

Fish swim-bladder trade in India

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Processed fish air bladder or swim bladder are highly priced for edible purposes as well as medicinal value in many countries of Southeast Asia. In addition, they are widely used for preparing isinglass which finds application in industrial processes such as wine and beer breweries and preparation of cosmetics. Over the last few decades, global demand for swim bladders has increased exponentially which are sourced from countries with a fairly good production of fishes that are most sought-after for their swim bladders. Croakers are the most preferred and highly priced groups in the swim bladder trade, while several other fishes have also been added to the list in recent years.

In India, fish swim-bladder trade is historically well documented with earliest mentions dating back to the 1800s and reportedly spanned across the coastal regions of the country. The northern Arabian Sea region, including Mumbai, is famous in the global fish swim bladder trade

but is poorly known in the domestic sector mostly due to its restricted/closed trade network. The dried fish air bladders, also called “fish maw” and locally known as “*Bhot*” in Maharashtra, are collected and prepared from croakers (Family: Sciaenidae), threadfins (Family: Polynemidae), eels (Family: Congridae & Muraenesocidae), sea bass (Family: Latidae), groupers (Family: Epinephelidae) and catfishes (Family: Ariidae) (Table 1). However, the latter three fish families are less preferred and low-valued. Large-sized croakers are often called “gold” by fishers due to the attractive price they fetch. The region off Gujarat and Maharashtra, from where these fishes are caught along with other high-value fishes like pomfrets and seer fish, is locally called as “*golden belt*” by the local fishers. Often violent conflicts at sea due to fishing access issues and mixed craft gear combination operations for these fishery resources are reported.

The fishes used in the swim bladder trade are mostly bycatch in diverse fisheries operating various gears in Maharashtra such as purse seine, gillnets, bag nets, trawls and hook and lines, with seasonal targeted fishery for eels observed in certain areas. While aggregations of large-sized croakers are recorded, there is limited information on the biological reasons of aggregation (spawning/migration/feeding/habitat suitability etc). Large-sized croakers like Blackspotted croaker, *Protonibea diacanthus*, Bengal corvina *Daysciaena albida*, Soldier croaker *Nibea soldado* and Bronze croaker *Otolithoides biauritus* are in high demand for air-bladders along with eels (*Muraenesox* spp., *Congresox* spp.). Air-bladders from medium to small sized eels and medium-sized croakers and polynemids are also collected and traded. The price varies according to the species, count per kg, texture, quality, size/thickness of the air-bladder and increases with size and sex of the fish; the price is higher for air bladders from male fish (Fig. 2, Table 1). Kolkata,



Fig. 1. Drying of catfish airbladders in raised platforms in closed rooms of aggregators/exporter

Table 1. Some fish groups/species observed in swim bladder trade in Maharashtra and their price (1\$ = 72₹)

Group/family/Species	IUCN Red List status, Maximum size	Sex	Wet/Dry	Count/kg	Rate (₹)
Croaker, Sciaenidae			Wet	50	1,500-2,000
<i>Otolithoides biauritus</i>	Data Deficient, 160 cm TL		Wet	40	1,750-2,500
			Wet	30	4,500-5,500
			Wet	20	8,000-11,000
			Wet	10	12,000-17,500
			Wet	5	18,000-21,000
			Wet	3	22,000-25,000
Croaker, Sciaenidae					
<i>Protonibea diacanthus</i>	Near Threatened, 120 cm TL	Male	Wet	10	25,000-27,000
		female	Wet	10	17,000-21,000
		Male	Wet	5	140,000-165,000
		female	Wet	5	75,000-95,000
		Male	Wet	2	5,55,000-6,50,000
		female	Wet	2	4,00,000-5,00,000
		Male	Wet	1 kg or above	7,00,000-9,00,000
		female	Wet	2 kg or above	5,50,000-7,00,000
Eels, Congridae & Muraenesocidae			Wet	10	10,000-13,000
<i>Conger cinereus</i>	Least Concern, 140 cm TL		Wet	5	15,000-20,000
<i>Congresox talabonoides</i>	Not Assessed, 250 cm TL		Wet	3	22,000-28,000
<i>Muraenesox bagio</i>	Not Assessed, 200 cm TL				
<i>Muraenesox cinereus</i>	Least Concern, 220 cm TL				
Threadfins, Polynemidae			Dry	50	13,000-15,000
<i>Eleutheronema tetradactylum</i>	Not Assessed, 200 cm TL		Dry	25	20,000-23,000
<i>Leptomelanosoma indicum</i>	Not Assessed, 142 cm TL				
Catfish, Ariidae			Dry	50	800-1,000

*Highly variable with local and international trends. Information collected from stakeholders.

Mumbai, Veraval and Chennai are the major collection and export centres of fish maws in India, with aggregators/agents from distant landing centres across the country sending the air bladders to exporters based in these hubs. There are multiple channels involved with several collection agents, in addition to individual suppliers and networks, in place for the exporters. The fresh fish is normally auctioned through competitive bidding, where the highest bidder collects the fish and the air bladder is extracted by an experienced person without damaging the fish or the bladder, after which the fish is mostly resold (@150-250 for eel/*O. biauritus* to 400-600 ₹/

kg for large threadfins and *P. diacanthus*). The fresh air bladder is cleared of vessels, tissues and blood, washed and sun-dried or dried in closed areas. Processed fish maws are sorted by size, weight and quality and packed according to value, importer demand and destinations.

Although India is one of the major suppliers of fish maws globally, the domestic and international trade, supply chains and demand drivers are not well documented. In addition to their swim bladders, there is also a high export demand for frozen/chilled croakers and eels to China, Vietnam, Korea, Japan, Middle East and EU countries. The meat of



Fig. 2. Fishmaws of (a) Catfish (b) Eel (c) Conger Eels (d) Male *P. diacanthus* (e) Female *P. diacanthus* (f) Seabass

polynemids and seabass meat are of high demand in local markets for domestic consumption. The price of fish, fish maws and the first sale price has increased considerably in the last decade. India is one of the top five countries that contributes to 50% of the global swim bladder trade in volume and 70% in value (Sadovy de Mitcheson *et al.*, 2019). Similar to other high-priced luxury dried seafood items like sea cucumbers and shark fins (trade of which is presently illegal in India), the major export destinations for fish air bladders from India are countries like Hong Kong, China, Singapore and Thailand while very small quantities are also exported to UAE, US, UK and Canada. India's fish maw trade to Hong Kong as declared in the Hong Kong Harmonised System (HKHS) Code (0305210, for dried fish maws) ranged from 278 t in 2015 to 154 t in 2021, showing a decreasing trend in overall export contribution since 2015 (<https://tradeiddds.censtatd.gov.hk>).

The Government of India has specialized rules for ensuring the quality of exported dried air bladders and categories for different types of fish maws and size grades (count) per kilogram traded viz; Export of Dried Fish Maws (Quality Control and Inspection) Rules, 2002. Exporters are supposed to use the ITC HS code 03057200 from 01.01.2012 for "Fish heads, tails and maws". Prior to this, exporters dealing with swim bladders exported mixed-species products and often provided broad HS codes, with or without mentioning the product details. This is likely to have resulted in misreporting or under-reporting the quantity of export. The export and

trade data accuracy has improved considerably in recent years and recognising the complexity in classification and coding of marine products in trade, we recommend further standardization using taxon-specific and distinct codes for marine products for certain species/groups in export to avoid data deficiency and scientific uncertainty in management guidance. Several destination countries are also demanding taxon-based information for import in the recent years and imports are also being checked by rapid DNA-based technologies for taxon identification. The trade and export data can be assessed as a proxy in relation to the capture production trends. Underreported/misreported catch or landings trend data often doesn't reflect the actual status of exploited groups and trade dynamics. The fish maw demand and trade is expected to grow, as many export destination countries are moving away from other luxury seafood products like shark fins, the trade of which has been widely regulated or prohibited, globally. Swim bladder trade from India is entirely driven by high economic value due to export demand, while in the domestic market swim bladders have limited market and user demand. The export demand and incomparable price with other seafood products make these fish groups a highly targeted and trade-preferred group, which in turn necessitates monitoring fishery and trade dynamics of the various species exploited for air-bladder trade. The catch of many large-sized croakers often draws public and media attention and with the access to international traders, and price structure through social media, fishers and traders

of many regions are well aware of the high value of swim bladders which provides the fishers an upper hand in bargaining for best prices from traders. With support of social media and internet, trade networking expands from local to an international level even in minor ports and often attracts highly competitive bidding. Visibly, the economic benefits of the swim bladder trade have started directly reaching the community. Fishers and fish/fish product exporters of Maharashtra are aware and concerned of the declining catch, often mentioning the rarity and falling catches of many large-sized croakers, especially *P. diacanthus* and *D. albida* which were once common in the coastal waters. Two large-sized species of croakers found in Indian waters *P. diacanthus* and *O. biauritus* are identified as “prioritised species” for mariculture by ICAR-CMFRI (Kizhakudan and Kizhakudan, 2017), whose declining catch trends have been a concern and management options are highly challenging due to complexity of multispecies and multigear fisheries.

Conservation aquaculture and Minimum Size Limits for catches from the wild have been used for reviving declining fish stocks as part of management and conservation measures in certain countries. In Mexico, the Totoaba aquaculture with *Totoaba macdonaldi*, a large sized croaker of 200 cm TL size is expanding whereas earlier

it was a depleted fishery. In Maharashtra, a Minimum Legal Size (MLS) of 70 cm total length (TL) has been recommended for commercial trade of *P. diacanthus*, which can also be implemented for better resource management (Chellappan *et al.*, 2018). Potential impacts of global demand on marine fisheries of the developing countries are still undocumented, both in the cases of legal trade and illegal trade. So, in the larger interest of conservation and sustainable utilisation, regular stock and population assessments based on species-specific information viz; exports, catch, fishery, exploratory surveys, are urgently needed. Identification of specific aggregation sites in fishing grounds and involvement of fishers and other stakeholders in developing trade regulations to maximize economic returns and ensure sustainability is desirable.

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