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RESEARCH ARTICLE

# Fisheries assessment of the Albanian lagoon fisheries

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**Abstract**. The present study uses fisher knowledge to outline the basic socio-economic framework of Albanian lagoon fisheries based on on-the-spot interviews conducted with fishers operating in the most important Albanian lagoons. The results indicated that Albanian lagoon fisheries were family-based, with spatial differences observed in vessels from the northern lagoon that were older, larger in size, with more powerful engines, and involved more persons in comparison with corresponding vessels from the southern lagoon. The results also indicated that lagoon fisheries were in decline, ageing fishers, and encountering problems with illegal fishery and invasive species. Most of the fishers were aware that protected areas existed in Albanian waters, whereas severe contradictions among fishers existed about the need to establish new Marine Protected Areas (MPAs). An aggravating factor that threatened the viability of the lagoon fisheries and coastal ecosystems was high incidental catches of the Blue crab, *Callinectes sapidus*. These issues revealed the increased marginalization of the Albanian lagoon fisheries that might be able to be generalized beyond this case study to other Mediterranean lagoons. The present work also highlighted the need to establish a decent stratified statistical survey to monitor the highly complex nature of lagoon fisheries.

**Keywords**: expert judgement, target species, multi-gear fishery

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## Introduction

Coastal lagoons are shallow areas with brackish water that stretch along coastlines and are separated from seas by natural barriers (Pérez-Ruzafa et al. 2011). They are a complex, highly fluctuating ecosystems, with large numbers of species with different behaviors and life cycles. Thanks to high primary and secondary productivity, lagoons are used by several fish species for breeding, feeding, and shelter (Pérez-Ruzafa et al. 2007, 2011). Lagoon fisheries rely on catching fish during migrations to sea (Katselis et al. 2013) and are conducted using several fishing methods and gears, such as fishing rods, trawl nets, and longlines (Kapetsky 1984, Ardizzone et al. 1988). Overfishing, pollution, eutrophication, habitat loss, the introduction of non-indigenous species, and climate change and its natural consequences are pressing problems in Mediterranean lagoons (GFCM 2015, Tosunoglu and Saygi 2018).

Quantifying the dependence of local communities on lagoon fisheries remains unknown, because it is inherently difficult to monitor (Cataudella et al. 2015). This is especially true of Mediterranean lagoon fisheries, where these problems have led to unquantifiable bias in monitoring fisheries and corresponding statistics.

The present study assessed lagoon fisheries in Albanian, where there are more than 390 km$^2$ of coastal wetlands or lagoons, most of which extend along the coastline of the Adriatic Lowland. The main Albanian coastal lagoons are the Karavasta, Butrinti, Narta, Kune-Vaini-Tale, Orikum, Patoku, and Viluni, whereas the Kallenga and the Lumi i Kripur, both near Narta, and the Murtemsa, near the Viluni lagoon, are small lagoons. The main issues of the study were to: (a) pinpoint the social features of Albanian lagoon fishers; (b) evaluate their degree of dependence on fishing; (c) provide information on fisheries-based expenditures of lagoon fisheries; and (d) identify the most common problems encountered by fishers. Efforts were also made to describe targeted, incidental, and discarded sensitive species caught by each combination of gears, seasons, and areas. The absence of an official authority responsible for monitoring Albanian lagoons and the lack of reference conditions means it is critical to use complementary empirical data sources, such as fisher knowledge (Stephenson et al. 2016). Although this method includes certain biases (Thurstan et al. 2016), fisher knowledge is frequently used as a supplementary source of information to provide insights into small-scale commercial fishers (Stephenson et al. 2016) in order to overcome the inherent limitations produced by the complexity and heterogeneity of lagoon fisheries (Cataudella et al. 2015).

## Materials and Methods

From April to mid May 2019, 15 lagoon fishers from southern (Lagoon of Narta) and 28 fishers from northern (Lagoon of Kune-Vaini) Albanian lagoons were interviewed on-the-spot (Fig. 1). The Narta Lagoon has a surface area of 41.8 km$^2$, a maximum depth of 1.5 m, and an average depth of 0.7 m. About a third of this surface area is used for salt extraction. The Narta Lagoon is divided from the Adriatic Sea by the low hills of Zverneci-Treporti and by a littoral cordon about 8 km long with a width of 100–1,400 m (Pano et al. 2009); it is connected to the Adriatic Sea by two artificial channels, the South and the North


Figure 1. Map of the study areas where the interviews were conducted.

channels. The freshwater regime of the Narta Lagoon is determined by the hydrologic and climatic conditions of the surrounding area and water exchange with the Adriatic Sea, and a shallow zone forms a barrier in the middle of the southwestern part of the lagoon (Pano et al. 2009). The Kune-Vain lagoon complex is located on both sides of the estuary of the River Drin of Lezha on the Adriatic coast (Fig. 1). The area to the south continues with the marshes and low-lying coastal lands of Tale that extend as far north as the estuary of the River Mat. The values of the nature and biodiversity of the Kune-Vain area means it is protected as a Managed Nature Reserve (Category IV, according to IUCN). This complex spreads over 30 $km^2$, of which 11 $km^2$ are covered by water, while the remainder are marshes, reeds, forests, shrubs, and cultivated lands (Miho et al. 2013).

Prior to conducting on-the-spot interviews, local fishing cooperatives were informed of the research and were asked to encourage their members to participate in it. The interviews were conducted privately in one-to-one sessions to prevent the interviewees from being influenced by the presence or interference of other colleges. To stimulate fisher perceptions and to minimize any potential bias, all interviews were conducted by the same person to ensure that the questions were presented identically and freely answered without prompts or influence. The questionnaire consisted of four parts facilitating the quantification of the results and the investigation of the relations among different factors and attitudes: (a) fisher profile; (b) fisheries typology (i.e., target and incidental species caught, gear characteristics); (c) dependence on fisheries (fishing intensity and frequency); (d) income from fisheries and fisheries expenditures (i.e., fuel, vessel and gear maintenance, crew salary); (e) personal views on fisheries management and problems encountered.

Descriptive statistics (i.e., estimated means and standard deviations) and frequency of occurrence (%) were applied to all statements. The non-parametric chi-square test ($\chi^2$-test) was used to examine whether there were possible associations and, if so, the degree of association among each participant's demographic characteristics (i.e., age, years of experience, education level). We chose this test among others (logit relation) because we aimed to describe the strength of a relationship between a categorical variable and demographic features and not to model the determinants of or predict the likelihood of an outcome (Zar 2010). One-way ANOVA was also used to compare mean monthly fishing activity (i.e., number of fishing days at sea) between the two areas. All of the analyses were conducted with the IBM SPSS Statistics 27.0.1.0 (SPSS 2020) statistical package.

## Results

### Fishing typology and dependency

The demographic structure of the fishers interviewed indicated that (Table 1) all of the fishers who participated in the survey from both the northern and southern lagoons were males and owners of fishing vessels. The majority were married (> 75% for both areas), employed one person as personnel (30.0 and 32.5%, respectively), of which 53.3% and 67.9% were family members, respectively. The lagoon fishers interviewed in this study spent from 10 to 30 fishing days at sea monthly. All the fishers interviewed were male, with a higher percentage of those from southern Albanian declaring that they started fishing earlier than those from the north (in the 1990s: $\chi^2$-test; $P < 0.05$; 60% vs 37%, respectively). The mean number of fishing days did not differ significantly (ANOVA; $F = 0.08$, $P > 0.05$) between the north and the south where mean annual fishing days were 178.0 vs 166.3, respectively (Fig. 2). The monthly fishing intensity pattern was not significantly different (ANOVA; $F = 0.54$, $P > 0.05$) between the two areas, and fishing activity peaked from September to January (Fig. 2).

The fishing gears that caught the majority of the catches in both areas (>62.2%) were nets, while less important fishing gears differed spatially and seasonally (Table 2). In the southern Albania lagoons, longlines contributed significantly to catches mainly

**Table 1**
Demographic structure of the Albanian lagoon interviewed fishers

| Parameters | North | South |
|---|---|---|
| Age | | |
| 26–49 | 37.0 | 58.3 |
| 50–65 | 44.4 | 33.3 |
| >66 | 18.5 | 8.3 |
| Years of fishing | | |
| 1–9 | 33.3 | 0.0 |
| 10–19 | 11.1 | 13.3 |
| 20–29 | 29.6 | 60.0 |
| 30–39 | 18.5 | 20.0 |
| 40–49 | 3.7 | 0.0 |
| 50–59 | 3.7 | 0.0 |
| 60–70 | 0.0 | 6.7 |
| Mean ± SD | 20.4 ± 13.2 | 28.1 ± 10.9 |
| Education level | | |
| Elementary school | 14.8 | 50.0 |
| High school | 51.9 | 16.7 |
| Private school | 22.2 | 0.0 |
| Student | 3.7 | 0.0 |
| University degree | 7.4 | 0.0 |
| Without elementary education | 0.0 | 33.3 |
| Marital status | | |
| Married | 75.0 | 93.3 |
| Single | 25.0 | 6.7 |
| Working status | | |
| Freelance | 14.8 | 33.3 |
| Private employee | 81.5 | 20.0 |
| Retired | 0.0 | 6.7 |
| Unemployed | 0.0 | 6.7 |
| Worker | 3.7 | 33.3 |
| Fishing vessel length (m; mean ± SD) | 5.1 ± 0.8 | 6.2 ± 0.3 |
| Years of construction (mean ± SD) | 27.1 ± 10.1 | 12.4 ± 2.6 |

**Table 2**
Percentages of the contribution of the frequency (%) of the fishing gears used in Albanian lagoons

| Fishing gear | Area | |
|---|---|---|
| Lagoon traps | North | South |
| All seasons | 37.5 | 0 |
| Nets | | |
| All seasons | 46.9 | 61.9 |
| Autumn-Winter | 3.1 | 0 |
| All seasons at 25% of total fishing | 9.4 | 4.8 |
| Longlines | | |
| All seasons | 0 | 4.8 |
| Spring-summer | 3.1 | 23.8 |
| Autumn | 0 | 4.8 |

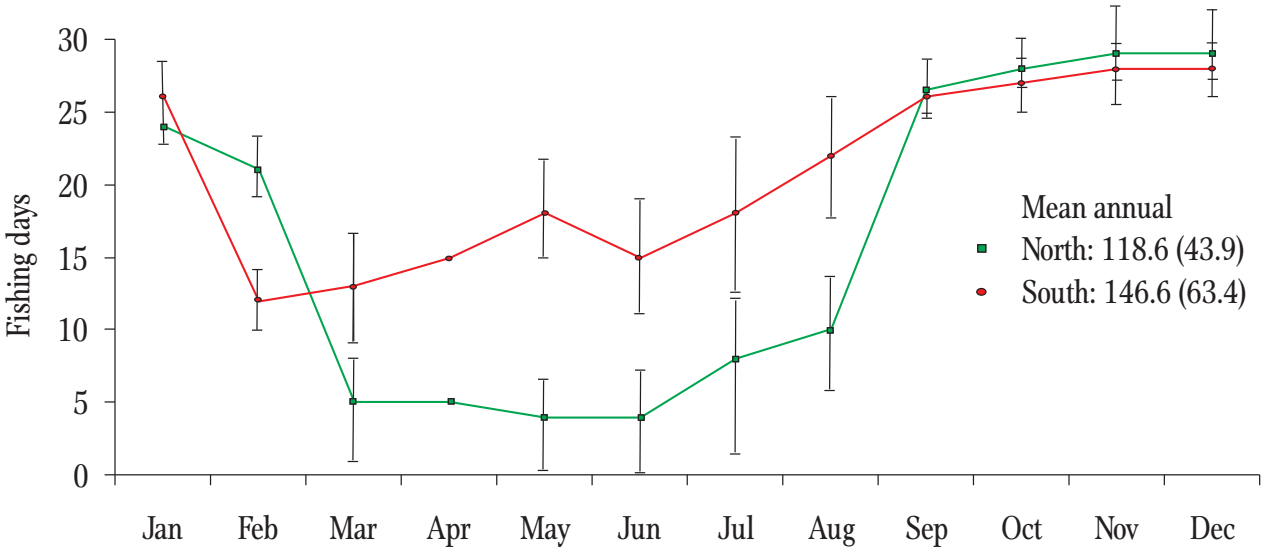


Figure 2. Mean annual and monthly fishing days per area of lagoon fisheries in southern and northern Albanian waters.

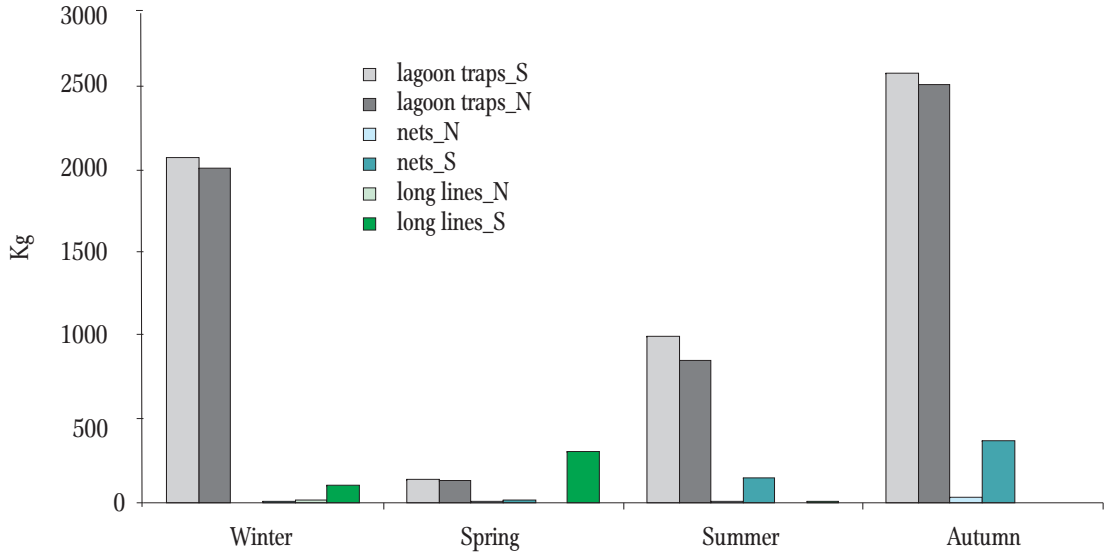


Figure 3. Seasonal contributions (kg) of the different gears used in Albanian lagoons.

during spring and autumn, whereas in northern Albania waters lagoon traps contributed significantly to catches throughout the fishing season (Table 2). Nets and longlines also contributed the most to the catches per fisher in both areas studied, whereas longlines and lagoon traps were used only in the southern and northern lagoons, respectively (Fig. 3). Target species composition differed by season and was mostly represented by *Sparus aurata* L., *Dicentrarchus labrax* (L.), *Anguilla anguilla* (L.), and *Mullus sp.* (Table 3). Regarding the economic cost of fishing the vast majority of fishers from the south (93.3%) stated that they earned a daily wage, while the same was true for a smaller percentage in northern Albania (42.9%).

**Table 3**
Target species caught and the percentages of contributions to total catches in Albanian lagoons

| Species | Winter | Spring | Summer | Autumn |
|---|---|---|---|---|
| *Anguilla anguilla* <50% | 27.9 | 23.3 | 18.2 | 42.4 |
| *Anguilla anguilla* >50% | 0 | 0 | 0 | 3 |
| *Carcinus* sp. 30% | 0 | 4.7 | 0 | 0 |
| *Merluccius* sp. <10% | 9.3 | 0 | 12.1 | 0 |
| *Mullus* sp. <50% | 20.9 | 16.3 | 54.5 | 24.2 |
| *Mullus* sp. >50% | 9.3 | 4.7 | 0 | 0 |
| *Dicentrarchus labrax* <10% | 14 | 11.6 | 0 | 6.1 |
| *Dicentrarchus labrax* 10–20% | 2.3 | 7.0 | 0.0 | 0.0 |
| *Sparus aurata* <10% | 16.3 | 14.0 | 6.1 | 6.1 |
| *Sparus aurata* 10–20% | 0.0 | 0.0 | 3.0 | 0.0 |
| *Penaeus* sp.<10% | 0.0 | 7.0 | 6.1 | 6.1 |
| *Solea* sp. <10% | 0 | 9.3 | 0.0 | 0.0 |
| *Solea* sp. 10–20% | 0.0 | 0.0 | 0.0 | 12.1 |
| *Atherina boyeri* <10% | 0.0 | 2.3 | 0.0 | 0.0 |

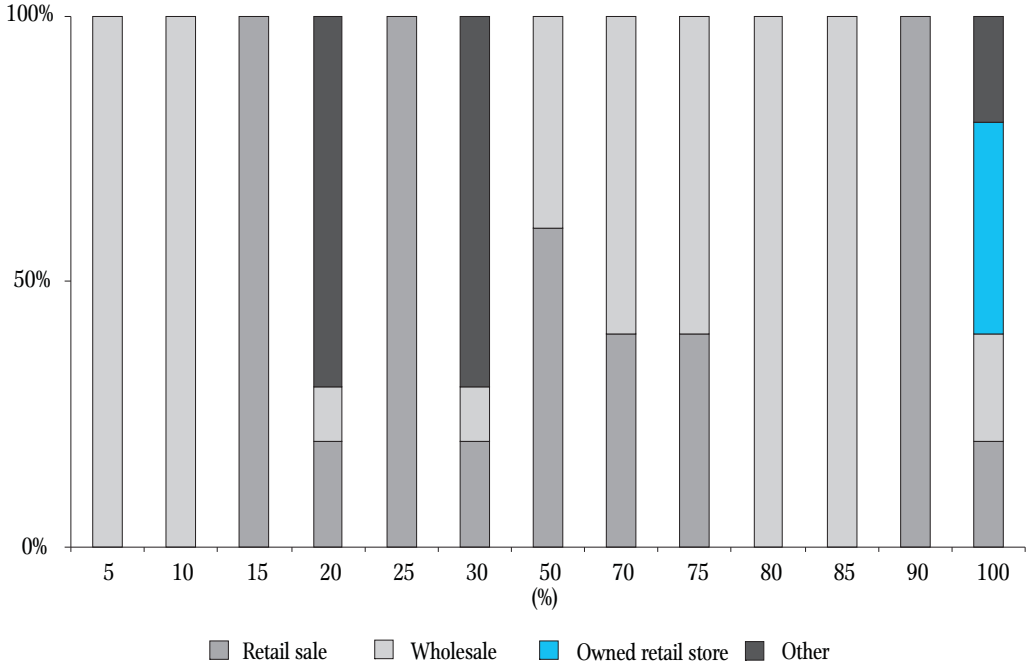

Figure 4. Distribution of the percentage contributions (%) of lagoon landings to markets.

## Views and perceptions

Fishers from both areas sold their catches mainly at retail and wholesale markets (Fig. 4). A higher percentage of fishers from the south considered illegal fishing with unauthorized gear the most critical issue (53.85%), whereas the most important issue for fishers from the north was modernizing fisheries legislation (38.4%) followed by illegal fishery (26.32%; Table 4). Although according to fishers the problem of illegal fishery was more pronounced in the north than in the south (20.7 vs 10.8%, respectively), the

**Table 4**
Most basic issues (ranked from 1 to 5) facing fisheries in both areas

| Issues | North | South |
|---|---|---|
| Blue crab | 10.67 | 0.00 |
| Climate change | 8.00 | 0.00 |
| Fishing without size criteria | 2.67 | 8.33 |
| Illegal fishing | 33.33 | 33.33 |
| Not organized OMP | 4.00 | 11.11 |
| Oil price | 2.67 | 0.00 |
| Price competition | 1.33 | 0.00 |
| Stock reduction | 2.67 | 2.78 |
| Theft of nets | 10.67 | 33.33 |
| Problems with the opening of the estuary | 4.00 | 11.11 |
| Unfair competition | 2.67 | 0.00 |
| Water pollution | 17.33 | 0.00 |
| Intensification of patrolling | | |
| No | 74.07 | 26.67 |
| Yes | 25.93 | 73.33 |

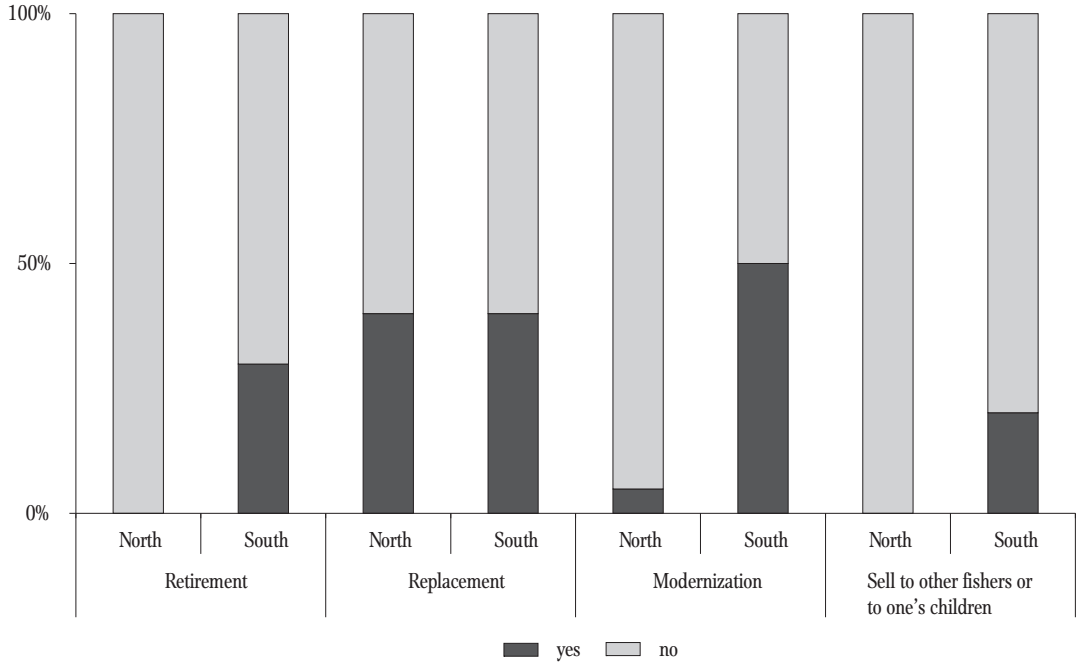


Figure 5. Frequency (%) of lagoon fishers' perceptions of future intentions in the coming years.

majority of fishers from both areas considered intensified patrolling (74.07% and 73.7%) to be an important solution to illegal fishery (Table 4). Other less significant problems faced by the lagoon fishers were the timing of the beginning of the fishing season in the lagoons, water pollution (in northern Albanian waters), and fishing without fish size criteria (in southern Albanian waters). The majority of commercial fishers from both areas studied considered areas (> 88%) stated that during the coming years they did not plan to retire from the fishing sector, and they did not intend to replace, modernize, or sell their vessels (Fig. 5).

None of the fishers from the south believed that new protected areas should be established and fewer than 40% of the fishers in the north did so, with 80% recommending coastal zones as new protected areas. The most important problem of the lagoon fishery faced in both areas was illegal fishing (33.3% in both areas). In the south, fishers declared that there are problems with the theft of nets (33.3%) and with the opening of the estuary (11.1%), while fishers from the north declared that there are problems with water pollution (17.3%) and *Callinectes sapidus* (10.6%). The vast majority of the respondents from the north do not want intensified patrolling (74%), in contrast with those from the south who declared the opposite (73%).

## Discussion

Lagoons are an important part of coastal ecology and the cultural heritage of local communities as well as important economic drivers (Pérez-Ruzafa et al. 2007). In the present study, fisher knowledge was used to outline the basic socio-economic framework of Albanian lagoon fisheries based on on-the-spot interviews conducted with fishers operating in the most important lagoons. A large percentage of the fishers started fishing during the decade of 2010–2019, all of them had licensed fishing vessels, and many of them (almost 85%) did not have relatives as crew members. Albanian lagoon fisheries exhibited spatial differences between vessels from the north and the south; those of the former were older and larger in size, with more powerful engines, and had larger crews, mostly family members, in comparison with those of the latter. The spatial difference of the fleet structure was also reflected in differences in the costs of fishing between northern and southern Albanian coastal waters. The costs of fishing vessel maintenance, purchasing fuel, and maintaining fishing gears were all higher in northern Albania than in the south. Increased fishing expenditures compounded by decreasing fish stocks directly influenced fishers' incomes.

An aggravating factor of Albanian lagoon fisheries is the gradual ageing (mostly represented by fishers older than 50) of the fisher population, which has also been observed in other Mediterranean coastal areas (Spain: Villasante et al. 2019, Croatia: Matić-Skoko and Stagličić 2020, Greece: Tzanatos et al. 2020, Turkey: Birkan and Öndes 2020). Coastal fishery has not been linked to the recruitment of young fishers, because of decreased incomes from fishing stemming from declining catches (INSTAT 2020), and, thus, they are reluctant to take up commercial fisheries, which explains the chronic shortage of young people in the European fishing industry (Eurofish Magazine 2018). Another important issue is that Mediterranean coastal fishery is not gender balanced, but male dominant (Greece: Tzanatos et al. 2020, Italy: Battaglia et al. 2010, Spain: Frangoudes et al. 2008, Villasante et al. 2019, Turkey: Birkan and Öndes 2020). Social norms in certain fisheries place the responsibility for generating income on men, while women engage in household duties (Biswas 2018), although women do play crucial roles in many lagoons often through unpaid labor (Kraak 2020, Theodorou et al. 2022). That subsequent generations are abandoning commercial fisheries could also reflect the lack of a long-term strategy in the fisheries sector that poses risks to the future of the coastal fisheries of countries such as Albanian. The uncertain future of fisheries is also aggravated by the small number of fishers who are fully dependent on fisheries, especially when other professions (e.g., agriculture) are more profitable. This fact is also justified by the high percentage of fishers (82.1%) who were uninformed about the status of the fisheries; this enhanced the lack of stakeholder participation in decision-making policies and the reluctance of fishers to participate in subsidy programs (Gonzalvo et al. 2015). In this context, it is worth pointing out that coastal fishers are also facing economic hardship provoked by market disruptions and a slump in tourism as a result of the COVID-19 pandemic (Bennett et al. 2020).

Spatial differences were also exhibited in the seasonal frequency of activity between the two areas studied. Lagoon fisheries in northern Albanian

waters exhibited peak activity from September to January, whereas this was not evident in the south. Nets and longlines were used commonly with each different gear types, which had a wide range of different technical features (i.e., mesh sizes, materials, dimensions, trap shapes, etc.) and were adapted to the heterogeneity of the life history traits of the target species (Stergiou et al. 2006) and local environmental patterns (Katselis et al. 2013). Fisher statements revealed that the species composition of Albanian lagoon fisheries is seasonally diverse with numerous species caught, and it varied with the fishing activity performed with different fishing gears. This pattern is also evident for small-scale fisheries in other Mediterranean lagoons (Cataudella et al. 2015).

Albanian lagoon fishers were more active in winter when they targeted mostly species from the families of Sparidae, Mugilidae, Moronidae, Anguillidae, and Portunidae, which are also present in more than 75% of Mediterranean lagoons (Pérez-Ruzafa et al. 2007, 2011). The minimum catch from lagoon traps was 50 kg, and it could reach up to 2 tons with discard quantities ranging from 20 to 40% of the total catch. Discards were a major problem in Albanian lagoon fisheries, and undersized catches of commercial fish was the main reason for the discards. Given that lagoons are nursery grounds for many marine species (Franco et al. 2010), undersized specimens are a significant percentage of their production and are a particularly complex issue in lagoon fisheries management (Kapetsky 1984). Another problem faced by fishers was the high abundance of the alien blue crab species *C. sapidus*, which first appeared in Albania in Patok Lagoon in 2006 (Beqiraj and Kashta 2010). The blue crab is characterized as a particularly aggressive species, and it is included among the Mediterranean's 100 „worst invasive species" since it has a negative effect on biodiversity and human activities (Streftaris and Zenetos 2006). High by-catches of *C. sapidus* negatively affected Albanian lagoon fisheries because of net destruction. This concurs with other Mediterranean areas, where this species reaches high abundances and exerts considerable negative effects in local fishing grounds (Ionian and Aegean Seas: Mancinelli et al. 2017). The blue crab also threatens lagoon ecosystems, which are rich in biodiversity and provide many services to humans (Barberá et al. 2019). In the Mediterranean basin, management plans to commercially exploit the species have been implemented; however, emergency research should focus on its negative impact on autochthonous biodiversity (Guijarro-García et al. 2019). The present study could be the starting point for a thorough assessment of the impacts caused by this alien species by setting guiding conservation priorities to safeguard Albanian coastal fisheries and fish biodiversity.

The results of the current study indicated reductions in the catches of most of the species caught in the lagoons. Despite the fact that lagoon species are vulnerable to overexploitation (Rivera-Velazquez et al. 2009, Garbin et al. 2014), there are no clear effects of overfishing on coastal lagoon populations or catch composition. Reductions are related more to changes in habitats or fishing regulations, markets, and environmental conditions in the lagoons than to fishing pressure (Pérez-Ruzafa and Marcos 2012). Fishers (100%) answered that they had not noted catching *S. aurata* individuals that originated from fish cages; in contrast, there was an increase (by about 80%) in sea bream landings from fish trap fisheries in the Mesolongi-Etoliko lagoon, which was probably influenced by the aquaculture activities in that area (Dimitriou et al. 2007).

A critical problem, mostly encountered in Albanian lagoon fisheries, is the intensity of illegal fisheries conducted by other commercial and unlicensed fishers, which can be attributed mostly to insufficient patrolling. Developing monitoring systems for ecosystem services (Zaucha et al. 2016) might trigger commercial fishers to establishing self-control measures (Agnew et al. 2009) by contributing their professional knowledge and experience to formulate effective management measures and in acting as guardians of traditional fisheries. Most of the fishers who participated in the survey were aware of existing protected areas in the lagoons, but contradictions existed about the need for establishing new protected areas (including Marine Protected Areas (MPAs)) in the north and south Albanian lagoons. None of the fishers from the southern lagoon believed that new

protected areas should be established, whereas only 30% of the fishers in the northern lagoon did so. The only MPA with the status of second level protection according to the IUCN is the National Marine Park of Karaburun-Sazani, which is located in the waters of the Vlora region in southern Albania. The lagoon fishers were paid for catching the species analyzed in this study. These species command high prices at market, but poachers also fish the lagoons.

## Conclusions

The current study highlights the need for trustworthy fisheries data to monitor the highly complex nature of Albanian lagoons, and it pinpoints the need for reliable fisheries data and the establishment of decent stratified statistical surveys (Moutopoulos et al. 2017). Recognizing the data limitations of the present study, it is important to note the lack of truly spatial coverage in more lagoons and the difficulty of generalizing the findings to the national level. Despite these weaknesses, this study sheds light on important issues in Albanian lagoons: gear alteration; the target and incidental species caught; problems lagoon fishers encounter continuously. Cooperation between stakeholders and experts in designing an efficient monitoring system will improve the quality of lagoon fisheries data. The new EU policy enhances the role of the fisher by bringing their expertise and experience into fisheries management (Stephenson et al. 2016). Commercial fishers can benefit from working with scientists to ensure that accurate information reaches the scientific community and that the spread of new misunderstandings is avoided, but for this to happen, more work must be done.

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