Incidental catches of endangered (Phocoena phocoena) and vulnerable (Delphinus delphis) cetaceans and catch composition of turbot bottom gillnet fisheries in the southeastern Black...

Article *in* Cahiers de Biologie Marine · November 2018

3 authors, including:

Sabri Bilgin
Sinop Universty

Tuncay Yeşilçiçek
Recep Tayyip Erdoğan University

Cah. Biol. Mar. (2018) 59 : 571-577
DOI: 10.21411/CBM.A.E3AED15B

Incidental catches of endangered (*Phocoena phocoena*) and vulnerable (*Delphinus delphis*) cetaceans and catch composition of turbot bottom gillnet fisheries in the southeastern Black Sea, Turkey

Sabri BILGIN[1], Ozay KOSE[2] and Tuncay YESILCICEK[2]
(1) *Sinop University Faculty of Fisheries and Aquaculture, TR57000, Sinop, Turkey*
(2) *Recep Tayyip Erdogan University Faculty of Fisheries and Aquaculture, TR53000, Rize, Turkey*
Corresponding author: sbrbilgin@hotmail.com

Abstract: The present study summarizes information on the incidental catches of cetaceans and the catch composition of turbot bottom gillnet fisheries between March 2010 and September 2011 along the Rize coast in the southeastern Black Sea, Turkey. A total of 723 specimens (133 *Scophthalmus maeoticus*, 507 *Raja clavata*, 8 *Squalus acanthias*, 71 *Phocoena phocoena*, 4 *Delphinus delphis*) were recorded from 136 turbot gill net fishing operations. The ‘danger index’ or catch per unit effort (CPUE, individuals per km.day of netting) for cetaceans was 0.09 ± 0.028 in 2010, 0.15 ± 0.032 in 2011 and 0.13 ± 0.023 overall for *P. phocoena* and < 0.003 overall for *D. delphis*. Monthly CPUE values for target *S. maeoticus* and non-target species *R. clavata*, and *P. phocoena* were similar in all years. An increasing CPUE trend between April and June was evident for target and non-target species in 2010 and 2011. The CPUE of *P. phocoena* was estimated highest in May as 0.18 ± 0.088 in 2010 and in April as 0.26 ± 0.086 in 2011. A similar pattern was evident for *S. maeoticus* and *R. clavata*. One-way ANOVA showed that no statistical significant difference of target and non-target species CPUE among 2010, 2011 and all data ($P > 0.05$). No new net damage due to cetacean interactions with the turbot gill nets was detected.

Résumé : *Captures accidentelles de cétacés menacés (*Phocoena phocoena*) et vulnérables (*Delphinus delphis*) et composition des captures par la pêcherie de turbot en Mer Noire sud orintale, Turquie.* Cette étude résume l’information relative aux captures accidentelles de cétacés et à la composition des captures de la pêcherie de turbot entre mars 2010 et septembre 2011 le long de la côte de Rize en Mer Noire sud orientale, Turquie. Un total de 723 individus (133 *Scophthalmus maeoticus*, 507 *Raja clavata*, 8 *Squalus acanthias*, 71 *Phocoena phocoena*, 4 *Delphinus delphis*) ont été récoltés au cours de 136 campagnes de pêche. L’indice de risque ou capture par unité d’effort (CPUE, ind.km^{-1}.jour^{-1}) pour les cétacés était de 0,09 ± 0,028 en 2010, 0,15 ± 0,032 en 2011 et 0,13 ± 0,023 globalement for *P. phocoena* et < 0,003 globalement for *D. delphis*. Les valeurs mensuelles de CPUE pour l’espèce cible *S. maeoticus* et pour les espèces non ciblées *R. clavata*, et *P. phocoena* étaient semblablespour les 2 années d’étude. Une augmentation du CPUE s’est produite entre avril et juin pour les espèces ciblées et non ciblées en 2010 et en 2011. Le CPUE de *P. phocoena* était maximal en mai 2010 (0,18 ± 0,088) et en avril 2011 (0.26 ± 0.086). Un patron du même type a été mis en évidence pour *S. maeoticus* et *R. clavata*. Une ANOVA à un facteur n’a pas mis en évidence de différence significative du CPUE des espèces entre les deux périodes (P > 0,05). Aucun dommage des filets liés à l’interaction avec les cétacés n’a été détecté.

Keywords: Turbot gillnet ● Cetaceans ● Harbour porpoise ● By catch ● Black Sea

Reçu le 16 octobre 2017 ; accepté après révision le 12 février 2018.
Received 16 October 2017; accepted in revised form 12 February 2018.

Introduction

Turbot, *Scophthalmus maeoticus* (Pallas, 1814), is one of the most important commercial demersal fish species in Turkey and over recent years, the average annual catch was about 884 ± 246 tonnes (TUIK, 2015). Legal turbot fisheries with turbot gill nets are conducted throughout the year, except for a closed season between 15 April and 15 June (Anonymous, 2017) in the Turkish Seas. However, in the last few years, the natural turbot stocks have been gradually exhausted, so that while turbot fishing production was 2,700 tonnes in 2000, total turbot fishing production fell to 769 tonnes in 2007, 528 tonnes in 2008, 383 tonnes in 2009 and 295 tonnes in 2010. Turbot gill net fishing effort is unquantified in the Black Sea and these fishing nets are the most dangerous fishing gears for incidental mortality of Black Sea cetaceans (Radu et al., 2003; Birkun, 2002). However, there is an attempt that the fishing boats engaged in turbot fisheries are between 7 to 30 m in length and that there are about 204 such boats operating 25,000 turbot gill nets from twelve ports in the western Black Sea alone (Tonay & Öztürk, 2003).

There are three cetacean species, the harbour porpoise, *Phocoena phocoena* (Linnaeus, 1758) common bottlenose dolphin, *Tursiops truncatus* (Montagu, 1821) and short beaked common dolphin, *Delphinus delphis* (Linnaeus, 1758) in the Black Sea (Zaitsev & Mamaev, 1997; Öztürk et al., 2004). In the Black Sea, all three species of small cetaceans have been subject to commercial exploitation in the past (prior to 1966 in the USSR, Romania and Bulgaria, and prior to 1983 in Turkey), and it is clear that other anthropogenic impacts such as habitat degradation, pollution, physical modification of the seabed, disturbance and especially incidental catch in fishing gears have further influenced and reduced populations of Black Sea cetaceans (Birkun, 2002). Almost all of the cetaceans, especially *P. phocoena,* are caught in bottom set gillnets targeting species that include turbot (*S. maeoticus*), spiny dogfish (*Squalus acanthias* Linnaeus, 1758) and sturgeon (*Acipenser* spp.) in the Black Sea and peak bycatch occurs in spring and summer months during the turbot fishing season, in the territorial waters of all six riparian countries (Birkun, 2002; Öztürk et al., 2004). Overfishing and declining water quality have also reduced the Black Sea fish stocks such as anchovy, sprat and other forage species on which these cetaceans prey (Kideys, 1994).

Bycatch values of Black Sea cetaceans has been already studied in some parts of the Black Sea, especially for the turbot gill net fishery (Öztürk et al., 1999; Birkun, 2002; Tonay & Öztürk, 2003; Radu et al., 2003; Tonay, 2016) in the western and central (Gönener & Bilgin, 2009) region. However, there has until now been no investigation on cetacean bycatch levels in the southeastern Black Sea. Bycatch estimation of fish and cetaceans in the turbot gill net fisheries of cetaceans may differ significantly between the seasons and geographical areas (Öztürk et al., 1999; Gönener & Bilgin, 2009; Tonay, 2016). The present study summarizes information on the incidental catch rates, or net danger index, for cetaceans, and CPUE for target fish species, *S. maeoticus* and non-target fish species, *R. clavata*, and *S. acanthias*. This paper also describes information on the catch composition of cetaceans and elasmobranch species during turbot bottom gillnet fishing between March 2010 and September 2011 along the Rize coast in the southeastern Black Sea, Turkey. The present study also examines turbot gill net damage in Turkish Black Sea waters for the first time.

Materials and Methods

Turbot gill net fishing operations surveys were conducted monthly between March 2010 and September 2011 on the Rize coasts of the southeastern Black Sea (Fig. 1). A total of 136 turbot gill net operations, 72 in the Iyidere area, and 64 in the Ardeşen area along the Rize coast, were conducted in water depths of between 10 and 50 m. To calculate the effects of turbot gill nets fisheries on the catch of target (*Scophthalmus maeoticus*) and non-target species (*Phocoena phocoena*, *Delphinus delphis*, *Raja clavata* Linnaeus, 1758, *Squalus acanthias*) during the closed fishery season, monthly sampling operation were conducted with a special permit for turbot gill net in the study area.

Turbot gill net sets belonging to commercial turbot gill net fishermen were used for monthly fishing operation. The characteristics of these nets were as follows: the rigged length of one turbot gill net panel was 72 m (about 40 fathom length) and one fleet of nets consisted of 5-7 such panels

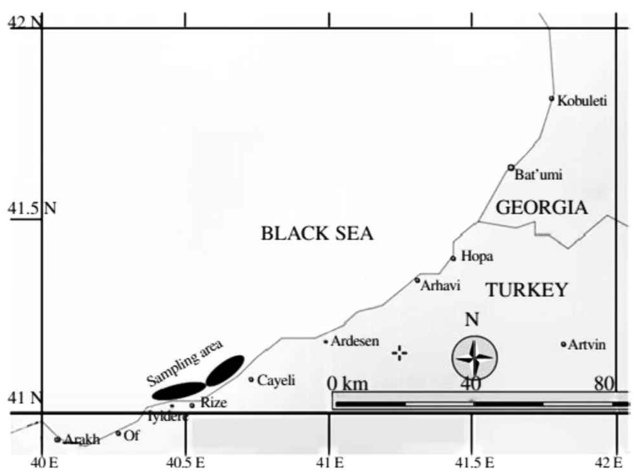

Figure 1. Turbot gill net fishing operations sampling area on the Rize coasts in the southeastern Black Sea.

(0.36-0.504 km in total). Monthly sampling operations was conducted with these set nets such that the total length of nets set ranged between 0.36 and 1.8 km (mean 0.60 ± 0.026 km) and the total soak time ranged between 3.81 and 18 days (mean 7.64 ± 0.219 days) for one fishing operation depending on sea conditions. Several turbot gill net operations were conducted on the same day (in April, May and June) at different depths with different lengths of turbot gill nets but with the same characteristics such as mesh size (320 mm stretched), mesh depth (7 mesh), twine thickness (210 d / 2×3 no) and hanging ratio (E = 0.36). The characteristics of the turbot gill net according to FAO standards showed detail in figure 2 (Nédélec, 1975).

Catch per unit effort (CPUE) or danger index was calculated as the number of caught individuals divided by the total set net length (km) x soak time in days (24 hours). Catch per unit effort (CPUE; individuals.km^{-1}.day^{-1}) for each species (target: *S. maeoticus*, by catch: *R. clavata*, *S. acanthias*, *P. phocoena* and *D. delphis*) were used for comparison of catch rate among the years and the months.

One-way ANOVA was used to determine the CPUE difference of the target and non-target species between months and years. The statistical analyses were performed with the software package PAST version 1.94b (Hammer et al., 2001). Statistical significance level of 0.05 was used.

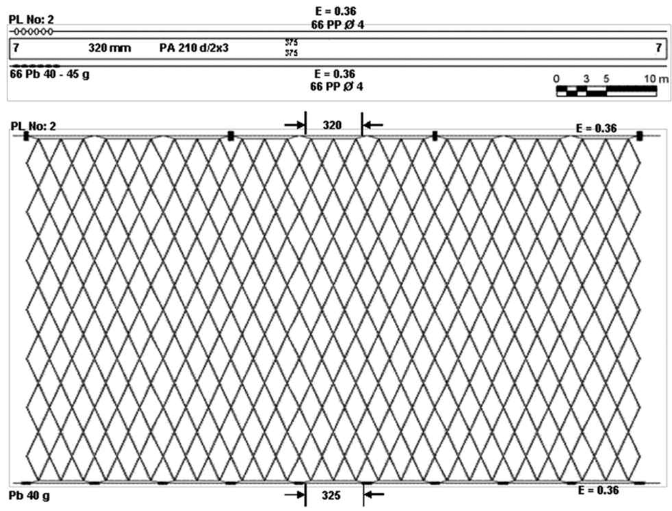

Figure 2. Characteristics of turbot gill net used in monthly samplings.

Results

A total of 136 operations (49 in 2010 and 87 in 2011) were conducted between March 2010 and September 2011 in two areas along the Rize coast. A total of 723 specimens (133 *S. maeoticus*, 507 *R. clavata*, 8 *S. acanthias*, 71 *P. phocoena*, and 4 *D. delphis*) were recorded in these operations. In 13 turbot fishing operations there were no individuals caught (Table 1). A total of 75 cetaceans (71 *P. phocoena*, 4 *D. delphis*) were catch incidentally during sampling. 13 of 71 caught individuals of *P. phocoena* were pregnant: 1 individual in February 2011, 5 in April 2011, and 7 in May 2011.

An interesting observation is that when *P. phocoena* bycatch was observed, a number of live *P. phocoena* and sometimes *D. delphis* were also observed around the sampling area and near the boat.

72 turbot gill net fishing operations in Iyidere region were investigated in more detail to determine levels of net damage. It was observed that only 7 fishing operations did not catch cetaceans in the net (net total length; 43.2 km, 216 km, 86.4 km, 129.6 km, 302.4 km, 201.6 km, 129.6 km, damage size; 2.9 × 2.6 m, 6.7 × 2.6 m, 2.4 × 1.6 m, 5 × 2 m, 2.5 × 1 m, 3 × 1.5 m, 4 × 2 m, respectively) and the damages were due to mechanical mesh torn. From the 136 turbot fishing samplings in the study, 71 *P. phocoena* individuals were observed as by catch in just 39 fishing operations and 4 *D. delphis* individuals observed by catch in just 4 such operations. *P. phocoena* and *D. delphis* had not explicitly damaged the turbot gill net, despite the fact that they had become caught and were regrettably drowned.

The catch composition for turbot gill net fisheries for 2010 and, 2011, and for both years are shown in figure 3. The highest catch rates were for *R. clavata* > *S. maeoticus* > *P. phocoena* > *S. acanthis* > *D. delphis*. The highest values of the percentage of catch composition were calculated as 62.0% in 2010 and 80.9% in 2011 for *R. clavata* and 12.3% in 2010 23.0% in 2011 for *S. maeoticus*. The percentage of catch composition of cetacean species was estimated to be 6.5% in 2010, 12.3% in 2011 for *P. phocoena* and 0.3% in 2010, 0.7% in 2011 for *D. delphis* (Fig. 3). Although *R. clavata* constitutes the most amount of the catch in the turbot fishing, this fish is not assessed in any way and is thrown into the sea after being caught by the fisherman in the Black Sea.

Yearly CPUE of species caught by turbot gill net fisheries between March 2010 and September 2011 are shown in figure 4. The CPUE was calculated as 0.18 ± 0.0039 in 2010, 0.33 ± 0.061 in 2011 and 0.28 ± 0.042 in all data for target fish species, *S. maeoticus* and as 1.32 ± 0.0493 in 2010, 0.82 ± 0.169 in 2011 and 1.00 ± 0.208 in all data for non-target fish species *R. clavata*. The danger index was calculated as 0.09 ± 0.028 in 2010, 0.15 ± 0.032 in 2011 and 0.13 ± 0.023 in all data for cetacean species, *P. phocoena*. This index was calculated as < 0.003 in 2010, 2011 and all data for *S. acanthias* and *D. delphis*. The CPUE values for all species were not statistically different among 2010, 2011 and all data (One-way ANOVA; $P > 0.05$) (Fig. 4).

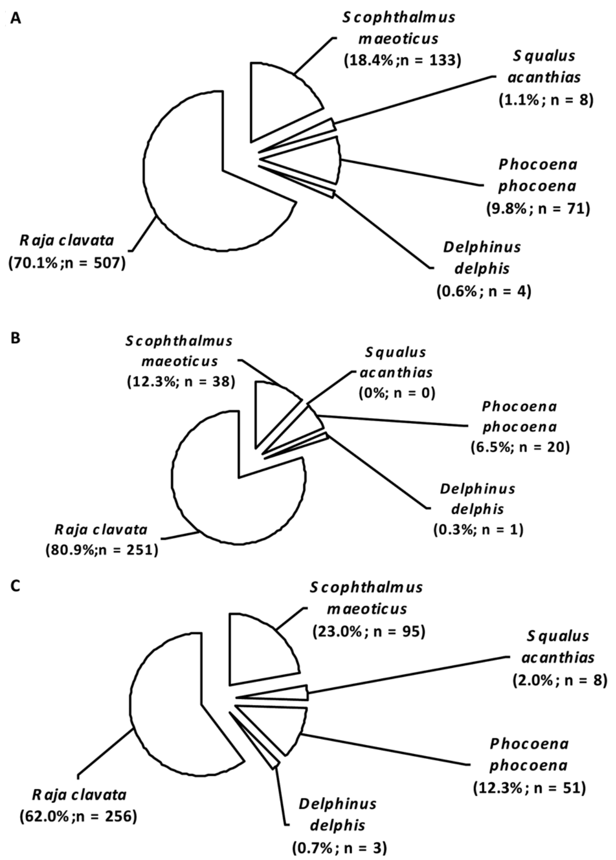

Figure 3. Percentage of catch composition for turbot gill net fisheries in the Black Sea. **A.** In 2010 + 2011. **B.** In 2010. **C.** In 2011.

Monthly the CPUE values for all species are shown in table 1. Monthly CPUE fluctuation patterns of target, *S. maeoticus* and non-target species, *R. clavata*, and *P. phocoena* were similar in both years. The increasing CPUE pattern between April and June was evident for all species in both years. The sampling procedure focused mainly these months. Therefore, the highest CPUE of target and non-target species was observed in spring season. Namely, *P. phocoena* was by caught mostly between April and June both 2010 and 2011. The highest CPUE value was calculated as 0.26 ind.km^{-1}.day^{-1} for *P. phocoena*. For both years; 2010 and 2011, April, May and June were the important time period for by catch level of cetaceans especially *P. phocoena*. Similarly catch levels of fish species firstly *R. clavata* and secondly *S. maeoticus* were the highest values in this period. The highest CPUE value was estimated as 0.48 ± 0.125 in April 2011 for *S. maeoticus* and as 3.48 ± 1.000 in May 2010 for *R. clavata*. Seasonally CPUE values for *P. phocoena*, *R. clavata* and *S. maeoticus* are shown in figure 5. There are no statically differences between the CPUE values of the species (P > 0.05). The seasonal patterns of the CPUE values were similar for *R. clavata* and *S. maeoticus*. The CPUE values of P. phocoena were similar in spring (0.14 ± 0.027) and winter (0.14 ± 0.071) but it was lower values in summer (0.09 ± 0.050) and zero in autumn (Fig. 5).

Discussion

Cetacean bycatch in the turbot gill net fishery was reported for the western coast of Turkish Black Sea (Öztürk et al., 1999; Tonay & Öztürk, 2003; Tonay, 2016) and also center coast of the Turkish Black Sea (Gönener & Bilgin, 2009). However, there has been no study investigation on the cetacean by catch levels in the southeastern Black Sea.

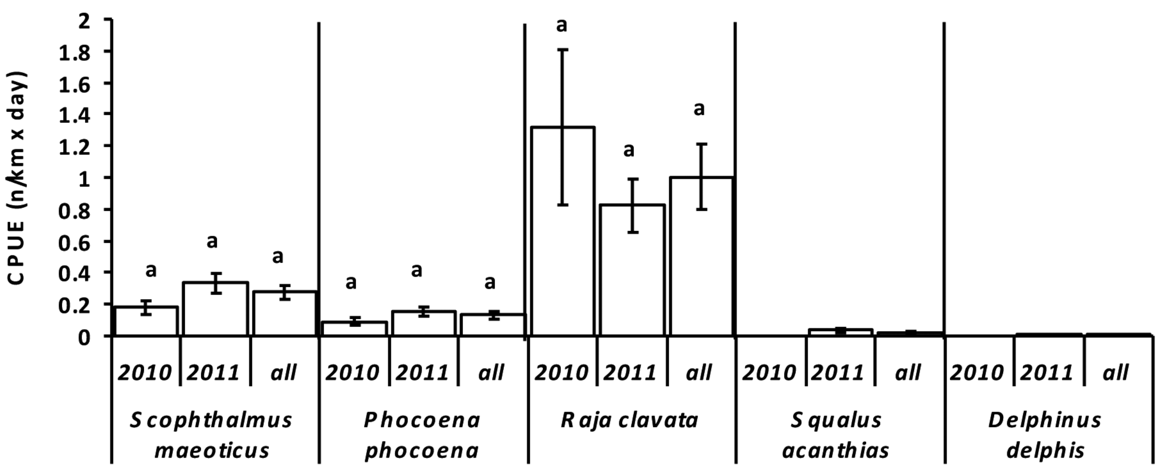

Figure 4. Yearly CPUE of species caught by turbot gill net fisheries between March 2010 and September 2011. Mean with different letters are significantly different (P < 0.05).

Table 1. Monthly CPUE of species caught in turbot gill net fisheries between March 2010 and September 2011. N: number of operations. The numbers in parentheses indicate the number of individuals. *Superscript numbers by exhibiting with asterisks refers to number of operations with no catches at all.

Year	Month	N	Species (CPUE ± SE; n/km x day)				
			Scophthalmus maeoticus	*Raja clavata*	*Squalus acanthias*	*Phocoena phocoena*	*Delphinus delphis*
2010	March	1	0.13 (3)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)
	April	28	0.19 ± 0.055 (21)	0.70 ± 0.095 (73)	0.00 (0)	0.06 ± 0.031 (6)	0.00 (0)
	May	10	0.10 ± 0.077 (6)	3.48 ± 1.000 (144)	0.00 (0)	0.18 ± 0.088 (10)	0.00 (0)
	June	2	0.24 ± 0.137 (3)	0.16 ± 0.158 (2)	0.00 (0)	0.08 ± 0.029 (1)	0.08 ± 0.019 (1)
	July	1	0.00 (0)	0.39 ‘4)	0.00 (0)	0.10 (1)	0.00 (0)
	August	0	-	-	-	-	-
	September	1	0.29 (1)	4.01 (14)	0.00 (0)	0.00 (0)	0.00(0)
	October	2	0.38 ± 0.184 (2)	1.73 ± 1.340 (9)	0.00 (0)	0.00 (0)	0.00 (0)
	November	1^{1*}	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)
	December	3	0.26 ± 0.130 (2)	0.65 ± 0.261 (5)	0.00 (0)	0.26 ± 0.130 (2)	0.00 (0)
2010		**∑49**	**0.18 ± 0.039 (38)**	**1.32 ± 0.493 (251)**	**0.00 (0)**	**0.09 ± 0.028 (20)**	**0.001 ± 0.003 (1)**
2011	January	1^{1*}	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)
	February	3	0.08 ± 0.077 (1)	0.88 ± 0.358 (10)	0.00 (0)	0.08 ± 0.077 (1)	0.00 (0)
	March	3	0.00 ± 0.000 (0)	0.96 ± 0.214 (12)	0.00 (0)	0.00 (0)	0.00 (0)
	April	23^{2*}	0.48 ± 0.125 (30)	1.64 ± 0.572 (123)	0.05 ± 0.039 (3)	0.26 ± 0.086 (20)	0.01 ± 0.005 (1)
	May	44^{2*}	0.37 ± 0.095 (55)	0.57 ± 0.099 (97)	0.04 ± 0.028 (5)	0.13 ± 0.039 (24)	0.01 ± 0.006 (1)
	June	10^{4*}	0.15 ± 0.088 (9)	0.34 ± 0.230 (14)	0.00 (0)	0.11 ± 0.075 (6)	0.02 ± 0.011 (1)
	July	1^{1*}	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)
	August	1^{1*}	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)
	September	1^{1*}	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)	0.00 (0)
2011		**∑87**	**0.33 ± 0.061 (95)**	**0.82 ± 0.169 (256)**	**0.03 ± 0.017 (8)**	**0.15 ± 0.032 (51)**	**0.01 ± 0.004 (3)**
All (2010+2011)		**∑136**	**0.28 ± 0.042 (133)**	**1.00 ± 0.208 (507)**	**0.02 ± 0.011 (8)**	**0.13 ± 0.023 (71)**	**0.01 ± 0.003 (4)**

When there is a turbot gill net fishery in the Black sea, the estimations of by catch compositions levels may differ significantly between the season and areas due to different movement and habitat characteristics of cetaceans and fish. Vinther (1999) reported a significant seasonal bycatch effect with highest bycatch of *P. phocoena* in August-September in the North Sea, accompanied by a decrease in the mean length of bycaught individuals, possibly due to increased diving behaviors of newly weaned calves, or because calving which occurs in early summer may have been in coastal waters while gillnet sampling was further offshore. Vinther also reported an increase in *Phocoena* strandings in the warmer months on the North Sea coast of Germany. We observed that by catch of *P. phocoena* level was highest in spring in coastal waters. At this time *S. maeoticus* migrates towards to the coast up to 20-30 m depth for spawning between April and June in the southeastern Black Sea (Zengin, 2000) since this migration patterns target (*S. maeoticus*) species' CPUE may be higher levels. Turbots therefore live embedding into the sandy bottom out of the reproduction period mainly autumn and winter seasons, and so to catch turbot in colder times is quite difficult using turbot gill nets (Zengin & Düzgüneş, 2003). In the Black Sea, the breeding and calving period of Black Sea cetaceans occurs in spring and early summer (Birkun, 2002). In the Turkish Black Sea coast, turbot fishing season coincidences with *P. phocoena* breeding and calving period and so, *P. phocoena*' CPUE "net danger index" may be higher in spring season. Another reason of higher net danger index of *P. phocoena* in spring season may be due to living space and feeding resources of them. According to Birkun (2002) fisheries have limited the living area and feeding resources of Black Sea cetaceans, since cetacean distribution and migrations largely depending on the distribution, migration and abundance of prey stocks. Reduction of fish stocks e.g. anchovy, sprat,

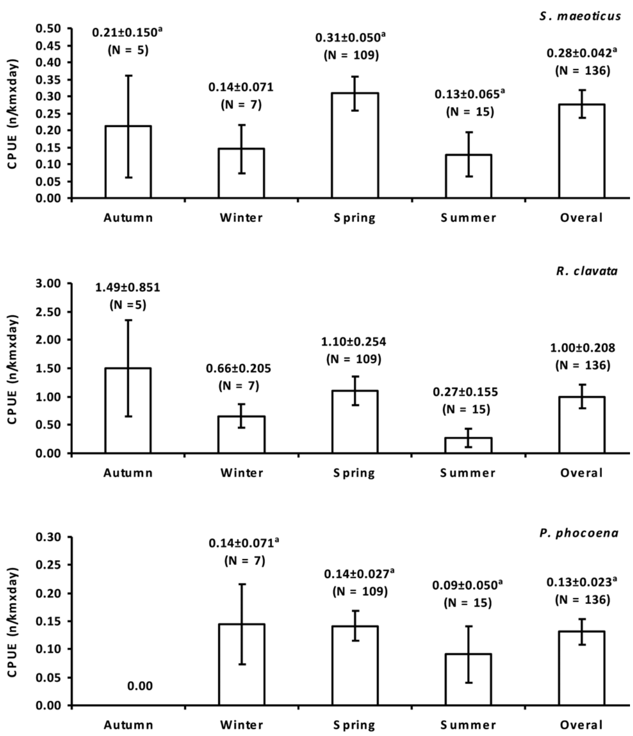

Figure 5. Seasonally CPUE of species caught by turbot gill net fisheries between March 2010 and September 2011.

whiting from fishing pressures which form part of the primary diet for cetaceans in the Black Sea (Birkun, 2002), is also a major threat for cetacean bycatch due to nutritional problems. During the present study, the stomach content analysis showed that the most of the *P. phocoena* have empty stomach and this may be one indicator of starvation for *P. phocoena* population in the Black Sea (unpublished data). Some fishing operations do attract cetaceans by providing them with an additional source of food (Gönener & Bilgin, 2007); however, especially *P. phocoena* was caught as an incidental catch in the fishing nets especially the turbot gill nets which are the most dangerous for the cetaceans in the Black Sea (Radu et al., 2003).

There has been little research focused on the bycatch levels of cetaceans within short time periods between April and June for turbot gill net fisheries in the Turkish Black Sea coast (Öztürk et al., 1999; Birkun, 2002; Tonay & Öztürk, 2003; Gönener & Bilgin, 2009; Tonay, 2016). Tonay & Öztürk (2003) reported a total of 13 *P. phocoena* were bycaught between May and June 2002 and 27 *P. phocoena*, one *T. truncatus* and one *D. delphis* were bycaught between April and June 2003 within 100 m isobaths and within 15 miles from the coast in the turbot gill net fishery in the western Black Sea. Gönener & Bilgin (2009) also reported a total of 94 *P. phocoena* were bycaught with turbot gill net fishery around the Sinop peninsula between March and May 2006 in the Black sea. The cetacean by catch also was studied in 1993-1997 between April and June on the western coast of the Turkish Black Sea, from the Bulgarian border to Istanbul by Öztürk et al. (1999) and a total of 63 specimens were examined and all specimens were *P. phocoena* except one specimen of *T. truncatus*. Recently, Birkun, (2002) reviewed interaction between cetaceans and fisheries in the Black Sea and he reported that a total of 385 cetaceans, 363 of *P. phocoena*, 10 of *D. delphis*, and 12 *T. truncatus* from cost of Romania, Bulgaria, Ukraine, Georgia and Russia. Tonay (2016) recently reported on estimating cetacean by catch in the Turkish western Black Sea turbot fishery. In this study from April through July 2007 and April through mid-September 2008, 24 harbour porpoises and one bottlenose dolphin were caught in turbot trammel nets and the by catch rate was reported as 0.18 individual harbour porpoises per km and 0.01 for bottlenose dolphin in 2007, and 0.19 for harbour porpoise individuals in 2008. In the present study, we estimated turbot gill net danger index as 0.09 ±0.028 ind.km^{-1}.day^{-1} in 2010, 0.15 ± 0.032 ind.km^{-1}.day^{-1} in 2011 and 0.13 ± 0.023 ind.km^{-1}.day^{-1} in all data for *P. phocoena*, for *D. delphis* it was calculated as < 0.003 ind.km^{-1}.day^{-1} in 2010, 2011 and all data. Our results concerning Turkish eastern Black Sea turbot fishery were compatible with the results of Tonay (2016) for *P. phocoena* and *D. delphis* in the Turkish western Black Sea turbot fishery. These results suggest that the most by catch cetaceans was *P. phocoena* in the Black Sea.

Although 71 *P. phocoena* and 4 *D. delphis* were recorded as by catch during our study, an interesting observation is that *T. truncatus* were never recorded as by catch during the study period. This case may be the result of the distribution, abundance, population structure, migration, ecology and behaviors of *T. truncatus* (Bearzi et al., 2008). But, these situations should be studied in more details for the Black Sea cetaceans. Conversely, Çelikkale et al. (1988) studied the distribution of Black Sea cetaceans in the Anatolian costs (about 1100 km coast length and 70 000 km^2 areas) and they reported that distribution of *P. phocoena* and *D. delphis* was largely in the southeastern Black Sea (from Sinop to Georgia border). Moreover, the distribution of *T. truncatus* was mostly in the western Black Sea (from Sinop to Bulgaria border).

There is some evidence that cetaceans, especially *T. truncatus*, may damage nets e.g. trammel nets, feeding on the caught fish, and reducing the fish catch (Buscaino et al., 2009). However, in our study, we did not detect any new net damages due to consequence of cetacean interactions for turbot gill nets. But, we detected mechanical mesh torn are most likely to be caused by fishing operational factors, probably due to rocky and crinkly sea bottom which turbot gill nets set there. E.g. one operation were set submerged beds and the most mechanical net damage (damage size: 6.7 × 2.6 m) detected for this operation.

In conclusion, turbot gill net fisheries in the Turkish seas have currently been banned between 15 April and 15 June (Anonymous, 2017). However, illegal turbot gill net fisheries were sometimes performed during this period when turbot comes to shore for spawning and the most of the by catch *P. phocoena* and *D. delphis* were obtained the mostly into this period. According to our results, especially for conservation of the Black Sea cetaceans and shut off from the turbot gill net and for the sustainability of turbot stocks, the turbot gill net fisheries banned time should be applied from 1 April to 30 June in the Black Sea.

Acknowledgements

The authors thank fishermen Sami Akmermer, Kazım Akmermer Uğur Akmermer and Ahmet Kalkavan for their help during the field studies and two anonymous referees for their suggestions and criticism that clearly improved an earlier version of this manuscript. This study was supported by the Recep Tayyip Erdogan University, Scientific Research Project (BAP 2010.103.03.2).

References

Anonymous 2017. Notified to regulate commercial fisheries with the number of 2/1. https://kms.kaysis.gov.tr/Home/Goster/75662?AspxAutoDetectCookieSupport=1

Bearzi G., Fortuna C.M. & Reeves R.R. 2008. Ecology and conservation common bottlenose dolphins *Tursiops truncatus* in the Mediterranean Sea. *Mammal Review*, **39**: 92-123.

Birkun A. Jr. 2002. Interactions between cetaceans and fisheries in the Black Sea. In: G. Notarbartolo di Sciara (Ed.), Cetaceans of the Mediterranean and Black Seas: state of knowledge and conservation strategies. *A report to the ACCOBAMS Secretariat, Monaco*. Section **10**, 11 pp.

Buscaino G., Buffa G., Sarà G., Bellante A.Jr.A.T.J., Hardt F.A.S., Cremer M.J., Bonanno A., Cuttitta A. & Mazzola S. 2009. Pinger affects fish catch and damage to bottom gill nets related to bottlenose dolphins. *Fisheries Science*, **75**: 537-544.

Çelikkale M.S., Ünsal S., Durukanoğlu H.F., Karaçam H., Düzgüneş E., Okumuş İ., Seyhan K., Özmen G., Dinçer A.C., Özer N.P., Köse S., Kılıç C., Demirel O. & Candeğer A.F. 1988. *Determination of biology and stock of dolphin species in the Black Sea*. Ministry of Food, Agriculture and Livestock: Ankara. 80 pp.

Gönener S. & Bilgin S. 2007. The effects of acoustic pingers on dolphins depredation around Sinop peninsula (Black Sea, Turkey) in bottom-set gillnets. *Science and Engineering Journal of Firat University*, **19**: 121-129.

Gönener S. & Bilgin S. 2009. The effect of pingers on harbour porpoise, *Phocoena phocoena* bycatch and fishing effort in the turbot gill net fishery in the Turkish Black Sea Coast. *Turkish Journal of Fisheries and Aquatic Sciences*, **9**: 151-157.

Hammer Ø., Harper D.A.T. & Ryan P.D. 2001. PAST: Paleontological Statistics Software Package for Education and Data Analysis. *Palaeontologia Electronica*, **4**: 1-9.

Kideys A.E. 1994. Recent dramatic changes in the Black Sea ecosystem: the reason for the sharp decline in Turkish anchovy fisheries. *Journal of Marine Systems*, **5**: 171-181.

Nédélec C. 1975. *Catalogue of small-scale fishing gear.* West Byfleet: Food and Agriculture Organization of the United Nations/Fishing News. 191 pp.

Öztürk B., Öztürk A.A. & Dede A. 1999. Cetacean by catch in the western coast of the Turkish Black Sea in 1993-1997. In: *Proc. 13th Annual Conference European Cetacean Society* (P.G.H. Evans, J. Cruz & J.A. Raga eds), pp 1-134. Turkish Marine Research Foundation (TUDAV) Ofis press: Istanbul.

Öztürk B., Aktan Y., Topaloğlu B., Keskin Ç., Öztürk A.A., Dede A. & Türkozan O. 2004. *Marine life of Turkey in the Aegean and Mediterranean Seas*. Turkish Marine Research Foundation (TUDAV) Ofis press: Istanbul. 200 pp.

Radu G., Nicolaev S., Anton E., Maximov V. & Radu E. 2003. Preliminary data about the impact of fishing gears on the dolphins from the Black Sea Romanian waters. In: *Workshop on demersal Resources in the Black Sea and Azov Sea* (B. Öztürk ed), pp. 115-129. Turkish Marine Research Foundation (TUDAV) Ofis press: Istanbul.

Tonay A.M. & Öztürk B. 2003. Cetacean by catches in turbot fishery on the western coast of the Turkish Black Sea. In: *International Symposium of fisheries and Zoology*, pp. 132-138. Istanbul University Press: Istanbul.

Tonay A. 2016. Estimates of cetacean by-catch in the turbot fishery on the Turkish Western Black Sea Coast in 2007 and 2008. *Journal of the Marine Biological Association of the United Kingdom*, **96**: 993-998.

TUIK 2015. *Turkish Statistical Institute, Fishery Statistics*. Turkish Statistical Institute, Printing Division: Ankara. 75 pp.

Vinther M. 1999. Bycatches of harbour porpoises (*Phocoena phocoena* L.) in Danish set-net fisheries. *Journal of Cetacean Research and Management*, **1**: 213-135.

Zaitsev Y. & Mamaev V. 1997. *Marine Biologica Diversity in the Black Sea: A Study of Change and Decline*, United Nations Publications: Black Sea Environmental Series. 208 pp.

Zengin, M. 2000. *Characteristics of population and biocenology of turbot (Scophthalmus maeoticus Pallas, 1811) in the eastern Black Sea*. Ph.D thesis, University of Karadeniz Teknik, institute of science, Trabzon, Turkey. 221 pp.

Zengin M. & Düzgüneş E. 2003. Variation on the turbot (*Scophthalmus maeoticus*) stocks in the South-eastern Black Sea during the last decade and comments on fisheries management. In: *Workshop on demersal Resources in the Black Sea and Azov Sea* (B. Öztürk ed), pp. 9-26. Turkish Marin Research Foundation (TUDAV) Ofis press: Istanbul.