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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) balıkçılığında 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 av oranı 1:0,273 kg tahmin edilmiştir. Trata ile yakalanan balık ve omurgasız türleri, Ege Denizi'nin kıyı bölgelerinde yaşayan tipik türlerdir. *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 Kinacıgil 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

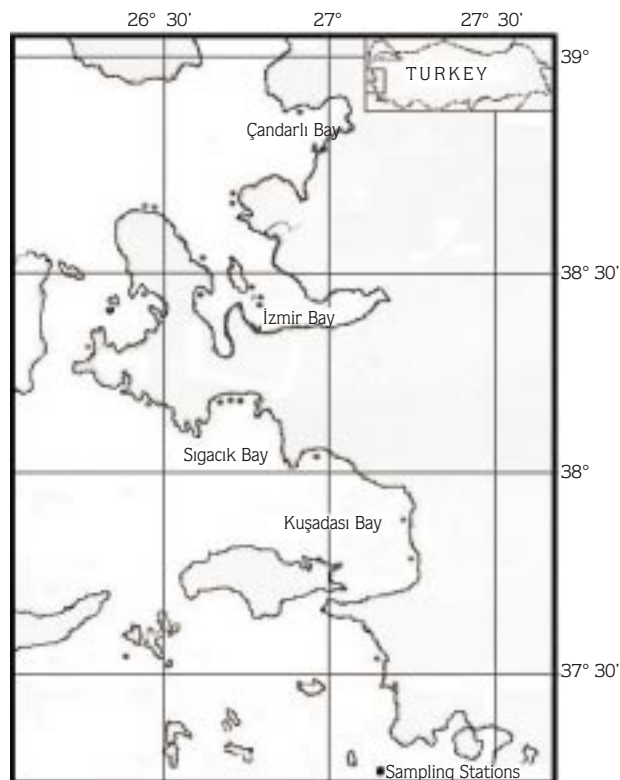


Figure 1. The sampling area.

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

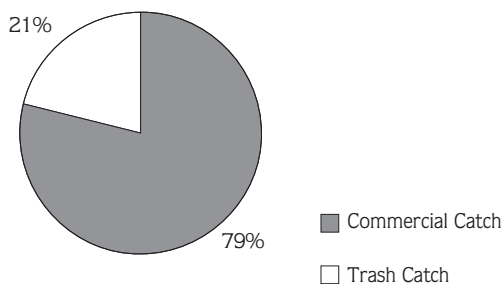


Figure 2. Commercial and trash catch proportions of beach seining.

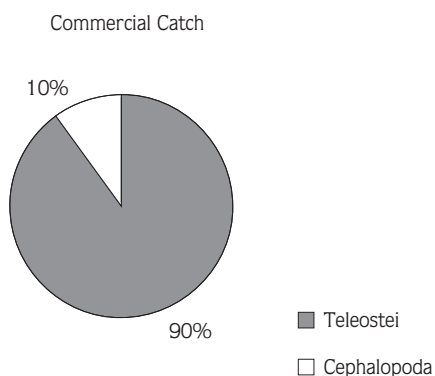


Figure 3. Teleostei and Cephalopoda proportions of commercial catches.

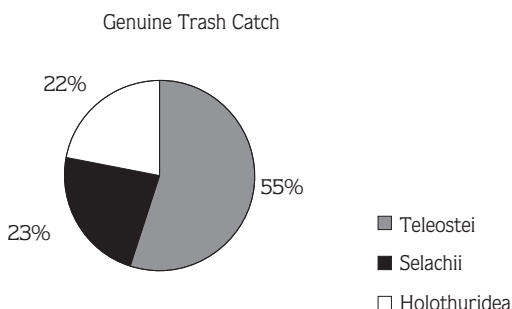


Figure 4. Teleostei, Selachii and Holothuridea proportions of trash catches.

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. scribea* 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.

| <i>P. erythrinus</i> | 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 |
| <i>M. barbatus</i> | | | | | | | | | | |
| 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 |
| <i>M. surmuletus</i> | | | | | | | | | | |
| 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 |
| <i>D. vulgaris</i> | | | | | | | | | | |
| 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 |
| <i>D. annularis</i> | | | | | | | | | | |
| 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 |
|----------------------|----------------------------------|-----------------------------------|-------------------|------------------------------|----------------------------|
| <i>P. erythrinus</i> | 15 cm | 40 | 17.726 | 13.295 | 75 |
| <i>D. vulgaris</i> | 15 cm | 13 | 45.568 | 19.139 | 42 |
| <i>M. barbatus</i> | 13 cm | 40 | 12.718 | 2.925 | 23 |
| <i>M. surmuletus</i> | 11 cm | 92 | 5.394 | 0.378 | 7 |
| <i>O. vulgaris</i> | 1000 g | 100 | 7.290 | 7.290 | 100 |

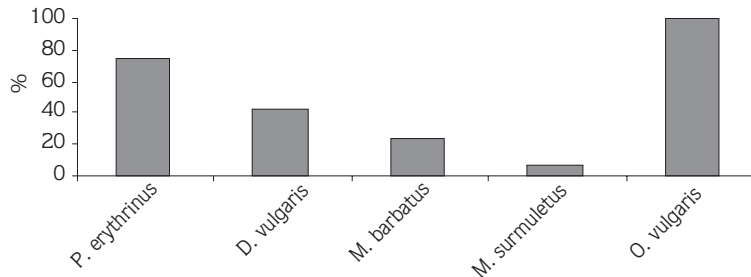


Figure 5. The proportion of the illegal landings of five commercial species during the survey.

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.

Acknowledgements

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