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Utilization of bycatch-Indian perspective

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Abstract
Bycatch plays a significant role in the fishery sector, because the non-targeted fishes are in demand as fishmeal. The oil sardines and mackerels are used in the manufacture of fish oil and constitute a major proportion of the fishmeal industry. The fishes of low value are utilized for the preparation of value-added fish products. The incidentally caught fish in bycatch can be used in ornamental fish trade thus increasing the income of fishermen. The article suggests that the utilization of bycatch in a better way would benefit the fishmeal sector and the economy of the country. The information on bycatch and its utilisation in India directs the sustainable capture and management of exploited fishery resources in India. This socioeconomic approach of utilization of bycatch can be applied to the global fishery for sustainable fisheries.

Keywords: Fishery, exploitation, fishmeal, discards, trawlers

Introduction

Bycatch, is the incidental capture of non-target species sold or discarded for different reasons (Gupta *et al*. 2002). Bycatch also includes non-commercial fish species and commercial species that are below minimum legal size or less profitable fishes owing to market conditions. The use of advanced technologies for fishing and fleet infrastructure has led to the capture of commercially important fish and their juveniles (Mahesh *et al*., 2019) [8]. Bycatch can be characterised as High-Value Bycatch (HVB) and Low-Value Bycatch (LVB). High-Value Bycatch involves targeted fishes whereas Low-Value Bycatch includes juveniles and fin fishes brought by multiday trawlers. Low-value bycatch (LVB) is mainly transported as raw material for fish meal production (Mahesh *et al*., 2019) [8]. The unusable or unwanted part of the bycatch is known as 'discards', often dead or half-alive will thrown back into the sea or be used as fish bait (Prabhakar, 2011). The existing literature assesses the importance of bycatch and its composition without detailing the utilization of non-commercial fishes (Dineshbau *et al*., 2013 [1]; Mahesh *et al*., 2019 [8]; Dineshbabu *et al*., 2022 [2]; Hulkoti *et al*., 2024) [5]. Hence, this article sheds light on the effective utilization of bycatch fishery resources and their socioeconomic perspectives. Jana *et al*. (2024) [6] assessed the bycatch from the Digha coast of West Bengal and found that Gobies, puffer fish, angler fish, some crab species, stomatopods, molluscs, and juveniles of fishes having high commercial value were discarded. In the overall catch, retained bycatch constituted a higher proportion followed by discards and target catch. Target catch and discards constituted 54.8%, and 35.8% respectively of the overall catch (Figure 1).

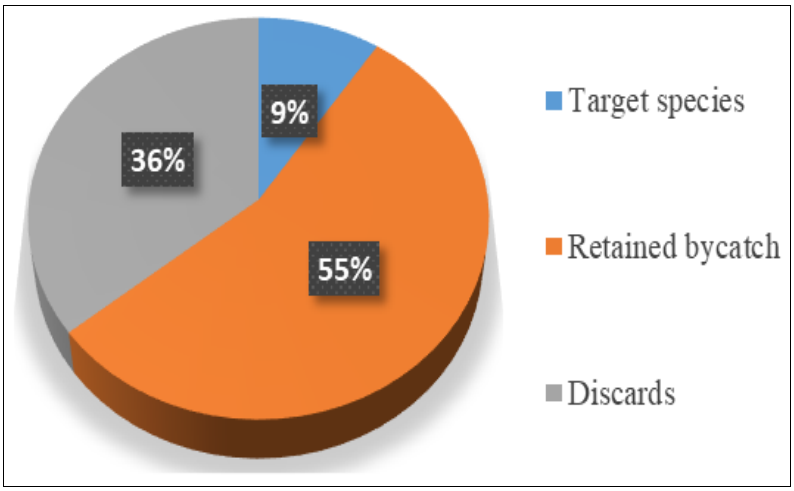

Fig 1: Wet weight of species in bycatch.

Bycatch and discards which were previously sent to pig farming and poultry are now used in the fishmeal industry. They also have their applications in aquaculture and other animal feed formulation processes (Malaweera and Wijesundara, 2014) [9]. Panda *et al*. (2020) [14] observed that significant increase in low-value fish species with a decrease in commercial fish species in by-catch. In the year 2010-11, the average bycatch contribution was 33.54%, increased by 12% in 2011-12 at Mangalore coast. In this region, more than 50% of by-catch (HVB) has been used for the fishmeal/fish oil industry. Fishes like Anchovies, clupeids, drift fish, gobies, ribbonfish, and croakers, are used for consumption by drying (10%) and salting (5%) and medium-size fish and soles were consumed freshly (12-

15%). The oil sardines and mackerels are used in the manufacture of fish oil, whereas 91% of oil sardines are used by the fish meal industry (Doddamani *et al*., 2014).

By-catch is unavoidable in any kind of fishing but the quantity of catch differs corresponding to the gear and vessel operated. The market-driven demand expedites the status of bycatch as the target catch. South East Asia in general and India in particular have achieved great success in the utilization of bycatch (Sultana *et al*. 2014) [14]. A significant increase of low-value fish species with a decrease in commercial fish species in by-catch has been observed from the West Coast of India (Hulkoti *et al*., 2024) [5]. Doddamani *et al*., (2014) showed the use of bycatch for fresh fish consumption (15.71%), surimi production (10.16%), dry fish consumption (8.59%), and 9.7% of the bycatch will be exported. The productivity of fishes in bycatch was found to be much higher in post-monsoon and pre-monsoon whereas species diversity and discards are more during winter from the West coast of India (Doddamani *et al*., 2014; Singh *et al*., 2023 [13]; Hulkoti *et al*., 2024) [5].

The low-value bycatch of India is retained and sold to meet the demand for seafood and other products. The bycatch has been used in the manufacture of traditional to value-added products. These products are prepared by using simple home-based methods or using high technology for large-scale production at cottage industries. These products can be: (i) cured, (ii) dehydrated protein-rich foods, (iii) hydrolyzed, (iv) fermented, (v) canned, (vi) minced, and (vii) miscellaneous products.

Moreover, the finfish and shellfish processing industries produce more than 60 % of fish waste (head, skin, trimmings, fins, scale, and bones) whereas 40% of fish products are edible (Malaweera and Wijesundara, 2014) [9]. These fish waste such as fish backbone have high protein and minerals; fish skin is a rich source of collagen and gelatin. The trimmings collected during fish processing are known for good nutritive value that promotes its utilization as animal feed. Fishbone has calcium phosphate whereas fish scale has collagen and hydroxyapatite. The treated sea fish waste has applications, as animal feed, dietetic products, food packaging applications (chitosan), and natural pigments, cosmetics (collagen), enzyme isolation, immobilization, biodiesel/biogas, soil fertilizer and moisture maintenance in feeds. The animal feed thus produced is significant for animal husbandry because it represents 40–50 % of the total variable production costs (Malaweera and Wijesundara, 2014) [9].

Marine fish waste is used as alternative feed for swine because it meets the protein requirements and is a source of protein. Crustacean shells and shrimp waste of the bycatch are good feed ingredients in animal feed production (Malaweera and Wijesundara 2014) [9]. The ornamental fish industry involves catch of coral reef-associated fishes and other fishes in India. These ornamental fishes are potentially landed as bycatch. Ranjeet *et al*. (2015) [12] analysing the fish diversity of bycatch from Kerala harbour found that fishes such as *Epinephelus diacanthus, Sufflamen capistratus, Scatophagus argus* and *Therapon jarbua* were in high quantity. These bycatch fishes help in the sustenance of marine ornamental fish trade and also are solutions for fisheries management. Better utilization of the incidental catch can reduce discards and moving them to ornamental fish trade yields additional income to the fishermen.

The trash fish or reduction fisheries, which otherwise would be discarded support the livelihood of fishermen by supplementing their income. The discards are largely composed of juveniles, and uncontrolled harvesting will be detrimental to the fish population. Utilisation of bycatch in a better way would benefit the fishmeal sector and the country's economy. The information on bycatch and its utilisation in India directs the sustainable capture and management of exploited fishery resources in India (Kodeeswaran *et al*., 2020) [7].

Conclusion

Bycatch has good market value, used in the fishmeal industry, as feed for swine, poultry and aquaculture. Fish oil is produced from sardines and mackerels, whereas other fishes are salted and dried for consumption. The article indicates that the low-value bycatch was in higher proportion to the overall catch. The low-value bycatch is utilized for the manufacture of value-added products and has its application in cottage industries. Fish waste is used as animal feed, dietetic products, food packaging, and natural pigments. The bycatch if utilized in a better way in the fishmeal industries increases the economy of the country. The knowledge of bycatch and their utilization helps in sustainable fisheries and the management of harvested fishery resources. This socioeconomic approach can be applied to the global fishery for sustainable fisheries.

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Competing Interests Author does not have any competing interests.

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