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RESEARCH ARTICLE

Characterization of small-scale and large-scale fisheries in Saranda (South Albania, Ionian Sea)

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Abstract

There have been increasing evidences for the negative impact of fishing on the Mediterranean trophic web and ecosystem recently. The aim of the present study was to provide a general overview on fisheries in south Albania, based on the landing survey of small-scale and large-scale fishing vessels in the fishing port of Saranda. A landing survey was performed at least 3 days a month from July 2016 to March 2017. The analysis was based on catch per unit effort (CPUE) for most species, which are caught by the small-scale and large-scale fishing vessels and landed in Saranda fishing port. The results indicated the overfishing of the target species and suggest that a proper monitoring program should be activated including the small-scale and recreational fisheries activities.

Keywords: European hake, small-scale fisheries, large-scale fisheries, striped red mullet, deep-water rose shrimp

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Introduction

The Mediterranean ecosystem has a long history of human disturbance and exploitation, where recent single species assessments are showing overexploitation of commercial fish and shellfish stocks along with a rapid decline of large predators, such as sharks (Ferretti *et al.* 2008, 2013; Fortibuoni *et al.* 2016). The impact of poorly regulated fisheries is widely documented in EU Mediterranean waters (Colloca *et al.* 2013; Vasilakopoulos *et al.* 2014). The status of fisheries and stocks in non-EU countries (including countries like Albania) is still unclear. Generally, the standardized fisheries data collection systems are not yet fully enforced by the national and local authorities in these countries. However, taking into consideration the recent reports of the working groups on stock assessment of the General Fisheries Commission for the Mediterranean (GFCM), it is possible to argue that in the non-EU countries the situation might be critical (GFCM 2016).

In recent years, there are also increasing evidences for the negative impacts of fishing on the Mediterranean trophic web and ecosystem. Analyses on the impact of fishing on the ecosystem, which were quantified through an index of loss in secondary production (Libralato *et al*. 2008), resulted in a general low probability of the ecosystem to be sustainably fished in the Mediterranean Sea, from both models and data (Libralato *et al.* 2005). Moreover, the meta-analysis of Mediterranean model outputs highlighted detectable signs of impacts of fishing from several ecosystem indicators (Coll and Libralato 2012).

The ecosystem change was so fast during the last 50 years that it has been directly witnessed in different Mediterranean areas by fishermen and vessel captains (Maynou *et al.* 2011). This was highlighted from analysis of landing statistics (Fortibuoni *et al.* 2017), and documented in several studies (Lleonart 1993; Abelló *et al.* 2002; Coll *et al.* 2006; Azzurro *et al.* 2011).

In addition, there is a growing concern about the damages on the benthic habitat caused by towed gears such as otter trawls, dredges and beam trawls (Pranovi *et al.* 2000; De Biasi and Pacciardi 2008; de Juan and Lleonart 2010).

There is a critical situation of commercial stocks as a consequence of continuous high fishing pressure by the fishing fleet in the Mediterranean Sea. Global climatic changes are also influencing the Mediterranean ecosystem by changing average temperature, productivity and acidity (Lazzari *et al*. 2012; Cossarini *et al*. 2015), with potentially large effects on exploited stocks (Colloca *et al.* 2014).

Although there is a general concern about the lack of adequate management measures to reverse the ongoing negative trends and drive Mediterranean fisheries toward a sustainable practice, overall picture of the situation of fisheries and ecosystems is still rather complex. The Mediterranean fishing fleet is made up by about 72,600 vessels of which 85.5% are artisanal vessels using a variety of gears (e.g., trammel nets, gillnets, longlines, traps, etc.), about 9% are trawlers and 5% purse seiners and pelagic trawlers (Sacchi 2011). Fleet data show major differences across the Mediterranean geographical sub-areas (GSAs). The largest artisanal fleets occur in Tunisia (GSAs 12–14), whilst trawlers are mainly concentrated in Egypt (GSA 26) and Algeria (GSA 4). In terms of fishing pressure on the shelf, the area with the highest number of artisanal vessels per km^2 is Cyprus (GSA 25), Morocco (GSA 3) and Algeria (GSA 4) (Colloca *et al.* 2014).

Albania is part of GSA 18 and its fisheries fleet contributes about 0.33% on the Mediterranean fishing fleet and it was represented by 180 trawlers and dredgers, 22 purse seiners for small pelagic species (anchovy and sardine) and 67 artisanal (small scale) boats in 2012 (Sacchi 2011). Sacchi (2011) reported that the estimated values of average power of the vessels is 280 Kw for trawlers and dredgers, 200 Kw for purse seiners and 80 Kw for artisanal boats. Furthermore, the number of fishermen working in trawlers was 729 and the number of

fishermen working in purse seiners for small pelagic and artisanal boats was 97 and 158, respectively (Sacchi 2011).

Our main goal was to provide a general overview on fisheries in south Albania, by presenting and discussing the results of the landing survey in the fishing port of Saranda (in Albanian: Sarandë) by taking into consideration the data collected from small-scale and large-scale fisheries in this port for about one year. The fisheries landing surveys were performed by representatives of Department of Aquaculture and Fisheries (Agricultural University of Tirana). Generally, the fisheries landing statistics, should be reported by the national fisheries inspectorate (Ministry of Agriculture) in Albania. All the presented results can be useful for national authorities, international organizations and scientific community, who have interest in the Albanian fisheries, as part of the Mediterranean fisheries.

Materials and Methods

Study area

Saranda (Figure 1) is a town of 36,500 inhabitants, which is located in south Albania and a popular touristic port during summer with the connection to Corfu (the Greek town in front of Saranda). In Saranda, there is also a fishing port, which hosts the third biggest fishing fleet in Albania. The fishing vessels are represented by 13 large-scale fishing vessels, including mostly trawlers. The small-scale fisheries is represented by 36 fishing boats with a length of less than 12 m, with and without the engine, which main fishing equipments are represented by long-lines and fixed nets (mainly trammel nets). Generally, all the fishing operations are performed close to the Bay of Saranda. Furthermore, the average engine power of the small-scale fishing vessels is 42 HP, but recently the tendency is toward a lower engine power per fishing vessel. Mainly, all the fishing vessels are fishing for deep-water rose shrimp (*Parapenaeus longirostris*), European hake (*Merluccius merluccius*) and striped red mullet (*Mullus surmuletus*), which are the most preferred species in the fish markets.

Data collection

Before the data collection, a technical survey was performed for the fishing vessels registered in the fishing port of Saranda, in order to have information about the fishing vessels by the technical point of view and their fishing equipment.

Based on this information, we identified large-scale fishing vessels, which were fishing all around the year for more than 5 years. Landing survey was performed at least 3 times a month (weather condition permitted) from July 2016 till March 2017 for both large-scale and small-scale fishing vessels.

During all the landing surveys, the fishers were interviewed about the time of fishing and the equipment used for fishing. The weights for each of the caught species were recorded by us in collaboration with the fishers. Furthermore, for the most abundant fish species, we measured the Total Length (TL).

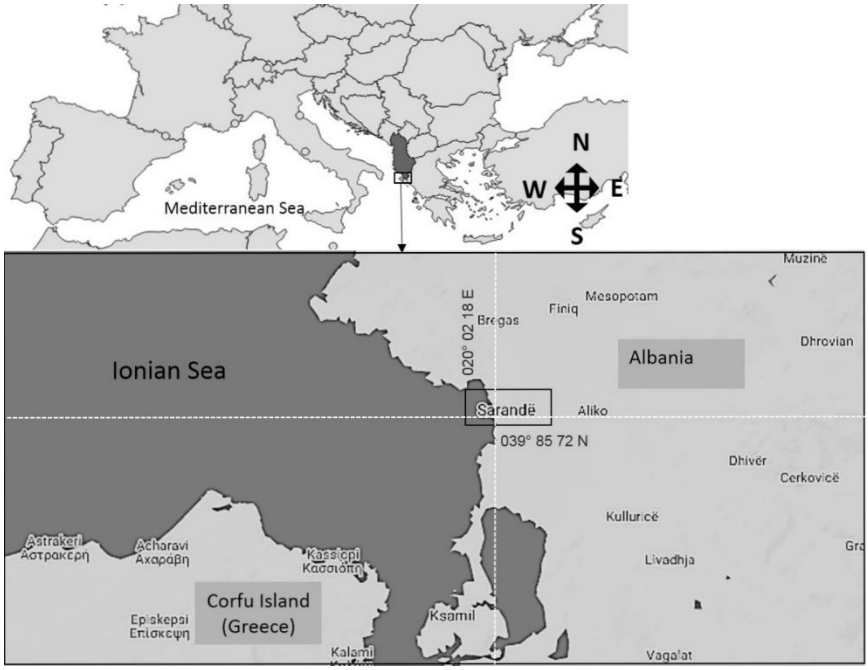

Figure 1. Map showing the location of Saranda (Sarandë) in Albania

Data analyses

The analysis was based on catch per unit effort (CPUE) data of most species caught by the small-scale and large-scale fishing vessels and landed in Saranda fishing port, where it is important to note that CPUE is frequently the single most useful index for long-term monitoring of fishery. We calculated the average CPUE based on the daily CPUE of each fishing vessel. For the large-scale fishing vessels, the CPUE was calculated as total catch per deployment hours of fishing equipment (Colloca *et al*. 2013), while in the case of small-scale fishing vessels, it was calculated as total catch per deployment hours of fishing equipment and total catch per 1000 m of deployed fixed nets (Guidetti *et al*. 2010).

All the data analyses and the graphics resulted by using Origin software (OriginLab, Northampton, MA).

We investigated also for the presence of individuals with TL lower than the permitted TL by the National Law on Fisheries, based on the measurements for

the two species, European hake (*M. merluccius*) and red mullet (*M. surmuletus*). Based on the national legislation, represented by the Law No. 64 of 31 May 2012 on Fisheries, which replaces the fisheries regime established by Law No. 7908 of 5 April 1995 on Fishery and Aquaculture, the individuals of European hake under TL 20 cm should be considered as bycatch and they should be thrown back in order to reduce the quantity of this species bycatch. In the case of red mullet, the permitted TL is over 11 cm.

Results and Discussion

It is interesting to note that the age of the fishing vessels were mostly 35-39 years. All analyzed large-scale fishing vessels were trawlers, which average trawler net length was 50 m, with an average mesh size of 26 mm. The average length of these vessels was 16 m, with an average engine power of 260 hp. Mostly, the fishing trials lasted from 6 to 8 hours during the day (3 to 4 fours per each fishing trial), where most of the trawler nets were deployed at a depth ranging from 50 to 300 m.

Most of the small-scale fishing equipment were represented by fixed nets of a length ranging from 600 to 2000 m with a 24 - 30 mm mesh size. The minimum length of the fishing boat was 6 m and the maximum length was 12 m, where the minimum engine power was 24 HP and the maximum was 125 HP. Generally, the fishing boats were fishing close to the Bay of Saranda at a depth from 30 to 120 m, where the fishing trials lasted not more than 9 hours and not less than 5 hours.

Regarding the comparison of the average CPUEs of trawlers (Figure 2), it resulted that there was a high variability between the fishing vessels, where the minimum values are represented by the fishing vessel 3, with a CPUE 6.74 kg/hour and the maximum is reached for the vessel 1, with a CPUE 8.08 kg/hour. The average CPUE was 7.35 kg/hour. The most fished species on a decreased order are represented by deep-water rose shrimp with a total catch of 1060 kg, European hake (total catch 511 kg) and red mullet (total catch 202 kg).

For each of the most fished species, the CPUE was calculated for each trawler. The comparison of the CPUE between fishing vessels is shown in Figure 3 for the striped red mullet (A), European hake (B) and rose shrimp (C). In the case of European hake (Figure 4), the average CPUE was 1.14 kg/hour, while the striped red mullet results (Figure 5) showed an average CPUE equal to 0.46 kg/hour. The minimum CPUE value for European hake was reached by the fishing vessel 3 (CPUE = 0.84 kg/hour), while the minimum CPUE for red mullet was reached by the fishing vessel 5 (CPUE = 0.31 kg/hour). The maximum CPUE value for European hake was reached by the fishing vessel 1 (CPUE = 1.46 kg/hour), while the maximum CPUE for red mullet was reached by the fishing vessel 4 (CPUE = 0.72 kg/hour). In the case of rose shrimp, the maximum CPUE value was reached

by the fishing vessel 5 (CPUE = 2.9 kg/hour), while the minimum CPUE value was reached by the vessel 4 (CPUE = 2.03 kg/hour), where the average CPUE was 2.47 kg/hour.

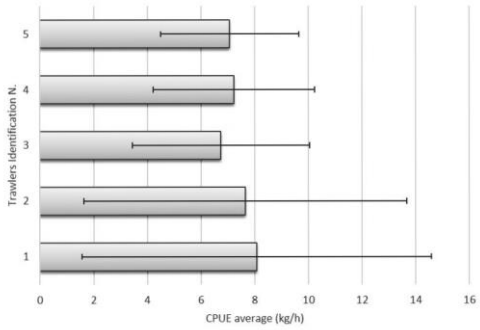

Figure 2. Comparison of the calculated average CPUEs of five analyzed trawlers from July 2016 to March 2017; the line represents the standard deviation.

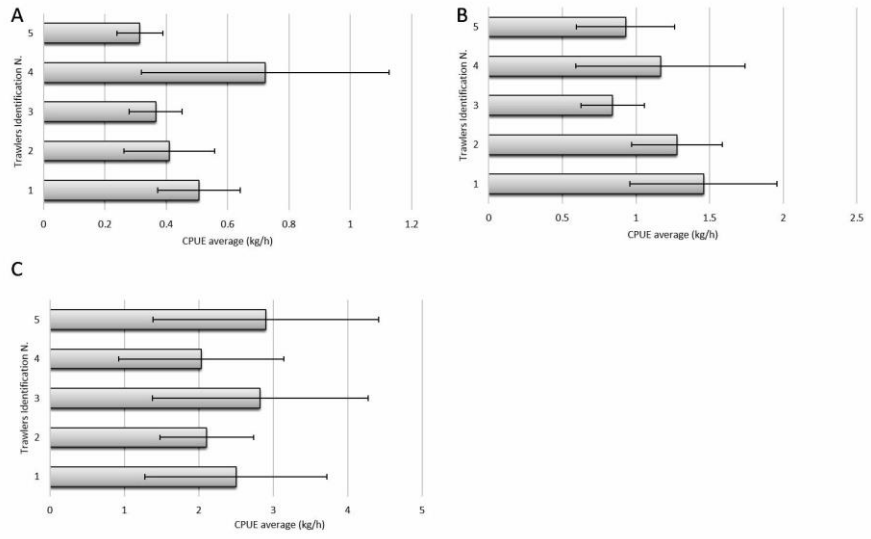

Figure 3. Comparison between trawlers CPUEs values calculated for (A) striped red mullet (*Mullus surmuletus*), (B) European hake (*Merluccius merluccius*) and (C) deep-water rose shrimp (*Parapenaeus longirostris*) from July 2016 to March 2017; the line represents the standard deviation.

Analyses on TL in relation to the Law on Fisheries showed that none of the measured individuals on fishing vessels board was under the minimum landing size (MLS) for red mullet. It was different for the case of European hake, where the fishing vessels with the minimum (vessel 3) and the maximum (vessel 1)

CPUE, performed fishing activities with 2 and 7 % of the total catch, respectively, considered as bycatch.

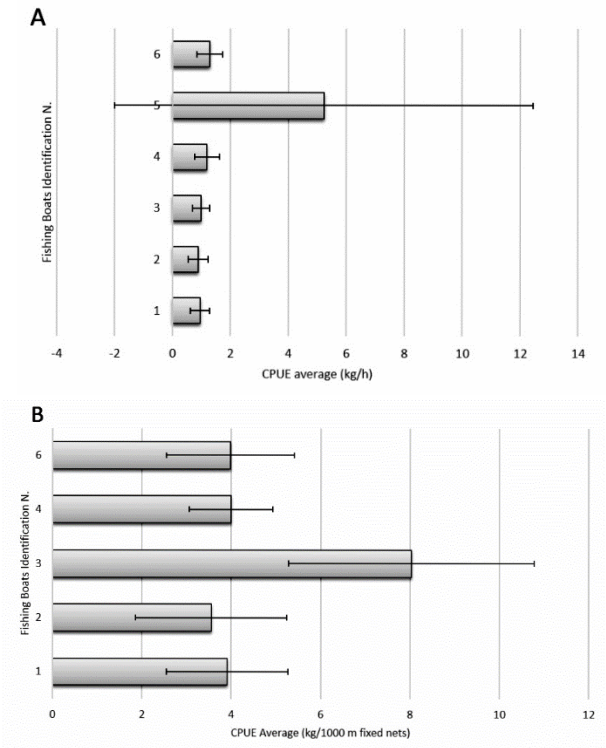

Figure 4. Comparison between the (A) calculated average CPUEs of artisanal fishing boats and (B) CPUEs calculated as total catch for 1000 m deployed fixed nets, from July 2016 to March 2017; the line represents the standard deviation.

There was a high variability in the average CPUEs between the artisanal fishing boats (Figure 4A) where the minimum value was represented by the fishing boat 2, with CPUE 0.88 kg/hour and the maximum was reached for the fishing boat 5, with CPUE 5.22 kg/hour, which presented also a large standard deviation, due to the fact that this boat was fishing sometimes by using longlines. The average CPUE was 1.84 kg/hour. The most fished species on a decreased order are represented by European hake with a total catch 140 kg and red mullet (total catch 52 kg).

The average CPUE of the boats using trammel nets was 6.5 kg/1000 m and this value was comparable to the average CPUE corresponding to the fishing boats operating along the coast of Italy, Spain, Greece, Croatia and France, which

average catch data obtained with fixed nets from more than 20 locations range from 3 to 10 kg/1000 m (Guidetti *et al.* 2010). These results (Figure 4B) suggested that the small-scale fisheries should be promoted as the only sustainable activity in the fisheries sector, though the higher profit coming from trawlers (their average CPUE was 4 times higher in comparison to the average CPUE of the artisanal fishing boats) makes trawlers more attractive in comparison to the small-scale fishing vessels and the relative fishing equipment.

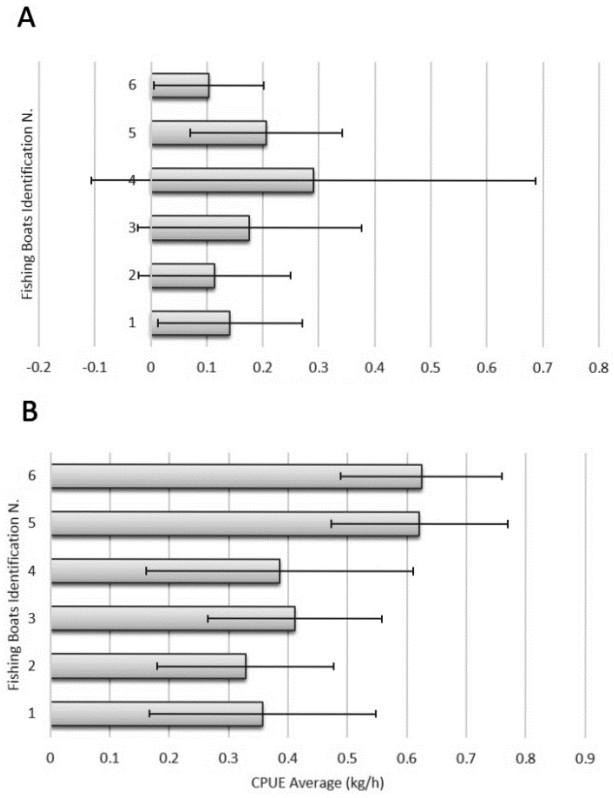

Figure 5. Comparison between artisanal fishing boats CPUEs values calculated for (A) striped red mullet (*Mullus surmuletus*) and (B) European hake (*Merluccius merluccius*) from July 2016 to March 2017; the line represents the standard deviation.

For striped red mullet and European hake, the most fished species, CPUE for each artisanal fishing boat was calculated (Figure 5). In the case of striped red mullet (Figure 5A), the average CPUE was 0.17 kg/hour, while the results of European hake (Figure 5B) showed an average CPUE equal to 0.45 kg/hour. The minimum CPUE for European hake was reached by the fishing boat 2 (0.33 kg/hour), while for striped red mullet it was reached by the fishing boat 6 (0.10 kg/hour). The

maximum CPUE for European hake was reached by the fishing boat 6 (0.62 kg/hour), while for striped red mullet it was by the fishing boat 4 (0.29 kg/hour). None of the measured individuals of European hake and striped red mullet was under the MLS.

We also made comparison between the artisanal fishing boats and trawlers for average CPUE on the European hake and striped red mulled (Figure 6). The CPUE for European hake was higher than that for striped red mullet in both fisheries scales. In the case of the artisanal fishing, the average CPUE of the European hake resulted to be roughly 2.7 higher than the striped red mullet, while in the case of trawlers the average CPUE of the European hake resulted to be roughly 2.5 higher than the striped red mullet. Due to the fact that more data are available for the large-scale fisheries of these two species in the Mediterranean region and there is a general lack of data on the small-scale fisheries in the Mediterranean including Albania, in comparison of these results with others surveys results, we considered just the results corresponding to the trawlers.

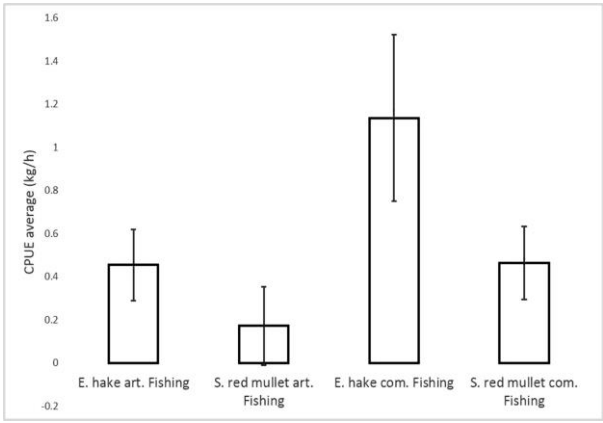

Figure 6. Comparison between artisanal fishing boats and trawlers CPUEs values calculated for striped red mullet and European hake from July 2016 to March 2017; the line represents the standard deviation.

In the Mediterranean basin, the CPUE for the striped red mullet has steadily decreased from 1968 to 2008 in the Balearic Islands, western Mediterranean. Landings and CPUE remained relatively constant from the 1990s to 2008 (Quetglas *et al*. 2016). Recent stock assessments indicate that the striped red mullet stocks are considered as overfished, and over-exploited in some cases, for the following Mediterranean sub-regions: GSA 06, GSA 07, GSA 09, GSA 05, GSA 25 (GFCM 2012). It is important to note that the GSA18 is not included in the list, but we suggest that a detailed investigation in the fishing markets and fishing port is needed in order to evaluate the sustainability of these fishing activities, because individuals under the MLS are frequently found in the markets.

Indeed, the analyzed average CPUE seems to be much lower (CPUE 0.17 kg/hour) than the average CPUE in the other regions of Mediterranean (CPUE 0.65 kg/hour), which remained relatively constant from the 1990s to 2008 (Quetglas *et al*. 2016).

In the case of European hake, its abundance (CPUE and biomass) has been regularly monitored during the MEDITS surveys from 2002 to 2011 in one of the most overfished areas of the Mediterranean basin (GSA01), indicating a slight increase on this species abundance; 1.01 kg/hr in 2002 to 1.52 kg/hr in 2011 (average CPUE 1.25 kg/hour). It seems that large-scale fishing vessels in the fishing port of Saranda showed a comparable CPUE (1.14 kg/hour) to GSA01, which represents one of the most overfished areas in the Mediterranean basin. This suggests that the European hake could be overfished close to the Bay of Saranda. A well-designed monitoring program should be activated also for the small-scale fisheries activities and an improvement in the monitoring of the large-scale fishing vessels should be considered as a requisite to reach the sustainability standards for these fisheries in the future.

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