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# Determination of catch composition trotlines used in North Aegean Sea

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## Abstract

*In this study was carried out between April 2015 and January 2017 at 0-120 m depth areas where commercial fishermen were fishing in North Aegean Sea, Çanakkale coasts. In this study, it is aimed to determine the species composition of caught species in trotline fishing and to determine the target and non-target catch rates. 6 different trotline types were used. As a result of 174 catching operations 7210 individuals were catched in total. When the ratio of the target species in catching with the trotlines are evaluated, the trotlines within the fishing gears such as fish pots, trammel nets and longlines catch more of the target species.*

***Keywords:*** *Çanakkale, trotline, bycatch, North Aegean Sea.*

# Kuzey Ege Denizi'nde kullanılan çapari takımlarının av kompozisyonu

## Öz

*Bu çalışma Kuzey Ege Denizi, Çanakkale kıyılarında ticari balıkçıların avcılık yaptıkları 0 – 120 m derinlikte Nisan 2015- Ocak 2017 yılları arasında gerçekleştirilmiştir. Çalışma da çapari avcılığında avlanan türlerin tür kompozisyonu ile hedef ve hedef dışı av oranları belirlenmiştir. Çalışmada 6 farklı çapari tipi kullanılmış olup toplam 31 türden 7210 bireyin avcılığı yapılmıştır. Çapari takımları ile yapılan avcılıkta hedef tür oranları değerlendirildiğinde gırgır ve dip trolü haricinde ki sepet, uzatma ağları, paragat gibi av araçları içinde çapari takımlarının daha çok hedef türü avladığı öngörülmektedir.*

***Anahtar kelimeler:*** *Çanakkale, çapari, yan av, Kuzey Ege Denizi.*

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## 1. Introduction

The concept of fishing, which is not targeted, has become an issue that is important today and needs to be paid more attention in the next process. Over time, the fishing pressure on the fish stocks is increasing and thus the problems caused by the fishing gears due to the decrease in fish stocks are of interest. Studies on non-target fishing can be listed as; [1] (first study of the discard prediction), [2] (non-target fishing in shrimp trawling), [3] (non-target fishing in Australian demersal trawling), [4] (the impact of non-target fishing on fisheries management), [5] (the impact of discard on economy). [6], is the most recent global waste estimate, such studies in our country are quite low. Different percentages have been determined by the researchers under the leadership of FAO in the studies aimed to determine the total discard rates of the world. [7], found this rate to be approximately 35%, while [6], estimated it to be 8%. In both cases, these discard rates are quite high. According to [6], the highest amount of discard in the world is in the Northwest Pacific region. FAO is reported to be around 18 thousand tons in the 37 th fishing zone in the Mediterranean and Black Sea, although its discard rate is not clear. The average rate for trawl fishing is 40-45% [8]. The other fishing gears that caused the most discarding were sea snail dredges (11,5%), encircling nets (7,4%) and midwater trawls (5.1%). FAO reports do not inform about the discard rates of handline fishing.

Çanakkale Region has a coastline of 671 km and is located in three different systems, namely the Marmara Sea, the Bosphorus and the Aegean Sea and intense fish migrations occur between these regions [9]. It is a region where fishing activities are carried out for sportive purposes and being a livelihood source. Intensive fishing activities are carried out with trotlines in this region.

Trotlines are a fishing gear to use for catching surface or ground pelagic fishes like mackerel, horse mackerel, chub mackerel, bluefish. Catching efficiency of trotlines are lower than fishing with fishing nets such as trawls and purse seines and also it is an important method of fishing, because it catches fish with high economic value [10]. According to [11], the number of licensed boats engaged in fishing in our country is 18.790 while the number of boats using longline, handline and trotline is 3340. This figure is approximately 18% of the total number. When the boats are included in the handline class with longline and trotline according to the regions, there are 1487 in the Black Sea, 1155 in the Aegean Sea and 698 in the Mediterranean Peninsula [12]. There is no record of longline and handline fishing boats in the Marmara Sea. The Aegean Sea's continental shelf is narrow and due to its special location, fishing activities are mainly concentrated on coastal fishing [13]. The coastal fishing is a day-long in the Aegean Sea and it's generally made with fishing boats with a length of 5- 12 m. Fishing methods used in coastal fishing are coastal trammel nets, handlines, traps and lift nets [14]. Ensuring the continuity of non-target species is important for maintaining the balance of the ecosystem. For this purpose, it is very important to determine the target and non-target catch rates of the fishing gear used in fishing. In this study, it will be determined the ratio of the fishing gear, which is used extensively in both coastal fishing and sportive fishing, in target, non-target and discarded fish species and rate of in production.

## 2. Material and methods

The research was carried out on the shores of the North Aegean Sea, the Dardanelles Strait, the shores of the Gallipoli Peninsula, around the Islands (Bozcaada-Gokceada), and Saros Bay, where fishermen fishing in 0 to 120 m depth (Figure 1).

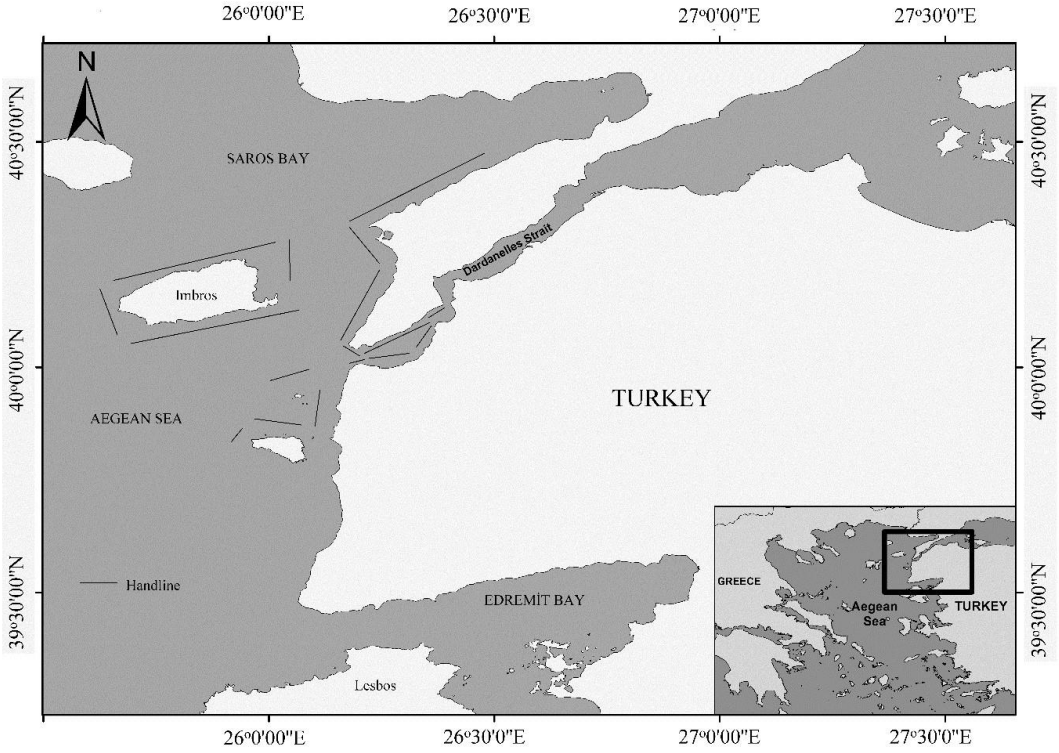


Figure 1. Fishing areas. (Çanakkale Strait, Gallipoli Peninsula, Saros Bay, Gökçeada, Mavra Islands, Bozcaada)

In the study, 6 different trotlines were used to determine the catch efficiency and catch composition. The trotlines used in the trials were the same features as the trotline used into this region.

### *2.1. Trachurus mediterraneus (Steindachner 1868) Mediterranean horse mackerel trotline*

Mackerel trotline; white, yellow, brown (mixed browny colors), orange, green colors are knotted to number 6, 7, 8, 9 hooks. 0.20 mm thick fishing line has been used as leader and 0.25 mm thick fishing line has been used as the surcease line. This trotline designed as 15 cm in length and 20 cm between leaders. 100-500 g weight is used according to the flow condition (Figure 2a).

### *2.2. Scomber scombrus (Linnaeus, 1758) Atlantic mackerel - Scomber japonicus (Houttuyn, 1782) Chub mackerel trotline*

Number 1, 2, 3, 4 hooks are knotted to white, pink, brown (mixed browny colors), orange, green colors as color. 0,35 mm fish line and 0,50 mm line as main body thickness were used as snood. These trotlines were equipped with 20 cm in length and 25 cm in length between snoods. 100-500 g weight is used according to flow (Figure 2b).

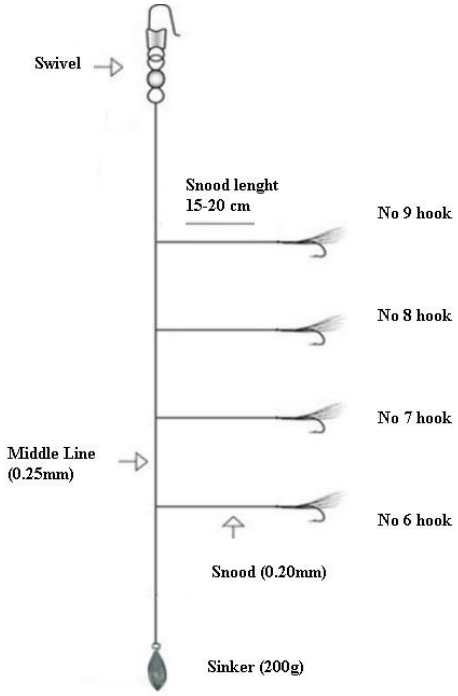


Figure 2a. Mediterranean horse mackerel trotline.

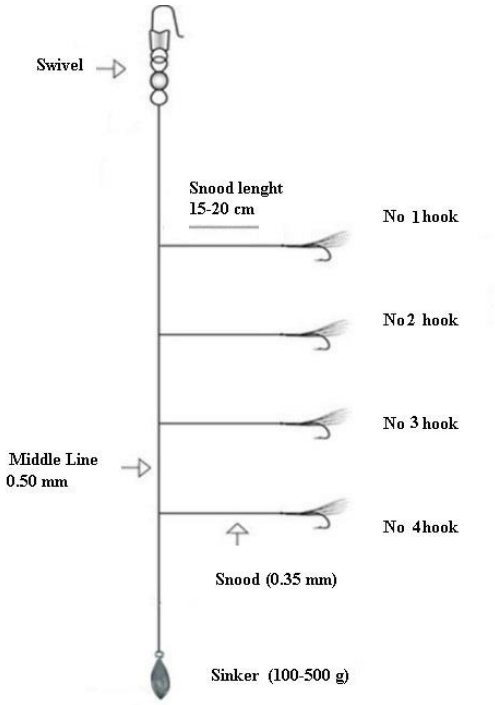


Figure 2b. Atlantic mackerel - Chub mackerel trotline.

### *2.3. Sarda sarda (Bloch, 1793) Atlantic bonito - Pomatomus saltatrix (Linnaeus, 1766) Bluefish trotline*

White, pink, red, orange, green colors are used as color in number 1/0, 2/0, 3/0, 4/0 hooks. 0,40 mm thickness used for snood, 0,60 mm used for fishing line and main body. These trotlines were equipped with a snood length of 60 cm and a spacing of 150 cm between snoods. 60-100 g weight is used according to flow (Figure 2c).

### *2.4. Pomatomus saltatrix (Linnaeus, 1766) Bluefish (Small) trotline*

Pink, white, red, yellow, green, orange colors are used as color in number 1/0, 2/0, 1, 2 hooks. 0,35 mm thickness used for snood, 0,50 mm used for fishing line and main body. These trotlines were equipped with a snood length of 25 cm and a spacing of 30 cm between snoods. 100-500 g weight is used according to flow (Figure 2d).

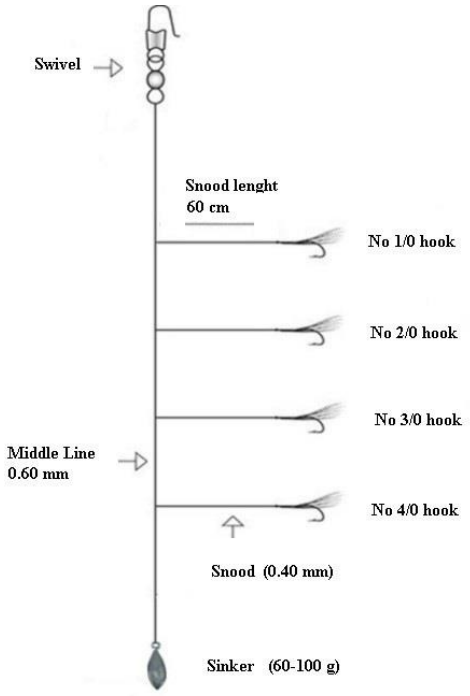


Figure 2c. Atlantic bonito - Bluefish trotline.

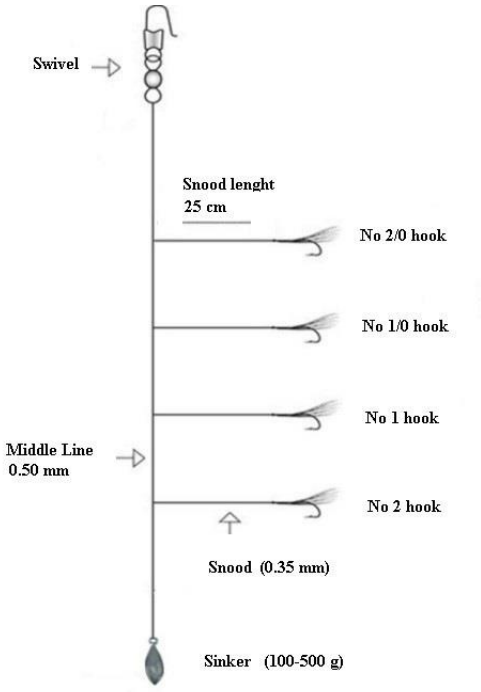


Figure 2d. Bluefish (Small) trotline.

### *2.5. Sarda sarda (Bloch, 1793) Atlantic bonito (Big) trotline*

Number 5/0, 6/0, 7/0, 8/0 hooks were used as hook numbers and as color white, yellow, red, orange, green colors were used. 0,70 mm thickness used for snood, 0,90 mm used for fishing line and main body. These trotlines were equipped with a snood length of 60 cm and a spacing of 100 cm between snoods. 50-100 g weight is used according to flow (Figure 2e).

### *2.6. Sardina pilchardus (Walbaum, 1792) European pilchard– Atherina boyeri (Risso, 1810) Big-scale sand smelt trotline*

Brown (mixed browny colors), white, yellow, green, orange colors are used as color in number 11, 12, 13, 14 hooks. 0,10 mm thickness used for snood, 0,15 mm used for fishing line and main body. These trotlines were equipped with a snood length of 10 cm and a spacing of 15 cm between snoods. 100-500 g weight is used according to flow (Figure 2f).

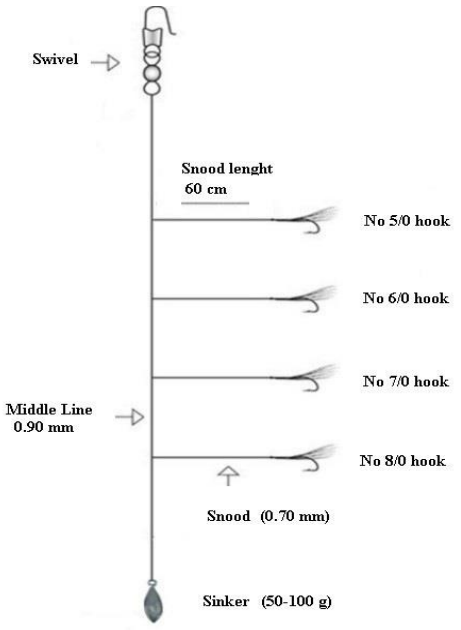


Figure 2e. Atlantic bonito (Big) trotline.

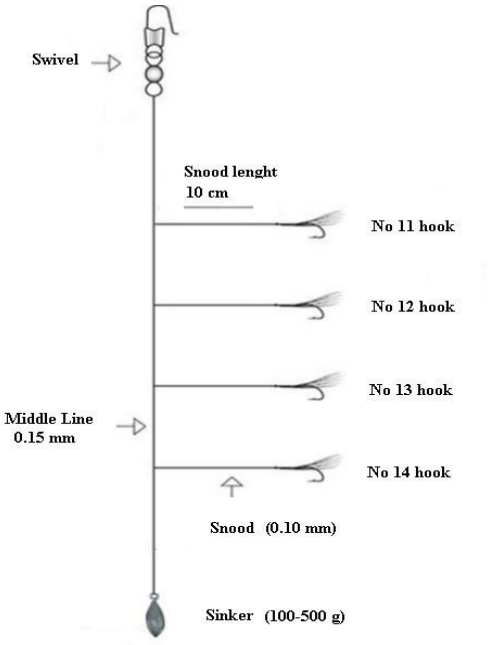


Figure 2f. European pilchard – Big-scale sand smelt trotline.

### *2.7. Fishing operation*

After preparing the trotlines to be used in the field, according to the flow and wind conditions, the fishing gears were left to the sea behind the boat. In these trotlines, the order of these gears were done randomly because of won't averting for each other's fishing activity. For the purpose of removing the effect of fishing efficiency, the trotlines were used alternately with an interval of 60 minutes. Captured species were separated for each trotline and their measurements were performed.

## 3. Results

Since the study was first in the North Aegean and the trotlines used had regional differences, firstly used tools, hooks, colors were determined, and the work was carried out with the trotlines prepared by considering these fishing tools. 7210 individuals of 31 species were caught. As a result of fishing, 15 families and 5870 bony fish belonging to 30 species and 20 *Loligo vulgaris* belonging to Loliginidae family (Squid) were sampled. Sparidae with 9 species, represented by more species among bony fish, followed by Scomberidae with 4 species. Serranidae, Centracanthidae, Clupeidae and Trachinidae families are represented by 2 species. Other families have contributed to diversity with 1 species. 1320 individuals from 4 families and 11 species are exemplified with baited Bluefish trotline. A total of 7210 fish were caught and 30 different species were identified. (Table 1).

Table 1. Catch composition obtained with the trotlines.

| **Class** | **Family** | **Species** | **Name** |
|---|---|---|---|
| Osteichthyes | Engraulidae | *Engraulis encrasicolus* | European anchovy |
| | Sphyraenidae | *Sphyraena sphyranea* | European barracuda |
| | Clupeidae | *Sardina pilchardus*<br>*Sardinella aurita* | European pilchard<br>Round sardinella |
| | Atherinidae | *Atherina boyeri* | Big-scale sand smelt |
| | Centracanthidae | *Spicara smaris*<br>*Spicara maena* | Picarel<br>Blotched picarel |
| | Carangidae | *Trachurus mediterraneus* | Horse mackerel |
| | Cepolidae | *Cepola rubenscens* | Red bandfish |
| | Sparidae | *Boops boops*<br>*Diplodus annularis*<br>*Diplodus vulgaris*<br>*Lithognathus mormyrus*<br>*Pagellus acerna*<br>*Pagellus bogaraveo*<br>*Pagrus pagrus*<br>*Spondyliosoma cantharus*<br>*Sparus aurata* | Bogue<br>Annular seabream<br>C. two - banded seabream<br>Sand steenbras<br>Axillary seabream<br>Blackspot seabream<br>Red porgy<br>Black seabream<br>Gilthead seabream |
| | Scombridae | *Scomber japonicus*<br>*Scomber scombrus*<br>*Sarda sarda*<br>*Euthyunus alletteratus* | Chub mackerel<br>Mackerel<br>Atlantic bonito<br>Little tunny |
| | Pomatomidae | *Pomatomus saltatrix* | Bluefish |
| | Scorpaenidae | *Scorpaena porcus* | Black scorpionfish |
| | Serranidae | *Serranus cabrilla*<br>*Serranus scriba* | Comber<br>Painted comber |
| | Triglidae | *Trigla lucerna* | Tub gurnard |
| | Trachinidae | *Trachinus araneus*<br>*Trachinus draco* | Spotted weever<br>Greater weever |
| Cephalapoda | Loliginidae | *Loligo vulgaris* | Common squid |

A total of 2435 individuals were caught with Horse mackerel trotline in a total of 7210 individuals caught by trotlines. Only 2 individuals can be caught at least as the gear is the Bonito trotlines. Shows the number of individuals caught by the trotline type (Table 2).

Table 2. Total number of individuals and species caught by trotline type.

| **Species** | Total number (n) | **Number of Individuals Caught by Trotline Type (n)** | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Bluefish (Small) | Big-scale. E. pilchard | Horse mackerel | Bonito Bluefish | Bonito (Big) | Mackerel Chub mackerel | **Grand total** |
| *Atherina boyeri* | 414 | 0 | 414 | 0 | 0 | 0 | 0 | 414 |
| *Boops boops* | 111 | 6 | 8 | 92 | 0 | 0 | 5 | 111 |
| *Cepola rubenscens* | 6 | 0 | 0 | 0 | 0 | 0 | 6 | 6 |
| *Diplodus annularis* | 3 | 2 | 0 | 1 | 0 | 0 | 0 | 3 |
| *Diplodus vulgaris* | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| *Engraulis encrasicolus* | 33 | 0 | 0 | 33 | 0 | 0 | 0 | 33 |
| *Euthynnus alletteratus* | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 2 |

Table 2. (Continued).

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *Lithognathus mormyrus* | 7 | 7 | 0 | 0 | 0 | 0 | 0 | 7 |
| *Loligo vulgaris* | 20 | 0 | 0 | 4 | 0 | 0 | 16 | 20 |
| *Pagellus acerna* | 71 | 30 | 11 | 29 | 0 | 0 | 1 | 71 |
| *Pagellus bogaraveo* | 414 | 53 | 41 | 253 | 0 | 0 | 67 | 414 |
| *Pagrus pagrus* | 8 | 1 | 0 | 5 | 0 | 0 | 2 | 8 |
| *Pomatomus saltatrix* | 1181 | 1181 | 0 | 0 | 0 | 0 | 0 | 1181 |
| *Sarda sarda* | 609 | 2 | 1 | 0 | 605 | 0 | 1 | 609 |
| *Sarda sarda* (Big bonito) | 2 | 0 | 0 | 0 | 0 | 2 | 0 | 2 |
| *Sardina pilchardus* | 89 | 4 | 13 | 61 | 0 | 0 | 11 | 89 |
| *Sardinella aurita* | 398 | 0 | 9 | 332 | 0 | 0 | 57 | 398 |
| *Scomber japonicus* | 1706 | 8 | 59 | 533 | 7 | 0 | 1099 | 1706 |
| *Scomber scombrus* | 568 | 20 | 0 | 50 | 9 | 0 | 489 | 568 |
| *Scorpaena porcus* | 2 | 0 | 0 | 1 | 0 | 0 | 1 | 2 |
| *Serranus cabrilla* | 108 | 9 | 0 | 15 | 0 | 0 | 84 | 108 |
| *Serranus scriba* | 65 | 0 | 0 | 2 | 0 | 0 | 63 | 65 |
| *Sparus aurata* | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 2 |
| *Sphyraena sphyraena* | 78 | 6 | 0 | 2 | 70 | 0 | 0 | 78 |
| *Spicara maena* | 9 | 0 | 3 | 6 | 0 | 0 | 0 | 9 |
| *Spicara smaris* | 45 | 16 | 1 | 16 | 0 | 0 | 12 | 45 |
| *Spondylosoma cantharus* | 3 | 1 | 0 | 2 | 0 | 0 | 0 | 3 |
| *Trachinus araneus* | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| *Trachinus draco* | 76 | 4 | 0 | 58 | 0 | 0 | 14 | 76 |
| *Trachurus mediterraneus* | 1177 | 56 | 29 | 938 | 1 | 0 | 153 | 1177 |
| *Trigla lucerna* | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| **Grand total** | 7210 | 1408 | 589 | 2435 | 694 | 2 | 2082 | 7210 |

2435 individuals (34%) were caught with Horse mackerel trotline among the total amount of catch according to the type of trotline used in the study. The second one is the Mackerel – Chub mackerel trotline with 2082 individuals (29%). Third one is Bluefish trotline with 1408 individuals (19%) and the fourth one is Atlantic bonito trotline with 694 individuals (10%). The fifth one is Big-scale sand smelt - European pilchard trotline with 589 individuals (8%). Last one is Bonito trotline (big bonito) with 2 individuals (0,003%) (Figure 3).

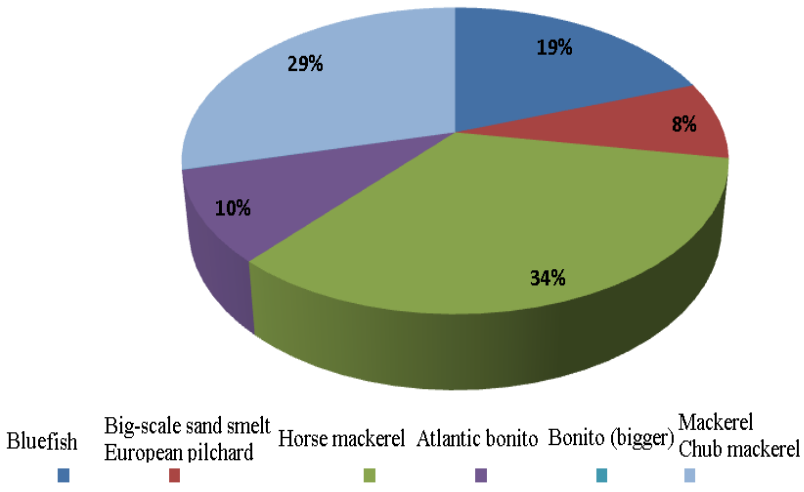


Figure 3. % Frequency values according to the trotline type.

Since the number of individuals caught in the Bonito trotline (big bonito) is only 2, the maximum rate of target species is 100%. Then, the target individual's most caught (87.2%) is the trotline type Atlantic bonito-Bluefish. The most common non-target fishing trotline type (61.5%), in other words trotline type with the lowest target catch rate is the Horse mackerel trotline. Then, the second most non-target individuals were caught (27.7%) with Big-scale sand smelt – European pilchard trotline. Distribution of target and non-target individuals according to the trotline type is given in Figure 4. 174 hunting operations were carried out with the trotlines used in the study. A total of 7210 and 781,57 kg of fish were caught. The target species and non-target species in 31 species hunted within the scope of the project were evaluated according to the surveys conducted with fishermen. (Figure 4).

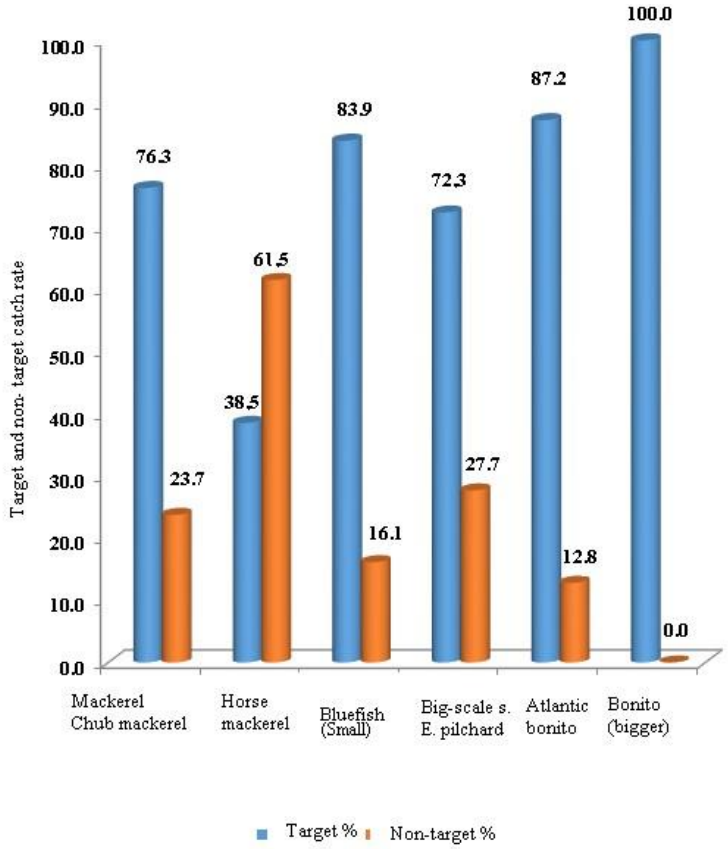


Figure 4. Distribution of target and non-target individuals for catching according to trotline type.

1497 (61%) target species were caught with Horse mackerel trotline, 938 (39%) were non-target individuals. 1588 (76,28%) target species were caught with Mackerel – Chub mackerel trotline and 494 (23,72%) non-target individuals were caught. 1181 (83,88%) target species were caught with Bluefish trotline, 227 (16,12%) were non-target individuals. 605 (87,18%) target species were caught with Atlantic bonito trotline, 89 (12,82%) were non-target individuals. 414 Big-scale sand smelt (70,29%) and 13 European pilchard (2,21%) target species were caught with Big-scale sand smelt – European pilchard trotline, 162 (27,5%) were non-target individuals

In order to extract the selectivity with the Bonito trotlines used in the study, enough data were obtained but only 2 individuals could be caught. The first fish from the caught Bonito was 56,2 cm in length and was caught with a white 5/0 straight galvanized hook

weighing 1854 grams and the second Bonito was caught 67,7 cm in length and weighing 4300 grams with orange 8/0 straight galvanized hook.

## 4. Discussion

In the study conducted in the Çanakkale Region, the studies conducted in the previous studies [15] indicated that 44 species were caught in the study using trammel nets. In another study using longline [16], a total of 61 species were caught as a result of fishing in 3 different regions (Saroz Gulf, Gallipoli Peninsula and Çanakkale Strait) in the North Aegean. The use of fish pots in the North Aegean Sea [17], catching yield trials, 49 species belonging to 27 families were caught. Almost all species caught were habitat dependent (not migrating) species. In a similar fish pot study, 59 species of 23 families were captured [18]. Trawl and beach seine studies carried out in the Gulf of Izmir; In total, 60 species were included in the catch composition of beach seine and 67 species for trawl catch composition [19]. In this study, which is used by trotlines, 31 species were caught. The reason for the low number of captured species diversity compared to other fishing gear, it is thought to be caused by catching only pelagic species with trotlines. Different results were obtained when the amount of fishing in other studies with fishing gear was evaluated. For example, in the study conducted by [20], in the Black Sea, a total of 11 different species, [21], in the Mediterranean, caught 25 species of fish using crossed and straight hooks. In this study, the number of caught species was taken as more samples compared to other studies when the studies done with fishing gears made at different time and in different regions were evaluated. The reason for this is that the North Aegean Sea, which is the study region, is due to its special ecosystem with the possible protection areas where the fish migrations are under the influence of different flow systems.

According to the type of trotline used in the study, 2435 individuals (34%) were caught in horse mackerel trotline with the highest number of catches. When the data on total weight basis is examined, the total length of the 781,57 kg product is chub mackerel with 266 kg. In the study, the most common target (87,2%) of the target trotline type is Bonito - Bluefish (surface) trotline. This is due to the fact that the Atlantic bonito fish migratory movement is very close to the surface. As the biggest problem in many studies on non-target species, which are the other fishing gears like longlines, are the caught of some species such as seagulls, mammals, sharks and sea turtles. However, in this study, the species has not been caught. The highest number of non-target catching (61,5%), in other words, trotline type with the lowest target catch rate is Horse mackerel trotline. The reason for this is that the Horse mackerel fish mixed with other pelagic species and the size of the hook is thought to be due to the small size.

In the study conducted with purse seine in comparison with other fishing tools, the target of the study and the non-target fishing gears were 91,09% of the catch amount in the Eastern Black Sea Region, 7,89% of the total amount was incidental and 1,02% has been observed that it forms discarded species. [22]. In a study conducted with the bottom trawl in the Western Black Sea, 98,38% of the total amount of the catches and 95,94% of the total weight are composed of target species. The ratio of non-target catch is 1,62% by total amount of catches and 4,06% by weight [23], In the study conducted in Taşucu Bay, in the winter to hunt 1 kg shrimp in the region; 1 kg incidental catch and 2 kg discard during catching; in spring for 1 kg shrimp, 3 kg incidental catch and 3 kg discard catch were calculated [14]. In the study conducted with Bogue trammel nets in the North

Aegean Sea, target catch, incidental catch and discard catch were determined as 82,82%, 15,44% and 1,75% respectively [24]. In a fishing with fish pot in İzmir Bay, 11 species (74%) with economic value in total catch and 8 species (26%) belonging to non-target catch [25]. In a study conducted in the North Aegean Sea with the longline, 37% of the total catch was identified as target species, 17% as incidental species and 46% as discarded species [16]. In this study, according to the trotline type, Bonito – Bluefish trotline has the most catch rate with 87,2%.

Most non-target individuals were caught with Horse mackerel trotline (61,5%), in the other words, the trotline type where the target catch rate is the lowest is the Horse mackerel trotline. When the ratio of the target species in catching with the trotlines are evaluated, the trotlines within the fishing gears such as fish pots, trammel nets and longlines catch more of the target species. 22 species were caught with Horse mackerel trotline, 18 with Mackerel – Chub mackerel trotline, and 6 with Bonito trotline. In the study, when an evaluation was made in terms of the species composition of the trotlines, the size reduction of the hook caused an increase the species composition.

18 species of fish were caught with Bluefish trotline. The fish that managed to swallow the trotline hooks and which are attracted to baited hooks (with European pilchard) has formed the species composition. Most fish were caught with no 2/0 hook in a study with Bluefish fishing gears [15] . In this study, most fish were caught with no 2/0 hook.

As a result, it is important to develop trotline fishing, which has become a traditional and important source of income for Çanakkale fishery and should be supported in both scientific and managerial terms. In parallel with the development of fisheries management in our country, it is necessary to increase the efficiency of such fishing gear, the reduction of non-target catch and the development of more environmentally friendly fishing gears and catching methods with species-specific fishing gears should be supported.

## Acknowledgment

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