim (1973) investigated the osteology of *Luciobarbusxanthopterus* and *M. sharpeyi* with special reference to their lateral-line system Nasri*et al*., (2013).

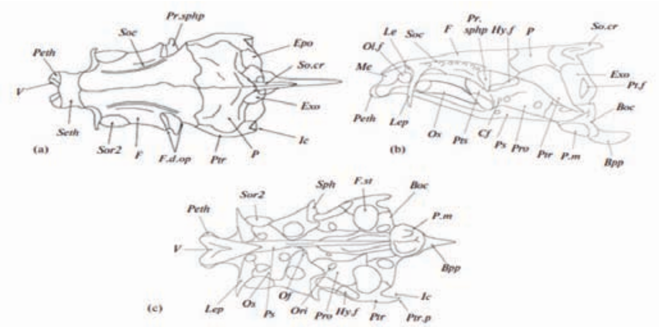


Fig. 1. Neurocranium of *C. macrostomum* (*SL* = 9.2 cm) in dorsal (a), lateral (b) and ventral (c) views (*Bpp*—basioccipital posterior projection; *Boc*—basioccipital; *Cf*—carotid foramen; *Epo*—epiotic; *Exo*—exoccipital; *F*—frontal; *F.D.Op*—dilatators fossa; *F.St*—subtemporal foramen; *Hy.F*—hyomandibular joint face; *Ic*—intercalar; *Le*—lateral ethmoid; *Lep*—lateral ethmoid process; *Me*—mesethmoid; *Of*—optic foramen; *Ol.F*—olfactory foramen; *Ori*—orifices; *Os*—orbitosphenoid; *P*—parietal; *P.m*—masticatory plate of pharyngeal process; *Peth*—preethmoid; *Pr.sphp*—lateral process of sphenotic; *Pro*—prootic; *Ps*—parasphenoid; *Pt. f*—posttemporal fossa; *Ptr*—pterotic; *Ptr.p*—pterotic process; *Pts*—pterosphenoid; *Seth*—supraethmoid; *So.cr*—supraoccipital crest; *Soc*—supraorbital sensory canal; *Sor2*—supraorbital 2; *Sph*—sphenotic; *V*—Vomer). Scale bar 5 mm.

(Adapted from M. Nasri, *et al*.,)

Advantages of employing integrated taxonomic tools:

1. Isoelectric focusing is a relatively quick and cheap identification technique (Lundstrom, 1981) compared with DNA-based extraction methods.
2. Several molecular methods includes DNA barcoding which is useful for identification of different fish species diversity and also identification and confirmation of new species. The application of molecular methods to the identification of the species in this study was found to be useful, fast and reliable.
3. Osteological studies provide additional information for a better understanding of the phylogeny of fishes.
4. Bones morphology is a good tool to determine the variance intergeneric and interspecific to investigate the phylogeny traits among species, genera and families and understanding the range of environmental and genetic influences on modification of bones which helpful the fauna to live in their habitat.
5. Fish-scale shape is especially useful for discrimination among genera, species and also sympatric populations.
6. Fish otolith is more laborious than the use of fish scales and also requires more knowledge and training, due to its superior accuracy.
7. This overall taxonomic tools are very useful in determining all integrated methods together which will give the researcher the overall idea about an individual species. It also act as taxonomy library.

Conclusion:

In recent times, the application of integrated taxonomical methods is one of the main tool for the identification of fish diversity. Traditional methods including morphology and meristics based identification methods is not used alone but the combination of all types of integrated taxonomical tools play a vital role and also it will give the clear cut idea about the individual fish species and it act as a taxonomic library.

References:

Alkahem, H.F., RJ, B. and Ahmad, Z., 1990. Some osteological distinction among four Arabian cyprinid species. Japanese Journal of Ichthyology, 36(4), pp.477-482.

Caldara, F., Bargelloni, L., Ostellari, L., Penzo, E., Colombo, L. and Patarnello, T., 1996. Molecular phylogeny of grey mullets based on mitochondrial DNA sequence analysis: evidence of a differential rate of evolution at the intrafamily level. Molecular Phylogenetics and Evolution, 6(3), pp.416-424.

Comi, G., Iacumin, L., Rantsiou, K., Cantoni, C. and Cocolin, L., 2005. Molecular methods for the differentiation of species used in production of cod-fish can detect commercial frauds. Food Control, 16(1), pp.37-42.

Heist, E.J. and Gold, J.R., 1999. Microsatellite DNA variation in sandbar sharks (Carcharhinusplumbeus) from the Gulf of Mexico and mid-Atlantic Bight. Copeia, pp.182-186.

Ibáñez, A.L. and O'Higgins, P., 2011. Identifying fish scales: the influence of allometry on scale shape and classification. Fisheries Research, 109(1), pp.54-60.

Nasri, M., Keivany, Y. and Dorafshan, S., 2013. Comparative osteology of lotaks, Cyprinion kais and C. macrostomum (Cypriniformes, Cyprinidae), from Godarkhosh River, western Iran. Journal of Ichthyology, 53(6), pp.455-463.

Piñeiro, C., Barros-Velázquez, J., Pérez-Martín, R.I. and Gallardo, J.M., 2000. Specific enzyme detection following isoelectric focusing as a complimentary tool for the differentiation of related Gadoid fish species. Food Chemistry, 70(2), pp.241-245.

***More References can be provided on request.**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