

Recent advances in the utilization of bycatch as quality protein

Suseela Mathew

ICAR-Central Institute of Fisheries Technology, Kochi

suseela1962@gmail.com

Introduction

Fishing has been shown to affect marine ecosystems through modifications in community structure and diversity, changes in trophic interactions, degradation of benthic habitat, and increasing mortality of unwanted bycatch species in addition to the direct impact on the abundance and productivity of targeted fish stocks. By catch or non-targeted fishes are also caught along with targeted species which have no demand on the market or should not be caught because their capture is against the goals responsible fisheries for management of the fish stocks. In addition to the direct impact on the abundance and productivity of targeted fish stocks, most of these fishes are discarded at on board itself. According to report of FAO, a total of 11,207,761 Mt of bycatch is estimated globally, and of these 84.86% is discarded. An interesting fact is that, more than 21% of global bycatch is contributed by Indian ocean region (FAO fisheries technical paper 339). Wild shrimp fisheries are responsible for roughly 50% and 80% of regional discard totals in the West Indian Ocean and West Central Atlantic, respectively. In the West Indian Ocean, Indian and Pakistani shrimp fisheries represented the largest sources of discards, whereas in the West Central Atlantic, shrimp fisheries off the south-eastern U.S. and in the Gulf of Mexico are responsible for most of the reported bycatch. Crab fisheries also added substantial quantities of discards to the West Central Atlantic total, while various species of carangids and mugilids, considered together, made a sizable contribution to aggregate removals from the West Indian Ocean. Efforts are being made to reduce the capture of this fish through technical changes to fishing operations and through management measures.

In most coastal states of India, a large proportion of bycatch from local fishing vessels which was previously discarded is now commonly bought at very low rates. The majority of it is dried with or without salt depending on the species and quality of raw material. It is then supplied as feed to the poultry and aquaculture industries and also used as manure (Aaron, 2007). The non-target species are *Acetes indicus*, *Oratosquilla nepa*, *Lagocephalus inermis*, *Dussumieria acuta*, *Nemipterus randali*, *Leiognathus bindus*, *Tetradon sp.*, *Cynoglossus sp.*, *Stolephorus sp.* and a number of skate species (Dineshababu et al., 2013). Although these species are collectively referred to as “non-target species” or “by-catch”. In general, by-catch is considered to be a valuable part of the trawl catch and a number of bycatch species can be utilized for food security as they are nutritionally good. Although discards of bycatch may have come down significantly, the current knowledge of their nutritional quality and composition is a matter of individual opinion rather than a verifiable fact.

Bycatch and discards: Indian coast

On the west coast of India, most of the bycatch from shrimp trawlers is landed, albeit often in a poor condition (Gordon, 1991). Bostock (1986) noted that trash occupies about 62% of the total trawler catch and none of this material is discarded at sea. King (1989) also found discarding

to sea happens in very limited cases. However, the proportion of quality fish landed had increased significantly as a result of demand from the Gulf countries for fresh fish (Ames & Ward, 1995). CIFT (1997) found that with increasing export demand for fresh fish, availability of traditional varieties for drying is very much reduced. A large proportion of bycatch from the east coast is carried to the west coast as the demand for fresh fish is high. Large quantities of fishmeal, containing squilla, Acetes, and other trash fish, is brought from west coast to east coast for poultry industry.

On the other hand, Gordon (1991) estimated that around 90,000 to 130,000 tonnes of bycatch were discarded in 1988-89 on the east coast of India, based on discards by Visakhapatnam trawlers. The discards were mainly fish of less than 20 cm, and included shrimp. Rao (1998) made a fresh estimate of discards for the same period, using the shrimp-bycatch ratio, and concluded that the discards could not have been more than 32,000 tonnes from the Visakhapatnam trawlers. With the increase in finfish exports in 1990s, he suggested that the proportion of discards would have further declined. The bycatch landing of commercial shrimp trawlers in different maritime states of India during 1979 are demonstrated in fig. 1

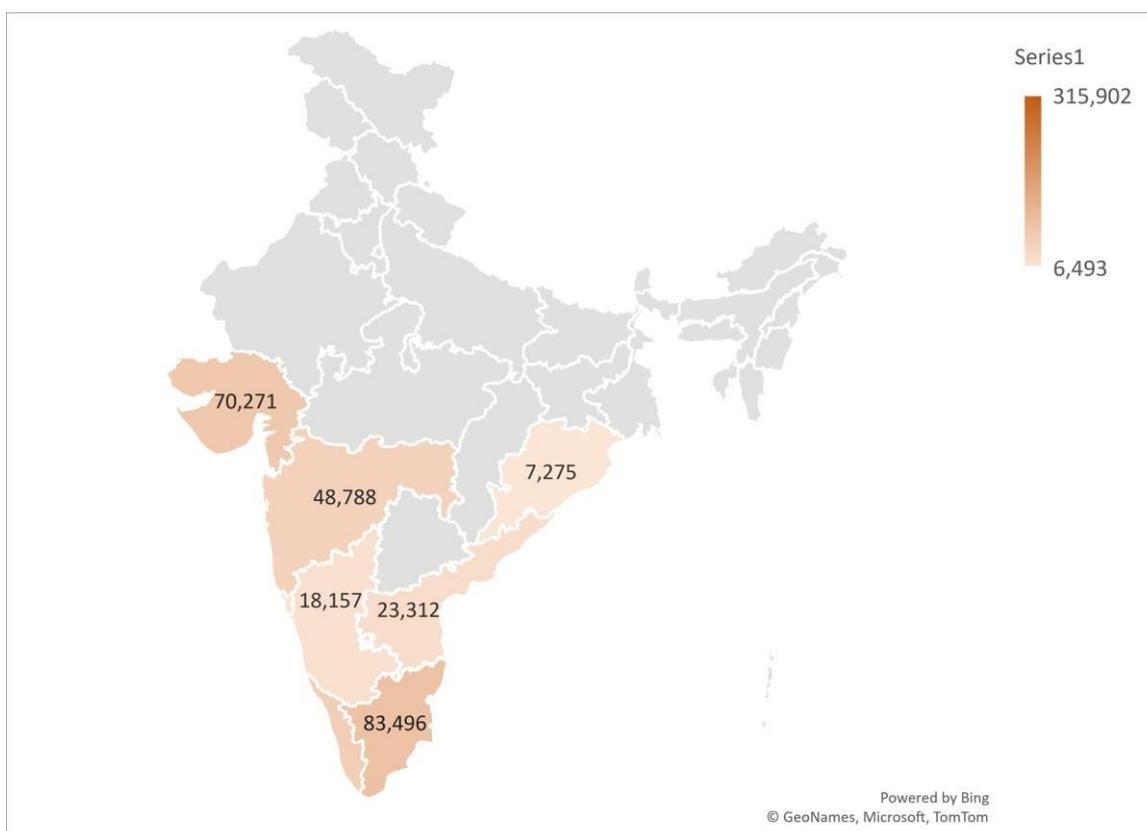


Fig 1: Landings of by-catches from commercial shrimp trawlers in different maritime states during 1979(CMFRI ,1981)

Current trends in utilization of Bycatch

In earlier times, major proportion of bycatch fishes are utilized for the production of fish meal. However, as an industry, fishmeal production is not very successful, because most of the

poultry units tend to make their own feed. During the peak period of brackish water aquaculture, there was a demand for 300,000 tonnes of fish for feed formulations. Waste from shrimp processing units, such as shrimp heads, which was discarded on the beaches or in sand pits, now command sufficiently good prices for being reduced to fishmeal. There is very little data on the demand characteristics for the fishmeal from the poultry or aquaculture sectors, and it is difficult to decide how the supply-demand situation is poised. In the short term, it could be assumed that the demand from the poultry industry has been a major factor in ensuring that more bycatch is landed (Pritchard et al., 1995).

The Integrated Fisheries Project (IFP) has utilised bycatch for commercial production of value-added products for a long time, but the response from the private sector to the initiative is muted, which makes it difficult to judge its success. The Central Institute of Fisheries Technology (CIFT) has demonstrated a number of new products utilising the trawler bycatches, again the uptake of the technologies has been low. Almost all problem species in the trawl bycatch were studied for making them useful, with little uptake by the commercial sector. A lot of work has been done to utilise squilla, which constitutes 3.12% of the total marine landings, with little success. Commercial Chitin/Chitosan production is taking place in Kerala, utilising the shrimp shell waste, technology was taken from ICAR-Central Institute of Fisheries technology, Cochin.

Bycatch fish: An excellent source of protein for rural folk

Small prawns and low-value fishes of marketable size are abundant in fishing bycatch. Non-penaeid prawns from daily trip boats, such as *Acetes* spp., *Nematopalaemon* sp., and others, can be hygienically dried and sold. Dried fish and prawns are in high demand and fetch a good price. Fresh *Acetes indicus* is used as an ingredient for variety of items including as cutlets, wafers, spirals, soup powder, and more (Zynudheen et al. 1998). Protein powder is made from *Acetes* by drying heat-coagulated pulp in the sun and under a vacuum and can be used as flavouring agent for various preparations (Garg et al. 1977). Mince extracted from tiny sciaenid, engraulid, and carangid fishes, can be used to make fish balls, crackers, and burgers (Yu and Siah 1996).

Anchovies are one of such by catch fishes and the landing of Anchovies in India shows a high potential and this low value fish has a high liking in the coastal population. Anchovies are small saltwater fish that grow up to 20 cm (8 in.) and prefer the warmer waters around the world. Anchovies belong to the family *Engraulidae* and there are 144 species in 17 genera, found in the Atlantic, Indian, and Pacific Oceans. The ICAR-Central Institute Fisheries Technology (CIFT) has developed a technology for the production of dried and powdered anchovies. It has better nutritional properties and good source of quality proteins and contains polyunsaturated fatty acids, vitamins and minerals.

Anchovy and its nutritional Importance

Zero hunger is one of the Sustainable Development Goals (SDGs) of the United Nations, and it continues to gain a lot of attention because the number of people suffering by malnutrition grew by 38 million from 2015 to 2016, to 815 million. All of the most frequent nutritional

deficiencies may be avoided by include particular foods in one's diet, and one preventative item that is common to all of them is fish. Because there has been a shift in fishing techniques and the promotion of sustainable fisheries is on the rise, combating hunger and malnutrition via sustainable fishing is a realistic option.

The raw material used for the development of dried fish and fish powder is Anchovy fish (*Stolephorous spp.*) (locally known as Nethili in Tamil Nadu) belong to lean fish category (Fig.2). Anchovies are common fish found in marine water environment which are an incredible source of omega-3 fatty to which promote the health of brain and heart. The proximate composition is a term usually used in the field of food or feed and its main components include moisture, ash, lipid, protein, and carbohydrate content which are expressed in percentage. Proximate composition analysis of anchovies revealed 16% protein, 2% fat. A variety of many other minor constituents are also present in small quantities like vitamins, free amino acids and non-protein nitrogenous compounds.



Fig 2: *Stolephorous spp*

Process of developing fish dry powder

The procured raw material for the purpose of product development was thoroughly cleaned to remove the extraneous materials present and was prepared for sorting and drying. The sorted and dried sample were then pulverised to obtain fine powder and done vacuum packing for extended storage life. The product was developed for supplying to 50 Anganwadi Centres of Mayurbhanj District, Odisha including the dried and powdered anchovy in collaboration with World fish centre, Malaysia and Govt. of Odisha. The detailed steps for the product development are illustrated in Fig. 3.

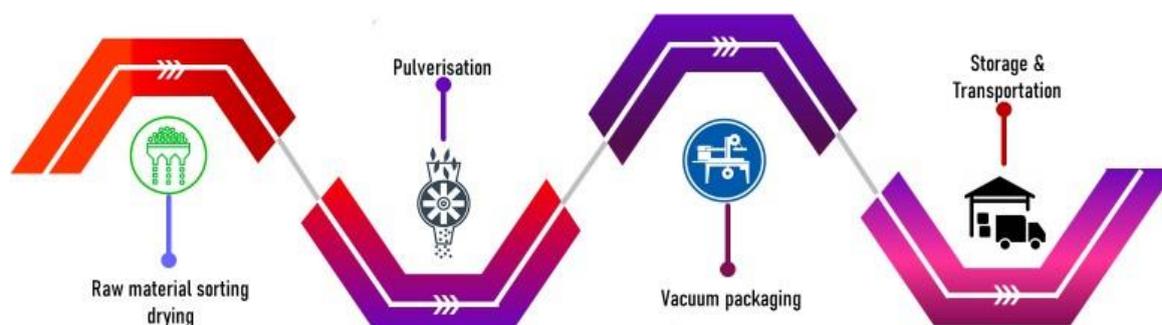


Fig 3: Process of development of fish dry powder

The products developed for the consumption purpose was distributed with the help of a private entrepreneur under the technical guidance of ZTMC-ABI and as per the guidelines of from ICDS, Govt of Odisha. A six-month study in children of 3-6years gave very encouraging results, as it improved the health status significantly. Not only anchovies, but other bycatch also can be utilized in a similar measure which will reduce the problem of malnutrition in our country.

Conclusion

Commercial fishing has an impact not only on the species targeted, but also on numerous other species captured by chance. One of the most effective methods to reduce the effects of bycatch is to use it more effectively. Fish has a high nutritional value due to its inexpensive and high-quality protein, which has a biological value of 15-23 percent. The high amount of health-promoting omega-3 PUFAs, notably eicosapentaenoic acid (20:5n-3, EPA) and docosahexaenoic acid (20:5n-3, DHA), has sparked renewed interest in fish eating (22:6n-3, DHA). Furthermore, fish is an excellent supply of vital amino acids, especially lysine, which is lacking in grains, contributing to the overall nutritional quality of a varied diet.

So rather than on board discarding of bycatch it can be effectively utilize for the nutritional security of our nation Anchovy a low value by catch fish demonstrated a high nutrient complement and hence can be an effective nutrient supplement for daily food. The higher content of essential amino acids, PUFA, MUFA and low sodium and high potassium and calcium could make a better nutrient for the consumers at a cheaper rate. The high-quality protein and essential fatty acids, vitamins and minerals found in fish and the effects of adding fish to traditional bland staple diets can stimulate appetite and increase nutrient rich food consumption of the young and the aged. Effective utilization of bycatch for addressing the problem of malnutrition in our country has to be addressed especially in fish consuming states in India.

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