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Bycatches and discards at major fish landing centres of Mumbai Coastal region, Maharashtra, India.

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Abstract

Trawlers are the major crafts in the mechanized sector in Maharashtra which exploit 50-70% of non-targeted bycatch. The by catch comprises of low value smaller fishes and juveniles of commercially important fishes in addition to large quantity of non-edible benthic biota which is discarded in the sea. This leads to degradation of marine ecosystem, loss of marine biodiversity, depletion of fishery stocks in the succeeding years and a long term economic loss to the fisheries. Assessment of bycatch and discards is thus essential to plan its effective utilization; conserve the marine ecosystem and biodiversity and frame sustainable fishery management policies. The present study aims to study the biodiversity of bycatch and discards at major fish landing centres of Mumbai coast, Maharashtra. The study will further help inframing suitable policies for sustainable fishery.

Keywords: bycatch, discards, biodiversity, sustainable fishery

Introduction

The commercial fishing is partially non-selective and the catch comprises of organisms that were not originally targeted. By catch is a catch that is either unused or unmanaged (Prabhakar, R. P. 2011). The unusable or unwanted by-catch is known as 'discards', which is afterwards thrown back to the sea, mostly dead or dying. According to FAO, unused catch is that which is not used for consumption, sold for any purpose, or reused by the fisher as bait. The unmanaged catch refers to individual species or groups of different species that does not have specific management and hence not sustainable. In global marine fisheries, by catch represents 40.4% of marine catches, exposing systemic gaps in fishery policies and management (Davies, R. W. D, et.al, 2009).

Today, by catch is a major conservation issues in the world degrading marine ecosystems. It disturbs the marine fauna including benthic invertebrates, juvenile fishes, sharks, sea turtles, seabirds and marine mammals (Lobo, A.S. 2012).Shrimp trawls, pelagic trawls, purse seines and the high sea drift nets are the major fishing gears which generate maximum by catch due to lack of selectivity resulting in capture of a huge quantity and diversity of non-target species By catch remove top predator and prey species at unsustainable levels thus altering biodiversity and functionality of marine ecosystem.

Even though bycatch is degrading marine ecosystems, a reliable understanding of bycatch is lacking due to several unresolved issues with respect to its definition, measurement and quantification. Bycatch and discards also have both direct and indirect impacts on marine biodiversity by killing huge amount of non-target species and young ones of commercially

valuable species (Kumar, A. B. & Deepthi, G. R., 2006).There exist immense potential for the development of value added products both for human consumption and non edible uses through the effective utilization of bycatch and discards (Aswathi, N. R., et al., 2011).By catch and discards from Indian maritime states and their implication on commercial fisheries have been studied (Gordan, A.,1991; Srinath, M., 2003;Kurup, M.P., et al.,2004; Dineshbabu, A. P. et al.,2010, 2012). The present study aims to study the biodiversity of by catch and discards at major fish landing centres of Mumbai coast, Maharashtra.

Materials and Methods

Area of sample collection: Samples of bycatch and discards were collected from three landing centres of Mumbai viz. Versova, New Ferry Wharf and Sassoon Docks.

Versova:

The Fish landings at Versova are done at natural site along the creek. This landing centre assumes additional importance because it falls within the city limits of the Greater Mumbai and is the biggest among the 23 fishing villages of the District. Most of the Versova fishermen keep their fishing confined to inshore waters up to 35metres depth and around 30 km away from the shore. About 335 boats overall length ranging from 5 to 15.5 m size operate from here. Of these, 175 are dol netters, 140 trawlers and 20 gill netters. This centre was exclusively a dol net centre till late seventies but the trend changed and dol net units were converted to small trawlers for daily fishing (Singh, V. V., & Vidyasagar, K. 1998)

New Ferry Wharf:

The New Ferry Wharf harbour was commissioned in April 1980 to accommodate the additional trawlers from Gujarat and provide facilities for fish landings. The new jetty for fish landings is an extension of the old 'Bhau-cha-Dhakka' which is used as a passenger jetty of Mumbai harbour. Trawlers, mostly from the Gujarat state visit Mumbai (New Ferry Wharf) seasonally and about 1,000 to 1,100 trawlers are operated from this centre during fishing season I.e. from August- September 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 (Singh, V. V., & Vidyasagar, K. 1998).

Sassoon Docks:

Sassoon Docks is the oldest Fisheries Harbour of Maharashtra and comes under the purview of the Mumbai Port Trust. During the peak fishing season the operative gear from the Sassoon Docks are mainly trawls, purse seines, dol nets, gill nets and hooks and line. Earlier about 50 nos. of purse seiners and about 700 to 800 trawlers were being operated during the season. The purse seiners are of 15 m length while the trawlers are of 12-15 m length. The trawlers operating here are somewhat wider than those in the other regions. During fishing season the trawlers undertake 4-5 days trips and each vessel land around 3 to 4 t of fish including 800 kg of head-on shrimps (Singh, V. V., & Vidyasagar, K. 1998).

Sample identification: The samples from the above-mentioned centers were collected during pre-monsoon period of 2015. Specimens were brought to the laboratory in the ice box and morphologically identified up to species level using various identification keys and CMFRI. They were sorted and grouped according to their taxonomical classification.

Results and Discussion

An annual discard quantity of bycatch worldwide is about 9.1 million tonnes i.e. 10 percent of annual catches and that is from 4.2 million tonnes by bottom trawls, 1.0 million tonnes from purse seines, 0.9 million tonnes from midwater trawls, and 0.8 million tonnes from gillnet fisheries (Stankus, A. 2021). According to the FAO, 52% of the world's marine fishery resources is fully exploited, 17% over-exploited, and 20% moderately exploited.

In the present study, 35 species of fishes representing 24 families; crustaceans: 9 penaeid and one non-penaeid prawn and squilla species; 8 species of crabs belonging to sub-order palinura and brachyura; cephalopoda: 1species of sepia, 2 species each of loligo and octopus were recorded (Table 1, 2 and 3). Abundance of ribbon fish, *Coliadus sumeiri*, juveniles of Sciaenids, Johnius and *S. crassicornis*, *Thalamata cranata*, Squilla were recorded. According to CMFRI, an estimated 69.3 t of bycatch, with a catch rate of 3.6 kg h-1 were landed at Versova, Mumbai forming 23% of total trawl landings during 2009- 2010. 86 species of marine organisms constituted the bycatch (54 species of fishes, 11 species of crabs, 5 species of cephalopods, 2 species of stomatopods, 8 species of penaeids and 6 species of non-penaeid shrimps).

In Versova, Mumbai an estimated 2,294 t of LVB (39% of total catch) was landed. Maximum bycatch was landed during April (45%) and the lowest during September 5 during year 2010-2011. In Versova, Mumbai, an estimated LVB landings of 4,567t were recorded, which formed about 29% of the total catch. Maximum catch was landed in January (44%) and minimum in October (21%). At Mumbai, 51 species of finfishes, 20 species of crustaceans and 11 species of molluscs were observed in LVB during year 2011-2012 (Dineshbabu, A. P. et al., 2013)

In Maharashtra, trawlers (33%), bag (dol) netters (20%), mechanized purse seiners (28%) and mechanized gill netters (8%) are the main crafts in the mechanized sector (CMFRI Annual Report, 2019). It is widely known that bottom trawl which is used for catching shrimps, exploits 50-70% non-targeted bycatch. Fishing gears like trawlnet have a negative effect on the biological diversity (5 years assessment from 2007-2011, CMFRI). The most vulnerable groups in the trawlnet are the juveniles of commercially important species that are being caught as bycatch as observed in the present study also.

Table- 1: Fishes identified from bycatch and discards at major Mumbai landing centres

Order	**Family**	**Binomial name**
Carchariniformis	Carcharinidae	*Scoliodon laticaudus* Müller and Henle, 1838
Perciformis	Trichiuridae	*Lepturacanthus savala* Cuvier, 1829
	Nemipteridae	*Nemipterus randalli* Russell, 1986
		N. japonicas Bloch, 1791
		N. bipunctatus Valenciennes, 1830
	Polynemidae	*Polynemus heptadactylus* Cuvier, 1829
		P. mulani
	Sciaenidae	*Johnius belangerii* Cuvier, 1830
		J. glaucus Day, 1879
		J. macropterus Bleeker, 1853
		J. macrorhynus Lal Mohan, 1976
		J. sina Cuvier, 1830
		J. vogleri Bleeker, 1853
		Otolithus ruber Bloch & Schneider, 1801
	Leiognathidae	*Eubleekeria splendens* Cuvier, 1829
	Serranidae	*Epinephelus diacanthus* Valenciennes, 1828
	Carangidae	*Seriolina nigrofasciata* Rüppell, 1829
		Decapterus russelli Rüppell, 1830
	Apogonidae	*Apogonquadri fasciatus* Cuvier, 1828
	Mullidae	*Upeneus moluccensis* Upeneusmoluccensis
	Lactariidae	*Lactarius lactarius* Bloch & Schneider, 1801
Anguilliformis	Muraenesocidae	*Muraenesox cinereus* Forsskål, 1775
Clupeiformis	Clupeidae	*Sardinella fimbriata* Valenciennes, 1847
		S. longiceps Valenciennes, 1847
	Engraulidae	*Thryssa mystax* Bloch & Schneider, 1801
		Coilia dussumieri Valenciennes, 1848
Aulopiformis	Synodontidae	*Saurida tumbil* Bloch, 1795
Pleuronectiformis	Cynoglossidae	*Cynoglossus cynoglossus* Hamilton, 1822
	Paralichthyidae	*Pseudorhombus sp.* Bleeker, 1862
	Psettodidae	*Psettodes sp.* Bennett, 1831
Tetraodontiformis	Tetraodontidae	*Lagocephalus lunaris* Bloch & Schneider, 1801
	Monacanthidae	*Aluterus monoceros* Linnaeus, 1758
Scorpaeniformis	Platycephalidae	*Grammoplites sp.* Fowler, 1904
Siluriformis	Ariidae	*Plicofollis tenuispinis* Day, 1877
Syngnathiformis	Fistulariidae	*Fistularia petimba* Lacepède, 1803

Table- 2:Crustaceans identified from bycatch and discards at major Mumbai landing centres

Order	Family	Binomial name
Decapoda/Dendrobrachiata	Penaeidae	*Fenneropenaeus indicus* H. Milne Edwards, 1837
		Penaeus japonicus Spence Bate, 1888
		Parapenaeopsis sculptilis Heller, 1862
		Parapenaeopsis stylifera H. Milne Edwards, 1837
		Metapenaeus affinis H. Milne Edwards, 1837
		M. monoceros Fabricius, 1798
		M. stridulans Alcock, 1905
		Solenocera crassicornis H. Milne Edwards, 1837
		S. choprai Nataraj, 1945
	Sergestidae	*Acetesindicus* H. Milne Edwards, 1830
Palinura	Palinuridae	*Panulirus polyphagus* Herbst, 1793
	Portunidae	*Thranita crenata* Rüppell, 1830
Brachyura	Portunidae	*Portunus pelagicus* Linnaeus, 1758
		P. hastatoides Weber, 1795
		P. sanguinolentus Herbst, 1783
		Charybdis feriata Linnaeus, 1758
		C. luciferJC Fabricius, 1798
		C. cruciata Herbst, 1794
Stomatopoda	Squillidae	*Harpiosquilla harpax* de Haan, 1844

Table-3: Cephalopods identified from bycatch & discards at major Mumbai landing centres

Order	Family	Binomial name
Sepiida	Sepiidae	*Sepia elliptica* Hoyle, 1885
Teuthida	Loliginidae	*Loligo duvauceli* d'Orbigny, 1835
		Loliolus sp. Steenstrup, 1856
Octopoda	Octopodidae	*Octopus aegina* Gray, 1849

The bycatch comprises of low value smaller fishes and juveniles of commercially important fishes in addition to large quantity of non-edible benthic biota which is discarded in the sea. Thus, trawl is the most destructive among the fishing gears which inflicts damage to bottom ecology and habitat degradation. In order to maintain sustainability it is pertinent to regulate trawling in the state. CMFRI had suggested to regulate the fleet to 50% of the existing fleet of trawlers.

Bycatch can be utilised for making value added products like fish meal, surumi, chitosan, protein hydrolysate, food, manure and animal feed. Central Institute of Fisheries Technology (CIFT), Cochin, taken initiative to prepare fish paste, fish sausages, fish pappads, fish wafers, fish spirals, fish save, fish diamond-cuts, fish jam, fish noodles and canned fish paste products from the by-catch species. It has also prepared fish silage i.e. poultry and animal feed from cheaper by-catch fish species. Bacteriological peptone was developed from threadfin bream used as a growth-supporting compound in microbiological media formulations.

Regulation and controlled fishing is practised to minimise bycatch. Increase in cod end mesh size of trawl nets to 35 mm and popularization of bycatch reduction devises among trawl owners are management measures suggested for reduction of

bycatches in trawlers. Bycatch reduction devices (BRDs) are structures inserted in fishing gear to reduce capture or enable the escape of non-target species from fishing nets. Various BRDs such as the Turtle Excluder Device (TED) and Juvenile Fish Excluder and Shrimp Sorting Device (JFE-SSD) have been developed across the world for trawler nets to mitigate bycatch (Boopendranath, M. R. 2007)

Conclusion

By catch is reported as an insidious problem of invisible fishing which results from widespread unmanaged fisheries where by enormous quantities of biomass are being removed from the ocean. Single day fishing trawlers invariably bring the bycatch to the shore whereas Multi-day fishing trawlers mostly discard the low value bycatch except for the last day's haul. By-catch and discards present many dilemmas for fisheries management but nevertheless until and unless we are able to manage all significant sources of fishing induced mortality associated with fishing, we cannot ensure whether the fisheries are exploited in a responsible and long-term sustainable manner consistent with an ecosystem approach to fisheries (FAO, 2010). Fishery can no longer survive merely on the revenue obtained from traditionally targeted stocks therefore commercialisation of bycatch may help sustain profits. But at same time, it is very likely that the bycatch stocks will also be overfished creating livelihood and social equity concern and related ecological impacts. Hence a comprehensive nationwide fisheries management policy is needed that addresses the implications of technological changes in fisheries and develop regulatory mechanisms to ensure sustainable fishery.

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