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Ichthyo-diversity in the bycatch of landing centers in Mumbai, Maharashtra

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Abstract

Present study evaluates the composition of ichthyofauna diversity in bycatch from the landing centers of Mumbai, including New Ferry Warf and Sassoon Dock. The bycatch composed of total 52 fish species belonging to 19 orders and 39 families. The perciformes dominanted the catch followed by clupeiformes and carangiformes. Among the 39 families, fishes of carangidae and engraulidae were dominant contributing 9.62 %. The Red listed Vulnerable species, the Grey bamboo shark (*Chiloscyllium griseum*) was also observed in the bycatch. Present study indicated that indiscriminating harvesting methods for maximizing financial profits may eventually lead to ecological imbalance in the coastal zones and threaten marine capture fisheries sustenance.

Key words : bycatch, Ichthyo-diversity, Ferry wharf, Sassoon Dock**.**

India with its nearly 7,500 kmcoastline has great potential for marine fishery. The Food and Agriculture Organization[19] (FAO), reported that around 140 million tonnes of fish were supplied globally in 2010, with roughly 85 % being consumed as food, and the remainder is discarded as trash, containing numerous useful substances such as oils, collagen, vitamins, etc. The discarded fish are termed as Bycatch[1].

Bycatch, or the unintentional capture of non-target species during fishing operations, has become a serious problem in global fisheries management and conservation over the last two decades[12]. It is a wastage of commercial resources, and is economically inefficient for fishing operations. Bycatch has become more prevalent with advancements in fishing techniques to maximize catch. To reduce the waste, catch selectivity should be increased, while edible species with good stock

health which are assumed bycatch due to its lack of commercial value should be protected[9]. Trawl nets catch even the smallest of the creatures due to the usage of extremely small cod-end mesh sizes as low as 8–10 mm. The bycatch in majority of marine landings in all the maritime states consisted of juvenile fish. Therefore, the catch of the Indian bottom trawl fleet is deemed bycatch and such a fishery cannot be considered managed[4]. The majority of bycatches are tossed into the sea because they do not meet the required marketable size requirements of edible fish species or as there is no commercial value for the fish species. In the ocean, it's difficult to take aim at and catch the desired species without collateral damage. Additionally, dumping or stranding of discarded fish on the coastlines pollute the environment and pose health risks to local communities that rely on the sea for their livelihood[15].

In 1979, the first survey of bycatch in Indian marine fisheries found that non-shrimp catch accounted for 79 % of total landings in the shrimp trawl fishery[17]. Another study conducted in 1999 [14] estimated that bycatch rates ranged from 56 % to 82 %. During the 2000–2004 period, the 4:1 non-shrimp to shrimp catch ratio was assumed to be maintained. Total shrimp catch in 2000 was estimated to be 450,000 tonnes, implying that the shrimp trawl fleet produces an additional 1,800,000 tonnes of bycatch[3]. However, in India, the by-catch is brought back to landing centres in countries like India because of its economic benefits. For example, in Gujarat, India's largest producer of marine fish, by-catch is primarily used to produce fish meal and fish manure[20]. Smaller varieties or bigger species found in abundance in the bycatch (soles, lactarius, lizard fishes, anchovies, carangids, sardines, mackerels, *etc.*) are frequently sun-dried and consumed locally[8].

Maharashtra, with a 720-kilometer coastline, is one of India's important marine states. The fishing vessels operate in five marine districts including Thane, Greater Mumbai, Raigad, Ratnangiri, and Sindhudurg. In 1994, Maharashtra, along with Gujarat, provided over 8.5 lakh tonnes of marine fish, accounting for 36% of India's total marine fish production[18]. It is therefore important to understand the bycatch faunal diversity and composition from landing centers of the Mumbai. Samanta *et al.*,[16] reported that mean monthly bycatch generated by shrimp trawling in Mumbai coast ranged from 11.82 to 20.65 kg per hour from October, 2015 to May, 2016. The present study was therefore undertaken to understand the ichthyofaunal diversity in the bycatch from two landing centres, namely Ferry-Warf and Sassoon dock, in Mumbai.

Study area :

1) Ferry Wharf :

The New Ferry Wharf was constructed in1980 to accommodate the additional trawlers from Mumbai and Gujarat to provide facilities for fish landings. The harbour commissioned in April 1980. Trawlers, mostly from the Gujarat state visit New Ferry Wharf seasonally and about 1,000 to 1,100 trawlers are operated from this centre during fishing season from August to May. These vessels are 8-10 m in length and 2.5-3 m in width. They also conduct 4-5 days fishing at a time[18].

2) Sassoon Dock :

The Mumbai Port Trust manages the Sassoon dock, Maharashtra's oldest fishing harbour. Fishing activities began in September 1996 at the Sassoon Dock's New Jetty, which can accommodate many larger boats and purse seiners at once. The trawlers that operate here are a little wider than those that operate in other areas. During the fishing season, trawlers travel for 4-5 days and land 3 to 4 tonnes of fish, including 800 kilogrammes of shrimp[18].

Collection and analysis of bycatch :

Bycatch samples were procured from local dealers at new Ferry Wharf and Sassoon Dock in April 2022 for 15 days. Samples were transported to the lab in an ice box and identified up to genus or species level using standard keys and literature[7]. Fishes were segregated according to their individual species, and photographed.

In present study, the bycatch composed of total 52 fish species belonging to 19 orders and 39 families (Table-1). We observed that perciformes were the dominant with 13 families represented by 14 fish species followed by clupeiformes with 3 families represented by 9 fish species, and carangiformes with 2 families represented by 6 fish species. Among the 39 families, fishes of families carangidae and engraulidae dominated the bycatch each contributing 9.62 %, followed by leiognathidae, clupeidae, pristigasteridae, terapontidae, and cynoglossidae contributing 3.85 % each, and the remaining families contributed 1.92% each.Though perciforme fishes dominated the bycatch representing 14 species, the Half-smooth Golden Pufferfish (*Lagocephalus spadiceus*) quantitatively dominated the bycatch. We also observed an IUCN listed vulnerable fish species, the Grey bamboo shark (*Chiloscyllium griseum*) in the bycatch.

Table-1. Checklist of fishes in the by-catch collected from Ferry-Warf and Sassoon dock landing centers in Mumbai.

Order	**Family**	**Scientific name**	**IUCN Status**
Teleost			
Acanthuriformes	Leiognathidae	*Leiognathus lineolatus*	DD
		Leiognathus brevirostris	DD
	Scatophagidae	*Scatophagus argus*	LC
Anguilliformes	Muraenidae	*Gymnothorax* sp.	DD
	Muraenesocidae	*Congresox talabonoides*	DD
Aulopiformes	Synodontidae	*Synodus indicus*	LC
Blenniiformes	Blenniidae	*Xiphasia matsubarai*	LC
Carangiformes	Carangidae	*Alectis indica*	LC
		Atropus atropos	DD
		Caranx para	DD
		Decapterus sp.	DD
		Megalaspis cordyla	LC
	Menidae	*Mene Maculata*	DD

Clupeiformes	Clupeidae	*Escualosa thoracata*	LC
		Sardinnella gibbosa	DD
	Engraulidae	*Coilia dussumieri*	DD
		Thryssa setirostris	DD
		Thryssa dussumieri	DD
		Thryssa mystax	DD
		Thryssa hamiltonii	DD
	Pristigasteridae	*Opisthopterus tardoore*	DD
		Pellona ditchela	DD
Dactylopteriformes	Dactylopteridae	*Dactyloptena orientalis*	DD
Gadiformes	Bregmacerotidae	*Bregmaceros mcclellandi*	DD
Gobiiformes	Oxudercidae	*Trypauchen vagina*	LC
Istiophoriformes	Sphyraenidae	*Sphyraena obtusata*	DD
Kurtiformes	Apogonidae	*Apogon* sps.	LC
Perciformes	Cepolidae	*Acanthocepola indica*	DD
	Gobiidae	*Gobius Polynema*	LC
	Ambassidae	*Ambasis* sp.	DD
	Serranidae	*Epinephelus diacanthus*	DD
	Gerreidae	*Gerres filamentosus*	LC
	Haemulidae	*Pomadasys maculatus*	LC
	Lactariidae	*Lactarius lactarius*	DD
	Terapontidae	*Terapon theraps*	LC
		Terapon jarbua	LC
	Polynemidae	*Filimanus heptadactyla*	DD
	Priacanthidae	*Priacanthus Hamrur*	DD
	Trichiuridae	*Lepturacanthus savala*	DD
	Sciaenidae	*Sciaena* sp.	DD
	Uranoscopidae	*Uranoscopus guttatus*	DD
Pleuronectiformes	Cynoglossidae	*Cynoglossus bilineatus*	DD
		Cynoglossus elongatus	DD
Scombriformes	Stromateidae	*Pampus argenteus*	DD
Scorpaeniformes	Platycephalidae	*Platycephalus* sp.	DD
	Scorpaenidae	*Scorpaena* sp.	DD
Syngnathiformes	Fistulariidae	*Fistularia petimba*	LC
Tetraodontiformes	Diodontidae	*Diodon holocanthus*	DD
	Monacanthidae	*Aluterus monoceros*	LC
	Tetraodontidae	*Lagocephalus spadiceus*	LC
Elasmobranchs			
Torpediniformes	Torpedinidae	*Torpedo sinuspersici*	DD
Orecpolobiformes	Hemiscylliidae	*Chiloscyllium griseum*	VU

DD (Data deficient), LC (Least concern), Vu (Vulnerable).

Trawl is the major fishing gear used along the Northwest coast of India. In Maharashtra trawling was introduced in 1961, and contributed 57.2% of total landings of the state in 2015-16 [13]. The trawlers catch large quantity of bycatch (60-65%) comprising of juvenile, undersized and inedible fishes which is discarded at sea and mostly goes unreported[5]. Low-value relatively small fishes and juveniles of commercially important fishes are caught in bycatch, as well as a large amount of non-edible benthic biota that is discarded in the sea. As a result, the trawl is the most damaging of the fishing gears, causing habitat degradation and bottom ecology damage. It is critical to regulate trawling in the state in order to ensure its long-term viability[11].

Present study examined the diversity of by-catch from Ferry Wharf and Sassoon Dock situated on the West coast of India. Where fishing boat/vessels come from Maharashtra southern Maharashtra coast and White painted vessels come at the landing area do fishing in the northern coast of Maharashtra and from Gujarat States. Samanta *et al*.[16] studied the bycatch and discards generated by single day Shrimp Trawls in Mumbai coast and observed that the maximum catch was contributed by Sciaenids (35%), followed by Sharks and Rays (10%), Anchovies (10%), Prawns (8%), Bombay duck (6%) and other demersal species. Jenishma *et al*.,[10] reported that the major, the major species/groups in discards of trawl operations along the Mumbai coast were jellyfish, *Trypauchen vagina*, stomatopods, crab, sciaenids, and shrimps. Dineshbabu *et al*.,[6] reported that in Mumbai, the low-value bycatch from the New Ferry Warf trawl landing centr included *Otolithes niger*, *Scomberoides* spp. *Platycephalus* spp., *Decapterus* spp., *Ilisha* sp., *Alepes* spp., *Cynoglossus* spp. and juveniles of Bombay duck, *Coilia* spp. and ribbonfishes. Kaur[11] reported that abundance of ribbon fish, *Coliadus dusumeiri*, and juveniles of Sciaenids in the bycatch form Mumbai.

In our study, most of the bycatch composed of juveniles of edible / commercially important fish species which have low market value or quantity. We also observed that bycatch is used for manufacturing fertilizers and for making fish food. However, the extent to which the bycatch is discarded, it may cause imbalance to the marine ecosystem and hamper sustainable marine capture fishery for the future generations.

From this study it could be concluded that extensive use of indiscriminating harvesting methods,such as trawling and purse seining, for maximizing financial profits may eventually lead to ecological imbalance in the coastal zones and threaten marine capture fisheries sustenance. Our study is in support of those reported earlier[6,10,16], suggesting that the a nationwide fisheries management policy is required for mitigating trawl bycatch utilising multidisciplinaryapproach. Management measures involving fishers and incentivizing can beadopted for bycatch mitigation so as to conserve and maintain the sustainability of our marine resources.

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