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Economic Perspective of Fishery Activities Sea of Marmara in Turkey

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Abstract

In the study, it is aimed to determine the fisheries related assets, financial conditions and annual incomes and expenses of the fishermen in Marmara Sea; to analyze the profitability and productivity comparatively; and to discuss the measures to be taken for the improvement of their activities. The data from 231 fishermen attained through questionnaires are utilized in the analyses. As a result, it is determined that the value and variety of the assets of fishermen increase with the vessel length. On the other hand, it is also determined that fishermen are under significant debt burden. In small vessel groups catching high priced species strategy is applied while in big vessels catching vast amount of target group species strategy is preferred. Estimated annual net profits, net fishery income, labor and capital productivity levels indicate that generally fishermen have achieved satisfactory outcomes.

Introduction

Sea of Marmara has the feature of an inland sea within the boundaries of Turkey. In the historical process the surrounding of Sea of Marmara always preserve the characteristic of being the centre of attraction and the settlements and industrial areas have soared in the region. So Sea of Marmara has been exposed to increasing pollution, and the deterioration in eco-systems has negative effects on fish populations (Yüksek, 2016). Despite this, the quantity of fish caught from Marmara Sea has been increasing since the 1980s. The average fishing quantity caught and landed in the last 30 years has increased by 10 tons in every decade. While the related figure was about 40 thousand tons in the 1980s, it was 50 thousand tons in the 1990s and it increased to 65 thousand tons in the 2000s. The quantity of sea products caught from Sea of Marmara that has a smaller fishing area than Black Sea, Mediterranean Sea and Aegean Sea, generally ranks second after Black Sea. Today, 18 species that have benthic, demersal and pelagic characteristics are caught in Sea of Marmara (Zengin, 2012). According to Statistical Institute of Turkey (TUIK, 2018) data, the quantity of total fish landed in the years 2014, 2015 and 2016 are 30095, 29338 and 29336 tons, respectively. These figures respectively constitute 13.02%, 8.48% and 11.12% of total sea fish production in Turkey. The fisheries activities in Sea of Marmara generate a crucial source of income not only for fisherman families live in the coastal area but also income for those working in the boats and revenue for those plying the trade of sea products (Güngör, Güngör, Zengin, & Demirkol, 2012).

The characteristic structure of fisheries in Marmara is coastal fishing of benthic/demersal species and largely purse-seines fishing of pelagic fish that rests upon

seasonal migration fact. During the seasonal migration of pelagic fish particularly such as bonito, bluefish, chub mackerel, horse mackerel, sardine, anchovy from Aegean Sea to Black Sea and from Black Sea to Aegean Sea through the straits, the fishing activities in Marmara speeds up. Among the pelagic fish the most crucial species is bluefish (*Pomatomus saltatrix*) (Akyol, Ceyhan, & Ünal, 2006). The other species caught and have a primary economic importance are anchovy, horse mackerel, bonito, sardine, chub mackerel, shrimp, mullet, red mullet, hake and gray mullet. Those species having secondary economic importance are whiting, turbot, flounder, picarel, shad, gurnard, sea-bass, garfish, thornback, shark and sea snail. In average of 2014-2016, the outcomes of fishery activity in Marmara sea is 29589 tons per year. This quantity consist of 57.90% anchovy, 15.60% sardine, 10.40% horse mackerel, 1.81% picarel and 4.64% other species. When the total sales value is taken into account, the share of the anchovy is 44.83%. Anchovy is followed by bluefish with 16.84%, horse mackerel with 12.65%, sardines with 9.83%, bonito with 4.71%, picarel with 1.84%, mullet with 1.66% hake with 1.13 and other spices with 6.52% (TUIK, 2018).

When the marine fisheries management in Turkey is examined, it doesn't seem possible to talk about the presence of a planned and well-functioning administrative structure and an efficient resource management. In the fisheries, besides big fishing vessels, a dispersed structure is observed that also involves small scale fishermen. Fishing principles are permanently violated, nonstop investments are made to fishing capacity without taking the current sources (total allowable catch) into account, and the fishing fleet grows quantitatively and qualitatively. Overfishing, the pressure of settlements and accompanying environmental pollution, the inadequacy of fish consumption, low level of becoming a cooperative and the inefficiency of existing cooperatives in marketing, the employment problems of fishermen and crew during the closed seasons, and the failure of the supervision in attaining the aims are among the principal problems of fisheries in Sea of Marmara (Zengin, 2012).

Since the beginning of the 2000s, FAO and administrators of fisheries have started to underline the necessity of social and economic studies for solving the fisheries management problems in several countries mainly active in coastal fisheries and the subject has gradually gained importance. In this context, several technical reports and handbooks have been published by FAO that involve various economic indicators for the improvement of sustainable sea fisheries (Lery, Prado, & Tietze, 1999; FAO, 1999; Tietze, Prado, Lery, & Lasch, 2001). A data base on socio-economic indicators for Mediterranean fisheries is formed by Franquesa, Malouli, & Alarcon (2001). A study on the economic performance and efficiency of sea fisheries is made by Tietze, Thiele, Lash, Thomsen, & Rihan (2005). Moreover, for the estimation of economic indicators in Mediterranean fisheries articles are published by General Fisheries Commission for the Mediterranean (GFCM) (Colloca, Ciespi, Cerasi, & Coppola, 2003; Franquesa *et al*., 2005). It is obvious that sustainable fisheries and fishing is possible with the co-utilization of biological and socio-economic indicators (Neiland, 1992; Anonymous, 1999; Sabatella & Franquesa, 2004).

The economics of fisheries can be identified as a relatively new field of study in Turkey. On the other hand in recent years it is seen that the number of studies on the subject is increasing. Those studies prepared in this context are mainly related to the determination of some social and economic characteristics of fishermen in certain regions (Uzmanoğlu & Soylu, 2006; Yücel, 2006; Dartay, Duman, Duman, & Ateşşahin, 2009; Yiğit, Soylu, & Uzmanoğlu, 2009; Doğan & Gönülal, 2011; Aksoy & Koç, 2012; Yağlıoğlu, 2013). Besides, in addition to the determination of social and economic characteristics of fishermen fishing in different seas, there are other studies on the economic analysis of fisheries activities. In this context those studies for Foça (Ünal & Hoşsucu, 1996; Ünal, 2001; Ünal, 2002; Ünal, 2003; Ünal, 2004); for Black Sea (Çeliker *et al*., 2006); for Aegean Sea (Çeliker *et al*., 2008), for Mediterranean Sea (Taşdan *et al*., 2010); for Mersin, Taşucu (Rad & Delioğlan, 2006); and for Samsun (Ceyhan & Gene, 2014) can be indicated. In addition to these studies, a study is prepared by Güngör, Zengin, and Güngör (2007) for shrimp fisheries in Marmara Sea. Consequently, it is seen from the literature that the number of studies on fishermen fishing in Marmara Sea (the same problem prevails for other seas) is insufficient. Unlike other studies, other fishery activity and non-fishing revenues of fishermen, productivity and profitability indicators are extensively studied in this study.

The aim of the research is (1) to determine the basic characteristics of the fishermen who catch fish in Sea of Marmara, (2) to determine and comparatively scrutinize the annual revenue and expenses of fisheries activities, (3) in this context to analyses the profitability and productivity of fisheries activities, and (4) to discuss the measures to be taken to improve the conditions and activities of fishermen.

Materials and Methods

In the study basically the primary data attained through face to face questionnaires with the fishermen fishing in Marmara Sea is utilized. The research contains those fishermen in Sea of Marmara fishing centers and whose entire or vast majority of income is earned through fishing. The list and the distribution of the lengths of 2523 fishing boats that belong to Marmara Sea fleet and which constitute the population of the research are attained from the records of the General Directorate of Fisheries and Aquaculture (BSGM, 2008). The calculation of sample fishermen size is done through

stratified random sampling method and through the boat lengths. By taking the boat lengths and fishing methods into account, the population is divided into four groups: group 1 (smaller than 9.0 m), group 2 (between 9.0 and 15.9 m), group 3 (between 16.0 and 25.9 m) and group 4(26.0 m and larger). The formula of the propositional allocation utilized in the sample is as follows (Yamane, 1967): $n = [N \Sigma (N_h S_h^2)] / [N^2 D^2 + \Sigma N_h S_h^2]$ Here, n denotes the fishermen sample size; N, the total number of fishermen; N_h, the number of fishermen in the strata (N_1=1704, N_2=502, N_3=164 and N_4=153); S_h^2, the variance of the boat lengths in the strata; $D^2=d^2/Z^2$; d, deviation from the average boat length (with a 5% deviation from the average (0.915 m)); Z, the Z value in the normal distribution table according to 95% confidence interval (1.96). According to sample calculation results 231 questionnaires are made with 9.16% sampling rate. The number of fishermen interviewed is 156 in the first group and 46 in the second group, 15 in the third group and 14 in the fourth group.

Following the determination of sample size, primarily the centers of fishermen are determined for the selection of sample fishermen. Then, sample fishermen determination is made randomly among the fishermen in these centers. In the settlement determination; primarily the fishing activities of fishermen in these centers, seine boats and trawlers, fishing characteristics in regional seas, marketing network, and target species are accepted as criterion. The study is executed in the fishing centers of 7 provinces and 22 districts that have coasts to Sea of Marmara (Figure 1). The most distinct characteristic fishing property for Sea of Marmara is to focus on the fishing methods and target species. In other words, if the fishing methods and activities of fishing boats in Sea of Marmara are examined, it is seen that there is a close relationship between each fishing method and the size/length group distribution of vessels (Zengin *et al*., 2010). In the Group 1boats fishing line, long liner, gill-nets (bottom and pelagic); in the Group 2 boats gill-nets, circular net, beam trawl, small bottom trawl (illegally); in the Group 3 boats circular nets, beam trawl, bottom trawl (illegally), small purse-seine and in the Group 4boats bottom trawl (illegally) and purse-seine are used.

In the study, the balance sheets of the fishermen are determined and presented primarily. In this context in order to determine the amount of fishermen' capital, the boats and other equipment that are used for fishing are examined. Then, in order to calculate the revenue generated by fishing in the period under review, the fish species that are caught and landed; and the price of these species (on boat selling price) are determined. In addition, other sources of income of fishermen are also included in order to determine the fisheries revenue and family income. Besides, those variables for the in detail determination of fixed- and variable-costs that arise from the use of inputs in the fishing boats for fishing are given place for the period under review (Seijo & Caddy, 2000; Sabatella & Franquesa, 2004). The figures attained with the survey are converted into Euro with the average exchange rate of Central Bank (1€ = 2.4 TL) in the reviewed period.

For the analysis of the fishing activities of fishermen, gross revenue, operating costs and production costs (=operating costs + capital interest) are calculated. In addition to these indicators, for the profitability analyses of fishing activities, gross profit, and net profit; and for the productivity analyses labor productivity, capital productivity and total factor productivity indicators are calculated. Moreover, net fishing income, fisheries revenue and family income indicators are also included in the study.

In the study, as there is no revenue generated from the use of the vessel in other, non-commercial fishing activities, such as recreational fishing, transportation, tourism and research; and governmental supports, total

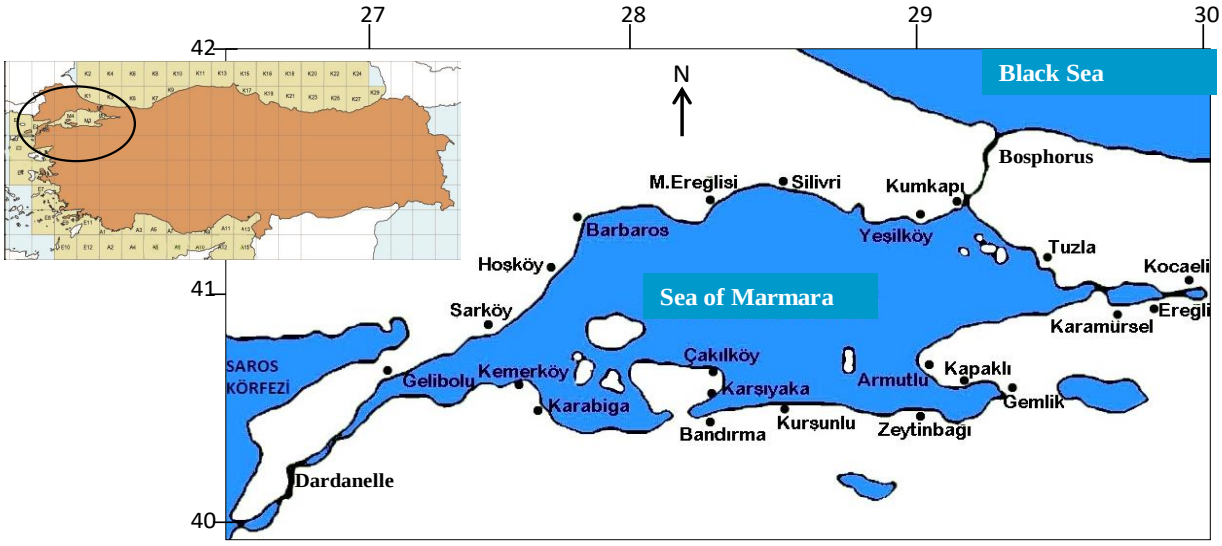

Figure 1. Research area.

revenue only comprises of the value of production (sale of landed seafood products) (Carvalho, Keating, & Guillen, 2016).

Fuel costs, crew wages, clothing and nourishment expenses, maintenance and repair expenses, boat rental, cleaning, fines and marketing expenses (ice, packing, commission, other) are included in variable costs. Fixed costs comprise of overhead expenses (fisherman executive expense, communication, diesel record book), ownership related taxes and right costs, permanent labor costs and fringe pays, hull insurance, the depreciation of boats and equipment, equity interest equivalent, interest expense and cooperative fee. Depreciations are calculated with straight line method and the economic life for boats and technical devices are taken as 35 and 15 years, respectively (Ünal, 2001). Equity interest equivalent is calculated by multiplying the amount of equities with real interest rate (Yılmaz, 1997).

The indicators related to the economic performance of the fishermen are calculated with the equations given below (Kay, Edwars, & Duffy, 2012; Özalp & Yılmaz, 2013, Carvalho *et al*., 2016):

Operating Cost=Variable Cost+(Fixed Cost–Capital Interests)

Production Cost=Operating Cost+Capital Interests

Gross Profit=Production Value–Variable Costs

Net Profit=Production Value–Production Costs

Net Fishing Income=Gross Revenue–(Operating Costs–Unpaid Labour Cost)-Loan Interest

Labour Productivity:

Labour Productivity=Production Amount/Labour Amount

Labour Productivity=Production Value/Labour Amount

Capital Productivity:

Rate of Return on Capital=Net Profit+Interest Expense / Average Assets

Rate of Return on Equity=Net Profit/Average Equity

Total Factor Productivity=Production Value/Production Cost

The values of the economic performance indicators calculated in the study are presented and discussed in terms of mean values and by groups. In addition, differences among groups mean values were statistically tested using one way analysis of variance (ANOVA).

Results

Balance Sheets of Fishermen

The balance sheets of the fishermen examined are presented by groups in Table 1. When the equipment in the inventories of fishermen surveyed besides their boats they use for fishing are studied, it is determined that 55.4% of them have fishing net, 32.4% have radio, 31.4% have radar and echo-sounder, 26.6% GPS, 20.3% sonar, 14.4% (only in 3. and 4. groups have) fish pump, 8.6% ice machine (only in 3. and 4. groups), 4.1% cooler (only in 3. and 4. groups), 5.4% current meter (only in 3. and 4. groups), 3.2% vessel monitoring system (VMS) (mostly in 4. group), 2.3% diving equipment (only in 1. group), and 1.4% generator (only in 3. and 4. groups). The value of the per fisherman assets that are used by the fishermen surveyed are found to be €8014, €23689, €98396, €754183 for group 1 to group 4, respectively and the average of all fishermen is €23495. Additionally, the differences among group means were found statistically significant (P=0.01) for all assets components. These figures reveal the average investment of fishermen. Inherently, the large part of the investment is the boats (67.8%). Fishing nets follow the boats (Table 1).

Table 1. Average capital investments and liabilities (balance sheet) values of surveyed fishermen (€)

Group	Assets									Liabilities	
	Boat	Fishing Net	Sonar	Fish Pump	Ice Machine	Other	Fixed Assets	Current Assets	Total	Liabilities	Equities
1	5137	2246	0	0	0	282	7665	349	8014	1256	6758
2	15653	5263	0	0	0	1540	22456	1232	23689	6952	16737
3	52557	239	4464	24731	3996	6840	92827	5570	98396	55622	42774
4	529605	115406	53640	1546	8487	23854	732538	21644	754183	289330	464852
Average	42305	9619	3562	1702	777	2397	60362	2163	62524	23495	39029
S[a]	175791	40214	26687	11966	5224	8880	227915	6968	234795	91598	143725
F[b]	156**	116**	33**	45**	23**	88**	251**	211**	250**	240**	255**

[a] S: Standard deviation

[b] F: F statistics of ANOVA, **: Significant at P=0.01

The origins of the assets and where they are supplied are seen in the liabilities. The shares of equities are 84.3%, 70.6%, 43.5% and 61.6% by groups, and the average for all fishermen is 62.4%. On the other hand, the rate of debts to assets reveals the debt burden. When viewed from this aspect, it is seen that the fishermen in the group 3have the highest debt burden with a rate of 56.5%. Those in the group 4 follow the group 3 with a rate of 38.4%, group 2 with 29.4% and 1. group 15.7%. It is possible to mention that the debt burden of all the fishermen is high with a rate of 37.6%. It is also possible to assert that these high debt burden rates and amounts increase the risks in terms of the sustainability of fisheries.

3/4 of the fishermen in Sea of Marmara maintain their economic activities by incurring debts during the open- and closed-seasons. The sources of these debts are middlemen (34.41%), bank (30.83%), fishing net supplier (16.55%), colleague (7.98%), processing plants (3.86%), petrol station (3.78%), boat yard (1.08%), and others (2.00%). When the debts of the fishermen are analyzed according to the origin, it is seen that most portion of the debts are from the commissioners and then from banks (Table 2). Fishing net supplier, other fishermen, processing plant, fuel supplier and shipyard companies are also crucial sources of debt. Among other sources of debts are the retailers, the government due to fines, cooperatives, relatives and tradesmen.

Quantity of Fish Caught and Fishing Expenses

The boats that attain fishing license in 7 provinces in the coastal Sea of Marmara and the amount of important fish species they catch for commercial purposes are presented in Figure 2; and the selling price of fish by groups, average quantity of fish caught by all fishermen, on-boat selling prices and sale revenues are presented in Table 3. The number of noteworthy species caught in groups 1, 2, 3 and 4 are found to be 14, 10, 5 and 9 respectively. The fishermen fishing in Marmara Sea catch 30.9 tons of fish (including shrimp) on average per season; which is 4.6 tons forth 1. group, 11.5 tons for the 2. group, 150.3 tons for the 3. group and 258 tons for the 4. group. According to the findings, shrimp catching (24.37% and 24.05% for group 1 and 2, respectively) with beam trawl and beach seine is characteristic for boats in the 1. and 2. group. For the 1. group the species to which the highest fishing amounts belongs besides shrimp are horse mackerel (20.50%), sardine (17.39%), bonito (14.18%) and young bluefish (6.23%)-bluefish (7.66%), where they are bonito (25.00%), horse-mackerel (14.12%), young bluefish (10.59%), sardine (10.24%) and blue fish (6.99%) for the 2. group. The highest amount of fish caught in the 3.and 4. groups are the pelagic fish. For the 3. group horse mackerel (32.43%), bluefish (20.10%), bonito (16.19%), young bluefish (11.81%) and anchovy (19.46%) are the most caught species, where for the 4. Group, horse mackerel (23.74%), bluefish (21.60%), bonito (20.68%), anchovy (18.41%) and young blue fish (11.14%) have the highest amount of fishing. However, it is necessary to note that the big and equipped seine boats of these groups (besides Sea of Marmara) also go fishing to Black Sea, Aegean Sea and Mediterranean Sea according to the season of the aforementioned fish species (Zengin, 2012).

The quantitative and qualitative characteristics of fish affect the selling price of them fishermen put on market. Delicious and demanded fish such as flounder, turbot and red mullet can find a customer with high prices as their catching amount and therefore supply are low. On the other hand, those fish having high catching amount and therefore high supply and on the contrary rank second in terms of consumption choices (demand) such as anchovy, horse mackerel, sardine and gray mullet have low on-boat prices. Those fish that migrate such as bluefish and bonito having high demand but can be caught abundantly between September and November can be sold with high prices in all groups of vessels. It is determined that 85.7% of the landed fish caught from Marmara Sea is sold by through the medium of commissioners.

When the seasonal total fishing revenue (production value) of the fishermen are examined according to the groups of fish species caught, it is calculated that the average value of the fish caught by the boats in group 1 is €11311. 17.9% of this total fishing revenue belongs to shrimp, 15.1% to horse mackerel, 14.8% to bonito, 11.7% to bluefish and 10% to sardine. The average value of the fish caught by the fishermen in

Table 2. Average indebtedness of fishermen by origin (€)

Group	Middlemen	Bank	Fishing Net Supplier	Fishermen/Friend	Processing Plant	Petrol Station	Boat Yard	Other	Total
1	240	506	97	82	0	2	28	300	1256
2	883	3768	881	485	0	480	79	376	6952
3	31833	14808	4986	542	0	2258	1000	194	55622
4	93095	85089	54464	27679	14881	10565	2515	1042	289330
Average	8086	7244	3887	1875	908	888	253	353	23495
S.	29477	23710	17864	16510	13982	6515	1265	1414	91598
F	56.8**	79.5**	45.9**	9.7**	3.7**	8.9**	15.0**	0.9	240**

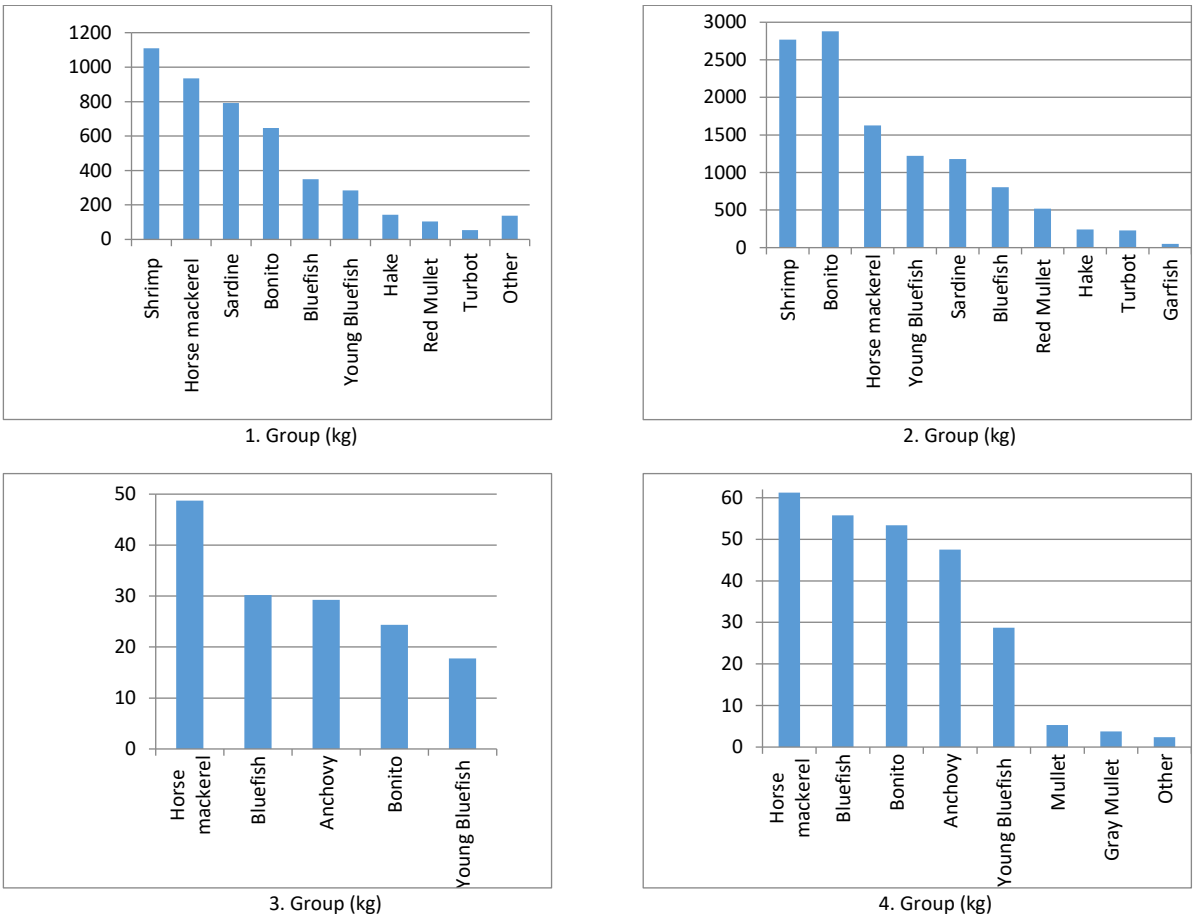

Figure 2. The quantity of fish species by groups.

group 2 is €33216. This figure is approximately three times of the same figure for group 1. 24.4% of the total fishing revenue in group 2 is from bonito, 16.3% from shrimp, 15.6% from young bluefish, 10% from bluefish and 9.4% from red mullet. The average values of the fish caught by the fishermen in group 3 and 4 are determined to be €351868 and €623356, respectively. 32.9% of the total fishing revenue in group 3 is from bluefish, 22.8% from horse mackerel, 18.3% from bonito, 17.2% from young bluefish and 8.8% from anchovy. In group 4, 33.1% of the total fishing revenue is generated with bluefish, 22.5% with bonito, 15.4% with young bluefish and 14.7% with horse mackerel.

Although horse mackerel and anchovy can find customers with relatively low selling prices (1.59€/kg and 1.04€/kg, respectively), the high amount of fish caught (7859kg and 4799kg, respectively) ensure satisfactory revenue for fishermen (12529€ and 4978€, respectively). The facts that for small boat groups instead of the fishing amount, the value of the fish caught is more important, and on the contrary for big boat groups the fishing amount is crucial are quite determinant on the revenue/income of fishermen. This, in turn, is related to the existence of the sustainable stocks of economic species in Sea of Marmara. In order fishermen to generate satisfactory income, besides the limited but high valued fish species, it is also crucial to ensure the sustainability of the stocks of small pelagic species such as anchovy, horse mackerel and sardine (Ceyhan & Gene, 2014).

Fishing Costs

In Table 4, the variable- and fixed-costs of fishing are given in detail and according to the boat groups. Additionally, by subtracting the interest of capital from production costs, the operating costs are calculated and presented in the Table 4.

The average fishing production cost of all the fishermen surveyed is calculated as €34494. The same figures are €4413, €15051, €157872 and €299306, for group 1 to group 4, respectively. Large portion of the total production costs, namely more than ¾ of it is composed of variable costs. The share of fixed costs is the lowest in group 3 (10.1%) and the highest in group 4 (27.7%). For production cost, operating cost and all cost components, the differences among the group mean values were found to be statistically significant (P= 0.01) except for cleaning, fines and fishing licensed costs.

When the production costs for the full sample are examined, the fuel costs (24.8%) rank first in all groups; crew (23.1%) and marketing costs (22.5%) follow it. The

Table 3. Seasonal averages of fishing quantities, price and fishing income according to fish species of surveyed fishermen

Fish Species	Fishing Income by Groups (€)				General Average				
	1	2	3	4	Quantity Caught (kg)[b]	Prices (€/kg)	Value (€)	S	F
Young bluefish[a]	1005	5185	60572	96073	3342	3.44	11508	974	3*
Anchovy	0	0	31078	48490	4799	1.04	4978	42086	29**
Horse Mackerel	1708	2874	80234	91620	7859	1.59	12529	31538	20**
Picarel	74	0	0	0	17	2.94	50	273	2
Gray Mullet	0	0	0	11172	229	2.98	681	1881	4**
Chub Mackerel	0	0	0	975	40	1.50	59	8463	9**
Sea-bass	0	0	0	11302	116	5.93	689	220	1
Bluefish	1319	3314	115611	206043	5761	3.75	21633	22241	20**
Bonito	1677	8100	64373	140554	5846	2.65	15502	8309	21**
Sardine	1132	1259	0	0	769	1.32	1015	198656	4**
Garfish	77	169	0	0	24	3.54	85	1014	1
Red Mullet	637	3124	0	0	173	6.08	1052	1537	11**
Sole	200	0	0	0	17	8.00	135	1650	2
Turbot	601	2754	0	0	82	11.60	954	523	0
Gurnard	141	0	0	0	15	6.42	95	326	1
Hake	629	1036	0	0	145	4.35	631	888	10**
Mullet	86	0	0	17128	342	3.22	1103	1252	15**
Shrimp	2026	5402	0	0	1300	1.88	2442	6198	11**
Total	11311	33216	351868	623356			75141	222900	19**

[a]Bluefish and young bluefish are accepted as different species by fishermen. Therefore, in the questionnaires fishing and price questions are asked for both separately.
[b]Fishing amount for sea-bass, bluefish and bonito is "piece".

share of the fuel costs decrease slightly from 26.5% to 24.3% with an increase in boat groups. If the fact that the boats in group 3 and 4 can benefit the subsidy of the Ministry of Food, Agriculture and Livestock, it can be claimed that the fishermen in these groups have an advantage in terms of fuel costs. In addition, it is also determined that the *special consumption tax-free* fuel application has increased the quest and navigation activities in the sea. 53.5% of the fishermen replied the related questions as "it has affected the number of fishing days and fishing quantity positively" and hence 26.6% of them go fishing more. They indicate that when the fuel is more expensive, they have to behave thriftier.

As aforementioned the crew and crew related costs constitute an important item in the production costs. In the study, it is determined that 89.8% of the wages paid to the crew is paid through a traditional method, namely sharecropping (share paying). In this payment method, 50% of the income (attained by subtracting the variable costs excluding daily labor during the fishing from the fish sale revenue) is given to the boat owner and the other 50% is shared by the crew. 6.2% of the crew, who works without this method, is paid through monthly wage method and the rest 4% is the unpaid family members.

The third most important cost group is the marketing costs most of which are comprises of commissions paid. It would not be misleading to claim that the share of commissions in the costs is quite high. Especially for the boats in group 3 the rate is quite high. The calculation method of the commission-namely as a share of fish selling value-causes the commissions to be high. Besides, the high rates reveal that fishermen are not efficient enough in the fish marketing system.

The boat maintenance and repair, and fishing net maintenance costs are other prominent elements of variable costs. The rental of the boats rented for landing the fish caught and other variable costs are relatively low.

The average fixed costs of all fishermen surveyed are found to be €7260. The same figure is lowest for group 1 (€927) and the highest for group 4 (€82862). In fixed costs, the highest items are the interest equivalent for fixed assets and the depreciation (amortization) of boats. The fisherman executive cost is calculated to be 3% of the variable costs, and this item constitutes a large part of overhead expenses. The overhead expenses are the third important fixed cost item.

12.2% and 87.8% of operating costs stem from fixed- and variable-costs, respectively. The most crucial items in the variable costs are the fuel costs (with and without special consumption tax subsidy - total) with 30.2%, the share of commissioner with 25.6% and the crew costs with 23.2%. The total of these three items is 80% and constitute the highest cost items of the fleet.

Fishing Profitability and Productivity Indicators

In Table 5 the fishing profits and the profitability and productivity indicators of fishermen carrying fishing activities in Marmara Sea are presented. In Table 5, various revenue indicators for determining the revenue levels are also included. The average gross fishing profits for group 1, 2, 3 and 4 are found to be €7824, €20893,

Table 4. Annual averages of variable and fixed costs items of surveyed fishermen (€/boat/year)

	Cost items	Boat Groups				General Average	S	F
		1	2	3	4			
Variable Costs	1. Fuel	1168	3837	39375	72604	8540	11035	123**
	2. Labour Cost	906	3596	44001	62120	7976	34547	118**
	Crew Share	623	2825	39761	55901	6977	30322	119**
	Victualing	245	635	3177	4896	797	4121	81**
	Clothing (Boot, Raincoat, etc.)	37	135	1063	1323	202	403	68**
	3. Boat Maintenance and Repair	264	802	6948	7188	1228	4074	88**
	4. Fishing Net Recruitment and Maintenance	264	822	6146	7563	1202	4629	64**
	5. Boat Rental	0	0	156	625	48	1624	6**
	6. Cleaning	3	5	120	156	20	36	1
	7. Fines	340	345	687	1713	447	164	2
	8. Marketing	542	2916	44496	64477	7771	23914	70**
	Commission	441	2305	34860	52238	6209	10890	48**
	Other	101	611	9635	12240	1562	15912	43**
	Total	3486	12323	141929	216445	27234	70313	188**
Fixed Costs	1. Overhead Expenses	153	479	4483	6795	904	2375	181**
	Fisherman Executive Expense	105	370	4258	6493	817	2109	188**
	Communication (Annual)	44	56	121	156	58	243	8**
	Diesel Record Book (Annual)	4	54	104	146	29	238	44**
	2. Taxes and Right Costs	49	113	902	1344	196	1117	12**
	Certificate of Seaworthiness	17	33	48	65	25	77	24**
	Green License (1/2 Annual)	10	13	20	25	12	86	0
	Fishing Licence (Annual)	2	30	37	93	15	30	12**
	Harbour (Anchoring) Expense	17	27	99	208	36	190	14**
	Warehouse/shelter Rent (Annual)	4	9	31	120	14	156	5**
	Boat Tax (Annual)	0	0	667	833	94	1076	4**
	3. Permanent Labour Costs	9	33	1131	4761	377	1255	8**
	4. Hull Insurance (Annual)	0	0	125	1729	114	597	6**
	5. Depreciation	301	856	4036	27147	2292	35669	25**
	6. Equity Interest Equivalent	383	1123	4641	36627	3018	7632	117**
	7. Annual Interest Expense	15	104	599	4396	338	15925	23**
	8. Cooperative Fee (Annual)	18	21	27	63	21	31	4**
	Total	927	2728	15943	82862	7260	55492	47**
Total Production Cost		4413	15051	157872	299306	34494	118240	130**
Total Operating Cost		4015	13824	152631	258284	31137	100011	137**

[a]:*Administrative charge= Variable expense *0.03.*

€209940 and €406911, respectively; and €47907 on average for all the fishermen surveyed. The average net profit for all sampled fishermen is €40647, while it is €6897, €18165, €193996 and €324049 for group 1 to group 4, respectively. Additionally, both gross profit and net profit averages differences by group were found statistically significant (P=0.01). These figures show that quite satisfactory profits are attained by the fishermen. Hence depending on these high profit values, the rate of returns (profitability) of the capital and equity are also found to be quite high. If all the fishermen are taken into account, the net rate of return of capital is 0.64. This figure reveals that in return of €1 of capital, fishermen generate €0.64 net return, that is quite high and can be well understood when it is compared with real interest rate (even with nominal interest rate). In fact, the same figure is higher for group 3 as 1.97. When the equity net rates of returns are examined, it is seen that they are higher than the capital rate of returns. But the variance analysis test revealed that capital profitability parameters were not found to be statistically different according to groups.

By taking the total working hours of boat crew into account, the labor productivity indicators per day fishing duration (8 hours) are examined via the amount and the value of fish. If all the fishermen are taken into account, it is determined that a fisherman catch 35.7 kg's of fish valuing €86.9. The amount of fish caught per working day labor is the lowest in group 1 with 9.11 kg's and the highest in group 3 with 82.5 kg's. The same trend also prevails among the groups in terms of laborproductivity. These differences were also found statistically significant.

Total factor productivity is an important indicator as it shows the productivity of all the inputs used in fishing and is calculated to be €2.2 for all the fishermen in average. This figure that shows the value of fish in return of €1 production cost is calculated to be €2.6, €2.2, €2.2 and €2.1 for group 1 to group 4, respectively. In contrary to labor productivity, total factor

Table 5. Annual average profitability, productivity indicators and incomes of surveyed fishermen

Indicators	Boat Groups				General Average	S	F
	1	2	3	4			
Gross Profit (€)	7824	20893	209940	406911	47907	110425	29**
Net Profit (€)	6897	18165	193996	324049	40647	104675	4**
Rate of Return on Capital (€)	0.86	0.76	1.97	0.42	0.64	0,78	0
Rate of Return on Equity (€)	1.02	1.09	4.54	0.70	1.04	0,79	0
Labour Productivity (kg/day)	9.11	18.96	82.47	54.61	35.69	82	35**
Labour Productivity (€/day)	22.62	54.68	193.07	131.93	86.86	149	46**
Total Factor Productivity (€)	2.56	2.21	2.23	2.08	2.18		1
Net Fishing Revenue (€)	7385	19658	202895	367170	44482	106019	7**
After-Tax Net Fishing Revenue (€)	7385	19658	201593	361638	44060	98023	6**
Non-Fishing Fisheries Revenue (€)	294	1052	2552	1321	654	618	5**
Total Fisheries Revenue (€)	7679	20710	204145	362959	44714	105997	7**
Non-Fisheries Revenue (€)	2279	1229	3530	5141	2326	3120	1
Total Family Income (€)	9958	21939	207675	368102	47041	105936	7**

productivity is the highest in group 1. If the profitability and productivity indicators are assessed in general, it is possible to claim that among other groups fishing in Marmara Sea, group 3 has better fishing performance.

Net fishing revenue expresses the pre-tax net revenue attained from fishing activities by the fishermen, particularly for groups 3 and 4. The figure involves the revenue attained for working as a fisher and the risk premium of fishermen including income and corporate tax. If all the fishermen are taken into account, net fishing revenue is found to be €44482.

Besides fishing activities fishermen in Marmara Sea may also generate revenue from various fishing related sectors. Particularly the owners of small boats may work as a captain in other boats, as a crewman, as a boat repairman, as a fishing net repairman, as a fishing net supplier, as a worker in fish processing plant, as a retailer of fish, as a worker in a fish restaurant and may value time. On the other hand, big boat owners may work as a commissioner, as an employer in fish processing plants, fish restaurants, companies of retail fish sale, fishing equipment stores. Among these sector related activities, the revenue generated by boat owner captains from direct fishing/fisheries activities such as being a captain, crewman in another boat, boat repairing, fishing net repairing, fishing net supplying are identified as non-fishing fisheries revenue and by adding after-tax net fishing revenue total fisheries revenue is calculated.

In Turkey the income of fishermen is taxed in two ways. Firstly, from the boats shorter than 20 meters that are under the exemption limit 1% retention tax is collected from the fish sales. Secondly, for those boats longer than 20 meters that are in the scope of corporate or income tax the owner fishermen are taxed based on net fishing revenue via real taxation system. In order to calculate disposable total fisheries revenue after tax net fishing revenue should be used.

If all the fishermen surveyed are taken into account, the average non-fishing fisheries revenue and total fisheries revenue are found to be €654 and €44714, respectively. By taking the revenue generated from non-fisheries other activities, the total family income of fisher family, in other words disposable annual income is calculated. The average non-fisheries revenue and total family income of the fishermen surveyed are €2326 and €47041, respectively.

Discussion

The fishermen surveyed make significant investments to their boats and equipment. With the vessel length; the value and variety of the assets in the actives increase. Moreover, the most crucial assets in all groups are the boats and fishing nets. As a result of the study it is also determined that fishermen face significant debt burdens. It is obvious that this high debt rate and amounts create risks for the sustainability of fisheries. The debt pressure causes fishermen not to obey fishing bans, over- and illegal-fishing, intensive fishing with seine nets and trawling nets in the strait. At the same time high debt burdens are caused by the borrowing in the closed season and the beginning of the season from the commissioners under the name of *advance* in return for the fish to be caught. For example, it is claimed that in order for a 25 meter seine boat to get prepared to the season, approximately an expense of €62500 should be made (Uras, 2014). It is indicated that the industry of sea fishing in Turkey does not have adequate equity and is considerably dependent on commissioners and fish processing/treatment sector (Çeliker *et al*., 2006; Üstündağ, 2013; Yılmaz, Yılmaz, Şen, & Özalp, 2013).

There are significant differences among the fish species and quantities of the fish caught by fishermen in Marmara Sea. The quantity of fish (including shrimp) caught increases with the vessel group from 4.6 tons to 258 tons. Following the shrimp, the highest fish caught in the 1. and 2. groups are bonito, horse mackerel, sardine and, young bluefish and bluefish. In the boats in group 3 and 4, the highest quantity caught belong to

pelagic fish such as horse mackerel, bluefish-young bluefish, bonito and anchovy, respectively. The facts that instead of catching large amounts, the price of the target species should be high for small boat groups; and the quantity caught should be high for big fishing boats are determined to have significant effects on the revenues of fishermen. In a study on Sea of Marmara made by Güngör *et al.* (2007), it is determined that the revenue generated by shrimp fishing is satisfactory.

If the production costs are examined, while the fuel costs rank first in all groups; crew costs and marketing (commission) costs follow it respectively. A similar result that fuel costs rank first is also found by Ünal (2004). It is determined that for off-shore fishing fuel costs constitute nearly 60% of total costs (Colloca *et al*., 2003). In the studies on Black Sea (Çeliker *et al*., 2006) and Aegean Sea (Çeliker *et al*., 2008), the top three variable costs are found to be the crew costs, fuel costs and the share of commissioner. In another study on Mediterranean Sea prepared by Taşdan *et al*. (2010), the top three variable costs are determined to be fuel costs, crew costs and victualing costs.

The special consumption tax reduction that has been applied for the fuel costs – that has significant importance for fisheries – till 2004 has positively affected fishing activities and fishing revenue. With the application, illegal fuel sales have been hindered to a certain amount (Kurtar, 2008, Çeliker *et al*., 2006). It is claimed that 26-30% of all the special consumption tax-free fuel usage is used by fishing boats (Üstündağ, 2013). From this subsidy, mostly big fishing boats benefit. In order to benefit the subsidy, the costs of diesel record books and the independent accountants who is necessitated for submitting a declaration to tax administrations should be covered; but these applications remove the attractiveness of the subsidy for small vessels that do not consume large amounts of fuel.

The fuel subsidy directly affects the fishing time and the effectiveness of the fishing (Kurtar, 2008). Theoretically fishing would be maintained to the point where marginal cost is equal to marginal revenue (Clark, 2006). It is also claimed that as fuel subsidies reduce marginal cost and trigger over fishing, it is the most significant factor that causes stocks to be damaged and that harms the market in terms of competition (Scott, 2010; Jacquet & Pauly, 2007). If the fact that most of the fishermen in Marmara Sea are coastal fishermen and they constitute the low income fishermen groups, it is seen that the application contradicts the social justice principle.

The high share of commission in the costs shows that fishermen are not effective enough in the fish marketing system. The borrowing of fishermen from the commissioners causes fishermen to be dependent to the commissioner and extinguish the chance of bargaining. After all, it also creates a crucial finance opportunity. Commissioners on the other hand ensure the fish supply.

In the study, it is also determined that the crew costs item is another important cost item. The most crucial advantages of the sharecropping method of wage payment for the fisherman are risk sharing and labor productivity encouraging. It may be mentioned that the questionable dimension of the method is related to the social security of the crew.

The level of net fishing profit found in the study shows that a satisfactory profit is generated. Hence, based on this high net profit figures the rate of return (profitability) of the capital is also found to be quite high. If all the fishermen are taken into account, in return of €1 capital, fishermen generate net revenue of €0.64. If this rate of return is compared with real interest rate (even with nominal interest rate), the highness of the ratio is well understood. In the studies on the fisheries in Black Sea, Aegean Sea and Sea of Mediterranean, the net rates of return are calculated to be lower, namely 8.6%, 51% and 38.8%, respectively (Çeliker *et al.,* 2006; Çeliker *et* al., 2008, Taşdan *et al.*, 2010).

In the study when all the fishermen surveyed are taken into account it is found that in return of 1 crewman's 1 day work on the boat 35.7 kg's of fish as caught that is worth €86.9. In addition, in return of a €1 expense, the value of the fish caught is determined to be €2.2. These figures indicate that the levels of profitability and productivity of the fishermen (for all groups) surveyed are quite satisfactory. Besides, those fishermen in the 3. group is found to have better fishing performance. On the other hand, the size of the capital in seine fishing in Black Sea constitute a little advantage; it is revealed that the quantity of fish caught for a unit of effort depends on the level of current stocks. It is determined that smaller vessels are more profitable than bigger ones (Çelikkale & Ulupınar, 1995; Dinçer & Mutlu, 2013).

In the study if all the fishermen are taken into account the net fishing revenue, non-fishing fisheries revenue and total fisheries revenue are found to be €44482, €654 and €44714, respectively. In other words, the disposable income generated through fisheries is €44714. When compared to other agricultural activities in the region (Anonymous, 2013) it may be claimed that more revenue can be generated from fisheries even it is a hectic and risky sector. The revenues determined in the researches made by Çeliker *et al. (*2006, 2008*)* in Black Sea and Aegean Sea are lower than the ones in this study, furthermore the difference is two folds for Aegean Sea and more than four folds for Black Sea. No doubt it may be claimed that the advantage of fishing in Sea of Marmara can be attributed to the socio-economic characteristics of the region, particularly to the existence of İstanbul - a metropolitan province- in the region.

When the revenues of fishermen are compared with the ones in other sectors of Turkey (as of 2013 monthly average wage for civil servant €800, for teacher €950, doctor €1300 (Anonymous, 2014), it is understood that fishermen generate satisfactory revenues.

In conclusion, for a sustainable fishery, the credit and marketing problems of the fishermen are crucial problems to be solved. For attaining a sustainable and optimal level of living sea resources namely fish stocks that constitute the basis of the economics of fisheries, the realization of an efficient fisheries management is quite crucial (Sinclair, 2003). In this respect, the insufficiency of living resources/stocks is going to appear to be an important problem for the fisheries in Sea of Marmara in the future.

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