MPEDA

Newsletter

VOL. VIII NO. 13 APRIL 2021

Marine Fish Landings in March

MPEDA Adopts Nirmala Nagar Fishing Hamlet

Highlights of Chairman's Visit to Andhra Pradesh

Aquascaping Ideas for Your Aquarium

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On the Platter

MPEDA Newsletter
VOL. VIII / NO. 13 / APRIL 2021

K. S. Srinivas IAS
Chairman

Dear Friends,

We were privileged when the Hon'ble Union Minister of Commerce & Industry, Shri Piyush Goyal inaugurated the e-Santa portal by MPEDA- NaCSA on 13th April 2021. The portal enables direct selling by registered aqua farmers to seafood exporters providing traceability, eliminating the exploitation by middlemen, and ensures that farmers get a fair price for their crops without any delay through direct benefit transfer to their accounts. The portal has gained nationwide importance as evident from the accolades we receive from stakeholders across the country, which they hail as a land mark one, ensuring the farmer an income proportionate to the efforts chipped in. MPEDA society, NaCSA monitors the sale to assure the farmer his returns in a time bound manner. Soon after the launch, M/s Nekkanti Seafoods, Andhra Pradesh procured over 5 tons of *Vannamei* shrimp from Shri K. R. Murthy Raju, a farmer from Akividu in West Godavari district of Andhra Pradesh. I congratulate both of them for their enterprising step.

During my visit to Andhra Pradesh in March 2021, I went to a small village, Nirmala Nagar in Guntur district, where farmers belonging to Scheduled Tribes are doing aquaculture of Black Tiger shrimp in an extensive mode. The yield per hectare was as low as 100 Kg per year as they were unable to stock more shrimp seeds due to lack of electricity in their farms. Due to low returns from shrimp farming, some of the farmers had returned to seasonal paddy culture in an effort to make both ends meet. MPEDA officers came to know their plight, and understood that by bringing electricity connection to the farming areas in Nirmala Nagar, we would be able to enhance the shrimp production, which would also help the farmers financially.

Banking on the wholehearted support from the District Administration of Guntur, MPEDA has adopted Nirmala Nagar village for aquaculture development as a replicable model to provide common infrastructure facilities through MPEDA scheme for Scheduled Caste and Scheduled Tribes. The Guntur District Administration is also contributing 25% of the project cost. Electric connection will help the farmers to acquire pumps and aerators, and they will be able to stock more seeds, increasing the productivity. MPEDA will guide the farmers of this tribal village the better management practices so as to produce residue free shrimp for export. MPEDA has already started mud crab grow out demonstration programme in the village in November 2020. The crabs reached marketable sizes within 5 months and are being harvested according to the sizes.

MPEDA has been propagating its own certification scheme 'SHAPHARI' as a measure to produce and export residue free shrimp from India. The certification of hatcheries is underway, and 13 hatcheries have been enrolled under the scheme to produce antibiotic residue free shrimp seeds to the farmers. I am glad to announce that M/s SVR Hatcheries, Kakinada has become the first 'SHAPHARI' certified hatchery in the country, as we handed over the certificate of recognition to the management on 27th April 2021. I congratulate M/s SVR Hatcheries, Kakinada for this historical achievement.

All the above steps are aimed to promote export oriented aquaculture from the country ensuring quality and traceability of the product in addition to assuring proper returns to the farmers for the efforts they take in sustaining the sector. MPEDA is hopeful of emulating such measures in other regions also to bring in collective development across the states.

Thank you,

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FAO- Code of Conduct for Responsible Fishing- Part 4

Post -harvest practices and responsible international trade

INTRODUCTION

Fisheries, including aquaculture, provide a vital source of food, employment, recreation, trade and economic well being for people throughout the world, both for present and future generations and should therefore be conducted in a responsible manner. This Code sets out principles and international standards of behaviour for responsible practices with a view to ensuring the effective conservation, management and development of living aquatic resources, with due respect for the ecosystem and biodiversity. The Code recognises the nutritional, economic, social, environmental and cultural importance of fisheries, and the interests of all those concerned with the fishery sector. The Code takes into account the biological characteristics of the resources and their environment and the interests of consumers and other users. States and all those involved in fisheries are encouraged to apply the Code and give effect to it.

POST-HARVEST PRACTICES AND TRADE

Responsible fish utilization

- States should adopt appropriate measures to ensure the right of consumers to safe, wholesome and unadulterated fish and fishery products.

- States should establish and maintain effective national safety and quality assurance systems to protect consumer health and prevent commercial fraud.

- States should set minimum standards for safety and quality assurance and make sure that these standards are effectively applied throughout the industry. They should promote the implementation of quality standards agreed within the context of the FAO/WHO Codex Alimentarius Commission and other relevant organizations or arrangements.

- States should cooperate to achieve harmonization, or mutual recognition, or both, of national sanitary measures and certification programmes as appropriate and explore possibilities for the establishment of mutually recognized control and certification agencies.

- States should give due consideration to the economic and social role of the post-harvest fisheries sector when formulating national policies for the sustainable development and utilization of fishery resources.

- States and relevant organizations should sponsor research in fish technology and quality assurance and support projects to improve post-harvest handling of fish, taking into account the economic, social, environmental and nutritional impact of such projects.

- States, noting the existence of different production methods, should through cooperation and by facilitating the development and transfer of appropriate technologies, ensure that processing, transporting and storage methods are environmentally sound.

- States should encourage those involved in fish processing, distribution and marketing to:

- reduce post-harvest losses and waste;

- improve the use of by-catch to the extent that this is consistent with responsible fisheries management practices; and

- use the resources, especially water and energy, in particular wood, in an environmentally sound manner.

- States should encourage the use of fish for human consumption and promote consumption of fish whenever appropriate.

States should cooperate in order to facilitate the production of value-added products by developing countries.

- States should ensure that international and domestic trade in fish and fishery products accords with sound conservation and management practices through improving the identification of the origin of fish and fishery products traded.

- States should ensure that environmental effects of post- harvest activities are considered in the

development of related laws, regulations and policies without creating any market distortions.

Responsible international trade

- The provisions of this Code should be interpreted and applied in accordance with the principles, rights and obligations established in the World Trade Organization (WTO) Agreement.

- International trade in fish and fishery products should not compromise the sustainable development of fisheries and responsible utilization of living aquatic resources.

- States should ensure that measures affecting international trade in fish and fishery products are transparent, based, when applicable, on scientific evidence, and are in accordance with internationally agreed rules.

- Fish trade measures adopted by States to protect human or animal life or health, the interests of consumers or the environment, should not be discriminatory and should be in accordance with internationally agreed trade rules, in particular the principles, rights and obligations established in the Agreement on the Application of Sanitary and Phytosanitary Measures and the Agreement on Technical Barriers to Trade of the WTO.

- States should further liberalize trade in fish and fishery products and eliminate barriers and distortions to trade such as duties, quotas and non-tariff barriers in accordance with the principles, rights and obligations of the WTO Agreement.

- States should not directly or indirectly create unnecessary or hidden barriers to trade which limit the consumer's freedom of choice of supplier or that restrict market access.

- States should not condition access to markets to access to resources. This principle does not preclude the possibility of fishing agreements between States which include provisions referring to access to resources, trade and access to markets, transfer of technology, scientific research, training and other relevant elements.

- States should not link access to markets to the purchase of specific technology or sale of other products.

- States should cooperate in complying with relevant international agreements regulating trade in endangered species.

- States should develop international agreements for trade in live specimens where there is a risk of environmental damage in importing or exporting States.

- States should cooperate to promote adherence to, and effective implementation of relevant international standards for trade in fish and fishery products and living aquatic resource conservation.

- States should not undermine conservation measures for living aquatic resources in order to gain trade or investment benefits.

- States should cooperate to develop internationally acceptable rules or standards for trade in fish and fishery products in accordance with the principles, rights, and obligations established in the WTO Agreement.

- States should cooperate with each other and actively participate in relevant regional and multilateral fora, such as the WTO, in order to ensure equitable, non-discriminatory trade in fish and fishery products as well as wide adherence to multilaterally agreed fishery conservation measures.

- States, aid agencies, multilateral development banks and other relevant international organizations should ensure that their policies and practices related to the promotion of international fish trade and export production do not result in environmental degradation or adversely impact the nutritional rights and needs of people for whom fish is critical to their health and well being and for whom other comparable sources of food are not readily available or affordable.

Laws and regulations relating to fish trade

Laws, regulations and administrative procedures applicable to international trade in fish and fishery products should be transparent, as simple as possible, comprehensible and, when appropriate, based on scientific evidence.

- States, in accordance with their national laws, should facilitate appropriate consultation with and participation of industry as well as environmental and consumer groups in the development and implementation of laws and regulations related to trade in fish and fishery products.

- States should simplify their laws, regulations and

administrative procedures applicable to trade in fish and fishery products without jeopardizing their effectiveness.

- When a State introduces changes to its legal requirements affecting trade in fish and fishery products with other States, sufficient information and time should be given to allow the States and producers affected to introduce, as appropriate, the changes needed in their processes and procedures. In this connection, consultation with affected States on the time frame for implementation of the changes would be desirable. Due consideration should be given to requests from developing countries for temporary derogations from obligations.

- States should periodically review laws and regulations applicable to international trade in fish and fishery products in order to determine whether the conditions which gave rise to their introduction continue to exist.

- States should harmonize as far as possible the standards applicable to international trade in fish and fishery products in accordance with relevant internationally recognized provisions.

- States should collect, disseminate and exchange timely, accurate and pertinent statistical information on international trade in fish and fishery products through relevant national institutions and international organizations.

- States should promptly notify interested States, WTO and other appropriate international organizations on the development of and changes to laws, regulations and administrative procedures applicable to international trade in fish and fishery products.

FISHERIES RESEARCH

- States should recognize that responsible fisheries requires the availability of a sound scientific basis to assist fisheries managers and other interested parties in making decisions.

Therefore, States should ensure that appropriate research is conducted into all aspects of fisheries including biology, ecology, technology, environmental science, economics, social science, aquaculture and nutritional science. States should ensure the availability of research facilities and provide appropriate training, staffing and institution building to conduct the research, taking into account the special needs of developing countries.

- States should establish an appropriate institutional framework to determine the applied research which is required and its proper use.

- States should ensure that data generated by research are analyzed, that the results of such analyses are published, respecting confidentiality where appropriate, and distributed in a timely and readily understood fashion, in order that the best scientific evidence is made available as a contribution to fisheries conservation, management and development. In the absence of adequate scientific information, appropriate research should be initiated as soon as possible.

- States should collect reliable and accurate data which are required to assess the status of fisheries and ecosystems, including data on bycatch, discards and waste. Where appropriate, this data should be provided, at an appropriate time and level of aggregation, to relevant States and subregional, regional and global fisheries organizations.

- States should be able to monitor and assess the state of the stocks under their jurisdiction, including the impacts of ecosystem changes resulting from fishing pressure, pollution or habitat alteration. They should also establish the research capacity necessary to assess the effects of climate or environment change on fish stocks and aquatic ecosystems.

- States should support and strengthen national research capabilities to meet acknowledged scientific standards.

- States, as appropriate in cooperation with relevant international organizations, should encourage research to ensure optimum utilization of fishery resources and stimulate the research required to support national policies related to fish as food.

- States should conduct research into, and monitor, human food supplies from aquatic sources and the environment from which they are taken and ensure that there is no adverse health impact on consumers. The results of such research should be made publicly available.

- States should ensure that the economic, social, marketing and institutional aspects of fisheries are adequately researched and that comparable data are generated for ongoing monitoring, analysis and policy formulation.

- States should carry out studies on the selectivity of fishing gear, the environmental impact of fishing gear on target species and on the behaviour of target and

non-target species in relation to such fishing gear as an aid for management decisions and with a view to minimizing non-utilized catches as well as safeguarding the biodiversity of ecosystems and the aquatic habitat.

- States should ensure that before the commercial introduction of new types of gear, a scientific evaluation of their impact on the fisheries and ecosystems where they will be used should be undertaken. The effects of such gear introductions should be monitored.

- States should investigate and document traditional fisheries knowledge and technologies, in particular those applied to small-scale fisheries, in order to assess their application to sustainable fisheries conservation, management and development.

- States should promote the use of research results as a basis for the setting of management objectives, reference points and performance criteria, as well as for ensuring adequate linkages between applied research and fisheries management.

- States conducting scientific research activities in waters under the jurisdiction of another State should ensure that their vessels comply with the laws and regulations of that State and international law.

- States should promote the adoption of uniform guidelines governing fisheries research conducted on the high seas.

- States should, where appropriate, support the establishment of mechanisms, including, inter alia, the adoption of uniform guidelines, to facilitate research at the subregional or regional level and should encourage the sharing of the results of such research with other regions.

- States, either directly or with the support of relevant international organizations, should develop collaborative technical and research programmes to improve understanding of the biology, environment and status of transboundary aquatic stocks.

- States and relevant international organizations should promote and enhance the research capacities of developing countries, inter alia, in the areas of data collection and analysis, information, science and technology, human resource development and provision of research facilities, in order for them to participate effectively in the conservation, management and sustainable use of living aquatic resources.

The Series on FAO : Code of Conduct for Responsible Fisheries concluded.

Role of trade-oriented research in export of seafood

Dr. Shine Kumar C.S, Deputy Director MPEDA (Marketing)

The policies and actions taken by the Government and stakeholders have made India the 4th largest exporter and producer of shrimp in the world. This indicates the tremendous growth achieved by the nation in the last decade. In order to continue the growth in exports and production in the seafood sector, the issues affecting the seafood sector need to be addressed strategically with adequate scientific backing.

Antibiotic & Biosecurity issues (A&B issues) in aquaculture and sustainability issues in capture fisheries are severely affecting the market access of Indian seafood in the International market. Concrete studies and policy recommendations are required to address these issues in the international scenario to enhance and maintain market access of Indian seafood. Research and recommendations are required in these areas in aquaculture and capture fisheries to develop suitable models. Such trade or farm-oriented research will bring in ideas and concepts to formulate policies which are helpful to defend India's position in the international market in terms of issues related to sustainability, contamination due to residues and biosecurity.

Trade or business-oriented research is the need of the hour to protect the interest of the farmer and seafood trade. Therefore, the allocation of funds and identification of projects need to be based on the core issues of the seafood sector. This article illustrates the requirement of research in relevant sectors of aquaculture and capture fisheries which is hampering India's status in international trade.

Research in Aquaculture

Issues related to antibiotic residue and biosecurity (A&B issues) are affecting the aquaculture sector, which ultimately leads to reduced export of frozen shrimps from the country. Biosecurity issues like WSSV (White Spot Syndrome Virus) and IHHNV (Infectious Hypodermal and Hematopoietic necrosis) etc are causing considerable economic losses to the shrimp farmers.

Currently India is facing market access issues related to banned antibiotic residue in Japan (100% inspection for Indian farmed shrimp) & EU (50% sampling of aquaculture products from India). Due to this, the EU is delisting Indian processors, which means they cannot export to the EU. In addition to this, the EU is not approving new processors who are exporting aquaculture products.

During 2019, Europe has imported 5,80,570 MT shrimp with a value of USD 4.6 billion under HS 030617. India's contribution in this is 13.2% (USD 0.6 billion). The total seafood import (under chapter 030617) of Japan during 2019 is 1,43,913 MT with a value of USD 1.4 billion. India's share is 22.38% (USD 0.32 billion). If we are able to address the antibiotic residue issues, we can increase the market share to the EU and Japan by about 50% (USD 3 billion).

Due to biosecurity issues, our shrimp exports are suspended or restricted in major markets like Australia, Saudi Arabia, Kuwait, China, Thailand and Canada. These countries have imported 7,23,730 MT worth USD 4.65 billion frozen shrimp (under HS 030617), of which India's share is 22.3% (USD 1.03 billion). Once we address the biosecurity issues, we can increase the market share in these countries by 50% (USD 2.3 billion).

To address these issues, research is required in aquaculture for developing suitable models in the following areas:-

1.Bring a status paper on antibiotic residue and biosecurity issues in shrimp production and export in the country with concrete recommendations in compliance with OIE, Codex, or importing countries requirements in these areas.

2. As shrimp is a major item for commercial aquaculture and export (more than 70% of export value), research needs to be concentrated on production and processing of shrimp to address the A&B issues.

3. Models for disease-free area/zone/region for shrimp production also need to be demonstrated by the scientific community to reduce crop loss for farmers in compliance with OIE guidelines.

Research in Capture Fisheries

Major importing countries like the US and EU are formulating regulations on sustainability & conservation of marine mammals and turtles. Non compliance with these regulations will affect the market access of our major marine resources and negatively impact the conservation of marine mammal and turtle resources.

According to the US, trawl fishing without Turtle Excluder Devices (TED) is adversely affecting the sea turtles. The US has also stressed that the TED designed in India have a conflicting effect on the Turtle resource. Due to this, the US banned import of wild caught shrimp from India in May 2018. The US also pointed out that the fishing practices followed in India were non-compliant with the US regulations to protect sea turtles. By addressing the issues related to this, India can possibly increase exports to the USA by USD 0.3 billion.

In brief, according to the US Govt. and other agencies, trawl fishing and gill net fishing in India is deteriorating the turtle and marine mammal resources. The US Marine Mammal Protection Act (MMPA) also demands comparability finding, which is equivalent to US standards.

The EU Regulation to prevent, deter and eliminate Illegal, Unreported and Unregulated (IUU) fishing entered into force on 1st January 2010. Only marine fisheries products validated as legal by the competent flag state or exporting state can be imported to or exported from the EU.

An IUU vessel list is issued regularly, based on IUU vessels identified by Regional Fisheries Management Organizations. Field level enforcement of IUU regulation is very much required.

Sustainable Certification of fishery and fish products are also a requirement of the trade for meeting the buyer's need. It is appropriate that a national authority needs to be recognized for sustainability certification of fishery and its products.

Research and recommendations are required in this direction for certification of major fisheries in India in compliance with international guidelines.

To address the issues in capture fisheries, research is required in the following areas for development of suitable models:-

1. Bring a status paper on trawl, gill net fishery and other fishing practices of India and impact of these fishing methods on the marine mammal and turtle population in Indian EEZ with a recommendation to state fisheries departments and the Government of India.

2. A status paper on sustainable certification of major fishery and development of national certification programme in Indian context.

3. A model certification programme on sustainable certification of Indian seafood may be developed and demonstrated in Indian scenario.

4. To improve prevention of IUU fishing, a model or action plan may be developed for implementing IUU regulation in Indian scenario.

Research updation and development of suitable models in aquaculture and capture fisheries in above mentioned areas are very much required to protect the interest of Indian farmers, fishers and trade.

The views, findings, models and recommendations from the fisheries research will be helpful to comply with the requirements of importing countries. Detailed research studies in these areas will defend India's position in international trade scenario and at organizations like WTO, FAO, Codex, OIE, IOTC etc as well as improve the ease of doing business.

Once the bottlenecks are resolved, Indian seafood industry can increase seafood exports by another USD 5.6 billion in the coming years with the existing production technology. This will make India the 2nd largest exporter in the world next to China.

MPEDA adopts Nirmala Nagar fishing hamlet

Nirmala Nagar, a hamlet in Guntur district, Andhra Pradesh, is home to 110 Scheduled Tribe aquaculture farmers

The Marine Products Export Development Authority (MPEDA) has adopted Nirmala Nagar, a hamlet at Pothumeraka Village, Repalle Mandal in Guntur District of Andhra Pradesh.

The hamlet is home to 110 Scheduled Tribe aquaculture farmers with 300 acres of brackish water aquaculture area. The adoption of the hamlet followed discussions between the Chairman of MPEDA and the State Administration.

MPEDA is well recognized not only for developmental and aquaculture farm promotional and export promotional activities but also for its commitment towards Scheduled Castes and Scheduled Tribe communities, Other Backward Class communities and groups which are suffering under extreme social and financial backwardness. MPEDA's various social and farm promotional activities, and extension programmes among the under privileged classes are the best examples of the Organization's commitment towards such societies. In accordance with the decisions taken by the Government of India from, time to time, more and more programmes are organized every year in the farming sector of such backward classes. MPEDA also focuses on key result areas for enhancement of quality, production, exports and technical know-how and making all-time efforts to achieve its goals.

About Nirmala Nagar

Nirmala Nagar is located in Tummala Panchayath, Pothumeraka Revenue Village, Repalle Mandal, Guntur district. There are 250 Scheduled Tribe families of around 1000 members in Nirmala Nagar, of which 470 are above 18 years old. There are around 15 government employees from this area from the Scheduled Tribe. Total 110 farmers are engaged in shrimp culture of Black tiger shrimp (*Penaeus monodon*). More than 300 acre of farming areas is available for aquaculture, of which 200 acre is exclusively used for aquaculture. Around 100 acres of land, which were earlier used for aquaculture have now turned into paddy farms, as a result of losses incurred in aquaculture due to lack of electricity supply.

There are 110 farmers with a total 200 acres who are regularly engaged in aquaculture of shrimp (*P. monodon*). Farmers generally do three crops a year by stocking 15,000 to 20,000 tiger shrimp seeds per acre, and are fed local feed. Each crop lasts for 3 months and they get a production in the range of 30-40 kg per acre.

Out of more than 300 acres of area, 100 acres of area is now used for paddy farming during August-December period and in the remaining period, the area is left idle. Here, the farmers get around 1500-1800 kg paddy per acre per year and it is sold at around Rs.16 -17 per kg. Since it is a brackish water area, the yield is less than that grown in the freshwater area. According to farmers, they get a net profit of around Rs.10,000/- per year from paddy crop.

MPEDA, Regional Division, Vijayawada has enrolled majority of the farms in Nirmala Nagar and Pothumeraka /Tummala Village. There are two Scheduled Tribe Societies formed and registered with NaCSA. However they are unable to deposit 25% money in the bank for availing 75% subsidy assistance of NaCSA for pump, electricity connection or bio security etc.

MPEDA Regional Division, Vijayawada has selected a farmer in Nirmala Nagar for demonstration of "Scientific Mud Crab farming" under MPEDA scheme, which is underway successfully since November 2020. The stocked crablets grew to marketable sizes between 500-1000gm within 5 months.

MPEDA has already conducted training / awareness programes among these farmers.A training programme for 15 selected active farmers from the Scheduled Tribe community was organized from 3rd to 7th November 2020 on "Better Management Practices and Diversification in Aquaculture."

A Farmers' Meet on "Antibiotic Issues, Better Management Practices and Diversification in Aquaculture" was organized in Nirmala Nagar on 6th November 2020 that benefited 94 participants. A group discussion held during the meet had echoed the need for electric power in the farming village for enhanced production and export and to improve the condition of farmers.

Considering the situation of the farmers and the bright farming prospects of the area, MPEDA has decided to help in bringing electric power there, which will enhance shrimp production for exports, increase area under farming and unit area productivity, besides improving income and standard of living, and create more job opportunities for the villagers. The development is expected to have ripple effect on neighbouring villages too.

The proposed plan of providing electric connection in Nirmala Nagar

Considering the situation, MPEDA has embarked on a mission to bring in a change in the village. Based on the proposal from MPEDA Regional Division, Vijayawada, MPEDA and the District Collector, Guntur District has to adopt the Village of Nirmala Nagar, and provide electric connection, Water testing devices and biosecurity measures such as crab fencing and bird scare netting. In addition, MPEDA will extend continuous technical support to the farmers and conduct extension programmes, and arrange bank loan to the farmers who are in need or credit to farmers by MPEDA -NaCSA on a buy back system.The total estimated cost of the project is Rs. 100 lakh, of which 75% will be borne by MPEDA and the remaining 25% by the district administration.

Visit of Mr. K. S. Srinivas IAS, Chairman, MPEDA to Guntur district and the discussions ensued with Mr. Vivek Yadav IAS, District Collector on the proposal for Nirmala Nagar adoption by MPEDA brought out this significant development in a short span of time. MPEDA and the District Collector have sanctioned their respective contributions of the estimated cost and the District Collector has already assigned the works of detailed estimation and execution with executing officers under the district administration.

A detailed map has been drawn using GIS tools. For cabling and laying of electric poles along an estimated 5.2 km, as many as 100 poles (erected at every 50 meters) will be needed.

Around 50 transformers of 25 KV each will be required for the purpose. This will enable the farmers to use aerators and motors. Once the village is adopted and provided with the basic requirements for aquaculture, production and export of shrimp can substantially be

Mr. K.S. Srinivas IAS, Chairman, MPEDA meets Mr. Vivek Yadav IAS, District Collector, Guntur district on adoption of Nirmala Nagar

increased, which in turn will improve the livelihood of the Scheduled Tribe farmers.

Chairman's visit to Nirmala Nagar

Chairman, MPEDA visited Nirmala Nagar in Pothumeraka village on 5th march 2021 and discussed with farmers the culture practices of the village. Chairman has also visited the MPEDA Crab Demonstration Project pond of Mr. P. Rajasekhar there. He was accompanied by Dr. S. Kandan, Project Director, RGCA and Mr. K. Sivarajan, Deputy Director, MPEDA Regional Division, Vijayawada. Dr. Kandan inspected the crabs, found that they are showing good growth rate and are healthy.

Visit of the Chairman MPEDA, to the MPEDA crab demonstration project pond

Chairman, MPEDA visits Nirmala Nagar farming area

Farmer showing the crab caught from MPEDA crab demonstration project pond to the Chairman, MPEDA.

Later, the Chairman addressed a small gathering of aqua farmers, during which he has briefed them the proposal drawn for the village.

Mr. K. S. Srinivas IAS, Chairman, MPEDA addresses the farmers

Chairman, MPEDA participates in a series of programmes in Andhra Pradesh

Chairman visits MPEDA ELISA Lab at Ongole in Prakasam district, Andhra Pradesh

Mr. K. S. Srinivas IAS, Chairman, MPEDA met Mr. Pola Bhaskara Rao IAS, District Collector, Prakasam District on 5th March 2021 at Ongole and held discussions on development and diversification of aquaculture in freshwater and brackish water areas of Prakasam district, and to formulate suitable projects to utilize SC/ST funds more effectively to the benefit of aquaculture development .

The District Collector directed the Joint Director of Fisheries, Prakasam District to identify farming villages/areas & beneficiaries in inland and coastal aquaculture for implementing new project proposals in tune with the MPEDA's proposal in Guntur district or similar proposals suiting to Prakasam district. The District Collector assured all support for aquaculture development in the district and sought MPEDA's help along with that of the District Fisheries Department for further growth of the sector.

Visit to the first NABL-accredited ELISA Lab of MPEDA at Ongole

Chairman, MPEDA visited the first NABL Accredited ELISA Lab of MPEDA at Ongole, Prakasam district.

Meeting of Chairman, MPEDA with the District Collector,Prakasam District.

Chairman congratulated the entire team of ELISA Lab on getting NABL accreditation. The sample receiving room, extraction room, machine room and analysis room were inspected by the Chairman, and had discussions on protocols and other operational aspects.

Visit to ELISA Lab, Bapatla

Chairman has also visited ELISA Lab, Bapatla in Guntur district. The status of work has been discussed with the staff members.

Chairman, MPEDA at Elisa Lab, Bapatla, Guntur District

Meeting of The Chairman, MPEDA with the District Collector Guntur and his Officials

Chairman, MPEDA met Guntur District Administration

Chairman, MPEDA was warmly welcomed by Mr. Vivek Yadav IAS, District Collector, Guntur and his Officials at the Collectorate Office. The Chairman discussed with District Collector, Guntur and his team about aquaculture activities in the district of Guntur.

Mr. Dineshkumar IAS, Sub Collector, Mr. Raghuram Reddy, Joint Director of Fisheries, Dr. S. Kandan, Project Director, RGCA and Mr. K. Sivarajan, Deputy Director, MPEDA, Vijayawada also took part in the discussion.

Chairman, MPEDA put forward the proposal to adopt Nirmala Nagar village, an exclusive hamlet of Scheduled Tribe community in Pothumeraka Village, Repalle Mandal, Guntur district by providing electric power connection in the farming village & farms, bio security measures like crab fencing and bird scare netting, water testing devices etc. to the ST farmers.

He told that MPEDA will contribute 75% of the cost and sought the remaining 25% from the district administration, which was readily accepted by the District Collector.

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India's marine fish landings increase in March

Dr. Joice V. Thomas & Dr. Afsal V.V. MPEDA-NETFISH

NETFISH collects the details of boat arrivals and marine fish landings occurring at selected major harbour/landing centres in the 9 coastal states of India to facilitate the Catch certification scheme of MPEDA. The number of boat arrivals and the quantity of various fishery items landed at these harbours are collected on a daily basis. Based on the data obtained from 95 harbours, the species-wise, harbour-wise and state-wise trend of marine landings during March 2021 were analyzed and the results are presented in this report.

I. ESTIMATION OF FISH LANDINGS

A total quantity of 60824.89 tons of marine catch landings was reported from the 95 selected harbours in March 2021. The Pelagic finfish resources contributed the highest share of 45% (27316.04 tons) to the total catch and it was followed by the Demersal finfishes with 30% share (18437.59 tons), Crustaceans with 14% share (8527.70 tons) and Molluscs with 11% share (6543.57 tons) (Fig.1).

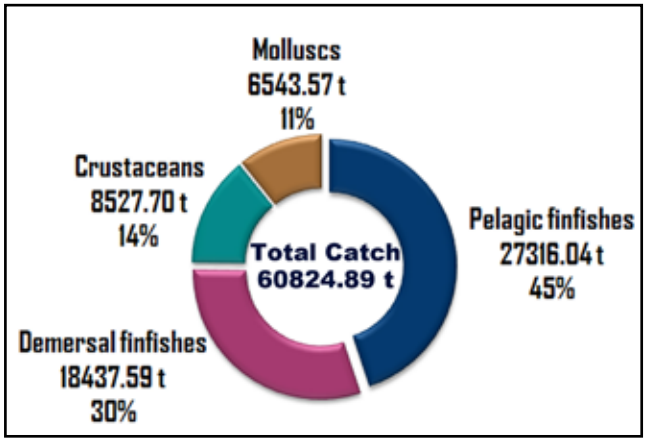


Fig.1. Catch composition of marine landings recorded in March 2021

The total catch comprised of about 263 species of marine fishery items, of which the highest five contributors were *Rastrelliger kanagurta* (Indian mackerel), *Lepturacanthus savala* (Ribbon fish), *Nemipterus japonicus* (Japanese threadfin bream), *Katsuwonus pelamis* (Skipjack tuna) and *Loligo duvauceli* (Squid)(Table 1).

Table. 1 Major fish species landed during February 2021

Sl. No:	Common name	Scientific name	Qty. in tons
1	Indian mackerel	*Rastrelliger kanagurta*	4192.23
2	Ribbon Fish	*Lepturacanthus savala*	3771.26
3	Japanese threadfin bream	*Nemipterus japonicus*	3059.66
4	Skipjack tuna	*Katsuwonus pelamis*	2957.24
5	Squid	*Loligo duvauceli*	2464.07

Considering various groups of fishery items landed, the top five contributors were Tunas, Coastal shrimps, Croakers, Ribbon fishes and Indian Mackerel, which together constituted 39 % of the total catch (Fig 2).

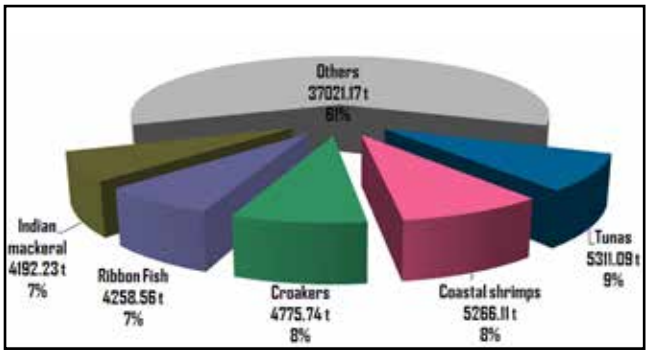


Fig. 2 Major fishery items landed during March 2021

Table 2 presents the total catch quantity of various categories of fishery items recorded during March 2021. Among the pelagic finfish resources, Tunas, Ribbon fishes & Indian mackerel were the major contributors whereas among demersal finfishes, the major contributors were Croakers & Japanese Threadfin bream. About 62% of the Crustacean catch consisted of different species of coastal shrimps, among which the highest landed species were *Parapenaeopsis*

stylifera (*Karikkadi* shrimp) and *Metapenaeus dobsoni* (*Poovalan* shrimp). Squids and Cuttlefish were the major Molluscan varieties landed during the period.

Table 2. Category-wise landing of various fishery items during March 2021

FISHERY ITEM	QTY. IN TONS	% OF TOTAL CATCH
Pelagic Finfishes		
Tunas	5311.09	8.73
Ribbon fish	4258.56	7.00
Indian mackerel	4192.23	6.89
Anchovies	3044.73	5.01
Scads	2504.15	4.12
Bombay duck	1387.13	2.28
Lesser sardines	1152.38	1.89
Indian oil sardine	1103.04	1.81
Shads	1055.58	1.74
Seer fish	517.96	0.85
Sailfish	417.70	0.69
Barracudas	326.88	0.54
Swordfish	292.79	0.48
Seerfish	282.54	0.46
Mahi mahi	229.61	0.38
Trevallies	208.41	0.34
Marlins	150.99	0.25
Needlefish	141.94	0.23
Mackerels	135.56	0.22
Herring	133.23	0.22
Indian salmon	101.98	0.17
Flying fish	83.02	0.14
Queenfish	81.07	0.13
Cobia	67.48	0.11
Mullet	65.74	0.11
Mullets	29.68	0.05
Milk fish	18.72	0.03
Barramundi	11.62	0.02
Halfbeaks	8.04	0.01
Pompano	2.06	0.00
Wahoo	0.15	0.00
Total Pelagic	27316.04	44.91
Demersal Finfishes		
Croakers	4775.74	7.85
Japanese threadfin bream	3059.66	5.03
Lizard fish	1751.61	2.88

Catfishes	1695.36	2.79
Reef cods	1143.68	1.88
Pomfrets	963.34	1.58
Sole fishes	813.44	1.34
Bullseyes	670.79	1.10
Sea breams	637.93	1.05
Moon fish	414.17	0.68
Sharks	382.60	0.63
Goatfish	327.87	0.54
Leatherjacket	321.58	0.53
Ponyfishes	277.72	0.46
Flat heads	233.98	0.38
Rays	230.19	0.38
Snappers	202.40	0.33
Eels	182.02	0.30
White Fish	102.05	0.17
Rabbit fish	83.54	0.14
Jobfish	30.02	0.05
Silver biddies	24.45	0.04
Perches	24.35	0.04
Indian threadfin	21.61	0.04
Halibut	21.43	0.04
Sweet Lip	9.31	0.02
Whiting	8.09	0.01
Sickle fish	7.48	0.01
Surgeonfish	5.21	0.01
Grouper	4.45	0.01
Spade fish	3.20	0.01
Parrot fish	2.83	0.00
Indian threadfish	2.83	0.00
Triggerfish	1.49	0.00
Grunt	0.61	0.00
Drift fish	0.55	0.00
Total Demersal	18437.59	30.31
Crustaceans		
Coastal shrimps	5266.11	8.66
Deep sea shrimps	2016.81	3.32
Crabs	1207.70	1.99
Lobsters	37.08	0.06
Total Crustaceans	8527.70	14.02

Molluscs		
Squid	4100.65	6.74
Cuttlefish	2142.29	3.52
Octopus	297.90	0.49
Baigai	2.73	0.00
Total Molluscs	6543.57	10.76
TOTAL CATCH	60824.89	100.00

State-wise landings: Among the 9 coastal states, the highest marine catch landings was reported in Gujarat with a share of 16206.38 tons (27%) (Fig.3). Maharashtra, in the second position, contributed 10712.39 tons (18%) to the total catch. Tamil Nadu & Pondicherry together held the third position with a total landing of 8185.93 tons (13%). The least marine landing during March 2021 was reported in Goa, with 1787.14 tons (3 %).

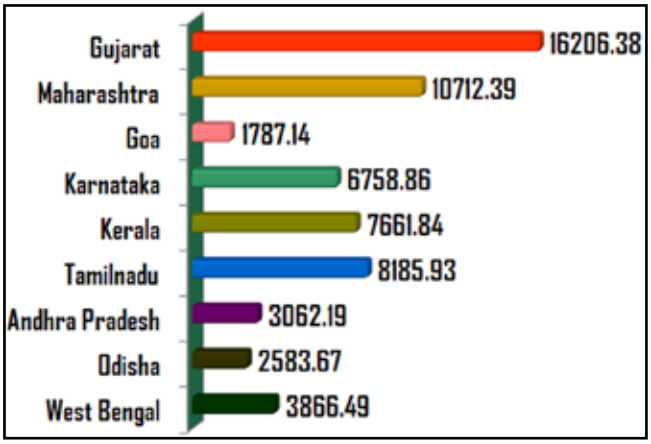


Fig.3 State- wise (in tons) during March 2021

Harbour-wise landings: The total landing reported from each harbour is given in Table 3. Of the 95 harbours, the New Ferry Wharf harbour in Maharashtra recorded the maximum fish landing, which was to the tune of 5046.62 tons (8%) and it was followed by the Porbandar and Okha harbours in Gujarat with 3952.24 tons (6.5%) and 3691.45 tons (6%) respectively. The least landing was reported from Jagathapatinam harbour in Tamil Nadu (0.56 tons).

Table 3. Harbour-wise catch quantity & boat arrivals during March 2021

State	Harbour	Catch Quantity (tons)	Boat arrivals (nos.)
West Bengal	Namkhana	1344.47	365
	Raidighi	847.66	294
	Deshapran	522.24	183
	Sankarpur	450.95	173
	Fraser Ganj	358.19	267
	Kakdwip	257.76	181
	Soula	85.21	59
Odisha	Paradeep	1438.44	307
	Bahabalpur	389.07	173
	Balramgadi	386.30	184
	Dhamara	234.32	90
	Balugaon	135.55	497
Andhra Pradesh	Visakhapatnam	1365.98	396
	Nizampatnam	527.45	156
	Kakinada	350.01	185
	Vodarevu	283.39	415
	Yanam	268.78	175
	Machilipatnam	206.96	147
	Pudimadaka	59.62	216

Tamil Nadu & Pondicherry	Chennai	1857.69	410
	Nagapattinam	1241.18	499
	Karaikal	1185.93	344
	Tharuvaikulam	1106.79	276
	Thengaipattinam	1061.28	625
	Colachel	600.17	246
	Pazhayar	303.99	582
	Poompuhar	173.12	490
	Pondicherry	147.54	106
	Kodiyakarai	89.55	490
	Tuticorin	81.62	246
	Rameswaram	68.87	177
	Mudasalodi	66.24	275
	Mandapam	47.45	266
	Pulicat	45.71	662
	Cuddalore	35.79	402
	Mallipatnam	35.29	214
	Chinnamuttom	26.38	483

Kerala	Kottaipatnam	10.81	86
	Jagathapatinam	0.56	7
	Thoppumpady	2407.78	385
	Sakthikulangara	1916.44	1298
	Munambam	1029.49	663
	Neendakara	820.78	811
	Beypore	327.42	321
	Vypin	223.73	152
	Kayamkulam	175.04	191
	Chellanam	140.33	357
	Azheekkal	101.66	304
	Puthiyappa	92.22	89
	Cheruvathur	70.10	183
	Thangassery	68.08	248
	Munakkadavu	52.52	263
	Ponnani	50.89	196
	Koyilandi	50.86	188
	Mopla Bay	44.25	333
	Thottappally	39.67	198
	Vaadi	27.88	285
	Chettuva	13.23	99
	Vizhinjam	9.50	284

Karnataka	Malpe	2457.94	1072
	Mangalore	1960.35	830
	Honnavar	1043.18	396
	Bhatkal	395.35	683
	Amdalli	301.37	199
	Gangolli	201.43	438
	Karwar	174.62	178
	Belekeri	121.29	95
	Tadri	103.35	187
Goa	Malim	1005.64	475
	Cutbona	465.53	216
	Vasco	272.54	208
	Chapora	43.43	309
Maharashtra	New Ferry Wharf	5046.62	942
	Sasoon Dock	1752.50	555
	Ratnagiri	1143.10	310
	Arnala	1132.74	468
	Harne	296.56	556
	Satpati	282.24	188
	Uttan	215.70	148
	Alibagh Koliwada	199.02	420
Gujarat	Sakharinate	196.92	188
	Versova	116.59	111
	Malvan	111.11	409
	Devgad	64.20	412
	Dabhol	57.49	264
	Vasai	52.11	60
	Dahanu	45.51	211
	Porbandar	3952.24	1441
	Okha	3691.45	1073
	Veraval	3458.50	2092
	Mangrol	2208.89	1779
	Vanakbara	1689.10	949
	Jaffrabad	757.55	320
	Chorwad	244.72	775
	Kotada	203.93	87

II. ESTIMATION OF BOAT ARRIVALS

A total of 37241 boat arrivals were recorded from the 95 harbours during the month. State-wise figures (fig. 4) show that the highest number of boat arrivals had occurred in Gujarat (23 %) followed by Tamil Nadu & Pondicherry (18 %) and Kerala (18 %). Harbour-wise details of boat arrivals are given in Table 3. The highest recording was from Veraval (2092 nos.), Mangrol (1779 nos.) and Porbandar (1441 nos.) harbours in Gujarat.

The Jagathapatinam harbour in Maharashtra had the least number of boat arrivals.

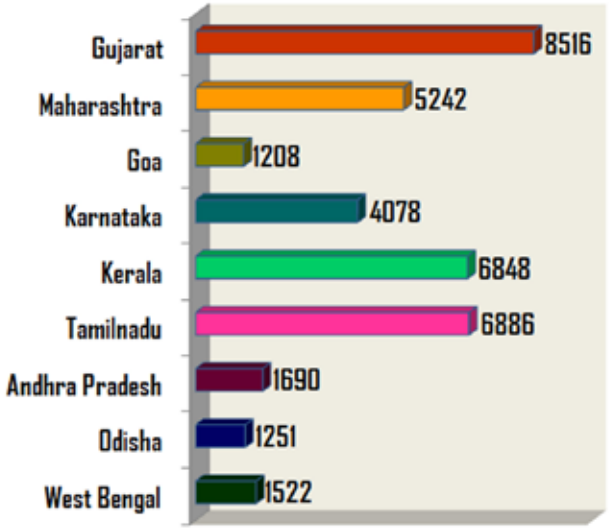


Fig.4 State-wise boat arrivals during March 2021

Summary: In March 2021, a total of 60824.89 tons of marine catch landings and 34189 nos. of boat arrivals were reported from 95 major fish landing sites of India. The total catch has shown an increase by around 1145 tons, compared to that of February 2021, the number of boat arrivals has also increased by around 3052 numbers. Pelagic finfish continued to be the major contributor to the total landings and the Indian mackerel has maintained its 1st position among the most landed fish species for the month.

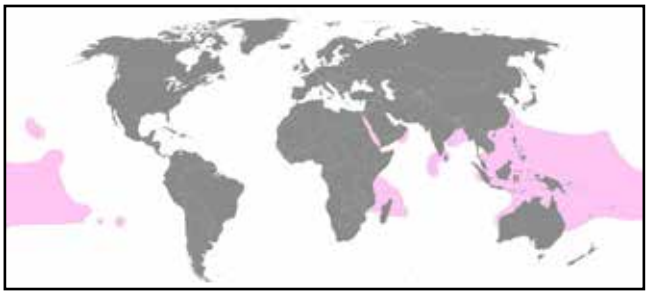
However, Tuna was the fishery item which recorded the highest total landings during the month. As in previous months, the state of Gujarat and the New Ferry Wharf harbour in Maharashtra continued in the first position in terms of total catch landed whereas, in the case of number of boat arrivals, the Gujarat state and the Veraval harbour in the state maintained its top position.

Sea Cucumbers - Significance & issues in conservation

Dr. T R Gibinkumar, Deputy Director MPEDA
(Market Promotion & Statistics)

Sea cucumbers are echinoderms belonging to the class Holothuroidea and so are also referred to as holothurians. They are marine organisms with a leathery skin and an elongated body containing a single, branched gonad. They are also called "Teatfish" in the US and some other parts of the world.

Sea cucumbers live chiefly among corals but are also found among rocks and in muddy and sandy flats. They are distributed from the shore to the greatest depths. Their lengths range from a few millimeters to more than 2m and they occur in all colour combinations. Some of them are really very beautiful while alive and are kept in marine ornamental aquariums. The Chinese, Japanese and Koreans consider them as a delicacy. The toxins of sea cucumbers are considered to have antiviral, antitumoral, anti cancerous, antifertility properties and find use in the pharmaceutical industry.



Distribution Map © Wikipedia

Holothurians have been harvested commercially for at least a thousand years, occasionally for the raw body wall or viscera, but mostly in order to be processed into a dry product called *bêche-de-mer* in French; *Iriko* in Japanese; *Teripang* in Indonesian; or *hai-som* in Chinese, which is considered a delicacy and a medicinal food by Chinese, Japanese, Koreans,

Melanesians, Polynesians, Micronesians and Africans communities. Sea cucumbers being defenseless creatures with very limited movements neither offer resistance nor attempt to escape at the time of capture.

For these reasons they have been indiscriminately fished. Harvesting in the tropics is usually done by hand, while wading in shallow waters, or gleaning, at low tide or by free-diving from small boats, although SCUBA and hookah have increasingly been used. Small bottom trawls and lift bags are used in deeper waters away from reefs. In shallow areas collection with spears, hooks and scoop net is done.

Most tropical fisheries are multi-specific and at an artisanal scale or for subsistence use. In some cases, fishing evolved to target many low-value species after stocks of the more valuable species were depleted. The vast majority of species are harvested for the *'bêche-de-mer'* or *'Teripang'* market (e.g. *Actinopyga mauritiana*, *Holothuria scabra, Thelenota ananas*), although some species are also consumed cooked, pickled or raw (e.g. *Apostichopus japonicus, Cucumaria frondosa, Parastichopus californicus*). Some domestic markets also demand the pickled intestines and gonads, while some commercial products have sea cucumber by-products (e.g. *"gamat"* oil from *Stichopus horrens*) and others are included in the aquarium trade. Asian markets are now accepting new product forms of sea cucumbers, such as semi-dried vacuum packed, frozen whole or as separate body parts. Processing methods to achieve the dried form (*beche-de-mer*) vary depending on the species, the final product to be achieved and the market to which the product will be sold.

Sea Cucumber market © Wikipedia

Taxonomy & Species

The taxonomy of some groups of sea cucumbers is complex, even for taxonomic experts, and has stimulated much research in recent years. Some sea cucumbers can be very difficult to identify at species level once processed, creating problems for trade officials. This has been identified as a bottleneck when attempting to implement conservation tools in the international trade (e.g. a CITES listing) and has led to the development of illegal, unreported and unregulated (IUU) trade.

Scientific classification	
Kingdom	Animalia
Phylum	Echinodermata
Subphylum	Echinozoa
Class	Holothuroidea
Orders	Apodida; Aspidochirotida; Dactylochirotida; Dendrochirotida; Elasipodida & Molpadida
Major Families	Holothuriidae; Stichopodidae; Cucumariidae

The majority of species harvested commercially belong to the order Aspidochirotida, specifically to the families Holothuriidae and Stichopodidae, and are mostly tropical. A few species belonging to the order Dendrochirotida, family Cucumariidae, are also fished commercially. Species in the orders Apodida, Dactylochirotida, Elasipodida and Molpadida are mostly not fished commercially.At present nearly 1400 species of sea cucumbers are known from all the seas in the world. There are nearly 200 known species in the seas around India, most of them in deep waters. About 75 species have been shown to be present in shallow waters while nearly 50 species can be collected from the intertidal region. Nearly 20 species of sea cucumber found in the Indian waters have the commercial importance. The Andaman and Nicobar Islands have vast varieties of sea cucumbers, followed by the Lakshadweep Islands, Gulf of Mannar and Palk Bay. Some of the commercially important sea cucumber species are mentioned below.

LIVE (photo by: S.W. Purcell)

PROCESSED (photo by: S.W. Purcell)

Holothuria fuscogilva (White teatfish)

LIVE (photo by: S.W. Purcell)

PROCESSED (photo by: S W Purcell)

Actinopyga miliaris (Blackfish)

LIVE (photo by: R. Aumeeruddy)

PROCESSED (photo by: S W Purcell)

H. nobilis (Black teatfish)

LIVE (photo by: S.W. Purcell)

PROCESSED (photo by: S W Purcell)

A. mauritiana (Surf redfish)

LIVE (photo by: P S Asha)

PROCESSED (photo by: D B James)

H. spinifera (Brown sandfish)

LIVE (Indian Ocean variety) (photo by: P. Bourjon)

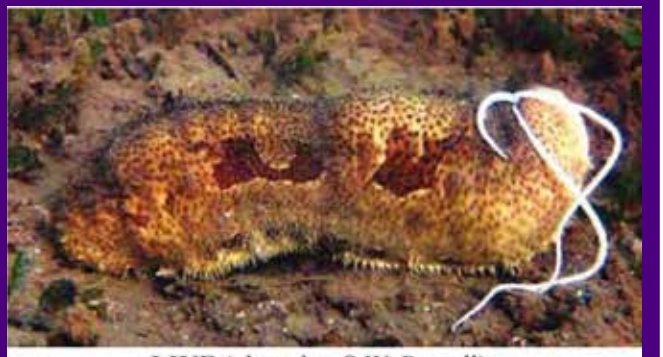
PROCESSED (Pacific Ocean variety) (photo by: S.W. Purcell)

A. echinites (Deep water redfish)

LIVE (photo by: S.W. Purcell)

PROCESSED (photo by: J. Akamine)

Thelenota ananas (Prickly redfish)



LIVE (photo by: S.W. Purcell)

PROCESSED (photo by: E Aubry SPC)

Bohadschia marmorata (Chalkyfish)

LIVE (photo by: S.W. Purcell)

PROCESSED (photo by: S.W. Purcell)

H. edulis (Pinkfish)

LIVE (photo by: S.W. Purcell)

PROCESSED (photo by: S.W. Purcell)

H. atra (Lollyfish)

LIVE (photo by: S W Purcell)

PROCESSED (photo by: S W Purcell)

H. scabra

LIVE (photo by: S. Ribes)

H. impatiens

Sea cucumber morphology

Sea cucumbers have an orally-aborally (longitudinally) elongated body. The pentamerous symmetry is sometimes recognizable by the presence of 5 meridional ambulacra bearing podia. Sea cucumbers live on the substrate of the sea floor with their ventral surface. This creeping sole bears the locomotory podia, while on the dorsal surface, the podia are often represented by papillae. Consequently, a secondary bilateral symmetry is also evident.

Sea cucumbers are typically 10 to 30 centimetres (3.9 to 12 in) in length, although the smallest known species is just 3 millimetres (0.12 in) long, and the largest can reach 1 metre (3.3 ft). The body ranges from almost spherical to worm-like. The anterior end of the animal containing the mouth corresponds to the oral pole of other echinoderms, while the posterior end containing the anus corresponds to the aboral pole. Thus, compared with other echinoderms, sea cucumbers can be said to be lying on their side.

Like all echinoderms, sea cucumbers possess pentaradial symmetry. Most sea cucumbers have five strip-like ambulacral areas running along the length of the body from the mouth to the anus. Sea cucumber typically possesses an internal skeleton composed of plates of calcium carbonate.

In most sea cucumbers, however, these have become reduced to microscopic ossicles embedded beneath the skin. A few genera, such as Sphaerothuria, retain relatively large plates, giving them scaly armour.

Diet and digestive system

Holothuroidea are generally scavengers, feeding on debris in the benthic zone of the ocean. The diet of most cucumbers consists of plankton and decaying organic matter found in the sea. Some sea cucumbers position themselves in currents and catch food that flows by with their open tentacles. They also sift through the bottom sediments using their tentacles.

A pharynx lies behind the mouth and is surrounded by a ring of ten calcareous plates. In most sea cucumbers, this is the only substantial part of the skeleton, and it forms the point of attachment for muscles that can retract the tentacles into the body for safety as for the main muscles of the body wall. Many species possess an oesophagus and stomach, but in some the pharynx opens directly into the intestine. The intestine is typically long and coiled, and loops through the body three times before terminating in a cloacal chamber, or directly as the anus.

Reproduction and life cycle

Most sea cucumbers reproduce by releasing sperm and ova into the ocean water. Depending on conditions, one organism can produce thousands of gametes. Sea cucumbers are typically dioecious, with separate male and female individuals, but some species are protandric. The reproductive system consists of a single gonad, consisting of a cluster of tubules emptying into a single duct that opens on the upper surface of the animal, close to the tentacles.

At least 30 species, including the red-chested sea cucumber (*Pseudocnella insolens*) fertilize their eggs internally and then pick up the fertilized zygote with one of their feeding tentacles. The egg is then inserted into a pouch on the adult's body, where it develops and eventually hatches from the pouch as a juvenile sea cucumber. A few species are known to brood their young inside the body cavity, giving birth through a small rupture in the body wall close to the anus.

In all other species, the egg develops into a free-swimming larva, typically after around three days of development. The first stage of larval development is known as an auricularia, and is only around 1 millimetre (0.039 in) in length.

This larva swims by means of a long band of cilia wrapped around its body. As the larva grows it transforms into the doliolaria, with a barrel-shaped body and three to five separate rings of cilia. The tentacles are usually the first adult features to appear, before the regular tube feet.

Holothurians as food and medicines

There are many commercially important species of sea cucumber that are harvested and dried for export for use in Chinese cuisine as Hoi sam. Some of the commonly available important food species of sea cucumber are *H. scabra, H. fuscogilva, A. mauritiana, Stichius japonicas, Parastichopus californicus, T. ananas, Acaudina molpadioides* etc.

Deep fried Sea cucumber © Wikipedia

Sea Cucumber in sauce © Wikipedia

Sea Cucumber with Mushroom © Wikipedia

Sea Cucumber Chips © Wikipedia

Some varieties of sea cucumber (known as *gamat* in Malaysia or *teripang* in Indonesia) are said to have excellent healing properties. In some countries there are pharmaceutical companies being built based on gamat. Extracts are prepared from different parts of the sea cucumber and made into oil, cream or cosmetics. A study suggested that the sea cucumber contains all the fatty acids necessary to play a potential active role in tissue repair. Another study found that lectin from *Cucumaria echinata* impaired the development of the malaria parasite produced by transgenic mosquitoes.

According to the American Cancer Society, although it has been used in traditional Asian folk medicine for a variety of ailments, "there is little reliable scientific evidence to support claims that sea cucumber is effective in treating cancer, arthritis, and other diseases" but research is examining "whether some compounds made by sea cucumbers may be helpful against cancer". Chondroitin sulfate and related compounds found in sea cucumbers can help in treating joint-pain, and that dried sea cucumber is "medicinally effective in suppressing arthralgia. Sea cucumbers are under investigation for use in treating ailments including colorectal cancer. Surgical probes made of nanocomposite material based on the sea cucumber have been shown to reduce brain scarring.

Products made from sea cucumber

Products made from sea cucumber are sold in the markets in the following forms: *konowata* (salted intestine), *konoko* (dried gonad) and dried muscle. *Konowata, konoko* and dried muscle of sea cucumber are considered a delicacy for Japanese.

a) *Konowata*

The prices paid for the product are very much higher than the price for fresh sea cucumbers. In preparation of *konowata*, before removal of the intestine, the animals are kept in clean seawater for a certain period to empty the intestine before gutting. After the intestine is removed, the contents are squeezed out by hand without breaking the canal. The intestines are washed in clean seawater and rinsed. The viscera are salted using 10—15% salt by weight of the raw viscera. One-third of the total salt is added to the product first to extract water from the body.

After draining occurs, more salt is added, and mixed thoroughly for five and half hours. The mixture is put into a wood barrel and covered with a lid to allow the product to be fermented. Occasional stir might be

needed during the fermentation period. The finished product is packed in bottles and distributed to retailers. The nutritive value of the product is 76.5% water, 9.3% protein, 1.3% fat, 0.5% carbohydrate and 12.4% ash. The price of *konowata* is paid partly on the length of the intestines. Longer intestines command higher price.

b) *Konoko*

This product is the most expensive product prepared from sea cucumber. It commands the price at US $200/ kg. The product is not common mainly because it is difficult to procure. The product does not weigh more than 2.5% of the body weight during the spawning season. Moreover during the post-spawning season the gonad is much smaller, only a small fraction of a percent of body weight.

Removal of gonads as well as intestines from sea cucumber does not kill animals. Small incision on the body wall is enough to remove the gonad and intestine. The cut made on the body wall will heal in 5—7 days. The intestine will regenerate, and the same quality or even more can be obtained in the following year.

c) Dried muscles

This product is made from the longitudinal muscles of sea cucumber. It is tender and tastes like high quality clam meat. Beside Japanese and Chinese, the product is also palatable to American and European. It is a high potential product for those markets. The removal of the long, thin longitudinal muscles is facilitated by placing the sea cucumber in pure, clean seawater to contract or shortening the muscles. The muscle is preserved in brine, and sold in the market in canned products.

d) Beche-de-mer

This product is used in gourmet soups or other delicacy Chinese dishes. It is the most common product made from sea cucumber. Price paid for the beche-de-mer varies greatly depending on the species of sea cucumber used and the care given during processing. The best species are large and the body walls are thick. Factors that may influence the quality of the product during processing are:

i. The sea cucumber takes a long time to die and the body disintegrates before death. It should be killed instantly by immersion in boiling seawater to preserve its wholesomeness.

ii. Scum from fine mud and debris on its body wall have to be removed without losing the nutritive matter of the body wall. Partial decomposition or softening of the outer wall facilitates removal of scum.

On completion of processing, the product is graded on the basis of length, appearance, odour and pieces per kg. Packing materials are jute (hessian) sacks and plastic bags. To avoid the re-drying, the vacuum pack may be a necessity. The good quality of the product should have uniform, non-distorted shapes. It should be hard and dry, moisture content allows up to 20—30 per cent. The product should have a pleasing odour and be free of dirt.

Restrictions on Sea cucumber & issues in conservation

The indiscriminate exploitation of sea cucumbers led to the decline in wild population and as a regulatory measure, the Ministry of Environment, Forests and Climate Change, Government of India implemented size regulation on the export of *"beche-de-mer'* in 1982, restricting the export of size below 77 mm length. As the regulation was not effective, the Government imposed a blanket ban in 2001 by listing all species of holothurians under Schedule 1 PART IV-C of The Wildlife (Protection) Act 1972, under the heading "Echinodermata" which is under implementation from 2003 onwards. According to this, sea cucumbers cannot be collected and transported in any form for commercial purpose. A total ban on harvesting of sea cucumbers brought a halt on even much needed research and breeding of these marine species. They are also protected under the Convention on International Trade in Endangered Species (CITES) of which India is a signatory.

A workshop on 'Strategies for Conservation and Resource Enhancement of Sea Cucumbers in India, held at CMFRI, Chennai on 25th August 2008 timely suggested that instead of a total ban, attempts should be made to adopt regulatory methods for conservation, supported by proactive measures like resource enhancement through sea ranching of hatchery-produced offspring of different species. However, the ban and resource management efforts have not been synergetic to prevent the depletion of stocks. A science-based conservation is mandatory instead of a blind-folded banning of sea cucumbers in order to renew and revive the over-exploited endemic stocks.

Many additional threats have been identified for sea cucumber populations worldwide, including global warming, habitat destruction, unsustainable fishing practices (e.g. blasting), the development of fisheries with little or no information on the species, and lack of natural recovery after overexploitation. Illegal, Unregulated and Unreported (IUU) fisheries are widespread in all regions, representing an indirect threat as it fuels unsustainable practices and socio-economic demand.The critical status of sea cucumber fisheries worldwide is compounded by different

factors including i) the lack of financial and technical capacity to gather basic scientific information to support management plans, ii) weak surveillance and enforcement capacity, and iii) lack of political will and socio-economic pressure exerted by the communities that rely on this fishery as an important source of income.The fast pace of development of sea cucumber fisheries to supply the growing international demand for beche-de-mer is placing most fisheries and many sea cucumber species at risk. The pervasive trend of overfishing, and mounting examples of local economic extinctions, urges immediate action for conserving stocks biodiversity and ecosystem functioning and resilience from other stressors than overfishing (e.g. global warming and ocean acidification), and therefore sustaining the ecological, social and economic benefits of these natural resources.

REFERENCES

1. P S, Asha. (2015). Present Status and Future Prospects of Sea Cucumber Breeding and Culture in India. Advances in Marine and Brackishwater Aquaculture, Pages 195- 201.

2. Asha P S, Vinod K, Ranjith L, Johnson B and Vivekanandan E (2017) Conservation and Sustainable use of sea cucumber resources in India: Suggestions and way forward. CMFRI Marine Fisheries Policy Series No. 7. CMFRI, page 80.

3. IFAW. Identifying Sea Cucumbers: Implementing and enforcing an Appendix II listing of teatfish [Accessed on 04.03.2021] (O'Toole+&+Shea_2019_Teatfish_online+version.pdf)

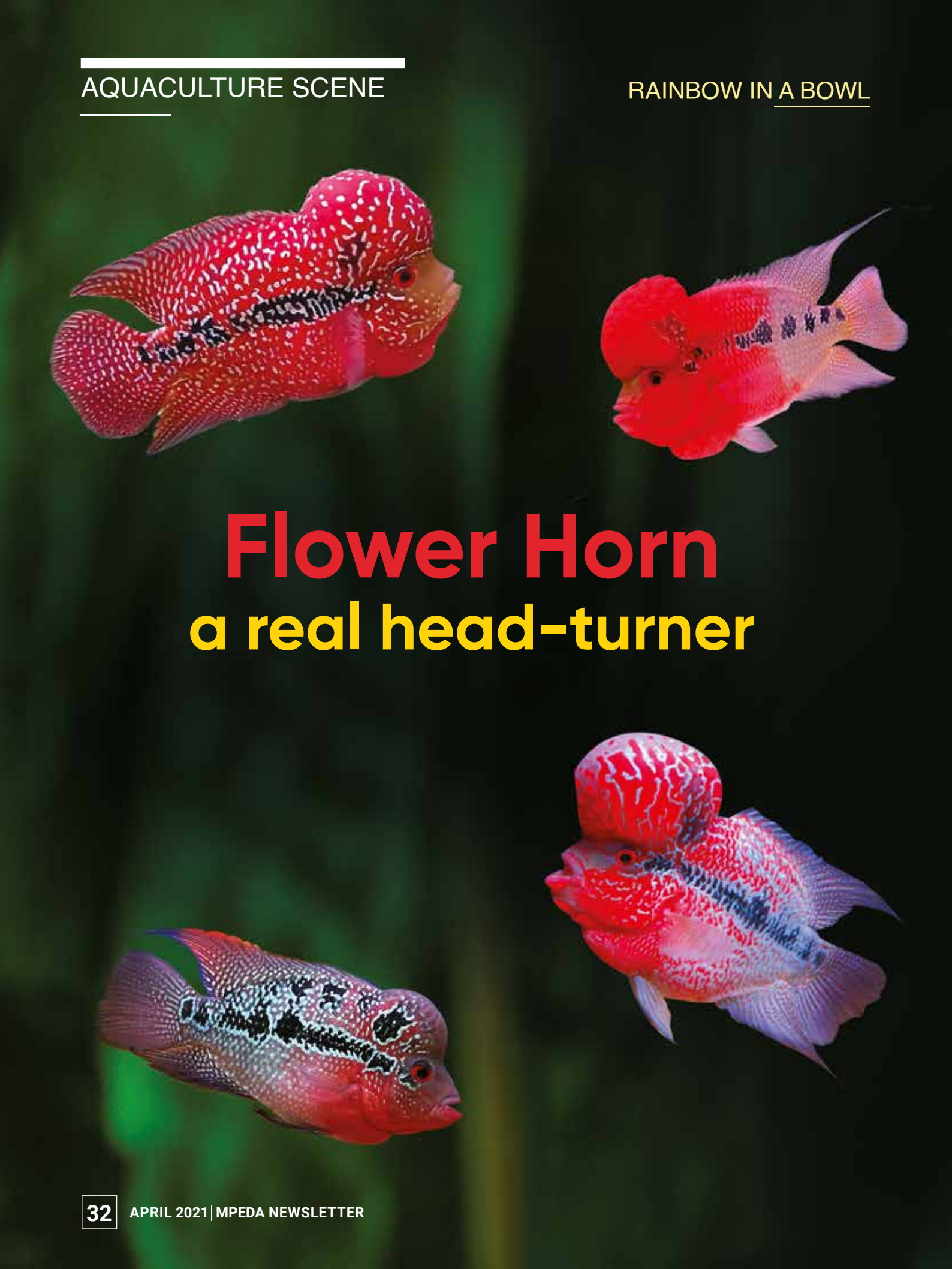
4. Dipanjan Kashyap, Sonmoina Bhuyan and Rajita Devi. Availability of Sea Cucumber in Indian Waters and its Importance. http://aquafind.com/articles/Sea_Cucumber.php (Accessed on 03.03.2020)

5. Giraspy Dab, Regunathan C, Jerald Wilson J, Marimuthun, and Kitto M.R (2012). Sea cucumber ban in India - is it a silent mockery of science and conservation. Aquaculture Europe, Vol 33(3), pages 23- 25.

6. Hampus Eriksson, Georgina Robinson, Matthew J. Slater, Max Troell (2011) Sea Cucumber Aquaculture in the Western Indian Ocean: Challenges for Sustainable Livelihood and Stock Improvement. A Journal of the Human Environment 41(2), pages 109- 121.

7. Purcell S W, Samyn Y and Conand C (2012). Commercially Important Sea Cucumbers of the World. FAO Species Catalogue for Fishery Purposes. No. 6. Rome.

8. Verónica Toral-Granda, Alessandro Lovatelli and Marcelo Vasconcellos - (eds) (2008) Sea cucumbers. A global review of fisheries and trade. FAO Fisheries and Aquaculture Technical Paper – 516, FAO, Rome.



Flower Horn
a real head-turner

V. K. Dey

V K Dey has over three decades of experience in diverse sectors of seafood industry in Asia-Pacific region. He was the Deputy Director of MPEDA and then associated with INFOFISH, Malaysia. As part of INFOFISH, he was involved in several studies related to seafood industry in the Asia-Pacific region and beyond, including setting up of Aqua-technology Park for ornamental fish. MPEDA has published Living Jewels, a collection of his articles on ornamental fish.

Flower Horn, the new generation aquarium fish of Asia, is a hybrid of Cichlasoma Cichlids. Cichlids constitute one of the largest groups of fish found in Eastern Africa and South and Central America. Due to its varied colour patterns, the members of the Cichlasoma genus stand out as a unique showpiece in the aquarium. In view of their unique display, and diverse courting and breeding habits, Cichlids have been an object of study for ichthyologists for the last few years. Flower Horns are known for their attractive colouration and bulging forehead in the male and, perhaps, this could have been the reason to name this fish "Flower Horn". They are generally hardy and tolerant to wide fluctuations of environmental parameters.

Although this latest hybrid has many differences from "Cichlids" in its colouration, appearance and even hump shaped forehead, it retains several similar characteristics such as the aggressive and territorial behaviour. Flower Horns are easy to breed, adapt to a new environment quickly and establish a friendly relationship with their caretaker. The male can grow up to 12 inches or more. Being territorial in nature, Flower Horn will not tolerate the presence of another in the same aquarium, unless ample hiding space is provided. They are at times ferocious and fight to death.Flower Horns need space and clean water to stay in good health; therefore, water quality should be maintained at all times. The water hardness required is pH 7 – 8 (dH 7 – 9). The tank bottom should have gravel with which they can build their nest. They are easy to pair. Matured males have a hump head and are larger than females. The forehead of the female is less conspicuous and tapers towards the mouth.

During courtship, the pair will make a small depression on the gravel bed and use it as a nest. Usually eggs are laid in these depressions. Fertilisation is external and more than 1000 eggs are laid at a time. Survival rate is reported to be as high as 70 percent. The eggs may remain attached to the gravel until they are independent or swimming, which under normal conditions will take about a week. During the initial stages live artemia nauplii would be ideal as food. There are more than a dozen varieties of Flower Horns in the market today. The body colour is a very important deciding factor on the quality of Flower Horn. The fish with the pearl dots on the entire body, resembling a twinkling star, is believed to be the higher priced Flower Horn.

The "Oriental Beauty" has the most attractive markings on the body. These markings connect closely from the tail to the gill and sometimes extend up to the head. It has a sickle shaped back fin and a semicircular tail. As the shining scales resemble twinkling stars, this variety fetches a higher price and is believed to bring luck and prosperity. The Flower Horn is considered to be a good "Feng-shui" fish. A single fish of this variety can even fetch a price of upto US$ 3000. The bigger the forehead, the higher the cost.

The "Galaxy Blue" shows its conspicuous colours in the dark. Its beautiful colours make it look like a hunter on a mysterious night. This variety has irregular stripes on the body and a pair of red gem eyes distinct from other varieties. Normally it has a perfect hump head, mouth looking like a cherry, and a neat straight back fin.With blue shining dots, the "Wonder Spark" looks like an ordinary Cichlid. It is also referred to as the "Panther Warrior" as it is the fastest swimmer among the Flower Horns. With a sequence of horizontal markings, the "Wonder Spark" is differentiated from others. It has lightning dots all over the body including its hump head and fins.

The "Storm Rider" has hard and solid scales, making it look like it is wearing a coat of mail. The fins show a perpendicular shape. There are seven different sizes of markings on the side of the body and five vertical stripes.The "Happy Star" has the most wonderful and colourful pattern on the whole body. It has red shining eyes and golden face. The abdomen is blue and red in colour and the body has eight clusters of markings. Their active character and appearance are believed to make the hobbyist feel happy.The "Royal Tiger" is so named because of the stripes on its body. It has a dark red and pink body, golden face and blue dotted scales. The "Red Beauty" has the most striking and beautiful red colouration among Flower Horns. It has two pairs of markings on the side of the body and blue dots distributed in the rear and extending to the tail.

As the name indicates, "Moonlight Beauty" belongs to the beauty of night. With seven vertical indistinct bands and seven horizontal clusters of markings on the body, " Moonlight Beauty" exhibits varied colouration during the night. "The May Blossom" is very ordinary and not like other varieties of Flower Horns. Due to its light colouration, it is also known as "Light Blossom". It has light red and light yellow body colour, with six clusters of distinct horizontal markings.

MPEDA organizes Farmers' Meet at Dahanu

The Panvel Regional Division of the Marine Products Export Development Authority organized a Farmers' Meet at Manphod Village, Taluka Dahanu, Palghar District on 'Eco-Friendly and Sustainable Aquaculture'.The meet, which was held on 22nd March 2021, and was aimed at creating awareness among the shrimp farmers regarding Pre-Harvest Test (PHT) Certificate, online sample booking and COVID-19 precautions. A total of 30 participants attended the meeting. The Meet was organized, adhering to the COVID-19 guidelines. Welcoming the participants and officials of the Department of Fisheries, Mr. Razak Ali, Deputy Director, Regional Division, Panvel, Maharashtra briefed them on the current scenario of Vannamei farming in Maharashtra compared to other states such as Gujarat and Andhra Pradesh.

The technical session started with the presentation of Mr. Atul Raosaheb Sathe on the 'procedures for e-login for farmers to book samples for PHT'. He explained to the farmers about the login procedures, entering of Farm ID ,filling up the details and online fee payment. The technical session was followed by an awareness

A view of the participants

class on COVID-19, its symptoms and precautions to be taken on farms .The slide on the guidelines on covid 19 precautions by MPEDA was shared with the participants. Mr.Amol Sonone, Assistant Fisheries Development Officer, Palghar, Department of Fisheries Maharashtra briefed the farmers regarding renewal and application for CAA permission and also on various financial assistance schemes under PMMSY along with the procedure to apply, documents required and quantum of subsidy amount with various schemes. A group discussion among MPEDA officials, officials of Department of Fisheries, Maharashtra and participants was also held.

Awareness campaign on abuse of antibiotics in aquaculture

Detection of chemical/antibiotic residues in export consignments of shrimp, fish and allied products is a serious issue. Besides, the buyers insist on a reliable certification system for the food products that shall not contain harmful substances as per the standards imposed by the importing countries. The issue of traceability of farmed shrimp is taken seriously. It has become, therefore, imperative for promotional/ governmental organizations to inform the farmers, mostly small and marginal, that they have to maintain highest quality standards of the shrimp they produce for sustainable production.

The government agencies have to ensure that laboratory facilities are available in the state for screening banned antibiotics prior to harvest by obtaining a PHT certificate. Through this, farmers can ensure that the produce they sell to exporters/processors are free from banned antibiotics and can demand better farm gate price for their produce. In order to make the shrimp farmers of Odisha aware of the banned antibiotics/ chemicals, MPEDA has been conducting a series of campaigns on “Abuse of Antibiotics in Aquaculture.

An awareness programme was organized at Talchua in Rajnagar block of Kendrapara district on 6th January 2021 by Regional Division, Bhubaneswar. Mr. Sibasish Mohanty, JTO, MPEDA and Mr. Manas Ranjan Biswal, Field Manager of NaCSA organized the meeting for shrimp farmers in the area.

Mr. Niranjan Bera, Sarpanch, Talchua Panchayat and Mr. Jayadev Jena, a leading farmer of the area were present. Both of them motivated farmers to register under CAA & enroll under MPEDA and also to make sure that they supply antibiotic-free shrimp produce.

Mr.Sibasish described the harmful effects that antibiotics pose to human health including drug resistance and other health issues. He encouraged farmers to stay informed by referring to the CAA-approved chemicals/ medicines. Leaflets on the harmful impact of use of antibiotics in aquaculture in Odia were distributed among farmers.

A view of the awareness campaign against the use of Antibiotics in Aquaculture

The farmers demanded an active task force to ensure that aquaculture inputs available in the market are antibiotic-free. Mr. Manas briefed them on the benefits of forming aqua societies. Farmers of Talchua village have expressed their interest in forming a society and to register under MPEDA/NaCSA Society Act to get updated information about aquaculture & international business.

The officials also discussed the role of farm enrolment in traceability, PHT certificate and other monitoring programmes carried out by MPEDA and the importance of quality produce in overseas export. The farmers sought more awareness campaigns to give timely information on the fluctuations in the international market, latest technologies, and modern equipment.

A total of 18 farmers attended the programme and thanked MPEDA for organizing the campaign in their region. The meeting ended with the vote of thanks proposed by Mr. Sibasish Mohanty, RD, Bhubaneswar.

Training programme on 'eco-friendly and sustainable aquaculture through species diversification'

MPEDA Regional Division, Kochi organized a training programme for the members of SC/ST community at Ayyampuzha Grama Panchayath in Ernakulam district. The training programme on 'eco-friendly and sustainable aquaculture through species diversification' was organized for five days from 1st to 5th March 2021.

The training was mainly aimed at imparting knowledge on sustainable and diversified aquaculture production through adoption of Better Management Practices (BMP). The training programme started with an informal inauguration attended by Mr. P. U Jomon, President, Ayyampuzha Grama Panchayath, Mr. K Surendran, former Member, Ayyampuzha Grama Panchayat, Ms. Savitha Ashokan, SC Promotor, Ayyampuzha Grama Panchayath and Mr. Viswakaumar. M,Assistant Director, MPEDA.

During the programme, the participants were provided insights on the new trends in aquaculture, different aquaculture practices of scampi and diversified species, cage farming, stock assessment, feed management, disease and health management, harvesting methods, post-harvest management, marketing aspects, reasons for failure in aquaculture and its remedies, importance of farm enrolment, Pre Harvest Testing (PHT), abuse of antibiotics in aquaculture, schemes - services of the Government to promote aquaculture and the role of RGCA in aquaculture.

The use of water quality testing using easy-to-use methods such as pH universal indicator solution, water testing kits for different parameters etc were demonstrated for the trainees. The technical sessions were handled by officials of MPEDA RD Kochi including Mr. Johnson D' Cruz, Deputy Director, Mr. Viswakaumar M., Assistant Director, Mr. P. Bijimon, JTO, Ms. Manjusha K., Field Supervisor, Mr. M. Shaji, Joint Director (Retired), MPEDA and Ms. Ramya K. D., Assistant Extension Officer, Matsyabhavan, Dept. of Fisheries, Ernakulam. After the technical sessions, an interactive session was held wherein questions raised by participants were clarified. This was followed by valedictory function. Mr. Johnson D' Cruz and Ms. Savitha Ashokan distributed certificates and stipends to the trainees. The programme was attended by 13 trainees belonging to the SC/ST communities.

Shri. Bijimon. P, JTO handling technical session

Shri. Johnson D'Cruz, Deputy Director, MPEDA ,handling technical session

Shri.Vishwakumar.M, Assistant Director,MPEDA , interacting with the trainees

Aquascaping: Different styles of underwater landscaping

Dr. T R Gibinkumar, Deputy Director MPEDA (Market Promotion & Statistics)

Aquascaping is the craft of arranging aquatic plants, as well as rocks, stones, cavework, or driftwood, in an aesthetically pleasing manner within an aquarium. In other words it is easily described as gardening under water. Aquascape designs include a number of distinct styles, including the garden-like Dutch style and the Japanese-inspired nature style. Typically, an aquascape houses fish as well as plants, although it is possible to create an aquascape with plants only, or with rockwork or other hardscape and no plants. Aquascaping is done in both freshwater and marine aquariums.

Aquacape © Heiko Bleher

DIFFERENT STYLES OF AQUASCAPING

Aquascaping is a beautiful art that always tries to bring the asymmetry of nature to the aquarium tank. Any strive to obtain symmetry will be giving an artificial look and it's better to go with the fact that Nature isn't perfect and that's exactly what makes it so beautiful. For instance, by avoiding big chunks of hardscape material (rock, driftwood etc) in the centre of the aquarium will make everything around look different, enhancing the beauty of the entire rock or driftwood itself. The best aquascape shapes are the ones following a smooth curve. There are several composition styles in this regard and the basic types are concave, convex and triangular layouts.

- The concave layout – higher on either side and lower in the middle, this layout offers the impression of open space in the centre.

- The convex shaped layout, or the Island style – plants are trimmed lower on either side and higher in the middle, which is very nice aesthetically and can be obtained with rocks to make a mountain looking scape.

- The triangular aquascape design – higher on one side, lower on the other, this type of layout creates very balanced visuals.

Basic composition styles – Concave; Convex & Triangular

Dutch style

The Dutch aquarium employs a lush arrangement in which multiple types of plants having diverse leaf colors, sizes, and textures are displayed much as terrestrial plants are shown in a flower garden. This style was developed in the Netherlands starting in the 1930s, as freshwater aquarium equipment became commercially available. It emphasizes plants located on terraces of different heights, and frequently omits rocks and driftwood. Linear rows of plants running left-to-right are referred to as "Dutch streets".

Although many plant types are used, one typically sees neatly trimmed groupings of plants with fine, feathery foliage, such as *Limnophila aquatica* and various types of Hygrophila, along with the use of red-leaved *Alternanthera reineckii, Ammania gracilis*, and assorted Rotala for color highlights. More than 80% of the aquarium floor is covered with plants, and little or no substrate is left visible. Tall growing plants that cover the back glass originally served the purpose of hiding bulky equipment behind the tank

Dutch style © Wikipedia

Japanese styles

a. Nature style

A contrasting approach is the "nature aquarium" or Japanese style, introduced in the 1990s by Takashi Amano. Amano's three-volume series, Nature Aquarium World, sparked a wave of interest in aquarium gardening, and he has been cited as having "set a new standard in aquarium management".

Amano's compositions drew on Japanese gardening techniques that attempt to mimic natural landscapes by the asymmetrical arrangement of masses with relatively few species of plants, and which set rules governing carefully selected stones or driftwood, usually with a single focal point. The objective is to evoke a terrestrial landscape in miniature, rather than a colourful garden.

This style draws particularly from the Japanese aesthetic concepts of Wabi-sabi, which focuses on transience and minimalism as sources of beauty. Plants with small leaves like *Glossostigma elatinoides, Eleocharis acicularis, Eleocharis parvula, Echinodorus tenellus, Hemianthus callitrichoides, Riccia fluitans, small aquatic ferns, Staurogyne repens*, and Java moss (*Vesicularia dubyana* or *Taxiphyllum barbieri*) are often used to emulate grass or moss. Colours are more limited than in the Dutch style, and the hardscape is not completely covered. Fish, or freshwater shrimp such as *Caridina multidentata* and *Neocaridina davidi*, are usually selected to complement the plants and control algae, but for reasons of minimalism the numbers of species are often limited.

Natural style © Wikipedia

b. Iwagumi: A Japanese Zen Style

The Iwagumi style is a specific subtype of the nature style. The Iwagumi term itself comes from the Japanese "rock formation" and refers to a layout where stones play a leading role. In the Iwagumi style, each stone has a name and a specific role. Rocks provide the bony structure of the aquascape and the typical geometry employs a design with three main stones, with one larger stone and two other smaller stones, although additional rocks can also be used.

The Oyaishi, or main stone, is placed slightly off-center in the tank, and Soeishi, or accompanying stones, are grouped near it, while Fukuseki, or secondary stones, are arranged in subordinate positions. The location of the focal point of the display, determined largely by the asymmetric placement of the Oyaishi, is considered important, and follows ratios that reflect Pythagorean tuning.

Iwagumi style © Wikipedia

c. Jungle style

Some hobbyists also refer to a "jungle" (or "wild jungle") style, separate from both the Dutch or nature styles, and incorporating some of the features of them both. The plants are left to assume a natural, untrimmed look. Jungle style aquascapes usually have little or no visible hardscape material, as well as limited open space. Bold, coarser leaf shapes, such as Echinodorus bleheri, are used to provide a wild, untamed appearance.

Unlike nature style, the jungle style does not follow clean lines, or employ fine textures. A jungle canopy effect can be obtained using combinations of darker substrates, tall plants growing up to the surface, and floating plants that block light, offering a dappled lighting effect. Other plants used in jungle style aquascapes include *Microsorum pteropus, Bolbitis heudelotii, Vallisneria americana, Crinum species, Aponogeton species, Echinodorus species, Sagittaria subulata, Hygrophila pinnatifida, Anubias species, and Limnobium laevigatum.*

Jungle style © Wikipedia

d. Biotopes

The styles above often combine plant and animal species based on the desired visual impact, without regard to geographic origin.

Biotope aquariums are designed instead to replicate exactly a particular aquatic habitat at a particular geographic location, and not necessarily to provide a garden-like display. Plants and fish need not be present at all, but if they are, they must match what would be found in nature in the habitat being represented, as must any gravel and hardscape, and even the chemical composition of the water. By including only those organisms that naturally exist together, biotopes can be used to study ecological interactions in a relatively natural setting.

Biotype style ©BAP- Lukasz Hebel

e. Paludariums

A paludarium is an aquarium that combines water and land inside the same environment. These designs can represent habitats including tropical rainforests, jungles, riverbanks, bogs, or even the beach. In a paludarium, part of the aquarium is underwater, and part is above water. Substrate is built up so that some "land" regions are raised above the waterline, and the tank is only partially filled with water.

This allows plants, such as *Cyperus alternifolius* and *Spathiphyllum wallisii*, as well as various Anubias and some Bromeliads, to grow immersed, with their roots underwater but their tops in the air, as well as completely submersed. In some configurations, plants that float on the surface of the water, such as *Eichhornia crassipes* and *Pistia stratiotes*, can be displayed to full advantage. Unlike other aquarium setups, paludariums are particularly well-suited to keeping amphibians.

Paludarium © Wikipedia

f. Saltwater reefs

Dutch and nature style aquascapes are traditionally freshwater systems. In contrast, relatively few ornamental plants can be grown in a saltwater aquarium. Saltwater aquascaping typically centers, instead, on mimicking a reef. An arrangement of live rock forms the main structure of this aquascape, and it is populated by corals and other marine invertebrates as well as coralline algae and macroalgae, which together serve much the same aesthetic role as freshwater plants.

Lighting plays a particularly significant role in the reef aquascape. Many corals, as well as tridacnid clams, contain symbiotic fluorescent algae-like dinoflagellates called zooxanthellae. By providing intense lighting supplemented in the ultraviolet wavelengths, reef aquarists not only support the health of these invertebrates, but also elicit particularly bright colors emitted by the fluorescent microorganisms.

Reef Aquascape © Wikipedia

REFERENCE

1. Hennig, Matt (2003), Amano versus Dutch: Two art forms in profile, Tropical Fish Hobbyist, Pages 68-74.

2. Harrison, Tim (2019). "A Brief and Incomplete History of Aquascaping". Barr Report.

3. James, Barry (1986), A Fishkeeper's Guide to Aquarium Plants, London: Tetra Press/Salamander Books, ISBN 0-86101-207-0

4. Iwagumi Aquascaping: A Beginner's Guide. The Aquarium Adviser.

5. Wikipedia (2021) https://en.wikipedia.org/wiki/Aquascaping (accessed on Feb 2021)

6. https://aquascapinglove.com/learn-aquascaping/what-is-aquascaping/(accessed on Feb 2021)

Indian pompano- An emerging mariculture species for addressing nutritional security and fishpreneurship

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In the backdrop of depleting marine resources in India, mariculture has great prospects for increasing the seafood production to meet the fish protein requirement of the country. Species diversification is one of the effective approaches to achieve sustainable fish production. Pompanos belonging to the Genus Trachinotus of Carangidae family are considered as a delicacy worldwide and farming of pompanos has successfully been practiced in many countries in the Asia-Pacific region. Indian pompano (*Trachinotus mookalee*) is a highly desired emerging mariculture species in India with high commercial value both in domestic and international markets. The seed production technology and grow out rearing of Indian pompano is successfully standardized by Visakhapatnam Research Centre of ICAR-Central Marine Fisheries Research Institute (ICAR-CMFRI). The fillets prepared from Indian pompano are whitish and boneless with a firm texture, making it suitable for a good table fish.

Harvested Pompano

Pompano products

Comparison of nutritional composition of farmed pompano and wild pompano

It is necessary to evaluate and compare the nutritional qualities of a newly introduced mariculture species to its natural counterparts. Nutritional composition of a fish species is decided by multiple factors including life stage and age, feed, season, locality etc. Studies conducted at ICAR-Central Institute of Fisheries Technology (ICAR-CIFT) revealed that nutritional quality of farmed pompano reared under different

aquaculture systems is superior to that of wild caught pompano.

Protein, water, fat and ash represents the proximate composition, accounting for 98% of edible portions of fish. Proximate composition of wild and farmed Indian pompano is given in Table 1. The major nutritional component, protein content of Indian pompano is 17-19%, indicating that it is a rich source of protein. Protein content of wild pompano was slightly lower to that of farmed pompano. The nutritional benefits of fish are greatly influenced by its fatty acid composition. Fat content was higher in pond reared fishes followed by cage reared fishes while the wild caught fish had the lowest fat content. Apart from this, the proportion of Long Chain Polyunsaturated Fatty Acids (LC PUFAs) having well known health benefits was higher in farm reared pompano compared to its wild counterpart. In this point of view, farming of Indian pompano attracts more significance compared to fresh water fishes which have negligible amounts of long chain PUFAs. Water has a technological role during processing of fish as water decides the texture of fish products.

The comparison of nutritional quality indicated that farmed Indian pompano provides adequate quantities of good quality protein and beneficial fats and helps in meeting the nutritional security needs of the country.

Table 1. Proximate composition of farmed and wild Indian pompano

Parameter	Wild pompano	Sea cage reared pompano	Pond reared pompano
Protein (%)	17.14	18.73	18.16
Fat (%)	1.89	2.13	4.99
Moisture (%)	80.12	76.85	76.24
Ash (%)	1.42	1.91	1.32

Processing yield and mince quality

Pompano is a white fleshed fish that makes it amenable for making value added products of high consumer acceptability fetching good prices in the retail markets. Average yield of various styles of pompano fish is given in Table 2.

Physicochemical property of fish mince is an important parameter deciding the technological requirement for processing. Water holding capacity of fish mince is one of the most technologically important attributes deciding the quality of mince based products like surimi and other value added coated fish products. Cooking loss during processing is also influenced by water holding capacity. Mince from cultured pompano displayed higher water holding capacity than wild pompano. Since the water holding capacity of wild pompano mince was poor, it showed higher cooking loss compared to cultured fishes. In addition, because of the lower fat content, hardness and chewiness of wild pompano was higher compared to farmed pompano.

Table 2. Processing yield of Indian pompano

Product	Yield
Beheaded and gutted pompano	65-70%
Steaks	60-65%
Fillet	45-50%
Mince	40-45%

Marketing and future prospects

The colour of flesh, taste of meat, nutritional composition and accrued health benefits are the positive drivers for consumer acceptability of any fish species. Marine fish are generally preferred for their richness in health beneficial omega 3 fatty acids. However, marine catches are seasonal and depleting every year. Farming of high valued marine fish is a viable option to meet the consumer demand while reducing pressure on wild stock. Indian pompano has all the desirable attributes making it as one of the highly desired marine fish in India and potential market demand exists for farmed Indian pompano in the domestic market.

Domestic market prices are very lucrative for Indian pompano, fetching Rs. 300/kg. Marketable table size of Indian pompano is 600 g which may be reached within 8 months culture period in sea cages or brackishwater ponds. Presently, the farmed Indian pompano is marketed in few maritime states of India including Kerala, Tamilnadu, Karnataka and West Bengal.

Coastal aquaculture sector of India is centered majorly on Pacific white shrimp, *Penaeus vannamei*. Species diversification by introducing new candidate species like Indian pompano is essential for ensuring sustainable development of coastal aquaculture in India. Diversified aquaculture provides safeguards against disease epidemics and international trade

issues associated with single species aquaculture. Indian pompano is presently marketed in the internal markets but has potential for export either as whole fish or value added products. Product diversification in the form of ready-to-cook products such as fillets, steaks, marinated, battered and breaded products or ready-to-eat products such as fish curries help in further expansion of the farmed pompano market. Live marketing of cage farmed pompano coupled with on-site product preparation can open new vistas in coastal tourism.

Exploring the potential export of Indian pompano in Europe, US and Asian markets requires continuous supply of raw material. For this, the production capacity needs to be scaled up by widening the farming of Indian pompano across the coastal states of India, either through open sea cage culture or fish ponds. The consumer demand and marketability of the farmed Indian pompano opens livelihood and entrepreneurial opportunities for fishers, youth and prospective fishpreneurs.

Understanding the immune system of fish

Dr. T R Gibinkumar, Deputy Director MPEDA (Market Promotion & Statistics)

Introduction

Fish possess innate and adaptive immune defence systems. The innate parameters are at the forefront of immune defence and are crucial factors in disease resistance. The adaptive response of fish is commonly delayed but is essential for long-lasting immunity and is a key factor in successful vaccination. The massive increase in aquaculture in recent decades has put greater emphasis on studies of the fish immune system and defence against diseases commonly associated with intensive rearing of a few economically important species.

Such research has helped define the optimum conditions for maintaining immunocompetent fish in culture, for selection of fish stock (breeding), as well as developing and improving prophylactic measures such as vaccination, and use of probiotics and immunostimulation in the aqua-cultured species. However, there is great variation in disease susceptibility and immune defence between different fish species.

The immune response described in one species may not be the same in other species. Indeed, the immune system is largely unknown in most fish species, especially in newly aquacultured species, limiting the development of immune control strategies against infectious disease. This article will describe the main components of the innate and adaptive immune system of fish.

A. Immune cells and organs in fish

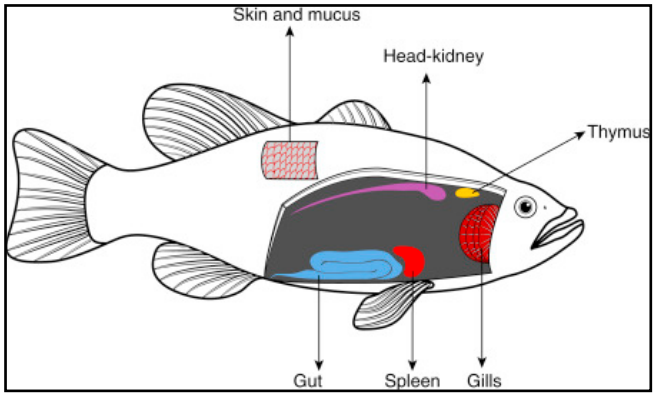
Fish live in an environment containing a great variety of infectious agents such as viruses, bacteria, fungi, protozoa and multicellular parasites and if they multiply unchecked can cause various diseases and even kill the fish. Thus fish have evolved effective immune responses that initially recognize the pathogens or other foreign molecules (antigens), triggering pathways that subsequently elicit effector mechanisms to attempt to eliminate them. The immune responses elicited fall into two main categories: innate (or non-specific) immune responses and adaptive (or specific) immune responses.

Immune responses are mediated by a variety of cells and secreted soluble mediators. Leucocytes are central to all immune responses, and include lymphocytes (T cells, B cells, large granular lymphocytes), phagocytes (mononuclear phagocytes, neutrophils and eosinophils) and auxiliary cells (basophils, mast cells, platelets). Other cells in tissues also participate in the immune responses by signalling to the leucocytes and responding to the soluble mediators (cytokines) released by T cells and macrophages.

The cells involved in the immune responses are organized into tissues and organs in order to perform their functions most effectively. These structures are collectively referred to as the lymphoid system, and are arranged into either discretely encapsulated organs or

accumulations of diffuse lymphoid tissue. The major lymphoid organs and tissues are classified as either primary (central) or secondary (peripheral).

Lymphocytes are produced in the primary lymphoid organs and function within the secondary lymphoid organs and tissues. In fish the lymphoid organs are considered to be the thymus, the bone marrow equivalent: the head kidney, spleen, gills, gut and other immune relevant organs such as the liver and the integumentary surface. The thymus, kidney and spleen are the major (non-mucosal) lymphoid organs of fish.



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A1. Thymus: The thymus is considered a key organ of the immune system in jawed vertebrates. It is thought to have evolved in early fish species as a thickening in the epithelium of the pharyngeal area of the gastro-intestinal tract. In most teleosts the thymus is located near the gill cavity and is closely associated with the pharyngeal epithelium and usually found as more than one pair of organs in teleosts. The structure of the fish thymus is highly variable between species and within a species in an age-dependent manner. In many fish species there is no clear cortico-medullary differentiation.

A2. Head Kidney (The bone marrow equivalent): The bone marrow is absent in fish but the cephalic portion of the kidney (head kidney or pronephros) is considered analogous to mammalian bone marrow, at least in terms of hematopoiesis. The trunk kidney (mesonephros) is also hematopoietic, although it also contains renal tissue. The active immune part, the head kidney, is formed by the two arms, which penetrate under the gills. The head kidney has a reticulo-endothelial stroma consisting of sinusoidal cells and reticular cells.

The types of hematopoiesis described within the fish head kidney include erythropoiesis, granulopoiesis, thrombopoiesis, monopoiesis and lymphoplasmopoiesis. The fish head kidney is also an important endocrine organ and also appears to be the primary organ for antibody production.

A3. The spleen: The spleen is a major secondary lymphoid organ in fish. It contains blood vessels, ellipsoids, red pulp and white pulp. However, the red and white pulp in fish is less clearly defined. The pulp occupies the majority of the organ with reticular cell network supporting blood-filled sinusoids that hold diverse cell populations, including macrophages and lymphocytes. The white pulp is often poorly developed and holds the melano-macrophage accumulations and the ellipsoids. The spleen can also be a major reservoir of disease and research is happening to find its role in protection against bacterial infection.

A4. The gills: The fish gill is a multifunctional organ involved in gas exchange, iono-regulation, osmoregulation, acid-base balance, ammonia excretion, hormone production, modification of circulating metabolites, aids in feeding and immune defence. The physical barrier of the fish gills consists of the gill epithelium, a glycocalyx layer and a mucus layer. The gill is a major organ for antibody secreting cell production following direct immersion immunization. Lymphocyte and T cells accumulations have been identified in the gill filaments.

A5. The gut: Leucocytes are abundantly present in the lamina propria and intestinal epithelium of the fish gut and fish is having a more diffusely organized immune system in their gut, containing lymphocytes, macrophages, eosinophilic and neutro-philic granulocytes.

A6. Other immune relevant organs: the liver and the integumentary surface: The first barrier against pathogens in fish is the integumentary surface which is equipped with mechanisms to protect against pathogen entry. The most important is the secretion of mucus, containing a diverse group of peptide-based molecules that act both directly and indirectly causing lysis of the bacterial cell wall. The production of mucus is significantly increased when a fish is subjected to stress, and it is apparent that most freshwater species have a higher production of mucus compared with marine species.

The liver metabolises protein, carbohydrate and lipid, secrete bile, do detoxification and also act as an important immune organ. The immune relevance of fish liver is understudied but the large impact on immune gene expression after bacterial infection suggests that the fish liver is actively involved in immune defence.

B. Innate and Adaptive immune response

The development of an immune system is essential for the survival of living organisms. Invertebrates, immunity can be divided into two components, the innate immune response and the adaptive immune response. The innate immune response is the initial line of de-fence against infection, which includes physical barriers and cellular response.

The adaptive immune response is capable of specific antigen recognition and is responsible for the secondary immune response. The innate immune system recognizes conserved molecular structures common to pathogenic microorganisms such as polysaccharides, lipopolysaccharides (LPS), peptidoglycans, bacterial DNA, and double-strand viral RNA, among others, through their interaction with specific receptors like toll receptors (TLRs).

These mechanisms of recognition may lead directly to successful removal of pathogens, for instance by phagocytosis, or may trigger additional protective responses through induction of adaptive immune responses. Cells of the innate immune system have a diverse array of functions. Some cells are phagocytic, allowing them to engulf and degrade pathogenic particles. Other cells produce and secrete cytokines and chemokines that can stimulate and help guide the migration of cells and further direct the immune response.

The adaptive system recognizes foreign structures by means of two cellular receptors, the B cell receptor (BCR) and the T cell receptor (TCR). Adaptive immunity is highly regulated by several mechanisms. It increases with antigen exposure and produces immunological memory, which is the basis of vaccine development and the preventive function of vaccines. The adaptive response generally starts days after infection and is capable of recognizing specific protein motifs of peptides, which leads to a response that increases in both speed and magnitude with each successive exposure.

The main effector cells of the adaptive immune response are the lymphocytes, specifically B cells and T cells. When B cells are activated, they are capable of differentiating into plasma cells that can secrete antibodies. Upon activation T cells differentiate into either helper T cells or cytotoxic T cells. Helper T cells are capable of activating other cells of the adaptive immune response such as B cells and macrophages, while cytotoxic T cells upon activation are able to kill cells that have been infected.

B1. Fish innate immune response

B1a. Pathogen recognition receptors (PRRs): The innate immune response is initiated by detection of infectious agents by pathogen recognition receptors which are germline-encoded. The basic characteristics of PRRs are the same; they all possess a protein domain for recognizing pathogen-associated molecular patterns (PAMPs), or danger-associated molecular patterns (DAMPs) coupled to a protein domain that interacts with downstream signalling molecules.

PRRs can be classified into five major groups.

1. The C-type lectins (CLRs),

2. The Toll-like receptors (TLRs);

3. The retinoic acid inducible gene I (RIG-I)-like receptors (RLRs);

4. The nucleotide binding oligomerization domain (NOD)-like receptors); and

5. The absent in melanoma (AIM)-like receptors (ALRs)

B1b. Antimicrobial peptides (AMPs): Fish continually fight against pathogens by secreting a wide range of antimicrobial peptides (AMPs) as an innate defence mechanism. AMPs, also known as host defence peptides, play major roles in the innate immune system, and protect against a wide variety of bacterial, viral, fungal and other pathogenic infections by disruptive 'lytic' or pore-forming 'ionophoric' actions. In general, AMPs are secreted in the saliva, mucus, circulatory system and other areas which are high-risk pathogen targets. In addition to their direct microbicidal effects, AMPs have other roles in inflammatory responses, including recruitment of neutrophils and fibroblasts, promotion of mast cell degranulation, enhancement of phagocytosis and decreasing fibrinolysis.

B1c. Fish complement system: The complement system is a major component of the innate defence in fish. Almost all of the mammalian complement components have homologues in teleost fish and are equivalent or comparable to the mammalian system from both a structural and functional viewpoint.

The expression of fish complement components: In teleost fish, mRNAs encoding complement components show a substantially wider tissue distribution, and are found in the head kidney, renal (body) kidney, intestine, gill, skin, brain and gonads. These results suggest that the teleost complement system is not only operating in

blood, lymph and body fluids but is also present at the local interface with the environment, potentially ready for invading pathogens. The extrahepatic production of complement components may also play a significant role in the clearance of damaged host cells, organ morphogenesis and tissue regeneration in fish.

Many complement components have been shown to be present in eggs and to be of maternal origin. Some teleost complement components have been recognized as acute-phase proteins suggesting to have an important role in immediate (first-line) defences against microbial infection.

The activation pathways of the fish complement system: The complement system of bony fish and cartilaginous fish appears to be fully equipped with the three C3 (Calvin Cycle)-activation pathways and the cytolytic pathway, and shows many of the effector activities known from the mammalian complement system, such as target cell killing, opsonization and anaphylatoxic leucocyte stimulation.

The anaphylatoxins produced after fish complement activation: Teleost fish, unlike any other known vertebrate group, contain multiple forms of the C3a anaphylatoxin as a result of the multiple isoforms of C3. All of these molecules are functionally active and play a prominent role in inducing oxygen free radical (superoxide) production from fish leucocytes. The C5a anaphylatoxin has also been characterized in fish, and as in mammals plays an important role in leucocyte chemotaxis and in triggering the respiratory burst of leucocytes.

B1d. Cellular components of fish innate immunity: A broad range of key cell types are involved in the innate defence of teleost fish, including monocytes/macrophages, non-specific cytotoxic cells (NCC), NK-like cells and granulocytes (e.g. neutrophils). Some teleosts have been reported to have both acidophilic and basophilic granulocytes in peripheral blood in addition to neutrophils, but in other species only the latter cell type has been found.

• **Monocytes/macrophages:** The mononuclear phagocytic system consists of endothelial cells and macrophages which line small blood vessels and eliminate an array of soluble macromolecular physiologic and foreign waste products from the circulation by receptor-mediated endocytosis and phagocytosis. Based on three different homeostatic activities – host defence, wound healing and immune regulation – macrophages are classified as classically activated, wound healing and regulatory macrophages.

• **Cells involved in non-specific cell-mediated cytotoxicity (CMC):** Non-specific cytotoxic cells (NCC), Natural killer (NK) like cells have been reported to be involved in non-specific cell-mediated cytotoxicity (CMC) in fish. NCCs spontaneously kill a wide variety of target cells including tumour cells, virally transformed cells and protozoan parasites, and express components of the granule exocytosis pathway of CMC.

• **Other innate immune cells:** neutrophils, mast cells and rodlet cells: Neutrophils are key components of the inflammatory immune response against a variety of bacterial, viral, protozoan and fungal pathogens. As one of the first cells recruited to an inflammatory site, neutrophils possess a formidable armoury of responses that in most cases efficiently remove the invading pathogens. Neutrophils can phagocytose, produce toxic reactive oxygen and nitrogen intermediates, degranulate and release neutrophil extracellular traps (NETs) in response to invading pathogens. Teleost mast cells are localized in the vicinity of blood vessels in the intestine, gills and skin, and may play an important role in the inflammatory response because they express a number of functional proteins which act against a broad-spectrum of pathogens. Rodlet cells are unique in fish and are characterized morphologically by their typical cytoplasmic inclusions, the so-called rodlets, and a thickened capsule-like cell border with a functional role in teleost host defence against parasites.

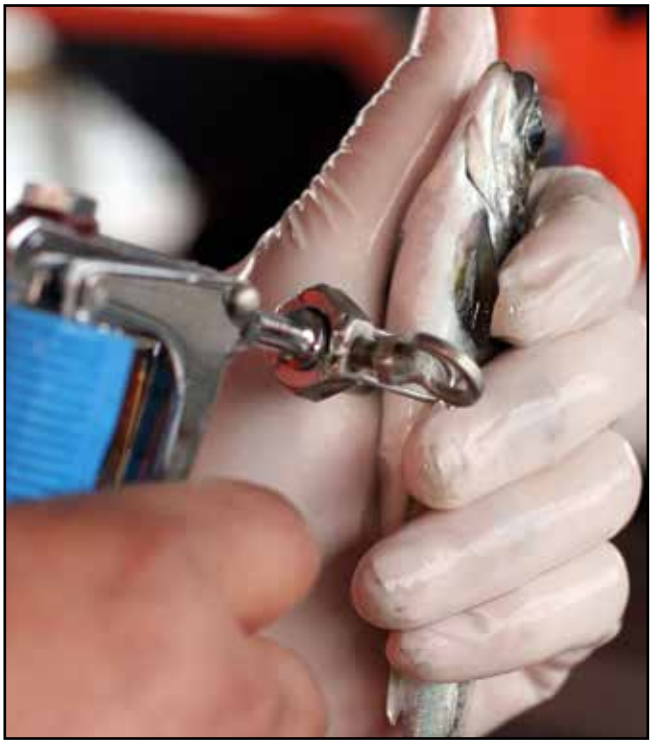
B2. Adaptive immune response in fish

The adaptive immune response is mediated by the actions of B & T groups of lymphocytes, B cells that mediate antibody (humoral) responses and T cells that mediate cell-mediated immune responses. In antibody responses, B cells are activated to secrete antibodies that circulate in the bloodstream and permeate the other body fluids, where they bind specifically to the foreign antigen that stimulated their production.

Binding of antibodies inactivates viruses and microbial toxins by blocking their ability to bind to receptors on host cells. Antibody binding also marks invading pathogens for destruction by phagocytic cells.

In cell-mediated immune responses, T cells are activated that react directly against a foreign antigen present on the surface of a host cell. Unlike B cells, T cells can only recognize antigen that can kill virus-infected host cells that have viral antigens on their surface, thereby eliminating the infected cells before

the virus gets a chance to replicate. In other cases, the T cell produces cytokines that activate the innate defence to destroy the invading microbes.



Vaccination of fish

Repeat infections by the same virus or bacteria are met immediately with a strong and specific response that usually stops the infection and has less reliance on the innate system. Vaccination against infection is possible due to this immune memory. The first adaptive response against an infection, called the primary response, often takes days to mature. In contrast, a memory response develops within hours of infection. Memory is maintained by a subset of B and T lymphocytes called memory cells, which can potentially survive for years in the body. Memory cells remain ready to respond rapidly and efficiently to a subsequent encounter with a pathogen, giving rise to stronger and faster so-called secondary responses.

B2a. The humoral adaptive immune response in fish:

• Immunoglobulins & B cells

A typical Immunoglobulin (Ig) molecule consists of two heavy and two light chains, each of which contain one amino-terminal variable Ig Superfamily domain and one or more carboxyl-terminal constant Ig Super family domains. Three isotypes, IgM, IgD and IgT (also called IgZ in zebrafish) have been identified in almost all studied species belonging to the main orders of teleost fish and IgM is the predominant Ig isotype found in teleost blood/serum. The specific immune response to infection and vaccination has been documented in fish by measuring IgM responses, and more recently IgT responses. The adaptive system of fish deviates from that in mammals due to the plastic nature of fish IgM in both structure and affinity. It could also diversify the antibody's capabilities by producing molecules with specialized effector functions. Another interesting deviation from the mammalian adaptive system is the apparent phagocytic activity of B cells described in some fish, which may indicate that fish lymphocytes have multiple roles.

B2b. The cellular adaptive immune response in fish

• T cell receptors (TCR) and co-receptors

They possess the complex of signalling molecules through which the antigen - TCR interaction occurs with the resultant cellular activation the also possess same basic machinery of co-stimulatory and co-inhibitory surface molecules, as well as transmembrane and intracellular enzymes that ensure the correct balance of activation or inhibition. T cells appear to recognize unprocessed antigen in a manner similar to that of pattern recognition receptors; thus T cells are more like innate immune cells with less dependence on major histocompatibility complex (MHC) presentation and are most abundant in epithelial and mucosal tissues. The fish T cell primary differentiation takes place in the thymus, from where mature T cells migrate to secondary lymphoid organs such as the head kidney and spleen. T cells can also be found in the gills, liver, olfactory pit and gut. Studies have confirmed that teleost fish possess specific T cell-mediated cytotoxicity as reported in humans and mice.

C. Immune regulation: the Cytokine network in fish

Cytokines are secreted proteins with growth, differentiation, and activation functions that regulate the nature of immune responses. Cytokines are involved in several steps of the immune response, from induction of the innate response to the generation of cytotoxic T cells and the production of antibodies.

In higher vertebrates, the combination of cytokines that are secreted in response to an immune stimulation induces the expression of immune-related genes through multiple signaling pathways, which contributes to the initiation of the immune response. Cytokines can modulate immune responses through an autocrine or paracrine manner upon binding to their corresponding receptors.

Cytokines have overlapping and sometimes contradictory pleiotropic functions that make their

classification difficult. Cytokines are produced by macrophages, lymphocytes, granulocytes, dendritic cells (DCs), mast cells, and epithelial cells, and can be divided into interferons (IFNs), interleukins (ILs), tumor necrosis factors (TNFs), colony stimulating factors, and chemokines. They are secreted by activated immune-related cells upon induction by various pathogens, such as parasitic, bacterial, or viral components.

Conclusions

The more we learn about the immune system of fish, the more we realize its complexity. Molecular evidence suggests a similar immune system exists throughout the jawed vertebrates yet marked differences are also apparent. The molecular tools are now well established to measure gene expression changes in fish but analysis of proteins and cell types are still in its infancy. Thus there is still a long way to go to really understand how fish defences are regulated and the different mechanisms that can contribute to protection against disease. Significant challenges are there before the future studies and the knowledge generated will definitely help in the development of novel disease control measures for fish, including vaccination. Although many efficient vaccines are available for fish, there are still a lot of diseases for which no successful treatment is available. Factors such as the immunogenicity of the antigens and the 'type' of immune response elicited are the major reasons why some vaccines are effective and others fail.

The immunogenicity of antigens can potentially be enhanced by adjuvants, and the type of immune response can be manipulated by immune regulatory factors (such as cytokines or pathogen associated molecular patterns (PAMPs) given at the time of immunization. Thus, a greater understanding of fish immune responses could lead to new or improved disease control strategies in this manner.

Another issue in vaccine development is the need for in vitro assays to determine the effectiveness of pilot vaccines. Currently there is an almost complete lack of established correlates of disease resistance, with disease challenge trials increasingly expensive and giving limited information. It seems likely that as we learn more about factors important for fish disease resistance such assays will naturally emerge and help future vaccine trials.

References

1. C. J. Secombes and T. Wang (2012). The innate and adaptive immune system of fish. In: Brian Austin (Ed) Infectious Disease in Aquaculture – Prevention & Control. Woodland Publishing. Pages 3- 48.

2. Sebastián Reyes-Cerpa, Kevin Maisey, Felipe Reyes-López, Daniela Toro-Ascuy, Ana María Sandino and Mónica Imarai (2013). Fish Cytokines and Immune Response. In book: New Advances and Contributions to Fish Biology. Pages 3- 57.

3. Ambika Binesh and Kaliyamurthi Venkatachalam (2019). Cytokine network regulating inflammatory response in fish. International Journal of Fisheries and Aquatic Studies; 7(3): Pages 295 - 298.

Audits by field offices to ensure implementation of MPEDA's COVID-19 guidelines in processing plants

As per the circular issued by the MPEDA, the officials of the Regional Division of MPEDA in Kolkata inspected seafood processing plants to ensure strict adherence to COVID-19 guidelines.

Inspections were carried out at M/s. Milsha Agro Exports Pvt. Ltd., M/s. Shimpo Exports Pvt. Ltd., M/s. Great Fishermen, M/s. New Saha Traders, M/s. A.S. Enterprise, M/s. Global Aqua, M/s. Matara Aquaculture West Bengal Pvt. Ltd., and M/s. Basu International Unit-V.

During the visit, it was observed that the units were fully aware of the COVID-19 guidelines and properly implemented them in the facilities as well as in all operations. This included strict monitoring of body temperature of all employees and visitors, social distancing and sanitization, visual observation and reporting of symptoms, and provision of quarters and canteen facilities to the workers to avoid social contacts.

Body sanitation at M/s. Shimpo Exports Pvt. Ltd., West Bengal

Sanitization of the unit at M/s. Global Aqua, West Bengal

Packaging material disinfection at M/s. Shimpo Exports Pvt. Ltd., West Bengal

Sanitizer tunnel of M/s. Basu International Unit-V.

Temperature monitoring at M/s. Matara Aquaculture West Bengal Private Limited

Hygienic fish handling: NETFISH and Vishakapatnam Port Trust organizes mass awareness drive

Mass communication programme by NETFISH at Vizag FH

NETFISH and the Visakhapatnam Port Trust jointly carried out a mass awareness drive on 23rd and 24th March 2021 on the new initiatives taken by the Harbour Management Committee at the Visakhapatnam fishing harbour.

The committee has decided to implement a toll system as a measure to generate funds for proper implementation of hygiene and sanitation measures at the harbour and also to restrict entry of unauthorized vehicles which hinder smooth traffic on the harbour premises. The awareness drive was intended to give wide publicity on different topics such as the need for toll collection, toll rates decided by the harbour management committee, importance of maintaining hygiene at the harbour, hygienic fish and ice handling methods and safe & secure transportation of fish catch materials.

The Traffic Inspector of Visakhapatnam Port Trust, State Coordinator of NETFISH, Fishery Development Officer from Department of Fisheries and the NETFISH member NGO - DFYWA were actively involved in the successful conduct of the programme. A vehicle mounted with a public address system and displaying banners related to hygienic handling of fish and ice was

Mass communication programme by NETFISH at Vizag FH

used to effectively pass on the message to the fishers. The entire harbour area was covered by the vehicle.

Handouts with the details of the toll fee decided for various types of vehicles and the information on fish quality management measures were distributed during the campaign. The messages were well received by the stakeholders and they expressed their support for the implementation of the toll system for the better management of the fishing harbour.

Breeding breakthrough for Indian sea bream species

CMFRI hope that closing the cycle of marine finfish such as the Picnic Sea bream, will allow the country to produce up to 5 million tonnes of fish in the sea each year

Indian scientists have expressed high hopes of developing the commercial aquaculture of Picnic Sea bream (*Acanthopagrus berda*), following a major research breakthrough. Also known as Black Sea bream and Goldsilk Sea bream, the fish is known for its excellent meat quality and fetches ₹ 450 to 500 per kg in the domestic market. Locally called as karutha yeri, the fish is an excellent species for mariculture owing to its faster growth rate, strong resistance to diseases and ability to cope up with wide variations in environmental parameters such as salinity and temperature.

The breakthrough, achieved at the Karwar Research Centre of the Central Marine Fisheries Research Institute (ICAR-CMFRI), is expected to open up enormous scope for the country's mariculture ventures in near future through species diversification, said Dr A Gopalakrishnan, director of CMFRI. "With the development of hatchery technology for Picnic Sea bream, Indian mariculture is poised for a new surge with exponential increase in marine finfish production and the next task of the institute is to standardise the farming protocol of the fish as no record of breeding and aquaculture of this fish is available in in the country," he said. "India targets 4 to 5 million metric tonnes of fish production in the next 10 years from mariculture.

Species diversification for mariculture is primarily aimed at achieving this target by enhancing the marine cage farming system across the coastal states of the country," he added.The Picnic Sea bream is the seventh marine finfish which has been successfully bred by CMFRI and it took around three years for the team to develop the seed production technology. Previously, the institute has succeeded in broodstock development of species such as like Cobia, Silver Pompano, Indian Pompano, Orange-spotted Grouper, Pink ear Emperor and John's Snapper. CMFRI is happy to transfer these technologies to those interested in commercial production of juveniles, said Dr Gopalakrishnan.

- www.thefishsite.com

International Women's Day: Two Kerala women to be honoured for successful ventures in fisheries sector

KOCHI: Raji George and Smija M B have all the reasons to cheer this International Women's Day. In a model for women empowerment, both of them showed their grit to become successful entrepreneurs in the fisheries sector. While Raji George from Angamali in Ernakulam district scripted the success story in integrated farming, Smija, an engineering diploma holder who hails from Moothakunnam, near Paravur in Ernakulam, chose cage fish farming as her profession.

Smija MB (Left) and Raji George (Photos I Express)

In recognition of their achievements, the Central Marine Fisheries Research Institute (CMFRI) honoured both the women entrepreneurs during the Women's Day celebration held at the institute.Raji started her entrepreneurial initiative by establishing a fish farm named 'Anna Aqua Farm' in a defunct quarry near Angamaly, after receiving training from the CMFRI and the Krishi Vigyan Kendra functioning under the institute. Apart from fish farming, she also runs 'Anna Agro Farm', an agricultural farm focusing on organic vegetable cultivation.

In addition, she undertakes fodder cultivation, an incubator for chicks and a poultry farm which includes chicks, ducks and quails.In as many as eight cages in a deep quarry of 60-feet depth, she farms fishes like gift tilapia, catla, catfish, rohu, mrigal and dam gold. Raji cultivates almost all types of vegetables on her agricultural farm avoiding the use of chemical fertilizers and pesticides. Important crops on the farm include tomato, bhindi, cowpea, brinjal, chilli, carrot, ginger, turmeric, cauliflower, cabbage and tapioca. Her poultry farm has over 250 chicks including local breeds and around 300 quails. Maintaining a sustainable integrated farming system in the homestead plot of 75 cents, Raji George also rears cows and goats. She also finds time to empower the housewives of the locality in poultry farming through experience sharing and disseminating technical information based on her experience. She strategically utilises social media platforms to find a market for her produce and she made home deliveries too.

Smija started her venture by establishing a cage fish farming unit in the Periyar with the technical guidance of the CMFRI. Gradually she expanded her farming into more cages by ensuring the participation of other women in her locality in the venture. Now, she is the leader of a self-help group named 'Periyar Activity Group'.

Her leadership skill helped her popularize the cage farming technology in her entire locality and she made a huge impact in the area with many women forming self-help groups and launching cage fish farming.Her initiative helped many families in the locality to find a regular income through cage fish farming. Apart from her farming activities, she also focuses on providing training to a large number of women in her area inspiring them to become small-scale entrepreneurs in cage farming.

-www.newindianexpress.com

ICAR-CMFRI goes for third harvest of open sea cage farming

Indian Council of Agricultural Research-Central Marine Fisheries Research Institute (ICAR-CMFRI) has gone for the third cage harvest of Indian Pompano and Orange Spotted Grouper, in Visakhapatnam.The cages were lifted in the presence of C. Suvarna, Chief Executive of the National Fisheries Development Board (NFDB).Principal Scientist, Visakhapatnam Regional Centre of CMFRI, Visakhapatnam, Subhadeep Ghosh, said that both the fish varieties have good demand in the domestic market and cage fishing was the future. In Visakhapatnam, the CMFRI has installed 15 cages in RK Beach and five at Mangamaripeta. In 10 cages, Pompano is farmed and in other 10 Grouper is farmed, said Dr. Ghosh.

While the production cost for cage farming is around ₹200 to ₹210 per kg, the sale price of Indian Pompano can go up to ₹350 to ₹450. Thus one can make an outright profit of ₹100 to ₹150 per kg in the domestic market, he said.According to the CMFRI officials, each cage can harvest to the tune to about 1.5 to 2 MT of fishes in one season. Thus per cage one can make a profit of ₹1.5 to ₹2 lakh.The Central government through the Pradhan Mantri Matsya Sampada Yojana (PMMSY)

is encouraging cage farming and farmers have good prospect, said Dr. Ghosh.On the harvest time, he said that the fingerlings weighing around 10 gms were put in the cage around first week of May, last year, and we harvested now after 10 months. Each 10 gm fingerling has now grown to a fish weighing between 750 and 850 gms, he said.Dr. Ghosh said that many farmers and the State Fisheries Department have evinced interest in cage farming. The State Fisheries Department has received about 100 applications from Visakhapatnam alone and all across the State it is around 1,000, he said.

-www.thehindu.com

India celebrates its first transgender seafood entrepreneur

Adhidhi Achyuth at the official launch of her fish vending stall in Kochi

Adhidhi Achyuth has been recognised as "the first transgender person in India's fisheries sector to start an entrepreneurial initiative". The recognition comes from the Central Marine Fisheries Research Institute (CMFRI), who provided her with a modernised fish vending stall in Vennala market, in Kochi.The 36-year-old decided to become an entrepreneur after undergoing difficult and unpleasant experience in securing a job and maintaining it as a means for living. Under the central government scheme of the Scheduled Caste Sub Plan (SCSP), CMFRI spent around ₹500,000 to set up the fish stall. It includes a freezer, a fish display table with cooler, billing machine, scales and other facilities for cutting and cleaning the fish, along with the facility for maintaining the fish in live and fresh conditions.

Live fish, from sources including aquaculture facilities, will be available form the fish stall, which was inaugurated by the cine artists Harisree Ashokan and Molly Kannamally. Apart from direct sale, home delivery of the cleaned and sealed packets of fish will be available for the pre-booked customers. Dr K Madhu, chairman of the SCSP scheme and principal scientist of the CMFRI, handed over the key of the stall to Adhidhi at the function."CMFRI have been providing training to become small-scale entrepreneurs in cage fish farming to the people belonging to the SC communities across the country," he said.According to Dr A Gopalalkrishnan, Director of CMFRI, the institute turned to Achyuth, who is part of the scheduled caste (SC) community, as the second phase of implementing the SCSP scheme focused on transgender members of the community.

"This is part of CMFRI's aim to gender mainstreaming of the transgender members, who are the most marginalised community in the society, by generating livelihood opportunities in the fisheries sector. The CMFRI will extend the service of the scheme to more transgender members in the SC community. The institute also aims to empower the transgender members by attracting them to cage fish farming in the future by giving them proper technical guidance," he said.

- www.thefishsite.com

Global Tuna Alliance, others introduce 2025 Pledge towards Sustainable Tuna

The Global Tuna Alliance, Friends of Ocean Action, and the World Economic Forum have introduced the 2025 Pledge towards Sustainable Tuna (25PST), a new global commitment supporting responsible global tuna fisheries management and harvesting.

The three organizations are inviting businesses throughout the tuna supply chain, governments, and civil society organizations committed to sustainable tuna to sign onto the pledge, which calls for signatories to commit to working towards a global tuna sector that meets the highest standards of environmental performance and social responsibility through demonstrable improvements in supply chain practices and fisheries management.The 25PST replaces the Tuna 2020 Traceability Declaration, a voluntary statement that emerged from a dialogue among governments, businesses, and civil society organizations convened by the World Economic Forum. Spurred by the UN Ocean Conference in 2017, the Tuna 2020 Traceability Declaration was endorsed by 67 leaders of the world's retailers, tuna processors, marketers, traders, and harvesters, with the support of 21 influential civil society organizations and six governments. The progress report published by the Global Tuna Alliance highlighted key achievements by the signatories on its completion, and 25PST will further build on this momentum, according to a Global Tuna Alliance press release.

"I strongly welcome the 2025 Pledge towards Sustainable Tuna and the clear commitment of leaders from a range of sectors to take better care of tuna fisheries globally. Improving fisheries management is a key focus of the Sustainable Development Goal for the ocean, SDG14, to conserve and sustainably use the ocean's resources. We have to work together to ensure tuna fisheries are environmentally and socially responsible, from bait to plate, and I urge seafood businesses, governments and civil society organizations to join this important pledge," said Ambassador Peter Thomson, the United Nations Secretary General's special envoy for the ocean and co-chair of Friends of Ocean Action.Tuna is a keystone species of the seafood industry – accounting for at least USD 42 billion (EUR 35.2 billion) of the USD 150 billion (EUR 125.6 billion) annual global seafood trade. Additionally, the tuna industry directly employs more than six million people, according to the Global Tuna Alliance. However, overfishing, weak management, and human rights, and labor concerns are threatening tuna stocks and creating risk and uncertainty for the industry and others reliant on tuna directly or indirectly for nutrition or their livelihoods.

Photo courtesy of WWF

Long and complex supply chains can make it difficult for product information to be recorded accurately and consistently and shared throughout each step in the chain, according to the Global Tuna Alliance. Commitment and collaboration across geographies and sectors are essential to improve the tuna supply chain, it said."Our shared vision of tuna meeting the highest standards of environmental performance and social responsibility will be boosted by the 2025 Pledge towards Sustainable Tuna and I strongly encourage other business, government and civil society leaders to sign up and join the movement towards much greater sustainability," Global Tuna Alliance Executive Director Tom Pickerell said.

- www.seafoodsource.com

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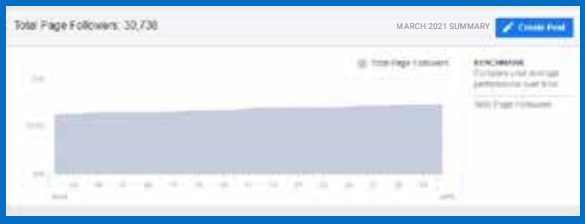

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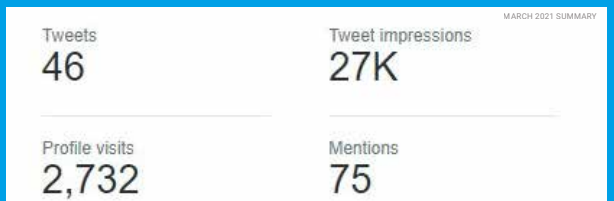

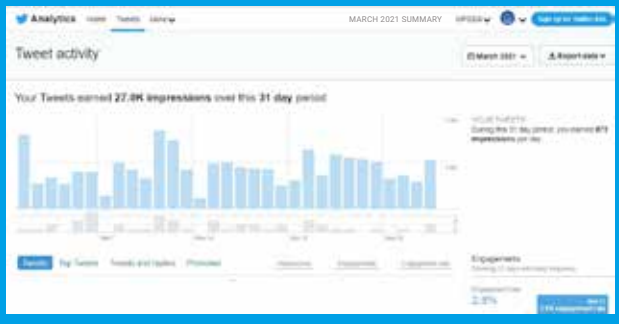

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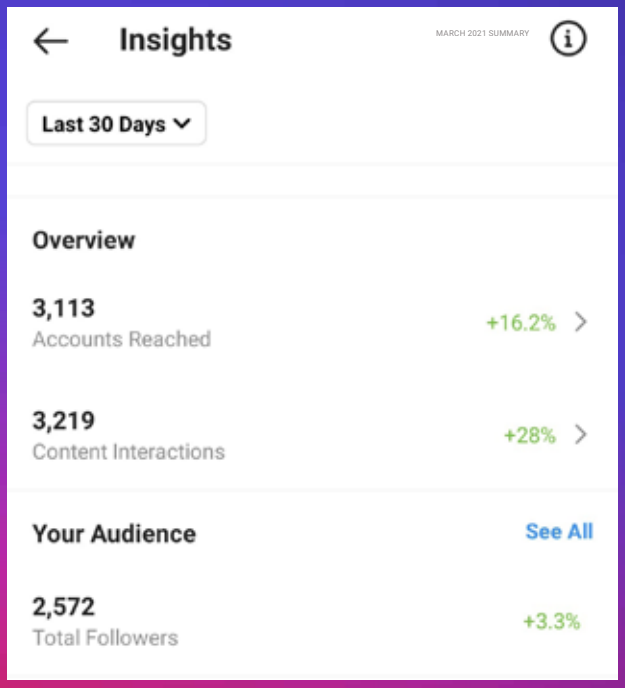

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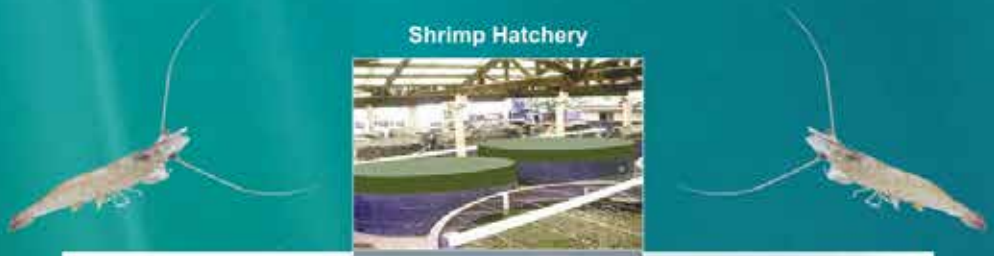

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