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Preliminary study of ABycatch of pelagic trawl fishery in the southern Black Sea Coast of Turkey: Moon jellyfish *Aurelia aurita*

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Present study was carried out in Southern Black Seaduring October 2008 and total 22 midwater trawl nets were towed.Horse mackerel (*Trachurusmediterraneus*) and moon jellyfish (*Aurelia aurita*)were caught by midwater trawl12 768 kg and 6415 kg respectively in the experiments. There are significant differences onthe mean length of horse mackerel in the hauls ($p<0.05$).Deadjellyfishcan increase the riskof pollutionin the Black Sea which is incidentalcaptured by the nets.

[Keywords:*Aurelia aurita*, Black Sea, By-catch, Grid system, Horse mackerel, Midwater trawl]

Introduction

The list of potential problems associated with discards is quite extensive: threatening endangered species, wasting resources, increasing fishery costs, damaging habitat, impacting the food web and redirecting ecosystem pathways[1].Usually termed by-catch, some of the captured organisms may be retained for sale or use, while others are discarded back into the sea because of either low value or regulatory requirement[2].Most studies focus on the discards of commercial species and it is often unclear whether non-commercial species are recorded, e.g. there are few references to discards of jellyfish[3].There has been little study of bycatch and discarding in midwater trawl fisheries in Europe. These fisheries are of recent origin, beginning in France in the early 1980's[4].

Target species in Turkish Black Sea coastal pairly midwater trawl fisheries is the anchovy and horse mackerel, whereby trawl fisheriesfor pelagic fishes are especially concentrated in the Black Sea[5-6-7]. Large quantities of jellyfish are discarded in the anchovy, horse mackerel, bluefish and bonito fisheries in Turkish waters[3].

*Aurelia aurita*is very common in the mixed layer down to the sub-thermocline region in the Black Sea[8]. Ctenophores population explosion was characterized by significant changes in the structure of plankton communities in the pelagic ecosystem of the Black Sea which effected fishproductivity[9].

Jellyfish may be amajor limiting factor for the population growth in copepods and larval fish. They may impedefishing activities and power plant cooling[10].

Horse mackerel (Carangidae) is a most of the economic fish in the Turkey small scale pelagic trawl fishery. In the present paper the effects of moon jellyfishwas studied forthe horse mackerel fishery by midwater trawl, which is the important bycatch species in the Black Sea.

Material and Method

The study was carried outpairlymidwater trawl used on commercial fishing boats, in the Black sea in 20-22, 25-26 October 2008. Pelagic fish species were caught by the fishing gear of fishermen in the region. The fishing field is between Kızılırmak and Yeşilırmak rivers, an important migration point of school fishes (Fig. 1).

Water depth of the fishing ground was between 18-72 m. Towing speed varied between 2.0-2.5 knots and towing duration was 180 minutes in all the hauls. Total 11 night and 11 daytime pelagic trawls were towed in the study. Catch amount data of species only recorded in the daytime sampling. Beside after each night hauls, the catches in cod-end were sorted separately according to horse mackerel and moon jellyfish. Data were recorded

total catch (kg) for *Aurelia aurita* and horse mackerel each hauls of night sampling (Fig. 2).

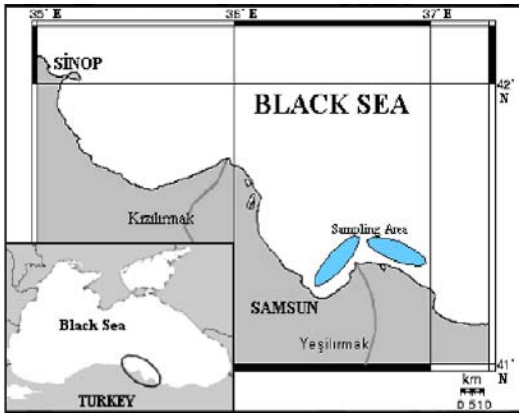

Fig. 1—The map of study

Then, total lengths of horse mackerel were measured to the nearest 1 mm. The Kruskal-Wallace one way analysisofvariance method was used to the mean length in the hauls.

Fig. 2—Collection and separation of *Aurelia aurita* and Horse mackerel

Results and Discussion

Horse mackerel (*Trachurusmediterraneus*) and moon jellyfish (*Aurelia aurita*) were caught by pelagic trawl in the study period total 9540kg and 8220 kg respectively(Fig. 3). A total weight of 12768 kg horse mackerel and 6415 kg jellyfish was caught in trawl cod-end during 33 hours of trawling in 11 night hauls. Catch amount of moon jellyfish and horse mackerel were given in Table 1.Mean catch of moon jellyfishand horse mackerel were found 1160.72±61.49kgand 583.18±43.49 kgrespectively.Whilecatch amount of moonjellyfish were decreasing, catch amount of horse mackerel increased. Table 1 shows that catch ratio of horse mackerel highest in 2, 4, 8, 11 hauls.There is reverse proportion between catch amount of jellyfish and horse mackerel (Fig. 4). Rising of moon jellyfish catch are negative affect catch efficiency of horse mackerel.While jellyfish catch amount were decreasing mean length of horse mackerel increasing were determined. Maximum and minimum average length of horse mackerel was determined 12.9±0.13 cm and 13.73±0.11 cm respectively.

Especially, mean length of horse mackerel is more than minimum landing size (13 cm) in 2, 3, 4, 5, 8, 10, 11 hauls. Mean length of horse mackerel is less than minimum landing size in 1, 6, 7, 9 no hauls. Differences between mean length of horse mackerel in the hauls are significant ($p<0.05$).

The results show that rising of moon jellyfish catch amount, selectivity of midwater trawl is reducing(Table 1). There is reverse proportion between catch amount of jelly fish and mean length of horse mackerel (Fig. 5).Rising of moon jellyfish catch are negatively affected mean length of horse mackerel. Small pelagic fishes have been important such as anchovy, horse mackerel, bluefish, sprat and allis shad in the Turkey fishery.

Table 1—Catch amount of jellyfish and horse mackerel

	Moon jellyfish	Horse mackerel		
Hauls	Total Catch	Total Catch	Total Length	Catch Ratio
1	1020	1736	12.8±0.09^{a}	1.7
2	150	2324	13.6±0.12^{b}	15.5
3	340	1162	13.3±0.08^{ab}	3.4
4	50	2100	13.7±0.11^{b}	42.0
5	580	616	13.2±0.17^{ab}	1.1
6	1500	322	12.6±0.06^{a}	0.2
7	400	840	12.9±0.13^{a}	2.1
8	120	1260	13.3±0.18^{ab}	10.5
9	1160	350	12.8±0.10^{a}	0.3
10	815	710	13.2±0.12^{ab}	0.9
11	280	1348	13.5±0.09^{b}	4.8
Total	6415	12768	12.8±0.09^{a}	50.2

Mean	583.182±43.49	1160.727±61.49	13.2±0.11	50.2

Test for total length: a, b (↓) Differences between groups show with different letter is significant ($p<0.05$)

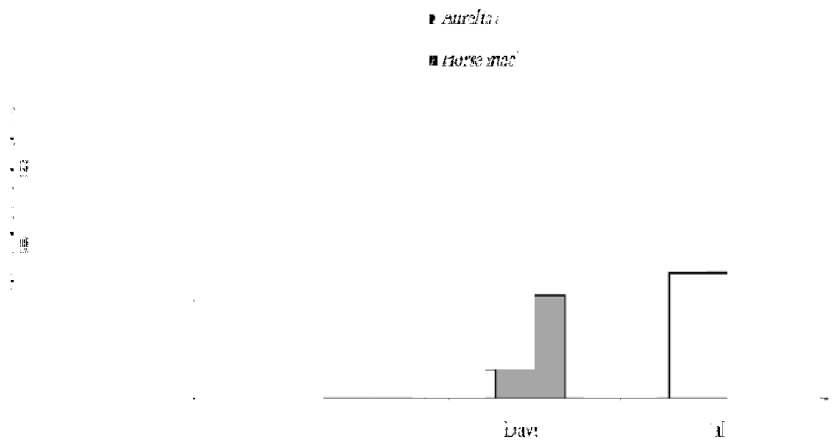

Fig. 3—Total catch amount of moon jellyfish and horse mackerel

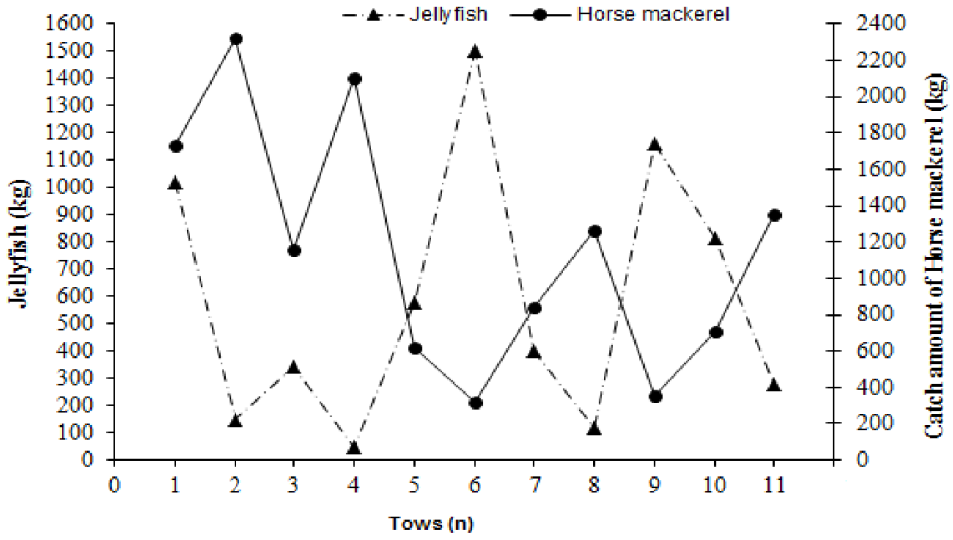

Fig. 4—Catch amount changing of moon jellyfish and horse mackerel

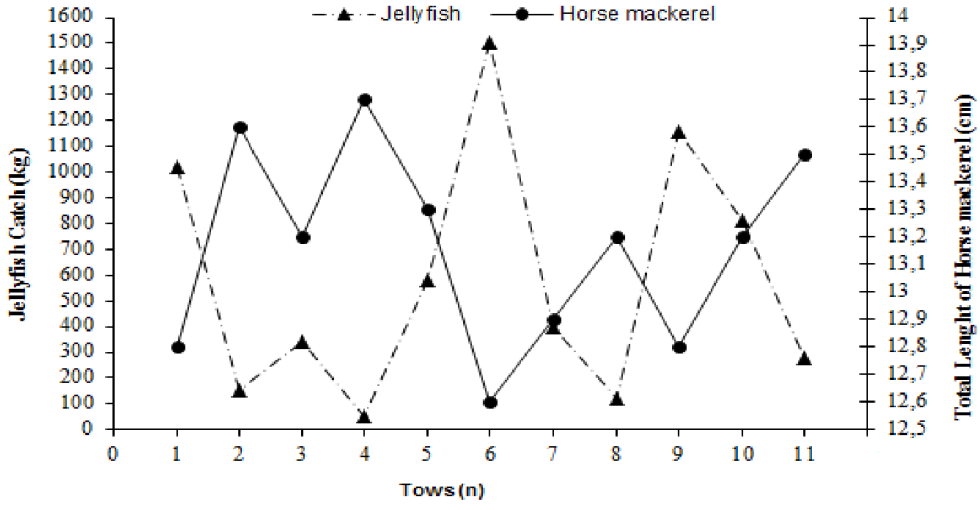

Fig. 5—Catch amount of moon jellyfish and mean length of horse mackerel

These species are usually caught by purse-seine and pairly midwater trawl in Turkish waters. Horse mackerel is second economic species in Black Sea by total 25010 tons catch production[11].

In the present study the effect of moon jellyfish(*Aurelia aurita*) on the catch efficiency and length composition of horse mackerel caught by the midwater trawl were studied. This data is provided information for the first time for moon jellyfish bycatch of Black Sea trawl fisheries.

Most of the species caught are discarded, and estimates of the ratio of bycatch and discards to the total catch in most trawl fisheries have been in the range 45–50 percent of the catch[12-13]. It was determined that large-sized jellyfish dominated midwater trawl catches (86.9**%** by weight) was followed by juvenile Pollock (11.6 %)[14]. The ratio of moon jellyfish bycatch to the total catch has been determined 33 percent of the catch in the present study.

In some fisheries the introduction of bycatch reduce devices (BRDs) including square mesh panels has been industry driven by the need to exclude jellyfish, reduce discards of target species, comply with reduce the costs of sorting fish[3].The devices varied depending on the need of the particular fisherman. Some fishermen developed grids to exclude turtles, rays, sponges, and jellyfish, because these animals were caught frequently or because the value of their target catch could be increased markedly[15].

Several fishermen took an interest in developing devices to reduce fishery bycatch in the sea. Grids are used to expel sea turtles and jellyfish[16]. Use of grid has proven to be successful in several experiments in Aegean Sea of Turkey[17-18].As no grid selectivity study on the midwater and bottom trawl could be found in the Black Sea.

In recent years,increasing ofjellyfishnegatively affectsthe Black Seaecosystem and fisheries. This study indicates that the moon jellyfish effect to size composition and catch efficiency of horse mackerel in the midwater trawl fishery of the Black Sea. However, deadjellyfishcan captured incidentally by the nets increased the riskof pollutionin the Black Sea.

The authors of this study recommend investigation of grid selectivity to reduce capture of these by-catch species in the Black Sea(Fig. 6).The use of grids to improve trawl selection depends little on the behavioural reactions of

species, but instead relies more on physical filtering the catch[19]. Grid designs tested in fisheries generally work by allowing those animals small enough to pass through a row of vertical bars to move into the codend while those that are too large are guided to their escape.

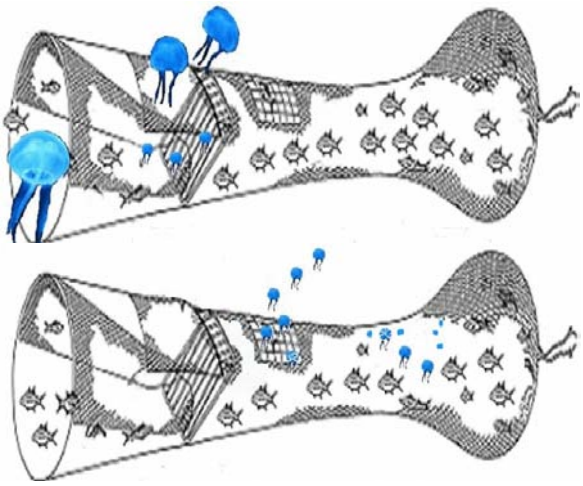

Fig 6—Speciesselectivity of grid and square mesh combinations

Consequently, large fish and other bycatch (dolphins, sharks, thornback ray and jellyfish) are expelled from the trawl, whereas the smallest fish can still be retained. Most of the recent work with grids has been done in the fishery, during which a grid with bar spacing of 35 mm and 70 mm diamond mesh codend significantly reduced the bycatch of fish when compared with a standard 70 mm diamond-mesh trawl.Trawl with the grid reduced the catch of commercially sized fish (whiting, haddock and cod) by 80–100% and undersized fish by 30–65% (by weight)[20].Besides, marine mammals and sturgeon are others bycatch in the Black sea trawl fishery. There are forbid fishery of dolphins protected by international laws and sturgeons are getting become extinct in Black Sea.

Grid practice could be preventing to catch of these species, on trawl fisheries in Black Sea. Additional we are consider getting more quality of target species and selectivity by grid systems in trawl net.

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