MPEDA

Newsletter

VOL. IX NO. 12 MARCH 2022

MAIN STORY
A & N Islands: Policy Interventions for Export Promotion

Pelagic Fin Fishes Top Marine Fish Landings in Feb 2022

Global Currency Outlook

A Guide to HACCP Implementation

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On the Platter

K. S. Srinivas IAS
Chairman

Dear Friends,

As you know, the Ministry of Commerce &Industry has set an export target of US$ 7.8 Billion during the current financial year for marine products. I am elated to inform you that the marine products'exports up to February 2022 has reached an all-time record figure of US$ 7.2 billion, and I am hopeful that at the current growth rate, the sector will easily achieve the target by the end of March. I congratulate all the stakeholders including the officers of MPEDA for achieving the landmark record in spite of facing many hurdles from many quarters including the Covid Pandemic situation.The support extended by the Ministry of Commerce & Industry, Govt. of India in boosting the exports is also commendable. As you all know, the country could achieve the export target of US$ 400 billion for the goods sector well before the closure of the financial year.

I also thank the Department of Fisheries for sanctioning two prestigious projects to MPEDA-RGCA under the Pradhan Mantri Matsya Sampada Yojana(PMMSY) scheme. The first project is to establish a Shrimp Evaluation Study Unit for Black Tiger shrimp at Rajakkamangalam in Kanya Kumari district of Tamil Nadu and the second project is to establish a pilot scale Brood Stock Multiplication Centre (BMC) for Black Tiger shrimp at Vizag.I am sure that these projects will go a long way in reviving the production and export of Black Tiger shrimp in the country. Another proposal on production of SPF polychaete broodstock cleared by PMMSY Apex Committee awaits approval.

Since my joining in MPEDA in August 2018, I could understand the constraints faced by the seafood sector in enhancing production and export of marine products. We face both tariff and non-tariff trade issues in all the major seafood markets such as US, EU, China, Japan, Russia Australia etc. The Covid pandemic has become a bolt in the blue for the sector, especially because of the suspensions of our companies by China. However, through timely interventions, MPEDA could guide the stakeholders and enhance their resilience. We helped the stakeholders to tide over the lock down environment, logistic disruptions, and also educated them on complying to import regulations. For the first time in the history of India, due to the initiative taken by MPEDA, a survey of marine mammals in Indian EEZ was done with the support of CMFRI and FSI. As physical participation in overseas fairs and buyer seller meets were constrained due to Covid -19 situations, MPEDA used virtual platforms effectively to interact with buyers and used social media to promote Indian seafood among them. We started a Quality Control Lab in Porbandar, renovated the lab in Bhubaneswar and opened more ELISA labs and Aqua One Centers to offer testing and diagnostic services to farmers. MPEDA realized the importance of modernization of fishing harbours and highlighted the importance of creating land-based infrastructure and professional management thereby enhancing the unit value realization for our marine products. As part of this, MPEDA has signed an MoU with Cochin Port Trust to modernize the Cochin Fishing Harbour. I am very happy to inform that Govt. of India has sanctioned the modernization projects of several harbours including Cochin. This will set the tone for more such modernization projects in future.I am sure that the efforts chipped in by MPEDA will go a long way in promoting our seafood sector, so that India will be able to grab 10% share in the global seafood trade not far from now.

Time has come for me to leave MPEDA and to join back to my parent cadre. At this moment, I thank Shri Piyush Goyal Ji, Hon'ble Minister of Commerce & Industry, Shri B. V R. Subrahmanyam, Commerce Secretary and officials of various departments and organizations, the Seafood Exporters Association of India, and all my colleagues in MPEDA and its societies, for the constant support, co-operation and encouragement extended to me during my tenure in MPEDA. I extend a warm welcome and best wishes to my successor in taking the sector to further heights in future.

Thank you all once again, Good bye!

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MPEDA organized Virtual Buyer Seller Meets in association with foreign missions abroad

Japan

MPEDA in association with EoI, Tokyo, Japan has arranged a Virtual Buyer Seller Meet (VBSM) with M/s. Hamasho Co. Ltd. from Japan on 18th February 2022. M/s. Hamasho Co. Ltd. was represented by Mr. Noburu Morimoto, President and Mr. Seiichiro Konda, General Manager (Sales). Dr. T. R Gibinkumar, Deputy Director (Market Promotion & Statistics), MPEDA welcomed the buyers to the meet. The buyers preferred value added products like Nobashi shrimp.

The exporters were called one by one to give the presentation and 9 exporters participated in the VBSM. Following the presentations, the buyers were asked on the various certifications, type of value added shrimps offered for export, seasons of catch, sourcing of raw material, processing equipments used, grades of shrimps available for exports etc.

Mr. Manoj Singh Negi, First Secretary (Commerce), EOI, Tokyo Japan participated in the meet and told that further VBSMs could be planned in association with MPEDA to augment the exports. Interpreter services were offered by Mr. Jun Nakayama, Executive Assistant, MPEDA Trade Promotion Office, Tokyo.

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Nigeria

MPEDA in association with Lagos Chamber of Commerce and Industry has organised a Virtual Buyer Seller Meet on 16th of February 2022. The VBSM was attended by 15 importers from Nigeria and 9 exporters from India. Dr. T. R Gibinkumar, Deputy Director (Market Promotion & Statistics), MPEDA gave an introduction about the marine products export to Nigeria. Indian seafood exports to Nigeria has reached USD 0.26 million in the current financial year (2021-2022) and frozen fish is the sole

Participants of VBSM with Nigeria

Table 1: Export of marine products to Nigeria during last five years					
	2016-17	2017-18	2018-19	2019-20	2020-21
Quantity (MT)	100	119	20	61	0
Value (Rs Crore)	1.39	2.89	0.35	0.89	0.00
Value (US$ million)	0.21	0.45	0.05	0.13	0.00

commodity exported to the market. The VBSM is aimed to uplift and diversify the exports from India to Nigeria. President, Lagos Chamber of Commerce and Industry briefed on the long term cooperation between Indian and Nigeria in trade and wished the VBSM would yield fruitful results.

The exporters from India gave presentations on their company, products, certifications etc. The importers had questions regarding various species of fishes offered for export from India and their fat content. Dr. Gibinkumar replied to the queries of the buyers and told about the vast variety of fish species available in India with variable fat content. The meeting concluded with the Vote of Thanks by Mrs. Anju, Deputy Director (Market Promotion & Development).

Marine product exports to Nigeria

In the last five years, Indian seafood export has decreased from US$ 0.21 million in 2016-17 to US$ 0 million in 2020-21, with an all time high value of US$ 0.45 million in 2017-18. Export summary reports are given in table 1.

Major item - wise exports to Nigeria

During the year 2020-21, India had no seafood exports to Nigeria. Frozen Fish, dried items and other items were exported to Nigeria earlier.

Target for exports to Nigeria in 2021-22

The target set for the export of marine products to Nigeria for the year 2021-22 is USD 0.30 million. During the period April - December 2021, India has exported marine products worth USD 0.26 million as per MPEDA data and has achieved 85% of the target.

It is to be noted that the total seafood import of Nigeria was USD 1307.62 million (2020-Trade Map, HS code: 03+1604+1605+1504+230120) and India's seafood export to Nigeria in 2020 was USD 0.19 Million with a share of 0.01%. The details of total and India import with % share shown in the table 2.

Table 2: Nigeria's global import scenario					
Year	2016	2017	2018	2019	2020
Nigeria's total Import (US$ million)	700.65	717.08	701.63	810.08	1,307.62
Nigeria's Import from India (US$ million)	0.75	0.25	0.19	0.39	0.19
India's share (%)	0.11	0.04	0.03	0.05	0.01

Global currency outlook forecast report

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USDINR

The Indian Rupee against the US Dollar has been consistently depreciating when seen over a longer period of time. RBI has been seen consistently intervening in the currency market to protect against sudden movements, especially during volatile global financial markets. This artificial creation of demand and supply tends to create an over-valued Rupee, which bursts once the whistle blows. Since 2008, every five years, the currency pair has seen a substantial shift in the range of its movement within a short period of time.

The USDINR chart indicates such large movements (marked in blue ellipses) in quick time to adjust for the over-valuation. The below table gives a better clarity of these large USDINR moves.

Start level	Start month	*End level*	*End month*	*% change*
39.98	Apr 2008	*52.17*	*Mar 2009*	*30%*
53.73	Apr 2013	*68.85*	*Aug 2013*	*28%*
63.33	Jan 2018	*74.40*	*Oct 2018*	*17%*

The green trendline connecting the lows is the support line and indicates a long term support at around 73-74 level. Also note the 377-day simple moving average which has indicated crucial turning points in history. Locally, FII inflows on account of LIC IPO may keep the Rupee buoyant and strong in Mar'22. From Apr'22 onwards, we feel the Indian Rupee is going to have a challenging time. In the last 6 months, dollar index has surged from 92 to 99 and it is expected to continue outperformance in 2022 due to Fed's more hawkish stance on interest rates compared to its European and Asian counter-parts.

US Fed's stance on quick unwinding of economic stimulus and their tone for increases in the interest rate trajectory (to contain the ever rising and sticky inflation) is getting more hawkish in each subsequent meeting. This will have a substantial impact on FII inflows into emerging markets including India. With lower dollar inflows, higher dollar index and higher crude prices, rupee will certainly face the heat. My sense is that Q2 and Q3 of 2022 will be the period when USDINR will substantially change its trading range, probably move towards 78-80. After 2018, could it be 2022 instead of 2023? Quite likely. Prepare for high volatility.

EURUSD

In a risk averse market scenario, funds are finding their way to safer-haven (read US Dollar). Further higher inflation in the US when compared to European countries has made the single currency witness a fall all the way to 1.09. European Central Bank in its March meeting announced that it was winding down

its asset purchase programme faster than anticipated even though Russia's invasion on Ukraine posed risk on growth.

After being dovish on interest rates for some time, ECB finally delivered a hawkish surprise opening the door to higher interest rates at some point later in 2022. With inflation expected to be considerably higher in short term, the high energy costs could further drag the demand.
On the daily technical chart, after the formation of a double top (blue ellipse) since the beginning of 2022, the currency pair, EURUSD has fallen below the psychological level of 1.10. In an extended downtrend, the support becomes important. As of now, the green line connecting lows of 2017 and 2020 is giving the much needed support. The pair fell to 1.08 on economic uncertainty, way below its 50-day simple moving average of 1.1270. The momentum indicator RSI 14 has revived from the oversold zone and is seen consolidating at 40 mark.

The above assessment runs a risk if the ongoing tensions between Russia and Ukraine worsens. On persistently rising geo-political concerns (rising crude prices are an uncomfortable fall out), there could be flight to safety and the dollar might continue to gain (weakening other currencies including the euro).

GBPUSD

Last year, the pound was relatively stable during the first six months, but the second half owing to increase in Covid fatalities and unwinding of fiscal stimulus in all major economies, the cable lost its firm base. This year saw the growth figures forecasted by IMF for UK slightly higher at 6.8% compared to 6% for US. The Bank of England (BoE) has been quicker than the US Fed to hike interest rates, there has been one hike of 0.15% in Nov 2021 and a subsequent 0.25% in Feb 2022 bringing the rate to 0.5% from 0.1% earlier.

This comes in the backdrop of inflation running at a 30 year high of 5.5% and highest government budget deficit in over 50+ years which currently stands at 14.9% of the GDP. During its March meeting the committee's stance would be noted for further cue. At UK, employment rates, wage growth and manufacturing activity is back to pre-pandemic levels. The case for US economy too does look similar, inflation rate is at 7.5%, the interest rate is still at 0% although there's expectation of 3-4 rate hikes in 2022 and all other economic indicators have rebounded at a quick pace to pre-pandemic levels.

Going ahead the hike in US interest rates, Ukraine-Russia conflict in the short term, high commodity inflation, an unexpected rise in global Covid cases and any Brexit related issues will be bearish for the pound.

On the daily technical chart, GBPUSD pair has broken past the green support line, connecting 2020 and 2021 lows. In the short term, if the Russia-Ukraine crisis worsens we can expect a flight to safety, leading to a weaker Pound (and stronger dollar), having attempted 1.3050 support.

The downward sloping double top marked in parallel channel, indicated a fall which has been witnessed already, but a further fall from here is likely given high energy prices and inflation levels. Support is seen at 1.29 level marked in brown.

USDJPY

Japanese Yen has been consistently under pressure throughout the year 2021, weakening from 102-103 levels to currently around 115-116. In the short term, developments surrounding the Russia-Ukraine saga would continue to influence the Yen considering its safe haven status.

In the medium term, economic performance and interest rate trajectory will have greater impact. With US inflation on fire and the Fed turning increasingly hawkish, a quick increase in the funds rate will favour a dollar rally. In Japan, on the contrary, there are no inflation worries for Bank of Japan (BoJ) and hence no fears of a weaker Yen. As Fed starts to raise rates and eventually reduce their balance sheet size, and with BoJ continuing their quantitative easing, such monetary policy divergence will keep pushing the Yen lower. Japan is the only major economy to report a larger budget deficit in 2022 compared to 2021. Moreover, a bleak manufacturing outlook and persistently higher crude oil prices paint a bearish Yen picture.

Technically, the USDJPY pair has easily gone above the January 2022 high of 116.35 and its immediate resistance 118.66 seen in December 2016. The price has moved within the upward sloping green parallel channel since October 2021 while MACD has indicated a negative divergence – marked in brown (it has moved down making lower peaks despite higher highs in the prices), suggesting a possible minor cool off before the next big up-move. An upward moving trendline (blue color) connecting the dollar lows of Jan'21 and Sep'21 comes around 113.10-113.30 – any break of this trendline could send the dollar plummeting though less likely scenario as of now.

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Marine landings in February 2022 constitutes more of Pelagic fin fishes

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

Marine fish landings at selected major harbours/ landing centres in India is monitored and recorded on a real-time basis by NETFISH, as part of the Catch Certification system of MPEDA. The Harbour Data Collectors engaged at around 100 landing sites across the country record the details of the fishing vessels arriving at the harbour/landing centre and the species-wise quantity landed by these vessels, on a daily basis. This report summarizes the species-wise, harbour-wise and state-wise fish catch and boat arrival trends observed in February 2022.

I.OBSERVATIONS ON FISH CATCH LANDINGS

A total of 66,248.62 tons of marine fish landings was recorded from the 97 selected landing sites during February 2022. The total catch was composed of 31,719.71 tons (48%) of pelagic finfish resources, 20,681.86 tons (31%) of demersal finfishes, 8,906.21 tons (13%) of crustaceans and 4,940.85 tons (8%) of molluscs (Fig.1).

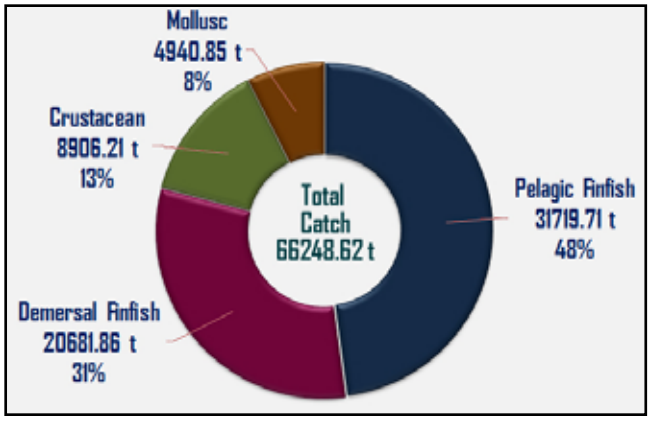

Fig.1: Catch composition of marine landings recorded in February 2022

Of the 249 species of marine fishery items recorded during the month, the top five contributors were *Rastrelliger kanagurta* (Indian mackerel), *Lepturacanthus savala* (Ribbon fish), *Nemipterus japonicus* (Japanese thread fin bream), *Otolithes ruber* (Tigertooth croaker) and *Katsuwonus pelamis* (Skip jack tuna)(Table1).

Table1: Major fish species landed during February 2022

Sl. No:	Common name	Scientific name	Qty. in tons
1	Indian mackerel	*Rastrelliger kanagurta*	8024.82
2	Ribbon fish	*Lepturacanthus savala*	5509.89
3	Japanese thread fin bream	*Nemipterus japonicus*	4551.53
4	Tiger-tooth croaker	*Otolithes ruber*	3056.62
5	Skip jack tuna	*Katsuwonus pelamis*	2261.40

The various species of fishery items recorded during the month were categorized group-wise and the catch trend was analyzed. Mackerels, Ribbon fish, Coastal shrimps, Croakers and Tunas were found as the major contributors, together forming 45 % of the total catch (Fig 2).The other major items reported were Threadfin breams and Squids, each contributing more than 3,000 tons, to the total catch.

Among pelagic fin fishes, the Indian mackerel and Ribbon fish dominated the catch, whereas among demersal fin fishes, Croakers and Japanese threadfin breams were the most landed items. About 62 % of the crustacean catch was comprised of different species of Coastal shrimps, within which the *Karikkadi* shrimp was the dominant species. In the case of the molluscan resources, squids and cuttlefish were the major items landed.

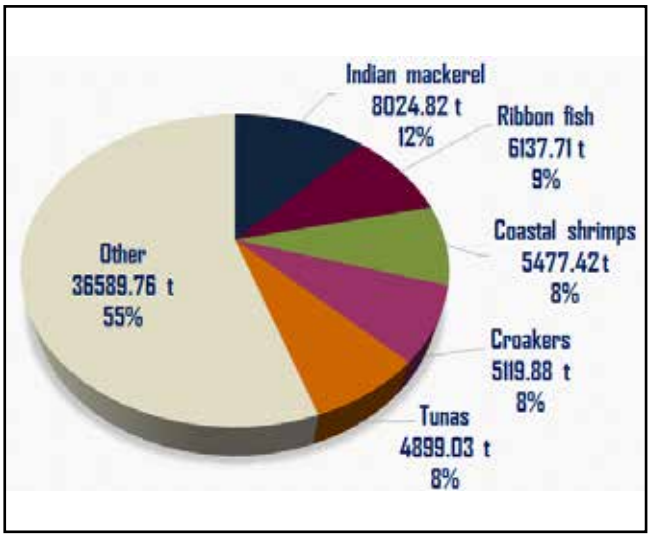

Fig.2: Major fishery items landed during February 2022

State-wise landings: The West coast states lead the tally in terms of total marine fish landings recorded during the month. Gujarat stood first, with a contribution of 14,778.41 tons (22%) to the total catch. Kerala, Maharashtra and Karnataka followed in the list with a share of 12,045.89 tons (18%) and 11,486.38 tons (17%) and 9,493.30 tons (14%) respectively (Fig.3).

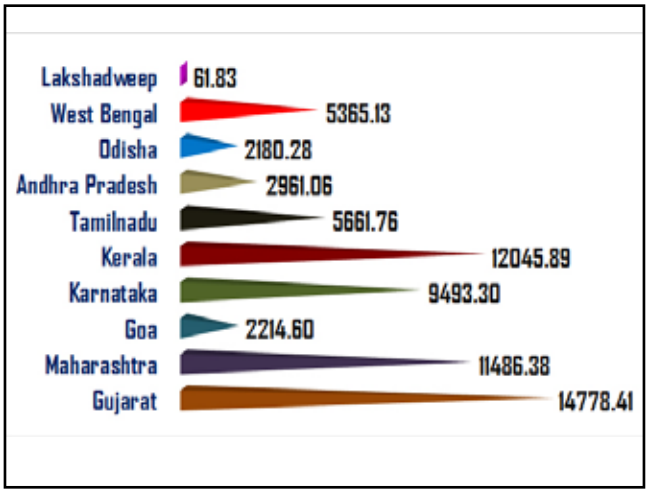

Fig.3: State- wise fish landings (in tons) during February 2022

Harbour-wise landings: The monthly landing is reported from 97 harbours along the 9 coastal states and the Lakshadweep Island. The New Ferry Wharf harbour in Maharashtra had recorded the maximum fish landings of 4,686.07 tons (7%), followed by Veraval and Mangalore harbours, with a landing of 4,306.93 tons (6%) and 3,528.76 tons (5%) respectively.

II.OBSERVATIONS ON BOAT ARRIVALS

A total of 39,553 nos. of fishing vessel arrivals was recorded from the 97 fish landing sites during February 2022. State-wise figures (Fig.4) shows that the highest number of boat arrivals had occurred in Kerala (27%) and then in Gujarat (18%) and Tamil Nadu(13%). Porbandar (1,964 nos.), Mangrol (1,614 nos.) and Veraval (1,312 nos.) harbours in Gujarat had recorded the highest fishing vessel arrivals during the month.

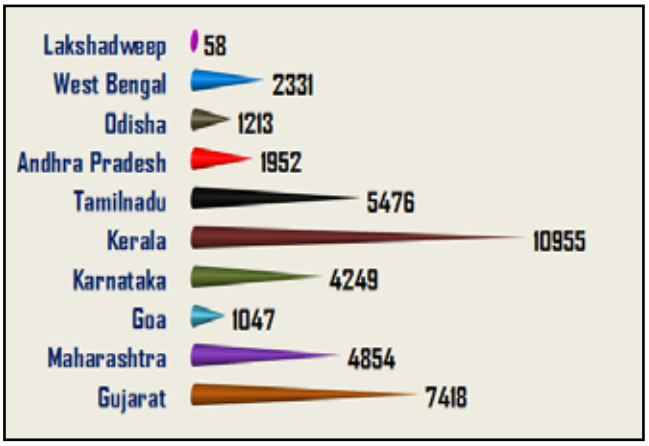

Fig. 4: State - wise boat arrivals (nos.) during February 2022

Summary: In February 2022, a total of 66,248.62 tons of marine landings and 39,553 nos. of boat arrivals were reported from 97 major fishing harbour/landing centres along the 9 maritime states and Lakshadweep Islands. The declining trend in the marine landings continued this month as well, with a decrease of 8,496.91 tons in total catch compared to that of January 2022.

The number of boat arrivals also decreased in February 2022, recording 1,608 nos. less than January 2022. Pelagic fin fishes continued to contribute maximum to the total landings. The Indian mackerel (*Rastrelliger kanagurta*) remained as the most landed species in this month as well.

Gujarat had remained in the first place among the states in terms of total catch landed whereas, Kerala continued in the first place with regard to the most number of boat arrivals recorded for the month. Among the landing sites, the New Ferry Wharf harbour remained in the first position in terms of total catch landed and the Porbandar harbour continued in the first place with most number of boat arrivals.

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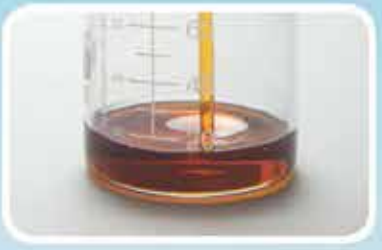
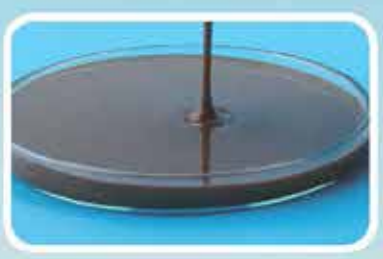

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Andaman and Nicobar islands - Policy interventions for promotion of Seafood export

Anjana Sunil, Nayanthara S., Gidhu Mohan & Sakthivel A., Marketing Service Section, MPEDA , Kochi -36

Introduction

The Andaman and Nicobar Islands is a union territory of India and having a vast potential for the development of fisheries. Large productive coastal areas and continental shelves along with unpolluted waters having numerous bays, creeks and inlets areas make it an ideal place for fisheries. Andaman and Nicobar Islands though being a thrust area in marine fisheries with its immense potential, it is a fact that it is not properly exploited.

The Andaman & Nicobar Islands are located at a distance of about 1000 NM from the mainland, India and less than 600 NM from neighbouring countries such as Thailand, Myanmar, and Malaysia. The bane for the development of the Fishing Industry in the Islands is that, at present, there is no connectivity, either by Air or Sea, between the Islands and the South East Asian Countries which are major markets for marine products. The marine products from the islands are routed through the mainland ports to different destinations, which is not economically viable, and also lead to compromise quality. Policies are required to be developed to overcome the existing hurdles and to increase the export and revenue of fishers from the Island.

Hurdles hindering the seafood production

Certain obstacles are hindering the development of fisheries sector in the island. Lack of proper infrastructure facilities in fishing vessels, harbor/landing centers, farming areas and processing plants for production, processing and export is the major reason to retard the growth of the sector. Non-allocation of suitable land for farming, insufficient processing centers, inadequate logistic facilities, shortage of potable water, absence of direct air connectivity, non availability of technically qualified manpower, poor data on fish and fishery resources, etc also hamper the promotion of seafood export from the Island.

Fisher-folk population	7100
MPEDA Registered Processing Units	1
No. of fish traders	38
No. of registered motorized non mechanized vessels	2311
No. of registered motorized and mechanized vessels	172
No. of registered non-motorized vessels	1630
No. of Ice plants	4
No. of cold storages	5
(Source: Fisheries Department – NIC Andaman)	

Interventions required enhancing the seafood export

1.Capture Fisheries

The quality of sea caught material can be improved through better handling and preservation of the catches onboard using the basic cold chain facilities such as Insulated/refrigerated fish hold, fish boxes, slurry ice making machine in all the Island fishing vessels. Fishing harbour/ Landing Centres such as Phoenix Bay, Junglighat, Mayabundar, Durgapur, Digilpur, Rangat Bay & Yerrata should be modernized by incorporating temperature controlled auction hall and chill room with uninterrupted supply of potable water, ice, fuel and electricity.

A net mending unit, boat building yard and approved handling facilities in the harbor premises will attract more vessels for landing and traders of the Island. Introduction of vessels with advanced facilities to collect and keep the fishes like Reef cod (Leopard coral

grouper and Humpback grouper), Mud Crab etc in live condition for export purpose will fetch USD 28-150/kg in the South East Asian markets such as Taiwan, Hong Kong and China. With the support of Govt. of India and fisheries institutions, Island administration can promote the deep sea fishing which in turn will increase the export of tuna and allied species into the world market.

2. Culture Fisheries

The reef fishes such as *Epinephelus areolatus* (Areolated Reef cod), *Plectropomus leopardus* (leopard coral grouper commonly called Dollar fish), *Variola louti* (Moon Tail Seabass) are the potential items in the Island waters having high demand in South East Asian countries and China. Mainly small size reef fishes of about 100 – 300 gm are landed in the Island and fetch lower price in export and domestic market.

There is an enormous scope to develop open sea cage farming in the Island to fatten reef fishes to about 500 – 1000 gm in order to fetch a higher price. Sea-cage farming of Cobia, Pompano, Seabass etc can also be encouraged based on hatchery produced seeds. Fattening of mud crabs are possible to experiment in the Islands at commercial scale, as it is having immense potential market in South East Asian countries.

Supply of mud crab seeds from a commercial hatchery can boost production of soft shell crab and mud crab farming. Seaweed culture of species such as *Gracilaria spp., Pyropia spp., and Sargassum spp.* can be prioritized and promoted as it has great potential and demand. Setting up of seed production units of commercially important culture species is also vital to decrease the pressure on wild stocks.

The Island is blessed with favourable environment and suitable climate similar to the South East Asian countries, so there is a prospect to adopt the farming practices from these countries. It is also imperative that the research organizations shall support aquaculture efforts through introduction of seed production technologies for commercial species and through genetic improvement measures.

Fig. 1: Epinephelus areolatus

Fig. 2: Plectropomus leopardus

Fig. 3: Variola louti

Fig.4: Sea Cage culture

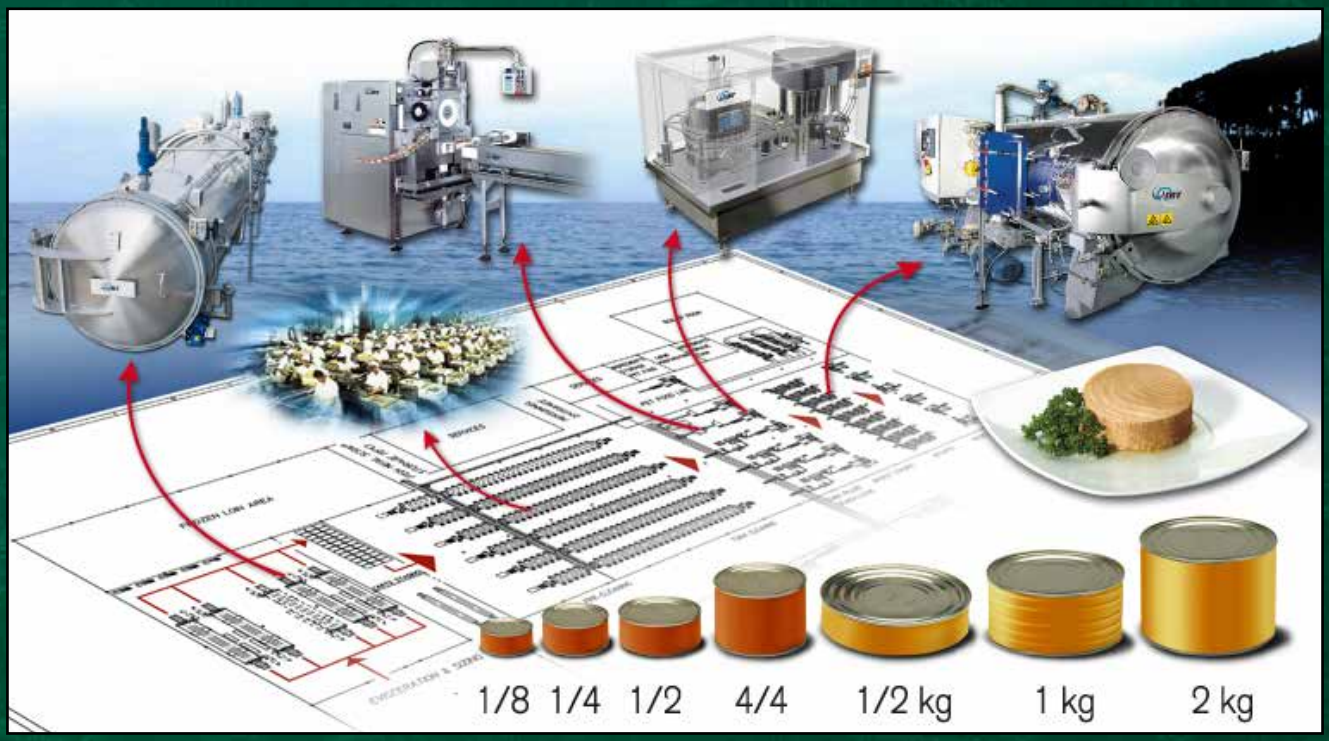

Fig. 5: Schematic representation of a canning unit

A&N islands is also home to the Pearl Oyster species such as *Pinctada fucata* (Oriental / Akoya Pearl oyster) and *P. margaritifera* (Black lip pearl oyster). Farming of silver and black pearls in bays and lagoons on racks or rafts will also help the island folk to enhance their livelihood revenue.

3. Processing and value addition

Processing plants with ample infrastructure facilities is crucial for handling high value fishes such as tuna and reef cods to export them in sashimi or valued added product forms. The technologies followed by the neighboring countries such as Maldives and Sri Lanka can be adopted to produce and export high quality tuna products such as fillets, loins etc. from the Island.

The rich resource of tuna will also be helpful in setting up canning facility. Introduction of factory vessels will enable the supply of enough quantity of quality seafood to the processing units in the island for reprocessing and export.

Even advanced technology can be infused in traditional processing methods such as drying to make dried and smoked product similar to *Katsuobushi* which are of good demand in East Asian and US markets.

4. Traceability

A proper reporting mechanism for collection of fish landing data in real time basis is required for effective management of fisheries sector.

A database on fish landing and implementation of Vessel Monitoring System in the fishing vessel is essential for monitoring and implementing fishery management plans in the Island.

This will help in fulfilling the traceability requirements of the importing nations as well as the safety of fishers at sea.

Accurate fishery data collection and monitoring will facilitate towards the formation of fishery database which includes fishing vessels operating in EEZ, catch quantity, species composition, capture area, biological condition of species harvested and fishing effort.

This will give the fundamental data for long term resource management, fisheries governance and insight to entrepreneurs for investment in the Island.

5. Market Promotion

Connectivity between the islands and nearby international destinations through air and sea routes will enhance the promotion of live & chilled fish exports

from the islands. It is pertinent to note that the seafood industry in the Island countries such as Sri Lanka and Maldives has already gained a brand identity in the international market.

There is a great possibility for creating a Brand Image for “Andaman tuna”, “Andaman reef cod”, etc in world markets because of the mode of fishing followed in the pristine waters of Island. Proper traceability and related documentation will help the island fishers to access neighboring export markets.

6. Training and Capacity Building

The fishermen community in the Andaman and Nicobar Islands use traditional methods of fishing and as a result of this, a large quantum of pelagic and oceanic fish resources is not tapped to potential.

Currently, there is lack of technical knowhow among fishers in the areas of fishing technology, value addition etc. Pilot demonstration of advanced fishing gears and crafts to fishers will help the fishers to adopt such fishing practices to enhance the economic viability of fishing operations.

Hands on training should be conducted in collaboration with Indian/foreign experts for developing good handling practices and producing value added products. Demonstration centers can be set up at strategic locations for creating awareness programmes and to introduce new techniques.Result demonstration and cross country visits are essential to augment the skills of the stakeholders for the optimal utilization and management of natural resources.

Empower womanhood of island by actively involving them in culture of seaweeds so as to augment seaweed production. Women SHGs can also be engaged in pearl culture activities to enhance their employment opportunities and earnings. The technology for pearly production is available with institutions such as CMFRI.

Conclusion

Andaman & Nicobar being a group of Islands completely cut off from the main land has many challenges and opportunities that need an entirely new approach to deal with. With a vast, yet untapped marine potential, Andaman and Nicobar Islands can significantly contribute to the marine product exports from India.

For achieving the above, policy interventions for enhancing the production, reducing the post harvest losses, increasing the unit value, addressing market access issues are essential. Policies must be able to meet the multi dimensional and emerging needs of island fisheries in all aspects.

The Island Administration has to tap funds available under various Central sector schemes for the overall development of the marine fisheries sector of the Island.

The vivid nature of seafood from sustainable and traceable resources, enhanced production, improved quality of products and the range of products offered through value addition can be used for branding and promoting Indian seafood in various overseas markets.

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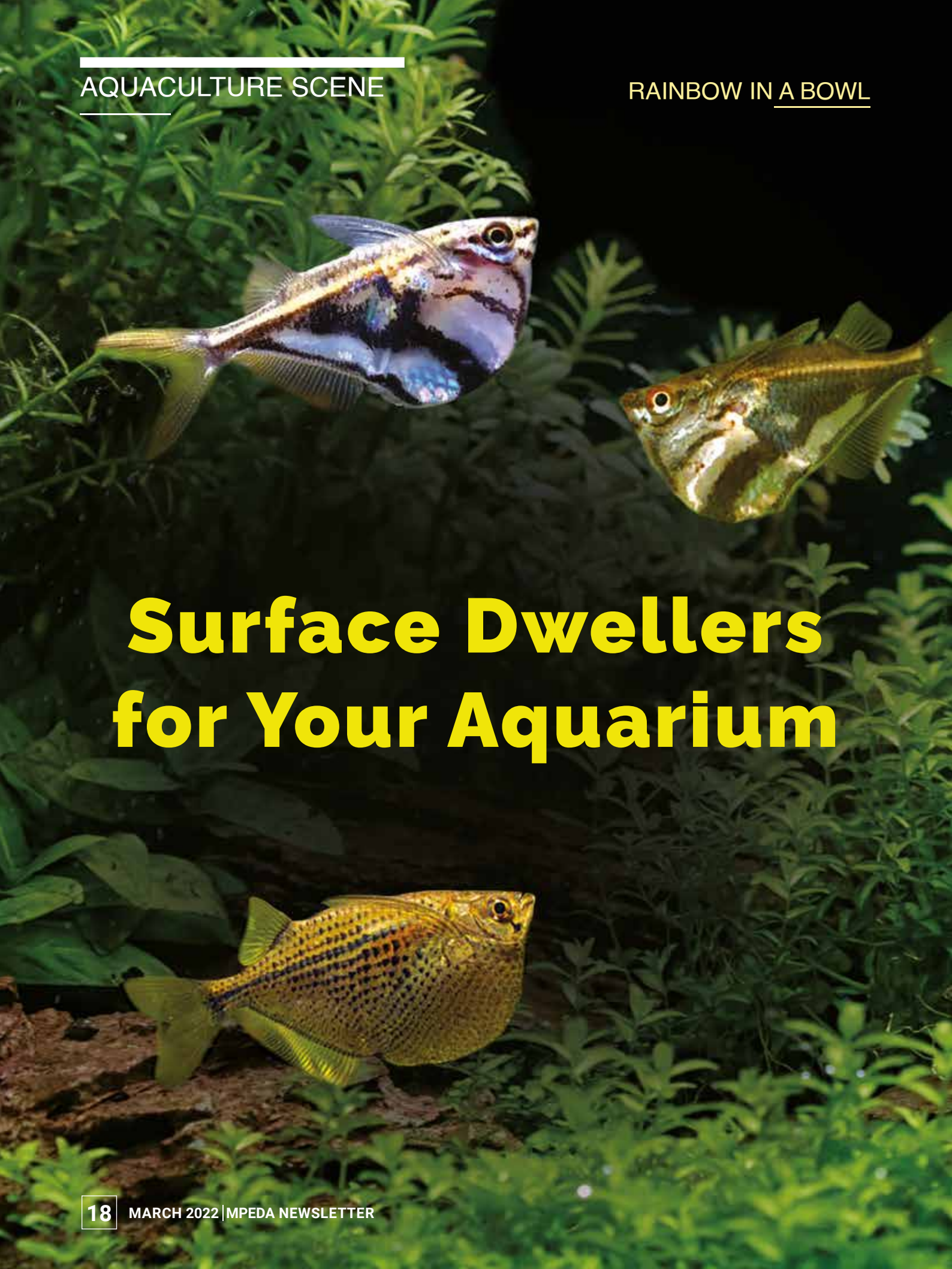

Surface Dwellers for Your Aquarium

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.

Hatchet fish, belonging to the family Characidae, are native to South America. They are found in the Amazon river and its tributaries, right from Peru. The distinguishing characteristic of hatchet fish is its triangular body (hatchet shaped belly) and a mouth that is placed at the top of its head. They swim near the water surface and feed on anything that comes their way. These popular aquarium fish often prefer to move in shoals in the natural habitat.

With an upward pointing mouth, straight dorsal line and a dorsal fin positioned near to the caudal fin, the fish are strictly surface oriented and feed from the water surface. The feed in the natural condition consists of insects that have fallen on the water surface. In the aquarium they will generally feed on all kinds of live, fresh and flake foods. However, flake or floating food is recommended to keep them in good nutritional balance. Depending upon the size of the fish, Cyclops, Daphnia, blood worms, and small brine shrimp can also be given. The aquarium should be covered as they like to jump out of the water. They require medium hard water, slightly acidic with pH between 6 and 7 and temperature 24 – 28°C.

They enjoy moving in shoals, hence it is suggested to have at least ten or more as a small shoal in a larger aquarium. Floating plants should also be provided for shade. These fishes are very delicate and should not be kept together with any aggressive fish. Since they are surface dwellers, it is advisable to have discus or angel fish in a community tank for the middle water layer and corydoras catfish for the lower layer. There are two varieties of hatchet fish, *Carnegiella strigata* (marbled hatchet fish), which has subspecies *Carnegiella strigata strigata* and *Carnegiella strigata fasciata*, and *Gasterolepecus sternicla* (silver hatchet fish).

The marbled hatchet fish, *C. strigata strigata*, is one of the most popular among the hatchet fish. It is a native of Peru while *C. strigata fasciata* is found in Guyana. They attain a size of 4 cm. They are deep bodied, silver purple in colour with greenish tint and dark broken lines that cross the lower body. Since they are active swimmers, the aquarium should be long enough to allow space for speed when swimming in a group. Ideal water conditions for breeding are pH 5.5 – 6.5, hardness 5 dGH, with temperature 24 – 28°C. It is difficult to differentiate sex but if viewed from above the water, the female is fatter.

Breeding is simple. Add peat extract to darken the water until it is almost opaque and provide subdued lighting. Feed them with small flying insects to induce spawning. After an extended courtship the female will deposit her eggs on plants. The eggs will hatch after a day and within 5 days the fry become free swimming. The fry must be fed finely powdered flake food for the first three or four days, followed by baby brine shrimp.

Silver hatchet fish *(Gasteropelecus sternicla)* is a native of Brazil and the southern tributaries of the Amazon, Guyana and Suriname. They are found in smaller streams with plenty of vegetation. Their maximum attainable size is 6 cm and they are generally regarded as good community fish. The water parameters are pH 6 – 7 with temperature 23 – 26°C and hardness 2 – 15 dGH. Males are slimmer than females. They will feed on mosquito larvae, and small flies and will also accept dry flakes. This fish is not successfully bred in captivity, unlike marbled hatchet fish.


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Application of genetic techniques in augmenting the fish production

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Since ancient times, wild fish and invertebrates such as molluscs and crustaceans, as well as seaweed have been serving as important sources of nutrition to people all over the world. Aquaculture has recently emerged as the world's fastest growing food production sector. According to SOFIA 2020, fish consumption has increased at an average annual rate of 3.1 percent from 1961 to 2017 which is 1.6 percent more than the annual world population growth. In 2018, world aquaculture production was 82.1 million tonnes, world capture fisheries have reached 96.4 million tonnes. Although there is gradual increase in production of finfish and shellfish across the world, still there is a high demand for protein requirement which can be fulfilled by aquatic animals. Genetic technologies can be used in aquaculture for a various reason, not just to increase production, marketability, culturability of fishes but natural resource conservation can also be improved with the right genetic technology. Genetic improvement programmes can provide both short-term and long-term benefits.

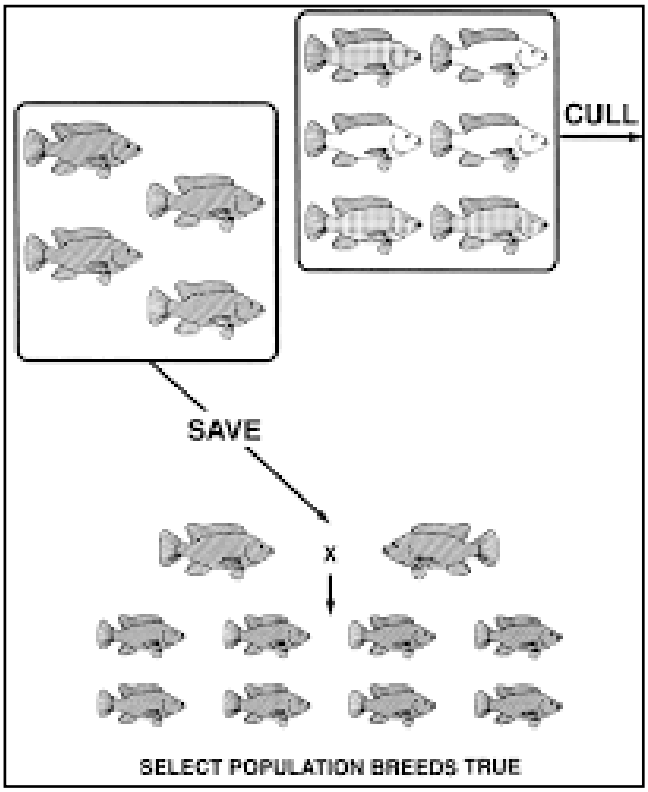
Long term strategies

Long-term breeding programmes will certainly be the only way to achieve domestication and the full potential of aquatic genetic resources. The breeding goal should be defined by a set of economically and/or socially important features that are inherited to some extent and can be recorded in an applied selection method. Data collection, record keeping, broodstock management, and monitoring are all required for long-term breed improvement initiatives.

Selective breeding

Selective breeding makes use of significant genetic variations present in majority of the traits having desirable qualities. Selective breeding can be done by two means as qualitative phenotypes and quantitative phenotypes. The qualitative phenotype breeding programme is simple one which targets only on desirable allele to get true breeding population and it can be achieved in one generation. The quantitative phenotype breeding programme is advanced one and needs longer period unlike the qualitative method. But in this method, getting true population is not possible though the population's mean gets improved in every generation.

It focuses on various traits like growth, feed conversion efficiency, fecundity etc. Farmers prefer the selection of fish based on quantitative type as it includes numerical measurement like length, weight rather than qualitative type which describes the category like colour, tail shape, etc. Thus, selection in the aquaculture species receives importance for growth rate since it increases



(Courtesy: FAO, 2000)

Fig.1: Selective breeding

the production as well as reduction in culture period which further reduces the management requirements. GIFT (Genetically Improved Farmed Tilapia) is one of the prominent paradigms of selective breeding. The nature of traits and their heritability influence the selection technique used. Selection process is carried out in three different ways such as individual, family and combined selection.

Individual selection

Individual selection is often known as 'mass selection,' and it is a breeding method in which breeding candidates are chosen based on their individual phenotype, or performance. Because of its simplicity, cheap without much infrastructural investment, this selection has been widely used in selection approach of the fish. It can only be used to increase features such as growth, form and colour that are documented on breeding candidates while they are still alive. It is ineffective for improving discrete and lowly heritable traits like survival rate. However, the problem often encounters with this selection is so called phenomenon of inbreeding depression. Inbreeding declines the genetic variety and the breeding potential of population for continued genetic progress. When using individual selection to prevent inbreeding, just a small number of individuals from each full and half-sibling family should be screened as breeding prospects. However, this necessitates the production of each family separately from the others before testing.

Family selection

Family selection is a breeding approach in which breeding prospects are graded based on the records of their full and half-siblings, or individuals who share genes with them. This selection approach can be used to improve features that can't be measured such as carcass quality while the breeding candidates are alive, other traits that can only be measured for groups of fish viz., feed utilisation and discrete traits with high or low occurrences which include survival rate, age at sexual maturity. Furthermore, when a trait's heritability is low, family selection is more successful than individual selection. However, this breeding programme needs more technical as well as infrastructural investment like tanks, ponds for maintaining from the stage of fertilized eggs to fingerlings.

Combined selection

When attributes or traits on breeding candidates are recorded, the family selection can be integrated with individual selection to improve the accuracy of breeding value estimations and thus produce a higher selection response. When it comes to fish, it usually relies on information from full and half-sibs i.e., parents, offspring or any other group of relative. Individual, full-sibling, and half-sibling information may be added and weighted in a combined selection index. It can also be done with Best Linear Unbiased Prediction (BLUP) procedures, which aids in estimating the breeding values as well as the modification of fixed effects at the same time.There are currently freely available computer programmes that can estimate breeding values using full pedigree information like PEST and ASReml.

Genetic engineering in selective breeding

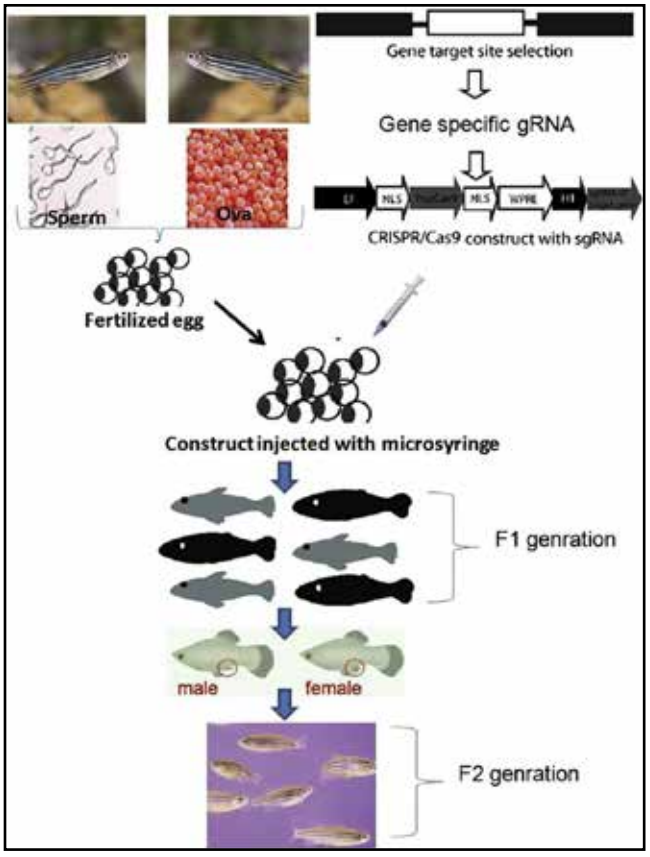
As high-quality products fetch a good price in the market, the industry has recently begun to examine other characteristics like flesh quality, etc. (Gjedrem, 1997). If the fraction of additive genetic variance connected to a locus or loci exceeds the heritability of a variable, selection efficiency can be improved by choosing the specific gene locus and it is known as marker assisted selection method (Danzmann and Ferguson, 1995). In aquatic species, however, identifying meaningful loci is still challenging one and requires lot of study on it. Micro-satellites probes assist in finding important loci and build pedigrees in mixed family groupings by revealing high levels of genetic variation. As there is no requirement of special rearing facilities, marking and disturbance in daily routine practices of fish farming, the marker assisted selection is practically suitable despite only for commercial or small-scale farms.

Transgenesis

A transgenic or genetically modified organism (GMOs) is a method used in aquaculture in which foreign DNA (deoxyribonucleic acid) inserted into host genomes artificially (Chen *et.al.*, 1996). The first successful transgenic fish was reported in 1985 when they microinjected the human GH gene into the fertilised eggs of goldfish *Carassius auratus* (Zhu *et.al.*, 1985). Furthermore, fish species are extremely ideal to genetic manipulation during their early developmental stages which hold up them to be good candidates for genetic alteration (Foresti, 2000). Transgenesis involves longer period of time for selection of a beneficial gene and its promoter to implant them into the host animal followed by undertaking the necessary screening to validate the transgene's stable inheritance.

A DNA construct containing genes for the desired trait(s) together with a promoter sequence is often

injected into the pronuclei of fertilised eggs to create a transgenic fish. The injected embryos are then incubated in-vitro or in-vivo before maturing into a fully formed transgenic organism. Transgenes can be passed on to future generations if they have become integrated into the DNA of a host organism. Genes from different species have been transplanted into a number of commercially important species like Atlantic salmon, common carp, Indian major carp, goldfish, zebrafish, etc.,



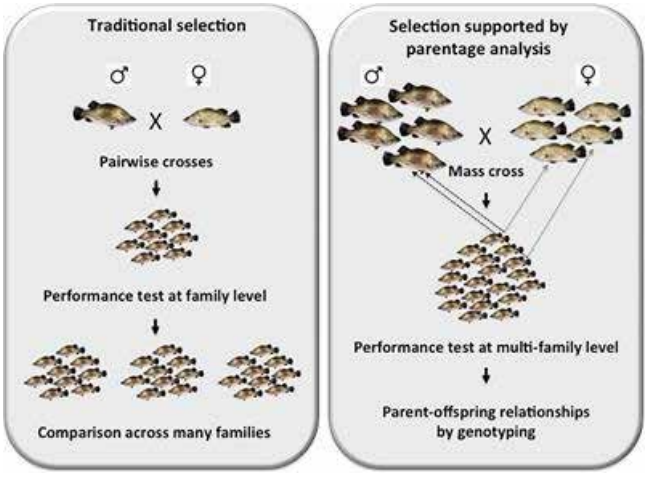
(Courtesy: Chaudhary et al., 2020)

Fig.2: Diagrammatic scheme to generate the transgenic fish using CRISPR/Cas9 technology

Genome Editing

One of the advanced genetic technologies is genome editing. In which, a particular genome is targeted for editing and it has been applied only to restricted species like zebrafish. There are different kind of targeted nuclease technologies like ZFNs (Zinc Finger Nucleases), TALEN (Transcription Activator-Like Effector Nucleases) and CRISPR (Clustered Regularly Interspersed Short Palindromic Repeats).

Among all these, CRISPR is commonly used by the researchers since it is precise and takes short period of time. This genome editing techniques are highly efficient technique and permit to modify the multiple genes precisely at specific site. Owing to this characteristic nature, the technique becomes simple, easy, precise, and predictable and thus aids in improving fish species through breeding process.



(Courtesy: Orban et al., 2021)

Fig.3: Genome based selection in Asian seabass

Short-term strategies

Short-term genetic improvement programmes may not necessitate the same level of maintenance of records or management as followed in long-term strategies, but they can yield considerable results in a short period of time using simple technology.

It doesn't mean that the technology is easy or management of brood stock and their record maintenance are not required. They are also required to sustain healthy and genetically appropriate manipulation stocks. Hybridization is one of the short-term programmes and it is done to integrate desirable traits from two genetically distinct groups and to get benefit from hybrid vigour (heterosis).

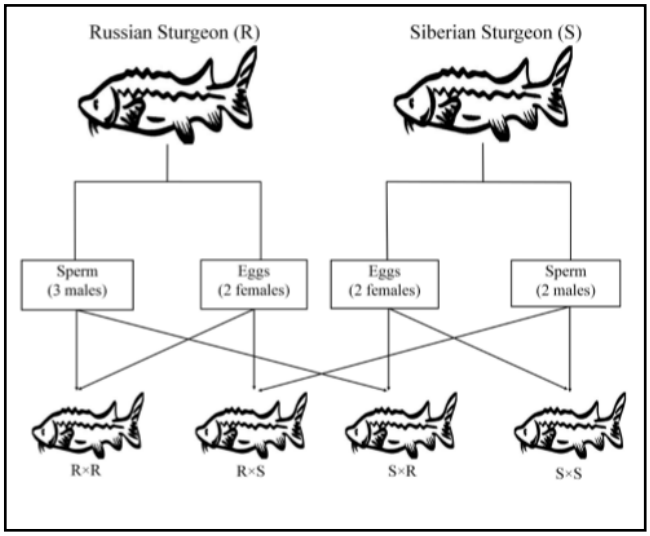
Hybridization

Hybridization is a good way for combining the desirable qualities of selected species and is considered as one of the simple, economical, and viable tools of such enhancement programmes in fishes. Hybridization is the process of two different species mating, and the offspring are known as hybrids. One of the goals of animal husbandry is to create a hybrid with selected or favoured features from each parent.

A hybrid is said to have hybrid vigour or positive heterosis when it has features that are superior to both parents, which is, of course, the ultimate breeding

goal. Hybridization may also be used to combine other valuable traits, such as better growth and flesh quality, disease resistance, and increased environmental tolerances.

Intraspecific hybridization (cross breeding) is a well-known method for producing more productive hybrids by crossing different genotypes of females and males in aquatic animals. Inter-specific hybrids improve productivity through hybrid vigour which transfers desirable traits.



(Courtesy: Shivaramu et al., 2014)

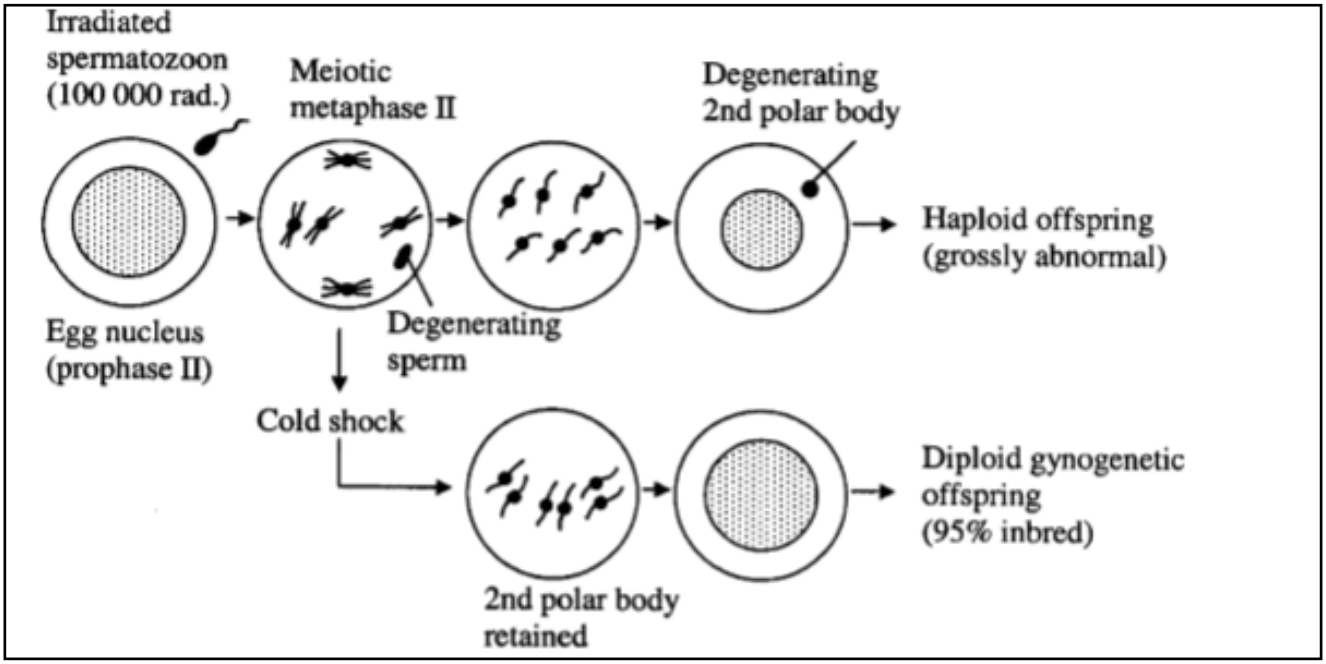
Fig. 4: Schematic diagram showing the establishment of Different crosses

It can also yield sterile or non-reproducing groups, but fertile hybrids are also available for certain aquaculture species. It has been known to produce fishes with increased growth rate, improved flesh quality, production of sterile animals, improved disease resistance and environmental tolerance, etc., so as to make the culture more profitable. However, certain important groups of fishes, such as salmonids and penaeid shrimp, do not create effective hybrids (Benzie *et al.*, 1995).

Chromosome manipulation

Many aquatic species have had their chromosomal sets manipulated (polyploidized) via thermal and chemical shocks for developing embryos. Polyploidy refers to a genetic state that can be produced artificially in fish and shellfish through manipulation of embryos. Polyploid individuals have extra sets of chromosomes beyond the normal diploid, like triploids having 3 and tetraploids having 4.

Triploid creatures are especially intriguing since they should be sterile, allowing them to concentrate more energy towards growth rather than maturation and reproduction. Guo *et al.* (1996) found that triploid oysters cultured by mating tetraploids with diploids had a greater survival rate and were larger than diploid controls. Triploids in aquaculture also conserve the genetic diversity of native populations.



(Courtesy: Gjedrem, T. & Baranski, M., 2010)

Fig. 5: Polyploidization of chromosomal sets for embryo development through thermal and chemical shocks

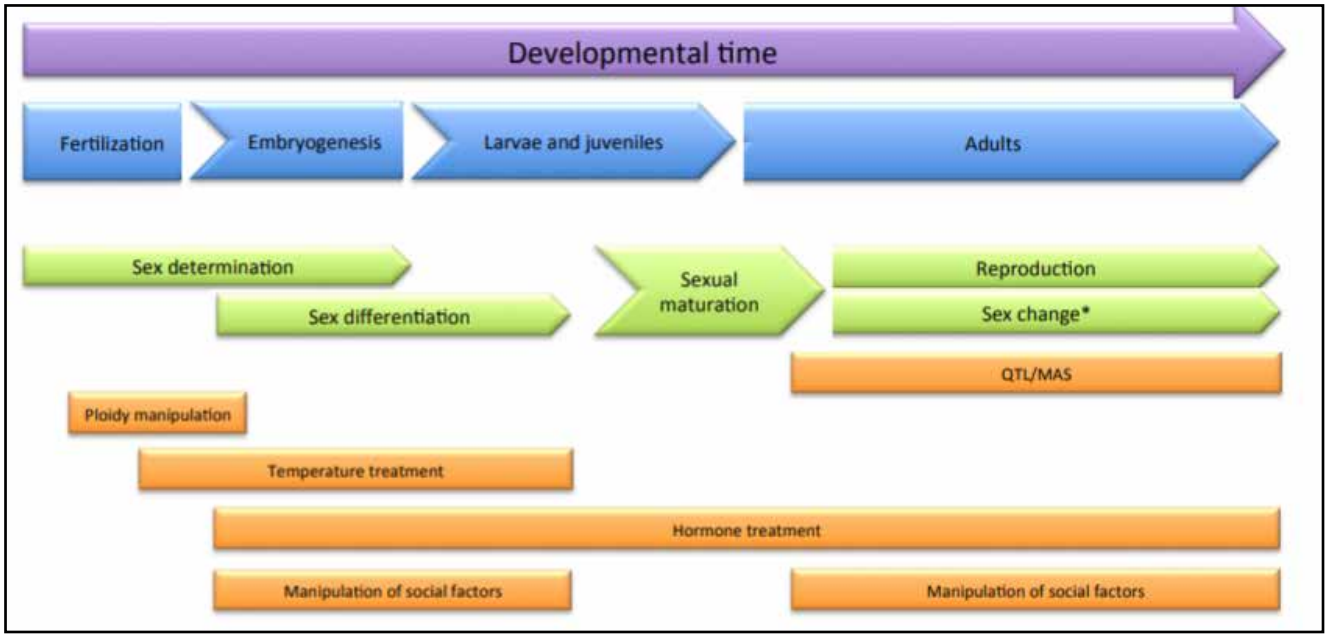


Fig. 6: Generalised model of targeted developmental time periods for applying strategies to manipulate sex in farmed fish.

Sex manipulation

Monosex fish populations are frequently preferred in aquaculture. This predilection could be due to growth differences between male and female. A unique sex chromosome (XX for females and XY for males) may result in a valued product. Monosex populations could reduce undesired reproduction. The production of all female groups would be an evident benefit in species where fish roe is prized, such as sturgeon caviar.

By giving androgens or oestrogens to early life cycle stages of fish, they can be directly "sex reversed," resulting in a group of all one sex fish (Dunham, 1995). Although the use of hormones early in the culture of aquatic animals is becoming more commonly tolerated because no residue remains when the organism reaches market size and in certain localities, still maintain limitations on the ingestion of hormone-treated fish. This difficulty could be handled with proper sex reversal and broodstock breeding, resulting in single-sex progeny without ever coming into direct touch with the hormone (Mair et. al., 1995).

Conclusion

It is known that aquaculture is one of the fast-growing sectors and it requires sustainable development through developing high performance culture species. The aquaculture sector need not to be restricted only to conventional breeding techniques or fundamental classic selection. Modern genetic techniques can also be employed for developing new species with good traits. In this context, genome manipulation serves as an important tool through improving the breeding techniques in fish.

Though the use of genetic techniques is considered as recent progress in fisheries and aquaculture, the techniques have been accepted widely for the genetic improvement in aquaculture species since it is strongly believed that these techniques have significant role in augmenting the fish production. Various aquatic species have been involved recently in selective breeding programmes in the world like Atlantic cod, Atlantic salmon, Hybrid striped bass, Nile tilapia, Red sea bream,Common carp and Rohu etc,.

Domestication and thorough utilization of genetic resources available in the aquatic species of the country can be comprehended only through proper planning in genetic breeding programmes with sufficient financial support. However, it raises two questions, one is the possibility of abandoning the conventional breeding techniques by the farmers and another one is that how best the genetically modified species diversity can be managed or maintained whilst conserving the natural genetic diversity of the aquatic species.

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Black Soldier Fly Larvae (BSFL) and its suitability in aquaculture industry

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INTRODUCTION

The demand for animal-derived protein sources will increase due to the combined effects of the growing human population and rising living standards in developing countries (FAO, 2009). Scarcity of resources has increased prices of animal feedstock during the last years, which represents 60-70% of production costs of animal production systems and results in competition between human food and animal feed. For instance, use of ingredients like fishmeal, fish oil, soybean meal and grains is on the rise in both human food and animal feed. Insects are proteinaceous and have high feed conversion efficiencies and growth rates, making them a high quality and potentially profitable feedstuff for production of animals.

The black soldier fly, *Hermetia illucens*, is a true fly (Diptera) of the family Stratiomyidae. Though originally native to the Americas, it now occurs worldwide in tropical and temperate regions and its lack of hardiness to the cold precludes its invasion of non-native regions such as Northern Europe.

Adults consume nothing but water, do not approach humans, do not bite or sting and do not vector or disseminate any specific diseases. Black soldier fly larvae (BSFL) are reported as feeding on an immense variety of organic material and have already been used in small-scale waste management purposes using substrates such as manure, rice straw, food waste, distiller's grains, fecal sludge, animal offal, kitchen waste, and so on. The diversity of substrates they can process and the efficiency with which they do so may be the highest among the flies. BSFL are also edible and have been studied as such. Their feed conversion ratios are known to be superior to both crickets and mealworms, and compared to those two, BSFL survival rate and nitrogen and phosphorus compositions do not vary highly with diet. They are not thought to be toxic. BSFL accumulate lipids from their diet for use as energy by the non-feeding adult, to the point that they can be converted to biodiesel. What they do not consume, combined with their nitrogen-rich frass, can be used as fertilizer. The larval development cycle is given in figure 1.

Their larval development time of over three weeks is longer than that of flies such as house and carrion flies (<5 days) meaning a single larva will consume a larger amount of substrate and produce larger pupae. Additionally, when BSFL are at the pre-pupa stage, they will instinctively leave the substrate and move to a high, clean place, a behavior called "self-harvesting" that removes an otherwise labor-intensive step from their farming. All these benefits make BSFL practical to rear and a suitable tool to valorize wastes, plus possibly a sustainable animal feed.

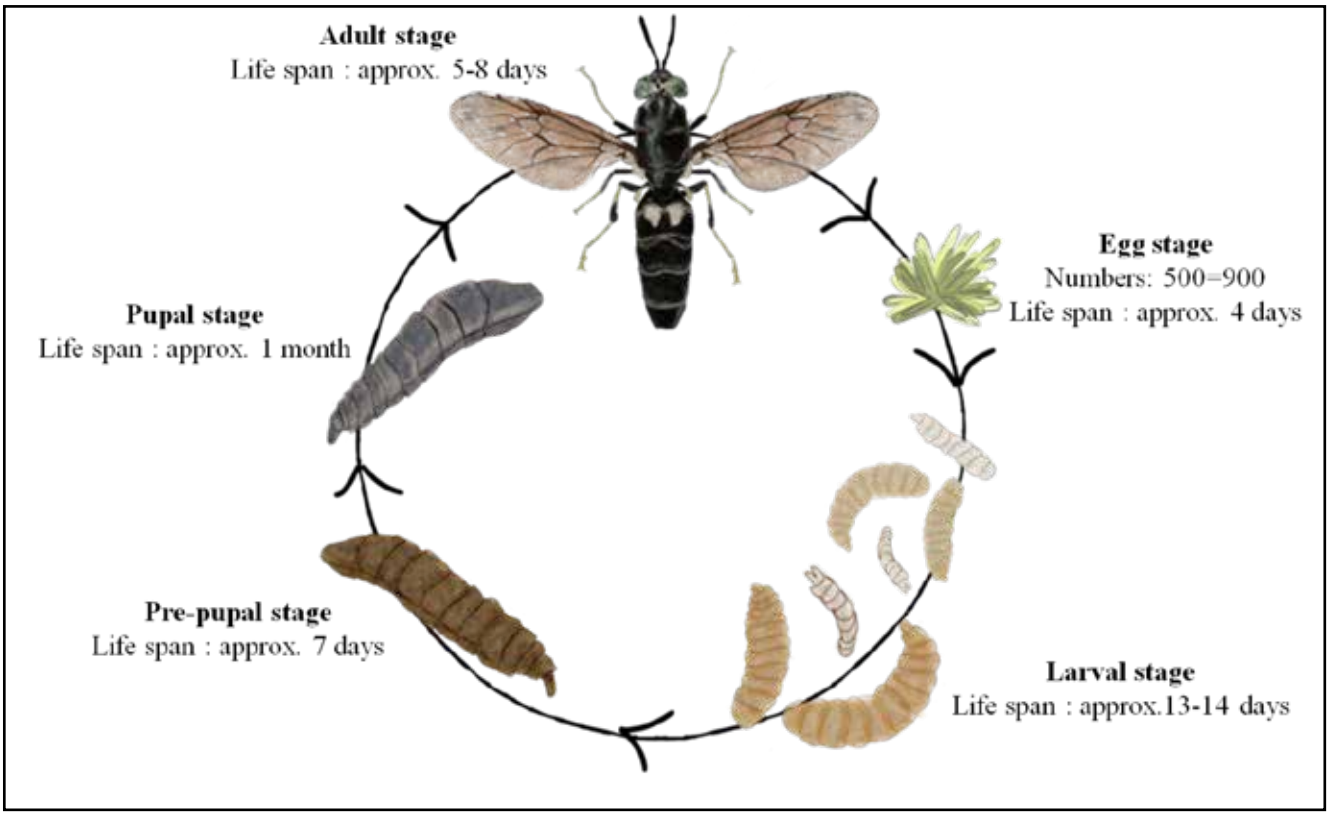

Fig. 1: Major events in life cycle of black soldier fly, Hermetia illucens

NUTRITIONAL COMPOSITION OF BSF LARVAE

Body composition of BSF larvae varies among different substrates not only in protein content (ranging from 37 to 63% dry matter; DM) but also fat content, which has the most variation (ranging from 7 to 39% DM). The protein and fat compositions of BSFL are impacted by what they consume (Table 1).

Although BSF larvae on average contain both a high protein and fat content, body composition of the larvae depends on the quality and quantity of food ingested. For instance, larvae fed swine manure have higher protein content than those fed cow manure, and diets based on spent grains result in higher protein content. The same applies for crude fat.

Fat content accounted for about 30% of the BSF larval biomass fed on manures, but chicken manure supported maximal larval growth and crude fat content. Large variation in body composition can also exist throughout the course of larval development itself. For example, crude protein content decreases with increasing age, the highest percentage was reported for larvae of 5 days old (61%), while it was less in 15 (44%) and 20 (42%) days old larvae. Dry matter content of fresh larvae is between 20 and 44% and depends on both diet and larval stage, because DM is higher in the later instars.

BSF larvae contain higher mineral concentrations compared to other insects used in managed feeding programmes. Manganese (Mn), iron (Fe), zinc (Zn), copper (Cu), phosphorus (P) and calcium (Ca) are found in high concentrations, with the highest Ca:P ratio reported being 8.4. Sodium (Na) occurs in a lower concentration compared to the levels in other insects.

Some authors found differences in mineral contents in BSF larvae reared on poultry or swine manure, possibly reflecting differences in mineral concentrations or availability between the two manure types. For instance, P content was significantly higher in BSF reared on poultry manure. Ash content is relatively high and ranges between 9 and 28% DM. All authors report a high Ca content in BSF larvae, which might be partly explained by the fact that the epidermis of BSF secretes a deposit of calcium carbonate ($CaCO_3$)

which may account for the high Ca and ash content. Conversely, newly emerged adults contain very little Ca (0.03%) since Ca occurs concentrated in the shed pupal cuticle.

Table 1: Mean % of crude protein and crude fat content of BSF larvae reared on different diets/substrates

Diet/substrate	% Crude protein	% Crude fat
Cattle manure	42.1	34.8
Poultry manure	40.1	27.9
Cattle blood and wheat bran	47.6	25.3
Swine manure	43.6	26.4
Restaurant waste	43.2	39.2
Municipal organic waste	39.8	30.1
Horse manure	40.9	12.9
50/50 Fish offal: Cow manure	41.9	30.44
By-products	41.7	27.8
Liver	62.7	25.1
Vegetables and fruits	38.5	6.62
Fish waste	57.8	34.6

SUITABILITY AS ANIMAL FEED

BSF as aquaculture feed

Protein replacement in fish diets has been investigated using the meals obtained from both larvae and pre-pupae of BSF for the following fish species: Channel catfish (*Ictalurus punctatus*), blue tilapia (*Oreochromis aureus*), hybrid tilapia (Nile tilapia, *Oreochromis niloticus* crossed with Sabaki tilapia, *Oreochromis spilurus*), rainbow trout (*Oncorhynchus mykiss*), Atlantic salmon (*Salmo salar*), turbot (*Psetta maxima*), yellow catfish (*Tachysurus fulvidraco*) and climbing perch (*Anabas testudineus*). Most of these studies showed that only low inclusion levels of BSF larvae have shown a similar performance to that of fish fed traditional feedstuff, which may be explained by high larval protein content. High inclusion levels in fish feed (>33%) reduced not only fish growth, but also palatability of the diet and protein digestibility. The type of substrate on which BSF larvae were reared and the processing method might affect their utilization by fish. For instance, BSF was included at least up to 50% in Atlantic salmon diet without affecting growth or fillet quality.

Although the replacement of fish meal with insect meal can increase the amount of fat or change the nature of lipids in fish and could, therefore, change the taste of the fish fillets, a partial inclusion of insect meal (10-50%) in the diet of fish does not affect FA profiles, aroma or flavour to the extent that this is perceived by consumers. For instance, no difference in organoleptic properties was found in Atlantic salmon or rainbow trout fed up to 50% of BSF meal.

BSF as pig feed

BSF larval meal is a suitable ingredient in pig diets, because of its high contents of amino acids and calcium, and its good palatability. However, its relative deficiency in methionine and cystine requires the inclusion of those amino acids in balanced diets. Moreover, due to the high ash and crude fat content, BSF larvae should better be mixed with other proteinaceous ingredients. Apparent digestibilities of dry matter and nitrogen tended to be better for the pigs fed soybean meal than BSF larval meal (85.3 and 77.2 vs 77.5 and 76%, respectively). In addition, weaned pigs did not perform well when fed on BSF larval meal, suggesting that additional refinement (cuticle removal and rendering) may be necessary to improve the performance of early weaned pigs.

BSF as poultry feed

To the best of our knowledge there are few studies available on this topic. BSF larvae and pre-pupae, grown on swine manure or kitchen waste, have been used satisfactorily as a feed additive for young chicks. Partial replacement of soymeal (10-20%) for broilers

showed a production performance, feed efficiency, mortality and carcass traits similar to those fed on commercial diets.

The partial (50%) or full replacement of soybean cake by partly defatted BSF larval meal in a diet for layers did not affect their laying performance, nor feed efficiency, if compared to organic standard diets for layers. The high apparent metabolisable energy and the amino acid apparent ideal digestibility coefficients of BSF larval meal, also make it a valuable ingredient for use in the formulation of broiler feeds. Additionally, several authors suggested BSF larvae have a suitable mineral content for the nutrition of poultry, according to broiler mineral requirements, cited by the National Research Council.

BSF as other animal feeds

Whole BSF larvae and pupae have been used to feed animals like alligators (*Alligator mississippiensis*) and mountain chicken frogs (*Leptodactylus fallax*). A complete replacement of commercial feeds by BSF larvae fed to young alligators resulted in lower consumption and growth compared to commercial feeds. BSF larvae fed to Mountain chicken frogs resulted in poor nutrient digestibility. It seems that an unprocessed form of BSF may be less useful for species that swallow their food whole like these species.

For example, calcium digestibility of whole BSF larvae in frogs was only 44% compared to 88% for BSF larvae that had been 'mashed'. Conversely, BSF larvae have been successfully utilized in captive feeding and breeding rogrammes for a number of lizard and amphibian species, mainly as source of minerals. Frass of BSF reared on dried distillers grains was evaluated as feed for commercial giant river prawn *(Macrobrachium rosenbergii)*, resulting in similar performance as regular prawn feed, with better economic returns.

Conclusion

Most feeding studies with diets containing BSF larvae and pre-pupae have been conducted on fish, pigs and poultry. The available studies that include BSF larvae in poultry, pig and fish diets suggest that it could partially replace traditional feedstuff in their diets, because high or complete replacement did not result in good growth performance. There are some factors that might be affecting the performance of animals fed on diets containing BSF larvae or pre-pupae.

First, BSF not only contains high protein content, but also contains more fat than necessary in the diet of most animals, which could affect the digestibility and/or the palatability of BSF larval meal. Second, BSF larvae also contain high levels of ash and hence higher levels of inclusion in the diet, especially of monogastrics, can decrease feed intake and cause other adverse effects.

Third, an unprocessed form of BSF may affect its digestibility and be less utilizable for species that swallow their food whole. Fourth, although many authors have stated that BSF larval meal contains high quality protein, it is important to evaluate the quality for specific animals fed BSF meal and to define what limiting amino acids are provided by BSF meal.

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Farmers meet on 'Prospects of open water cage farming'

Mr. K. Ganesh, Joint Director of Fisheries, Udupi during inaugural address

MPEDA Regional Division, Mangalore has organized a farmers' meet with a theme 'Prospects of open water cage farming' on 24th February 2022 at Kharvikeri, Kundapura in Udupi district, which had an active participation of 125 cage farmers under the banner of "Kundapura Taluk Cage Fish Farmers Association" in Panchaganga brackishwater estuary.

Even though India has rich water resource for aquaculture, our culture practices are constrained to pond based culture of Shrimp/Fish. Despite India's vast scope for open water cage farming, it is still in the nascent stage. These cage farmers in Kundapura are practising culture with unweaned fish seeds collected from wild or procured from middlemen and using trash fish for grow out. In order to upgrade their culture technology, MPEDA organised the meet .

The meet started with welcome address by Mr. K. V. Premdev, Deputy Director, MPEDA Mangalore. Mr. K. Ganesh, Joint Director, Dept. of Fisheries, Udupi inaugurated the meet. Mr. Ravi Raj Kharvi, President of Kundapura Taluk Cage Fish Farmers' Association also spoke on the occasion. The technical sessions were handled by Dr. Vishnudas Gunaga, Assistant Director, MPEDA, Mrs. Sumalatha, Assistant Director

Mr.K.V. Premdev, DD, MPEDA RD, Mangalore delivering welcome address

A view of participants

of Fisheries, Mr. Karthik Gowda, Technocrat, M/s Canares Aquaculture, Kumta, Mr. Bharata Raju, Karnataka State Co-ordinator, NaCSA, and Dr. S. Arasu, Project Manager, RGCA, Chennai .

The participants interacted with MPEDA, State Fishery officials and resource persons and got clarified their doubts. The programme ended with a Vote of Thanks by Dr. Ganesh K., Assistant Director, MPEDA, Mangalore.

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Guidance to HACCP implementation in seafood industry

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INTRODUCTION

The Hazard Analysis and Critical Control Point (HACCP) is an internationally recognized Food Safety Management System (FSMS). It is a systematic approach for the identification, evaluation and control of food-safety hazards and act as a tool for ensuring safe food. Currently, HACCP is endorsed worldwide by many countries and organizations, to assure the safety of food. Increasing consumer and public awareness on the seafood safety and hygiene in importing countries compelled the seafood processors to incorporate HACCP based food safety approach. But the demand for safety is not limited to exports; it is equally necessary for local consumers and regulators too. MPEDA constituted HACCP Cell as early as 1996 to assist the Indian seafood industry for the effective implementation of HACCP. Since its inception, HACCP has improved seafood safety and hygiene by focusing on controlling the significant hazards that can enter the food chain. HACCP system requires the application of the following seven principles to identify and control food safety hazards.

PRINCIPLES OF HACCP

1. Identify the hazards
2. Determine the Critical Control Points (CCPs)
3. Establish Critical Limits (CLs)
4. Establish a system for monitoring the CCPs
5. Establish the Corrective Actions (CA) to be taken when monitoring indicates that a particular CCP is not under control.
6. Establish procedures of verification to confirm that the HACCP system is working effectively.
7. Establish documentation & records concerning all the above principles and their application.

In June 2021, US Food and Drug Administration(FDA) published the 4th edition of "Fish and Fishery Products Hazards and Controls Guidance" (herein in after referred to as FDA HACCP guidance) for reference to ensure safe processing and importing of fish and fishery products; and in June 2020 the 6th edition of "Hazard Analysis and Critical Control Point Training Curriculum" was published to provide guidelines necessary to meet the HACCP training requirements and to assist processors in the development of their HACCP plans.

This article intends to provide an outline on HACCP implementation in seafood industries to improve the safety and quality seafood they produce. Seafood processors can access the above mentioned reference books on HACCP using the following links:

- Hazard Analysis and Critical Control Point Training Curriculum

https://www.flseagrant.org/wp-content/uploads/HACCP-Training-Curriculum-June-2020.pdf

- Fish and Fishery Products Hazards and Controls Guidance https://www.fda.gov/media/80637/download

STEPS IN DEVELOPMENT OF A HACCP PLAN

Having a HACCP system in place is essential for any food establishment or distributing enterprise to ensure the safety of the food products it handles. Setting up a HACCP plan is the primary step in implementing HACCP system in an establishment.

A HACCP plan is a document prepared in accordance

with the principles of HACCP to ensure the control of hazards, which are significant for food safety taking into consideration of species, product & process including packaging, storage & intended use. Assembling a HACCP team is an important step in building a HACCP plan.

A HACCP team should include individuals who have specific knowledge and expertise appropriate to the product and process.The team should be multi-disciplinary and include individuals from the areas related to day-to-day production such as engineering, production, sanitation, quality assurance & food microbiology. This HACCP team will be responsible for developing, implementing and maintaining the HACCP system.

As per the FDA HACCP guidance, a solid HACCP plan for food process can be accomplished following these 18 steps. These 18 steps can be divided generally into 3 sets: Preliminary Steps, Hazard Analysis Worksheet and HACCP Plan Form. To establish an effective HACCP plan and ensure food safety, each of the below mentioned steps must be implemented, monitored and reviewed regularly.

I. PRELIMINARY STEPS: These steps involve gathering information about the products and the process undergoing hazard analysis. Preliminary steps also include development of flow diagram that covers all steps in the process

STEP 1: Provide general information- Record the name and address of processing facility on both the hazard analysis worksheet and the HACCP plan form.

STEP 2: Describe the food- Identify the market name or Latin name (species) of the product, fully describe the finished product and describe its packaging.

Example:

1. Market name or Latin name (species) - Tuna (*Thunnus albacares*); Shrimp (*Litopenaeus vannamei*)

2. Description of the finished product- Fresh tuna steaks; Individually Quick Frozen, cooked, peeled shrimp.

3. Description of the packaging type- Vacuum-packaged plastic bag; Aluminum can.

STEP 3: Describe the method of distribution and storage

Identify how the product is distributed and stored during and after distribution.

Examples: Stored and distributed frozen; Distributed on ice and then stored under refrigeration or on ice.

STEP 4: Identify the intended use and consumer

Identify how the product will be used by the end user or consumer. The intended consumer may be the general public or a particular segment of the population, such as infants or the elderly. The intended user may also be another processor who will further process the product.

Examples:

1. How the product will be used -To be heated (but not fully cooked) and served; to be eaten after cooking.

2. End user or consumer - By the general public; by another processing facility.

STEP 5: Develop a flow diagram- The purpose of the diagram is to provide a clear, simple description of the steps involved in the process undergoing hazard analysis. The flow diagram should cover all steps in the process that the establishment performs and should include the non-fishery ingredients that the establishment uses. The flow diagram should be verified on-site for accuracy.

Example: Product flow diagram of frozen fish fillets-

Raw material reception → Sorting → Refrigerated Storage → dressing → Washing → Filleting → Inspection → Freezing → Glazing → Weighing and packing → Frozen Storage → Shipment

II.HAZARD ANALYSIS WORKSHEET

A thorough hazard analysis is one of the keys for an effective HACCP plan. The hazard analysis process involves identifying hazards that are reasonably likely to occur in the absence of its control. There is a sequence of steps that need to be completed when conducting a hazard analysis. It is advisable to use a standardized hazard analysis worksheet while conducting a hazard analysis to ensure that all steps in the hazard analysis process are completed. These steps will be discussed individually below using a blank worksheet (Form: 1) to provide a better understanding about hazard analysis.

Form 1: Example of hazard analysis worksheet

HAZARD ANALYSIS WORKSHEET

Firm Name:		Product Description:			
Firm Address:		Method of Storage & Distribution:			
		Intended Use & Consumer:			
1	2	3	4	5	6
Processing Steps	List all potential food safety hazards that could be associated with this product and process	Is the potential food safety hazard significant (introduced, enhanced or eliminated) at this step?(Yes or No)	Justify your decision for column 3	What control measure can be applied to prevent, eliminate or reduce this significant hazard?	Is this step a Critical Control Point? (Yes or No)

Set up the hazard analysis worksheet by entering the firm's name, address and product information. Then fill each column of the worksheet as follows :

Column 1: Enter each of the processing steps from the process flow chart (step 5) in Column 1 of the hazard analysis worksheet. Each step will have its own block on the worksheet, and should be listed in the same order as on the process flow chart.

Column 2: List all of the potential food safety hazards related to each type of product species and the process in column 2 of the hazard analysis worksheet. It is important to list 'every identified potential hazard' in column 2 for each of the listed processing steps in column 1.

Column 3: Record the result of the hazard evaluation (step 9). A "Yes" or "No" answer to the question: "Is the potential food safety hazard significant?" in this column.

Column 4: In this column explain why the hazard is significant or not. This justification normally includes the scientific, regulatory, or historical reasons for the decision.

Column 5: List control measures for those hazards that have been identified as significant and need to be controlled at a specific operational step.

Column 6: This column will be answered 'Yes' only if the step in column 1 is a critical control point (step 11).If there are no control measures that can be applied at a particular process step, that step cannot be the CCP.

STEP 6: Set up the Hazard Analysis worksheet

This step involves the setting up of a convenient Hazard Analysis worksheet suitable for the product. A standard worksheet can be designed following the below mentioned steps (Steps 7-11).

STEP 7: Identify the potential species-related hazards

Species-related hazards are unique hazards that are associated with specific types or species of fish (e.g., the species of fish, the way in which the fish is raised or caught, and the region of the world from which the fish originates). These hazards are introduced outside the processing plant environment before, during, or after harvest.

As the species involved in the process has already been identified through the product description at step 2, hazards related to these species can be identified by referring Table 3-2, "Potential Vertebrate Species-Related Hazards," and Table 3-3, "Potential Invertebrate Species Related Hazards," of the FDA HACCP guidance.

Based on whether the product is a vertebrate or invertebrate refer to the respective tables and list down the species related hazards.

STEP 8: Identify potential process-related hazards.

Process-related hazards are food safety hazards associated with the way in which the product is processed (e.g., the type of packaging, the manufacturing / preservation steps, and the kind of storage).

These hazards are introduced within the processing plant environment. Such hazards can be identified by referring Table 3-4, "Potential Process-Related Hazards" of FDA HACCP guidance. The table contains a list of potential hazards that are associated with specific finished fishery product, as a result of the finished product form, the package type, and the method of distribution and storage.

STEP 9: Understand the potential hazard

After the hazard identification is completed, the HACCP team must evaluate the hazards. A proper understanding about the hazard is very important in determining the significance of potential hazards. The HACCP team can refer the hazards and controls chapters of FDA HACCP guidance (Chapters 4 to 21) for each of the potential hazards. These chapters contain a section, "Understand the Potential Hazard," that provides information about the significance of the hazard, the conditions under which it may develop in a fishery product, and methods available to control the hazard.

STEP 10: Determine whether the potential hazard is significant

Not all the potential hazards identified are significant. The next step in the hazard analysis is to determine which hazards are sufficiently significant that they must be addressed by the HACCP plan.

The hazards and controls chapters of FDA HACCP guidance (Chapters 4 to 21) contain a section, "Determine Whether this Potential Hazard is Significant," that provides information about how to assess the significance of potential hazards. With the information provided in these chapters, the HACCP team can determine whether the hazard is significant for the particular product or process.

A significant hazard is one that is reasonably likely to occur and may cause a health risk to the consumer if it is not controlled. Two questions help in identifying whether a hazard is significant or not.

(1) Is the hazard reasonably likely to occur in the finished product in the absence of control?
(2) Is the hazard likely to cause consumer illness or injury?

STEP 11: Identify Critical Control Points

For each significant hazard that was identified during the hazard analysis, there are one or more points or process steps in the process where the hazard can be controlled. These points or steps are called Critical Control Points (CCP). A CCP may manage more than one food safety hazard.

In some cases, multiple CCPs are necessary to control a single hazard. If there is no control measures that can be applied at a particular process step, that step cannot be the CCP.Under this head in each of the chapters on the various hazards of FDA HACCP

guidance, a table is provided showing the different possible control strategies for that hazard. The HACCP team will decide which strategy is most appropriate for their facility. Suppose the HACCP team identified the 2nd strategy provided in the box/table for control strategies in the chapters for hazards (Chapters 4 to 21) as the most appropriate strategy for their facility, they have to refer to "Control strategy Example 2" in the following pages of the FDA HACCP guidance to complete the remaining steps of the HACCP plan. For example, the possible control strategies for the hazard 'Metal inclusion' are given in Table 1.

If the Strategy No is 2: an Equipment check is identified as most appropriate strategy, then we have to refer "Control strategy Example 2-Equipment checks" provided in the FDA HACCP guidance to complete the remaining steps of the HACCP plan.

Table 1: Control strategies for the hazard 'Metal inclusion'

Control strategy	*May apply to primary processor*	May apply to secondary processor
1. Metal detection or separation	✓	✓
2.Equipment checks	✓	✓

Another tool that can help identify which steps are CCPs is the CCP Decision Tree. CCP decision tree provided in Fig. 1 can be used to determine whether a processing step under evaluation is a CCP or not.

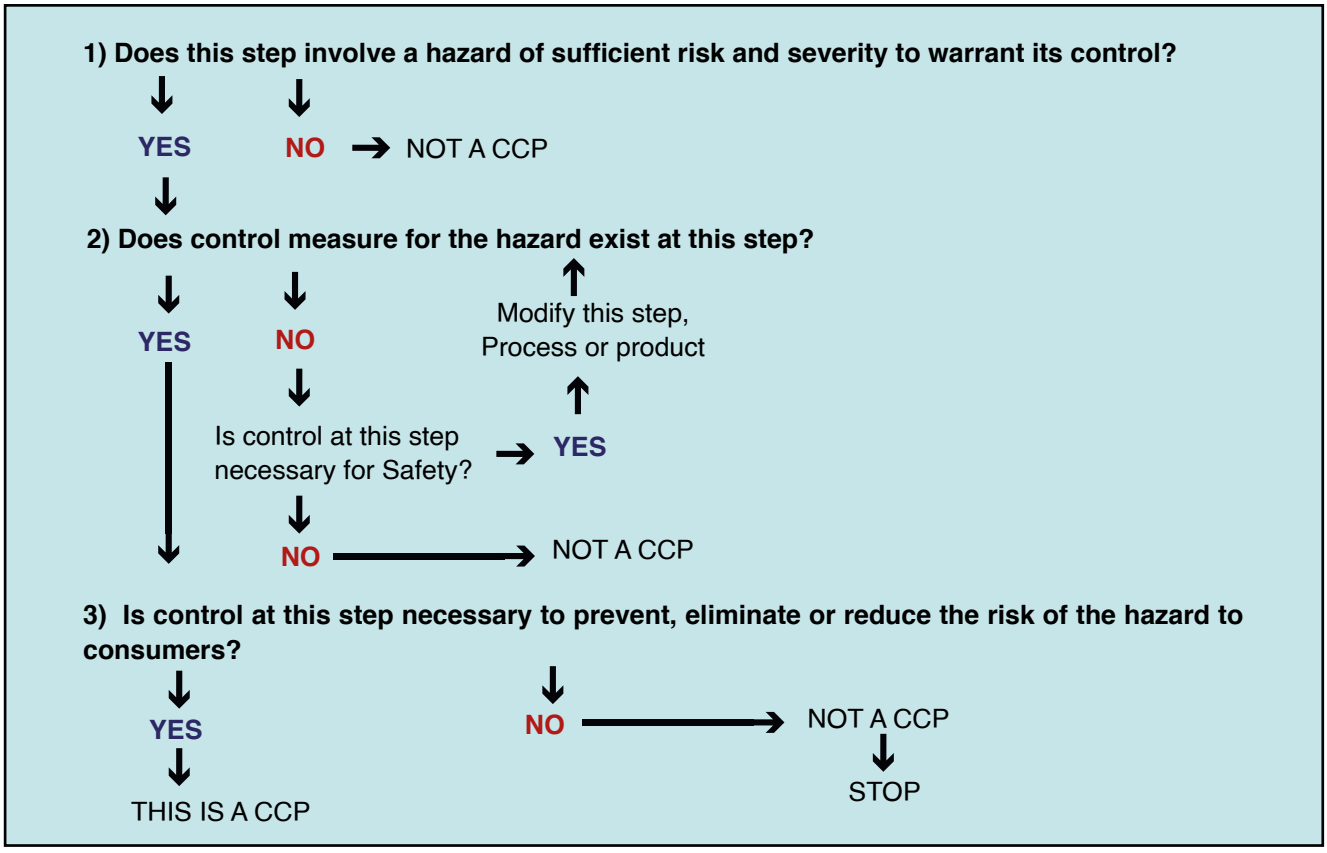

Fig.1: Example of HACCP decision tree

II.HACCP PLAN FORM

HACCP plan form is the continuation of Hazard analysis worksheet, but both are designed separately. HACCP plan form can be completed by following the below mentioned steps comprising of HACCP principles 3 to 7. A blank HACCP plan form is provided in Form 2 for reference.

Form 2: Example of HACCP Plan Form

HACCP PLAN FORM

Firm Name:		**Product Description:**							
Firm Address:		**Method of Storage & Distribution:**							
		Intended Use & Consumer:							
1	2	3	4	5	6	7	8	9	10
Critical control point(CCP)	Sig-nificant hazard	Critical limits for each control measure	Monitoring				**Cor-rective action(s)**	**Records**	**Verification**
			What	**How**	**Frequency**	**Who**			

Signature of Company Official: _____ Date: _____

Set up the HACCP Plan form by entering the firm's name, address and product information. Then fill each column of form as described below:

Column 1: Find the processing steps that have identified as CCPs in Column 6 of the Hazard Analysis Worksheet. Record the names of these processing steps in Column 1 of the HACCP Plan Form.

Column 2: Enter the hazard(s) for which these processing steps were identified as CCPs in Column 2 of the HACCP Plan Form. This information can be found in Column 2 of the Hazard Analysis Worksheet.

Column 3: Enter the critical limit(s) in Column 3 of the HACCP Plan Form (step 13).

Columns 4, 5, 6, and 7: Enter the "What," "How," "Frequency," and "Who" monitoring information in Columns 4, 5, 6, and 7, respectively, of the HACCP Plan Form (step14).

Column 8: Enter the corrective action procedures in Column 8 of the HACCP Plan Form (step 15).

Column 9: Enter the names of the HACCP monitoring records in Column 9 of the HACCP Plan Form (step 16).

Column 10: Enter the verification procedures in Column 10 of the HACCP Plan Form (step 17). (Sign and date the HACCP Plan Form by the most responsible individual on-site at the processing facility or a higher level official.)

STEP 12: Set up the HACCP Plan Form

This step involves the setting up of a convenient HACCP Plan Form suitable for the product. A standardized HACCP plan form can be designed following the steps described below (Steps 13 -18).

STEP 13: Set Critical Limits

This step involves the setting of critical limits (CL) for each hazard at each CCP identified in the hazard analysis. A critical limit is the identification of maximum or minimum value to which a parameter of the process must be controlled in order to control the hazard. The determination of the critical limit must be based on scientific information or data. Setting an operational limit stringent than critical limits will provide a chance to bring the process under control before the critical limit is exceeded.

STEP 14: Establish monitoring procedures

The HACCP plan form must list the monitoring procedures at each CCP. CCP monitoring is used to ensure that a critical limit is met and a potential hazard can be controlled. Critical limits can be quantitative or qualitative. There are four elements that are required in an effective monitoring system.

- What will be monitored?
- How will monitoring be done?
- How often will monitoring be done (frequency)?
- Who will do the monitoring?

STEP 15: Establish corrective action procedures

A corrective action must be taken whenever there is a deviation from a critical limit at a CCP. For each processing step where a significant hazard is identified in the HACCP Plan Form, describe the procedures that will be used when the monitoring indicates that the critical limit has not been met.

It is important to note that, when a deviation occurs, a corrective action must be taken on all affected food products produced since the last monitoring observation

or measurement. A pre-determined corrective action is recommended wherever possible.

STEP 16: Establish a recordkeeping system

Efficient and accurate record-keeping is essential to the application of HACCP system. This step involves the documentation of different records for developing HACCP plan, records generated by the HACCP system, documentation of methods and procedures used and the records of employee training program.

Accurate record keeping can help line managers and business owners to keep track of their food production processes and corrective actions.

STEP 17: Establish verification procedures

Verification procedures of HACCP plan determines that the HACCP plan is being implemented properly and the practices used are consistent with the HACCP plan.Verification helps to check whether the HACCP system is working to control significant hazards and whether modifications of the HACCP plan are required to reduce the risk of recurrence of deviations.

The HACCP records have to be verified within 7 days of generation. It is generally recommended that HACCP verification be done at least annually and whenever there is a significant change in the food processing and handling system.However, the frequency of verification should be determined by the HACCP team after careful

consideration and must be sufficient to ensure that the HACCP plan is being implemented effectively.

STEP 18: Complete the HACCP Plan Form

Once we finished the above steps for all the identified significant hazards that relate to the product, it marks the completion the HACCP Plan Form.The signature with date of the most responsible individual on-site at your processing facility or a higher-level official is needed in the HACCP plan Form. It signifies that the HACCP plan has been accepted for implementation by your firm from that date.

Conclusion

HACCP has emerged as one of the main strategies used in the food industries worldwide to ensure food safety. Apart from improving food safety, the application of the HACCP system provides significant benefits such as the ease of inspection by regulatory authorities, the reduction of final product losses and the promotion of international trade by increasing the customer confidence on safety of food.

While the continuing trend towards trade liberalization gives food producers increased access to international markets, it also presents new challenges in terms of ensuring the quality and safety of domestic and exported food supplies.

In comparison to the non-HACCP processors, HACCP firms were more diversified in their export markets and were able to target the more developed and lucrative markets. Every entrepreneur, who wants to enter the food industry or an existing player who is concerned about food safety should consider the implementation of HACCP systems to ensure food safety, which enables better access to the premium markets.

References

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2. Hazard Analysis and Critical Control Point Training Curriculum 6th Edition – June 2020

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Processed shrimp shells could soon replace fossil fuel-derived wastewater filters

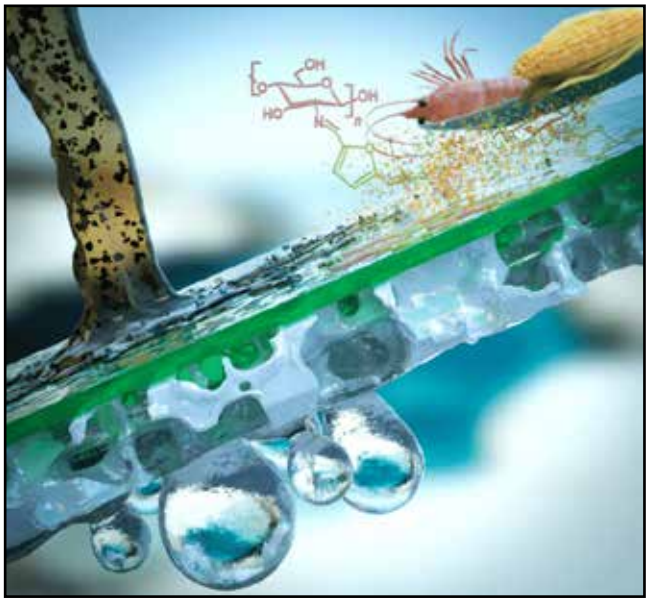
Shrimp shells, plant extracts and recycled plastic have helped King Abdulla University of Science and Technology (KAUST) researchers build a sustainable thin-film composite membrane that could replace conventional membranes made from fossil fuels.Thin-film composite membranes are widely used in applications such as wastewater treatment, gas separation and chemicals production. They include a porous support topped by an ultrathin layer that contains nanoscale pores.

These pores can trap molecules and tiny particles while allowing liquid solvents to pass through. Most of these membranes are made using materials derived from fossil fuels, some of which are toxic. So, a KAUST research team in Saudi Arabia led by Gyorgy Szekely set out to re-engineer these membranes using green materials and processes.

The team made the porous support using recycled plastic and coated this with a natural non-toxic polymer called chitosan, derived from shrimp shells. The National Aquaculture Group (Naqua) in Saudi Arabia produces about 50,000 tonnes of shrimp shell waste annually, which is used to produce 135 tonnes of chitosan per year.

To form chitosan into a nanoporous membrane, the team cross-linked its polymer chains using 2,5-furandicarboxaldehyde (FDA), a molecule derived from plant waste via green processes. The researchers selected eucalyptol, produced from the leaves of the eucalyptus tree, as the solvent for this reaction. They also used a catalyst called TMG, a greener alternative to the harsh compounds typically used to speed up the cross-linking.

"Converting abundantly available waste biomass into value-added materials, such as this membrane, not only solves a waste management issue but also generates a value-added product," says Szekely. Using



waste materials also means the new membrane has a similar cost to conventional membranes, he adds. After optimising the membrane preparation process, the researchers tested the membranes using acetone that carried polystyrene molecules of different lengths, along with a smaller molecule called methyl styrene dimer.

The membrane allowed acetone to flow through at a similar rate to conventional membranes. "It can also filter out molecules of an equivalent size to dyes or active pharmaceutical ingredients," says Cong Yang, a PhD student in the team. "Therefore, this membrane is practically applicable for biomedical, textile, pharmaceutical or food industries."The researchers also showed they could fine-tune the membrane's properties with a non-toxic solvent called TamiSolve. They now hope to collaborate with local shrimp farms to ensure a sustainable supply of chitosan, as well as develop processes to make the membranes on a larger scale.

www. thefishsite.com

CMFRI identifies new fish in Indian waters

The Central Marine Fisheries Research Institute (CMFRI) has identified a new carangid (Vatta) species from the Indian coast. It belongs to the 'queen fish' group and is named Scomberoides pelagicus'. The fish is locally known as pola vatta .

The CMFRI confirmed it as a new species after detailed taxonomic and genetic analysis. "The new fish is distinct by deep ovate body, concave dorsal head profile and stout and less numerous gill rakers on the first gill arch compared to the closely related species," said a communication.

There are over 60 species of carangids in the Indian seas and four of them belong to the 'queen fish' category. The newly-described one is the fifth queen fish from the Indian waters."In the wake of many resources being increasingly threatened by depletion owing to their increasing role in the human food chain,

identification of more new fishes assumes significance as it helps enrich marine biodiversity", said E.M. Abdussamad, principal scientist who identified the fish.He said that the find would help better Indian marine biodiversity status. The identification, he said, would greatly help policy makers, marine scientists and other stakeholders to work on management and conservation plans.

www.thehindu.com

KVK's organic manure 'Fishlizer' hits market

Organic fish manure developed by the Ernakulam Krishi Vigyan Kendra (KVK) is set to hit the market under the brand name 'Fishlizer'. The fish manure is being produced by women entrepreneurs trained by the KVK. A communication from the KVK said that housewives Sini Sha from Cherai and Ivy Jose from Munambam had set up their start-ups Lachoos Malsyavalam and Ivees Agro Hub with the adoption of the KVK's technology for producing organic manure using fish waste.

The 'Fishlizer' initiative is an outcome of a series of training programmes provided by the KVK aimed at promoting start-ups in producing the manure on a commercial scale.

The Kirshi Vigyan Kendra functioning under the Central Marine Fisheries Research Institute (CMFRI) provides technology for producing the manure and support its marketing, said Shinoj Subramanian, head of the KVK. "In order to ensure the quality of the product, the KVK team will regularly visit the start-up units for monitoring", he said.

The organic manure from fish waste was developed in tandem with the Central government's Swachh Bharat campaign

www.thehindu.com

India expects to hit seafood-export record

India's seafood-export value is likely to hit an all-time high in its current fiscal year, which ends 31 March, 2022.The growth mainly comes from sales of shrimp, India's top seafood export, and from strong demand from the United States and China. India's seafood exports between April 2021 and January 2022 reached a value of USD 6.7 billion (EUR 5.9 billion), despite a slight dip in January's export totals, Seafood Exporters Association of India President Jagdish Fofandi said.

"The growth has come mainly from aquaculture and the U.S. market. We were doing USD 700 million [EUR 618 million] worth of exports every month and by February, we are likely to exceed the all-time high of USD 7.02 billion [EUR 6.2 billion] in exports achieved in the FY18," Fofandi said.

India topped the tables in U.S. shrimp exports for the ninth consecutive year in 2021, sending 680.8 million pounds (308,805 MT) of shrimp to the U.S., up from 543.5 million pounds (271,728 MT) in 2020 and its previous record of 622.8 million pounds (282,584 metric tons) in 2019.

India's seafood-export value sunk to USD 5.96 billion (EUR 5.3 billion) in 2020-2021 fiscal year, down 10.6 percent from the USD 6.67 billion (EUR 5.9 billion) it achieved in 2019-2020.

InCred Equities Research Analyst Nitin Awasthi said given considerable growth in demand, particularly from China, and recent increases in farm-gate rates, shrimp prices are expected to remain firm.

New Diamond Aqua Enterprise Managing Director Durai Murugan said U.S. and Chinese demand remains strong, an indicator prices will remain high.

"Farmers in Andhra Pradesh are stocking and production is in full swing," Murugan said. "Higher prices are pushing farmers to focus on 50- and 60-counts. Indian production is likely to stay higher this year compared to last year. U.S. inflation and supply chain issues are still going on and so the prices are likely to sustain."

www.seafoodsource.com

Customs duty revamp gives fisheries sector a boost

India's fisheries sector has emerged as a key beneficiary of the customs duty rejig to boost local production, even as much of the attention has been focused on the manufacturing industry.

The Union budget announced a sharp reduction of basic customs duty from 30% to 10% on live black tiger shrimp, which farmers use for breeding, and from 30% to 15% on both frozen krill, a feed for fish, and on algal oil derived from certain marine algae for making aquatic feed.

These inputs used in shrimp culture were given relief on basic customs duty as India is a major exporter of shrimps and there are several farms in coastal Andhra Pradesh and Tamil Nadu, Central Board of Indirect Taxes and Customs (CBIC), Chairman Vivek Johri said in an interview.

To support the food processing sector, the duty on frozen squids and mussels, a shell fish, too was halved to 15%. Increasing farmers' income is a policy priority for the government, including for those in the fisheries sector, Johri said.

The government is also running a five-year scheme -- Pradhan Mantri Matsya Sampada Yojana up to FY25, aimed at addressing the gaps in the fisheries value chain from fish production to post-harvest infrastructure and marketing. Under this scheme, India has set a fisheries export target of Rs. 1 trillion, additional seven million tonnes of fish production, and generation of 5.5 million jobs over the years. The policy priority is to help achieve a 'blue revolution' through sustainable and responsible development of the fisheries sector.

India's marine product exports have been growing robustly, and a big part of it is due to shrimp exports. Frozen shrimp makes up 74% of India's marine product exports in dollar terms, followed by frozen fish and frozen squids.

As per provisional estimates from the commerce ministry, export of marine products grew 35% to $ 6.1 billion during the April-December period of 2021 compared to $ 4.5 billion in the same period the previous year.

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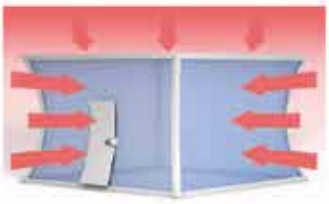

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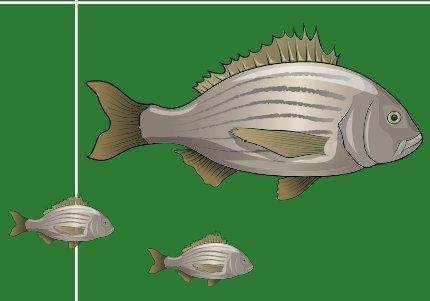
5	Kalai Selvan (Raju) Tuna Paradise Co. Ltd. CEO 49/7 Moo.7 t.Khokkloy, A. Takuathung Phang Nga82140, Thailand Tel: +66 76452033 Fax: +66 7645232 Email: kselvan1974@gmail.com raju@tunaparadise.com Skype : rajutpc		
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