Scientific Research and Essays Vol. 5(21), pp. 3572-3584, 4 December, 2010
Available online at http://www.academicjournals.org/SRE
ISSN 1992-2248 ©2010 Academic Journals

Full Length Research Paper

Comparative approach to analyze fishing fleet profile of Turkey and European Union as an indicator of fishing effort

Naciye Erdogan Saglam[1] and Ertug Duzgunes[2]*

[1]Ordu University, Fatsa Faculty of Marine Sciences, Fisheries Department, 52400 Fatsa/Ordu, Turkey.
[2]Karadeniz Technical University, Faculty of Marine Sciences, Fisheries Department, 61530 Camburnu/Trabzon, Turkey.

Accepted 13 October, 2010

Turkey has big potential in the fisheries sector, having coasts to four different seas with diverse physical, chemical and biological properties supporting a large diversity of economical fish species. Along with the development in the Turkish economy, fishing industry has also developed in the vessel construction and fishing gear manufacturing. Being supported by subsidizes from the government, Turkish fishing fleet became an important power in the surrounding seas. During the pre-accession period to European union (EU), there are several questions raised requiring answers: (1) How to reduce fishing effort that is presumed to be higher than the acceptable levels considering exploited resource potential, and (2) How to adopt EU's common fisheries policy (CFP) to manage fisheries in the country. However, lack of reliable and secure data on catch, stock biomass, fishing fleet and effort, catch per unit effort, and monitoring, control and surveillance services make it difficult to reach an acceptable agreement with stakeholders. In this article, Turkish fishing fleet was reviewed using such profitability indicators such as catch per unit effort (tonnage, engine power), age of the vessels etc, employed as in the EU in order to respond claims that Turkish fishing fleet is bigger than it is supposed to be. The data used in this study were collected from the databases of Under Secretariat of Maritime Affairs and Ministry of Agriculture along with Turkish statistical institute (TSI). According to results of the data provided from national sources and comparison with EU fishing fleet, total fishing effort of Turkey is not much more than some of the EU member countries.

Key words: Fishing fleet, Turkey, EU, fishing effort, profitability.

INTRODUCTION

Marine living resources and ecosystems have been seriously threatened due to pollution, unplanned urbanization, climate change, over fishing and ecological problems in the world. Among these issues only fisheries can effectively be controlled using short and mid-term applicable measures while the others need long term global or multinational actions.

At present, in Turkey, like in many other countries, there is a trend to increase fishing fleet capacity mainly to catch highly migratory fish species in the coastal waters of Turkey and to carry out offshore fishing in distant international waters, e.g. the Indian Ocean, the Mediterranean and the Black Sea. There are several conventions that Turkey need to adopt her fishing management rules according to internationally accepted and reinforced such rules as The United Nations convention on the law of the sea (UNCLOS) by implementing exclusive economic zone (EEZ) allocating certain sovereign rights and responsibilities for resource management to individual countries, FAO Code of conduct for the responsible fisheries including precautionary approach and common fisheries policy (CFP) of EU as well as the convention on biological

*Corresponding author. E-mail: ertug@ktu.edu.tr. Tel: 0462 7522419. Fax: 0462 7522158.

Table 1. Data sources and types of data used.

Source	Type of data
Ministry of agriculture and rural affairs (MARA)	Number of vessels above 10 m, fishing method, fishing gears and other equipment (cold storage, fish pump, etc), engines (numbers of engines, horse power, kW), number of crew, fish finders and navigation equipments (Arpa, 2005).
Under Secretariat of Maritime Affairs (USMA)	Name and owner, construction year, vessel specifications (length, width, drafts), registered city and port (USMA, 2004).
Turkish Statistical Institute (TSI)	Number of vessels below 10 m, fishing method, horse power, kW of engines, number of crew (TSI, 2004-2008).

diversity (CBD), The International commission for the conservation of Atlantic Tunas (ICCAT), General Fisheries Commission for the Mediterranean (GFCM), International Council for the Exploration of the Sea (ICES), Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), to have open access rights to fish in international waters or in EEZ of any countries with bilateral fishing agreements.

Fisheries management is a governmental system of management rules based on well defined objectives and a mixture of implementation of management rules to put in place by monitoring, control and surveillance, which is based on biological arguments for sustainable exploitation of the biological resources (Duzgunes and Erdogan, 2008). In general, there are certain difficulties for administrative authorities to apply precautionary approach principle of FAO and CFP of EU, to exploit renewable resources by satisfying all stake holders. This is very important especially in regions largely dependent on fisheries in terms of employment, income and nutrition source. However, there are serious disagreements about how optimally manage fisheries in the region due to the fact that fisheries statistics are not reliable and satisfactory, not allowing an adequate understanding of current state of fishery resources and reasonable projections for the future fisheries. Without healthy projections about the state of fisheries, it is impossible to evaluate biological, ecological and socio-economic aspects of sustainable fisheries (Ferraris, 2002). Ecological damage may have negative effects on the fish population itself and also on other species in the habitat, economic waste due to over investment causing over capacity and resulting in the loss of future economic income (Bergh and Davies, 2001).

Determining the optimal fishing effort, measured as gross tonnage, engine power (KWA) and number of vessels, is vital in resource management for the sustainable use of already damaged stocks. Therefore, there should be a fragile balance kept between resource capacities and fishing effort. Any failure in assessing resource capacity and related ecological parameters may have serious impact on the exploited fish stocks. It should be noted the ecosystems are dynamic and being evolving under many different factors that is global warming, over fishing and environmental pollution. Any forecasting efforts of fishing effort should consider such factors in optimal.

EU Commission had advised to reduce fishing fleet in compliance with CFP fleet management strategy (EU, 2005). At present, there is no available detailed data about Turkish fishing effort other than number of vessels and other general information on some figures related size, equipment, engines and crew numbers. This study it is aimed to derive some detailed figures as it is used in EU countries in order to compare Turkish fleet with EU countries mainly neighbors in the Black Sea and the Mediterranean. In this paper, Turkish fishing fleet profile was analyzed and compared with several EU countries. All fleet data was reviewed with their capture fish production in order to compare fishing fleet capacities and productions using catch per fishing unit as an indicator. On the other hand, the argument of EU Commission to impose reduction of Turkish fishing fleet was discussed and evaluated in line with CFP provisions.

MATERIALS AND METHODS

Data collection and organization

There are two vessel registry systems in Turkey; the first operated by the Ministry of Agriculture and Rural Affairs (MARA) covers all licensed fishing vessels and the second one operated by under secretariat of maritime affairs (USMA) manages general maritime issues. Moreover, the data obtained from Turkish Statistical Institute (TSI) regarding artisanal fishing vessels below 10 m that are not registered in the database of MARA, which were compiled from port masters located along the coastal cities. MARA fishing fleet 2003-2004 records included 2237 fishing vessels over 10 m overall length (OAL). In case of vessels smaller than 10 m, the records of TSI were used in the analyses.

The raw data taken from the three sources in Table 1 were standardized by checking for missing and erroneous records. In order to profile fishing fleet in Turkey and compare it to those of other EU member countries, a modified method given by Ferraris (2002) was applied. Number of vessels, type of fishing activities, tonnage, and engine power, number of engines and brands, geographical distribution, overall length (OAL), construction material, age, navigation and fishing equipments were considered. The relationships among net tonnage, gross tonnage, and OAL and

engine power were determined in order to harmonize the data as carried out in the EU.

All types of legislative statistical documents of EU and Turkish fisheries were obtained from the web sites of EU Directorate General for Maritime Affairs and Fisheries (EU, 2009a), FAO, and Protection and Control DG of MARA (KKGM, 2009), Turkey.

In order to respond, the recommendations of the European Commission on the reduction of Turkish fishing fleet, mean tonnage, engine power, age and mean production quantities were derived. Basic statistical tools and statistical analyzes (χ^2, student t) were done where necessary (Sokal and Rohlf, 1981).

RESULTS

Fishing fleet profile of Turkey

Number of fishing vessels reached to 17681 in 2007, more doubling in last 15 years (TSI, 2008). Of these vessels, 94% is made of wood, 5% is iron and 1% is fiberglass. There are 543 purse-seiners (3%), 725 trawlers (4%), 394 multi purpose vessels (2%), 202 carriers (1%), and 15959 artisanal vessels below 10 m OAL (90%) (Table 2). Majority of the vessels are located in the Black Sea and Aegean Sea (Figure 1).

Only ten percent of Turkish fishing fleet are actively involved in commercial fisheries (TSI, 2008). The majority (90%) are artisanal vessels and few are trawlers (4%), purse seiners (3%), multipurpose (2%) and carriers (1%) (Table 2). Big portion of vessels are under 20 GT (92%) and 10 m OAL (85%). There are no crew in 61% of the vessels, 35% has 1-4 crew and 4% has over 5 and more crews. Ninety-five percent of vessels lack generators and any cold store facilities (TSI, 2008). All of these figures strongly indicate that Turkish fishing fleet is mainly composed of artisanal fisheries.

The operational area of Turkish fishing fleet is mainly coastal areas of Turkey. In recent years, few big purse seine vessels are fishing in the Mediterranean off Egypt, Algeria, Morocco and Italy with special fishing agreements to catch migratory small and big pelagics.

Turkish fishing fleet (over 10 m) carries out purse seining (41%), trawling (40%), gill netting (13%), dredging (2%), beach netting (2%), and long lining (2%) (Table 3). Purse seining, trawling and gill netting are mainly carried out in the Black Sea and Sea of Marmara. Therefore most of the big fishing vessels (>20 m) are based in the Black Sea, Sea of Marmara (Figure 2). Purse seiners, targeting pelagic species like anchovy, pilchards, sprat, bonito and blue fish mainly are operated in the Black Sea and the Sea of Marmara. During the fishing season (May to June) some of these big vessels (approximately 85 vessels) are also operated in the Mediterranean to catch blue fin tuna.

Mean capacity, engine power and net tonnage of the fishing vessels above 10 m are 30±1.27 GT, 117±3.0 KW and 12±0.7 NT and fishing vessels over 20 m are values are 150±7.9 GT 507±16.0 KW, and 58±5.0 NT, respectively (Table 4). Over the last decade, the number of engines in vessels had increased along with the increase in the OAL.

Most of the fishing vessels over 10 m have one (75%) engine and the rest have two (16%) or three (9%) engines. These figures are 50, 31 and 19% for the vessels over 20 m, respectively. Most of the purse seine and trawl vessels have more than one engine to prevent any fishing activities due to engine break down, and to increase vessel speed during operation.

Regarding all vessels, total Turkish fishing fleet capacity was estimated to be approximately 180825 GT and 913358 KW (TSI, 2008). Big proportion of this capacity is located in the Black Sea and Sea of Marmara.

Gross tonnage, engine power and net tonnage data versus OAL groups were also reviewed and all these technical parameters increased in line with the vessel length up to 45 m. In the bigger vessels, there is a slight increase in engine power but gross tonnages and net tonnages are lower. In the 60-65 m size group of vessels engine power decreased 62% as in the previous size group. Gross tonnage and net tonnage slightly increased due to modifications (addition of new spaces for cold storage, accommodation areas etc.) in the form of vessel (Figure 3).

There are 52 different brands of engines used in the fishing fleet. Most popular brands are Volvo (45%), Mann (8%), Iveco (4%), Caterpillar (3%), Delphin (3%), and Daewoo (2%). Scania, Perkins, Mercedes, Cummins, Fiat and MTU are more rare brands (Table 5). Volvo, Iveco, Caterpillar, Daewoo, Scania and MTU are found often in big iron vessel while Delphin, Perkins, Mercedes, Cummins and Fiat are very popular in wooden vessels.

Engine brand in the vessels has changed according to the age of fishing vessels. Volvo engines are still dominant in the vessels even though there is a decreasing trend in their preference with the introduction of such new brands as Mann, Mercedes and Iveco (Figure 4).

There is no significant preference differences as for the size of vessels but types of fishing vessel are effective on main engine brand ($p<0,05$). Volvo is the top brand in the fleet with 33% rate in multi purpose vessels, 16% in purse seiners and 8% in trawlers while Mann engines preferred as 6, 3 and 2%, respectively (Figure 4).

In this study, relationships between net tonnage (NT) and gross tonnage (GT), gross tonnage and vessel length (OAL), and gross tonnage and engine power (HP) of 2143 vessels were also derived and given in Table 6.

Although there were 2237 vessels in the database, ninety-four vessels had no relevant data, so they were not included in regression analyses.

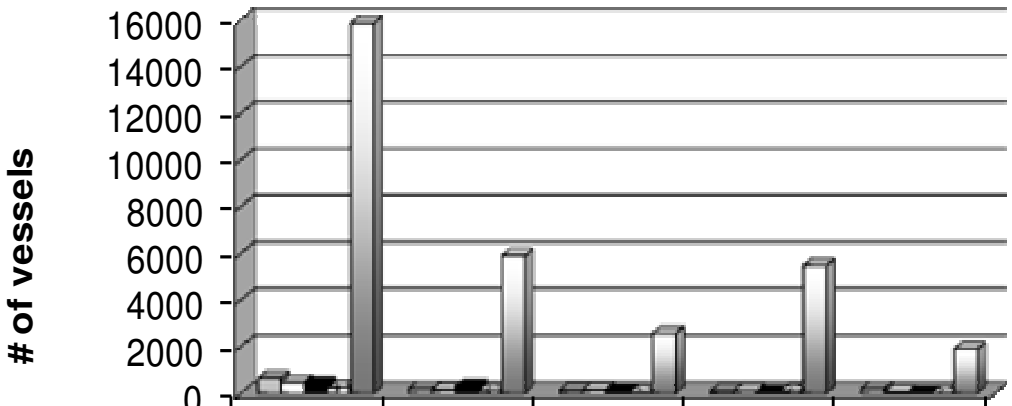
Turkish fleet were found to be very old (18 years) considering the economic life span of 20 years for a given vessel. Wooden vessels are even older (21 years). The vessels constructed in the last decade are mainly made of iron. Therefore, the average age of iron made vessels was found to be the youngest (14 years old). Most of the

Table 2. Fishing fleet characteristics of Turkish fleet as for official statistics (TSI, 2008).

Total	2002	2003	2004	2005	2006	2007
	17696	**18542**	**17953**	**18396**	**17823**	**17681**
Operation type						
Trawler	566	404	433	688	725	655
Purseseiner	448	408	400	510	543	493
Trawler-Purseseiner	416	492	342	443	394	423
Carrier vessels	53	134	306	295	202	252
Other	16213	17104	16472	16460	15959	15858
Material of construction						
Wood	16993	17796	17212	17344	16747	16560
Iron-sheet	622	645	670	977	943	1051
Fiberglass	81	101	71	75	133	70
Tonnage (gross ton)						
1 - 4	13323	14477	14352	14166	13024	13423
5 - 9	2416	2210	2007	1931	2352	1904
10 - 19	1069	942	734	942	1 033	983
20 - 49	403	413	347	562	590	553
50+	485	500	513	795	824	818
Engine power (kW)						
1 - 9	7571	9197	7612	7049	6104	6658
10 - 19	3434	3085	3119	3770	3519	3172
20 - 49	3117	3096	3500	3436	3446	3435
50 - 99	1498	1445	1717	1397	1801	1802
100+	2026	1629	1873	2675	2953	2614
Without engine	50	90	132	69	-	-
Length range (m)						
1 - 4.9	372	472	260	172	158	226
5 - 9.9	14571	15586	15467	15379	15073	14820
10 - 19.9	2231	1930	1654	2018	1745	1716
20+	522	554	572	827	847	919
Number of crew employed						
Without crew	8595	11621	11260	11230	10277	10793
1 - 4	6512	6363	6137	6305	6793	6102
5 - 9	1321	235	275	445	395	332
10 - 19	673	179	145	191	189	212
20 - 29	405	114	101	172	146	203
30+	190	30	35	53	23	39

old vessels were located in the Mediterranean (22 years old), whereas at the areas where fishing activities are at the highest, the vessels were generally younger (17 years). Older vessels were generally used in the trawling whereas younger are used in the purse-seining (Figure 5).

There are two peaks in the growth of the Turkish fleet above 20 m. The first one was in the period between 1970 and 1974 and the second from 1990 to 1994. In the first growth pulse was generated right after establishment of the first fisheries law which led to the release of new governmental subsidizes to the construction of new ships, fishing gears, fish finders, navigation instruments. The second pulse within 1990 and 1994 was created by similar patterns. During this term, fish food processing plants were subsidized by the government. The



	Turkey	Black sea	Marmara	Aegean Sea	Mediterranean
Trawler	655	206	137	101	211
Purseseiner	493	164	164	114	51
Trawler-Purseseiner	423	309	72	37	5
Carrier vessels	252	117	39	96	0
Other	15858	5904	2570	5485	1899

Figure 1. Distribution of vessels according to the seas in 2007 (TSI, 2008).

Table 3. Fishing activities of fishing fleet over 10 m.

Fishing type	Black sea		Marmara		Aegean sea		Mediterranean		Total	
	#	%	#	%	#	%	#	%	#	%
Purse seining	737	17.11	709	16.47	148	3.43	159	3.69	1753	40.70
Trawling	717	16.65	611	14.19	98	2.28	313	7.27	1739	40.39
Dredging	63	1.47	3	0.07	0	0	1	0.02	67	1.56
Beach seining	6	0.14	35	0.81	9	0.22	17	0.39	67	1.56
Gill netting	203	4.72	245	5.69	48	1.11	68	1.59	564	13.11
Long lining	8	0.18	27	0.62	1	0.02	32	0.74	68	1.56
Undefined	3	0.07	9	0.21	0	0	2	0.05	14	0.33
Total	1737	40.34	1639	38.06	295	7.06	592	14.54	4272	100.00

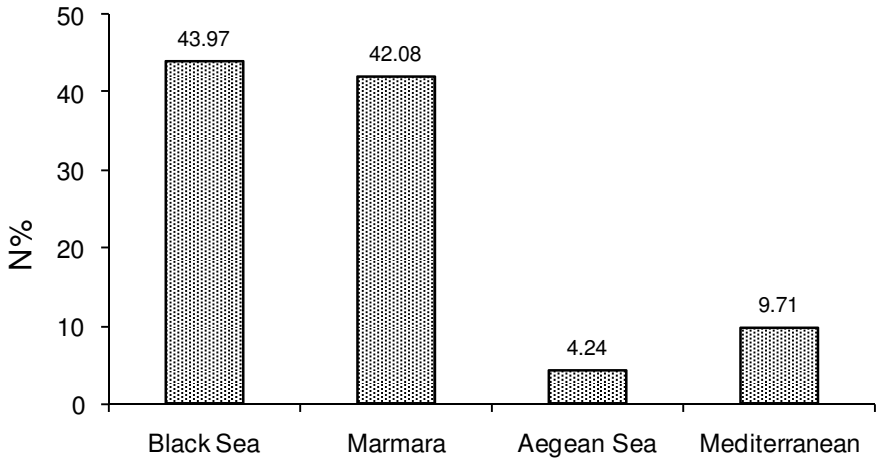


Figure 2. Distribution of vessels (>20 m) in the Turkish Seas.

Table 4. Capacities and number of engines of fishing vessels over 10 and 20 m (mean±SE).

Parameter		OAL (m)	Black sea	Marmara	Aegean sea	Mediterranean	Total
GT		10	45±3.5	40±1.8	11±0.6	27±1.4	30±1.27
		20	160±16.2	160±6.1	115±7.3	99±5.1	150±7.9
NT		10	18±2.2	16±0.7	5±0.2	12±0.7	12±0.7
		20	62±10.5	60±2.5	46±3.1	41±3.7	58±5.0
KW		10	173±7.0	141±7.0	42±2.0	138±5.0	117±3.0
		20	495±23	627±29	409±27.0	340±16.0	507±16.0
# Engines	1	10	763(69.75%)	710(68.80%)	323	156	1952(74.93%)
		20	253(43.93%)	242(43.84%)	38	87	620(49.48%)
	2	10	208(19.01%)	202(19.57%)	-	-	410(15.68%)
		20	200(34.72%)	190(34.42%)			390(31.12%)
	3	10	123 (11.24)	120(11.63%)	-	-	243(9.29%)
		20	123(21.35%)	120(21.74%)			243(19.40%)

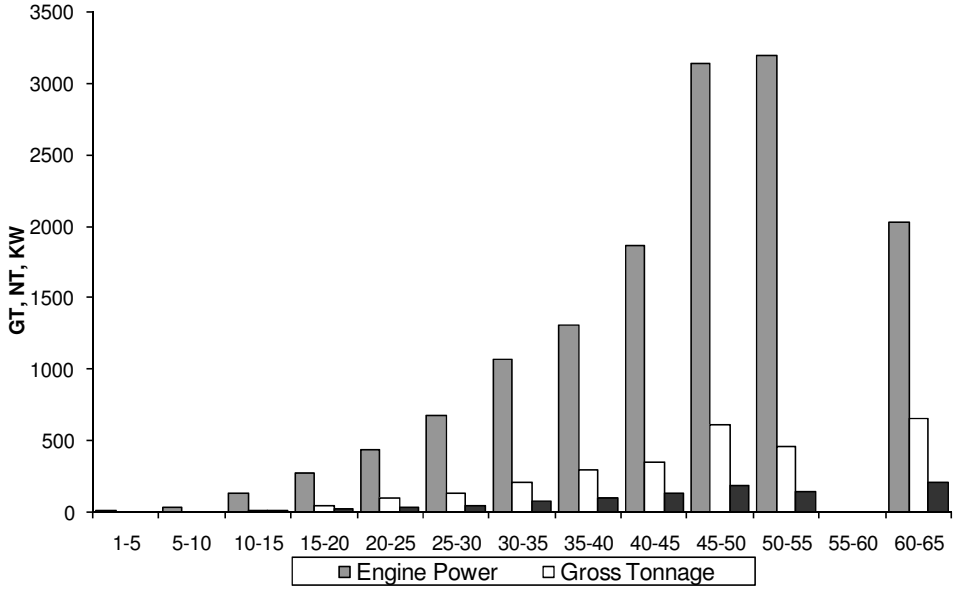


Figure 3. Fleet capacity measures according to the vessel OAL (m).

increase in the capacity in the processing units created huge increase in the demand from the capture fisheries. Thus, number and size of vessels increased once again. It reached to a peak in 1990's and sharply decreased due to stabilization measure applied by MARA to control fishing effort (Figure 5).

Supporting units

In recent years, there is a great demand by the markets to get fish the freshest as possible, the fishermen felt constrained to have cold storage facilities, ice makers, fish pumps and other auxiliary equipments, obligating electricity production in the vessels. In the Turkish fleet, 25% of vessels above 10 m (612) have generators of various capacities (TSI, 2004). Majority of the vessels having generators are made of iron (75%). Considering fishing method employed, most of multipurpose vessels has generators (47%), followed by purse seiners (40%), trawlers (11%) and the others type of vessels (2%) (Table 7).

Fish pumps, are increasingly used to speed up transporting captured fish from water to carrier vessels for grading, handling and transportation to the port, and are also more frequently used in the vessels above 20 m

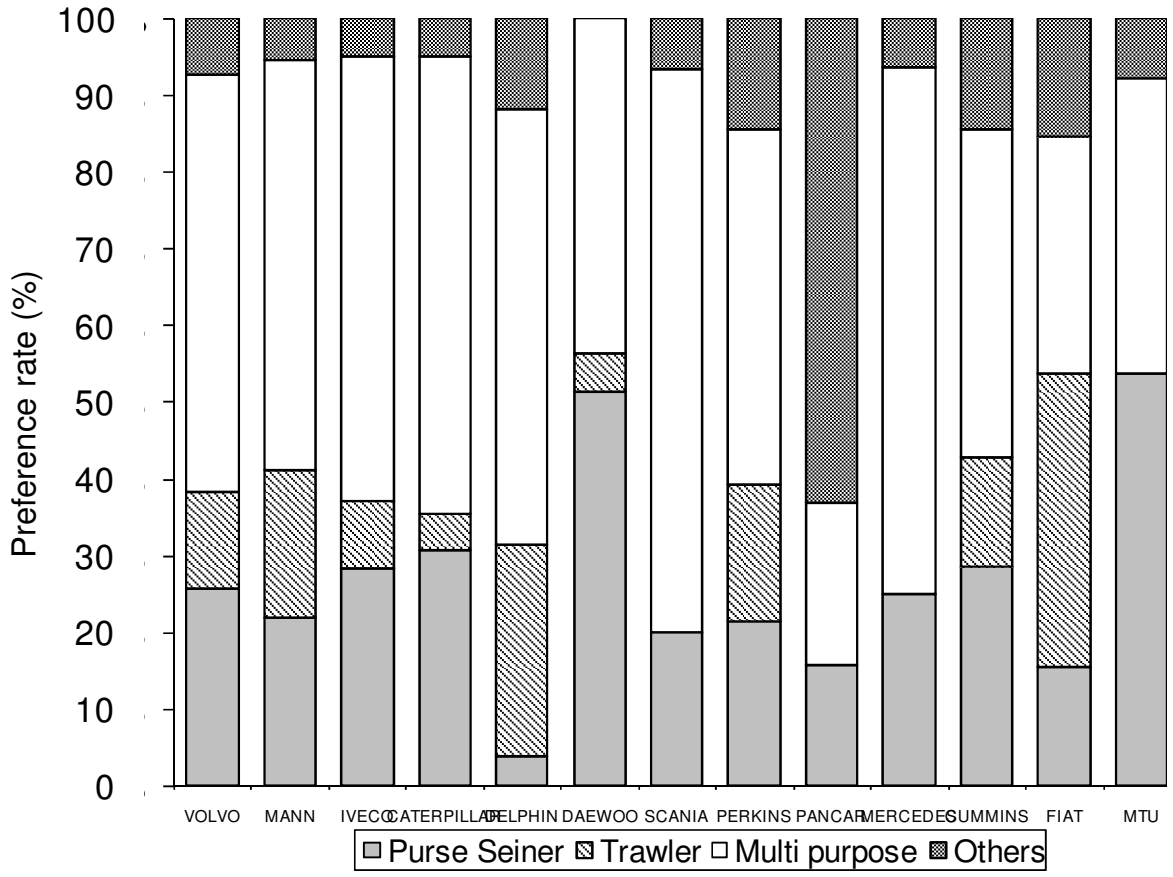


Figure 4. Preference of main engine brands as for fishing vessel type.

Table 5. Main engine brands in the Turkish fishing fleet.

Brand	Iron		Wood		Total	
	#	%	#	%	#	%
Volvo	515	60	279	31	794	45
Mann	74	9	74	8	148	8
Iveco	70	8	11	1	81	4
Caterpillar	49	6	13	1	62	3
Delphin	23	3	28	3	51	3
Daewoo	35	4	4	0	39	2
Scania	21	2	9	1	30	1
Perkins	2	0	27	3	29	1
Mercedes	5	1	11	1	16	1
Cummins	2	0	11	1	13	1
Fiat	4	0	9	1	13	1
MTU	12	1	1	0	13	1
Others	52	6	404	45	466	26
Total	864	100	881	100	1755	100

(41%) in the recent years (Table 7) (MARA, 2007). Approximately half of the multipurpose (47%) and purse seine (46%) vessels have fish pumps.

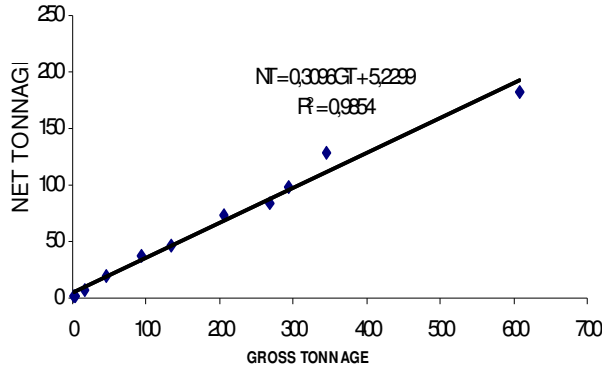
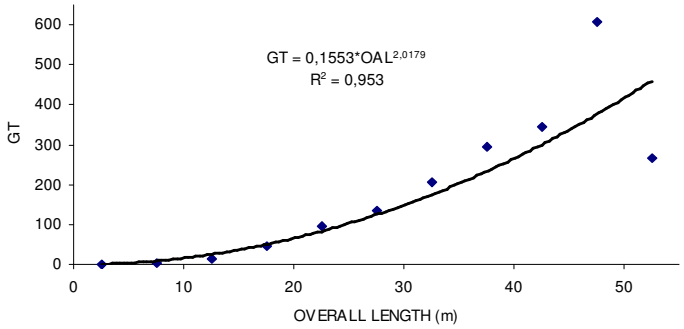
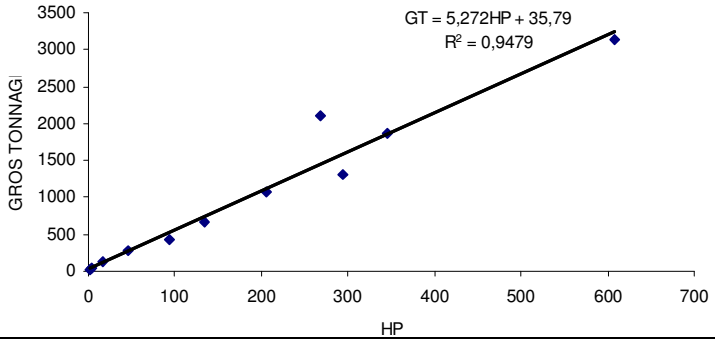
Majority of the fishing fleet has no echo-sounders (93%), and sonars (97%). Echo-sounders and sonars are mainly used in pelagic fishing operations in the Black Sea. Echo sounders are more often found in trawl (67%) and purse-seiners (80%) and more than half of the purse seiners (58%) have sonar (Table 7). All of multi purpose vessels have at least one echo-sounder, and eighty-four percent of them have sonars.

Very low ratio of fishing vessels (2.2%) has cold storage units and other such related equipment as ice machines. Seventy percent of multipurpose vessels and one-third of trawl and purse-seiners have cold storage capabilities (TSI, 2008). The volume of deep freeze and cold stores ranges from several cubic meters to over 50; of which 43% of the vessels have units smaller than 10 m^3, 29% has 10 to 20 m^3, 27% has 20 - 50 m^3, and 6% has over 50 m^3 (TSI, 2005).

EU fishing fleet

In order to reduce fishing mortality, reduction of the fleet had been targeted in the early 1990s by using the instrument of Multiannual Guidance Programmes (MAGPs) in EU. The main aim was to achieve better

Table 6. Relationships between GT-NT and HP (USMA, 2004)

Relationships	Graph
NT = 0.3096 GT + 5.2299 r = 0.9927	
GT = 0.1553 OAL $^{2.0179}$ r = 0.9762	
GT = 5.272 HP + 35.79 r = 0.9736	

balance on a sustainable basis between fish resources and the fishing activities of the EU fleet, particularly for those targeting endangered stocks. MAGPs were not effective to reach main purpose due to increasing efficiency of fishing vessels by technological improvements in the fishery activities.

EU has the biggest fleet of the world even though as result of the reduction policy, current fleet capacity in terms of total number of vessels, total volume capacity and total engine power decreased to 88188 pieces, 1920487 GT and 7011029 KW in 2007, from 97678 vessels, 2016984 GT and 7721232 KW in 1999, respectively (EU, 2009b). Greece, Italy and Spain are the leading countries in terms of number of vessels as 17857, 14125, and 13353, respectively. In terms of gross tonnage, Spain, UK, France, Italy and Greece have larger portion among EU countries. On the other hand, Spain, Italy, France, Portugal, Poland, Malta, Lithuania and Greece have the biggest engine capacities (Table 8 and Figure 6).

Although Greece has the highest number of vessels, most of them are composed of small vessels. Spain, Italy, UK and France have less but bigger vessels in terms of GT and KW. Fishing fleet of Spain, Italy and France were modernized using EU funds leading increase in fishing efficiency.

Mean age of EU fishing fleet is 21 years. The new member states Bulgaria and Romania have the youngest fleet but are represented by a small number and small sized vessels. On the other hand, fleets of Denmark and

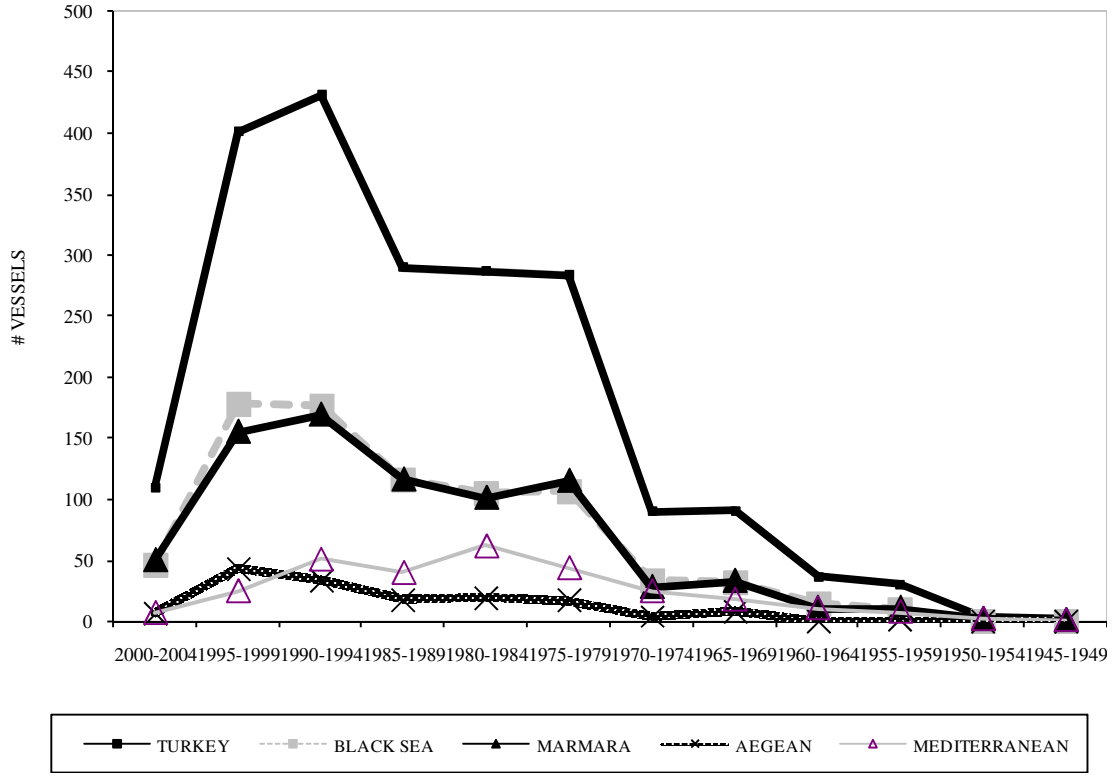


Figure 5. Age of Turkish fishing fleet (Erdogan, 2006).

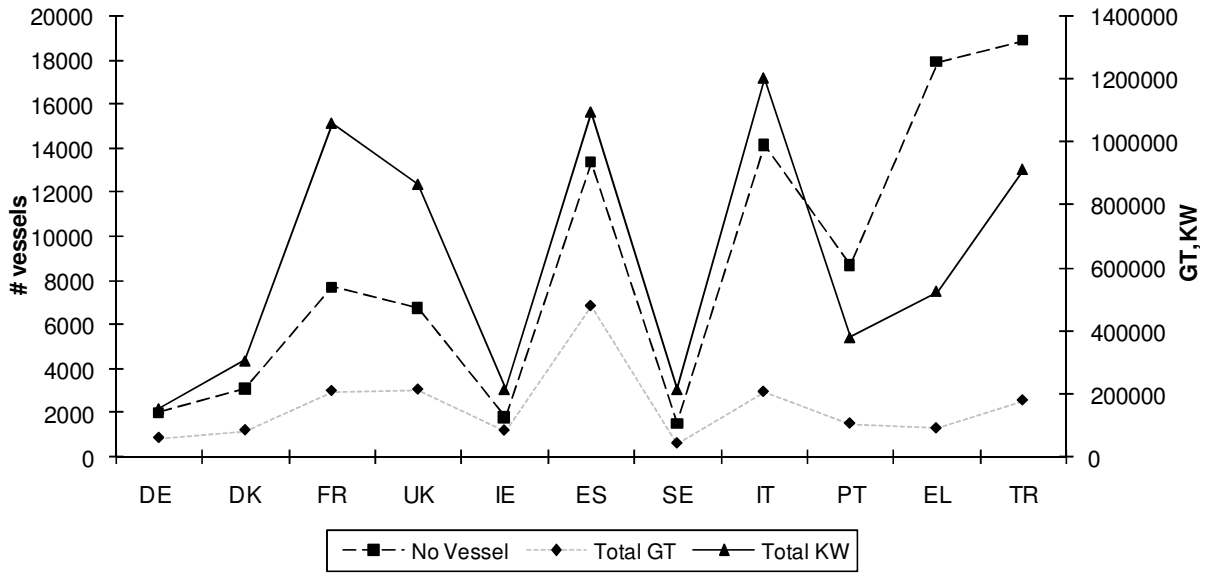


Figure 6. Fishing fleet size of selected EU countries (EU, 2009c).

Poland are the oldest, 28 and 26 years, respectively. In case of Spain, the mean age of fleet is also 16 years and has more than 13000 vessels. Fleets of other member states are over 20 years old. In order to balance fishing effort and capacity of fishing resources, EU encourage fleet reduction by using financial tools. The decrease in vessel numbers was 12.4% from 2000 to 2005 compared with a fall of 5.8% from 2005 to 2008 (Zampogna, 2009). On the other hand, introduction of new vessels having less GT had been supported by removing old vessels which their GT is more than the new one. Spain is the leading country renewing her fishing fleet using

Table 7. Equipments used in Turkish fishing fleet over 10 m.

Equıpment	Seas	Purse seıner			Trawl			Multı purpose			Others			Total		
		W	I	T	W	I	T	W	I	T	W	I	T	W	I	T
Generator	Black Sea	18	88	106	9	11	20	45	122	167	5	2	7	78	222	300
	Marmara	16	98	114	6	10	16	19	76	95	1	1	2	42	185	227
	Aegean	3	10	13	1	2	3	0	2	2	1	0	1	5	14	19
	Mediter.	5	5	10	11	19	30	12	13	25	0	1	1	28	38	66
	Total	42	201	243	27	42	69	76	213	289	7	4	11	153	459	612
Fish pump	Black Sea	9	67	76	5	1	6	32	72	104	4	1	5	50	141	191
	Marmara	9	79	88	1	2	3	9	52	61	1	1	2	20	134	154
	Aegean	0	3	3	0	2	2	1	1	2	0	1	1	1	7	8
	Mediter.	1	0	1	4	2	6	1	3	4	0	0	0	6	5	11
	Total	19	149	168	10	7	17	43	128	171	5	3	8	77	287	364
Echo-sounder	Black Sea	39	94	133	89	19	108	121	196	317	17	4	21	266	313	579
	Marmara	34	102	136	52	19	71	71	152	223	12	2	14	169	275	444
	Aegean	21	15	36	13	8	21	5	8	13	1	0	1	40	31	71
	Mediter.	6	7	13	57	34	91	21	20	41	0	2	2	84	64	148
	Total	100	218	318	211	80	291	218	376	594	30	8	38	559	683	1242
Sonar	Black Sea	16	85	101	15	5	20	44	110	154	5	2	7	77	202	279
	Marmara	18	86	104	10	4	14	15	63	78	1	2	3	44	55	99
	Aegean	2	9	11	1	3	4	3	6	9	0	0	0	6	18	24
	Mediter.	11	5	16	80	38	118	25	21	46	0	3	3	116	67	183
	Total	47	185	232	106	50	156	87	200	287	6	7	13	243	342	585
Radar	Black Sea	102	34	136	70	17	87	122	214	336	11	3	14	235	338	573
	Marmara	122	270	392	26	15	41	63	147	210	5	2	7	226	297	523
	Aegean	14	14	28	23	11	34	11	13	24	1	1	2	49	39	88
	Mediter.	10	7	17	122	64	186	57	31	88	3	5	8	166	100	266
	Total	248	325	573	241	107	348	253	405	658	20	11	31	676	774	1450
Deep freeze and cold store	Black Sea	8	50	58	20	11	31	43	114	157	3	2	5	74	177	251
	Marmara	8	54	62	3	7	10	9	53	62	0	1	1	3	7	10
	Aegean	1	4	5	0	2	2	2	3	5	0	0	0	3	9	12
	Mediter.	4	4	8	64	44	108	7	9	16	0	1	1	75	58	133
	Total	21	112	133	87	64	151	61	179	240	3	4	7	155	251	406

W: wooden, I: Iron, T: Total (Erdogan, 2006).

subsidizes of EU.

Comparison of Turkish and EU fishing fleets

Mean gross tonnage is 10 GT in Turkey while the EU average is 22 GT. Similarly mean engine power is 49 KW in Turkey and 81 KW in the EU. Lithuania, Belgium have rather high mean GT values (200 and 187 GT, respectively) comparing with the other EU countries, Ireland, Latvia, Spain, UK, Italy and Germany ranging from 46 to 30 GT. Similar figures are obtained in the comparisons of engine powers; 563 KW in Belgium, 222 KW in Lithuania and followed by Sweden, France, UK and Ireland (Table 8).

The fishing fleets of Turkey and Greece are almost identical in terms of number of vessels. Ratio of artisanal vessels, less than 12 m OAL (15652 vessels, 89%) in Turkey is lower than that in Greece (16900 vessels, 94%). But, in case of total GT and total KW values of Turkey's fishing fleet is twice as big as Greece (Table 8).

Total gross tonnage and engine power of Turkish fleet is 180825 GT and 913358 KW which are less than Spain (480189 GT, 1094469 KW), Italy (208136 GT, 1202071

Table 8. EU fishing fleet characteristics according to the 2006 data (EU, 2008a).

Country		# Vessel	Total (GT)	Total (KW)	Mean (GT)	Mean (KW)	Production (t)	Median age	Production/ Vessel # (t)	Production/ GT (t)	Production/ KW (t)
Germany	DE	2017	61867	155619	30	77	285667	25	142	4.6	1.8
Belgium	BE	107	20035	60190	187	563	24569	23	230	1.2	0.4
Bulgaria	BG	2537	8333	63061	3	20	5433	16	2	0.7	0.1
Denmark	DK	3135	85728	306607	27	98	910650	28	290	10.6	3.0
Estonia	EE	993	20702	53060	21	53	768267	20	774	37.1	14.5
Finland	FI	3196	16416	169382	5	53	131737	23	41	8.0	0.8
France	FR	7699	210503	1058733	27	137	595275	21	77	2.8	0.6
England	UK	6759	215025	865451	32	128	669493	22	99	3.1	0.8
Ireland	IE	1846	84549	216828	46	118	262482	23	142	3.1	1.2
Spain	ES	13353	480189	1094469	35	81	768267	16	58	1.6	0.7
Sweeden	SE	1567	43922	216883	28	138	256356	28	164	5.8	1.2
Italy	IT	14125	208136	1202071	15	85	289459	22	20	1.4	0.2
Cyprus	CY	872	5454	40573	6	46	1880	28	2	0.3	0.0
Latvia	LV	897	37248	61384	42	68	139785	23	156	3.8	2.3
Lithuania	LT	264	52658	58722	200	222	150618	25	571	2.9	2.6
Malta	MT	1412	15166	98744	11	70	1336	23	1	0.1	0.0
Poland	PL	884	31600	99911	36	113	156246	26	177	4.9	1.6
Portugal	PT	8714	106915	380454	12	43	211767	22	24	2.0	0.6
Romania	RO	440	2560	8526	6	19	6068	17	14	2.4	0.7
Slovenia	SI	175	1057	10796	6	65	1227	22	7	1.2	0.1
Greece	EL	17857	92360	527534	5	29	92026	23	5	1.0	0.2
EU Total	EU	86703	1947894	7061376	22	81	5620543	21	65	2.9	0.8
Turkey	TR	18836	180825	913358	10	49	426496	18	23	2.4	0.5

KW), UK (215025 GT, 865541 KW) and France (210503 GT, 1058733 KW) (Table 8 and Figure 6).

Capture production and fishing effort of EU countries including Turkey, figures of catch per unit effort (as per vessel, per GT and per KW production) were also derived as 65 tons/vessel, 2.9 tons/total GT and 0.8 tons/total KW were obtained for EU countries while 23 ton/vessel, 2.4 ton/total GT and 0.5 ton/total KW for Turkey (Table 8). Estonia, Lithuania, Denmark, Belgium, Poland, Sweden, Latvia and Ireland have obtained the highest per vessel production, ranging from 3.8 to 37.1 tons, in 2006. Estonia, Denmark, Finland, Sweden, Poland, Germany, Latvia are the leading countries in terms of fish production per GT.

DISCUSSION

European Union is the world's second biggest capture fisheries producer (5.6 million tons) after China (17053191 tons) in 2005 (EU, 2007; UNdata, 2009). The EU fishing fleet consists of more than 88100 vessels; greatly vary in size and fishing capacity or potential catching power. Recently, number of vessels declined due to measures taken by EU in an attempt to balance with the resource capacity with the existent fishing power. EU supported actions for modernization of fleet to ensure improved safety, working conditions, products quality and selectivity in fishing (EU, 2008b), but these measures increased present fishing capacity further by adding capabilities of being able to fish more effectively and stay at the sea longer.

Fishery management, even in EU, has not been successfully applied, producing claimed outcomes e.g. sustainable use of resources. Stocks of herring and cod collapsed in spite of application of unsuccessful management implementations. Political and scientific conflicts together with insufficient monitoring, control and surveillance services resulted in the observed collapse (Hjermann et al., 2004). Along with the collapse of any stocks, fishing capacity for a given country will increase naturally. Allowing further use of the fishing effort may create over fishing unless any type of subsidizes are applied as in EU by multi-annual guidance programs (MAGP). All stake holders should be eager for sustainable management plans of any stock for successful outcomes to prevent overcapitalization as economical waste. Effective reinforcements of rules agreed upon are also a must (Lindebo et al., 2002; Cunningham and Greboval, 2001).

Having a rich diverse group of economical fish species utilizing diverse marine and freshwater habitats, fisheries

sector is very important for economical and social aspects in Turkey. According to the latest data, total fish production is 661991 tonnes of which 81% is obtained from capture fisheries, both in seas (488966 tonnes) and 7% from inland waters (44082 tonnes) (Figure 2) (TSI, 2007). With this production level, Turkey is the 30th country in the world and 6th in the EU. The value of capture fish production is about 764 million €. Fisheries are not only food but also an important source for the employment. Recently export of sea food (18953 tonnes) provides over 89 million €. Number of registered fishing vessels is 17823.

Historically, Turkey has coastal fisheries operating small purse seiners and trawlers in surrounding seas. After Fisheries Law enacted in 1971, there was a significant increase in fish production and fishing capacity (size and engine power of vessels, and fishing gears).

At present, there is no Total Allowable Catch (TAC) and quota system in Turkey due to lack of fish stocks assessments. The existent fisheries management policy is going to be improved for the rational exploitation of fisheries resources based on sustainability, efficiency and equity. Fleet registry, licensing and VMS (over 24 m vessels) has already been completed. The amendments to Fisheries Law have been completed and sent to the National Assembly for ratification. In case of fishing fleet reduction, there is no possible way to scrap some of the vessels due to lack of any national or EU funds like MAGP, Financial Instrument for Fisheries Guidance (FIFG), and the new European Fisheries Fund (EFF) as it was applied to old member states during their accession period (EU, 2008c).

When the negotiations on fisheries sector had started between Turkey and Fisheries and Maritime DG in EU Commission, an important question raised was on the magnitude of the fishing power compared to the resource capacity (Arpa, 2008). Fisheries and Maritime DG insisted that Turkish fleet has been over fishing, damaging sustainability of the stocks. Therefore, it needs to be reduced to the “optimal” levels. However, current state of stocks in Turkish waters had not been assessed with comprehensive scientific research. There should be ecosystem based stock assessment studies and TAC estimations to implement quota allocations and “optimal” level of fishing fleet in Turkey.

Also, reliability of national fishery statistics is also in question. At present, the only reliable data is about the number of fishing vessels, but it lacks the information on catch per unit effort in Turkey. Thus, it is unfair to judge Turkey to reduce number of vessels without any scientific evidence. Also only a small proportion of vessels, which captures majority of fishing production, operate on a seasonally full time basis, and the rest are artisanal fishing boats having minor importance on total harvest (MARA, 2003).

In the EU, fleet reduction in member countries funded by MAGPs since 1983 to achieve a better balance between resource and fishing effort. In spite of MAGPs, significant reduction in the fleet to manage sustainability could not be achieved due to technological progresses increasing fishing efficiency of the vessels. After 2002 CFP reform, FIFG was established to keep fishing effort and fish availability in balance. Turkish fishermen are also under the threats of several social, biological and environmental problems such as adaptation to CFP, conflicts with other stake holders, resources degradation, invasive species, and climate change and over exploitation of the resources. Due to national economical problems, unfair competition between big and small scale fishermen, rigid surveillance services and low earnings, many fishermen were forced to stop fishing and to scrap their vessels. However, lack of any funding mechanisms prevents their smooth transition to other livelihood possibilities. On the other hand, EU experts have reported that fishing vessels are far away from rantability, and subsidizes provided by the government are not enough to reach the goal of reduced fleet for better sustainability. In a situation, where even subsidizing does not have sufficient impact on the reduction of fishing effort, it is unfair to demand Turkey to reduce its fishing fleet/effort. In EU, even though the number of vessels decreased, along with the modernization of the vessels fishing power per vessel increased substantially. In Turkey, generally, most of the capture fish production is carried out by the fishing vessels (purse-seiners and trawlers) over 10 m OAL (15%) having higher impact on the resources as in Greece. In the Mediterranean, 80% of the EU Mediterranean fishing fleet (58767 unit) is composed of vessels below 12 m overall length (Mikhailov et al., 2006). Despite all efforts, there is no remarkable reduction in the fishing fleet other than changing ownership from fishing vessel to service vessel for offshore aquaculture industry in EU.

Parameters, production per vessel, per GT and per KW can be used as indicators to evaluate catch per unit effort (CPUE) of the fishing fleet (Arpa, 2008). Although the number of vessel in Greece and Turkey is similar to each other, production per vessel value of Turkey is above 4 times higher than that of Greece, 10 times than that of Bulgaria and Cyprus, 20 times than that of Malta and similar to that of Italy and Portugal.

In case of production per GT, Turkey’s productivity is more than Greece, Portugal, Malta, Cyprus, Italy, Spain, Belgium and Bulgaria. Lastly, production per KW is higher than Greece, Cyprus, and Italy and similar to France, Spain and Portugal. So according to these data, it is unfair to judge Turkish fishing fleet unprofitable and to demand reduction in the fleet. Constructions of new vessels, prohibited since 1997, are managed by Turkish Government. New vessels are only permitted by removing an old vessel from the fleet.

EU fishing fleet, especially in the countries having vessels with high mean GT and KW values are rather old, mean age in the EU is 21 and the oldest vessels belong

to Cyprus (28), Sweden (28), Denmark (28), Poland (26), Lithuania (25), Germany (25), Belgium (23), Finland (23), Ireland (23), Malta (23) and Greece (23). In Turkey mean age is 18 years (Table 8).

Conclusion

Turkish fishing fleet when compared to the some other EU country fleets is not significantly bigger and unprofitable. It is essential that Turkish government should establish a funding mechanism for fishermen eager to withdraw from fishing by scrapping their vessel in corporation with EU Commission. There is also an urgent need to implement a new fisheries management system in line with EU CFP regardless of Turkey being a member of EU in close future and stock assessment studies should be initiated immediately. Fishery data collection system need to be reorganized to collect reliable and secure catch and landings, by-catch, and fishing effort as fishery dependent data for VPA and cohort analysis.

Fisheries are not only a source of food production but also an important sector for employment. There were 136782 licensed fishermen and 45643 part-time and full-time workers employed in the fishing vessels and landing ports in Turkey (TSI, 2008). Any reduction in the fleet would have great social and economic impact on the coastal communities. So reduction decisions should be considered together with a compensation system by offering alternative employment opportunities.

Supporting Turkey in the accession period with the similar system as it is done to some members of the EU by special financial instruments and flexible transition process would be fair and enable smooth transition of those willing to quit fishing activities.

ACKNOWLEDGEMENTS

Authors are grateful to MARA and Under Secretariat of Maritime Affairs which provided valuable data about fishing vessels. Special thanks to Dr. Hamdi OGUT for critical editing of the manuscript.

REFERENCES

Arpa H (2005). Personal communication. General Directorate of Control and Protection. MARA. Ankara.

Arpa H (2008). Personal communication. General Directorate of Control and Protection. MARA. Ankara.

Bergh PE, Davies SL (2001). Monitoring, control and surveillance. In: A Fishery Manager's Guidebook. FAO Fisheries Technical Paper. No. 624. Rome, FAO. (ed. K.L. Cochrane), pp. 175-204.

Cunningham S, Greboval D (2001). Managing fishing capacity: A review of policy and technical issues. FAO Fisheries Technical Paper 409.

Duzgunes E, Erdogan N (2008). Fisheries Management in the Black Sea Countries. Turk. J. Fish. Aquat. Sci., 8: 181-192.

Erdogan N (2006). Evaluation of the Turkish Fishing Fleet on the Basis of Fisheries Management. PhD Thesis, Eagean University, Graduate School of Natural and Applied Sciences. Department of Fishing and Processing Technology, p. 143.

EU (2005). Fleet Management. About the Common Fisheries Policy. http://ec.europa.eu/fisheries/cfp/management_resources/fleet_ management_en.htm.

EU (2007. Fisheries Statistics. Data 1990-2006. Eurostat Pocketbooks. 2007 Edition. Luxembourg. p. 68.

EU (2008a). Facts and Figures on the EU Fishing Fleet. Evolution of the fleets number of vessels tonnage engine power. http://ec.europa.eu/fisheries/fleetstatistics/ index.cfm?lng=en

EU (2008b). About the Common Fisheries Policy. http://ec.europa.eu/fisheries/cfp_en.htm.

EU (2008c). A new fund for the sustainable development of fisheries in the European Union.

EU (2009a). Directorate General for Maritime Affairs and Fisheries. http://ec.europa.eu/dgs/fisheries/index_en.htm.

EU (2009b). Facts and Figures on the EU Fishing Fleet. http://ec.europa.eu/fisheries/fleetstatistics/index.cfm?lng=en

EU (2009c). Evolution of the Fleet's number of vessels, tonnage and engine power. Facts and Figures on the EU Fishing Fleet. http://ec.europa.eu/fisheries/fleetstatistics/ index.cfm?lng=en.

Ferraris J (2002). Fishing fleet profiling methodology. FAO Fisheries Technical Paper. No 423. Rome, FAO. 87 p. http://ec.europa.eu/fisheries/cfp/structural_measures/ arrangements_2007_2013_en.htm.

Hjermann DØ, Ottersen G, Stenseth NC (2004). Competition Among Fishermen and Fish Causes the Collapse of Barents Sea Capelin. www. pnas.org/cgi/doi/10.1073/ pnas.0402904101.

KKGM (2009). General Directorat of Protection and Control, Ministry of Agriculture of Rural Affairs. http://www.kkgm.gov.tr/

Lindebo E, Frost H, Løkkegaard J (2002). Common Fisheries Policy Reform: A new Fleet Capacity Policy. Danish Research Institute of Food Economics (FOI). Copenhagen. Report, 141: 46.

MARA (2003). Support to the Turkish Authorities in Charge of Legislative Alignment to the Acquis in the Fisheries Sector. Final Project Report. March 2003. Ankara, p. 5.

Mikhailov K, Conides A, Papaconstantinou C (2006). Marine Resources. International Action for Sustainable of the Mediterranean and Black Sea Environment. Final Scientific Conference, Istanbul.

Sokal R, Rohlf J (1981). Biometry, 2nd ed., W.H Freeman Com. USA. p. 859.

TSI (2004). Fishery Yearbook of Statistics 2003. Turkish Statistical Association. Prime Ministry, Ankara.

TSI (2005). Fishery Yearbook of Statistics 2004. Turkish Statistical Association. Prime Ministry, Ankara.

TSI (2007). Fishery Yearbook of Statistics 2006. Turkish Statistical Association. Prime Ministry. Ankara.

TSI (2008). Fishery Yearbook of Statistics 2007. Turkish Statistical Association. Prime Ministry, Ankara.

UNdata (2009). Fish Production. http://data.un.org/Data.aspx?d=FAO&f=srID%3A3500

USMA (2004). Personal Communication. National Vessel Registry Database. Under Secretariat of Maritime Affairs. Prime Ministry. Ankara.

Zampogna F (2009). The EU-27 fishing fleet continued to decline in 2008. Agriculture and fisheries, Eurostat, Statistics in Focus, 49/2009.