Small-scale fisheries in the southern Black Sea: Which factors affect net profit?

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Abstract

Small-scale fisheries (SSF) is a local and community-based activity that can be traced back to ancient times, and thus, closely related to the history of humankind. However, large-scale fisheries have grown tremendously, approaching an industrial sector in the last century, due to their socio-economic and political properties, including both national and international aspects. This progress towards industrial-scale fisheries led to the involvement of scientific research, first aiming to improve production efficiency, and then, to protect ecosystems as resources exploited for fisheries activity, by mitigating their adverse impacts. During this evolutionary progress, SSF was usually neglected because of their limited production ability, and thus minimal economic contribution, until the later phase when the protection of ecosystem resources gained sufficient importance. As a result of this, many countries lack data on SSF, undermining efforts for the creation of proper policies for this type of fisheries. The aim of this study was to evaluate the productivity and the effects of some demographic characteristics, boat structures, and some cost (input) items on the net profit of SSF in the Black Sea.

The eligible sample for this study consisted of 5575 small-scale fishing boats in the Black Sea. The number of fishers to be surveyed was determined as 315 using the “Simple Random Sampling” method, based on operators of boats < 12 m, i.e., boats in the SSF. Questionnaires were conducted face-to-face with fishers. In this study, it was tested if six parameters were investigated to determine whether they had a significant effect on net profit in SSF. These parameters were: (1) engine power; (2) number of fishing days; (3) boat length; (4) consumption of fuel in fishing; (5) education level of fishers; and (6) overall professional experience of fishers. To do so, Simple Linear Regression Analysis was performed to determine the effect of the data considered as independent variables when the net profit was set as the dependent variable. Atlantic bonito, *Sarda sarda* (Bloch, 1793); whiting, *Merlangius merlangus* (Linnaeus, 1758); rapa whelk, *Rapana venosa* (Valenciennes, 1846); and turbot, *Scophthalmus maximus* (Linnaeus, 1758) were the most important commercial fish species for small scale fishing. When catch per boat in SSF was evaluated, Kırklareli province ranked first with 97 007 kg, with Atlantic bonito (44 778 kg) being the most common species caught. Samsun had the second-largest catch per boat with 91 761 kg. The total net profit of 303 boats was calculated as €1 794 938 and the mean net profit per boat was €5924. The highest per boat mean net profit (€25 909) was in Kırklareli. According to the results of the study, the number of days at the sea, boat length, engine power, and fuel cost had a significant effect on the net profit while education level and professional experience were not important in productivity. The economically-fragile SSF sector may need some kind of supporting subsidy. It would be beneficial to provide support to the majority of fishers active in the SSF in terms of complementary alternative employment opportunities in the regions where they are located.

Keywords

Black Sea, net profit, productivity, revenue, small-scale fisheries, total cost

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Introduction

Small-scale fisheries (SSF) is not considered as an economic sector. In their own right since SSF tend to be closely related to local communities, traditions, and values (Kolding et al. 2014). SSF catch is usually for direct consumption in the local community and trading is mainly dependent on irregular opportunities such as unexpectedly successful catch performance and the availability of proper logistics for market delivery. Many SSF, which may have important conservation values, are overseen by self-governing mechanisms, but they are under increasing pressure. For example, the Food and Agriculture Organization of the United Nations (FAO) estimated that around 90% of all the people who work in fishery sectors are active in the SSF around the world, which collectively contribute to almost half of global fish catches (FAO 2018) and this contribution increases by two-thirds when the proportion directly used for human consumption is considered. Given the importance of SSF in the human food supply, the attention of both scientists and decision-makers has been drawn to the challenges faced by SSF for sustainable fishery management. Studies have shown that SSF can make a significant contribution to nutrition, food security, sustainable livelihood, and poverty reduction, in addition to being more eco-friendly features than industrial or large-scale commercial fisheries (Berkes et al. 2001; Béné et al. 2007). According to the FAO (2020), about 90% of the 35 million people recorded worldwide as fishers are classified as small-scale and a further 20 million people are estimated to be involved in the small-scale post-harvest service sectors.

The amount of main SSF marine products used for human consumption, such as fish flesh, roe, fins, etc. is around 30 million tons/year (Jacquet and Pauly 2008). Other products of industrial fisheries, such as fish-meal and fish oil which are not produced for direct human consumption, yield about 35 million tons/year. Crowder and Murawski (1998) reported that approximately 40 million tons of fuel is consumed per year in industrial fishery, with 1 to 2 tons of target species and 8 to 10 tons of discarded bycatch species per 1 ton of fuel, although a global rate for bycatch rate is difficult to estimate. In the case of SSF, annual fuel consumption is around 5 million tons with a product: fuel ratio ranging between 4:1 and 8:1 and much lower discarded bycatch (Jacquet and Pauly 2008). These authors also estimated that 25 to 27 million dollars of subsidies are annually provided to industrial fisheries worldwide, whereas this value is around 5 to 7 million dollars for SSF. Such a comparison clearly demonstrates the level of importance of small-scale fishery in the overall fishery sector. However, not much is known about product-related processes, such as capture, preservation, value-adding, and marketing, which are highly variable, and difficult to track through an established value chain chart compared to a well-established organization (Staples et al. 2004). It has been emphasized that global SSF activities, which involve more than 12 million fishers for the subsistence of their households, have not been managed sustainably due to their lower visibility. The contribution of SSF to gross national domestic product (GNPD) has been underestimated because of the difficulty of following a product’s value chain from catch to the market.

Due to the inherent variability, complexity, and uncertainty, it is difficult to create a consensus definition that would be applicable to all global SSFs. Therefore, sectoral-based definitions for SSF have to be general. SSF has been defined as a dynamic and developing sub-sector of fisheries, using labor-intensive catching, processing, and distribution technologies to take advantage of marine and inland fishing resources (Staples et al. 2004). Nonetheless, the general perception of SSF implies characteristics, namely that it is predominantly artisanal, local, coastal, traditional, small, subsistence, non-industrial, low-tech, and poor (Natale et al. 2015).

Fisheries, in general, is defined as an activity that involves the catching, preservation, processing, transporting, and marketing of the product. Additionally, there are bilateral related sectors, such as construction and repair/maintenance of fishing gear, boats, and engines. There is no doubt that SSF plays a prominent role in the value chain, in the fishery market as a product supplier, and in the industrial and service sectors as a dependent customer. All these associated sectors, together with fish production, create the total contribution of the fishery sector to national, regional, and local economies.

The aim of this study was to analyze the socio-economic status of the SSF in the Black Sea. A set of socio-economic indicators were investigated that enabled an estimate of their significance to net profit in the SSF so that these results can be exploited to enhance the management of fisheries in the region. The following SSF fleet composition will provide the required data and information.

Data from 2017 reported a total of 14,479 fishing boats operating in Turkey. Of these, 12,983 (89.7%) have a boat length less than 12 m and thus constitute the SSF fleet active throughout the coasts of Turkey. These proportions are similar in the Black Sea, with 5,575 fishing boats, of which 5,141 (88.6%) are shorter than 12 m (TURKSTAT 2017; GDAR 2018).

These numbers indicate that the majority of boats involved in the Black Sea fishing are actually part of the Black Sea SSF, both in terms of structure and function. Although the number of boats in the SSF fleet is known, data and information concerning the socio-economic properties are scarce and limited. As result, it is almost impossible to predict their potential socio-economic performance. Such predictions are essential for developing efficient management strategies and solutions, considering both the sustainability of SSF activities and ecosystem resources and thus achieving a more rational use of resources and sustainable levels of the fishery.
Material and methods

The sample was drawn from the SSF in the Black Sea. These numbered 5141 (88.6%) with a boat length < 12 m of a total of 5575 fishing boats operating in the Black Sea (TURKSTAT 2017; GDAR 2018). The majority of these smaller boats (59%) were located and operated in the eastern provinces of Ordu, Giresun, Trabzon, Rize, and Artvin. The coastal waters of these eastern provinces were closed for bottom-pelagic trawling and hydraulic dredge fishing in the 1980s, which may have resulted in such an SSF profile in the area (Fig. 1) (Mısır et al. 2020). Of the 5141 boats, 196 (3.8%) are C licensed (10–12 m) whilst the rest are D licensed (< 10 m). Regardless of their licenses, 447 of these boats (8.7%) were out of operation for various reasons, 1322 of them (25.7%) use only long lines, and the remaining 3372 boats (65.59%) used at least one or more extension gill nets or circular nets (Mısır et al. 2020).

The study was based on a field survey, to be conducted by face-to-face interview, in order to collect data via a specifically prepared questionnaire. The number of fishers to be surveyed was determined by using the simple random sampling method, using the following equation (Yamane 1967).

\[
n = \frac{N(zC)^2}{Nd^2 + (zC)^2}
\]

where, \(n\) is the number of boats surveyed; \(N\) refers to the total population of boats (5575); \(z\) is the standard normal distribution value corresponding to the desired confidence level (95%); \(C\) is the coefficient of variation; and \(d\) is the margin of error (+10%), accepted in the study.

In order to arrange the meetings with fishers, a series of informative meetings was first organized with the regional authorities, including the departments of Provincial Directorates of the Ministry of Agriculture and Forestry and Fisheries Cooperatives in order to prepare the work program schedule for each fishing port where the project personnel would meet with fishers who were boat owners in order to conduct the surveys.

The questionnaire forms were used to create the main data resource. The survey consists of three sections, each of which has a set of questions on: a) the social status of the boat owners; b) information on boats and fishing operations; and c) the economic features of their fishing operations.

Considering the possible variations due to demographic or technological differences which can influence the comparability of the analysis leading to bias, a set of parameters free from such bias were selected for evaluating the efficiency of SSFs in the Black Sea. Costs and revenue figures were converted to Euro equivalents (€) for standardization purposes at the exchange rate quoted by the Central Bank of the Republic of Turkey for 2015 (CBRT 2021).

There were six parameters selected to test for their influences on the net profit in SSF. These were: (1) engine power, (2) numbers of days at sea, (3) length of boat, (4) fuel costs, (5) education level, and (6) professional experience of fishers. Once these parameters were selected and the data associated was collected, collated, and compiled for analysis, a simple linear regression analysis (SLRA) was performed in SPSS, version 13.0 (IBM Inc., Armonk, NY, USA). This was done to determine the effect when data from the selected parameters were designated independent variables and the net profit was designated as the dependent variable. The SLRA is a statistical test that predicts the relations between the independent and the dependent variables and the nature of the relation (Nakip 2005). The calculation to determine revenue generated was performed prior to performing the SLRA. This calculation was made by multiplying the catch for each species by the mean sale price for that year. The unit price of fish caught by SSF is usually higher than that caught by industrial fishery, due mainly to the freshness of the product. After estimating the value of the catch, the net profit was calculated by subtracting the total costs including fuel, boat, and fishing gear maintenance and repair, clothing, documents, and registration expenses from this catch value (EC 2001).

Results and discussion

Even though the calculated number of fishers to be surveyed was 284, face-to-face interviews were carried out with 315 boat owners from 15 provinces including...
(eastern) Giresun, Ordu, Artvin, Rize, Trabzon, (central) Samsun, and (western) Bartın, Zonguldak, Kastamonu, Sinop, Sakarya, Kırklareli, Istanbul, Kocaeli, and Duzce (Fig. 2). However, the data collected from 12 participants were not suitable for analysis due to incomplete information and incorrect answers and was not included. Consequently, the total number of questionnaires used in the analysis was 303.

During the study, 32.3% of the respondents were in the age group aged 50–59 years with the mean value of 49.7 ± 11.4 years while the range was 21–78 years. Dağtekin (unpublished) in a study carried out in Trabzon province reported that 42% of the boat owners were in the 40–49 years age group. Similarly, Uzmanoğlu and Soylu (2006) stated that 35.7% of the fishers in Karasu were between the ages of 40–49 years. Çeliker et al. (2006) determined that the age of fishers in the Black Sea varied between 25 and 70 years and the mean age was 46.45 years. In a later report from the Aegean Region, Çeliker et al. (2008), found that the ages of the fishers varied between 19 and 73 years. Another study conducted along the Mediterranean coasts of Turkey (Taşdan et al. 2010), revealed that the mean age was 40 years while Güngör et al. (2012) stated that the largest age grouping of fishers in the Marmara Sea was between 41 and 50 years (34.2%).

The fishers’ education level was predominantly primary school level (48.6%). This proportion for Turkish fishers showed a slight improvement on earlier studies. The proportion who were primary school graduates in earlier studies were: 58.44% in the Black Sea (Çeliker et al. 2006), 78.6% in Karasu, a coastal town in the western Black Sea (Uzmanoğlu and Soylu 2006), 70.1% for the Aegean Sea (Çeliker et al. 2008), 60.7% along the Mediterranean coasts of Turkey (Taşdan et al. 2010), 60% in Trabzon on the Black Sea coast (Dağtekin unpublished), and 64% for the Sea of Marmara (Güngör et al. 2012). Thus, it appears that the education level of the fishers operating in the Turkish SSF is mainly elementary school.

In the presently reported study, the mean number of years of experience of the fishers surveyed was 29.4 ± 12.7. The household population of fishers varied between 2 and 7 family members. The corresponding mean values were 3.38 in the Aegean region (Çeliker et al. 2008), 3.8 in the Mediterranean (Taşdan et al. 2010), and 3.68 in the Black Sea region (Çeliker et al. 2006). In a study conducted in the Marmara region, it was reported that 88.4% of fishers were married (Güngör et al. 2012) while another study determined that 81% of the fishers in the Eastern Black Sea were married (Özbek unpublished). The maximum number of children at home was 5, but the mean value was 2.14 (Table 1). Similar figures were reported in previous studies, including 2.2 for the Black Sea region (Çeliker et al. 2006), 1.7 for the Aegean Region (Çeliker et al. 2008), and 1.9 for the Mediterranean coasts of Turkey (Taşdan et al. 2010). The number of individuals living in households in the Black Sea Region was higher than the other fishing communities in Turkey. The majority (78.3%) of fishers have social security. The ratio of fishers who have a second revenue source was 43.9%. The number of children who also engaged in the fishing profession was 19%. Although 51.4% of the fishers reported being moderately satisfied with their job, the majority of (87.7%) of the interviewed fishers intended to continue their profession in the future. Despite the difficulties of fishing as a profession, their preference for continuing their job mainly stems from the lack of other job opportunities, experience relating only to fishing, and their passionate love for the profession. Nevertheless, 68.5% of fishers were not satisfied with the legal regulations, which are currently in the notification (Table 1).

The analyses of the distribution of catch by species, the net profit by province, and the relation between inputs
and net profit of SSF were performed using data from fishing operations in one season along the Black Sea coastline of Turkey. Kırklareli, the westernmost province, was where the maximum yield (97 007 kg) of fish was caught. Atlantic bonito, *Sarda sarda* (Bloch, 1793), was more frequent and one of the most important species in the populations studied. The mean value of the catch of Atlantic bonito was 44 778 kg/boat in Kırklareli and 22 977 kg/boat in Samsun. Moreover, Atlantic bonito was also the top species caught by the boats in Kocaeli province (19 183 kg) whilst anchovy (10 500 kg) was the second species caught most often by boats (Table 2). Every year, Atlantic bonito migrates for reproduction and nursery from the Mediterranean Sea through the Turkish Straits system, consisting of the Straits of the Dardanelles, Sea of Marmara, and the Straits of the Bosphorus, to the Black Sea and return through the same path for feeding (Genç et al. 2019). Due to its migration pattern, the Atlantic bonito catch is greater in provinces close to the Bosphorus. Rapa whelk was also an important catch species for SSF. When the regions are compared with each other, the revenue obtained from rapa whelk in the Samsun region was higher than the other regions, in terms of higher landing volume [kg] and thus revenue. It should also be noted that prices for rapa whelk vary with the mean length and this is an effective factor for changing the revenue level in disparities between regions. Turbot, *Scophthalmus maximus* (Linnaeus, 1758), stocks in the Black Sea were overexploited (GFCM 2019). Therefore, the landing volume per boat was far lower than historical records show. The total number of gillnets and entangling nets in the boats comprised 107 331 panels in the Turkish Black Sea coasts. The number of gillnets and entangling nets for turbot, whiting, *Merlangius merlangus* (Linnaeus, 1758), Atlantic bonito, and red mullet, *Mullus barbatu*

### Table 1. Socio-demographic characteristics of fishers on the Turkish Black Sea coasts.

| Category                          | Variable | [%] |
|-----------------------------------|----------|-----|
| Age (years)                       | 20–29    | 4.2 |
|                                   | 30–39    | 15.7|
|                                   | 40–49    | 26.2|
|                                   | 50–59    | 32.3|
|                                   | 60–69    | 18.5|
|                                   | ≥70      | 3.2 |
| Marital status                    | Single   | 10.5|
|                                   | Married  | 89.5|
| Number of children                | 0        | 13.2|
|                                   | 1        | 15.8|
|                                   | 2        | 39.2|
|                                   | 3        | 21.9|
|                                   | 4        | 8.0 |
|                                   | 5        | 1.9 |
| Level of education                | Primary school | 48.6|
|                                   | Secondary School | 21.1|
|                                   | High school | 25.9|
|                                   | Associate degree | 2.6|
|                                   | University | 1.9 |
| Social security                   | With social security | 78.3|
|                                   | Without social security | 21.7|
| Second revenue                    | Fishing only | 56.1|
|                                   | Having a second revenue | 43.9|
| Fishing experience (years)        | 1–10     | 8.4 |
|                                   | 11–20    | 25.0|
|                                   | 21–30    | 24.4|
|                                   | 31–40    | 26.6|
|                                   | 41–50    | 7.5 |
|                                   | ≥50      | 8.1 |
| Number of children engaged in fishing profession | Yes | 19.9|
| Satisfaction                      | Satisfied | 34.8|
|                                   | No Satisfied | 13.4|
|                                   | Moderate level satisfied | 51.8|
| Do you plan to continue the profession in the future? | Yes | 87.7|
| Are you satisfied with the legal regulations? | Yes | 31.5|
|                                   | No | 68.5|

### Table 2. Landing volume by region mean per boats [kg].

| Region        | Target species | Total |
|---------------|----------------|-------|
| Artvin        | 2487           | 3378  |
| Bartın        | 4820           | 790   |
| Düzce         | 15 500         | 3200  |
| Giresun       | 41 656         | 2400  |
| İstanbul      | 43 322         | 3900  |
| Kastamonu     | 22 525         | 5475  |
| Kırklareli    | 19 857         | 1150  |
| Kocaeli       | 10 050         | 8950  |
| Ordu          | 22 225         | 6900  |
| Rize          | 2627           | 1995  |
| Sakarya       | 17 010         | 7233  |
| Samsun        | 25 929         | 4500  |
| Sinop         | 40 144         | 2887  |
| Trabzon       | 187            | 3144  |
| Zonguldak     | 10 596         | 1267  |

**Abbreviations:** (1) anchovy *Engraulis encrasicolus*, (2) horse mackerel *Trachurus mediterraneus*, (3) Atlantic bonito *Sarda sarda*, (4) bluefish *Pomatomus saltatrix*, (5) whiting *Merlangius merlangus*, (6) turbot *Scophthalmus maximus*, (7) red mullet *Mullus barbatus*, (8) scorpion fish *Scorpaena porcus*, (9) shad *Alosa immaculata*, (10) grey mullet *Liza aurata* and *Mullus cephalus*, (11) sea bream *Diplodus sargus*, (12) rapa whelk *Rapana venosa*, (13) Others.
Each of the six selected parameters had some effect on net profit, with the exceptions of professional experience and education level (see Table 5). The variable with the strongest effect was the length of the boat (19%). A moderate effect was found for both fuel consumption while fishing (11%) and boat engine power (8%), while the weakest was the number of days at sea (3%). The management of SSF is important not only for the protection of natural resources but also for the sustainable living standards of the citizens whose subsistence is dependent on this activity. We estimate that a total of 26,800 people are reliant on the Black Sea SSF made up of approximately 6700 crew, who are directly dependent on fishing, on the Black Sea coastline of Turkey on 3372 active boats, and including the number of people in their households. Thus, it would be reasonable to assume that the numbers reliant to some extent on the Black Sea SSF will exceed 100,000 when the sectors related to the fishing, such as wholesalers and retailers, equipment manufacturers of engines and the fishing gear are also considered. Nonetheless, the focus of this study was to analyze only the profitability of fishing performance of the boats smaller than 12 m, as they compose the core of the SSF fleets. A further aim was to raise awareness of the sustainable use of fishing resources as a social responsibility, which goes far beyond simple environmental issues.

**Table 3.** Total and mean revenue, net profit, and total costs of boats by provinces.

| Province | Number of total boats | Interviews number of boats | Total net profit [€] | Mean net profit [€] | Mean total revenue [€] | Mean total costs [€] |
|----------|-----------------------|----------------------------|---------------------|---------------------|------------------------|----------------------|
| Artvin   | 233                   | 13                         | 111,341             | 8565                | 11,596                 | 3031                 |
| Bartın   | 180                   | 12                         | 36,766              | 3064                | 5458                   | 2394                 |
| Düzce    | 67                    | 7                          | 78,271              | 11,182              | 15,618                 | 4436                 |
| Giresun  | 514                   | 27                         | 58,988              | 2185                | 6184                   | 3999                 |
| İstanbul | 214                   | 21                         | 108,035             | 5145                | 8791                   | 3646                 |
| Kastamonu| 208                   | 16                         | 128,899             | 8056                | 10,928                 | 2872                 |
| Kırklareli| 85                    | 10                         | 259,090             | 25,909              | 30,703                 | 4794                 |
| Kocaeli  | 134                   | 19                         | 189,101             | 9953                | 12,832                 | 2879                 |
| Ordu     | 401                   | 20                         | 208,855             | 10,043              | 19,007                 | 8964                 |
| Rize     | 915                   | 39                         | 43,835              | 1124                | 4573                   | 3449                 |
| Sakarya  | 57                    | 7                          | 89,215              | 12,745              | 18,501                 | 5756                 |
| Samsun   | 398                   | 23                         | 173,980             | 7564                | 11,850                 | 4286                 |
| Sinop    | 364                   | 23                         | 103,244             | 4489                | 7938                   | 3449                 |
| Trabzon  | 974                   | 46                         | 84,323              | 1833                | 6626                   | 4793                 |
| Zonguldak| 397                   | 20                         | 128,994             | 6450                | 10,605                 | 4155                 |
| Total    | 5141                  | 303                        | 1,794,938           | 5924                | 10,108                 | 4184                 |

**Table 4.** Boat features, number of fishing days, and fuel costs.

| Parameters                | Min. | Max. | Mean | SD  |
|---------------------------|------|------|------|-----|
| Engine power [kW]         | 2.98 | 261.00| 45.54| 42.50|
| Number of days at sea     | 10.00| 310.00| 159.08| 79.06|
| Length of boat [m]        | 4.40 | 12.00| 7.47 | 1.63|
| Fuel costs [€]            | 66.00| 9917.00| 1482.50| 1325.28|
| Age of boat               | 1.00 | 45.00| 14.95| 9.89|

**Conclusion**

The number of days that the boats of SSF fleet spend at sea is low. According to FAO criteria, the boat is considered active when it is at sea fishing even for one day. Therefore, when the mean revenue and catch per boat is reported, it is unlikely to reflect the status of the active boats throughout the year.
The mean age of fishers in this study was late middle age. As SSF is an active form of artisanal fishing, if this sector is to be encouraged then it will be necessary to provide support to attract younger people into the SSF, as has been reported previously (Çeliker et al. 2006, 2008; Taşdan et al. 2010; Dağtekin unpublished).

The majority of the fishers were primary school graduates. When the reasons for practicing SSF were examined, it was found that this job was sought around 20% of the time as either a hobby or as a post-retirement activity. This finding would also explain why some of the boats reported relatively few active days. The mean net profit was €5924 per fisher per season. This figure will have been influenced by the fifth of respondents who considered their activity in the SSF as part-time. However, it would be beneficial to provide support to the majority of fishers active in the SSF in terms of complementary alternative employment opportunities in the regions where they are located.

Almost all settlements along the Black Sea coast have traditional shipbuilders who build, repair the boats, and provide maintenance services. With an investor group of at least two people in a fishing port and shelter, a new employment opportunity can be created for the fishing sector, so that coastal fishers will be able to access services for boat maintenance, repair and construction works with less cost in their local settlements. There are some examples that have been applied and successfully managed around the Gulf of Gökova, in the Aegean Sea SSF (Ünal and Kızılkaya 2019). The SSF sector can also be supported by other means. For instance, stocks of turbot, sturgeon, etc. can be restored by releasing hatchery-produced juveniles within the frame of a well-designed and executed stock enhancement program (Charles et. al. 2003). Also, SSF boats can also be utilized for tourism purposes (Lai et al. 2016). Viable suggestions are continuously forwarded and promoted by FAO and EC via workshops and reports for strengthening of SSF (EC 2018; FAO 2020).

Within the value chain, different systems should be investigated to increase the fisher’s revenue. With cooperation, all scenarios can be developed, including e-commerce, which has come to the fore during the recent pandemic. Moreover, any changes to the legal standards for fishing gear may cause an acute increase in overall operational costs for SSF fishers who are not able to adapt due to their vulnerable economic status. Thus, a subsidy program will be needed and recommended when such changes in the legal standard for fishing gear are proposed and implemented. The overall evaluation of the results suggests that the Black Sea SSF in Turkey is not sustainable under current circumstances, like many other countries.

Recently, marine cage culture systems have been increasing in the Black Sea. It is very likely to pose some potential conflicts with the capture fisheries sectors. These include over-exploitation of marine areas as well as supply to local markets. Nevertheless, a well-designed marine spatial planning program can result in a symbiotic existence for the SSF and aquaculture, large-scale fisheries, ports and shipping in the Black Sea, instead of destructive competition.

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