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Research Article

Characteristics of Marine Recreational Fishing in the Çanakkale Strait (Turkey)

V. ÜNAL[1], D. ACARLI[1] and A. GORDOA[2]

[1] Ege University, Faculty of Fisheries, 35100 Bornova, Izmir, Turkey
[2] Centro de Estudios Avanzados (CEAB-CSIC)
Acc. Cala St. Françesc 14. 17300 Blanes, Girona, Spain

Corresponding author: vahdetunal@gmail

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Abstract

The economic and harvest impact of Marine Recreational Fishing (MRF) in the Çanakkale Strait were analysed along with fishing policy, sociology and habits of fishers. Data sources included field survey data carried out along the entire length of the Çanakkale Strait and policy information gathered from published sources. MRF policy is commendable, even in the fishing tourism sector, and is better developed than that in many other European countries. In Çanakkale, recreational fishers make up 9.9% of the population. Recreational fishers are typically men (90%), primarily those between the ages of 25 and 49 yrs. The occupation of the recreational fishers ranged from self-employed (28%), students (28%), retired persons (22%) and public employees (15%), to currently-unemployed persons (7%). An analysis of diel behaviour showed that most recreational fishers preferred fishing during the day (56.1%), while the evening was the next most preferred time for fishing (18%), followed by the night-time (9.8%), while a substantial number of recreational fishers (16.1%) reported that they fished at any time of day. The most popular type of fishing was shore-based (68%), followed by boat-based (21%), and underwater fishing (11%). The mean daily fishing times were 6.07 h d^{-1}, 6.18 h d^{-1} 4.75 d^{-1} for boat-based, underwater and shore-based fishing, respectively. Summer and autumn were the preferred seasons for shore-based and underwater fishing, while autumn and winter were preferred for boat-based fishing. The highest Catch per Unit Effort (CPUE) was observed for boat-based fishing (2.77 kg h^{-1}), followed by underwater (0.97 kg h^{-1}) and shore-based fishing (0.81 kg h^{-1}). The catch composition included 51 species, though the catch composition of each fishing type was mostly comprised of only 3 or 4 species. The impact of the MRF harvest was high (30% of commercial fishing), particularly for bluefish (*Pomatomus saltatrix*) and picarel (*Spicara smaris*) species. The economic impact of MRF was highly negative. Several indicators, including the following, revealed a high percentage of catch trading (47%) being conducted under the guise of a recreational label: annual fishing intensity, total costs, target species, and sales. At present, it is evident that the highly developed recreational fishing policy in Turkey is not sufficient to ensure that recreational fishing is sustainable or to prevent fishing conflicts in Turkey. This study revealed the need for establishing monitoring, control and surveillance programs to ensure the sustainability of fish resources and fisheries including MRF.

Keywords: Recreational fishing; Fisheries management; Economic impact; CPUE; Çanakkale Srait; Dardanelles.

Introduction

Recreational fishing (RF) has several different definitions, and although the term is generally understood to indicate the harvesting of fish for personal use, fun, or for challenge (PAWSON *et al.,* 2008), perceptions of RF vary greatly among countries due to cultural differences. The code of practice of recreational fishing (EIFAC, 2008) took the different views on RF into account and provided the following definition: 'Fishing of aquatic animals that do not constitute the individual primary resource to meet nutritional needs and are not generally sold or otherwise traded on export, domestic or black markets', where the difference between RF and subsistence fisheries may seem ambiguous. Subsistence fishing developed into recreational fishing as social and economic development evolved. Thus, in between both fishing types, intermediate scenarios varying with the development level in the different regions are to be expected. An overview of RF in nine countries addressed topics such as the number of anglers, fishing frequency, expenditure, and fishing constraints, and provided both notable differences and similarities revealing the need to invest in RF research, monitoring and education (DITTON, 2008). Although the importance of RF has been demonstrated and studies have shown an increase in RF effort (McPHEE *et al.,* 2002), RF policy, monitoring and management are largely overlooked at the national and international level. Unlike commercial fisheries, where data on catch and effort are regularly collected for assessment and management purposes, data on RF that would allow the estimation of recreational catches, the detection of trends and the evaluation of impacts are rare (GARTSIDE *et al.,* 1999; RANGEL & ERZINI, 2007).

The results of several studies have revealed the deficiency, or even nonexistence, of Marine Recreational Fishing (MRF) policy in many European states (SFITUM, 2004; GAUDIN & DE YOUNG, 2007). In many of these states, a marine recreational fishing license is not required and long lines and other professional fishing gear are permitted in MRF (SFITUM, 2004). The need for a harmonised policy and comprehensive management strategy for MRF in Europe was one of the major issues addressed in the First Mediterranean Recreational Fishing Congress (KRAMER, 2006). In Mediterranean countries, marine recreational fishing is a long-standing tradition that is deeply rooted in local seaside communities, but there is a low degree of knowledge on this activity in the area. Studies on recreational fishing in other regions are abundant and diverse, ranging from its economic importance to its harvesting impacts (CANTRELL *et al.,* 2004; COLEMAN *et al.,* 2004; COLL *et al.,* 2004; COOKE & COWX, 2004), clearly compiled recently (Ø YSTEIN, 2008).

The few studies carried out in the Mediterranean region revealed that recreational fishing catches appear to be far from negligible (MORALES-NIN *et al.,* 2005; CARDONA *et al.,* 2007), but these studies also suggest that the economic impact of RF is considerable, and in some regions greater than that of professional fishing (FRANQUESA *et al.,* 2004). Moreover, signs of competition between recreational and professional fishing reveal the need for comprehensive management in Mediterranean coastal areas (LLORET *et al.,* 2008a). If such comprehensive management is not realised, social and economic conflicts may arise and could be intensified by the reduction of fish resources. The condition of fish resources in the Mediterranean shows a steady decrease

(LLEONART, 2005) and some resources are already overexploited (LLEONART & MAYNOU, 2003), scenarios which could trigger conflicts among different fishing sectors. Moreover MRF data should not be underestimated by managers and fishing administrations as this information can be used to describe and assess littoral fish communities, thus providing additional and complementary data (GORDOA, 2009).

The few studies on MRF in the Mediterranean come from the northwestern region, while in the Mediterranean basin there is a general lack of MRF studies. In Turkey, at the most eastern side of the basin, as a result of its increasing standard of living, MRF appears to be increasing. In addition, 55% of the Turkish population lives along the vast coastline (8 140 km), offering an optimal scenario for the development of MRF, including in the fishing tourism sector. Therefore, the fisheries management authority in Turkish waters (Fisheries Department of Ministry of Agriculture and Rural Affairs) has paid extensive attention to the regulations of MRF. Nevertheless, due to the difficulties in monitoring and enforcement, there are no specific policies or management plans for MRF in Turkey. Therefore, the objective of this study is to provide initial data and a general overview of MRF in Turkey through the analysis of three different subjects: legislative, extractive and socioeconomic. The results will be valuable for assessing the extent of MRF relative to impacts on coastal fishery resources as well as its interaction or competition with commercial fisheries and will contribute essential data for more comprehensive fisheries management plans.

Methodology

Study site

The survey was carried out along the Çanakkale Strait, 68 km in length, which connects the Marmara Sea and the Aegean Sea (Fig. 1). The strait's width varies from

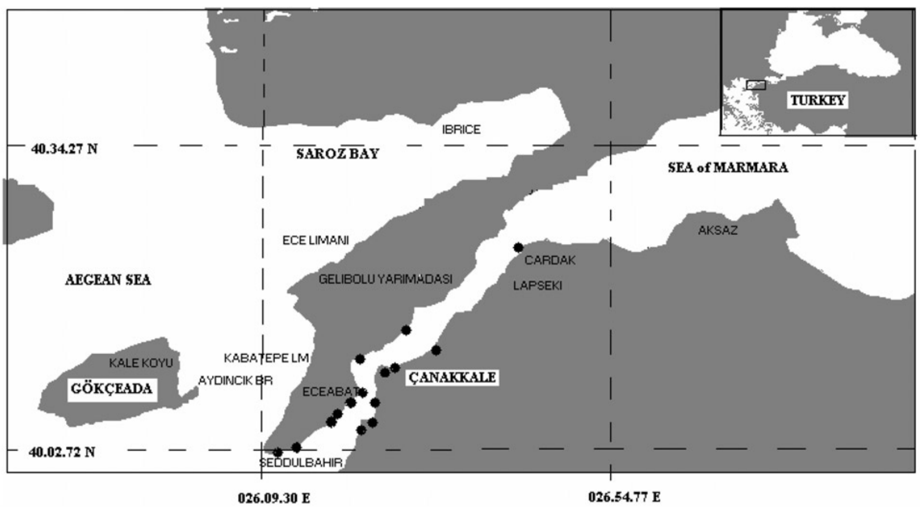

Fig. 1: Study site and survey areas.

1 200 metres to 6 000 metres with a depth of approximately 55 metres, though the depth can reach up to 80 metres at some points. This passageway is a migratory route for many fish species moving between the Aegean and Black Seas, and it is characterized by low salinity (< 30 psu), and a shallow surface water (< 40 m) current coming from the Black sea (ZERVAKIS *et al.,* 2000). Çanakkale, with a population of 70 000 residents, is a well-known coastal city for both recreational and commercial fisheries where MRF is one of the main leisure activities, 9.9% of the population participating. The estimated number of total recreational fishers in Çanakkale in 2006 was 6 922 while the estimated number of commercial fishers was 5 987. The Ministry of Agriculture and Rural Affairs (MARA) is the main state administration for fisheries management, including the management of RF in Turkey. According to Fisheries Law (1380), MARA publishes an RF circular annually in order to update regulatory measures (ANON., 2008).

Data collection and analysis

Information on MRF policy was collected from published sources, specifically fishing circular, reports, and journal articles. Fishing data, including the traits of fishers and fishing activity, catch and costs were gathered from field surveys carried out from January 2007 to September 2007. Recreational fishers were selected randomly for face-to-face interviews along the shoreline of the Çanakkale Strait and jetties (Fig. 1) and were visited on weekdays and weekends. The content of the questionnaires was optimized in August 2006 using an exploratory survey in the field from which the unnecessary or unclear questions were removed. Exploratory survey protocols can improve fisher's reactions and comprehension, allowing the survey response rate and quality to be optimized.

The items on the questionnaire that were related to fishing activity concerned: the possession of a fishing license, fishing type (shore based, boat based, and underwater fishing), fishing gear, fishing hours per day, fishing days per year, species caught, and annual catch in weight. The socio-economic questions considered: age, gender, education, fishing experience, expenses by type (bait, fuel, equipment, transportation, repairing and maintenance), inspection, personal experience, and the acceptance of fishing policy by the fishers. During the survey, MRF policy in Turkey was explained and clarified using the existing information from different published sources (primarily from fishing circulars).

For each fishing type the number of fishing hours per day and the number of fishers was not estimated by averaging the declared daily fishing hours, because the mean would weight evenly both the very active fisher and the fisher. The daily fishing hours per fisher (DFHF) were estimated as:

$$DFHF_i = \frac{\sum_i^n DHF_i}{\sum ADF_i}$$

Where DHF_i and ADF_i are the fishing hours and days declared by each fisherman.

For each fishing type, the average annual effort per fisher, in fishing hours, was estimated in two steps to avoid any bias due to potential relationships between fishing hours per day and annual fishing days (e.g., the more active fisher could exhibit both longer fishing days and more fishing days per year). First, the total annual fishing hours per fisher (TAFHF) was estimated by the product of the declared daily hours (DHF) and the annual fishing days (ADF) of each fisher:

$$TAFHF_i = DHF_i \times ADF_i$$

Second, the mean annual effort per fisher (MAEF) was estimated over the total number of fishing hours per fisher per year:

$$MAEF = \frac{\sum_{i=1}^{n} TAFHF_i}{n}$$

The mean catch per unit effort (MCPUE), expressed as catch (kg) per hour and fisher, was estimated for each fishing type. The estimation also prevented any bias due to a possible relationship between fishing intensity and fishing efficiency (e.g., active fishers could exhibit higher fishing rates). First, annual CPUE per fisher (ACPUE) was estimated by dividing the annual catch declared per fisher (ACF) by the total annual fishing hours per fisher (TAFHF):

$$ACPUE_i = \frac{ACF_i}{TAFHF_i}$$

Then, MCPUE was estimated as the mean over the total number of fishers, ACPUE:

$$MCPUE = \frac{\sum_{i}^{n} ACPUE_i}{n}$$

The percentage of fishers per fishing type in the studied sample was considered to be representative of the fisher population. Thus, the total number of fishers per fishing type was estimated by applying those percentages to the total reported number of fishers reported by MARA. Once estimated, the number of fishers per type (NFM), MCPUE (kg/h fisher), MAEF (mean annual fishing hours per fisher) and the annual fishing effort in hours per type (AFE) were estimated by multiplying the NFM and the MAEF. The total catch per fishing type (TC) was estimated by multiplying the AFE and the MCPUE.

The declared catch per species was summed up for each fishing type separately and the catch composition was estimated as a percentage and extrapolated to the total catch (TC) to estimate the total annual catch per species (TCS). Finally, the total value of the catch was estimated by applying the market price to each species.

Results

MRF Policy

The Turkish MRF differentiates between Amateur and Sports activities; the latter refers to recreational fishing activity performed, individually or in teams, according to the rules of national or international sports federations. The MRF circular consists of seven sections including: objectives and definitions, performing amateur fishing, restrictions and bans for species, restrictions and bans for fishing gear and for areas, legislation and enforcement and general provisions. MRF infractions are also subject to specific penalties such as the seizing of illegal fishing gear, loss of catch or payment of fines.

There is no compulsory license system for MRF in Turkey. MRF policy considers specific rules for: non-Turkish residents, tourists, amateur fishing guides, and amateur fishing tourism. Non-Turkish residents are required to obtain a ‘certificate of visiting amateur fisher’ for 2 years. Foreign tourists can practise only two of the types of fishing: boat-based and shore-based. Boat-based fishing requires a fishing tourism certificate and a fishing stamp, while shore-based recreational marine fishing tourism is free and permission is not required. MARA provides authorization for tourism-fishing for 2 years to tourist agencies, organizations or individual enterprises engaged in MRF.

The current MRF specific policy measures are focused on the prohibition of sale, daily bag limits, lengths or weights limits and gear type restriction. Although the only permitted types of gear are line fishing (angling) and spear fishing, specific gillnets (5 m in length, 1.5 m in height and 28 mm in mesh size) are permitted for bait fish. The catch of several species is strictly prohibited for both MRF and professional commercial fishing and certain species have specific minimum size and maximum catch limits as conservation measures. The fishing circular (ANON., 2008) covers full list of these species.

Characterization of recreational fishers

The total number of surveyed fishers was 190, which represents 2.7% of the estimated fisher population. Among MR fishers, males made up 90% of the total number of surveyed fishers. The education levels of survey respondents' ranged from non-educated to bachelor's degrees and the percentage of recreational fishers who had a high school or bachelor degree was 63.6%. The occupational status of recreational fishers showed (Fig. 2a) that most were students or were self-employed, while a substantial number of the fishers were retired and the number of unemployed fishers was low. The age structure showed that approximately 60% of fishers were between 25 and 49 years old (Fig. 2b).

Although RF licenses are not mandatory, more than half (53%) of recreational fishers held one, though there were large differences between fishing types in this respect; the proportion of fishers with RF licenses was 21% for shore-based fishery, 46% for underwater fishery and 65% for

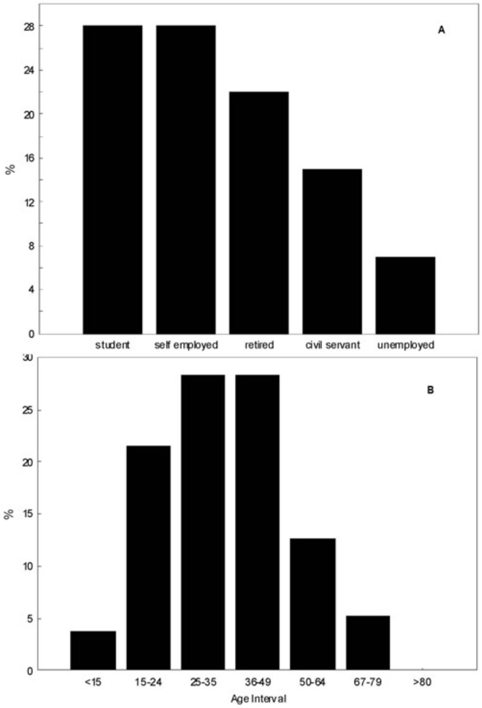

Fig. 2: **a)** Occupational status of recreational fishers (%). **b)** Age structure of fishers (%).

boat-based fishery. In addition, approximately 23% of shore-based fishers, 14% of boat-based fishers and 4% of underwater fishers reported that they were not familiar with MRF policy. When asked about the suitability of MRF regulations, most of the fishers found them inadequate: 55% of shore-based fishers, 58% of divers, and 63% boat-based fishers, respectively. Questions regarding the degree to which control measures are used revealed differences among fishing types: 26% of shore-based fishers, 58% of underwater fishers, and 73% of boat-based fishers indicated that they had been inspected during the past year. However, among those interviewed, 98% of shore-based fishers, 88% of underwater fishers, and 78% of boat-based fishers had never been fined during the year of the study.

The boats used in MRF were generally open, and ranged from 4.0 to 16.5 m in length (average = 8.4 ± 3.6), similar to the traditional small-scale fishery boats. Almost half (44.8%) of the boat-based recreational fishers were boat owners with an average of two or three fishers per boat.

Recreational Fishing Activity

Investigations of diel behaviour in MRF showed a day-time (56.1%) preference, followed by evening (18%), and night-time preferences (9.8%). A substantial number of fishers (16.1%) indicated that they fished at any time of day.

The most popular fishing type was shore-based (68%), followed by boat-based (21%), and underwater fishing (11%). The distribution of fishing gear was as follows: fishing line (82%), underwater fishing (8%) and trolling (9%). Most of the shore- and boat-based fishers (64%) indicated that they bought their own bait, while 36% catch their own bait. Seasonal patterns of MRF varied among the different fishing types and seasons (Table 1). Summer and autumn were the preferred seasons for shore-based and underwater fishing, while autumn and winter were preferred for boat-based fishing.

Fishing effort and CPUE

The number of fishing hours per day and per fisher varied among the different fishing types. Boat-based and underwater fishing types had longer fishing days with average values of 6.07 and 6.18 hours/day, respectively. Shore-based fishers had shorter fishing days, with an average of 4.75 fishing hours per day. The average number of annual fishing days per fisher and type was: 75.5, 53.2 and 102.3 days for shore-based, underwater and boat-based fishing, respectively. The frequency distribution of the fishing days by fishing type clearly shows a high proportion of fishers with a number of annual fishing days that is incompatible with a standard working activity (Fig. 3). The annual average number of fishing hours per fisher and type were similar for shore-based (359.3 hours per year, Confidence Interval (CI 0.95), 277.7 – 440.8) and underwater (329.1 hours per year, CI: 177.9 – 480.3) fishing types and both were far below the annual fishing intensity of boat fishers (621.8 hours per year, CI: 432.2 – 811.3).

Catch rate per hour, CPUE (kg/h), varied between fishing types (Table 2). Boat-based fishing was the most efficient fishing type with a fishing power 3 times above the other fishing types. Moreover, boat fishers displayed a high fishing effort, so in spite of the smaller number of boat fishers the total annual catch of boat fishing was the highest.

Catch composition

Based on the personal interviews, the catch composition of RF is represented

Table 1
Seasonal distribution of fishing activity in percentages for each fishing type.

RF types	Winter	Spring	Summer	Autumn
Shore based	8.2	26.8	33.3	31.7
Boat based	30.3	13.6	22.7	33.4
Underwater	18.5	18.5	30.8	32.2

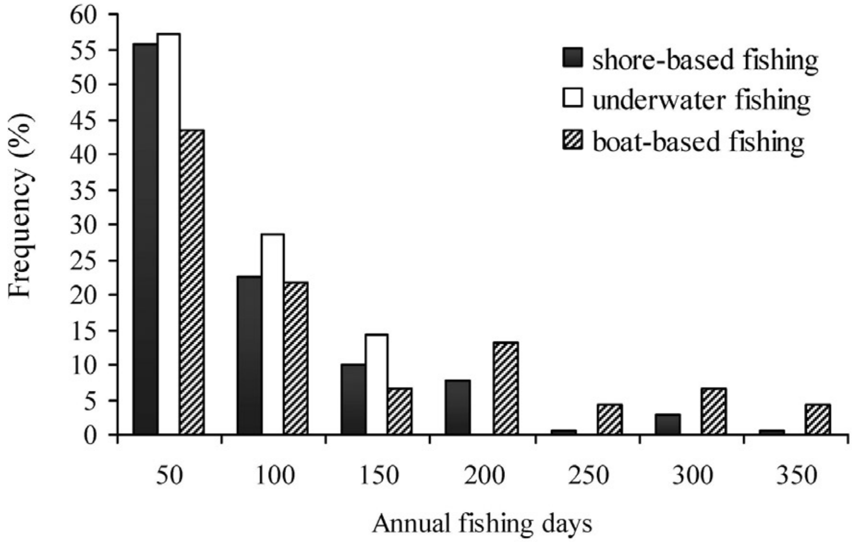

Fig. 3: Annual fishing days frequency distribution declared per fishing type.

Table 2
CPUE and fishing intensity in: hours per day and year per fisher and type.
Estimations of fishers' total population: number of fishers per modality,
total number of fishing hours per type and total annual catch by each fishing type.

Modality		**R.Fisherman**			**R. Fishermen Population**	
	h/day	CPUE (kg/h)	Annual n° h	n° fishers	Annual n° h	Annual catch (kg)
Shore-based	4.75	0.97	359	4 707	1 691 224	1 657 400
Boat-based	6.07	2.77	621	1 523	946 942	2 623 028
Underwater	6.18	0.81	329	692	227 833	184 545

by 51 species (Table 3) where Sparidae showed the highest species richness (25% of the total). Boat-based fishing was the fishing type with highest species richness (42 species), followed by shore-based fishing (31 species), and underwater fishing (27 species). Despite the high number of species, the catch composition of each fishing type was dominated by 3 or 4 species which represented more than 70% of the total catch (Table 3). The dominant species of boat-based catches were *Pomatomus saltatrix* and *Scomber* spp., while *Spicara smaris, Pomatomus saltatrix* and *Pagellus acarne* were dominant in shore-based catches. In underwater fishing, *Rapana venosa, Mytillus galloprovincialis* and *Holothuridea* dominated the catches and all fish caught were in the mugilids group. Four of the target MRF species (*Pagrus pagrus, Anguilla anguilla, Epinephelus marginatus,* and *Squatina aculeata,*) were endangered and were listed on the Red List of the IUCN.

Table 3
Species contribution (%) to the total catch per fishing type.

Family	Species	Boat	Shore-based	Underwater
Anguillidae	*Anguilla anguilla*		0.02	
Atherinidae	*Atherina boyeri*	0.03	0.76	
Belonidae	*Belone belone*	0.56	0.54	
Bivalvia	*Mytillus galloprovincialis*		0.05	20.52
Bivalvia	*Pecten* spp.			0.17
Carangidae	*Trachurus* spp.	7.83	3.07	
Carangidae	*Lichia amia*	2.85		0.24
Centracanthidae	*Spicara smaris*	4.23	31.87	
Clupeidae	*Sardinella* spp.	1.32	0.03	
Congridae	*Conger conger*		0.14	0.02
Gastropoda	*Rapana venosa*			30.97
Holothuridea	*Holothuridea*			20.06
Labridae	*Labrus* spp.		0.01	0.06
Loliginidae	*Loligo vulgaris*		0.01	
Moronidae	*Dicentrarchus labrax*	0.70	3.12	2.00
Mugilidae	*Mugilidae*	0.42	0.87	10.02
Mullidae	*Mullus surmuletus*		0.01	0.07
Octopodidae	*Octopus vulgaris*	2.15	0.06	0.64
Pomatomidae	*Pomatomus saltatrix*	25.62	20.00	0.14
Rajidae	*Raja* spp.	7.02		
Sciaenidae	*Argyrosomus regius*	0.01		
Scombridae	*Sarda sarda*	2.79	0.77	
Scombridae	*Scomber scombrus*	8.66	0.51	
Scombridae	*Scomber japonicus*	8.33	0.27	
Scombridae	*Thunnus thynnus*	0.41		
Scombridae	*Auxis rochei*	3.73		
Scophthalmidae	*Scophthalmus maximus*	0.11	0.01	0.58
Scophthalmidae	*Scophthalmus rhombus*			0.02
Scorpaenidae	*Scorpaenidae*	0.18		
Sepiidae	*Sepia officinalis*	0.01		
Serranidae	*Epinephelus marginatus*	0.80		0.66
Soleidae	*Solea solea*			0.03
Sparidae	*Sparus aurata*	2.30	7.58	0.19

(continued)

Table 3 (Continued)

Family	Species	Boat	Shore-based	Underwater
Sparidae	*Pagellus acarne*	1.77	16.88	0.04
Sparidae	*Pagrus pagrus*	1.87	1.96	
Sparidae	*Diplodus vulgaris*	0.93	7.76	3.01
Sparidae	*Diplodus sargus*	0.97	2.13	1.59
Sparidae	*Diplodus puntazzo*	1.14	0.78	1.63
Sparidae	*Spondyliosoma cantharus*	0.13	0.37	0.05
Sparidae	*Boops boops*	0.03	0.18	
Sparidae	*Diplodus annularis*	0.05	0.16	
Sparidae	*Dentex dentex*	2.20	0.10	0.49
Sparidae	*Oblada melanura*	0.46		0.03
Sparidae	*Sarpa salpa*	0.11		5.91
Sparidae	*Lithognathus mormyrus*			0.83
Squatinidae	*Squatina aculeata*	0.91		
Triakidae	*Mustelus* spp.	8.78		
Triglidae	*Trigla* spp.	0.52		
Xiphiidae	*Xiphias gladius*	0.02		
Zeidae	*Zeus faber*	0.04		

Catch Value and Fishing Costs

The total catch value by species and fishing type is shown in Table 4. The total value of the annual catch fished by type was approximately 9.2 million € for the boat-based fishery, 6.2 million for the shore-based fishery and 0.26 million for underwater fishing which targeted invertebrate species with a low commercial local value.

The annual distribution of cost by type is shown in Table 5. The annual mean expenditure per fisher varied with fishing type. Boat-based fishers incurred the highest costs (1 376 €, CI 0.95, 887.3-1864.6) followed by underwater (453 €, CI 0.95, 251.2-654.7) and shore-based fishers (213 €, CI 0.95, 122.4-303.5).

Assuming, that the recreational fisher population in Çanakkale uses the different fishing types in the same proportion estimated in this study (11% underwater fishing, 21% boat-based and 68% shore-based fishing), then the total annual costs of MRF fishing types would be: 1 million €, 2.09 million € and 0.31 million € for shore-based, boat-based and underwater fishing types, respectively. With the exception of the underwater fishing type, the catch value was much higher than the associated fishing costs (six times higher in shore-based fishing and nearly five times higher in boat-based fishing). It is worth noting that mooring price and boat acquisition costs were not considered in the sample design, so the costs of the boat-based fishers could have been twice that estimated in this study (but still low) if mooring associated costs observed in previous studies (SFITUM, 2004) were applied.

Table 4
Total catch by species estimated for fisher population by fishing type and their corresponding value in €.

Species		Total catch (kg.)		Price		Catch value €	
	Boat	Share	Underwater	€ kg.	Boat	Shore	Underwater
Anguilla anguilla		280		3.60		1 008	
Atherina boyeri	909	12 594		1.80	1 637	22 669	
Belone belone	14 725	8 956		2.25	33 131	20 150	
Mytillus galloprovincialis		746	37 863	0.68		504	25 558
Pecten spp.			314	2.03			637
Trachurus spp.	205 413	50 889		2.25	462 178	114 499	
Lichia amia	74 707		450	4.05	302 565		1 823
Spicara smaris	110 913	528 243		1.71	189 662	903 295	
Sardinella spp.	34 647	466		2.25	77 955	1 049	
Conger conger		2 332	36	0.45		1 049	16
Rapana venosa			57 152	0.45			25 719
Holothuridea			37 013	0.45			16 656
Labrus spp.		93	107	2.93		273	313
Loligo vulgaris		93		4.05		378	
Dicentrarchus labrax	18 320	51 775	3 693	6.75	123 657	349 480	24 931
Mugilidae	11 087	14 413	18 496	2.25	24 946	32 429	41 616
Mullus surmuletus		93	129	5.85		546	752
Octopus vulgaris	56 301	980	1 186	2.93	164 681	2 865	3 469
Pomatomus saltatrix	671 933	331 499	257	5.18	3 477 252	1 715 506	1 331
Raja spp.	184 062			1.35	248 483		
Argyrosomus regius	260			4.50	1 169		
Sarda sarda	73 062	12 734		2.25	164 389	28 651	
Scomber scombrus	227 024	8 443		3.15	715 124	26 594	
Scomber japonicus	218 622	4 431		2.03	442 709	8 973	
Thunnus thynnus	10 827			3.60	38 978		
Auxis rochei	97 877			1.80	176 179		
Scophthalmus maximus	2 815	140	1 072	10.13	28 502	1 417	10 850
Scophthalmus rhombus			36	6.08			217
Scorpaenidae	4 807			2.48	11 898		
Sepia officinalis	390			2.25	877		
Epinephelus marginatus	20 918		1 214	7.65	160 023		9 291

(continued)

Table 4 (Continued)

Species		Total catch (kg.)		Price		Catch value €	
	Boat	Share	Underwater	€ kg.	Boat	Shore	Underwater
Solea solea			50	6.08			304
Sparus aurata	60 199	125 612	350	6.08	365 709	763 094	2 127
Pagellus acarne	46 557	279 724	71	3.60	167 604	1 007 006	257
Pagrus pagrus	48 939	32 511		5.40	264 269	175 559	
Diplodus vulgaris	24 296	128 644	5 551	5.40	131 199	694 678	29 975
Diplodus sargus	25 422	35 356	2 943	6.30	160 159	222 744	18 543
Diplodus puntazzo	29 883	12 874	3 008	5.40	161 368	69 518	16 241
Spondyliosoma cantharus	3 421	6 064	86	6.30	21 555	38 201	540
Boops boops	866	3 032		1.58	1 364	4 775	
Diplodus annularis	1 343	2 612		1.71	2 296	4 467	
Dentex dentex	57 687	1 586	907	10.13	584 081	16 057	9 186
Oblada melanura	12 126		50	3.83	46 383		191
Sarpa salpa	2 815		10 909	2.03	5 700		22 091
Lithognathus mormyrus			1 529	3.83			5 848
Squatina aculeata	23 820			1.80	42 876		
Mustelus spp.	230 402			1.49	342 147		
Trigla spp.	13 599			3.60	48 956		
Xiphias gladius	650			6.30	4 093		
Zeus faber	1 083			4.50	4 872		

Table 5
Distribution (%) of total expenditure in MRF.

	Equipment	Transport	Bait	Fuel	Maintenance
Underwater	49	51	-	-	-
Boat-based	15	6	12	35	32
Shore-based	46	37	17	-	-.

Discussion

The results of the present study indicate that the magnitude of MRF in Turkey should be of major concern. Turkish MRF policy is highly structured and commendable in contrast with many countries (GAUDIN & YOUNG, 2006), to the extent that fishing tourism is also regulated with a specific certificate mandatory for its practice. The development of the fishing tourism industry around the world has progressed from independent fishing tourism to "fishing packages", depending on the physical access to fishing localities and on the legal framework of the region (BORCH, 2004), which is essential for the sustainable development of the fishing tourism sector. The weak point in MRF policy is the absence of a mandatory license for Turkish citizens, although many fishers obtain a volunteer certificate. The results showed that fishers that possessed a fishing certificate had an increased knowledge of marine policy compared to other fishers. Thus, recreational fishing licenses, still unimplemented in many countries, would not only allow the magnitude of the recreational fisher population to be gauged, but would also increase the level of compliance with fishing laws.

MRF fishing types in this study showed differences in CPUE, and the boat-based fishery was highly efficient compared to spear fishing and shore-based fishing. The estimated average catch rates of boat-based fishers were higher than those reported from the western Mediterranean regions (MORALES-NIN *et al.,* 2005; LLORET *et al.,* 2008a), even considering the differences in the unit of fishing effort between studies (day, hook/h and hour). Shore-based catch rates were also higher than those estimated for recreational fishing in the northwestern Mediterranean (GORDOA, 2009). The higher catch rates could be indicative of a higher fish biomass and/or higher catchability due to the long and narrow structure of the Çanakkale Strait.

The social characterization of recreational fishers showed a relatively moderate education level, with a low proportion of unemployed fishers. These characteristics may cause MRF in Turkey to be very different from what is generally considered to be subsistence fishing. However, this result is in contradiction to the reported fishing intensity: the percentage of fishers declaring more than 100 fishing days per year was 34% for boat fishers and 20% for shore-based fishers. Moreover, more than half of recreational fishers declared that they sold their catch. Marketing recreational fishing products was 45% in shore-based (mostly by retired persons at 42% and the self-employed at 33%), 73% in underwater fishery (mostly by student at 47% and self-employed at 32%) and 75% in boat-based fishery (mostly by the self-employed at 51% and students at 24%). Although subsistence activities such as fishing provide much more than a marginal existence and can still provide a wholesome way of life (LYMAN, 2002), these results are indicative of a high percentage of fishing activity that is neither recreational nor subsistence.

The different seasonal patterns observed among fishing types showed that shore-based and underwater fishing are primarily conducted during the best climatic conditions (summer-autumn) but the boat-based fishery was also conducted in colder months (autumn-winter), indicative of a temporal fishing strategy that was closely linked to seasonal patterns of *P. saltatrix* (AKYOL & CEYHAN, 2007). MRF impact on bluefish was considerable, as indicated by the total catch in Çanakkale which represents 9.8% of total national commercial catch (8 399 tonnes). Additionally, this species is experiencing a decreasing trend, since the estimated commercial catch in 2002 (AKYOL & CEYHAN, 2007) was three times (25 000 tonnes) higher than that four years later. In Çanakkale, the MRF annual total catch was approximately 4 464 tonnes, representing 30% of commercial fishing in 2006 (19 000 tonnes, according to statistics from the municipality of Çanakkale). On the other hand, the estimated catch of picarel (*Spicara smaris*), mostly harvested by the shore-based fishery (639 tonnes), represents more than 35% of the total national catch of this species (TUIK, 2007). The specific catches on targeted species and the total MRF catch is in agreement with the harvesting impact of this activity that has been highlighted in several studies (SUTINEN & JHONSTON, 2003; COLL *et al.,* 2004; COOKE & COWX, 2004; LEWİN *et al.,* 2006; LLORET *et al.,* 2008a,b). Furthermore, all of these RF activities have a negative impact on ecologically vulnerable species such as *Pagrus pagrus, Anguilla anguilla, Epinephelus marginatus* and *Squatina aculeata*, which are included in the IUCN Global Red List under the categories of endangered or critically endangered species. Most of these species were caught by boat-based MRF, while spear fishing impacts only on one endangered species (*Epinephelus marginatus*).

The economic impact of MRF has been estimated as being both positive and valuable in many regions (STEINBACK, 1999; FRANQUESA *et al.,* 2004; COWX & ARLINGAUS, 2008) but in this case the impact was the opposite. The results showed, with the exception of the underwater fishing type, that the catch value of MRF was considerably higher than the associated fishing costs of this activity. Thus, the MRF economic impact was highly negative rather than positive in Çanakkale, and presumably has negative effects on local commercial fishing since competition for fish resources was particularly high for bluefish and picarel. It is necessary to highlight that, in spite of the magnitude of the MRF harvest shown in this study, MRF catch is still a totally black landing and is neither recorded nor accounted for in resource assessment or management practices. Moreover, although MRF-caught fish may not be traded, the present study showed that almost half of recreational fishers sold the bluefish they caught. So this activity directly interferes with the official market and presumably affects market prices. It should be noted here that almost half of the RF activity in Çanakkale is not recreational, but is commercial fishery that is performed under the title of recreational fishery.

MRF is not monitored with the same rigor as commercial fisheries (LLORET *et al.,* 2008a), and in fact is rarely monitored at all. The study area and all other Turkish regions are never monitored. However, since conflicts between the MRF and small-scale fisheries have grown and are clearly justified by our results, MARA will have to pay more attention to this issue in the very near future. At present, it is evident that the current policy measures are not sufficient to ensure that fishing practices are sustainable or to minimize fishing conflicts in Turkey. Aside from the technical measures, monitoring, control and surveillance (MCS) are required to ensure sustainability in MRF. Furthermore, the need for a mandatory license system should be considered by MARA and, following Kramer's recommendation (2006), its funds should support the monitoring, control and surveillance of MRF.

In summary, there is an urgent need to pay more attention to and collect further data on MRF, and to establish a consistent monitoring, control and enforcement system. Additional studies should be aimed at assisting science-based fisheries management in MRF. Once requirements are met, MRF could be integrated into fisheries management more easily.

References

AKYOL, O. & CEYHAN., T., 2007. Exploitation and Mortalities of Bluefish (*Pomatomus saltatrix L.*) in the Sea of

Marmara. *Turkish Journal of Applied Biological Sciences,* 1 (3): 25-27.

ANONYMOUS, 2008. *Denizlerde ve iç sularda amatör (sportif) amaçlı su ürünleri avcılıgını düzenleyen 2/2 numaralı tebliğ*. Tebliğ no: 2008/49. Ankara, T.C. TKB, KKGM, 112 pp.

BORCH, T., 2004. Sustainable management of marine fishing tourism. Some lessons from Norway. *Tourism in Marine Environments,* 1 (1): 45-97.

CANTRELL, R.N., GARCIA, M., LEUNG, P. & ZIEMANN, D., 2004. Recreational anglers' willingness to pay for increased catch rates of Pacific threadfin (*Polydactylus sexfilis)* in Hawaii. *Fisheries Research,* 68: 149-159.

CARDONA, L., LOPEZ, D., SALES, M., CARALT, S. & DIEZ, I., 2007. Effects of recreational fishing on three fish species from the *Posidonia oceanica* meadows off Minorca (Balearic archipelago, western Mediterranean). *Scientia Marina,* 71 (4): 811-820.

COLEMAN, F.C., FIGUEIRA, W.F., UELAND, J.S. & CROWDER, L.B., 2004. The impact of United States recreational fisheries on marine fish populations. *Science,* 305 (5692): 1958-1960.

COLL, J., LINDE, M., GARCIA-RUBIES, A., RIERA, F. & GRAU, A.M., 2004. Spear fishing in the Balearic Islands (west central Mediterranean): species affected and catch evolution during the period 1975-2001. *Fisheries Research,* 70: 97-111.

COOKE, S.J. & COWX, I.G., 2004. The role of recreational fisheries in global fish crises. *Bioscience,* 54: 857-859.

COWX, I.G. & ARLINGHAUS, R., 2008. Recreational fisheries in the twenty-first century. p. 75-92. In: *Global Challenges in Recreational Fisheries.* Øystein, A. (Ed). Oxford, UK, Blackwell.

DITTON, R.B., 2008. An international perspective on recreational fishing. p.1-376. In: *Global Challenges in Recreational Fisheries.* Øystein, A. (Ed). Oxford, UK, Blackwell.

EIFAC CODE OF PRATICE FOR RECREATIONAL FISHERIES., 2008. SEC/EIFAC/ OP42. *FAO.* Rome,

FRANQUESA, R., GORDOA, A., MINA, T., NUSS, S. & BORREGO J., 2004. The recreational fishing in the Central and Western European Mediterranean frame. *FAO Fisheries Report,* No. 739.

GARTSIDE, D.F., HARRISON, B. & RYAN, B.L., 1999. An evaluation of the use of fishing club records in the management of marine recreational fisheries. *Fisheries Research,* 41: 47-61.

GAUDIN, C., & DE YOUNG, C., 2007. Recreational fisheries in the Mediterranean countries: a review of existing legal frameworks. *Studies and Reviews. General Fisheries Commission for the Mediterranean.* No.81. Rome, FAO, 87 pp.

GORDOA, A., 2009. Characterization of the infralittoral system along the North East Spanish coast based on Sport shorebased fishing tournaments catches. *Estuarine, Coastal and Shelf Science,* 82 (1): 41-49.

KRAMER, R., 2006. Recreational Fishing and Fishing Resource Conservation Management. In: 1st *Mediterranean Congress of Salt Water Recreational Angling,* September 2006, Palma de Mallorca.

LEWIN, W.C., ARLINGHAUS, R. & MEHNER T., 2006. Documented and potential biological impact of recreational fishing: insight for management and conservation. *Reviews in Fisheries Science,* 14 (4): 305-367.

LLEONART, J. & MAYNOU F., 2003. Fish stock assessments in the Mediterranean: state of the art. *Scientia Marina,* 67 (Sup-

pl. 1): 37-49.
LLEONART, J., 2005. Maditerranean and Black Sea. In: *Review of the State of World Fishery Resources.* FAO Fisheries Technical Paper, No. 457. Rome, 235 pp.
LLORET, J., ZARAGOZA, N., CABALLERO, D., RIERA V., 2008a. Biological and socioeconomic implications of recreational boat fishing for the management of fishery resources in the marine reserve of Cap de Creus (NW Mediterranean). *Fisheries Research,* 91 (2-3): 252-259.
LLORET, J., ZARAGOZA, N., CABALLERO, D., FONT, T., CASADEVALL, M., RIERA V., 2008b. Spearfishing pressure on fish communities in rocky coastal habitats in a Mediterranean marine protected area. *Fisheries Research,* 94 (1): 84-91.
LYMAN, J., 2002. Cultural values and change: catch and release in Alaska's Sport Fisheries. p.29-36. In: *Catch and release in Marine recreational Fisheries.* J. Lucy & A. Studholme (Eds). AFS Symposium 30. Bethesda, MD.
McPHEE, D.P., LEADBITTER, D., SKILLETER G.A., 2002. Swallowing the bait: is recreational fishing in Australia ecologically sustainable? *Pacific Conservation Biology,* 8 (1): 40-51.
MORALES-NIN, B., MORANTA, J., GARCIA, C., TUGORES, M.P., GRAU, A.M., RIERA, F. & CERDA M., 2005. The recreational fishery off Majorca Island (western Mediterranean): some implications for coastal resource management. *ICES Journal of Marine Science,* 62 (4): 727-739.
ØYSTEIN, A., 2008. *Global Challenges in Recreational Fishing.* Blackwell Publishing Ltd, 376 pp.
PAWSON, M.G., GLENN H., PADDA G., 2008. The definition of marine recreational fishing in Europe. *Marine. Policy,* 32 (3): 339-350.
RANGEL, M.O. & ERZINI, K., 2007. An assessment of catches and harvest of recreatioanal shore angling in the north of Portugal. *Fisheries Management & Ecology,* 14 (5): 343-352.
SFITUM, 2004. *Sport Fishing: an informative and economic alternative for tuna fishing in the Mediterranean (SFITUM).* EC Project 02/C132/11/41. Final Report, December 2004
STEINBACK, S.R., 1999. Regional Economic Impact Assessments of Recreational Fisheries: An Application of the IMPLAN Modeling System to Marine Party and Charter Boat Fishing in Maine. *North American Journal of Fisheries Management,* 19 (3):724-736.
SUTINEN, J.G., JHONSTON, R.J., 2003. Angling management organizations: integrating the recreational sector into fishery management. *Marine Policy,* 27: 471-487.
TÜİK, 2007. *TURKSTAT, Fishery Statistics.* Prime Ministry Republic of Turkey, Turkish Statistical Institute, 60 pp.
ZERVAKIS, V., GEORGOPOULOS, D. & DRAKOPOULOS, P.G., 2000. The role of the North Agean in triggering the recent Eastern Mediterranean climate changes. *Journal of Geophysical Research,* 105 (C11): 26103-26116.