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Trawl Bycatch Diversity of Bivalves (Mollusca: Bivalvia) in Neendakara Fishing Harbour, Kollam

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Abstract: ***In India, the fishery exploits species that widely vary in their life history traits and habitats. About 800 species of elasmobranches, teleosts, crustaceans, molluscs and echinoderms are taken by the trawls, and at least 300 species are the target species to the fishery (Vivekanandan, 2013). In the Neendakara harbour, molluscan species are the dominant species landed as by catch during the study period. From the collected samples, the bivalve species were sorted and recorded. Bivalves are the most diverse group of marine invertebrates and they include morphologically diverse group of organisms. The diversity of bivalves landed at the Neendakara fishing harbour, one of the major fish landing centers at Kollam, Kerala is included in this paper. The study period was for one year from August 2013 to May 2014. Altogether 46 species of bivalves were recorded during the study period. These 46 species belong to 13 orders, 16 families and 27 genera. The species composition data showed that the species of the family Arcidae have maximum species composition (21%), followed by family Glycymeridae, Pinnidae, Pectinidae, Dimyidae however, had less species composition (less than 1%). The collection represented the economically important species such as Perna viridis, Perna perna, Anadara indica, Anadara inequialis and Anadara gibbosa. Results also revealed that majority of the species identified belonged to sand dwelling or bottom dwelling animal category. Majority of these species belong to the non target species and hence they are discarded into the sea after the target group are selected. It is already known that the bottom trawling affects the natural habitat of bivalves and also inversely affects the diversity of bivalve fauna. This paper focus on the species diversity of bivalves landed as trawl bycatch, the number and species come under the discards and the impact of trawling on these bivalves.***

Keywords: Trawl bycatch, Mollusca, Bivalves, Arcidae, species diversity

1. Introduction

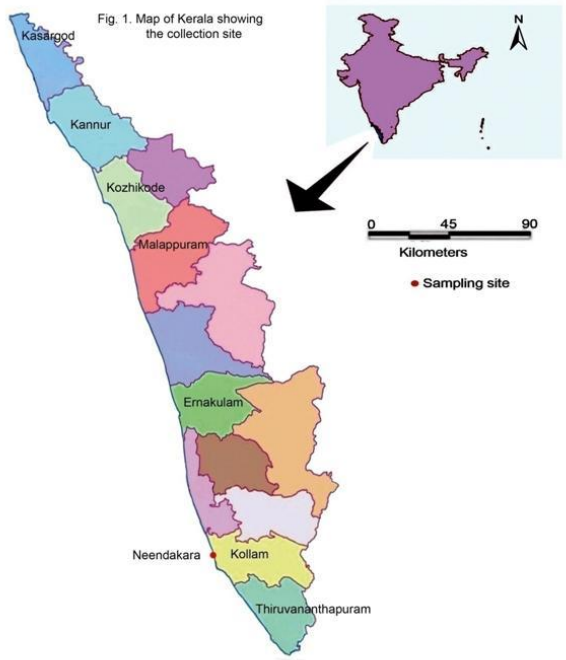
Fisheries are a large growing economic sector all around the world. It provides protein rich food and a good source of providing employment to millions of people. Commercial fishery is one of the major industries in world around. Dredging and trawling are the two types of modern fishing method that used worldwide. These modern fishing techniques, particularly some of them are highly harmful to

the marine ecosystem. Trawling is towing a net behind a boat at various depths. Bottom trawling is also used to capture fish in large scale. A wide variety of gear such as trawl, several variants of gillnet, hooks and line, trammel net, boat seine, net and ring seine are operated along the entire coast. The catch consists of more than 50 commercially important species or groups of finfish, crustaceans, bivalves and gastropods (CMFRI, 2012). The outputs of some of the techniques are the conversion of sea floor in to a less productive desert.

Studies showed that there has been an increasing interest on the potentially wider impacts of commercial fishing including changes to habitats and effects on non-target species (Sanchez *et al*., 2007; Wilma Blom *et al*., 2009; Voultsiadou *et al*., 2011). In commercial fishing, it is estimated to produce 27 million tons of discards per year in the world (Alverson *et al*., 1994). Discards include non target marine fauna and flora like fin fishes, shell fishes, reptiles, mammals, etc. out of which a total of 8.3% are the molluscan species (FAO, 2001). Large filter-feeding bivalves are more vulnerable to trawling disturbance than others. Larger bivalves in the path of a beam trawl typically suffer mortality of 20% or more (Lindeboom and de Groot 1998; Bergman and Van Santbrink, 2000). For this reason some of the bivalves like *Arctica islandica* (L.) have almost disappeared in heavily trawled areas (Rumohr and Krost 1991; Craeymeersch, Piet, Rijnsdorp and Buijs, 2000). Thus world molluscs are categorized under the endangered group as a result of commercial fishery. In India the destruction of marine ecosystem due to over exploitation is reported by Venkataraman and Wafar (2005).

2. Materials and Method

Samples were collected by monthly intervals from the trawl by catch landed at the Needakara fishing harbour, Kerala, India (8°56′19″N lat.; 76°32′25″E long.). The landing center is situated at the mouth of Ashtamudi backwaters. It is one of the major fishing harbours along the south west coast of India. The map of collection sites, fishing harbour and the sorting sites are presented in Figs.1-3. Collections were made during August 2013 to July 2014. The bivalves collected were preserved in 10% formalin for further taxonomic identification. After that the specimens were examined by taken into consideration of the various morphological characters for identification. Each bivalve species collected from the trawl by catch was identified up to their species level using field guide, standard books, FAO identification keys and online data bases.



3. Results and Discussion

Bivalves are economically important and highly valuable species. A series of survey done along from the coastal habitates of India have recorded high diversity and abuandance of bivalves (Alagarswami and Narasimham, 1973; Rao, 1974; Kripa and Mathew Joseph, 1993). From India, a total of 3271 species of molluscs are known to occur, belonging to 220 families and 591 genera, of which 1900 are gastropods, 1100 bivalves, 210 cephalopods, 41 polyplacophorans and 20 scaphopods (Appukuttan, 2008). Kurup *et al.* (2003) reported 103 species of fin fishes, 65 gastropods, 12 bivalves, 8 shrimps, 2 stomatopods, 12 crabs, 5 cephalopods, 3 echinoderms, and 4 jelly fishes as discards by bottom trawlers in Kerala coast. Deepthi (2008) reported 10 species of Porifera, 10 species of Cnidaria, 128 species of mollusca included 25 bivalves, 73 species of Arthropoda, 17 species of Echinodermata, 248 species of fishes, three species of reptilian and three miscellaneous species included in Bryozoa, Sipunculida, Annelida from Sakthikulangara and Neendakara fishing harbours of Kerala under the discarded bycatch category.

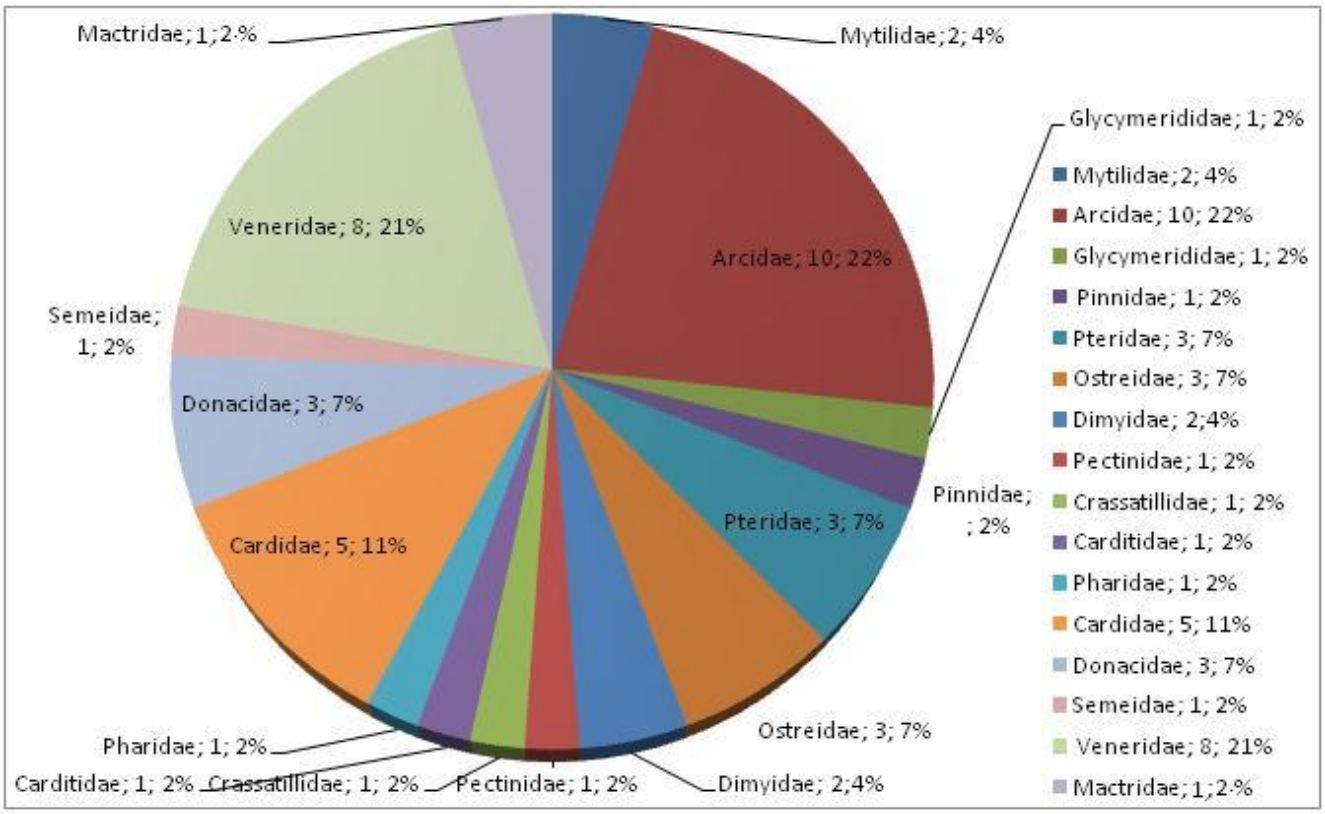


Figure 5: Species composition of various families in the Bivalves in trawl bycatch of Neendakara fishing harbor Table. 1. Trawl by catch diversity of bivalve in Neendakara harbour, Kerala, India

The taxonomical study of the collected bivalve species shows the presence of 46 species (Table 1). A total of 494 specimens were collected. In which 46 species of bivalves were recorded and identified during the study period. These 41 species are under 13 orders, 16 families and 27 genera. It include 2 species from mytilidae family, 10 species from Arcidae family, one Glycymeris species, one Pinnidae species, 3 species from Pteridae family, 3 species from

Ostreidae family, 2 species from Dimyidae and Mactridae families, one species each from the families, Pectinidae, Crassatillidae, Carditidae, Pharidae, Semeidae, along with 5 species from Cardidae family, three species from Donancidae family and 8 species from Veneridae. Among the bivalves 21% of the collected species are in Veneridae family, 4% in Mytilidae, 22% in Arcidae, 4% in Mactridae and others were even less than one it percentage of species composition. The percentage composition of species and their numerical abuandance were shown in fig.2.

Table 1: Trawl by catch diversity of bivalve in Neendakara harbour, Kerala, India

SI	Species	Common name	Abundance
1	**Class: Bivalvia** **Order: Mytiloida** **Family: Mytilidae** *Perna perna* (Linnaeus,1758)	Brown mussel	15
2	*Perna viridis* (Linnaeus,1758)	Asiangreen mussel	34
3	**Order: Arcoidea** **Family: Arcidae** *Anadara pumila* (Dunker, 1868)	Cockle	2
4	*Anadara indica* (Gmelin, 1791)		8
5	*Anadara gibbosa* (Reeve,1844)		1
6	*Anadara inequivalis* (Bruguiere, 1789)		18
7	*Anadara biangulata* (G B Sowerby I, 1833)		3
8	*Tegillarca rhombea* (Born, 1778)		3
9	*Tegillarca nodifera* (Martens, 1860)		6
10	*Tegillarca aequilatera* (Dunker, 1868)		7
11	*Mesocibota bistrigata* (Dunker, 1868)		3
12	*Trisidos tortuosa (Linnaeus,1758)*	Twisted Ark	8
13	**Family: Glycymerididae** Glycymeris sp.	bittersweet clams	1
14	**Order: Pinnoidea** **Family: Pinnidae** *Artina vexillum* (Born, 1778)	flag pen shell	3
15	**Order: Pterioidea** **Family: Pteridae** *Pinctada margaritifera* (Linnaeus,1758)	Black-Lip Pearl Oyster	2
16	*Pinctada imbricata* Roding, 1798	Atlantic pearl	1
17	*Pinctada capenensis* (Sowerby III, 1890)	Cape Pearl Oyster	1
20	**Order: Ostreioidea** **Family: Ostreidae** *Crassosterea biliniata* (Roding)		4
21	*Crassosterea gigas*	The Pacific oyster	1
22	*Saccostrea cucullata*	hooded oyster	5
23	**Order: Dimyoidea** **Family: Dimyidae** *Anomia ephippium* (Linnaeus,1758)	saddle oysters	2
24	*Anomia cytaeum* (Gray, 1850)	Jiggle shell	1
25	**Order: Pectinoidea** **Family: Pectinidae** *Volachlamys singaporina* (Sowerby,1890)	Singapore scallop	1
26	**Order: Crassatilloidae** **Family: Crassatillidae** *Crenocrassatella yaguri* (Makiyama, 1921)		14
27	**Family: Carditidae** *Cardites bicolar* (Lamark, 1819)		7
28	**Order: Solenoidea** **Family: Pharidae** *Siliqua radiata* (Linnaeus,1758)	Sunset siliqua	4
29	**Order: Chamoidea** **Family: Cardidae** *Acanthocardia echinata* (Linnaeus,1758)		8
30	*Acanthocardia spinosa* (Lightfoot,		18
31	*Maoricardium setosum* (Redfield,		12
32	*Vasticardium burchardi* (Dunker,	Buchard's	16
33	*Fulvia scalata* (Vidal, 1994)		9
34	**Order: Veneroida** **Family:Donacidae** *Donax scrotum (Linnaeus,1758)*		28

35	*Donax cuneatus (Linnaeus,1758)*	Cuneate wedge	29
36	*Donax faba*	wedge clam	6
37	**Family: Semeidae** *Semele cordiformis* (Holten, 1802)		4
38	**Order: Cyrenoidae** **Family: Veneridae** *Placamen gilvum* (Philippi, 1849)		3
39	*Placamen tiara* (Dilwyn, 1817)		2
40	*Gafraarium divaricatum* (Gmelin,		4
41	*Circe scripta (Linnaeus,1758)*	Circular	17
42	*Circenita callipyga* (Born, 1778)		12
43	*Callista ericina (Linnaeus,1758)*	Reddish callista	9
44	*Paphia rotundata (Linnaeus,1758)*	Venus clam	28
45	*Paphia textile* (Gmelin, 1791)	Textile venus	31
46	**Order: Mactroidea** **Family: Mactridae** *Mactra violacea* (Gmelin, 1791)	violet trough shell	42

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4. Conclusion

Trawling directly affects the sea bottom. Due to trawling the sea bottom is disturbed and churned up by scraping, sediment re-suspension, physical destruction of bed forms and removal or scattering of non-target benthos. While the effect of one passage of trawl net would be relatively minor, the cumulative effect and intensity of trawling may generate long-term changes in benthic communities (Collie *et al.*, 1997). The concentrations of important nutrients, namely total phosphorous and total nitrogen significantly get reduced in the sediments after trawling (Muthuvelu *et al.*, 2013). The trawling disturbs the natural trophic level. Thus the benthic communities decline in each trawling process and thereby destroy the marine ecosystem. The present study reports more number of bivalve species than the earlier studies which indirectly indicates the increased exploitation of this fauna and their species diversity. Study of this kind will be helpful to taking remedies against over exploitation of these bivalve fauna and for taking preventive measures for maintaining good species diversity intact.

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