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Bycatch Reduction in Trammel Net Fishery for Prawn (*Melicertus kerathurus*) by Using Guarding Net in İzmir Bay on Aegean Coast of Turkey

Cengiz Metin[1,*], Gökhan Gökçe[2], İlker Aydın[3], İsa Bayramiç[3]
[1]Ege University, Underwater Research and Application Centre, 35440, İzmir, Turkey.
[2]Çukurova University, Faculty of Fisheries, Department of Fishing Technology, 01330, Balcalı, Adana, Turkey.
[3]Ege University, Faculty of Fisheries, Department of Fishing Technology, 35100, Bornova, İzmir, Turkey.

* Corresponding Author: Tel.: +90 232 7521163/170; Fax: +90 232 3747450;
E-mail: cengiz.metin@ege.edu.tr

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Abstract

In this study, by-catch reduction in trammel nets used for prawn fishery in İzmir Bay was studied between May and October 2003. In shrimp trammel net fishery catching of discard species is an important problem due to a series of reasons such as disentangled species causes extra work for fishermen and decreases the labour life of nets. A Guarding net was attached to lead line of traditional shrimp trammel net as a modification to minimize this problem. Control Nets (CNet) originated from traditional commercial nets and were compared against two groups of Experimental nets (Exp1 and Exp2) in two periods. In the first period of the study, Exp1 net group caught 36.46% fewer shrimp (*Melicertus kerathurus*) in comparison to CNet. In addition to this, 35.62% crab (*Goneplax rhomboides*), 40.71% mantis shrimp (*Squila mantis*) and 44.77% purple dye murex (*Bolinus brandaris*) were caught fewer than those in CNet net group. In the second period of the study, Exp2 net group was put into the trial. In this period, Exp1 net group compared with CNet net group caught less shrimp (8.09%), crab (66.15%), mantis shrimp (26.79%) and purple dye murex (32.25%). Exp2 net group caught fewer shrimp (0.99%), crab (50.63%), mantis shrimp (17.33%) and purple dye murex (25.92%) than CNet net group. This study indicates that the net modification was capable of reducing bycatch. Rising of trammel net above the lead line from muddy ground prevents discarding of demersal species from net. Therefore, the height of guarding net is an important criterion for bycatch reduction.

Keywords: By-catch reduction, trammel net, prawn, Aegean Sea.

Introduction

Prawn species are caught by trawls, beam trawls and pots worldwide. However, in some parts of the world (e.g., India, Japan and Turkey) prawns are also caught with trammel nets (Kalawar *et al*., 1985, Engvall, 1991, Fujimori *et al*., 1996, Tomas *et al*. 2003). Turkish fisheries regulation restricts the operation of bottom trawls and beam trawls from April to September (Anonymous, 2003) when the prawns exhibit inshore migration prior to spawning between April and August (Turkmen and Yilmazyerli, 2006; Klaoudatos *et al*., 2008). Therefore, prawns are caught only with trammel nets within 6-7 months fishing season in İzmir Bay. After restriction of beach seining (Anonymous, 2000), those boats are not only tended to catch prawn with trammel nets, but also gillnets are used to catch red mullet (Aydın *et al*., 2006). This conversion caused overfishing for prawn species and increased the amount of bycatch. Gokce (2004) reported 72 species which include 29 economically potentialed bycatch species and 43 discarded species were caught by trammel nets in İzmir Bay. These numbers were determined as 32, 11 and 21 respectively in red mullet gillnet fisheries in the same region (Aydın *et al*., 2008). The purple dye murex (*Bolinurus brandaris*), mantis shrimp (*Squila mantis*) and crab (*Goneplax rhomboides*) are the most abundant discarded species (Gokce and Metin, 2007) and often crushed by the fishermen to make easier to disentangle from the net on the boat deck; thus, discarded purple dye murexes, mantis shrimps and crabs die or suffer due to considerable injuries, and the unwanted catches of these species may therefore increase their mortality. Disentangling of these species also means extra work for fishermen and often damages their gear. Entangled purple dye murexes, mantis shrimps and crabs reduce the net area for the target species. From a commercial standpoint, the prawn trammel net fishery requires to reduce the bycatch for more net efficiency and decreasing time of labour. Utilization of guarding nets may allow reducing the bycatch by preventing the entanglement of purple dye murexes, mantis shrimps and crabs.

In this study, prawn trammel nets with guarding net were compared with standard prawn nets for reducing the bycatch of the purple dye murex, mantis shrimp and crabs.

Materials and Methods

Experiments were performed between 1st of May and 7th of October 2003 in two periods. A total of 39 sea trials were conducted in Izmir Bay on Aegean coast of Turkey (Figure 1). The prawn trammel nets are traditionally set on sandy and muddy grounds. The nets are set between 10 and 40 m in depth. A unit of trammel net is 100 m long. Approximately 15 and 20

Figure 1. Study Area, Izmir Bay western part of Turkey.

nets (1,500 and 2,000 m long) are used for prawn trammel net fishery. The experiments were carried out aboard 8.5 m long "Oğulcan", a commercial boat usually setting trammel nets. The present study was conducted in two periods with 3 units of trammel nets for each experimental net group. In the first period, Control Net (CNet) and Experimental net 1 (Exp 1) were examined and in the second period of the study Experimental net 2 (Exp 2) were added versus the other net groups. Technical specification and illustrations of the nets were given in the Table 1 and Figure 2. The floats and hanging ratio are the most important materials which adjust height of the net in water column. Therefore, in the first period**,** different numbers of floats were compared between the Exp 1 (312 floats) and the CNet (250 floats) and in the second period**,** hanging ratios of guarding nets were compared between Exp 1, Exp 2 versus CNet. Total numbers and weight of prawn, crab, mantis shrimp and purple dye murex species were recorded for each net group. Wilcoxon matched paired test was used to find whether differences occurred in mean catch rates of species for the nets.

Results

In the first period of the study**,** a total of 461 *M. kerathurus*, 233 *G. rhomboides*, 407 *S. mantis* and 612 *B. brandaris* were caught with control nets (Table 2). Exp1 net caught 17 % less prawn (P= 0.036), 44 % less crab and mantis shrimp (P= 0.001 and P= 0.002, respectively) and 49 % less murex (P= 0.011) than the CNet (Figure3).

In the second period of the experiment**,** the highest catch was also caught by CNet between the all net types (Table 2). Exp 1 caught very few *M. kerathurus* (4%) versus the CNet and the differences were not significant (P= 0.761). Although, *S. mantis* were caught 27% less than the CNet with Exp 1, the statistical differences were not significant (P= 0.169). Beside these, *G. rhomboides* and *B. brandaris* were caught by 68% (P= 0.002) and by 32% (P= 0.040) less than the CNet, respectively.

Prawns were caught by 2% (P= 0.981) less than the CNet by Exp 2. The catches of crab (54% less, P=0.024) and murex (30% less, P= 0.027) species were significantly different from the CNet. Exp 2 caught 13% less *S. mantis* than the CNet. Differences were not significant (P= 0.407). Figure 3 Mean catch values of four species by study periods and net groups.

Discussion

Bycatch reduction studies around the world mostly concerned with the trawl fisheries (Fonseca *et al*., 2005; Graham, 2003; Broadhurst, 2000). However**,** there has been very few studies concerning artisanal fishery.

G. rhomboides, *S. mantis* and *B. brandaris* species are the major problems due to reducing net area; increasing labour time and forcing disentangle of species from the nets in artisanal trammel net fishery in Turkey. Attaching guarding net to lead line method, increased floats and changing hanging ratios of guarding nets were the means employed to minimize these problems. This means, that surface of the nets that encounter the species has to be raised from the bottom with guarding nets. Thus, reaching and entagling of those three species to the nets were prevented by this modification.

In both periods of the study, bycatch species were significantly reduced in Exp 1 and Exp 2. However, in the first period of the study, the Exp 1 caught 17% less *M. kerathurus* than the CNet. Differences in the catch of *M. kerathurus* were originated from using extra floats; because the nets stand more vertical by extra floats. In the second

Table 1. Technical details of prawn nets in the study.

			No. of mesh in depth	Stretched mesh size (mm)	No. of mesh in length	Material	Length (m)	Units
CNet	Upper part	Inner layer	50	40	5000	PA 110 d/2	200	
		Outer layers	$5^{1/2}$	220	910	PA 210 d/2	200	
	Lower part	Inner layer	50	40	5000	PA 110 d/2	200	
		Outer layers	$5^{1/2}$	220	910	PA 210 d/2	200	
	Float line					PP Ø 5	101	
	Lead line					PP Ø 5	106	
	Floats					PE Ø 3.5		250
	Sinkers					Pb 30 gr		277
Exp1	Upper part	Inner layer	50	40	5000	PA 110 d/2	200	
		Outer layers	$5^{1/2}$	220	910	PA 210 d/2	200	
	Lower part	Inner layer	50	40	5000	PA 110 d/2	200	
		Outer layers	$5^{1/2}$	220	910	PA 210 d/2	200	
	Float line					PP Ø 5	101	
	Lead line					PP Ø 5	106	
	Floats					PE Ø 3.5		312*-250
	Sinkers					Pb 30 gr		277
Exp2	Upper part	Inner layer	50	40	5000	PA 110 d/2	200	
		Outer layers	$5^{1/2}$	220	910	PA 210 d/2	200	
	Lower part	Inner layer	50	40	5000	PA 110 d/2	200	
		Outer layers	$5^{1/2}$	220	910	PA 210 d/2	200	
	Float line					PP Ø 5	101	
	Lead line					PP Ø 5	106	
	Floats					PE Ø 3.5		250
	Sinkers					Pb 30 gr		277

*Float number of Exp1 in first period of the study,
CNet, Control nets; Exp1 and 2, Experimental nets 1 and 2,
PA, polyamide; PP, polypropylene, PE, polyethylene; Pb, lead

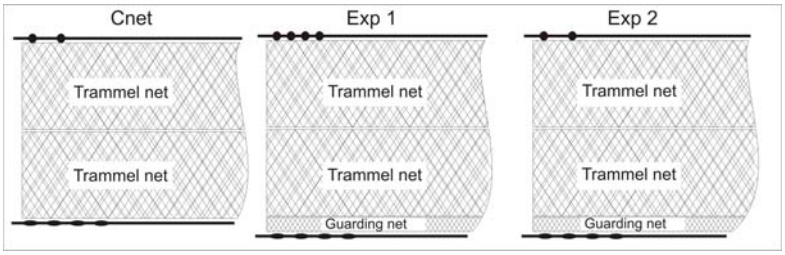

Figure 2. Illustrations of the Control nets (CNet), Experimental Nets 1 and 2 (Exp1 and Exp2).

Table 2. Total catch of target and three discarded species by study period and net type

Net Group	First Period of the study				Second Period of the study			
	M. kerathurus	*G. rhomboides*	*S. mantis*	*B. brandaris*	*M. kerathurus*	*G. rhomboides*	*S. mantis*	*B. brandaris*
CNet	431	233	407	612	305	226	308	446
Exp1	358	130	229	312	293	72	224	302
Exp2					298	105	267	313

period of the study the catch of the target species in the Exp 1 and the Exp 2 caught 4% and 2% less than the CNet, respectively. In the commercial fishery, a 10% decrease of target species is a successfully reduced ratio (Broadhurst and Kennelly, 1996; Fonseca *et al*., 2002).

As a result of this study, using guarding net on the lead line of prawn trammel net, significantly reduced bycatch species. However, on the target species a 4% decrease is not significant for commercial fishermen besides decreasing labour time for fishermen on the deck.

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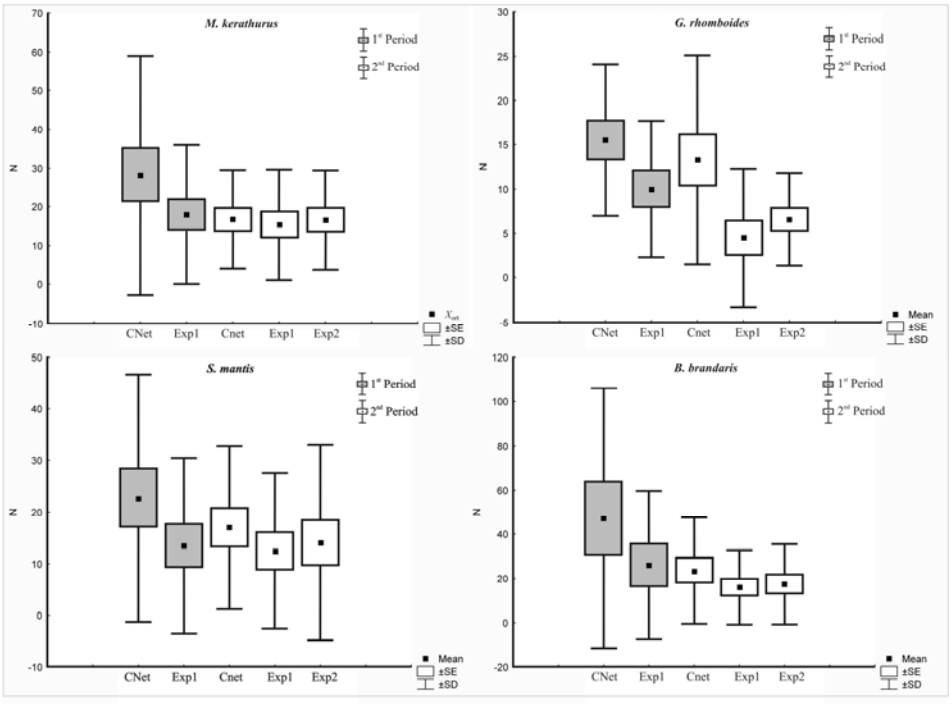

Figure 3. Mean catch values of four species during study periods and net groups.

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