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Research Article

Retained and Trash Fish Catches of Beach-Seining in the Aegean Coast of Turkey

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Abstract: In this study, findings of the qualities and quantities of commercial and trash catches from beach-seining in coastal waters of the Aegean Sea are presented. A total of 62 finfish and eight invertebrate taxa were identified in catches sampled during May, June, July and September 1996, with 42 taxa being retained and 28 taxa being genuine trash catches. The estimated total ratio of commercial to genuine trash catch (kg) was 1:0.273. The fish and invertebrate species caught from beach seine fishery were typical of those that inhabit coastal embayments in the Aegean Sea. *Diplodus vulgaris*, *Diplodus annularis*, *Sarpa salpa*, *Pagellus erythrinus*, *Boops boops*, *Spicara flexuosa* and *Mullus barbatus* species dominated finfish catch, whereas *Loligo vulgaris*, *Octopus vulgaris* and *Eledone moschata* species from Cephalopods dominated in the commercial catch. *Serranus cabrilla, Chromis chromis, Raja mirelatus, Bothus podas, Crenilabrus tinca, Dasyatis pastinaca, Lepidotrigla cavillone, Raja clavata* and *Serranus scriba* species dominated the finfish catch and *Holothuria tubulosa* from the class Holothuridea dominated and some Crustaceans (e.g. *Squilla mantis, Palaemon* sp.) in the genuine trash catch. The rate of trash fish was found to be 21% of the total catch. This proportion supports the continued prohibition on the use of beach-seining gear.

Key Words: Beach-Seine, trash catches, Aegean Sea

Türkiye'nin Ege Denizi Kıyılarında Kıyı Sürütme (Trata) Balıkçılığında Alıkonan ve Atılan Değersiz Balık Miktarları

Özet: Bu çalışmada, Ege Denizi kıyılarında, kıyı sürütme (trata) balıkçılığından elde edilmiş, ticari olan ve değersiz avların kalite ve kantitesinin bulguları sunulmuştur. Mayıs, Haziran, Temmuz ve Eylül 1996 süresince örneklenmiş, toplam 62 balık ve 8 omurgasızdan, 42 adedi alıkonan ve 28 adedi ise gerçek değersiz av olarak atılanlar şeklinde tanımlanmıştır. Ticari avın gerçek değersiz ava oranı 1:0,273 kg tahmin edilmiştir. Trata ile yakalanan balık ve omurgasız türleri, Ege Denizi'nin kıyı bölgelerinde yaşayan tipik türlerdi. *Diplodus vulgaris*, *Diplodus annularis*, *Sarpa salpa*, *Pagellus erythrinus*, *Boops boops*, *Spicara flexuosa*, *Mullus barbatus* türleri ticari avın dominant balıklarıyken, *Loligo vulgaris*, *Octopus vulgaris* ve *Eledone moschata* türleri Cephalopodlarda ticari avda dominanttır. *Serranus cabrilla, Chromis chromis, Raja mirelatus, Bothus podas, Crenilabrus tinca, Dasyatis pastinaca, Lepidotrigla cavillone, Raja clavata, Serranus scriba* türleri dominant gerçek değersiz balıklar ve *Holothuria tubulosa* (Classis: Holothuridea) ve bazı Crustacea'ler (*Squilla mantis, Palaemon* sp.) de değersiz türler arasında dominant olarak bulunmuştur. Toplam değersiz balık oranı % 21 olarak bulunmuştur. Bu oran bile av aracının yasaklanmasına haklı bir destek sağlamaktadır.

Anahtar Sözcükler: Trata, değersiz av, Ege Denizi

Introduction

Alverson et al. (1) defined the term "bycatch" as discarded catch plus incidental catch. "Incidental catch" was the retained catch of non-targeted species, and "discarded catch" was the portion of the catch returned to the sea as a result of economic, legal or personal considerations. Discards may be defined as all those parts of the catch that are not used, but are discharged into the water as whole organisms, like unwanted fish or invertebrates (2). In addition to these terms a new concept that has arisen is "trash fish". Isa (3) defined that term as meaning the unnecessary wastage of fishery resources, and that trash fish are a part of the discards. Isa (3) delineated two groups of trash fish: "commercial trash fish" and "genuine trash fish". Genuine trash fish includes noncommercial and unconsumable fish.

Discard is one of the most important problem in fisheries all over the world. Alverson et al. (1) estimated average global discards at 27 million tonnes (ranging from 17.9 to 39.5 million tonnes), which is 27% of the

total world catch, and 564,613 tonnes are discarded in the Black Sea and the Mediterranean.

Although economic losses run to billions of dollars, the authors point to inadequate data to determine the biological, ecological, economic and cultural impacts of discards. Quick solutions to the problem seem unlikely and much more information is required (1). The common opinion amongst authors regarding trash landings is that an increase in fishing intensity for trash fish in shallow waters may result in the deterioration of useful demersal resources with a reduction of age at first capture and age composition of catch; such practices also endanger the stock of juvenile species and tend to produce failure in recruitment (3).

According to Kınacıgil et al. (4), discard and bycatch problems are very important in Turkish waters, mainly due to the multispecies nature of the fisheries. However, there are large gaps in both qualitative and quantitative discard statistics in Turkey.

Until recently, beach seiners caught young fish and genuine trash fish as well as adults from the littoral zone of the Aegean coast. No information was collated regarding the proportion of these fish groups. In April 2001, commercial beach seining was prohibited in all Turkish territorial waters, except for Edremit Bay. There is a seasonal closure in this area between 1 May and 31 August (5).

The effects of beach seines on sea grasses and young fish populations were investigated by Hoşsucu et al. (6-8), and Akyol and Özekinci (9). This study investigates the commercial and genuine trash fish proportion of beach seining on the Turkish Aegean coast for the first time.

Materials and Methods

The study was carried out on the Aegean coast of Turkey, lat 37°30'N – 38°55'N, (Figure 1).

The research vessel "Hippocampus" (16.5 m long, 135 HP) belonging to the Fisheries Faculty of Ege University was used in the survey during May, June, July and September 1996. Data were collected from 34 valid hauls between the depths of 4 and 30 m in the infralittoral zone.

The beach seine net used in the survey had a maximum length of 500 m hauling rope, a total of 400 m of wing length, and 36 mm mesh size codend. The

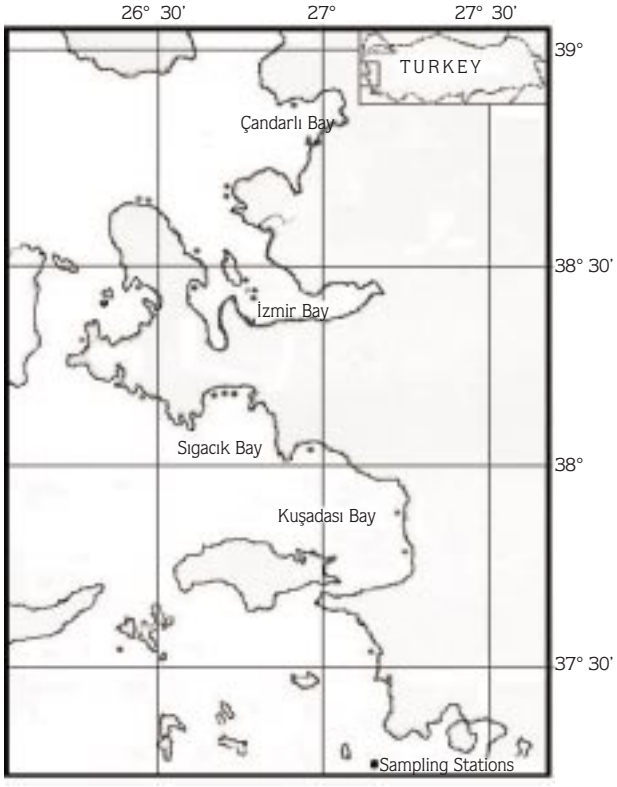

Figure 1. The sampling area.

rope and net are set from the vessel in a semi-circle starting and ending at the shoreline. One or two hauls during the daytime were carried out. A detailed drawing of the gear design is given in Akyol and Özekinci (9).

The entire catch was sorted and total weights and numbers were recorded on deck. The fork lengths (FL) of five fish species of commercial importance (*Pagellus erythrinus*, *Diplodus vulgaris*, *Diplodus annularis*, *Mullus barbatus* and *Mullus surmuletus*) were also measured to the nearest cm. The proportion of illegal landings for *Pagellus erythrinus*, *Diplodus vulgaris*, *Mullus barbatus* and *M. surmuletus* was obtained by dividing the amount of the illegal catch by the total catch. As the length measurements were taken for FL, the minimum landing size (MLS) of these species had to be converted into FL as well. However, there is no published data for the conversion of total length (TL) to FL. For this reason, by using the previous observations of another with this species, minimum landing fork lengths were assumed to be approximately 1 cm smaller than minimum landing total lengths. Legal MLS are 15 cm for *P. erythrinus* and *D. vulgaris*, 13 cm for *M. barbatus*, 11 cm for *M. surmuletus* and 1000 g for *Octopus vulgaris* (5). As there

is no MLS for *Diplodus annularis*, 10 cm, which is the length at first maturity (10) for the Mediterranean, is considered the critical length. Monthly catch per haul of commercially important species were obtained by dividing total catch (kg) by the number of hauls.

Results

A total of 62 finfish and eight invertebrate species were identified in catches throughout the survey (Table 1). A total of 42 taxa were retained and 28 taxa were genuine trash fish. *D. vulgaris* and *D. annularis* were

Table 1. Taxonomic composition of commercial and genuine trash beach-seine catches.

Commercial Catches				Genuine Trash Catches			
Species	N	Weight(g)	%	Species	N	Weight(g)	%
Diplodus annularis	1251	40,440	15.45	*Serranus cabrilla*	107	8318	11.66
Mullus barbatus	348	12,718	4.86	*Callionymus lyra*	1	37	0.05
Diplodus vulgaris	648	45,568	17.41	*Serranus hepatus*	39	808	1.13
Spicara flexuosa	345	12,982	4.96	*Coris julis*	38	1160	1.63
Pagellus acarne	125	4858	1.86	*Citharus linguatula*	32	978	1.37
Sparus aurata	8	845	0.32	*Arnaglossus laterna*	108	1311	1.84
Pagellus erythrinus	409	17,726	6.77	*Crenilabrus tinca*	94	4186	5.87
Boops boops	352	15,727	6.01	*Gobius niger*	12	261	0.37
Trachurus trachurus	4	129	0.05	*Trigloporus lastoviza*	42	1781	2.5
Trigla lucerna	14	1393	0.53	*Serranus scriba*	86	3073	4.31
Scorpaena porcus	115	5790	2.21	*Lepidotrigla cavillone*	194	3836	5.38
Mullus surmuletus	91	5394	2.06	*Uranoscopus scaber*	18	1200	1.68
Trachurus mediterraneus	114	2667	1.02	*Blennius ocellaris*	5	95	0.13
Spicara smaris	159	4830	1.85	*Chromis chromis*	488	6295	8.82
Zeus faber	25	2912	1.11	*Bothus podas*	108	4340	6.08
Scomber scombrus	3	553	0.21	*Labrus merula*	5	1330	1.86
Alosa fallax	26	850	0.32	*Balistes capriscus*	2	700	0.98
Sardina pilchardus	17	370	0.14	*Syngnathus acus*	1	3	0.004
Diplodus sargus	79	6570	2.51	*Raja mirelatus*	11	4689	6.57
Puntazzo puntazzo	51	4110	1.57	*Raja radula*	7	2939	4.12
Spondyliosoma cantharus	138	5735	2.19	*Torpedo marmorata*	2	680	0.95
Sarpa salpa	182	21,380	8.17	*Scyliorhinus canicula*	2	340	0.48
Trachinus draco	91	5115	1.95	*Dasyatis pastinaca*	5	4015	5.63
Solea vulgaris	3	230	0.09	*Raja clavata*	3	3350	4.7
Merluccius merluccius	3	310	0.12	*Myliobatis aquila*	1	80	0.11
Sparus pagrus	37	3980	1.52	*Holothuria tubulosa*	106	15,514	21.74
Scorpaena scrofa	5	810	0.31	*Squilla mantis*	1	24	0.03
Oblada melanura	50	1350	0.52	*Palaemon* sp.	1	5	0.01
Lithognathus mormyrus	3	610	0.23				
Spicara maena	121	2750	1.05				
Trachinus radiatus	7	530	0.2				
Saurida undosquamis	10	1150	0.44				
Scorpaena notata	9	250	0.1				
Lophius piscatorius	1	70	0.03				
Dentex dentex	25	4570	1.75				
Pagellus bogaraveo	34	355	0.14				
Scomber japonicus	13	950	0.36				
Loligo vulgaris	164	11,443	4.37				
Eledone moschata	24	4871	1.86				
Sepia officinalis	15	1435	0.55				
Octopus vulgaris	12	7290	2.79				
Penaeus japonicus	6	135	0.05				
TOTAL	5137	261,751	100	TOTAL	1519	71,348	100

found to be the dominant commercial fish; *Holothuria tubulosa* and *Serranus cabrilla* were found to be the dominant trash species during the survey period.

Commercial catch and genuine trash catch proportions were 79% and 21%, respectively (Figure 2). Commercial catches were divided into two main classes: Teleostei (90%) and Cephalopoda (10%) (Figure 3). Genuine trash catches were also divided into three main classes: Teleostei (55%), Selachii (23%) and Holothuridea (22%) (Figure 4).

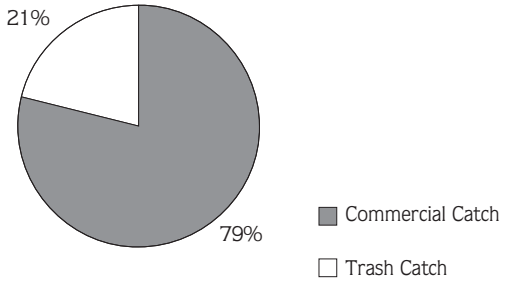

Figure 2. Commercial and trash catch proportions of beach seining.

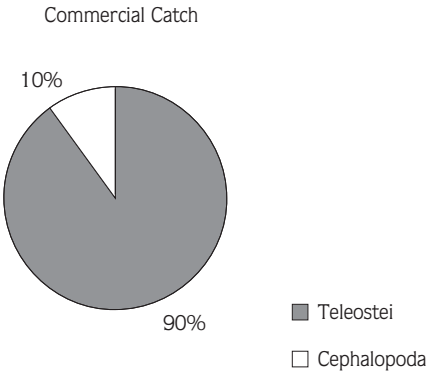

Figure 3. Teleostei and Cephalopoda proportions of commercial catches.

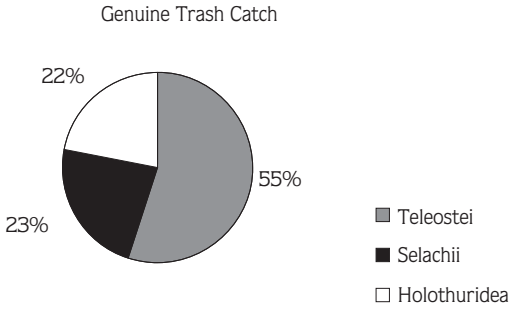

Figure 4. Teleostei, Selachii and Holothuridea proportions of trash catches.

The ratio of total weights of commercial catch to genuine trash catch was found to be 1:0.273 kg. However, some of the commercial catch is observed to be fish caught illegally due to the lack of checks during landing and marketing. These can be referred to as "black fish" (2).

Mean fork lengths of *P. erythrinus, M. barbatus, M. surmuletus*, *D. vulgaris* and *D. annularis* were 11.7 ± 0.16 cm (6.9-22.2 cm), 12.6 ± 0.15 cm (9.3-18.3 cm), 12.5 ± 0.28 cm (6.1-20.4 cm), 12.8 ± 0.3 cm (8.1-20.8 cm) and 11 ± 0.13 cm (7-16 cm), respectively (Table 2). Maximum catch per haul was 4.99 kg/haul in May 1996 for *D. annularis*.

The proportions of illegal landings are given in Table 3 and Figure 5. In terms of weight, 100% of *Octopus vulgaris*, 75% of *P. erythrinus*, 42% of *D. vulgaris*, 23% of *M. barbatus* and 7% of *M. surmuletus* were found to be illegally landed.

Discussion

Descriptions of the retained and trash catches from beach seine fishery on the Aegean coast of Turkey, lat 37°30'N–38°55'N, have not been reported previously. Machias et al. (11) pointed out that the main problem in the Mediterranean is the absence of the monitoring of the discarded fraction of the catches. Our results are the first to provide catch details from beach seine fishery along the Aegean.

The fish and invertebrate species caught from beach seine fishery were typical of those that inhabit coastal embayments in the Aegean Sea. *Diplodus vulgaris*, *D. annularis*, *Sarpa salpa*, *Pagellus erythrinus*, *Boops boops*, *Spicara flexuosa* and *Mullus barbatus* species dominated finfish catches, whereas *Loligo vulgaris*, *Octopus vulgaris* and *Eledone moschata* from the Cephalopods dominated in commercial catches. *Serranus cabrilla, Chromis chromis, Raja mirelatus, Bothus podas, Crenilabrus tinca, Dasyatis pastinaca, Lepidotrigla cavillone, R. Clavata* and *S. scriba* species dominated finfish catches and *Holothuria tubulosa* from the class Holothuridea dominated and some Crustaceans (e.g. *Squilla mantis, Palaemon* sp.) in genuine trash catches. Isa (3) points out that although most trash species are not of commercial importance, their existence supports the ecosystem of benthic communities in the food chain.

Table 2. Monthly catch per haul and length-weight statistics of some commercial fish.

P. erythrinus	Sampling dates									
	May 96		June 96		July 96		Sept. 96		Total	
	FL	W	FL	W	FL	W	FL	W	FL	W
Minimum	7.5	7	7.2	6	8.5	11	6.9	6	6.9	6
Maximum	22.2	210	16.5	76	17.9	106	13.8	50	22.2	210
Mean	12.5	42	11.3	28.3	11.4	28.8	10.9	23.8	11.7	32.6
Standard Error	0.35	4.18	0.26	2.2	0.25	2.44	0.35	2.28	0.16	1.74
n	71		70		60		16		217	
Catch per haul (kg)	3.23		1.42		0.41		0.23		1.48	
Hauling number	6		6		6		3		21	
M. barbatus										
Minimum	9.5	10	9.3	11	10.1	15	12	29	9.3	10
Maximum	18.3	121	16.5	70	17	65	16.8	55	18.3	121
Mean	12.9	37.4	12.2	28	12.1	27.3	13.5	38.9	12.6	32.5
Standard Error	0.25	2.62	0.21	1.61	0.36	2.4	0.5	3.3	0.15	1.38
n	65		60		20		9		154	
Catch per haul (kg)	2.51		1.56		0.18		0.17		1.57	
Hauling number	6		6		1		3		16	
M. surmuletus										
Minimum	11.9	26	12.3	25	6.1	3	7.1	5	6.1	3
Maximum	17	84	20.4	150	20.1	131	17.5	95	20.4	150
Mean	13.3	39	15	63.6	14.2	55.9	10	20.5	12.5	39.9
Standard Error	0.21	2.4	0.37	5.75	0.76	7.28	0.33	2.53	0.28	2.59
n	28		27		21		49		125	
Catch per haul (kg)	0.44		0.46		0.2		0.18		0.35	
Hauling number	6		5		2		4		17	
D. vulgaris										
Minimum	8.5	14	8.1	11	8.2	13			8.1	11
Maximum	15.5	90	18.6	141	20.8	226			20.8	226
Mean	11.7	38.2	13	55.7	13.7	74.7			12.8	56.5
Standard Error	0.34		0.5	7.3	0.59	9.51			0.30	4.51
n	39		23		40				102	
Catch per haul (kg)	2.16		0.66		6.55		0.12		2.47	
Hauling number	6		6		6		5		23	
D. annularis										
Minimum	8	10	7	6	8.2	12	8.6	12	7	6
Maximum	16	89	14.6	71	12.3	39	14.3	70	16	89
Mean	11.5	33.6	10.5	24.7	10.6	23.8	10.9	30.4	11	29.3
Standard Error	0.19	1.98	0.24	1.97	0.27	1.64	0.58	5.7	0.13	1.29
n	79		50		20		11		160	
Catch per haul (kg)	4.99		1.83		0.63		0.35		1.99	
Hauling number	6		6		4		7		23	

FL: Fork Length (cm); W: Weight (g)

Table 3. Illegal landing rate.

Species	Min. landing weight or size (TL)	Subsampling rate for measurements	Total amount (kg)	Illegally landed amount (kg)	Illegal landing percentage
P. erythrinus	15 cm	40	17.726	13.295	75
D. vulgaris	15 cm	13	45.568	19.139	42
M. barbatus	13 cm	40	12.718	2.925	23
M. surmuletus	11 cm	92	5.394	0.378	7
O. vulgaris	1000 g	100	7.290	7.290	100

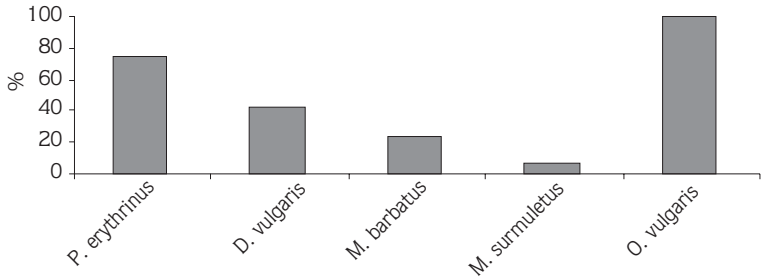

Figure 5. The proportion of the illegal landings of five commercial species during the survey.

In Turkish beach-seine fishery, the catches are usually marketable, except for trash catches. In this study, 21% of the total catch was estimated to be trash fish. However, illegally landed smaller sizes of *P. erythrinus* (75%), *M. barbatus* (23%), *M. surmuletus* (7%) and *D. vulgaris* (42%) are not included in this number. In other words, in a strictly controlled fishery this proportion would be even higher. According to Gray et al. (12), solutions to discarding problems in multispecies fisheries elsewhere include the development of more selective fishing gears and practices that minimise the capture of non-target species and undersized individuals of the target species.

Ege University Faculty of Fisheries has investigated the effects of beach-seine fishery on young fish populations and the littoral zone since 1988 (6-9). The fishing gear was found to be not selective enough and was destructive for the near-shore ecosystem, especially on *Posidonia* beds and young fish populations. In addition, the trash fish rate was also found to be rather high in this study.

The results of this study emphasise the correctness of the decision to prohibit beach seining. However, why Edremit Bay is still open to this type of fishing remains to be investigated.

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