Brief Communication

Pufferfish fishery and trade in Tamil Nadu: Value addition paves way for enhanced domestic consumption

L. Remya[1*], A. R. Anuja[1], Shoba Joe Kizhakudan[1], S. Mahalingam[2], M. Midhun[2], R. Rajkumar[2], A. Rameshkumar[2], S. Joseph Jagan[2], S. Suresh[2] and M. Manojkumar[2]

[1]ICAR-Central Marine Fisheries Research Institute, Kochi-682 018, Kerala

[2]Mandapam Regional Centre of ICAR-Central Marine Fisheries Research Institute, Mandapam Camp- 623 520, Tamil Nadu

*E-mail: lremya9@gmail.com

One of the most practical solutions which addressed poorly in fishery management measures is the search of abundant, underutilized, nutritious, highly fecund, less vulnerable and low value fishes. Though highly poisonous, the skinned, gutted and beheaded (dressed/processed) Pufferfishes of coastal waters are being increasingly used for consumption by domestic consumers in India as evident from the increase in their landings at different landing centres, whereas it was previously discarded at sea itself. Tetrodotoxin (TTX) is a heat-stable potent neurotoxin that blocks sodium conductance in skeletal muscle, and poisoned victim is unable to breathe, and eventually dies from asphyxiation. TTX, in family Tetraodontidae (Pufferfish) is typically concentrated in the liver, ovaries, intestines, and skin. In most species, tetrodotoxin concentrations in the muscle are low, which is why, when properly processed, this fish is commercially exploited and safely consumed in countries such as Japan, China, Korea and USA. Unlike most of conventional fishes, puffers do not have intramuscular bone, makes them convenient to consume. In addition, this product is devoid of typical fishy odour, look like broiler piece with an apparent colour, thus popularly called as 'white chicken' among fishers and consumers. Monthly samplings and personal enquires on edible Pufferfish fishery and trade were conducted at various landing centres and villages along Tamil Nadu during 2018-23.

Monthly samplings to various Fish Landing Centres (FLC) and personal enquires using pre-tested questionnaire at dry fish units were conducted at various landing centre along Gulf of Mannar (GoM), Palk Bay (PB) and Coromandel Coast (CC) during 2018-23. Data on Pufferfish production in the area was extracted from the National Marine Fisheries Data Centre (NMFDC) ICAR-CMFRI, Kochi. Pufferfish species were identified following Sujatha and Padmavathy (2015) based on samples collected from commercial catches.

Fisher's Share in Consumer Rupee: The fisher's share in the consumer rupee calculated as the percentage of the consumer price that the fisher receives and gives an idea about the portion of the final price benefits the primary producer (fisher) was used as given below.

$$\text{Fisher's Share in Consumer Rupee} = \left(\frac{\text{Price received by fishers}}{\text{Price paid by consumer}}\right) \times 100$$

Marketing Efficiency: Marketing efficiency measures how efficiently the value chain adds costs and margins without significantly reducing the producer's share. A higher marketing efficiency indicates more equitable distribution of the consumer price. The Acharya's method for calculating marketing efficiency was used as given below.

$$\text{Marketing Efficiency} = \left(\frac{\text{Price received by fishers}}{\text{Total Marketing Costs+Margins}}\right)$$

The annual production of Pufferfish (Tetraodontidae) in Tamil Nadu during 2018 to 2023 indicate estimated catch of Pufferfish in 2019 was 1158t and highest catch followed by a steep low in 2020 (27t), probably due to COVID19 restrictions in fishing. The showed an increasing trend after the fall and reached to 1008t in 2023. Mechanised sector brought 94% of catch with multiday and single day contributing 71% of the total. Among motorised crafts,

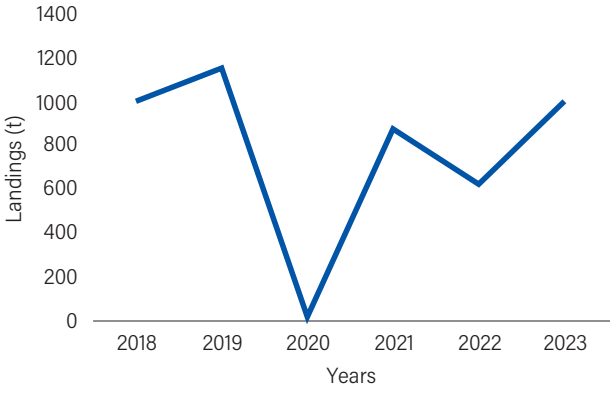


Fig. 1. Estimated landings of Pufferfish in Tamil Nadu during 2018–2023

outboard hook and line and outboard gillnet caught 44% and 33% of Pufferfish respectively.

Genus *Arothron* formed on an average of 71% of the total Pufferfish landing along Tamil Nadu (Fig. 3). The major catch came from the GoM and PB as this group is associated with inshore and reef areas. *A. immaculatus* contributing 31%, dominated among the Pufferfish species landings. *Lagocephalus* spp. especially *Lagocephalus lunaris* contributed to the bulk of Pufferfish catches in CC

The marketing channel of dry Pufferfish followed the Fisher-Collection agent- Wholesaler- Retailer- Consumer route. The total price spread which represents the difference between the price paid by the consumer and the price received by the fishers, captures the cumulative cost and margin added at each stage of the value chain. During 2018 to 2023, the price spread of the dry fish value chain has steadily increased, indicating a growth of approximately 56%. The widening spread suggests that the marketing costs and margins by intermediaries such as collection agents, wholesalers, and retailers has increased. Despite the rising consumer prices, the fisher's share in consumer rupee remains relatively low, as much of the added value benefits intermediaries indicating inefficiencies in the value chain. The fisher's share in the consumer rupee has gradually increased over the years, from 5.88% in 2018 to around 10.71% in 2023(Fig. 4). This implies that fisher's share of the consumer price is not significantly improving, indicating limited direct benefit from the higher consumer costs. The marketing efficiency improved from 6.25% in 2018 to around 12% in 2023 but the marketing efficiency of the dried Pufferfish value chain is still relatively low.

The Pufferfish is landed in the trawl and gillnet landings in Tamil Nadu, and also as trashed catch. Small dry fish units are involved in processing /dressing of Pufferfish in Tamil Nadu. People with special skill to remove head, viscera and skin of Pufferfish in a single cut were engaged for dressing

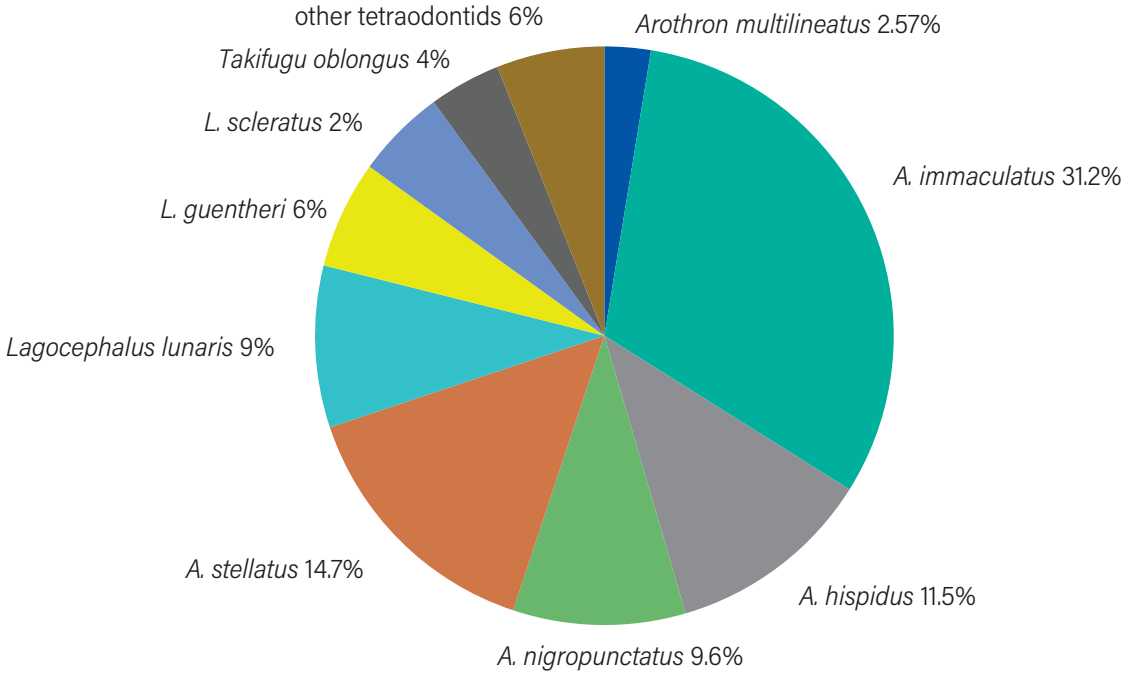


Fig. 3. Average annual species composition of Pufferfish in Tamil during 2018-23

Collection of Pufferfishes from the landing centre

Dressing of Pufferfish in dry fish unit

Dressed Pufferfish pieces

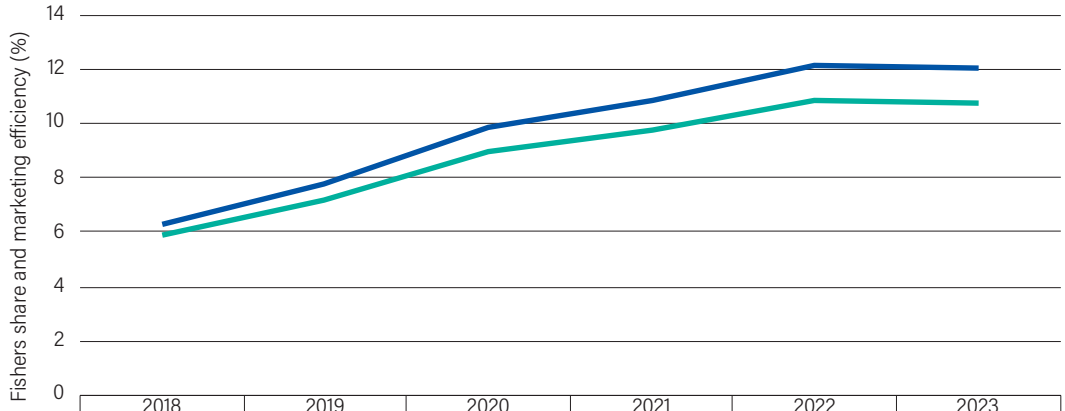
A single dressed Pufferfish

Salt curing process of Pufferfish

Cured Pufferfish

Head, skin and viscera discarded during the dressing process

Uncured slices of Pufferfish



	2018	2019	2020	2021	2022	2023
Fisher's Share (%)	5.88	7.22	9	9.77	10.8	10.71
Marketing Efficiency (%)	6.25	7.78	9.89	10.82	12.11	12

Fig. 4. Trend in fishers share in consumer rupee and marketing efficiency (%)

and curing. The wages for dressing the Pufferfishes was at the rate of ₹3 per kg fresh fish. Dressed Pufferfish from GoM and PB, especially *Arothron* species, both in salted and unsalted form, fetch good market prices (₹200 -250) and genus *Lagocephalus* ₹200 to 250 in CC of Tamil Nadu. The net weight of cured fish comes 27-35% of raw fish. While cured fish has traditionally been the preference, dressed (uncured) Pufferfish is gaining popularity, particularly in inland regions viz., Rajapalayam, Namakkal, Madurai, Coimbatore, Trichy etc. with increased consumption upto 60% higher from that of early 2000. Consumers in coastal areas are also starting to accept it more readily. This shift could be driven by changing consumer tastes, availability, or even interest in diverse seafood options. The demand dynamics for Pufferfish might continue to grow as people become more familiar with it and its culinary uses. The fatality case associated with Pufferfish in Tamil Nadu appears negligible. Almost 70-80% of the Pufferfish landings in southern Andhra Pradesh, Gujarat, Kerala and Mangalore finds are marketed to Tamil Nadu, due to the acceptance of Pufferfish by the fish consumers in Tamil Nadu. However, awareness on potential toxicity by consuming incorrectly processed Pufferfish is desirable to avoid any fatalities in future.

References

Sujatha K. and Padmavathi P., 2015. *J. Mar. Biol. Assoc. India*, 57(2): 95-104.