



# S O U V E N I R



15TH - 17TH FEBRUARY 2023 | BISWA BANGLA MELA PRANGAN  
KOLKATA, WEST BENGAL



## 23<sup>rd</sup> India International Seafood Show 2023

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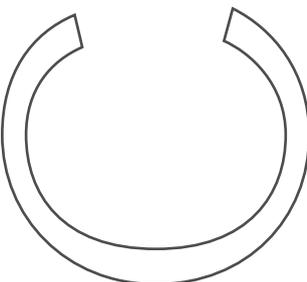
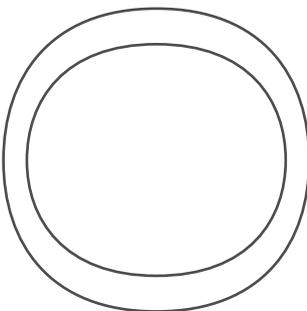
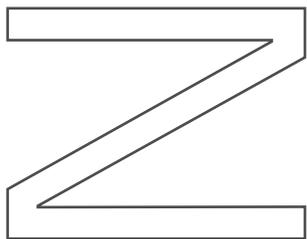
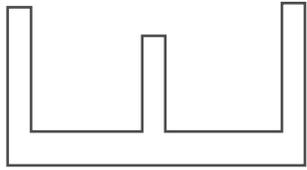
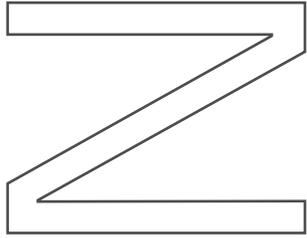
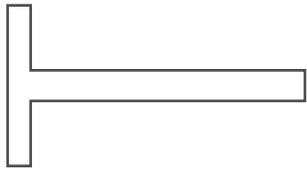
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23<sup>rd</sup> India  
International  
Seafood Show 2023



07

## FOREWORD

Message from Chairman of MPEDA

09

## MESSAGE

Message from National President of SEAI

11

## MESSAGE

Message from President of India

13

## MESSAGE

Government Messages

28

## EC MEMBERS

Office bearers of SEAI

32 WALK DOWN MEMORY ANE  
Snapshots from the 22nd edition of the India International Seafood Show 2021 held in Kerala

58 ARTICLE  
Recent Trends in Fish Processing and Packaging

77 ARTICLE  
Food allergens and its management as per international and national requirements

87 ARTICLE  
Odisha - Blue Revolution 2036

92 ARTICLE  
A Path towards Sustainable Fishery - Marine Stewardship Council (MSC) Certification – An Outline

102 ARTICLE  
Sectorial musings

106 ARTICLE  
SEAI and School of Industrial Fisheries, CUSAT, Towards sustainable and safe seafood from India

112 ARTICLE  
Need for synergizing domestic marketing and international trade towards augmenting fish consumption

SOU  
VENIR





## FOREWORD



**Shri D V SWAMY**  
Chairman  
MPEDA

Seafood Exports from India have continued the growth trend, despite all odds. Thanks to the exponential and sustainable growth of aquaculture in the country. India has become one of the leading suppliers of quality seafood to all the world's major markets. It exported seafood worth US \$ 7.76 billion in 2021-2022, a record achievement with 30 per cent growth over the previous year.

India International Seafood Show (IISS) is the most critical seafood event in India and one of the largest Seafood Fairs in the world. The show is jointly organized by The Marine Products Export Development Authority (MPEDA) and the Seafood Exporters Association of India (SEAI). Over the years, the show has grown in stature, acquiring International recognition and global acceptance. The organizers' vision is to provide a common forum for seafood processors, exporters, importers, processing machinery manufacturers and allied industries to meet under one roof for the benefit of the sector.

Considering the excellent leap seafood production in India has made from 2012 onwards, the show will focus on "IISS – The world's Seafood Basket." Furthermore, IISS 2023 will be hosting an International Buyer Seller Meet (IBSM) with the participation of buyers from major and emerging seafood-importing countries.

The 23rd Edition of India International Seafood Show, hosted at Biswa Bangla Mela Prangan, Kolkata, West Bengal, will further add splendour to the export basket of the nation. I extend my best wishes and success to all the show's participants.





## PRESIDENT'S MESSAGE



Shri Jagdish Fofandi  
President  
SEAI

Dear Professional colleague,

Seasons Greetings from the Seafood Exporters Association of India! It gives me immense pleasure to welcome you all to the city of joy - Kolkata. The city where the soul lives in the real people, their unfettered enthusiasm for its culture, traditions, temples, literature, history, food, music, sports, theater, and even politics with the famous Adda sermons. Amalgamation of tradition and modern, with colonial architecture, museums, art galleries, this city offers something or other to everyone.

We are also thrilled to host the 23rd edition of the India International Seafood Show, the largest seafood show in Asia from February 15 to 17, 2023 at the grand lawns of Biswa Bangla mela prangan at a time when the seafood exports created an all time record of surpassing Rs 50,000 Crores in the last fiscal. IISS as a biennial event offers ocean of opportunities for exporters and importers of Indian marine products, providing an umbrella for various stakeholders of this sector, to assemble under the same roof, build trade relations and contribute towards the progress of seafood exports from the country. The event also provides an excellent platform for entrepreneurs to exchange technological ideas and foster business development.

Hosted jointly by Marine Products Export Development Authority and the Seafood Exporters Association of India. With over 350 stalls, IISS 2023 edition with apt theme of the World's Seafood Basket, is expected to have more than 3000 delegates from India and abroad. We have arranged all the ingredients to make this edition a fabulous programme with no stones unturned. I am happy that you have made the right decision to be part of this epoch making event creating a history of sort in our sector with unforgettable memories as the takeaways; be it business or the intangible experience. I wish the fraternity all success!

Cheers!

Jagdish Fofandi  
National President





सत्यमेव जयते

राष्ट्रपति

भारत गणतंत्र

PRESIDENT

REPUBLIC OF INDIA

**MESSAGE**

I am happy to know that the Marine Products Export Development Authority (MPEDA) in association with the Seafood Exporters Association of India (SEAI) is organizing the 23<sup>rd</sup> edition of India International Seafood Show (IISS-2023) on the theme "IISS-The World's Seafood Basket" from 15th to 17th February, 2023 at Kolkata, West Bengal.

The fisheries and aquaculture sector has long been an essential source of food, nutrition, employment and income for millions of people, especially in coastal and rural areas of the country. The participation of international buyers will provide tremendous opportunity for the Indian seafood sector to get acquainted with the stringent food standards maintained by the export market and various advanced techniques. I am confident that this biennial event will serve as a platform for the Indian seafood sector to showcase the value-added and sustainable seafood that India can offer to the world markets.

I appreciate MPEDA for doing such a commendable job in providing all necessary assistance to stakeholders in the entire value chain of the seafood industry of the country.

I extend my greetings and felicitations to the organizers and participants and wish the IISS-2023 every success.

(Droupadi Murmu)

New Delhi  
November 18, 2022





His Excellency  
Shri Narendra Modi  
Prime Minister of India





মুখ্যমন্ত্রী, পশ্চিমবঙ্গ  
मुख्यमंत्री, पश्चिम बंगाल  
وزیر اعلیٰ مغربی بنگال

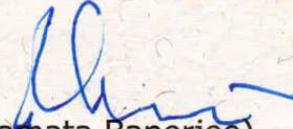
CHIEF MINISTER, WEST BENGAL

2<sup>nd</sup> February, 2023

### MESSAGE

I am happy to learn that the 23<sup>rd</sup> edition of **India International Seafood Show**, organised by **Marine Products Export Development Authority (MPEDA)** in association with **Seafood Exporters Association of India (SEAI)**, will be held at Biswa Bangla Mela Prangan, Kolkata, from 15<sup>th</sup> – 17<sup>th</sup> February, 2023 and a souvenir will also be brought out on the occasion to commemorate the grand event.

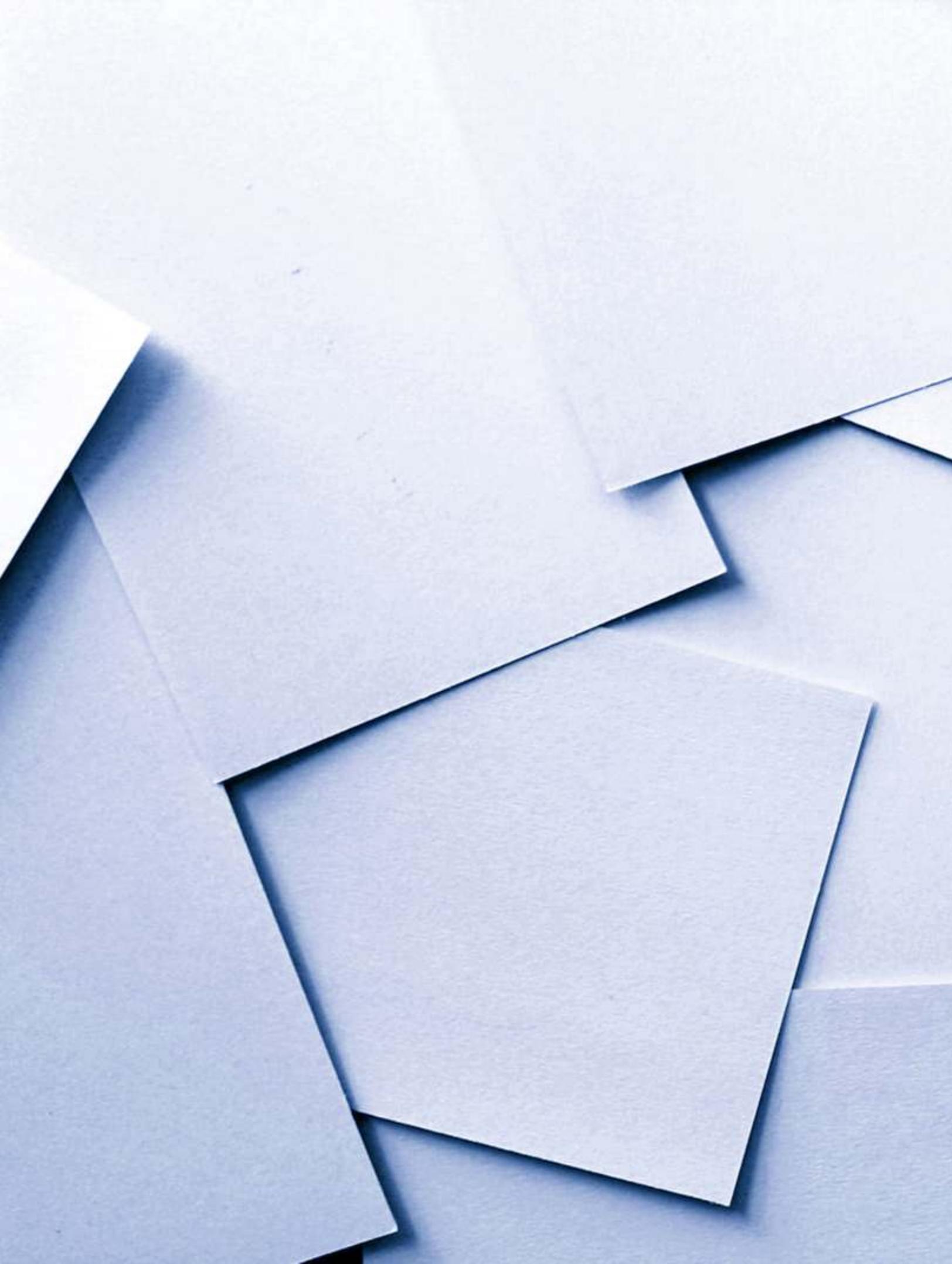
I take this opportunity to congratulate both MPEDA and SEAI for taking this initiative and extend my best wishes for the success of the event.

  
(Mamata Banerjee)

**Shri D. V. Swamy, IAS**  
Chairman, The Marine Products Export  
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**Shri Piyush Goyal**  
Minister of Commerce &  
Industry, Consumer Affairs,  
Food & Public Distribution  
and Textiles,  
Government of India



## MESSAGE

I am delighted to learn that the Marine Products Export Development Authority (MPEDA), in coordination with the Seafood Exporters Association of India (SEAI), is organizing the 23rd edition of the biennial India International Seafood Show (IISS-2023) in Kolkata from 15th to 17th February, 2023.

It is gratifying to note that seafood exports from India have shown exemplary growth bringing India among the top five seafood exporters in the world. The seafood exports have grown significantly to reach \$7.7 billion in 2021-22 despite the challenging global situation that indicates the incessant efforts of MPEDA and all other concerned authorities towards exploring new possibilities for the industry and working with them for the benefit of fishermen, aquafarmers and exporters alike.

Under the visionary leadership of Hon'ble Prime Minister Shri Narendra Modi, India's maritime sector has scaled new heights and contributed in boosting trade and commerce. The Government has focussed on port led development by expanding port capacities and increasing the efficiencies of the existing systems with the vision of building an Aatmanirbhar Bharat. Given the immense potential and encouraging growth trends, I am confident that marine exports will continue to rise in the near future.

With this ongoing vision to continue this growth trend and expand our seafood market, I am sure that IISS 2023 will serve as an excellent platform for the exchange of experiences and exposure to new technologies, which would ultimately help in boosting our marine exports. I would like to congratulate both MPEDA and SEAI for their efforts in organizing this event and wish IISS-2023 a grand success.

  
Piyush Goyal





**Shri Parshottam Rupala**  
Minister  
Fisheries, Animal  
Husbandry & Dairying  
Government of India



## MESSAGE

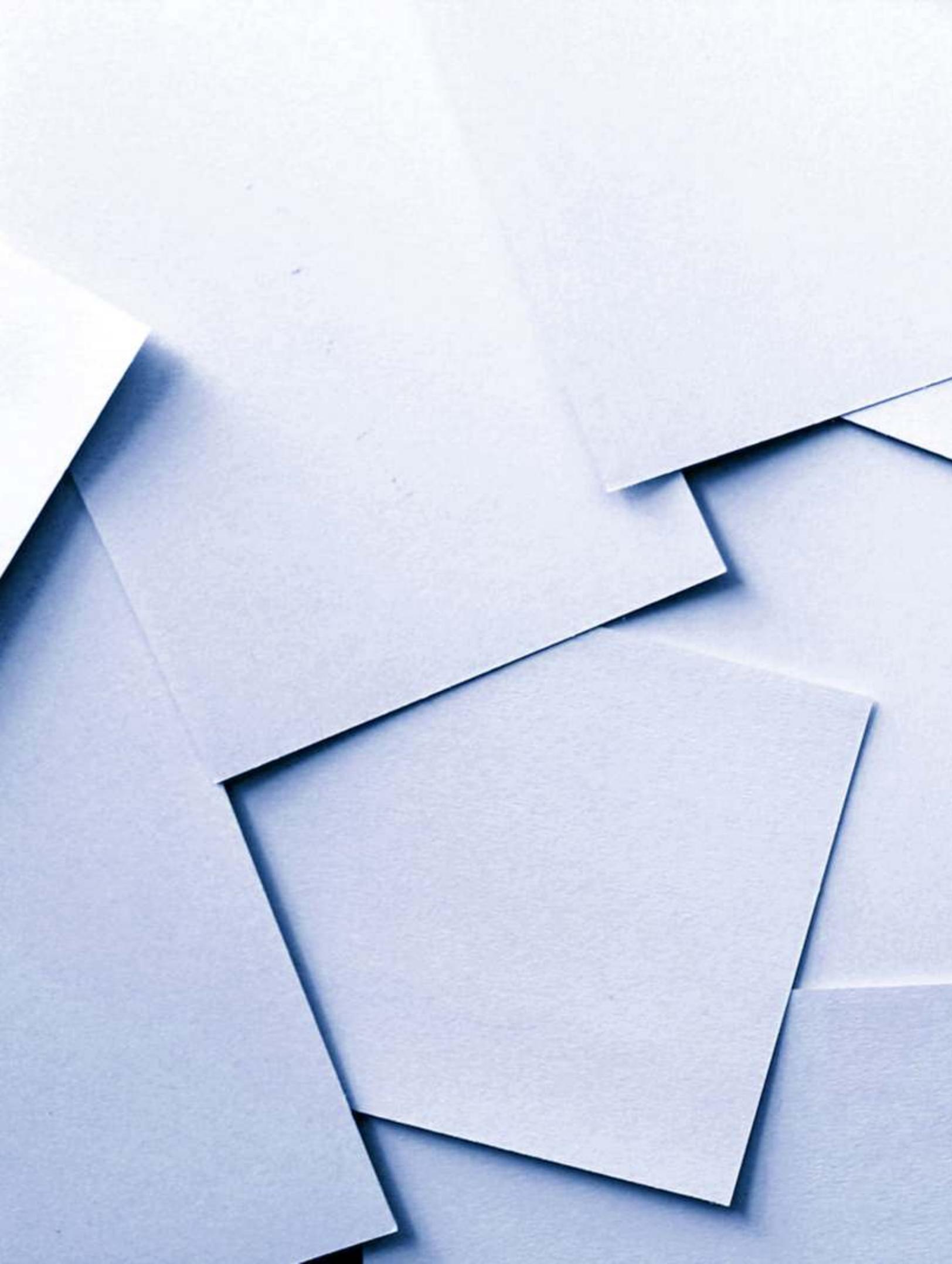
I am glad to know that Marine Products Export Development Authority (MPEDA) in association with Seafood Exporters Association of India is organizing the 23rd edition of India International Seafood Show (IISS)-2023, a biennial event, from 15th - 17th February, 2023, at Biswa Bangala Mela Prangan, Kolkata, West Bengal. "The theme of the show is "IISS The world's Seafood Basket".

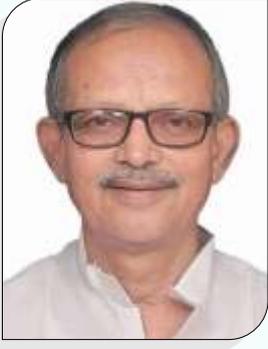
India is one among the world's largest seafood producers and exporter of fish and fish products to the major developed markets of the world. The Indian seafood industry has been showing positive growth. Seafood is one of the fastest moving commodities exported from India which generates employment and income.

I hope that the present edition of IISS will offer an excellent platform for seafood importers, seafood processors and exporters, policy makers, other stakeholders to gather latest information, exposition of innovative technologies and acquire recent development in this sector. I am sure that technical sessions and interactions during the show will pave way for exploring and expanding seafood trade.

I extend my greeting to the Organisers and wish this biennial event all success.

**Parshottam Rupala**





**Shri Biplab Roy Chowdhury**  
Ministry of State  
(Independent Charge)  
Department of Fisheries  
Govt. of West Bengal

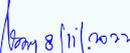


## MESSAGE

I am happy to know that the Marine Products Export Development Authority (MPEDA) and the Seafood Exporters Association of India (SEAI) is jointly organising the 23rd edition of India International Seafood Show (IISS-2023) at Biswa Bangla Mela Prangan, Kolkata, West Bengal from 15th-17th February, 2023.

The theme of IISS-2023 is "IISS - The World's Seafood Basket". I hope that this show will provide a platform for the business to showcase the value added and sustainable seafood from India and the participants will get acquainted to the advanced techniques and technologies.

I take opportunity to congratulate both MPEDA and SEAI and extend good wishes for the success of the event.

  
Biplab Roy Chowdhury





**Shri Rajesh Agrawal**  
Additional Secretary  
Government of India  
Minister of Commerce  
& Industry  
Department of Commerce



## MESSAGE

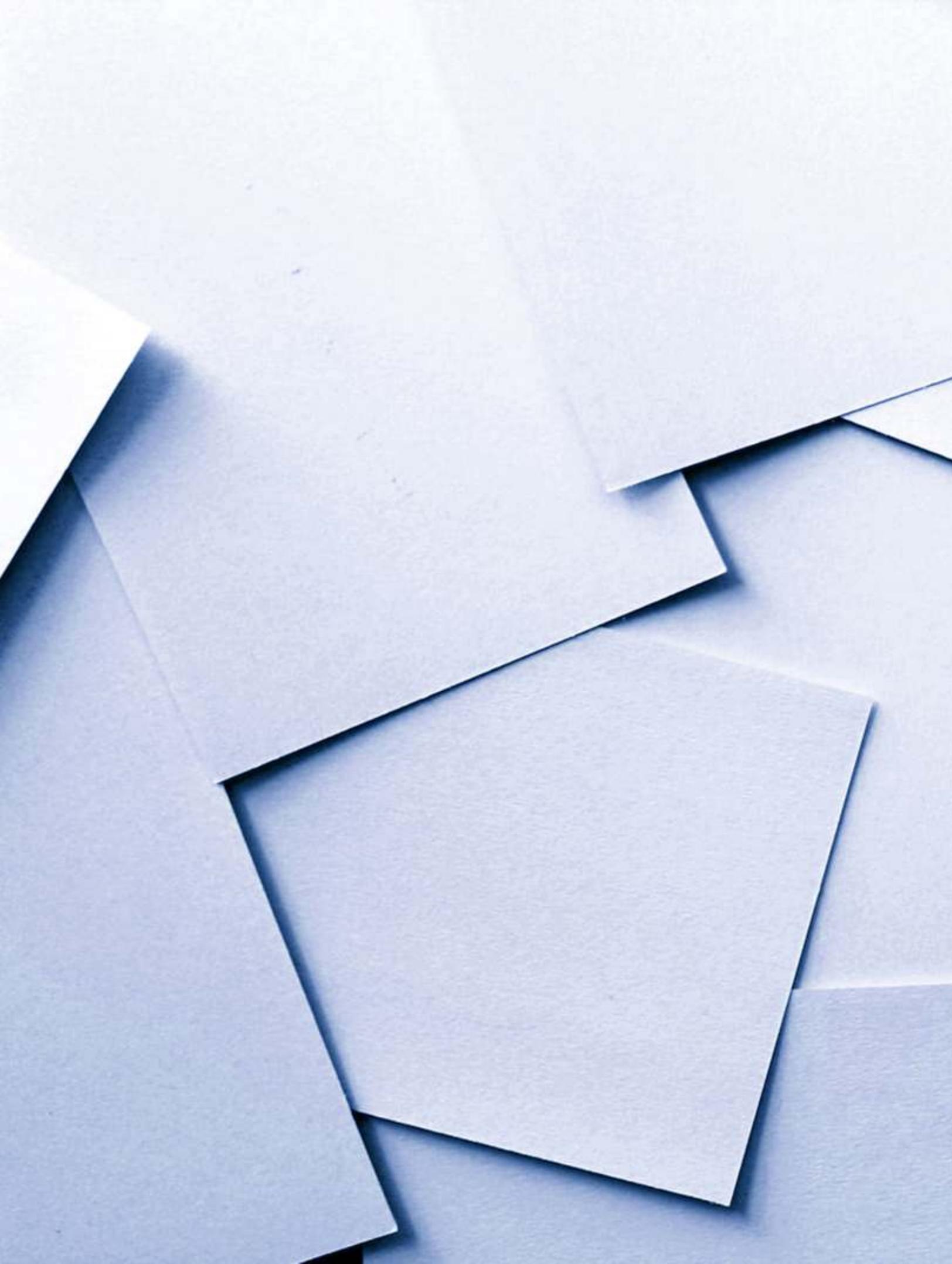
I compliment Marine Products Export Development Authority (MPEDA) and Seafood Exporters Association of India (SEAI) for organizing the 23rd edition of biennial India International Seafood Show (IISS-2023) at Kolkata, West Bengal from 15th to 17th February 2023.

I am sure that the biennial show would provide an opportunity to the exporters and other stakeholders in India to discuss the matters of common interest in the field of production, manufacturing, processing, quality management, etc. with their overseas counterparts, with an aim to increase export of value-added seafood products from India.

I am confident that the IISS 2023 will not only contribute significantly in export promotion and leveraging new markets for our seafood, but also will strengthen India's position as one of the important players in this sector globally.

I extend my best wishes for successful organization of IISS 2023.

Rajesh Agrawal





**Shri Sunil Barthwal**  
Commerce Secretary  
Government of India



## MESSAGE

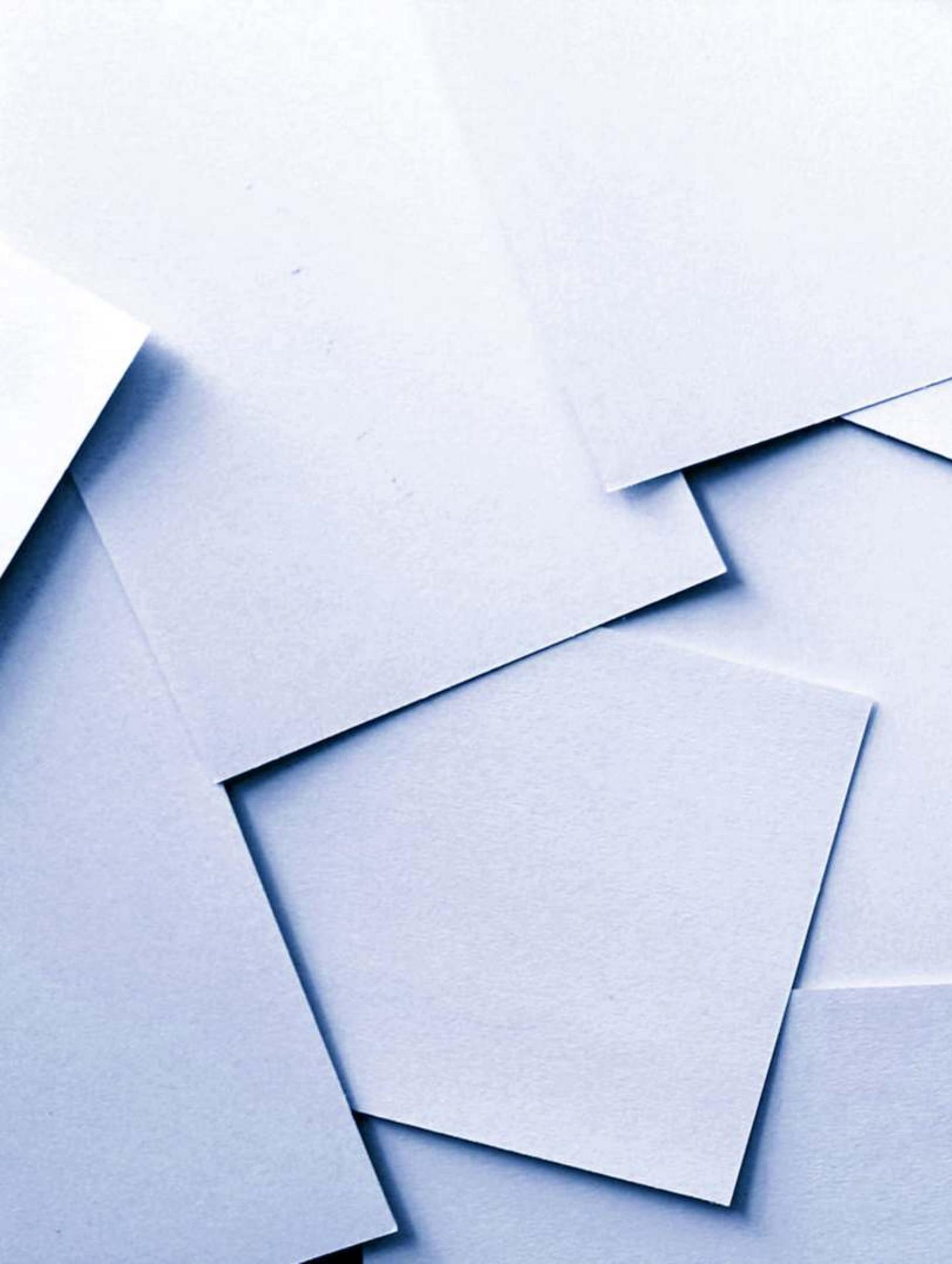
It is heartening to know that Marine Products Export Development Authority (MPEDA) in coordination with the Seafood Exporters Association of India (SEAI) is organizing the 23rd edition of biennial India International Seafood Show (IISS-2023) at Kolkata, West Bengal from 15th to 17th February 2023.

I am sure that this Show will provide a useful platform to share best practices being followed globally and promote adoption of some of these practices and new technologies in the industry. This would also prove to be a catalyst for our seafood exports given the unprecedented growth it has been witnessing in the past few years especially with the all-time high achievement of US\$ 7.75 billion worth of exports in FY 2021-22.

I wish the IISS 2023 event, a grand success.

A handwritten signature in blue ink, appearing to read 'Sunil Barthwal'.

Sunil Barthwal





**Shri Santosh Sarangi, IAS**  
**Director General**  
**Government of India Ministry**  
**of Commerce & Industry**  
**Directorate General of**  
**Foreign Trade**



## MESSAGE

It is heartening to know that the Marine Products Export Development Authority in association with the Seafood Exporters Association of India (SEAI) is organizing the 23rd edition of India International Seafood Show at Kolkata, from 15th to 17th February, 2023. IISS 2023 presents tremendous scope for tapping new avenues and introduces various technologies and products to the global market. I hope that this biennial show will project capabilities as well as future potentials in Seafood Industry.

I wish this biennial event all success.

Santosh Sarangi, IAS

## OFFICE BEARERS OF SEAI



**Mr. JAGDISH FOFANDI**  
National President



**Mr. Y. Surya Rao**  
Vice President



**Mr. Rustom Irani**  
Vice President



**Mr. D. B. Ravi Reddy**  
Treasurer



**Mr. Elias Sait**  
Secretary General

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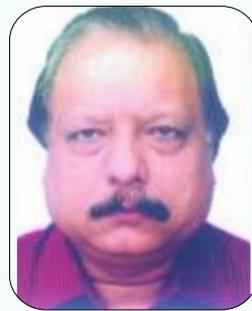
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**APPROVAL NO:243**

## **DHANANI FROZEN FOODS UNIT-I**

**EU APPROVAL NO:265**

**MANUFACTURER AND EXPORTER OF FROZEN SEA FOODS.**



### **ALL TYPES OF FIN FISHES CEPHALOPODS & CRUSTACEANS**

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**MR. SHIVSHANKAR SINGH (MANAGER)**

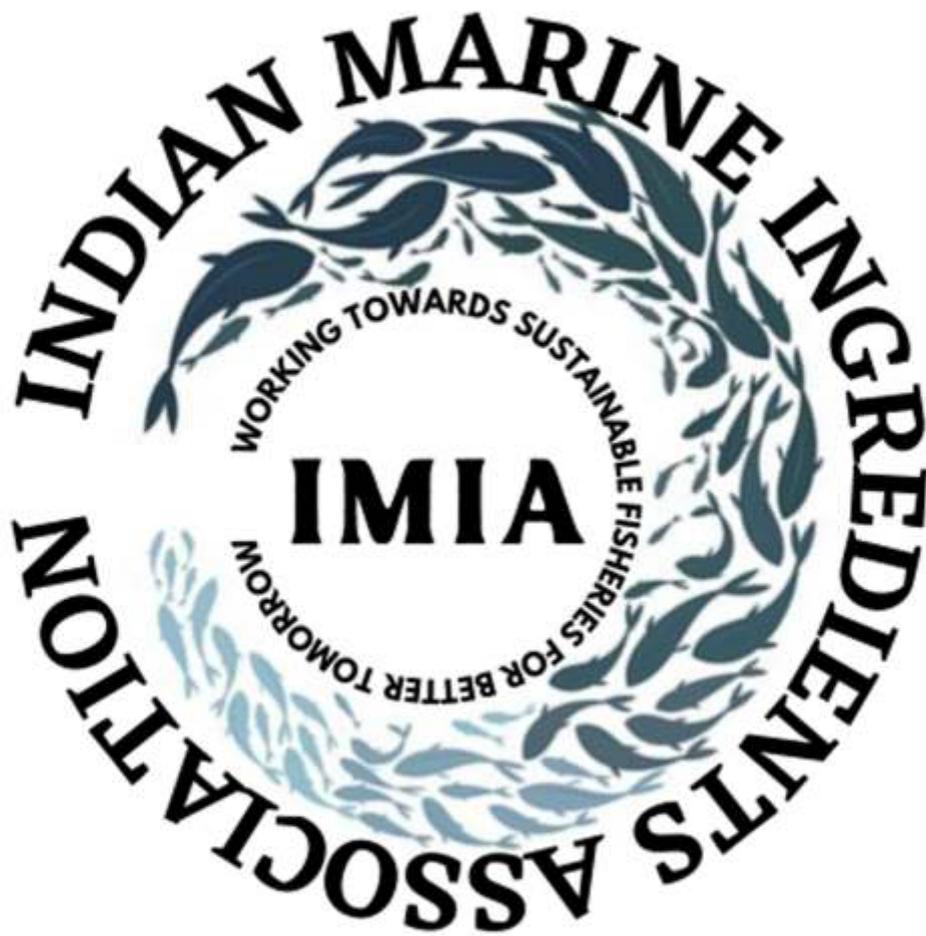
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*WITH BEST  
COMPLIMENTS  
FROM*





## *Fishery Improvement Project Karnataka and Kerala*



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Email : [president@imia.co.in](mailto:president@imia.co.in)



The Indian Marine Ingredients Association (IMIA) is a non-profit organization established to work toward improving the sustainability of marine resources through the development of Fishery Improvement Project (FIP) as well as promoting and implementing sustainable fishing practices in the territorial waters of the Republic of India.

A successful FIP requires multi-stakeholder efforts to improve fishing practices and management so that species, habitats, and people can all thrive. Main objectives of the FIP are to maintain sustainable fisheries stock, to minimize environmental impact and to ensure effective fisheries management.





## *Fishery Improvement Project Tamil Nadu*



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## Fishery Improvement Project Karnataka State







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## Fishery Improvement Project Tamil Nadu







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# Recent Trends in Fish Processing and Packaging



**George Ninan**

Director

ICAR-Central Institute of Fisheries Technology, Kochi-29

George.Ninan@icar.gov.in



## Introduction

Health, nutrition and convenience are the major factors driving the global food industry in this era. Fish products have attracted considerable attention as a source of important nutritional components like high-quality protein, essential vitamins, minerals and polyunsaturated fatty acids in the human diet. About 20 % of the world's population derives at least one-fifth of its animal protein intake from fish, and some small island states depend almost exclusively on fish. Among the animal protein sources, fish protein is one of the cheapest and it accounts for about 40 % of the total animal protein intake of an average person in the tropics. However, the protein intake from fish is not uniform throughout the world. It is highest in most of the islands, Japan, Canada and some regions of Africa. Apart from protein, fish also contains a considerable amount of fat. The fat content ranges from 0.2% to 25%. However, fat

from fatty fish species contains polyunsaturated fatty acids (PUFAs) namely EPA (eicosapentaenoic acid) and DHA (docosahexaenoic acid), which are essential for proper growth of children and are associated with the prevention of cardiovascular diseases such as coronary heart disease. The presence of PUFAs in the diet of pregnant women helps in the proper brain development of babies. The fat also contributes to the energy supply and assists in the proper absorption of fat-soluble vitamins namely A, D, E, and K. Fish is also a rich source of vitamins, particularly vitamins A and D from fatty species, as well as thiamine, riboflavin and niacin (vitamins B1, B2 and B3). As fish is highly nutritious, it is extremely susceptible to spoilage, due to intrinsic and extrinsic factors. Proper processing and packaging help in maintaining the keeping quality of fish for an extended period. Worldwide, an array of processing and packaging methods are

thus followed for enhancing the shelf life of fish and fishery products.

## Value addition

Value addition is the process of changing or transforming a product from its original state to a more valuable state. A broad definition of value addition is economically adding value to a product by changing its current place, time, and form characteristics as per the market preferences. Value addition can be accomplished in a number of different ways, but for fishery products, the most important one is the innovative approach. Innovation focuses on improving existing processes, procedures, products, and services or creating new ones. Value addition should start with intelligent market information on customers and competitors to make sure an opportunity exists. The contribution of fisheries to the economy of a country will be greater than the value of the catch at the place of landing if value addition is practiced. Value addition also results in added costs and these costs need to be recovered, if the operation is to be economically feasible. This requires consumers to have enough purchasing power to recover the costs. World over, the general wealth and purchasing power of consumers are showing an increasing trend, which can be exploited for marketing diversified value-added fish products. Many raw commodities have intrinsic value in their original state. For example, freshly harvested or cultured fish and shellfish have a value of their own. While harvesting, if the quality is maintained by proper handling and chilled storage, it increases its value. In culture varieties, feeding fish with carotenoid pigments improves the colour of flesh, and is considered as adding value. A wide range of diversified fishery products in live, chilled, frozen, thermally processed, dried, salted, smoked,

fermented and combinations of these processes have entered the market to meet the consumers' demand.

## Live fishery products

Globally, there is a great demand for live fish and shell-fishes. These products fetch the maximum price compared to all the other forms of value-added products as it maintains freshness. The candidate species for live transportation include high-value species, cultured grouper, red snapper, seabreams, seabass, red tilapia, reef fish, air-breathing fishes, shrimp, crabs, lobster, clams, oysters, and mussels. These are normally transported in air cargo maintained at low temperatures to lessen the metabolic activities of the animals. Although it's a better way of supplying in its fresh form, it's highly cost-intensive and the problem of mortality has to be tackled effectively.

## Chilled fishery products

Chilling is an effective method for maintaining the freshness of fish products. This normally involves keeping fish in melting ice or slurry ice to maintain the fish temperature around 1- 4 °C, which delays the enzymatic action and microbial activity, thereby extending the shelf life of the products. Traditionally, chilling is carried out using melting ice, either flake ice/tube ice or crushed block ice. Of late, slurry ice has been introduced for chilling. A wide range of fish and shellfish products varying from whole, headless, peeled gutted, headless gutted fish, fillets, steaks, loins and cubes can be preserved by chilling. The shelf life of fish from different environments has been studied by ICAR-CIFT, Kochi extensively. A shelf life of 12-15 days has been achieved for seerfish and black pomfret. Indian Mackerel and Indian oil sardine had a very short shelf life in ice (3-7 days), due to rancidity

and belly bursting. Tilapia from freshwater and brackish water showed a significant difference in shelf life when stored in ice. The former kept longer (14-15 days) than the latter (8-10 days).

## Frozen fishery products

Freezing is method to retain the quality and freshness of fishery products for a long time. This involves the conversion of water present in fishery products to ice i.e., a phase change from liquid to solid phase takes place in freezing. This retards the microbial and enzymatic action by reducing the water available for their action. Normally, products are frozen till it attains a core temperature of -18 oC or low and are stored in cold stores maintained at this temperature. Frozen products form one of the largest portions of fishery products traded all over the world. Plate freezing, air blast freezing, cryogenic freezing and individual quick freezing are the methods adopted by the industry to preserve food products. A wide variety of fish, shrimp and cephalopods in various forms are preserved in frozen form. Among fish products, whole, whole gutted, headed and gutted, filleted, loins, steaks, breaded and battered and minced fish are frozen and stored. Shrimp-based products range from head-on individual quick frozen (IQF) to headless, peeled and deveined, peeled and undeveined, easy peel shrimp, butterfly style, stretched shrimp, skewered shrimp, breaded or tempura shrimps and cooked shrimps. Various IQF packs of whole squid, squid tubes, squid fillets, rings, stuffed squid, cuttle fish, octopus, sushi and sashimi, squid fillets, pine cut blanched and cooked products, seafood mix and analogue products from surimi are frozen and marketed. The recent trend in the marketing of frozen products is consumer retail packs. Mainly, fish steaks, fillets, fish fingers, cleaned and blanched shrimps and cephalopods in small individual packs are frozen

and marketed in supermarkets in many countries. Apart from these, various value-added ready-to-fry products like balls, cutlets, specialty products and curry products are also frozen and marketed.



## Dried and salted fishery products

Drying is probably one of the oldest methods of food preservation. It removes water from fish, which in turn reduces the water activity of the product thereby assuring microbial stability and guaranteeing extended shelf-life of the product. In some cases, salt (sodium chloride) is used to prolong the shelf life of fish. Salt absorbs much of the water in the food and makes it difficult for microorganisms to survive. Lean fishes are mainly preserved by dry or kench salting in which 3-4 % of coarse salt is normally used. For fatty fishes such as herring, sardine, anchovy and mackerel, wet salting or pickle curing (3-3.5 %) is normally followed. In some cases, brining is also practiced as a preparation for smoking or drying in which fishes are immersed in the saturated salt solution for 30 – 90 min depending on the size of fishes. Sun drying is the most economical way of fish drying. With the advancements in the sector, various modern equipments have evolved for the effective drying of fish products. The drying form will vary with the fish species and size. Normally,



small varieties of fishes and shell fishes like anchovies, Bombay duck, lizard fish, shark, ribbon fish, thread fin breams, lesser sardines, small freshwater fishes and small-sized shrimps are dried whole after proper washing whereas large varieties of fishes like sharks, catfishes, etc. are washed, degutted and spread open to dry for human consumption. Traditionally, dried fish is considered as an item usually consumed by people from lower-income strata. Therefore, the prices paid for this product were rather very low until the recent past. The drying activity is normally woman-centric in many underdeveloped and developing nations. Sun drying is the method predominantly used for drying. As the consumers are aware of the quality of dry products, these products fetch low prices in local as well as international markets. However, with the introduction of modern automatic hygienic drying techniques and attractive packaging, it is possible to fetch better prices for dried fishery products.

## Smoked fishery products

Smoking is one of the most widely used traditional fish processing methods employed in many countries to preserve fish. The preservation effect

of smoke is a result of the drying (withdrawal of moisture) of the product during smoking as well as due to the absorption of smoke particles into the flesh. The smoke particles, mainly phenolic compounds absorbed by the product, inhibit bacterial growth on the surface of the product. The smoke particles also have a positive effect on the taste and colour of the product and in many instances, smoking is normally practiced to improve these sensory characteristics. Three different smoking methods are normally practiced. In cold smoking, the temperature is below 30 °C and the product is not cooked in this method. In hot smoking, the temperature varies between 65 – 100 °C, which leads to cooking of the product. In smoke drying method, the product is first hot smoked, so that it gets cooked, and then, with continued smoking, the product is dried (temperatures vary between 45-85 °C). Salmon, trout, mahseer, mackerel, small varieties of marine and freshwater fishes, oyster and clams are normally preferred for smoking. 'Masmin' is a cooked, smoked and dried product of commercial importance in the Lakshadweep islands of India. Very fresh skip jack tuna is normally preferred for making this product.



## Thermally processed fishery products

Thermal processing is one of the most efficient methods of food preservation widely practiced all over the world. The main objective of thermal processing is to achieve long-term shelf stability. Thermal processing generally involves heating the food products packed in hermetically sealed containers for a predetermined time at a pre-selected temperature to eliminate the pathogens of public health significance as well as those microorganisms and enzymes that deteriorate the food during storage. Fishery products being low acid food ( $\text{pH} > 4.5$ ), the microorganism of significance is *Clostridium botulinum*, which is a rod-shaped, anaerobic mesophilic pathogen capable of producing highly heat-resistant spores and produces 'botulinum' toxin. These products have to be processed in such a way that all the points in the container should achieve a minimum lethality of 2.52 minutes, when processed at  $121.1\text{ }^{\circ}\text{C}$  ( $250\text{ }^{\circ}\text{F}$ ), which corresponds to 12 decimal reduction of *C. botulinum*, which is known as 'botulinum cook'. In practice, fish products are processed beyond this lethality for safety reasons. Historically, heat processing started in glass containers. Over the years, different containers like metal, rigid plastic containers and flexible retortable pouches have been developed for thermal processing. The selection of prime-quality fish is important for heat processing. Thermal processing of various ready-to-eat fish products has been studied and reported by ICAR-CIFT, Kochi. Mohan et al. (2015) studied the effect of filling medium on cooking time and quality of canned yellowfin tuna (*Thunnus albacares*).

Retort pouch processing: As in canning, retort pouch food is sterilized after packing, but the

sterilization procedure differs. The pouches are processed in an over-pressure retort. The time and temperature will be standardized depending on the product. Besides, cost reduction, retort pouch packages have unique advantages like boil-in-bag facility, ease of opening, reduced weight and don't require refrigeration for storage. The energy saving is more in processing in flexible pouches compared to cans. Processed food products can be kept for long periods at ambient temperatures. Bindu et al. (2007) reported that ready-to-eat black clam (*Villorita cyprinoides*) product in indigenous retort pouches remained in good condition even after storage for one year at ambient temperature ( $28 \pm 2\text{ }^{\circ}\text{C}$ ).

## Fermented fishery products

Fermentation is the most important way of preserving fish. Fermented fish paste and sauce have a much more important place in the daily diet of many North East Indian states and South East Asian countries than salted or dried fish. During the fermentation of fish, protein is broken down by endogenous enzymes in the presence of a high salt concentration (20-30 %). The high salt concentration also inhibits the growth of microorganisms. However, salt-tolerant microorganisms will grow in the fermented products, which are responsible for the characteristic taste and flavour. In some cases, boiled or roasted rice is added as a carbohydrate source for fermentation. Although fermented fish products are a good source of protein, they can be consumed only in limited quantities because of the high salt content of these products. The species used for fermentation include anchovies, herring, deep-bodied herring, fimbriated herring, mackerel, round scad, slip mouth, carps, catfish, climbing perch, gourami, mudfish, shrimp, mussels, oysters and octopus. Fermented fish can



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be in the form of sauce (Nuoc-mam, Nampla, Patis and Shottsuru), paste (Bagoong, Balao-balao, Belachan, Ngapi, Prahoc and Trassi) or whole or pieces of fish, which retains its structure as much as possible (Colombo cure, Pedah-siam, Sushi, Anchoa and Momone).

## Specialty fishery products

Due to increased fishing pressure, many common fish stocks are becoming exhausted. As a result, the search for new fishing grounds for new stocks is continuously increasing, which lands some strange fishery resources. As these resources are not common, consumers will be reluctant to purchase them. These can be used for the preparation of some specialty products. A wide variety of specialty products are produced and consumed in different countries, which include fish based products like mince, surimi, balls, cutlets, fingers, patties, burger, coated products and many imitation products, specialty shrimp based products like whole shrimp, peeled shrimp, peeled and de-veined (PD), peeled and un-de veined (PUD), cooked shrimp, stretched shrimp (Nobashi), barbecue, sushi (cooked butterfly shrimp), skewered shrimp, shrimp head-on (centre peeled), shrimp head-on cooked (centre peeled) and coated shrimps in different forms. The range of products also includes lobster tail, crab claws, coated oyster and mussels and pickle, wafers, fish with mixed vegetable products etc. The range of product varies with the region and eating habit of the people.

**Fish mince:** Fish mince is prepared by concentrating only edible muscle part after removing all the other parts like scale, skin, gut and bones. Fish mince acts as the base material for majority of the value-added products. It is prepared by split opening the fish ventrally and

passing through the meat bone separator. Larger bones are normally removed manually and fine pin bones are then separated by passing the mince through a pin bone remover, so that the bone content in the final mince should not exceed 2 % as it affects the quality of mince. As fish mince is used as the base material for preparation of various other products, monitoring the quality of mince is very important. So, the temperature should be maintained below 10 oC during the preparation of mince. Normally, fish mince is stored under frozen condition. Fish mince is used for the preparation of surimi, fish balls, fish finger and other specialty products.

**Fish finger:** Fish fingers are regular rectangular sized fish portions made from either frozen fish fillet or fish mince. Skinless and bone less fillets are partially frozen to get the correct shape of the finger. For ease of cutting operation, frozen slabs of 1.5 cm thickness are used. The frozen slabs are passed through a motor operated band saw to cut into suitable size. A typical British fish finger weights around one ounce (28 g) and in Asian countries it varies from 20 to 25 g. They are battered and breaded before freezing or cooking. They are normally frozen stored and consumed as snack food after frying in vegetable oil.



**Fish Balls:** Fish balls are restructured convenient product, which is believed to have originally come from China. These are similar to the products like Kofter of India, Polpette of Italy, Koningsberger Klopse of Germany, Swedish meat balls, Koeftte of Turkey, and Nunh Hoa of Vietnam. It is prepared from a mixture of fish, fat particles, water, carbohydrate, ginger, garlic, pepper and salt. During the processing, meat is mixed with the ingredients and carbohydrate source, which will bind the particles directly or indirectly. The mixture is then formed to the desired shape and this shape is retained after freezing or cooking. Balls are also prepared from crab, shrimp and clams. They are normally battered and breaded before freezing or cooking like other specialty products and are frozen stored.

**Fish cutlet:** Cutlet is a spicy snack food popular in many Asian, European and South American countries. However, the spiciness will be more in Asian countries than in other countries. Fish cutlets are prepared by mixing the cooked fish meat with the cooked potato, fried onion, chilly, ginger, garlic, pepper, turmeric, coriander, oil, salt and other ingredients based on the consumers taste. After proper mixing, they are shaped desirably and battered and breaded. Cutlet can also be prepared from cooked meat from skeletal frame remaining after filleting the fish. Frozen storage is normally practice and is consumed after frying in oil.

**Fish Burgers (Fish Patties):** Burgers are similar to cutlets except the spiciness, which is less in burgers. White meat from lean variety of fish is known to give better product. In the preparation, fish meat or mince is cooked and mixed with cooked potato, fried onion, carbohydrate source, spices, herbs and salt and formed into desired shape. It is normally frozen stored and whenever

required it is thawed, heated and eaten as sandwiches with fresh vegetables, leaves and plain buns.

**Surimi:** Surimi is a myofibrillar protein concentrate, obtained from mechanical deboning of fish flesh, which is washed with chilled water and with added cryoprotectants. In the preparation, the fish is split into two and washed thoroughly and the mince is separated mechanically using meat bone separating machine. The mince thus obtained is washed number of times to remove water soluble proteins, pigments, enzymes and lipid and to concentrate myofibrillar protein, which gives characteristic gelling and elastic properties. This surimi can be used as base material for the preparation of textured imitation products like lobster tail, crab legs, shrimp, scallop, crab stick etc. The utmost care has to be taken while preparing surimi. Not all the fishes give same textural properties and lean fishes are preferred over their fatty counterparts. Alaskan Pollack is the most preferred species for surimi preparation. In Asian countries thread fin breams is the preferred species. The temperature should be always less than 10 oC throughout the process of surimi preparation, as a slight abuse in temperature causes great changes in the textural properties. It is frozen stored till it is used for the product preparation. Although there is considerable loss of many important nutrients in the process of surimi preparation, the high demand and attractive prices are magnetizing many fish processing establishments to adopt surimi processing.

Apart from the few products discussed above, there are large numbers of value-added products produced and consumed all over the world. As it is highly impossible to cover every product in detail, only the commercially important and most

commonly used fishery products are dealt here.

## Advanced processing techniques

### *High pressure processing*

High Pressure Processing is also known as high hydrostatic pressure (HHP) or ultra-high pressure (UHL) processing. It is a non-thermal, cold pasteurization technique, which generally consists of subjecting food, previously sealed in flexible and water-resistant packaging, to a high level of hydrostatic pressure (pressure transmitted by water) up to 600 MPa / 87,000 psi for a few seconds to a few minutes (1 – 20 min). HHP utilizes a very common medium, i.e., water, to apply the pressure on the product to be treated. HHP transmits isostatic pressure (100–1000 MPa) instantly to product at low temperature and might have comparable preservation effect as thermal processing through inactivating undesirable microorganisms and enzymes. An HPP unit consists of a pressure compartment in which food is kept and water is introduced into the chamber. Food is then pressurized using this water. HPP compromises cellular functions such as DNA replication, transcription, translation already at lower pressures (= 100 MPa) which impairs bacterial growth. At higher pressures, microorganisms start suffering lethal injuries due to loss of cell membrane integrity and protein functionality.

### Pulsed electric field (PEF) processing

PEF is an efficient non-thermal food processing technique using short, high voltage pulses. It is used for inactivation of spoilage and pathogenic microorganisms in various food products. Electric

pulses are applied for destroying harmful bacteria in food. Microbial inactivation is achieved by dielectric breakdown of the bacterial membranes. Food material is placed between electrodes. The field intensity is typically 20–80 kV cm<sup>-1</sup>) and the exposure time is a few milliseconds or nanoseconds. It enhances the shelf life of the food without quality loss. The PEF mechanism is called electroporation. Very short electric pulses of high voltage are applied to the food. Small pores are formed in the cell membrane of the food by the electric pulses without damaging the cell compounds, such as vitamins. Pulsed electric field is generally used for liquid food or semi-solid food that can flow easily.

### Extrusion

Use of fish mince with cereals for extrusion process will enable production of shelf-stable products at ambient temperature. Extrusion cooking is used in the manufacture of food products such as ready-to-eat breakfast cereals, expanded snacks, pasta, fat-bread, soup and drink bases. The raw material in the form of powder at ambient temperature is fed into extruder at a known feeding rate. The material first gets compacted and then softens and gelatinizes and/or melts to form a plasticized material, which flows downstream into extruder channel.

### Irradiation

Irradiation is a process of applying low levels of ionizing radiation to food material to sterilize or extend its shelf life. Radiation inactivates food spoilage organisms, including bacteria, moulds, and yeasts. Radiation also destroys disease-causing organisms, including parasitic worms and insect pests, that damage food in storage.



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Irradiation is harmful or noxious to humans. However, the dose for seafood pre-treatment is low, therefore making it safe for consumption. Food irradiated under approved conditions does not become radioactive.

## Microwave processing

Microwave heating of foods is attractive due to its instantaneous and rapid increase in temperature, controllable heat transmission, and easy clean-up opportunities. It is currently being used for a variety of domestic and industrial food processing applications. The largest use of industrial microwave processing of food has been for tempering of meat for further processing. Currently, most food industries use microwave at 915 MHz for tempering purposes. Precooking of bacon is the second-largest application of microwave heating in the food industry. Microwave heating is found to be an ideal system for cooking bacon compared to conventional grilling. The third largest application of microwave processing is in sausage cooking. The quality of the sausage patty is improved along with better yield by using the microwave process.

## Pulsed light preservation

Pulsed light (PL) is an alternative technique to continuous ultraviolet treatment for solid and liquid foods. PL consists of successive repetition of high-power pulses of light/short time high-peak pulses of broad-spectrum white light. Comparatively, PL has a thousand times strength greater than the normal UV light which is quite continuous. Pulsed xenon UV uses the full spectrum of ultraviolet light to disperse germ-killing energy. The light spectrum includes wavelengths from 180 to 1100 nm with a considerable amount of light in the short-wave UV

spectrum. Similar to other non-thermal food processing technologies, PL also has potential in the inactivation or elimination of microbes in food. Specific examples of foods processed by PL include fish, vegetables, fruits, and meat. PL can be used alongside other novel technologies as a hurdle in the inactivation of microbes on the surfaces of foods.

## Ultrasound processing

US is a compressional wave with a frequency of over 20 kHz. Sound wave bearing certain frequency that is more than the normal human hearing frequency. The frequency of US used in the food industry for microbial inactivation ranges from 20 kHz to 10 MHz. The bactericidal action of US is mainly due to the cavitation process, in which microbubbles are produced and collapsed within a liquid medium. During the cavitation process, the temperature can increase to as high as 5500 °C and the pressure can increase up to 100 MPa, resulting in localized microbial sterilization. The bactericidal mechanisms of ultrasound include breakage of cell walls, disruption and thinning of cell membranes and free radical activity due to the collapse of cavitation bubbles.

## Ohmic heating

Ohmic heating is direct resistance heating by the flow of an electrical current through food, so that heating is by internal heat generation. Ohmic heating is defined as a process wherein electric current is passed through materials with the primary purpose of heating the object. During ohmic heating, heating occurs in the form of internal energy transformation (from electric to thermal) within the material. Therefore, it can be explained as an internal thermal energy generation technology and it enables the material

to heat at extremely rapid rates from a few seconds to a few minutes. Ohmic heating have a large number of actual and potential future applications, including its use in blanching, evaporation, dehydration, fermentation, extraction, sterilization, pasteurization and heating of foods.

## Cold plasma technology

Ionization of gas molecules gives rise to plasma. Cold plasma is a non-thermal treatment that works in the temperature range 25–65 oC. Cold plasma has high antimicrobial activity and efficient enzyme inactivation capacity. The composition of the plasma reactive species largely depends on the composition of gas, which is ionized. The gases commonly used for the generation of plasma include argon, helium, oxygen, nitrogen and air. The gases are subjected to any of the types of energy like thermal, electrical, magnetic field, etc., to generate plasma containing positive ions, negative ions, and reactive species like ozone and singlet oxygen.

## Advances in packaging

### *Reduced oxygen packaging for fish preservation*

High levels of oxygen present in food packages may facilitate microbial growth, off-flavours and off-odours development, colour change and nutritional losses, thereby causing significant reduction in the shelf life of food. Therefore, control of oxygen level in food package is important to limit the rate of these deteriorative and spoilage reactions in food. The use of proper packaging to minimize food losses and provide safe and wholesome food products has always been the focus of packaging research. Reduced Oxygen Packaging (ROP) means removing, %

displacing, replacing or controlling the oxygen content in a package below the 21 % normal oxygen concentration. ROP includes vacuum packaging (VP), modified atmosphere packaging (MAP), controlled atmosphere packaging (CAP) and cook-chill (CC) and sous-vide packaging (SV).

## Vacuum Packaging (VP)

Vacuum packaging is one of the best methods for effectively delaying fat oxidation as it limits the availability of oxygen molecule for oxidation. In vacuum packaging, air is removed from the package and the package is hermetically sealed so that vacuum is maintained inside the package. The air removal creates a vacuum inside the packs and lack of O<sub>2</sub> in packages minimizes oxidative deteriorative reactions and aerobic bacterial growth. Vacuum packaging can thus considerably extend the viable shelf life of many food products. Many studies have proved the effectiveness of vacuum packaging on prolonging the keeping quality of fish by slowing down the lipid oxidation and microbial growth. For example, Arashisar et al. (2004) reported lower microbial counts in vacuum packed rainbow trout. Rajesh et al. (2002) found that vacuum packed seer fish (*Scomberomorus guttatus*) steaks had an extension of 10 days of storage life compared with those kept in air.

Vacuum packed foods maintain their freshness and flavour 3-5 times longer than with conventional storage methods, because they don't come in contact with oxygen. Foods maintain their texture and appearance, because microorganisms such as bacteria, mould and yeast cannot grow in vacuum. Freezer burn is eliminated, because foods no longer become dehydrated from contact with cold, dry air. Moist foods won't dry out, because there's no air to

absorb the moisture from the food. Dry, solid foods won't become hard, because they don't come in contact with air and therefore, can't absorb moisture from the air. Foods that are high in fats and oils won't become rancid, because there's no oxygen coming in contact with the fats, which causes the rancid taste and smell. Although vacuum packaging is advantageous, it suffers from a few drawbacks. It is not a viable technology for products with crisp and delicate nature and sharp edges. It requires strict maintenance of temperature as anaerobic conditions created in this method will help in the growth of pathogens like *Clostridium botulinum* and *Listeria monocytogenes*

## Modified Atmosphere Packaging (MAP)

In modified atmosphere packaging, the atmosphere of a packed food is modified so that its composition is different from air. However, the atmosphere may change over time due to the permeability of the packaging material or the respiration of the food. It is primarily the enrichment of Carbon dioxide (CO<sub>2</sub>) in the storage atmosphere as a means of controlling microbial growth, which results in the extension of shelf life of products. It is well documented that the shelf life of marine products can be extended by MAP. But the extension in the keeping quality of fish depends on the raw material quality, temperature, gas mixtures and packaging materials. It is critical to optimise the gas mixture composition in MAP to ensure both product quality and safety. Various atmospheres have been studied in fish packaging. Nitrogen (N<sub>2</sub>), Oxygen (O<sub>2</sub>) and Carbon dioxide (CO<sub>2</sub>) are the main gases used commercially in seafood, although trace gases, such as carbon monoxide,

nitrous oxide, sulphur dioxide, argon, and xenon are commented as possible gases for MAP in meat, fruits, and vegetables.

MAP technology can be applied to any fish varieties. However, the gas combinations have to be optimised for better results. The composition of the gas mixtures used for MAP of fresh fish varies, depending upon whether the fish in the package is lean or oily fish. It has been recommended that gas mixtures for the lean fish and fat fish should be 40 % CO<sub>2</sub> + 30 % N<sub>2</sub> + 30 % O<sub>2</sub> and 60 % CO<sub>2</sub> + 40 % N<sub>2</sub>, respectively. Higher amount of CO<sub>2</sub> is used for fatty fish with a comparable reduction in the level of O<sub>2</sub> in the mixture leading to 40-60 % N<sub>2</sub>. Yesudhasan et al. (2009) reported that there was an extension in shelf life of seer fish steaks stored in 60 % CO<sub>2</sub>:40 % N<sub>2</sub> atmosphere. The shelf life of fish steaks packaged in MA was 21 days whereas air-stored samples had a storage life of 12 days only in chilled storage. By excluding O<sub>2</sub>, the development of oxidative rancidity in fatty fish is slowed. On the other hand, O<sub>2</sub> can inhibit the growth of strictly anaerobic bacteria like *Clostridium botulinum* although there is a very wide variation in the sensitivity of anaerobes to Oxygen. As MAP creates anaerobic conditions favouring the growth of most harmful pathogens like *Clostridium botulinum* and *Listeria monocytogenes*, measures have to be taken to control these pathogens by maintaining the temperature strictly.

## Cook-chill (CC) and Sous-vide (SV) packaging

Cook chill packaging, in which cooked food is hot filled into impermeable bags, which have the air expelled and are then sealed. The food placed in bag is rapidly chilled at temperatures that inhibit c

the growth of psychrotrophic pathogens. Sous-vide packaging is similar except that the food is cooked in the bag after sealing and not before sealing as is done in cook chill packaging. Sous-vide is a French word for “under vacuum” and sous-vide cooking is defined as “raw materials or raw materials with intermediate foods that are cooked under controlled conditions of temperature and time inside heat-stable vacuumized pouches”. Sous-vide products are typically heated at relatively mild temperatures (65–95 °C) for a long period of time followed by rapid cooling to attain a temperature of 3 °C in the centre of the product. The heat treatment and vacuum packaging techniques used in sous-vide technology delay the oxidation of lipids and muscle pigments while slowing down the microbiological spoilage of cooked foods during refrigerated storage (Baldwin, 2012). Sous-vide technology not only improves the product quality, but also provides economic advantages. Immersion (water or steam) cooking provides a very efficient means of transferring heat directly to the product and reduces the use of flavour enhancers. It can also ensure better use of labour and equipment through centralized production. Sous-vide processed dishes are stored at temperatures below 3.3 °C to prevent the growth of *Clostridium botulinum*, *Bacillus cereus* and other pathogenic microbes resistant to the pasteurisation. The UK Advisory Committee on the Microbiological Safety of Food recommends for cooked-chilled products with an extended shelf-life of more than 10 days a heat treatment at 90 °C for 10 min or equivalent lethality and strict chill conditions to control *Clostridium botulinum*. In order to eliminate non-spore forming pathogens such as *Listeria monocytogenes*, a heat treatment at 70 °C for 2 min or an equivalent heat process is required.

## Active Packaging

Active packaging refers to the incorporation of certain additives into packaging systems to alter the packaging atmosphere and to maintain it throughout the storage period with the aim of maintaining or extending product quality and shelf-life. Traditionally, packaging has been used in a passive manner to protect the content from physical, chemical, and microbiological contamination. Active packaging provides some additional functions in comparison with traditional passive packaging materials. There are two types of active packaging systems viz., scavenging systems (O<sub>2</sub>, CO<sub>2</sub>, H<sub>2</sub>O, ethylene, taints) and releasing systems (CO<sub>2</sub>, H<sub>2</sub>O, antimicrobials, antioxidants). Among these, O<sub>2</sub> scavenger is the most commonly used technique and antimicrobial packaging is the most promising version of active packaging.

**Oxygen Scavengers:** Typical oxygen absorbing systems are based on the oxidation of iron powder by chemical means or scavenging of oxygen through the use of enzymes. The Oxygen scavengers were first developed and introduced into the food packaging market in Japan in 1976 by the Mitsubishi Gas Chemical Co. Ltd. under the trade name Ageless™. It should be noted that discrete oxygen scavenging sachets suffer from the disadvantage of possible accidental ingestion of the contents by the consumers. However, in the last few years, the development of oxygen scavenging adhesive labels that can be applied to the inside of packages and the incorporation of oxygen-scavenging materials into laminated trays and plastic films have enhanced and will encourage the commercial acceptance of this technology.

Studies conducted at ICAR-CIFT on the active

packaging of fishery products have demonstrated a significant extension of shelf life over air-packed samples. Remya et al. (2017) studied the combined effect of O<sub>2</sub> scavenger and antimicrobial film in extending the shelf life of fresh cobia (*Rachycentron canadum*) fish steaks stored at 2°C in a plastic pouch of multilayer film of ethylene–vinyl alcohol and found that storing in dual active packaging system doubled the shelf life of chilled stored fish. Mohan et al. (2009) reported that O<sub>2</sub> scavenger was effective in reducing the O<sub>2</sub> content of the pack up to 99.95 % within 24 h and it extended shelf-life of chilled stored seer fish (*Scomberomorus commerson*) up to 20 days compared to only 12 days for air packs.

## Intelligent Packaging

Intelligent packaging is defined as packaging systems, which monitor the condition of packaged foods to give information about the quality of the packaged food during transport and storage. Intelligent packaging is packaging that in some way senses some properties of the food it encloses or the environment in which it is kept and is able to inform the manufacturer, retailer and consumer of the state of these properties. Intelligent packaging and active packaging are not mutually exclusive. Although distinctly different from the concept of active packaging, tal



features of intelligent packaging can be used to check the effectiveness and integrity of active packaging systems. Both packaging systems can work synergistically to realize the so-called smart packaging. Smart packaging provides a total packaging solution that on the one hand monitors changes in the product or the environment (intelligent) and on the other hand acts upon these changes (active). Many intelligent packaging concepts involve the use of sensors and indicators. To date, three major technologies exist for realizing intelligent packaging: sensors, indicators, and radio frequency identification (RFID) systems.

## Conclusion

Fish require immediate processing and packaging to retain its quality. In addition to the existing fish preservation methods, many advanced processing techniques have been developed over the years to meet the consumer demand of fresh, safe and minimally processed fish. Modern packaging technologies have also become increasingly popular by causing major changes in the storage, distribution, and marketing of raw and processed fish products in many countries. Advanced packaging technologies along with intelligently applied gentle hurdles has proven to have a synergistic effect in further improving the shelf life and organoleptic quality of fish and fish products. Value addition techniques will help to satisfy the rising consumer demand for processed and convenience (ready-to-cook/ready-to-eat) fishery products, which will also aid many nations to enhance their international seafood trade.

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# Food allergens and its management as per international and national requirements

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## Introduction

Two important aspects related to food processing are food safety and food quality. Food safety hazards like biological hazards (bacteria, viruses, parasites, protozoan, and prions etc.) and chemical hazards (pesticides, heavy metals, natural biological toxins, adulterants etc.) have already received attention both from food safety researchers and regulators. Over the last two decades, food allergens have been recognized as a food hazard. Food allergies are emerged as a major public and personal health burden which is growing in nature. Food allergens are a serious threat to sensitive individuals, showing an increasing tendency. It also has gained importance due to the increase in food allergy incidences in many countries especially in US, Canada, Europe, Australia, New Zealand, UK, and Japan where the regulations on food allergens are very stringent. All the developed countries have their own set of guidelines to deal with the food allergens but are not well documented in developing countries. Food allergies affect more than 1 to 2 % of general population but within a maximum of 10% with increased prevalence in children and adults. Even though it affects a comparatively lower population in the world, the allergic reactions can be severe or potentially fatal. Risks due to challenges in health, regulatory requirements and business plans make food allergy as an important concern in food industry. Including of an Allergen Control Plan in the food processing industries is a critical component for ensuring product safety.

Adverse reactions to food can be broadly classified into food intolerance and food allergy/hypersensitivity. Food allergy is regarded as a public health problem that must be considered seriously. Even the intake of minute amounts of food allergens can cause allergic reactions in sensitized individuals. Among the adverse reactions to food, there are immune-mediated and non-immune-mediated reactions. An allergy is a hypersensitivity reaction where symptoms appear rapidly following exposure to macromolecules or proteins. They are commonly

mediated by a specific class of antibody, known as immunoglobulin E (IgE), which is normally generated as part of immune reactions or other immunological pathways. Symptoms range from mild hives to severe gastrointestinal and respiratory symptoms, such as nausea, vomiting, throat swelling, asthma, and the most serious food allergic reaction of anaphylactic shock.

In contrast, food intolerances are reproducible non-immune-mediated reactions whose symptoms can sometimes take days to manifest themselves. They do not necessarily have an immunological basis although coeliac disease, is one of the best-defined food intolerances. Food intolerances comprise non-immune-mediated responses that are dependent on enzyme deficiencies, pharmacological reactions, or, as is true in the majority of cases, arise by unknown mechanisms. It includes intolerances secondary to metabolic disorders (e.g., lactose intolerance), reactions to toxic contaminants (e.g. histamine in scombroid fishes), or pharmacologically active food components (e.g. caffeine in coffee causing jitteriness, tyramine in aged cheeses triggering migraine). It is important to distinguish food allergy from other non-immune mediated adverse reactions to foods, particularly since more than 20% of adults and children alter their diets due to perceived food allergy.

## Types of food allergies

The antigens which stimulate the production of IgE antibody are called as allergens. There are four different types of allergic reactions. In case of IgE mediated food allergy the symptoms appear within minutes to 2 hours and are known as type I or immediate hypersensitivity which are also called as 'true' food allergies. IgG or IgM mediated cytotoxic hypersensitivity comes under type II which can lead to issues like autoimmune haemolytic anaemia. Hence testing of food antigen specific IgG for diagnosing food allergy is not recommended. Type III comprises immune complex of antigen and antibody mediated hypersensitivity. The associated

manifestations are localized arthus reaction, serum thickness, systemic lupus erythematosus. Type IV hypersensitivity comprises food antigen-specific T-cell responses affecting the gut mucosa, associated with disorders like celiac disease. Celiac disease is a hypersensitivity reaction against the wheat gluten fraction containing alcohol soluble gliadins and acid-, alkali-soluble glutenins, accompanied by an autoimmune component.

## Shellfish and fish allergens

Seafood is a significant contributor in human nutrition and health and generally comprises fishes (chordates) and shellfishes (crustaceans and mollusks). The leading drivers of seafood consumption are nutrition, taste and convenience, and the main barriers include price, availability, and concern about quality. Fish and shellfish are

Order	Fish	Allergen Protein Identity
Clupeiformes	<i>Clupea harengus</i> (Atlantic herring)	Parvalbumin
	<i>Sardinops sagax</i> (Pacific pilchard)	Parvalbumin
Cypriniformes	<i>Cyprinus carpio</i> (common carp)	Parvalbumin
Gadiformes	<i>Gadus callarias</i> (Baltic cod)	Parvalbumin
	<i>Gadus morhua</i> (Atlantic cod)	Parvalbumin Enolase Aldolase
Perciformes	<i>Lates calcarifer</i> (barramundi)	Parvalbumin
	<i>Oreochromis mossambicus</i> (tilapia)	Tropomyosin
	<i>Thunnus albacares</i> (yellowfin tuna)	Parvalbumin Enolase Aldolase Parvalbumin
Pleuronectiformes	<i>Lepidorhombus whiffiagonis</i> (megrim)	Parvalbumin
Salmoniformes	<i>Oncorhynchus keta</i> (Pacific salmon)	Vitellogenin Parvalbumin
	<i>Oncorhynchus mykiss</i> (rainbow trout)	Parvalbumin
	<i>Salmo salar</i> (Atlantic salmon)	Parvalbumin Enolase Aldolase
Scorpaeniformes	<i>Sebastes marinus</i> (redfish)	Parvalbumin
<b>Shellfish</b>		
Crustacean	Crab	
	Northern sea shrimp	
	American lobster	Tropomyosin
	White leg shrimp	Arginine kinase
	Shrimp	Myosin light chain
	Spiny lobster	Sarcoplasmic binding protein
	Black tiger shrimp	
	Narrow-clawed crayfish	
Brine shrimp		
Mollusca	Pacific oyster	
	Abalone	
	Brown garden snail	Tropomyosin
	Scallop	
	Tropical green mussel	
	squid	

important causative of severe acute hypersensitivity reactions like fatal anaphylaxis. Many major and minor allergens were identified and reported both in the case of fish and shellfishes (Table 1). Seafood allergy is a type of food allergy which is most regular and it included both fish and shellfish, part of “big eight” food allergens. Crustaceans mainly shrimps are the 3rd major source of food induced anaphylaxis in the world after peanut and tree nut and are reported to affect >2% of population. Many of the allergens are having the potential for cross reactivity. IgE mediated reactions can result nausea, vomiting, abdominal pain and diarrhea which can be triggered within minutes of ingestion.

## **Code of Practice on Food Allergen Management (CXC 80-2020)**

The scope of this CoP focus on allergen management starting from primary production to manufacturing, and retail food service. This CoP is to manage allergies mediated through IgE and non IgE. Globally the eight major allergens are causing majority of allergies. Other than this, other recognized allergens are also need to be considered while exporting. This CoP does not cover non-immune mediated intolerances such as lactose intolerance and sulphite sensitivity. This code has to applied in conjunction with the General Standard for Labelling of Prepackaged Foods (CXS 1-1985) and Code of Hygienic Practice for the Transport of Food in Bulk and Semi packed Food (CXC 47-2001). It outlines the principles of food allergen management for different sections.

### **Primary production**

Principle - ‘Where the introduction of an allergen may adversely affect the allergen profile of food at later stages of the food chain, primary production should be managed in a way that reduces the likelihood of introducing such allergens.

The code says that care has to be taken to reduce the

likelihood of allergen cross contact via equipment’s used for harvest, storage areas, storage bags and transportation vehicle.

### **Establishment: design and facilities**

Principle - ‘Establishment design should prevent or minimise the potential for allergen cross-contact with respect to delimitation and isolation of areas, location of equipment, process flow, personnel movement and ventilation systems’.

Facilities commonly handle multiple allergens using the same equipment. Use of dedicated processing lines for food with specific allergen profiles is ideal. Adequate separation between lines can prevent or minimize allergen cross-contact when foods with different allergen profiles are processed at the same time.

### **Control of operation**

Principle - ‘The unintentional presence of allergens in food is prevented or minimised by taking preventive measures through GHPs and HACCP-based controls at appropriate stages in the operation.

A structured assessment of the likelihood of allergen cross-contact resulting in a risk to the consumer with a food allergy and taking control measures is important. Equipment and preparation areas should be adequately cleaned between manufacturing foods with different allergen profiles to prevent or minimise the potential for allergen cross-contact.

### **Establishment: maintenance and sanitation**

Principle - ‘The effective management of food allergens is facilitated by establishing effective maintenance and cleaning programs that prevent or minimise the potential for allergen cross-contact’.

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## **Establishment: personal hygiene**

Principle - ‘Personal hygiene practices should prevent or minimize the potential for food handlers to contribute to allergen cross-contact’.

## **Transportation**

Principle - ‘Foods containing allergens should be managed during transportation so that allergen cross-contact is prevented’.

## **Product information and consumer awareness**

Principle - ‘Consumers should have access to adequate and correct information on the allergenic nature of a food.

It should be ensured that those with allergies can avoid allergenic foods and ingredients’.

## **Training**

Principle - Personnel engaged in food operations should have sufficient training in food allergen management to implement measures to prevent or minimise allergen cross-contact and ensure the correct label with appropriate allergen information is applied to food.

## **US Food Allergen Labeling and Consumer Protection Act (FALCPA)**

The eight major allergens identified are milk, egg, fish, shellfish, tree nut, peanut, wheat and soybean and these accounts for 90% of food allergic reactions. As per the International Codex Alimentarius guidelines and the US Food Allergen Labeling and Consumer Protection Act (FALCPA) food manufacturers has to label specifically the allergen source and any product with an ingredient or

food protein derived from any of these food allergens (USFDA 2004). Under the FASTER (Food Allergy Safety, Treatment, Education, and Research) Act of 2021, sesame is being added as the 9th major food allergen effective from January 1, 2023.

The law requires that the customer can use the food labels to identify the food source of all major food allergens. Identity of the allergen should be written in the name of common or usual name of an ingredient and it must be declared at least once on the food label. The name of the food source has to be given in parentheses following the name of the ingredient (E.g. lecithin (soy)). A “contains” statement of the allergen source has to be given immediately after or next to the list of ingredients (E.g. Contains wheat soy).

In addition to the major food allergens, FDA also monitors other allergens, food ingredients, or food additives that are causing a significant health risk. This is to evaluate emerging evidence about non-listed food allergens in a consistent and transparent manner. Non-listed food allergens are identified based on evidence of IgE mediation in food allergy, its prevalence, severity and potency. More than 160 foods are identified as causative of IgE-mediated food allergic reactions of varying severity and lower prevalence rates.

## **How to prevent allergen cross contact?**

Allergen cross-contact happens through the accidental entry of allergens into foods that are not declared on the labels. Allergen control plan is a written document showing effective control measures to minimize allergen cross-contamination.

Prevent misbranding, controlling through separation by time and space between allergen and non-allergen containing products, or between comprising diverse allergens is important and which can be introduced at all steps in processing. Seafood processors must meet the requirements of 21 CFR 117.4. Seafood processors must ensure that their employees have

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been trained in the controls necessary to prevent allergen cross-contact. FDA has identified the following recommendations to assist allergen cross-contact control program.

- **Receiving** – Comparing the labels of ingredients against product specifications with the list of declared allergens and segregate. Damaged packages has to be segregated to prevent the allergen cross contact. A color-code system to identify the specific allergen hazard can be utilized. Need to ensure the integrity of ingredients received by transportation system.
- **Storage** – Adequate storage precautions can be taken to prevent allergen cross contact. Dedicated storage areas to ensure physical separation of allergen and non-allergen containing products is useful. Make clear procedures for storing allergen and non-allergen containing products when dedicated storage area is not available. Dedicated colour coding for major allergens in the storage area. Ensure procedures to prevent mixing of allergen and non-allergen containing products and disposal of damaged packaging materials.
- **Processing** – Adequate designing of the facility, equipment and processes to prevent allergen cross-contact has to be ensured. Lay out design to minimize allergen cross contact, unidirectional traffic flow of employees with an allergen free buffer zone, air flow control, partitioned areas, facility and process design upgradation, physical barriers with sufficient spacing to protect during spillage, dedicated sections for processing the product, dedicated and color coded equipment's, utensils and employee apparel, change of work clothing when employees move from an allergen to a non-allergen area, movement of materials through closed lines, waste disposal procedure, control of aerosolized allergenic material. The production process can be scheduled in such a way to prevent the cross contact of allergen and non allergen containing products including effective allergen cleaning and sanitation procedures.

- **Rework and work-in-progress (WIP)** – Entry of finished or partially finished products can increase the risk of introduction of allergens. Hence the separation of such materials should be under control by means of colour coding, separate storage area and proper labelling.

The FDA's "Current Good Manufacturing Practice, Hazard Analysis, and Risk-Based Preventive Controls for Human Food" rule (CGMP & PC rule, 21 CFR part 117) gives the requirements for manufacture, process, pack, or hold human food. The CGMP & PC rule provides requirements for allergen preventive controls to prevent allergen cross-contact in manufacturing and packaging and to prevent undeclared allergens. The FDA monitors food allergic reactions based on the complaints received from the consumers and take regulatory action(s) to improve product safety and protect the public health. Analytical testing methods to verify the food labeling based on immunoglobulin antibodies by enzyme-linked immunosorbent assay (ELISA), immunoblotting, DNA-based polymerase chain reaction and mass spectrometry are followed.

## **Food allergen labelling and information requirements - EU Regulation No. 1169/2011**

An Allergen Control Plan is a critical component in product safety. Allergen provisions for prepacked, prepacked for direct sale and non-prepacked foods can be found in the EU Food Information for Consumers Regulation (No. 1169/2011) (EU FIC) and Commission Delegated Regulation (EU) No. 78/2014. The allergen rules came into effect in the UK and the EU on 13 December 2014. This guidance provides allergen provisions for prepacked, prepacked for direct sale and non-prepacked foods. These guidance notes are intended to help producers, manufacturers, packers, importers, distributors, wholesalers, retailers, caterers and also for enforcement officers responsible for enforcing relevant measures.

It provides informal and non-binding technical guidance on the interpretation and practical application of EU FIC's specific requirements on allergen labelling and information. Penalties are outlined in the Food Information Regulations 2014 (SI 2014/1855). It emphasizes any of the 14 specific allergens in the ingredients list of prepacked food. The 14 allergens listed are cereals containing gluten (wheat, rye, barley, oats and their hybridised strains), crustaceans and products, egg and products, fish and products, peanuts and products, soybeans and products, milk and products, nuts, celery and products, mustard and products, sesame seeds and products and sulphur dioxide and/ or sulphites (greater than 10 mg/Kg). In case of non-prepacked food, such as retailers, restaurants, takeaways, bakeries and institutional caterers the EU FIC requirement was to provide information on allergenic ingredients in writing and/or orally. Failure to meet the allergen requirements is a criminal offence due to the impact of non-compliance on public health.

## Crustaceans

- The rule covers all including for example lobster, crab, prawns.
- Labelling of crustaceans and products made from them need to have a clear reference such as 'prawns (crustaceans)', 'crayfish (crustaceans)', 'lobster (crustaceans)', shrimp paste (crustaceans)

## Fish

- The rules do not name any species of fish because 'fish' means all species of fish and fish products. The generic terms provisions allow the generic name 'fish' to be used in an ingredient list only where there is no specific reference to a common fish species name on the label.
- Labelling of fish ingredients or products need to have a clear reference to the food; for example, 'cod (fish)', 'salmon (fish)', 'tilapia (fish)'

## Sulphur dioxide

- The labelling rules apply to sulphur dioxide and/ or sulphites that have been deliberately added in the preparation of the food or have been added to an ingredient used in a preparation of the food.
- The rules require sulphur dioxide and/ or sulphites to be labelled when present above 10mg/kg or 10mg/litre

All written mandatory allergenic information should be easily visible. Precautionary allergen labelling is to be used to indicate the unintentional presence of allergen.

## Food Safety and Standards (Labelling and Display) Regulations, 2020

Food labelling is considered as an important element in order to improve the consumer safety. Food Safety and Standards (Labelling and Display) Regulations, 2020 requires inclusion of mandatory declaration of allergen information and the regulation. Declaration on food allergen separately as 'Contains..... (Name of allergy causing ingredients)' is required for following foods and ingredients namely

- (I) Cereals containing gluten; i.e., wheat, rye, barley, oats, spelt or their hybridized strains and products of these (To be declared as name of the cereal);
- (ii) Crustacean and their products (To be declared as Crustacean);
- (iii) Milk & Milk products (To be declared as Milk);
- (iv) Eggs and egg products (To be declared as Egg);
- (v) Fish and fish products (To be declared as Fish);
- (vi) Peanuts, tree nuts (e.g. almonds, walnuts, pistachio, cashew nuts) and their products (To be declared as Nut);

(vii) Soybeans and their products (To be declared as Soy);

(viii) Sulphite in concentrations of 10mg/kg or more (To be declared as sulphite)

Provided that in case presence of ingredients due to cross-contamination which are known to cause allergy may be declared separately as 'May Contains..... (Name of allergy causing ingredients)'. This declaration is not required in the case of oils derived from these ingredients. Raw agricultural commodities are exempted from the allergen labelling requirements. In case of prepared food served for immediate consumption such as in hotels or by food service vendors or caterers or halwais or hospitals or at religious gathering or food served in airline/railways/passenger vehicle or any mobile unit shall accompany or display the information relating to allergen. Food Service Establishments shall also mention the information relating to food allergens on the menu cards or boards.

## Summary

An allergic reaction can be produced by a tiny amount of food containing allergen in

immunologically sensitive individuals. Symptoms range from mild to severe and also can be worse situations like anaphylaxis. Food compounds involved in the allergic immune responses are mostly represented by proteins intentionally added or unintentionally incorporated into food by cross-contamination. As there is no cure for food allergy, it is of highly important to provide clear and accurate information about allergenic ingredients. The big eight major allergens are given higher priority by USFDA while EU emphasizes information of 14 specific allergens in the labels. As per the codex code of practice, food allergen management starts from primary production to manufacturing, and retail food service. FDA enforces regulations requiring companies to list ingredients on packaged foods with specific labeling requirements for major allergens. Providing specific allergen information as per Food Safety and Standards (Labelling and Display) Regulations, 2020 of India is aligning with the European and US standards of labelling. Compliance of precautionary allergen labelling to indicate the unintentional presence of allergen or accurate information on allergen along with effective methods to prevent allergen cross contact can prevent triggering of allergic reactions in sensitive individuals and ensures safety.



# Odisha - Blue Revolution 2036



**Aditya Dash**  
Managing Director  
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What is the most glorious aspect of our history? According to me, it would be our maritime trading links. Our holiest shrine, Shri Jagannath temple is in the coastal town of Puri. Even the world-famous Sun Temple is situated next to the sea. If we are to reclaim our glory days, we need to reconnect with our ancient maritime outlook. A literal “blue ocean” strategy. The secret to Odisha’s prosperity lies in harnessing the economic might of the ocean. In this article, I will give a brief guideline for a ‘Blue Revolution’ that focuses on our capture fisheries and aquaculture.

In 2006 when I joined the seafood industry, the total seafood exports from Odisha was around 500 crores INR. In 2022 Odisha would have exported almost 5000 crores INR worth of seafood. This huge jump has been possible due to the introduction of the Pacific White Leg Shrimp in India. A study conducted by Government of Gujarat found out that 1 hectare of shrimp farming creates 10 jobs across the value chain. In the coming decade, active policy interventions can truly unleash a blue revolution that will result in job creation and overall rural development. For this the state government should focus on 5 major programs. Managing aquatic diseases to enhance productivity. Encourage species diversification and finance breeding programs for important species. Solve the infrastructure deficits that plague the aquaculture sector. Invest in a brand “Odisha” for aquaculture products sourced from Odisha.

Covid-19 showed us the importance of public health and how important it is to manage and contain a pandemic. In shrimp aquaculture, there are more than 14 different pathogens that cause diseases. These lead to mortality and overall reduce the profitability and productivity of the sector. The private sector solution towards tackling diseases simply burdens the farmer with expensive and time consuming tests and increased costs by using various additional inputs such probiotics and other supplements in the hopes of containing the damages done by disease. What is needed is a public health approach so that various aquaculture diseases are

being monitored and appropriate actions are implemented. The number 1 strategy should be an effective testing strategy. Here it is important to note that with shrimp related viruses, more than expensive equipments you need qualified lab technicians to detect the various pathogens. Genics a start-up based out of Australia, has commercialised a unique PCR based pathogen detection technology. This technology was developed by CSIRO (Commonwealth Scientific and Industrial Research Organisation) Australia. The fisheries department should explore collaborating with such companies so that our farmers can get affordable access to world class technology. Apart from that active monitoring and management measures should be implemented every year, so that disease outbreaks are identified and appropriate measures such as dredging of creeks etc can take place.

Currently one can safely say that 70-80% of aquaculture output by value is contributed by only 1 shrimp species, that is *Litopenaeus Vannamei* aka The Pacific White Leg shrimp. Aquatic diseases ensure that productivity will be low as long as diseases are present. Apart from disease management measures the Government of Odisha should invest in a *Vannamei* and Black Tiger shrimp breeding program. The private sector will not make the investment since the returns are too uncertain, apart from that there will be very little protection on the intellectual property developed by a private company. How can a private sector ensure ownership over the breeding lines they would have developed over a decade? A successful case study would Ecuador’s shrimp breeding program that was started in the 1990s following the devastating outbreaks of the White Spot Syndrome Virus (WSSV). Unlike India and rest of the world that went on to develop Specific Pathogen Free (SPF) breeding lines of shrimps. Ecuador developed Specific Pathogen Resistant (SPR) breeding lines. The results are there for everyone to see, Ecuador is now the largest shrimp producer in the world. Apart from sponsoring breeding programs for commercially important species such as *Vannamei* shrimps and

Indian Major Carps. The state government should also establish a multi species hatchery to promote species diversification. As of writing this article an agreement has been signed between MPEDA's (Marine Products Export Development Authority) research and development division and Odisha state fisheries department for the establishment of a multi species hatchery at Gopalpur on Sea.

Like any economic activity, aquaculture can get a big boost if the government could address the infrastructure deficits. The most glaring one is port connectivity. As of now, our products are exported either through Vizag port at Andhra Pradesh or Kolkata port at West Bengal. The ports in Odisha, do not have reefer cargo handling facilities. Farming, processing and maintaining the cold chain requires a lot of energy. Ideally this energy should be from electricity. However due to absence of 24x7 electricity facilities, a significant amount of aquaculture activities is powered by diesel generators and motors. This results in more pollution, it depletes India's foreign exchange and it increases the cost of production. Farming and Processing of aquaculture products in neighbouring states such as Andhra Pradesh are not at all reliant on diesel, they enjoy good electricity connectivity. Apart from port and electricity connectivity the government should focus on road connectivity. In this aspect, the credit should go to both the state and central government where the road connectivity has improved over the past decade.

I can have the best farm and the best factory, still I will not be able to sell my frozen shrimps at Disneyland USA or Wholefoods. The reason for this is that shrimp from India has been categorized as "avoid" by the Monterey Bay Aquarium's Seafood Watch. Seafood Watch publishes a list of species and their origins and educates consumers who are interested in being more aware about their consumption impact. It has ratings of avoid, good alternative, certified, and best choice. As things stand now, Odisha and rest of India are in the avoid category. However, there is a pilot program being

implemented in Andhra Pradesh and if successful it might lead to an outcome where product of Andhra Pradesh would be eligible for sale at prestigious outlets such as Disneyland and Wholefoods Market. Odisha has adequate environmental laws, and the measures are being implemented. This is why, it is imperative that the public sector such as the Department of Export Promotion take up the task of creating a brand "Odisha" as far as seafood and aquaculture products are concerned. To expect this from the private sector there are coordination challenges. Just like Odisha has done a fantastic job with marketing Odisha as a tourism destination, we should also make an effort towards creating a brand for our seafood products.

In 1976, my father started his business by purchasing 2 trawlers for operations in the waters off Paradeep. I hear stories about the abundance of catch and how the average voyage days was a mere 2 to 4 days. The current scenario is startlingly different with the average voyage days ranging from 20 to 25 days and the catch a fraction of what it used to be in the glory days of fishing. We are on a race to the bottom as far as this vital resource is concerned. With financiers of commercial trawling more interested in other lucrative businesses like construction, the plight of the traditional fishermen is dire.

All is not lost. Things were similar in Australia a few decades ago. However proactive government policies saved the day. Something similar needs to happen in Odisha.

The first thing we need to do is establish more marine sanctuaries. These no-fishing zones will let the fishing stock thrive and re-populate the overfished areas. Apart from establishing sanctuaries we need an effective monitoring and enforcement system. I am talking about more marine police stations and greater coordination with the Coast Guard. This needs to change. We need to realize that our fisheries are an important resource that need to be managed carefully. The role of new technologies such as satellites can also be explored.

We also need to increase our efforts at value addition. The way things stand now, a bulk of the catch is simply going for fish meal processing and to the local wholesale market. The export demand for sea caught products has decreased. The main reason being that in Europe and North America consumers want seafood with sustainability certifications. Also, the lower cost of farmed shrimp lowers the demand for sea caught products.

Two active interventions are required from the government. Recently the Odisha government announced a policy of including fish in the mid-day meal scheme. This is an excellent policy. The government should go a step further and ask for a minimum quantity of ready to eat and/or ready to cook seafood products to be prepared in the mid-day meal kitchens. This will make the introduction of seafood in these schemes a safer and easier to implement option. Needless to say, it will give a huge boost to the local seafood value addition industry.

The second intervention would be for Odisha government to attain sustainability certification for one of its fishery resources. The certificate I have in mind (and which is in high demand) is Marine Stewardship Council (MSC) and the fishery we should begin with is Chilika Lake. Some excellent work has been done recently in Chilika with the removal of illegal prawn farms. The administration should go a step further and take steps to certify all the wild caught products from Chilika Lake. Private

companies cannot do this since they do not have the legal mandate nor the resources. Some of the biggest seafood companies in Europe however are extremely interested in such a project and would be more than willing to actively contribute. Apart from that, the Maharashtra government has taken a very proactive and pragmatic approach towards mangrove conservation, which can be adopted in Odisha. A collaborative approach in finding a right balance between conservation and livelihood has worked very well for Maharashtra and can be replicated in Odisha too.

We need to sharpen our maritime focus. Recent trends have been encouraging - from the Sagar Mala Project to the coastal highway to the recent announcement of a separate Department of Fisheries in the Central Government. I sincerely hope that the Government of Odisha also creates a separate Department of Fisheries, instead of clubbing it with Animal Resource Development which is currently the case. So the next time you are enjoying a lavish “Chad Khai” bhoji, try and find out about the curious stories of the Hilsa, the Bhekti, the Chingudi, the Khoinga and the Kankada.

If Odisha is to grow prosperous as per tradition we must seek the blessing of Lakshmi, the Goddess of Wealth and Prosperity who also happens to be the daughter of Varuna, God of the Oceans. The answer has been there right in front of us all along!



# A Path towards Sustainable Fishery - Marine Stewardship Council (MSC) Certification – An Outline



**Dr. Ranjit Suseelan, Ph.D. Head (INDIA),**  
Marine Stewardship Council,  
1-3 Snow Hill| London EC1A 2DH| United Kingdom



## Introduction

The Marine Stewardship Council (MSC) is an international not-for-profit organization established to transform the way the oceans are fished by creating market recognition and incentives for well managed and sustainable fisheries worldwide. The MSC has developed a logo to inform consumers that when they buy seafood products with a MSC logo they are supporting healthier oceans and a healthier environment. MSC supports development of sustainable marine fisheries by promoting responsible environmentally sound, socially beneficial and economically viable fisheries practices while maintaining the biodiversity, productivity and ecological process of the marine environment. Both the end customer and the fishing industry gain through this certification. MSC environmental standards for sustainable fishing are based on FAO Code of Conduct for Responsible Fisheries (CCRF). MSC Certification is a set of Principles and Criteria for sustainable fishing which is used as a standard in a third party, independent and voluntary certification programme. These were developed by means of extensive international consultative process through which the views of stakeholders in fisheries were gathered. MSC certification contributes to SDG14 on Life Below Water, which commits countries to conserve and use the oceans sustainably, seas and marine resources for sustainable development. MSC's work also contributes to other goals including food security (SDG2), decent work (SDG8), sustainable consumption and production (SDG12) and strengthening global partnerships for sustainable development (SDG17).

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## Major Markets:

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## Products:

- A. BLOCK FROZEN – HLSO, P&D, PDTO, PUD, HOSO, EZPL & PVPD
- B. IQF - HLSO, P&D, PDTO, PUD, HOSO ,EZPL, PVPD & BUTTERFLY
- C. COOKED PRODUCTS – CPDTP, CP&D, CPUD, HOSO

**OUR BRANDS : KLAR & BAY TROVE**

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PINCODE-523101.

**BUSSINESS CONTACT: Mr.ANTONI SAMY, PHONE: +91 8886676129 E.MAIL : antonythains@gmail.com**

## The three basic principles of MSC Certification are:

Principle (P1): A fishery must be conducted in a manner that does not lead to overfishing or depletion of the exploited populations and for those populations that are depleted, fishery must be conducted in a manner that demonstrably leads to their recovery.

Principle (P2): Fishing operations should allow for the maintenance of the structure, productivity, function and diversity of the ecosystem (including habitat and associated dependent and ecologically related species on which the fishery depends).

Principle (P3): The fishery is subject to an effective management system that respects local, national and international laws and standards and incorporates institutional and operational frameworks that require use of the resource to be responsible and sustainable.

To determine if each principle is met (for guidance on how certification can be approached see <https://www.msc.org/documents/getcertified/fisheries>), the MSC Fisheries Standard comprises 28 performance indicators (Fig. 1). These are used by independent conformity assessment bodies (CABs) to score the fishery (Fig. 2). To ensure the MSC program and its associated benefits are accessible to all fisheries including those from the developing world, the MSC developed a set of precautionary risk-based indicators for the assessment of data-deficient fisheries - the Risk-Based Framework (RBF).

An infographic on the characteristics of a credible FIP is given in Fig. 3. The first step is to identify fisheries which have the potential for MSC certification.

## Why MSC?

A number of ecolabeling programs exist for wild capture fisheries. The MSC, however, is a globally recognized and truly independent third-party certification program that holds the most credible sustainability standard for wild-caught fish for the following reasons:

- The MSC is fully compliant with the Food and Agriculture Organization (FAO) Guidelines for the Ecolabelling of Fish and Fishery Products from Marine Capture Fisheries and is consistent with the ISEAL Alliance codes of good practice on standard setting and impact monitoring.
- Accredited, third-party Conformity Assessment Bodies (CABs) complete fishery assessments against the MSC standard.
- The MSC assessment methodology is fully defined and publicly available, as is the guidance for use of the methodology. Performance indicators are measurable with detailed scoring guideposts for each.
- The MSC standard not only ensures that responsible management practices are in place, but also that fisheries are operating at sustainable levels (e.g., stocks are above the point of impaired recruitment; the fishery does not cause serious or irreversible harm to habitat structure or function).
- The program includes annual monitoring and review processes to ensure that certified fisheries continue to meet the MSC standard.
- A robust traceability system, the MSC Chain of Custody (CoC) certification program, ensures that MSC certified products can be traced back to a certified fishery at each point in the supply chain.
- The MSC certification process is fully transparent, and stakeholders play an active role in each assessment to reduce the risk of undue influence by any one party during the

certification process. Each assessment team is required to consult with stakeholders at several points during the assessment process in order to ensure a scientifically robust outcome.

## Benefits of MSC Certification

For fisheries, benefits of MSC certification could include

- retention of current markets (particularly for those selling to companies that are committed to sourcing MSC certified products)
  - access to new markets
  - preferred supplier status
  - price premiums
  - product differentiation
  - international recognition of sustainable practices
  - improved fishing practices
  - improved fishery management
  - increased knowledge about the fishery
  - improved community organization and involvement
  - motivation for improved practices by peer group fisheries
  - a credible sustainability claim
  - confidence in the sustainability of the fishery
  - security in fishing-related livelihoods for the future
  - local pride
- For seafood buyers, sourcing from an MSC certified fishery
- provides confidence in the sustainability of the product
  - allows for a credible and traceable sustainability claim
  - demonstrates a public commitment to sustainability
  - helps to meet growing consumer demand for sustainable products

## Who Is Eligible for MSC Status?

The MSC standard is applicable to all wild-capture fisheries around the world (except for those that use poison or dynamite, or target sharks for their fins), including small-scale fisheries and fisheries in developing countries. In fact, a number of small scale and developing

country fisheries around the world have already received MSC certification. Many small-scale fisheries lack sufficient data to be evaluated against certain performance indicators in the MSC's standard assessment tree. In response to this challenge, the MSC developed its Risk-Based Framework, which uses stakeholder feedback to assess risk in lieu of a quantitative analysis. This approach provides fisheries an additional way to be assessed when quantitative information is not available.

## The CAB

The CAB conducts the pre-assessment or full assessment of the fishery against the MSC standard. CABs are a third party, independent of both the MSC and the fishery client. A pre-assessment team typically comprises one or two expert team members, while a full assessment team consists of two to four experts. CABs may contract independent consultants (e.g., scientists or former fishery managers) to serve on an assessment team.

## Fishery Stakeholders

Stakeholder involvement is a key part of the MSC process, particularly during full assessment. During full assessment, stakeholders are invited to provide feedback about nominations for assessment team members, the performance indicators to be used in the assessment, the performance of the fishery in relation to the MSC standard, peer reviewers, the public comment draft report, the final report, and the determination of whether or not a fishery should be certified. Participants in an assessment will vary depending on the nature of the fishery and the extent of local interest, but fishery stakeholders often include

- producers
- other members of the fishery's supply chain
- fishery managers
- government officials
- academics

- environmental NGOs

Ideally, a diverse group of stakeholders should be part of the process so that all fishery sectors are represented and can provide as much information about the fishery as possible during the assessment process, ensuring an accurate and robust analysis by the assessment team.

## The MSC

The MSC serves as the standard holder. It ensures that the program keeps up with best practice guidelines and the best available science, and that CABs are applying the standard appropriately. The MSC does not certify fisheries itself. Accreditation Services International (ASI) accredits independent CABs to conduct assessments against the MSC standard. This third-party approach ensures that the program is robust and credible, and meets best practice guidelines.

## The MSC Certification Process

There are two distinct components of the MSC certification process:

- Pre-Assessment—a preliminary (and, if desired, confidential) review to determine whether a fishery is ready for full assessment
- Full Assessment—a more intensive process that determines whether the fishery meets the MSC standard and can be certified.

### MSC Pre-Assessment

Pre-assessment provides a brief analysis of the fishery against the MSC standard, and usually takes approximately six months to complete. An MSC pre-assessment provides guidance as to whether or not a specific fishery is likely to meet the MSC standard for sustainable fishing. The goals of a pre-assessment are to

- obtain a clear understanding of the nature, scale, and intensity of the fishery
- evaluate the potential of the fishery to achieve MSC certification
- identify any issues that may compromise a full assessment

An accredited third-party CAB is contracted by the client to conduct the pre-assessment. The assessment team does not precisely score the fishery against the MSC criteria during pre-assessment, but will provide a brief red/yellow/green “traffic light” analysis of how the fishery aligns with each performance indicator and what issues would likely prevent the fishery from meeting the MSC standard.

Based on the analysis, recommendations and next steps include:

- If the pre-assessment finds the fishery likely to meet the MSC standard, the CAB will recommend that it proceed to full assessment.
- If the CAB identifies actions that should be undertaken by the client prior to proceeding with full assessment, the client may desire to work with stakeholders to develop a comprehensive FIP.

### MSC Full Assessment

MSC full assessment will determine whether the fishery can be certified and is eligible to use the MSC ecolabel. Full assessment usually takes 12 to 18 months to complete. Fisheries that are likely to meet the MSC standard (based on the results of a pre-assessment or FIP review meeting) are ready to enter the MSC full assessment process. During MSC full assessment, the CAB evaluates whether the fishery complies with the MSC environmental standard for sustainable fishing. The full assessment process involves

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If you decide to enter MSC assessment, an accredited third party certification body will independently score your fishery against the 28 performance indicators (PIs) that make up the MSC Fisheries Standard. The PIs sit within three core principles: sustainable fish stocks; minimising environmental impact; and effective management, as shown in the assessment tree below.

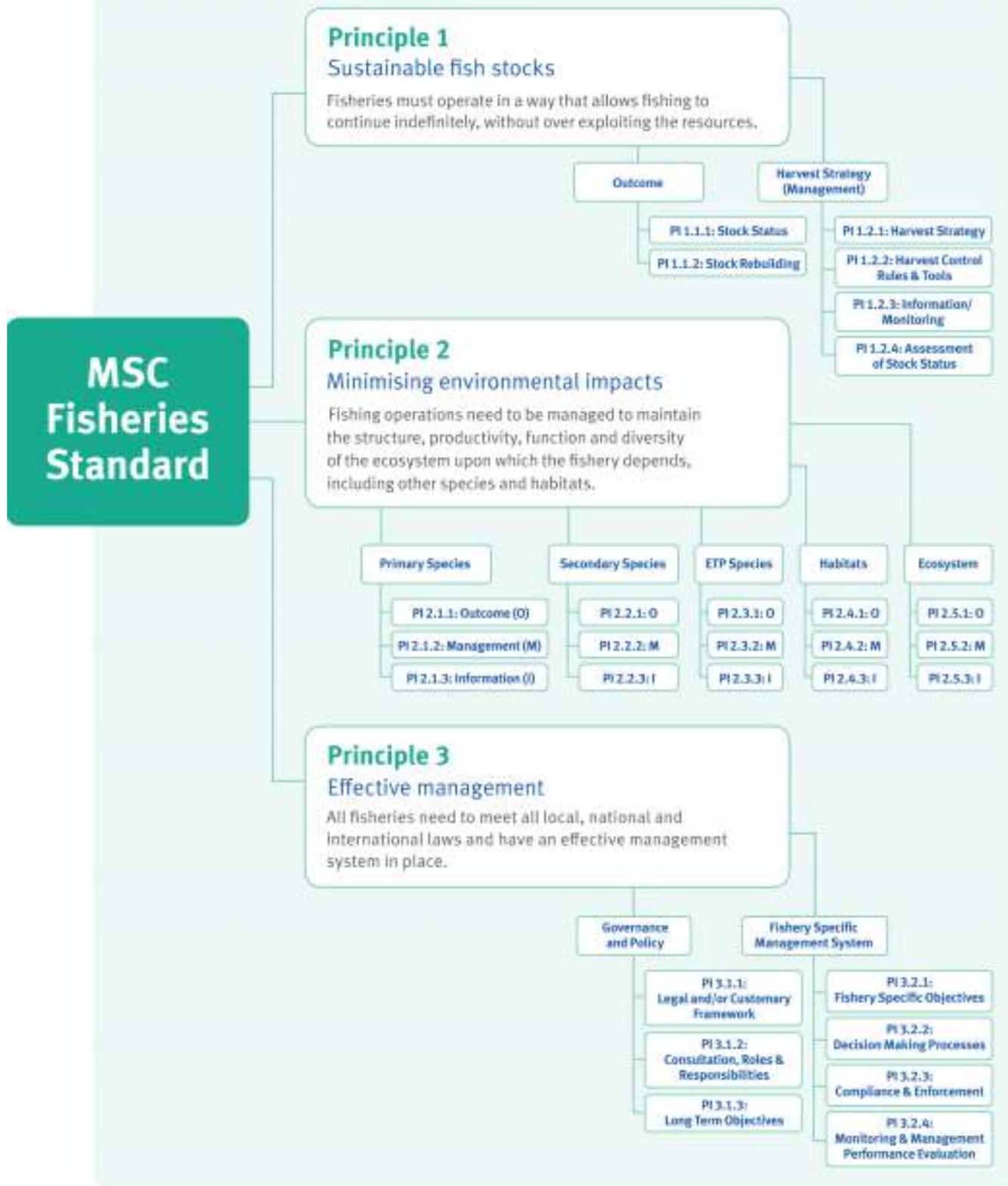


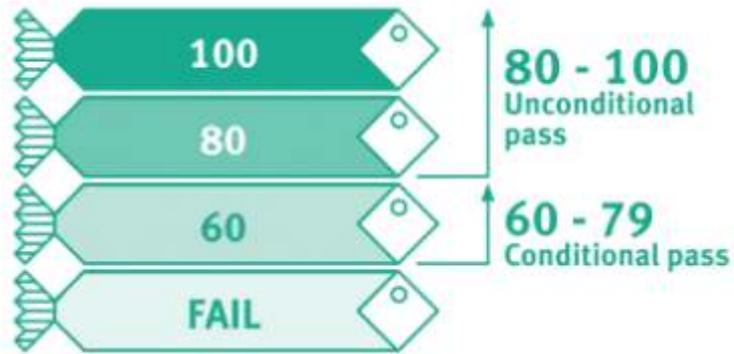
Fig. 1. MSC principles and performance indicators (source : [www.msc.org](http://www.msc.org))

## How does the scoring process work?

Your fishery will be assigned a score for each performance indicator where 60 is the minimum acceptable performance, 80 is global best practice and 100 is near perfect performance.

### In order to be certified, your fishery must score:

- At least 60 for each of the 28 performance indicators
- An average score of 80 across all performance indicators under each of the three principles



If your fishery scores between 60 and 79 for any performance indicator, you will be required to take appropriate action to improve performance against the particular indicator so that it scores 80 or above within a predetermined timeframe (typically five years).

Fig. 2. MSC fishery scoring guideposts (source : [www.msc.org](http://www.msc.org))

# 4 steps to a credible FIP

## Supporting fisheries as they move towards MSC certification

Fisheries that are keen to become MSC certified but do not yet meet the MSC Fisheries Standard may choose to make the necessary improvements to their operations through a Fishery Improvement Project (FIP). A credible FIP involves four key stages, each with associated tools and support mechanisms.



### Stakeholder engagement

Stakeholder engagement underpins every stage of the FIP process. Different stakeholder groups need to work together to deliver improvements



### Pre-determined timeframe

There should be a pre-determined limit to the amount of time spent as a FIP. This should generally be no longer than five years



### Stakeholder training

The Working to MSC certification guide and Capacity building training program equip stakeholders with knowledge to implement successful FIPs



Fig. 3. MSC infographic on fishery improvement project (source : [www.msc.org](http://www.msc.org))

- formation of an expert assessment team
- an information-gathering phase and site visit
- development of a detailed assessment report that scores the fishery against the MSC performance indicators
- client review of the assessment report
- peer review of the assessment report
- stakeholder review of the assessment report
- final determination of whether the fishery meets the MSC standard
- a period during which stakeholders can lodge objections to certification.

The full assessment process is public and involves stakeholder participation in many steps along the way. The MSC certificate is valid for five years, after which a fishery must be re-assessed in order to remain MSC certified.

### **Chain of Custody**

Certification of a fishery alone does not allow the sale of product with the MSC ecolabel. This requires separate CoC certification. The fishery assessment will identify the point at which fishery certification ends and chain of custody certification must begin. CoC is the responsibility of those buying and selling the certified product. You might want to reach out to relevant points in the supply chain during the full assessment to inform them of this requirement. A site visit is required to assess supply chain companies against the CoC standard, so there can be substantial cost-savings from having the CAB conduct CoC certification of any local companies at the same time as the full assessment of the fishery.





## Sectorial musings:

The Marine products sector in our country has been showing continuous upward trends over the past decade with the periodic usual corrections as reflected in the global situation. Some thoughts about the sector that pervades every player in the field is penned down. These are not comprehensive factors influencing the trade, but a run down of the issues at hand.

**Kenny Thomas**  
National Managing Committee member of SEAI

## Obvious challenges.

1) Over fishing - Ocean wealth is eroded with the over fishing getting out of control in recent times. This has led to less catch and spending more time at sea, with its usual economic repercussions.

2) Not respecting regulation with regard to mesh size, observing ban period, catching of juveniles. Despite stringent regulations in place all over the country, the implementation at field level poses questions.

3) Uncontrolled pollution both Industrial and household along the coast.

## Other challenges

### a) Environmental related

#### i) Controlling the flow of fresh water into the oceans by dams and checkdams.

The amount of water flowing into the ocean from the 70's to now has reduced to a trickle. Reduce flow of water increases the salinity as well as density of the sea.

Dense Saline water takes a long time to heat but once heated takes much longer to cool down. Prolonged period of high temp water absorb high amount of moisture and this result in frequent and more severe storms which causes and fishing disruption.

India's plan to link the rivers and curtail flow of fresh water to the oceans will have distasous long term effect where the disasters will outweigh any gains several fold. Water from the rivers carry nutrient that are food for marine life. Less nutrient will lead to shifting of resources

#### ii) Acidic ocean.

Depletion of ozone layer and increase emission of carbon dioxide create more acidic water.

This along with overfishing of predatory fish will lead to rise of opportunistic species like jellyfish, squid, cuttlefish and Octopus besides affecting the flora and fauna of the oceans.

#### iii) Uncontrolled disposal of plastic waste in the sea.

This is resulting in the accumulation micro plastics. In the near future importing countries will need producing country to monitor micro plastic and enforce steps to minimize such contamination.

b) Too much dependence on traditional market of EU, USA and China Western Economic growth is stagnant and the population is growing at a negative rate. There will be fewer people to consume fish in these countries. Purchasing power of consumers in these countries will slow These countries are also subject to long drawn out recessionary condition from time to time.

c) Availability of Crew Crew are not coming from traditional fishing families. In fact they are coming from interiors in many cases from tribal populations.

Last 30 years of prosperity has led fishermen to educate their children and divert them to other fields. For instance only 10% of the youth in Kharva community in Veraval fish for a living.



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**SINCE - 2007**



This has resulted in poorly trained crew that lack skill and motivation.

d) Lack of technology to exploit oceans beyond 100 fathoms as well as fishing beyond 50 to 70 nautical miles. Almost 90% of India's fish is exploited in waters within these depth. Fishing beyond this depth requires huge investment in craft and gear as well concerted effort in R.D by scientific organization. The resource availability at these depths are estimated to be larger than that from our current fishing. The proof of this is hundreds of Chinese flagged vessels fishing close to and within our EEZ with capacity of 1500 to 3000 MTON . These vessel are exploiting resource in a depth of upto 1500 fathom. The Indian deep sea fishing policy is not very friendly, practical status of value addition.

e) The small quantity of value addition is from ocean fishing are confirmed mainly to freeze dried shrimps, breaded squid rings, Sahimi grade cephalopods and portion control fish fillets, surimi analogues like crab sticks . The other value addition which we fail to recognize as value addition is products that have moved up the value chain.

i) India does not have a single large resource except for pelagic fishes where it is difficult to do value addition.If we were to exploit the deeper waters which has a huge deep sea squid resource potential it could boost value addition and keep our factories running.

ii) Non availability of skilled workforce that can give the same productivity and finish as competing nations of Thailand, Vietnam, Indonesia.



# SEAI AND SCHOOL OF INDUSTRIAL FISHERIES, CUSAT, TOWARDS SUSTAINABLE AND SAFE SEAFOOD FROM INDIA



**Dr. S. Sabu**

**Director, School of Industrial Fisheries,  
Cochin University of Science and Technology (CUSAT)**

**Dr. Mini Sekharan**

**Director, School of Industrial Fisheries,  
Associate Professor, School of Industrial Fisheries, CUSAT**

## Introduction

Aquatic foods heavily contribute to food security and nutrition in the 21st century. The concept of "Blue transformation" by the Food and Agricultural Organization (FAO) emphasizes the need for substantial efforts from all FAO member countries to achieve sustainable development objectives (SDGs). Fish and fishery products are one of the most traded food commodities in the world. On average, 40% of the fish produced are internationally traded. Food fish consumption is likely to rise by 15% to supply, on average, 21.4 kg per capita in 2030, determined mainly through growing incomes and urbanization, fluctuations in post-harvest practices and distribution, as well as in dietary trends concentrating on improved health and nutrition.

## Sustainable seafood

Sustainable fishing means leaving enough fish in the ocean and protecting habitats and threatened species. People who depend on fishing can maintain their livelihood by safeguarding the seas. Responsible harvesting and utilization of fishery resources are essential, as almost 90% of global marine fish stocks are fully exploited or overfished. According to the data computed by the World Bank, the situation is worst in low- and middle-income countries, where weak regulation and enforcement have produced above-average declines in fish stocks. Ensuring a sustainable seafood supply is a global challenge that has gained top priority in policies aligned with Sustainable Development Goals (SDGs). SDG 14

targets Life Below Water, worries conservation and sustainable use of the oceans, and marine resources for sustainable development and demands international cooperation for the oceans to get back in balance. SDG-2 aims to create sustainable food production systems to strengthen food security. Indian fisheries aim to meet the sustainable development goals (SDGs) through sustainability certifications. Fisheries sustainability certifications ensure the fishery is well managed, sustaining the resources for future generations and livelihoods and providing incentives for improved fisheries management. Ensuring Seafood safety, i.e., supplying the best quality, safe fish and fishery products to the consumer, is our prime responsibility.

## SEAI and School of Industrial Fisheries, CUSAT signed MOU for sustainability certification

The Seafood Exporters Association of India signed an MOU with the School of Industrial Fisheries, Cochin University of Science and Technology (CUSAT) on 2nd February 2023. The main objective is to work towards meeting the objectives of sustainable development goals (SDGs) of Indian fisheries through Marine Stewardship Council (MSC) certification. In addition to the academic and industry support initiatives, the School of Industrial Fisheries, CUSAT will offer R&D support for the seafood exporters consortium in obtaining the Marine Stewardship Council's (MSC) sustainability certification of coastal and deep-sea seafood resources from the Arabian Sea through the MoU. Both parties will join to meet the sustainable development goals (SDGs) of Indian fisheries through MSC certification.



Dr. S. Sabu, Director School of Industrial fisheries handing over the signed MoU to Mr. A.J. Tharakan, MD Amalgam foods in the presence of Prof. K. N. Madhusoodanan, Honble Vice Chancellor, CUSAT Prof. P.G. Sankaran, Pro-VC, Dr. Meera V, Registrar and other officials from CUSAT and Mr. Ramakrishnan, Secretary, SEAI, Dr. Ranjith Suseelan, MSC India head, and Dr. Sunil K Mohammed, chair SSNI.

## Background regarding the certification steps taken by SEAI, MSC, WWF

SEAI had formed two consortia of Seafood Exporters of India viz., (i) Kerala Forum for Crustacean & Cephalopod Sustainability (SEAI-KFCCS) and (ii) Forum for Deep Sea Shrimp Sustainability, Kerala (SEAI-FDSSK) and is working for the conservation and management of Shrimp & Cephalopod Trawl Fishery and the deep sea trawl fishery in Kerala. In collaboration with critical stakeholders, the consortia are committed to obtaining the Marine Stewardship Council's (MSC) sustainability standard for the above fisheries. SEAI has completed the Pre-assessment against the MSC standard and is implementing the Fishery Improvement Programs (FIP) for the trawl fishery of the eight species (five species of shrimp and three species of cephalopods) through the fund raised by the two consortia. The eight species are *Parapenaeopsis stylifera*, *Metapenaeus dobsoni*, *Uroteuthis*

*duvauceli*, *Sepia pharaonis*, *Amphioctopus neglectus*, *Aristeus alcocki* (Arabian red shrimp), *Heterocarpus chani* and *H. woodmasoni* (Thakkali/nylon shrimp).

The FIP for shrimp and cephalopod trawl fishery became active on 01.03.2019, and FIP for deep-sea shrimp trawl fishery became active on 01.12.2019. Through various activities, the FIPs are in the process of implementing the actions at the field level and are addressing the conservation issues with policymakers. The pre-assessment carried out by accredited auditors has indicated several gaps in the science and management of the resources. This project collaboration will benefit both Parties, meeting their organizational mandates and the cause of sustainable use of natural resources and conservation of the eight species and their critical habitats. The Objective of this MOU is to express the willingness of both parties to engage in an effort to develop academic collaboration between both parties and facilitate student exchange; faculty

exchange for teaching and research; collaborative research and publication; organizing joint training programmes, conference, seminars, symposia, and workshops; and developing other mutually beneficial programs.

## **Areas of Collaboration in MOU**

Subject to the availability of manpower and other facilities, the parties hereby agree to extend their cooperation on the following activities:

1. SIF-CUSAT and SEAI will jointly work towards meeting the objectives of sustainable development goals (SDGs) of Indian fisheries through Marine Stewardship Council (MSC) certification
2. Facilitate and support research and monitoring to meet the MSC Fishery Improvement Project (FIP) action points.

## **School of Industrial Fisheries, CUSAT**

School of Industrial Fisheries has been successfully conducting the Multi-disciplinary Masters Programme in Industrial Fisheries since 1976. This Professional Post Graduate Degree Programme is one of the primary sources of human resources for the fisheries industry and academic and research institutions in India and abroad. Central Government/State Government Fisheries Institutions/ Departments recruit postgraduates from this School. The entrepreneurial skill acquired from this programme has given confidence to the postgraduates to venture into their own business in different facets of fisheries. The employability of this programme has been attracting talented students from both the state and outside states to join this programme. The School introduced a new post Graduate

programme in Seafood Safety and Trade in 2012 with the support of the university grants commission by realizing the need for specialized manpower required in the area of seafood safety and seafood trade in international business.

The School also offers Ph.D. programs under the Faculty of Marine Sciences. Research areas of the School include Aquaculture, Fishery Biology, Craft and Gear Technology, fisheries economics, fisheries management, Fish Processing Technology, Seafood safety, Ornamental Fisheries, and Fish Marketing & Trade. The school alumni spearhead the Fisheries Administration, Research, and Academic institutions under the state and central governments. The Alumni of the School are well-received by the industry and trade inside and outside the country. The excellent research capabilities of the School offer a significant opportunity to do contextually-relevant rigorous research in fisheries. The School has the expertise to take up industrial and socially beneficial projects and offer consultancies in multi-disciplinary areas of fisheries for national and international platforms. Showcasing these strengths, the School of Industrial Fisheries, Cochin University of Science and Technology, Kerala, is considered one of the country's sought-after destinations for fisheries education.

## **Consultancy works offered by School for the seafood industry**

1. Seafood processing, value additions, and food safety
2. Seafood waste utilization
3. Sustainable fisheries and stock assessments

# SHAFI MARINE

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4. Molecular taxonomy and genetic characterization
5. Brand building, Digital marketing for export promotion- E-Commerce for seafood Supply chains
6. Market research and consumer behaviour, Business Analytics, and Econometrics

7. Fish business Entrepreneurship, DPR, Feasibility studies etc.

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A hand is shown holding a blue fishing net, which is draped over a large pile of fish. The fish are of various species, including what appear to be sea bream and other marine fish. The background shows a body of water and some distant structures, suggesting a fishing boat or pier.

# Need for synergizing domestic marketing and international trade towards augmenting fish consumption



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## Introduction

Fisheries is a fast-growing sector in India, which provides nutrition and food security to a large population of the country as well as providing income and employment to fishermen and fish farmers. The fisheries sector registered a sustainable growth rate of over 10 per cent and contributed over one per cent of India's annual gross domestic product during the last decade. Overall fish production in India has increased from 0.75 million tonnes in 1950-51 to 14.5 million tonnes in 2021-2022. Marine fish landings in India were estimated as 3.05 million tonnes during the year 2021-22. There has been a gradual increase in India's contribution towards global fish production over the years. The growth rate in marine fisheries was about 5.65 percent, whereas the growth rate of 33.64 percent has been achieved in inland fisheries in the country during the last decade. The country has an estimate of the value of marine fish landings during 2021 at landing centre (LC) level of Rs 53,647 crores, (14.24% increase over 2020) and at retail centre (RC) of Rs. 76,640 crores (14.06 % increase). The unit price per kg of fish at LC was Rs.176.04 (2.19 % increase over 2020) and at RC was Rs.251.48 (2.03 % increase). The average annual growth rate of fish and fish products exported from India in terms of quantity and value for the last decade (2010-11 to 2021-22) was 6.97 per cent and 17.32 per cent respectively.

Fish and fish products have recently emerged as the largest group in agricultural exports from India, with 1.36 million tonnes in terms of quantity and Rs. 7.76 million US \$ crores in value during 2021-22 compared to 1.15 million tonnes in terms of quantity and Rs. 5.96 million US \$ crores in value during 2020-21 (MPEDA 2020-21). This has constituted for around 10% of the total exports and 5.23% to the Agriculture GVA of the country rightfully earning the title of being a "sunrise" sector.

## The Resilience of Indian seafood export

A feature that deserves special attention when one speaks about the India seafood exports is the resilience of the sector. This has been witnessed in the global recession in 2007-8 as well as in the context of the global pandemic. Even though the world economy was hit with the economic recession in 2008, the seafood exports grew consistently in terms of quantity and value. The impact of recession did not affect India's seafood trade mainly due to the economic stimulus, strength of the banking system and the demand for retail products increasing coupled with lower demand for ready to serve and ready to cook due to the poor purchasing power in developed countries. The demand for food stamps increased in the developed countries including US and EU with massive economic stimulus provided to the working population. In the South East Asian countries, the recession was countered with more productivities and stronger governmental regulation. The Indian seafood export in particular remained resilient due to the increased demand for raw fish rather than value added products from the retail outlets – former constituting the bulk of the Indian export basket. The commodity-wise export of marine products

indicated that considering the total export the post-recession period (2008-2021) performed better than the pre-recession period (1994-2007). Overall, the growth rate of quantity in pre-recession period increased from 4.32 to 8.12 percent during the post-recession period. Further, it was found that the unit value realization in dollars which had registered a negative growth rate of -0.54 per cent during the pre-recession period, showed a positive growth rate of 7.12 percent during the post-recession period.

## Covid Pandemic and Seafood Exports

However, given the fact that there has been buyer alerts and rejections, this necessitates the need for harnessing the domestic market so that the fish food is available across the Indian masses and also provides a steady source of revenue for exporters. In the context of the global pandemic, it has been seen that there has been changing export destinations (with preliminary studies pointing at shift of India export destinations from the US to Asian countries) and given that there is an emerging movement across the world that focus on the food justice, calling for greater consciousness and responsibilities among consumers and producers to ensure that local communities and



Marine Products Exports over the years ( Source MPEDA)

local economies flourish even as firms and companies engage in international trade. Therefore, one could argue that there is better scope now more than ever for encouraging domestic consumption. In this endeavour, it is also important that we make use of existing policy frameworks to achieve this goal. An ideal existing policy would be the Pradhan Mantri Matsya Sampada Yojana (PMMSY).

## Paradox of export: The missing fish on the Indian plate

Amidst quantum increase in the seafood export, the sector is grappled with challenges which include the reduction in landings coupled with geographical separation of landings often result in irregular supply of raw materials, resulting in non-realization of economies of scale for exporters. In addition, the seasonal variations in marine catches constrain the operations of the firms. During lean seasons, the majority of firms face shortage of raw materials resulting in low-capacity utilization. More than 60 per cent of the landings occur during the post-monsoon period which coincides with the highest export demand period. Thus, to restore parity between demand and supply, raw materials are often purchased at higher prices with even forward marketing with the boat owners. The increasing demand for fish in the domestic market may push up the prices of many exportable fish varieties. The high purchase price and other operating expenses like labour cost, water and electricity charges increase the cost of production to exorbitant levels. There exists uncertainty in prices in the international market with the economic recession spreading to most of the target markets. The price uncertainties lead to delay in payments, loss in revenue, delay in realizing new markets, additional cost on storage, delay in shipment and increased demurrages. In addition, ecolabelling and other

private standards by international retailers for environmental and social purposes also result in high costs and low margins in fish export.

Equally important is the fact that from the point of view of the domestic food security – chief concern of any democratic country, there has been the challenge of domestic fish food security is an important issue considering the fact that export prices of fish are lower than the domestic prices, coupled with umpteen trade restrictions and measures. In the context of covid pandemic, and changing the international trade relations, the World Bank estimated a shrinkage of world trade by more than 5 per cent (World Bank 2020). Consequently, global fish markets in fish too can be expected to shrink or at best, alter. Therefore, reliance on domestic market presents the potential adaptation and coping strategy for exporters. Given this context, it is important to ensure the availability and affordability of high-value fishes whose consumption could be augmented by creating awareness in the country. The awareness level on high value fish consumption has indicated that only 15.3 percent of the consumers were aware about export prices of high-value fishes being low compared to its domestic prices. The exports of fish have been done at a price lower than domestic retail price (less than a dollar) across 42 countries. The price comparison of the high-value species like cephalopods, pomfrets, seer and ribbon fishes has indicated that the domestic prices were on an average 20-25 per cent more than the export prices. This has been due to the fact that high-value fishes do not cater to the domestic market on account of low and inconsistent demand. The exporters in order to reap in the export economies of scale tend to export more quantity at a lower price margin. The revenue gains are contributed mostly by quantity effect rather than the price effect. The exporters make their revenue mostly out of selling more quantities rather than at competitive prices. The paradox export thus

# INDIAN EXPORTS



## COMPANY APPROVAL NO & CERTIFICATIONS

NON EU APPROVAL NO : 214  
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ISO CERTIFICATION NO : ISO22000:2018  
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FSSAI CERTIFICATION NO : 10021021000894  
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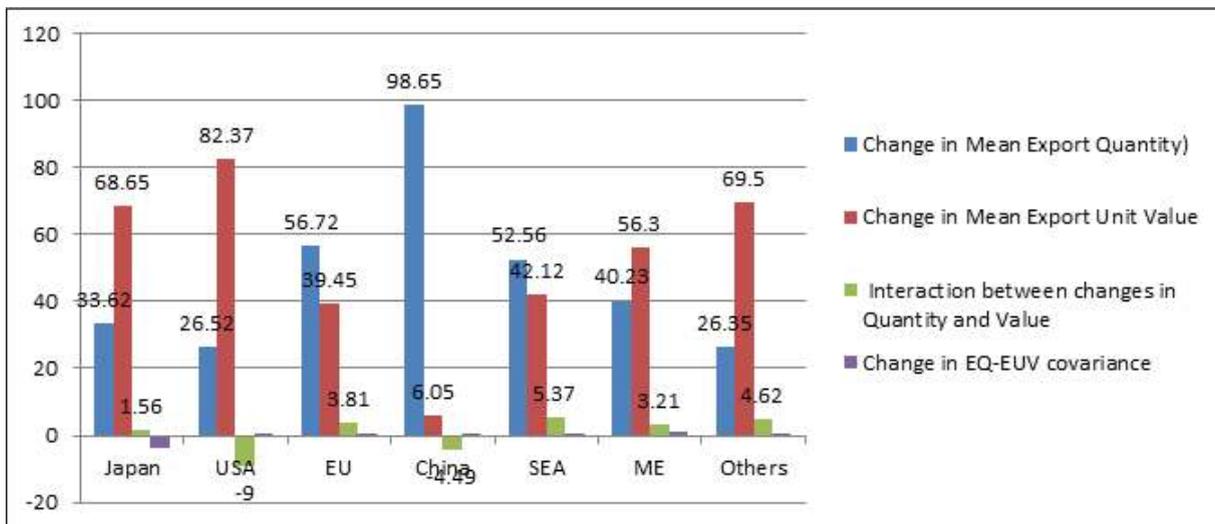
Processor & Exporter of all kind of seafood products

refers to the sale of a higher quantity of fish at a lower export price compared to the prices prevailing in the domestic market.

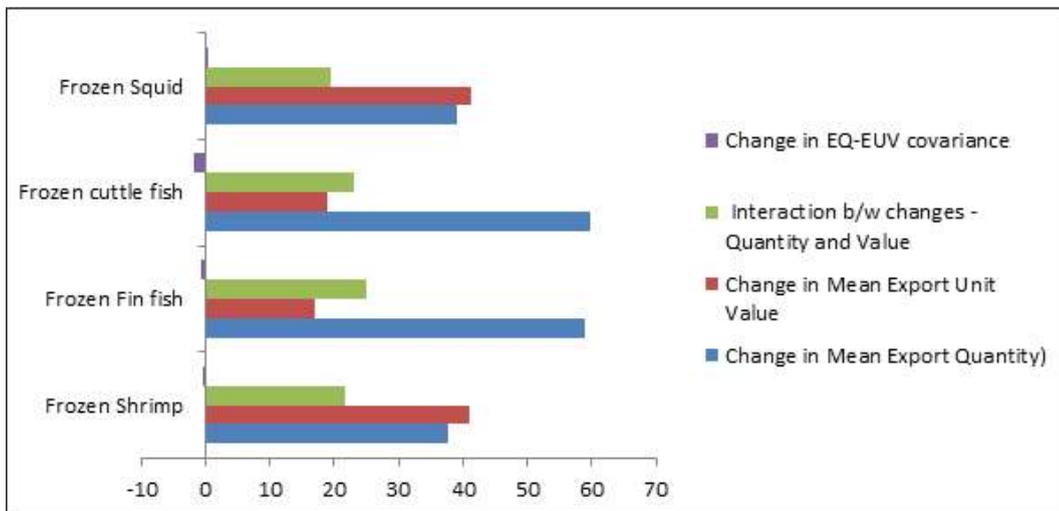
## Revenue realization : Exports trade and domestic markets

The revenue realization between the export trade with trading partners and domestic marketing across the coastal states using decomposition analysis is given in the following Figures

The decomposition analysis across the trading partners indicate that change in the mean export quantity accounts for the revenue realization for the EU, China and South East Asia markets. In addition the decomposition analysis across the commodities indicated that the mean export quantity accounts for the revenue realization for the Frozen fin fish and frozen cuttle fish .



Decomposition analysis of Indian marine exports across destination



Decomposition analysis of Indian marine exports across commodities

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Decomposition analysis- Landing Centre Price (LCP) & Retail Centre price (RCP) across states

States	Landing Centre Price				Retail Centre Price			
	Change in mean prices	Change in mean quantity	Interaction between changes in mean value and quantity	Change in quantity and value - EUV covariance	Change in mean prices	Change in mean quantity	Interaction between changes in mean value and quantity	Change in quantity and value - EUV covariance
West Bengal	69.54	13.24	21.67	4.45	64.67	16.92	21.69	-3.28
Odisha	51.28	20.7	28.56	-0.77	48.05	24.38	28.33	-0.76
Andhra Pradesh	55.67	28.45	16.75	-1.05	51.44	32.32	16.92	-0.68
Tamil Nadu	40.45	43.55	16.58	-0.59	41.78	42.58	15.99	-0.35
Pondicherry	28.48	85.17	18.08	-31.72	29.25	68.56	18.56	-16.37
Kerala	94.2	8.9	5.67	-8.77	89.78	8.46	7.25	-5.49
Karnataka	44.55	34.63	22.08	-1.16	44.79	34.81	20.90	-0.50
Goa	91.65	7.13	12.69	-11.48	86.78	7.21	12.02	-6.01
Gujarat	56.65	30.89	13.98	-1.75	65.21	18.55	16.44	-0.21
Maharashtra	53.31	28.97	20.99	-3.63	52.33	29.89	19.99	-2.65

The decomposition analysis across the domestic trade across the states indicate change in the mean price mostly accounts for the revenue realization for the Landing center and retail markets

## Impediments in the fish trade

The reduction in landings coupled with geographical separation of landings often result in irregular supply of raw materials, resulting in non-realization of economies of scale for exporters. In addition, the seasonal variations in marine catches constrain the operations of the firms. During lean seasons, the majority of firms face shortage of raw materials resulting in low capacity utilization. More than 60 per cent of the landings occur during the post-monsoon period which coincides with the highest export demand period. Thus, to restore parity between demand and supply, raw materials are often purchased at higher prices with even forward marketing with the boat owners. The increasing demand for fish in the domestic market may push up the prices of many exportable fish varieties. The high purchase price and other operating expenses like labour cost, water and electricity charges increase the cost of production to exorbitant levels. There exists uncertainty in prices in the international market with the economic recession spreading to most of the target markets. The price uncertainties lead to delay in payments, loss in revenue, delay in realising new markets, additional cost on storage, delay in shipment and increased demurrages. In addition, ecolabelling and other private standards by international retailers for environmental and social purposes also result in high costs and low margins in fish export.

## fish consumption of India

Currently, about 80 per cent of the fish produced globally is consumed by people as food. This proportion is not expected to change till 2030. Given that the production is expected to grow by 23.6 per cent during the 2010 to 2030 period and the world population is projected to grow at 20.2 per cent over the same period, the world will likely manage to increase the fish consumption level, on average. At the global

level, annual per capita fish consumption is projected to increase from 17.2 kilograms in 2010 to 18.2 kilograms in 2030. The trend in per capita consumption, however, is diverse across regions. In general, per capita, fish consumption is expected to grow fast in the regions with the highest projected income growth (China, India, South East Asia). However, the highest growth in fish consumption is expected in South Asian Region (SAR), where per capita fish consumption is expected to grow at 1.8 per cent per year over the 2010–30 period. In all of these regions, however, the growth in per capita fish consumption is expected to slow relative to the 2000–06 period. Adding together all its regions (CHN, EAP, JAP, SEA, IND, and SAR), Asia is expected to represent 70 per cent of global fish consumption by 2030. Though a major producer and consumer of fish globally and a net exporter, consumption per capita in India is well below the world average.

Fish has become an integral constituent in the food basket of the Indians as it is considered to be a healthy food with a high level of edible protein. Globally, fish provided 6.7 per cent of all protein consumed by humans and offered a rich source of long-chain omega-3 fatty acids, vitamins, calcium, zinc, and iron. One of the major advantages of including fish in the consumption basket is the availability of wide range of products across a huge price range and geographical spread across different states. On one side, fish could be poor man's protein (low-value fishes) ensuring food security, and on the other, a delicacy offered at a huge price and comparable with other protein sources (high-value species like shrimps, pomfrets and seer fishes etc.). It has been estimated that around 60 per cent of the Indian populace consumes fish and the consumption pattern varies spatiotemporally and across the different social fabrics. The annual per capita consumption of fish for the entire population is estimated at 5-6 kg whereas for the fish-eating

population it is found to be 8 -9 kilogram, which is a poor 50 per cent of the global rates. Moreover, the Pradhan Mantri Matsya Sampada Yojana (PMMSY) - the flagship scheme of the Government of India in the fisheries front- emphasizes on augmenting domestic fish consumption from 5 kg to 12 kg per capita is a step taken in the right direction.

Fish is less expensive than other animal protein sources and is inexpensive in terms of nutrition value in comparison to even vegetables and grains. Food security policies in India are by and large obsessed with cereals. Given our vulnerability to inflation in pulses, a large part of which is imported, India would do well to seriously think about fishing its way out of protein deficits. A preliminary examination of the average annual per capita fish consumption in India indicate that Tripura, Kerala, Manipur, Odisha and Assam are the top fish consuming states (Department of fisheries, 2019)

is estimated that the Indian population will reach 1.5 billion by 2030 and cross 1.6 billion by 2050 (The UN Department of Economics and Social Affairs ,2020). The increasing population necessitates identifying and harnessing cheaper protein sources like fish. The fish produced in the country exhibits competing use /users within domestic and international markets. Due to their ease of access to marine fisheries, coastal states/Union Territories (UTs) are likely to be higher consumers of fish compared to the non-coastal states/union territories. However, higher access alone may not lead to higher fish consumption and cultural and religious factors play an important role in state-wise patterns of fish consumption. The species diversification in the export basket indicated that almost all the varieties including sardine and mackerel which are often the most consumed fish in the domestic market are exported. The non-availability of fish in the

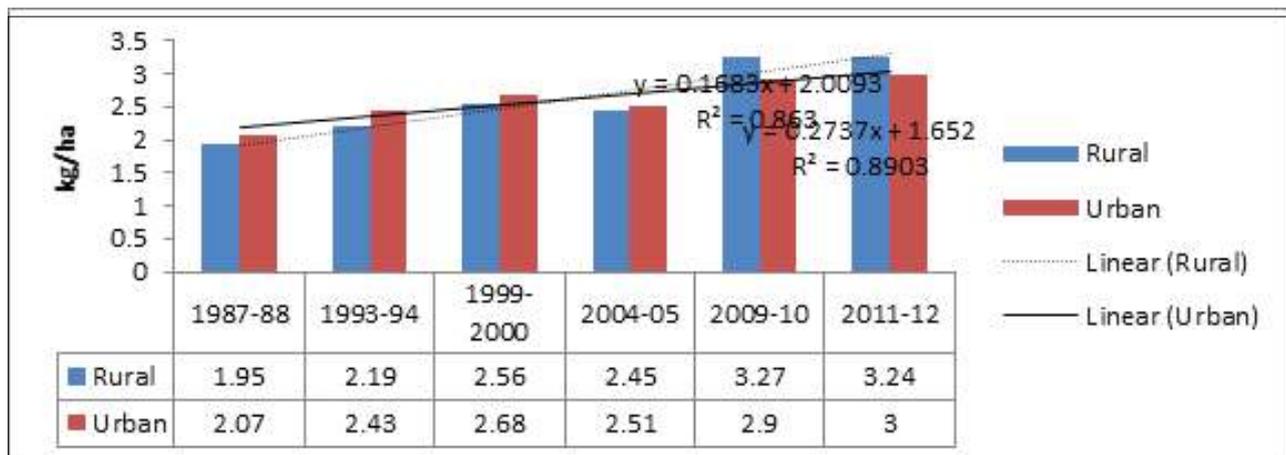


Fig: 1 Average per capita fish consumption in India (kg/ha)

The existing per capita availability of fish is 6.5 kg and is expected to reach 9.0 kg by 2030. The Indian Council of Medical Research recommends per capita fish consumption be 12 kg per annum. The regional tastes and preferences of the fish-eating population of the country and the frequency of fish consumption also exert substantial influence on the market. It

domestic fish market will lead to a situation where the domestic consumers are devoid of fish in the market at affordable prices. The domestic fish food security is questioned because the export prices are lower than the domestic prices coupled with umpteen trade restricting means and measures by the buyer countries (Paradox of export).

The Indian government is striving to provide food security to all its citizens through various policies and programmes. The National Food Security Act and Pradhan Mantri Garib Kalyan Anna Yojana are important steps in this direction, which aims to give adequate quantities of cheap cereals (predominantly wheat and rice) to the most vulnerable segment of the rural and urban population. Although this effort is laudable, food strategies must not merely be directed at ensuring just food security for all, but must also address providing adequate quantities of nutritious, safe and good quality foods that could address the makeup of a healthy diet.

Despite rapid economic growth during the past decades, India's average per capita calorie and protein intake have grown only modestly, although the per capita fat consumption has registered higher growth. Calorie and protein source in the Indian diet is diversifying with fruit/vegetable and animal-based food share increasing and cereal and pulses declining. The implication is that the implementation of the cereal-based National Food Security Act will have only a limited impact in achieving the goal of providing nutritional security to the vulnerable section of the population. This necessitates the need to enhance fish consumption.

India's per capita calorie, protein, and fat consumption remain significantly below that of more developed countries such as China and the United States. The implication is that in the coming years, with rising per capita income and urbanization, India's demand for various superior food products will continue to increase necessitating a possible change in the food production system and agricultural trade. Deliberations on the potential of the food and agriculture sector to meet the demands and challenges posed by this analysis and, its implications for all components in the food chain would be useful.

Summarising a 1966 survey of possibilities of increasing food production to meet India's nutritional requirements, Kent (1987) notes that, "fish is one item in our requirements of food that has the largest potential for increased production causing, at the same time, no strain on India's limited land resources. For a country with such low levels, qualitatively of food consumption, like India, fish ought to command high priority in the solution of India's long term food problem". With excessive dependence on cereals, the Indian diet is often characterised by both energy as well as protein deficiency, which can be met through fish consumption. In comparison to vegetables and grains, fish is relatively expensive based on weight but it is quite inexpensive in terms of nutritional value.

The Pradhan Mantri Matsya Sampada Yojana (PMMSY)- the flagship scheme of the Government of India in the fisheries front-emphasizes on augmenting domestic fish consumption from 5 kg to 12 kg per capita is a step taken in the right direction. It is important to note that fish consumption is restricted mostly within the near vicinity of less than 50 km of the production centres. Nevertheless, the demand pattern has not improved much and the increased fish consumption was found mostly among the existing fish consumers rather than adding new consumers into the fish consuming population.

## Assessing fish consumption paradigms across coastal states India)

The major advantages of including fish in the consumption basket are its availability of wide range of products across a huge price range and geographical spread across the different states. On one side, fish could be a poor man's protein (low-value fishes) ensuring food security, and on the other, a delicacy offered at

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huge prices and comparable with other protein sources (high-value species like shrimps, pomfrets and seer fishes. It's been estimated that around 60 per cent of the Indian populace consumes fish and the consumption pattern varies spatiotemporally and across the different social fabrics. The annual per capita consumption of fish for the entire population is estimated at 5-6 kg whereas for the fish-eating population it is found to be 8 -9 kilogram, which is a poor 50 per cent of the global rates. The per capita consumption of other meats such as chicken (2.7 kg), beef (1.3 kg) and mutton (0.6 kg) are less compared to fish. India has a higher part of fish protein in total animal protein consumption than the developed countries. The share of meat, fish and egg in protein intake was only 7% in rural India and 9% in urban India. The share was 26% in both rural and urban Kerala and was 10% or more in only 5 other major States: West Bengal, Assam, Andhra Pradesh, Tamil Nadu, and Karnataka. The Indian Council of Medical Research recommends per capita fish consumption be 12 kg per annum. Moreover, the fish consumption will also be influenced by the availability and price of its immediate substitutes. Ghee, butter, and eggs could act as substitutes for fish in Indian diets. The demand and supply of fish in the years 2017, 2020, 2025 and 2030 were calculated assuming the population of India to be 1.28 billion, 1.36 billion, 1.45 billion and 1.53 billion, respectively with 60 per cent population consuming fish @ 12 kg/capita. The result shows that the supply-demand gap would be 1.75 Million tonnes by 2017 and would double by 2030.

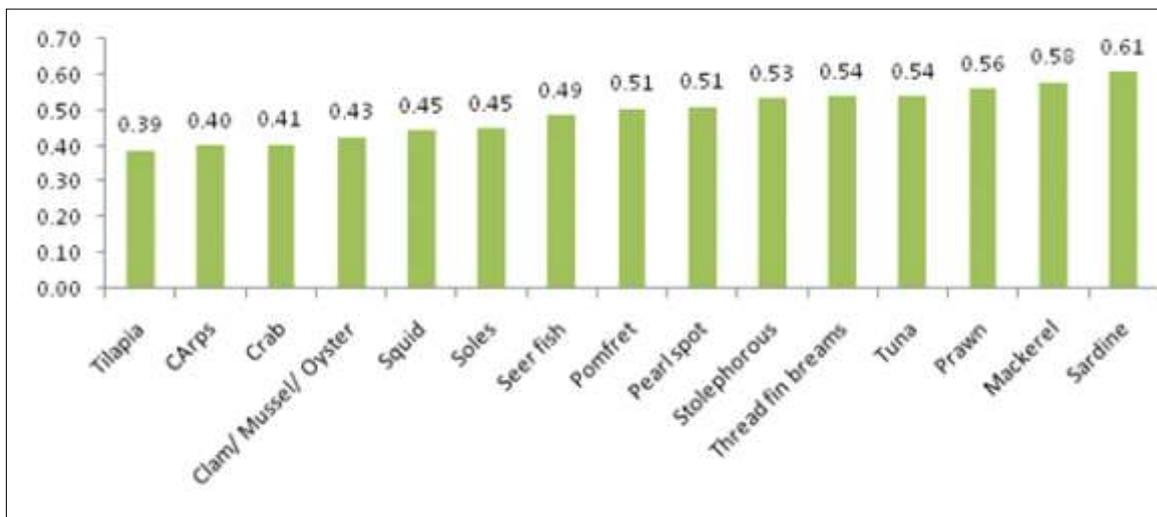
Fish preferences can vary based on several factors such as place of residence (rural and urban) as well as income level (poor and non-poor households). The fish trade is also differentiated based on market destinations like domestic and international channels. Increasing wealth and urbanization have a strong influence on the consumption of fish and

fishery products. About 8 to 21 per cent of the consumers belonging to the higher income group spent their income more on fish compared with the lower-income groups (5 -16 per cent). Similarly, the part of the budget spent on fish is more in the urban areas (6-32 %) compared to rural areas (3-15%). Freshwater species appeared to dominate the household fish consumption especially for those living in the deltaic countries with rich inland waters like India, China, Vietnam, Bangladesh and Thailand which imply that the geographical factors also determine the fish consumption.

A, comprehensive understanding of the fish consumption patterns across different coastal and non-coastal regions of the country is the need of the hour given its nutritional security implications. In this context ICAR – CMFRI has done numerous studies on fish consumption paradigms across the different coastal states on India. The study identified varied results like the quality, good taste and cheap rate may as the prime reasons to be acknowledged as the effective factors in the consumers decision in the preference of the buying place. The results indicates that drivers for buying fish have the highest part worth value for all the selected study areas of Andhra Pradesh (36.43), West Bengal (56.00) , Kerala (52.00) expect for Odisha (32.44). Quality, nutrition and taste and preference are the major drivers for buying fish for the consumers. The results also indicates that fish vendors at doorstep, way side markets etc. and even the landing center and supermarkets have considerable importance in choosing the purchase place by the consumers for fish consumption. The quality, good taste and cheap rate may the reasons behind the consumers' decision in the preference of the buying place. Due to the increase in the fish consumption the meat consumption is decreased. People are willing to travel to about 1-2 km to buy good quality fish. The Garrette ranking technique for constraints in fish

consumption found that the main constraint in the consumption of fish was observed to be the lack of fresh fish, followed by irregular supply, wide fluctuations in price, and consumption restricted due to high price. The per capita annual fish consumption of the respective

states are given below ( Figure) and the results indicates that the state Kerala has got the highest per capita fish consumption followed by West Bengal and Andhra Pradesh. In addition the preferred fish species across the country is given in the figure below



The preference indices indicated that the most preferred fish across PAN India was found to be sardine, followed by mackerel, prawn and tuna

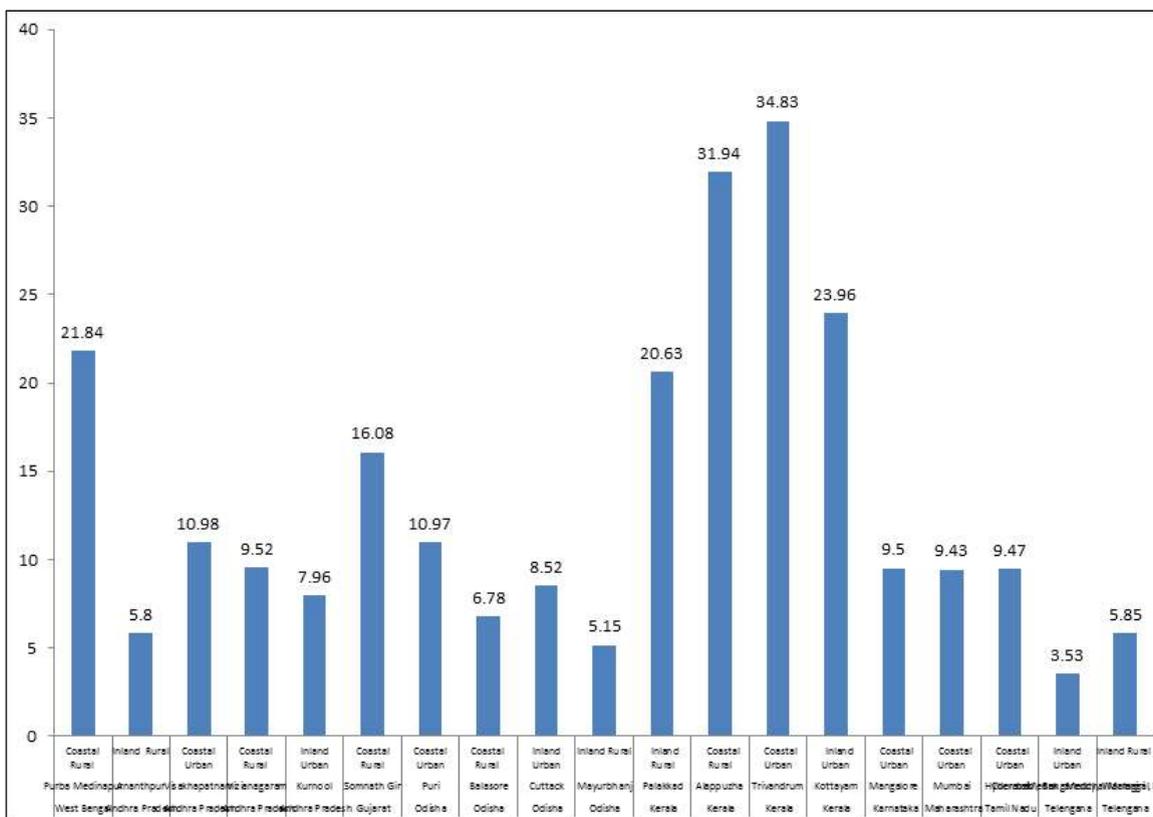


Figure Percapita fish consumption of the Coastal states of India

## Fish consumption- Drivers and impediments

The consumption of fish in India is increasing significantly due to lifestyle changes and higher cost of meat. In addition, the perception of fish as a healthy food with high levels of digestible protein, PUFA and lowering cholesterol capability is also a major factor for its increased consumption. The reduced availability, seasonal consumption and exorbitant prices were the major constraints. Most domestic consumers were unaware about low export price. The significant deleterious effects of fish supply–demand mismatch in domestic market and advocates for government intervention to ensure fish food security.



Figure- Drivers for fish consumption

## Changing consumer preferences

The seafood industry of India has gone drastic changes over the years in suiting the eating habits and consumer preferences toward the fish products. India is gearing up to produce and

supply value added products in convenience packs by adopting the latest technologies and by tapping the unexploited and under exploited fishery resources. There has been considerable structural change in the seafood processing and export industry for the last few years. Large quantities of fish/shellfish are discarded at sea because it is currently uneconomic to preserve and bring them ashore. It has been estimated that the global amount of discard of by-catches is in the range of 17-39 million tons/year with an average of 27 million tons/year. Factors discouraging the landing of the by-catch are the low market value of the material, the size and species composition, the lack of suitable refrigerated storage space on-board and over-exploitation of most the available species in the inshore areas. The rapid development of the value addition of fish products over the last four decades made a major contribution to the increased exploitation of these deep sea varieties and the by-catches. It has been found that consumption of fish may be greatly increased by making better use of the existing catch. Due to lack of infrastructural facilities like ice plants, landing facilities etc. the quality of the fish is downgraded particularly in developing countries leading to their use as aquaculture feed. Through improvement in infrastructure facilities, the quality of the landings can be upgraded for direct human consumption. The upgradation of these species may be achieved by use of improved handling and processing techniques on one hand and developing different products on the other preparation of value added product using a species in glut it is sure way of better utilization and distribution of the species when the landing is scanty.

## The future of fish and the fish consumer

The demand of the high value-added product is expected to increase in future not only because of the increasing population but due to

increasing consciousness of fish and fishery products as a health food items. To achieve our vision and increase value addition, we should assist the supporting industries in the country, like additive manufacturers, batter and bread manufacturers, flavour and marinade manufacturers and machinery manufacturers and packing material manufacturers as our exporters are facing tight competition from foreign countries as these additives and machineries not available in the country at a competitive rate. However, policy structure within the PMMSY calls for such an approach envisioning “an economic revolution through blue revolution” Through this, the country is equipping the manufacturing sector to engage with the primary sector so that it can ultimately benefit the community that is engaged in fishing. This vision is also reflected in the allocation within the scheme with 42% of the total estimated investment of the 20,050 crores being earmarked for creation and upgradation of fisheries infrastructure facilities including the construction and modernisation of Fishing Harbours and Landing Centers, development of Post-harvest and Cold Chain Infrastructure capacities as well as Fish Markets and Marketing Infrastructure, Integrated Modern Coastal Fishing Villages and Development of Deep-sea Fishing. Therefore, the important externalities that will be generated with conscious consumers in all spheres of production and harvesting is set to be reaped with the PMMSY.

In addition, urbanisation can play an important role in driving the fisheries sector growth, For example, the expansion of supermarkets and hypermarkets from major cities into smaller cities will help to have more growth potential and benefits consumer trends toward convenience and evolving modern and urban lifestyles. Keeping in mind that there is also greater environmental consciousness among consumers especially in the post pandemic

scenario which saw a shift towards more healthy, more local and more environment friendly consumption, new initiatives such as ecolabelling of the value added products to new cut, ready-to-eat product, gourmet quality product and seafood products in multiple formats, shapes, dimensions and flavor profiles such as seafood medallions, there is tremendous scope to shift from “fast food to slow food (Pietyrikowski 2004). Apart from the present product forms marketed finfish species, tuna species such as skipjack and yellowfin have good potential for value addition. The skipjack products could be further expanded to include improved smoked/dried products such as katsuobushi and arabushi for the Japanese market, dried and smoked fish flakes and fish extractives. Some of these products are already produced in countries like Maldives and SriLanka. Yellowfin tuna also holds good potential for product and market diversification. Tuna loins, fresh and frozen steaks can be produced for export purpose. Other finfish varieties such as seabass, grouper can be exported as slices, steaks and fillets in fresh/chilled and frozen form. Tilapia is produced by both capture and culture fisheries in inland areas can be marketed fresh/chilled with improved packaging like tray packs. Significantly large quantities of carps can also marketed as value added carp products such as carp cooked in traditional curry sauces.

There is a large potential for value added crab products both for domestic and export markets. The products identified for value added production are cut crab (half-cut and quarter-cut-crab), stuffed crab, crab balls, stuffed claws, picked meat and crab mince meat products. These products have good potential when marketed in retail packs. Marinated shrimp (great tasting shrimp marinated in a variety of sauces), Breaded sole fingers(sole fillets cut long ways into strips and breaded) Fish sticks(minced fish meat with spices in a

batter) are yet another value added products that can be introduced in our country. Large quantity of molluscs such as squid, cuttlefish and octopus and bivalves such as cockles, mussels and clams can be exported with improved packaging such as fillets (pine-cut, shell-cut and double-skinned), squid rings and cuttlefish strips, which have a potential when marketed in retail packs. The most popular snack foods - Fish and shrimp crackers can be produced from low value fish species or small shrimp. Japanese threadfin bream, bigeye tuna can be used. The main ingredients are fish mince, tapioca flour, salt and spices. There are good opportunities to produce fish and shrimp crackers with improved technologies.

With simple processing methods and attractive packaging, these products could gain popularity in the domestic market. These products should

be market at a lower cost to compete with or replace similar higher cost conventional products. Traditional brick-and-mortar stores are increasingly adapting to e-commerce, sales of value added seafood online through e-malls and online retailers will also have high market potential. Therefore, one should aim to co-exist with innovations in new marketing such as online trade with perhaps more indigenous modes of productions that are environment friendly. This has been a rising trend across consumers over the pandemic. With government intervention, India stands poised to make the step in the right direction. Promising examples from Kerala include the involvement of women in fisheries engaging more directly in the market through initiatives such as Theeramythri and Kudumbashree.





# ARNAV FISH INTERNATIONAL

Arnav group of companies is led by Mr. Manoj Kumar Sonkar, Managing Director/ Proprietor of this flourishing business. With 25 years of expertise in the fish and fisheries products, he had a humble start in 2009 when he founded Arnav Fish International and took it to the heights where today it stands due to his keen interest and vast knowledge in this business.

Located in the hub of aquaculture and Sea Corridor, i.e.; Andhra Pradesh, the company is engaged in processing and export of chilled fish to Domestic as well as International markets.

The Factory is approved by the Marine Products Export Development Authority of India and Export- Inspection Agency to International standards in terms of all working areas such as Labs, daily production maintaining quality etc.



ROHU FISH



CATLA FISH



TILAPIA FISH



ROOPCHAND



PANGASIUS

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