

Crustacean species diversity in by-catch in dumps collected from Chilaw to Kalpitiya, Sri Lanka

Suganja Thuraisingam, Suganja Thuraisingam

Department of Aquaculture and Fisheries, Faculty of Livestock, Fisheries and Nutrition, Wayamba University of Sri Lanka, Makandura, Gonawila, Sri Lanka

Abstract

Fishery by-catch discard practices constitute a purposeless waste of valuable living resources, which plays an important role in the depletion of marine populations. Furthermore, it may have a number of adverse ecological impacts, provoking changes in the overall structure of trophic webs and habitats. Invertebrate by-catch is mostly undocumented for in Asia in productive and ecologically sensitive marine ecosystems. This includes Gulf of Mannar where various fishing gears and vessels are being operated. Samples were collected at 29 landing sites from Halawatha to Kalpitiya and described the fishing practices interviewing people between March to June 2015. Species were identified using taxonomic keys. Seventeen invertebrate species were recorded in class crustacea. Family Portunidae had the maximum species composition. Main vessels were one day boats, Theppam, Vallam and the main gears were gill nets of various mesh sizes, beach seines, traps and hand nets. Gear regulations, management plans, awareness for by-catch reduction and opportunities for unavoidable by-catch utilization needs to be introduced.

Keywords: By-catch, Crustacean species, Gulf of Mannar

1. Introduction

By-catch is one of the most significant issues affecting fisheries management today ^[1]. It is the capture of non-target species, including non-living material (debris) which is caught while fishing as defined by Hall (2000).

There are several reasons for neglecting by-catch because of small magnitude and invisible in past decades ^[2]. However, increasing fishing pressure shows the impacts of by-catch. In 2000, it was resulted in a mean estimate of 27.0 million metric tons of global discards, based on a target catch of 77 million metric tons ^[3]. Nationally by catch was estimated of 40% in shrimp fisheries ^[2].

The commercial fisheries practices are ever increasing in frequency ^[4]. The industrialization of fisheries such as expansion in new areas, using complex fishing vessels (trawling) has occurred due to increasing human population growth to fulfill their marine protein needs ^[5]. Consequently, this trend has increased incidental catches and alters the structure and function of marine ecosystems and biodiversity⁶. Trawling and dredging scoops up everything. Similarly bottom set long line, Gill net, push net ^[1] and beach seine are responsible for by-catch due to the inadequate selectivity. Hence a large by-catch is the final outcome ^[2].

By-catch results in a complex set of an issue which includes biological, ecological, economic and socio-cultural impacts⁷. It impacts population level of organisms due to depletion of undersized individuals. Affecting ecosystem level ^[7], leading to species conservation problem. The fishing communities need high cost to purchase new techniques for fishing operations while by-catch is occurred ^[9]. And also it conflicts with people gaining protein needs from fishery resources in Asian countries would lead nutritional problems. In the Indian

Ocean purse seine fisheries by-catch is estimated as 3.5 percent with the species of neritic tunas and some endangered sharks ^[8]. The pole-and-line, gillnet fleets, which land as much fish as the other gears combined, appear high amount of by-catch of ecologically sensitive species like sharks and turtles. This shows difficult for maintenance of community structure, ecosystem stability and positive economic consequences ^[8].

The Gulf of Mannar is a shallow area of water connected to the coast of India and Sri Lanka ^[10]. There are 282 different types of marine invertebrate recorded ^[10]. A large numbers of people in the region are doing fishing activities for their livelihood. Main vessels and gears in the area are one day boat, Theppam, Vallam and multi day boats with various mesh size gill nets, beach seine and push net. However by-catch specially, the invertebrate by-catch has not being quantified. Due to the by-catch removal of bottom living crustaceans, food web is changed which leads mega fauna like shark vanish. The sustainability of future fishery and species diversity will be questionable. Therefore the study attempts identifying crustacean species and the fishing practices (fishing vessels & gear) that result in by-catch in selected areas of Gulf of Mannar.

2. Materials and Methods

2.1 Study Area

This research was carried out in the fish landing sites of Gulf of Mannar in Sri Lankan waters during the period of March to June 2015.

study area was limited to an area between 79° 30' - 80° 10' E and 7° 30' - 8° 30' N. Twenty nine fish landing sites were randomly selected from Chilaw to Kalpitiya which are located in the region of Gulf of Mannar.



Fig 1: Location of fish landing sites from Chilaw to Kalpity

2.2 Data collection

Sample collection

This study was mainly concentrated on the fishing gears mostly gill nets due to the availability of data. Species was generally ignored by the fishers, were considered as by-catch. The discarded crustacean species trapped in fishing gear or from land were collected. Samples were geo-tagged and preserved in ice. All morphometric features were recorded and photographed at the collecting site. Finally, species identification was done in the laboratory by using available identification keys and catalogues.

Questionnaire based on data collection

Pre-tested questionnaire was prepared to achieve the information regarding the incidental catch rate, gears and vessels used in particular area, targeted and discarded species as by-catch. Twenty nine respondents were selected for the discussion.

3. Results and Discussion

3.1 Crustacean by-catch composition

Manipulative experimental and modeling approach was used to look at the crustacean by-catch species. Their responses are influenced by the rate of population reduction. The estimation of target species and by-catch is difficult. Finally seventeen species were identified in phylum Arthropoda in class Crustacea as by-catch composition in study area.

Table 1: Species composition of Crustacean by-catch

Order	Family	Species	
Stomatopoda	Squillidae	<i>Oratosquilla oratoria</i>	
	Lysiosquillidae	<i>Lysiosquillina maculata</i>	
Achelata	Scyllaridae	<i>Thenus orientalis</i>	
Brachyura	portunidae	<i>Charybdis natator</i>	
		<i>Charbdis lucifera</i>	
		<i>Charybdis feriatus</i>	
		<i>Portunus pelagicus</i>	
		<i>Portunus haanii</i>	
		<i>Portunus sanguinolentus</i>	
	Calappidae	<i>Calappa bilineata</i>	
		<i>Calappa hepatica</i>	
		Matutinae	<i>Ashtoret lunaris</i>
		Parthenopidae	1 species
	Dromiidae	<i>Lauridromia dehaani</i>	
	Droppidae	1 species	
	Epialtidae	2 species	
	Hippidae	1 species	

Seventeen species of crustaceans were recorded during the four month study period, of which 83% were brachyuran crabs, represented by a wide range of 10 genera and 15 species (Table 1). The major species of commercially important brachyuran crabs in the landings were *Portunus sanguinolentus*, *Portunus pelagicus*, *Portunus haanii*, *Charybdis lucifera*, *Charybdis natator* and *Charybdis feriatus*, represented. Figure illustrates selected crustaceans in the bycatch. The family Portunidae comprised of 6 species. *Calappa* and *Portunus* were the species rich genera represented by 2 and 3 species respectively. One species belonged to the family Matutinae, 1 to Parthenopidae and 2 to Dromiidae. Stomatopods (11.1%) were another important group in the bycatch consisting of two species *Oratosquilla oratoria* and *Lysiosquillina maculate*. Lobsters, represented by the scyllarid lobster *Thenus unimaculatus* formed about 0.05%. Shrimp represented chiefly by juveniles and decomposed specimens which were not identified.

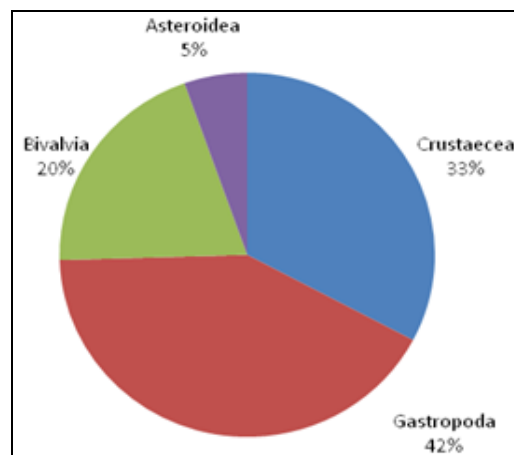


Fig 2: By-catch species composition of various classes in the invertebrate at fish landing sites from Halawatha to Kalpitya

Species richness and diversity are indicative of the stability of a community. The present study provides baseline information on the diversity and abundance of invertebrate species based on landed catch at fish landing sites, which can act as an important reference data set for further studies related to

fisheries management, ecological impact assessments of by-catch, conservation and pollution in the region. There were mostly motorized one day boats and non-motorized Theppam used for fishing with various mesh size gill nets, beach seine, traps and push nets. Interviewing Fish retailers many of the species caught in the by-catch have potential uses for non-human consumption, poultry feed and fertilizers.

4. Conclusions

This research was a comprehensive study of by-catch composition from Sri Lankan coastal waters. Many demersal invertebrate species are protected, listed or endangered in this region (Red list 2012). Lyla net fishery was very destructive and could change species composition and populations structure of a region in the long term. It is worrisome because it directly affects the species diversity and balance in Gulf of Mannar.

By-catch is a conundrum in global marine fisheries which can cause significant impact on marine trophic chains. In fish landing sites, most of the species are discarded due to lack of utilization. The crustacean by-catch finds as manure and poultry feed. A first step towards understanding and solving the by-catch problem is to identify and quantify by-catch. This study assists in understanding crustacean species discarded as by-catch; which leads to decline biodiversity. High crustacean as invertebrate by-catch emphasizes the need for sustainable fishing practices. Gear regulations and area management plans are essential in the study area.

5. Acknowledgement

The authors would like to thank Wayamba University of Sri Lanka for providing the budget logistic support. My special appreciation goes to fishing communities from Chilaw to Kalpity areas and other Department of Aquaculture and fisheries staff members for their great help during research.

6. References

1. Cook R. By-Catch Mortality by Fishing Gear. In: By-Catch Mortality by Fishing Gear. Reykjavik, Iceland: Reykjavik Conference on Responsible Fisheries in the Marine Ecosystem, 2001.
2. Davies RWD. Defining and estimating global marine fisheries by-catch. *Marine Policy*. 2009; 33(4):661-672.
3. Alverson DL, Freeberg MH, Murawski SA, Pope JG. A global assessment of fisheries by-catch and discards. *FAO fisheries*, 1994, 339.
4. Anderson SC Trends. Drivers and Ecosystem Effects by Fisheries. *Fisheries* (Bethesda), (April). 2010.
5. Cudmore WW, Investigator P. *Marine Fisheries – Causes for Decline and Impacts*. 2009, 1-84.
6. United Nations. *The Impacts of Fishing on Vulnerable Marine Ecosystems*. 2006.
7. Hall MA, Alverson DL, Metuzals KI. By-catch: Problems and solutions. *Marine Pollution Bulletin*. 2000; 41(1-6):204-219.
8. David A, Gillett B, Itano D. Examining by-catch rates in the Indian Ocean. ISSF, Available at: <http://issf-foundation.org/2013/03/27/examining-bycatch-rates-in-the-indian-ocean/> [Accessed July 24, 2015]. 2013.

9. Lewison RL. Understanding impacts of fisheries by-catch on marine mega fauna. *Trends in Ecology and Evolution*. 2004; 19(11):598-604.
10. Miththapala S. *The Gulf of Mannar and its surroundings*. IUCN. 2012.