



Preliminary assessment of the impact of Covid-19 Pandemic in the small-scale and recreational fisheries of the Canary Islands

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ABSTRACT

Covid-19 pandemic has affected worldwide in many different ways. Fisheries around the world are not an exception due to the long-term isolation and the non-activities period suffered. To do an evaluation of its impact on the fishing sectors in the Canary Islands, 87 online and phone questionnaires were carried out between July and September 2020, conducting the interviews to artisanal fishermen, fishmongers, recreational charter boats fishermen and tackle shops along the archipelago. Both, the artisanal and recreational fishing sectors have been affected by this pandemic, but in an unequal manner. The drop of the demand of fresh fishing products in the islands markets due to the closure of hotels, restaurants and other services, and the highly significant decreasing in the number of tourists, provoked an estimated income loss for the artisanal fishermen about the 40% on average, but the majority of vessels continued their activities during the pandemic, with very limited effects on direct employment. However, the fishmonger's activity apparently was not affected and increased their monthly income in relation to the previous year. Likewise, the infeasibility of fishing charter companies due to the great reduction in the number of tourists contrasted with the significant increase in the number of recreational fishing licenses immediately after the confinement ended. Even though that fishing tackle shops increased sales by over 60% in relation to the similar period of the year before, only 4.4% of these shops declared not to have had economic losses.

1. Introduction

The COVID-19 generated a global health crisis that has forced governments to take measures to contain the pandemic that meant a restriction or limitation of the movements of people, as well as of the economic activity at various scales and intensities. This is causing a global economic recession not yet adequately dimensioned, which has also been associated with a humanitarian and food crisis [1]. The responses of different governments have been very disparate, and not always more related to face the health crisis than the economic one. Thus, while some countries responded initially with a home confinement of the population to limit the spread of the virus, with greater or less temporal length and severity, in others the normal social activity

continued [2]. In the specific case of Spain, where the population was confined between March 14th and June 21st, 2020, most of the commercial activity was deeply affected by the closure, except for those that were considered essential (e.g., supermarkets, agriculture, livestock, fishing, etc.). The initial closure affected the entire tourism industry, not only in hotels and apartments, but also all businesses related to catering (restaurants, bars, etc.) and leisure (theatres, cinemas, museums, sports facilities, etc.); once this initial confinement phase was completed, tourism and leisure activity has not been fully reactivated with its modulated reopening to the public according to the variations in the intensity of infection that the population has shown in the different regions.

In almost all the countries which restrict the movement of citizens,

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fishing was considered from the beginning an essential activity aimed at guaranteeing the supply of fresh food to the population. However, this did not necessarily imply a solution to the social and economic crisis that directly affected the rest of economic sectors due to the closure. According to the [1], the protection measures taken by governments to contain the spread of the disease, have impacted all the seafood supply chain, from fishing production, to processing, the transport of input supplies and of products to wholesale and retail markets, as well as demand. Fishing activities have decreased in both artisanal and recreational sectors during the pandemic, but the impacts of the crisis have been not equal in both sorts of fisheries, and between the different groups of fishermen. According to Global Fishing Watch, global industrial fishing activity had dropped globally by about 6.5 percent at the end of April 2020, compared with previous years, because of restrictions and closures related to COVID-19 [3]. Nevertheless, in those areas more affected by the pandemic the drop was much severe. In this way, the [4] estimated that Mediterranean and Black Sea fisheries suffered reductions of up to 80% in the number of operating vessels. But, while small-scale/coastal vessels less than 10% still operated, large-scale vessels operated between 40-100% depending on the cases. At the beginning of the pandemic, the immediate response was a general decrease in captures, greater than 75% in most of the Mediterranean countries, with the exception of Turkey, where production continued at pre-crisis levels thanks to a constant demand, encouraged by decreasing prices and dedicated consumer campaigns [4]. In April, some signs of improvement were evident, due to the adaptation of some fisheries to market demand. In contrasts, in those countries where fisheries were also totally closed at the beginning of the confinement, because they were not considered essential activities [5,6], the economic losses were larger due to the underestimation of the role of fish in the food chain [7].

In those places where tourism is the main economic industry, just as is the case of the Canary Islands, a fall in demand of fish took place due to the closure of hotels and restaurants [8], as well as restrictions on exports. In addition, changes in consumer preferences caused a drop in prices [1,4]. Data from the European Market Observatory for Fisheries and Aquaculture indicated a significant price decline in European countries fisheries of 20-70%, particularly in those of the Mediterranean region, with price varying significantly across products and countries. But the oversupply and its consequent price drop seems to be a factor that has increased the demand for locally sourced fish [1].

In the Canary Islands, the artisanal fishing sector is a low intensity economic sector with a decreasing trend, which contributes around 0.04% of GDP in 2018 and supports 0.16% of the active population of the Archipelago (J. Macias, Canaest Consultores, Comm. Pers.). In spite of the importance of fresh fish in the islander diet, there is an inefficient distribution chain of fresh products of high economic value depending on the small-scale fishery, made up of intermediaries, small fish markets, restaurants, and taverns, as well as some large supermarkets that value the local product. However, the market penetration of artisanal fresh fish in the sphere of the large tourist industry of the Canaries traditionally has been very small, which limits its market possibilities. The main reason for this is that the artisanal fleet is unable to guarantee the regular supply of the domestic market, among other reasons due to the overexploitation of islands fishing grounds [9]. The high demand of imported fishing products competes with local ones, which reduce the profit of Canary fishermen due to lack of competitiveness and an effective commercial organization of the artisanal fishing industry. Thus, local artisanal fishing only contributes 1/6 of the total fishery products that enter the Archipelago's markets. However, it should not be forgotten that the vast majority of fish products imported are not destined to satisfy the demand of islands markets, and are immediately re-exported to other national, European and Asian markets, particularly to China [10], acting the main Canarian ports (i.e. Puerto de La Luz and Las Palmas and Santa Cruz de Tenerife) as mere transshipment platforms to Asian markets or to entry to the EU of the catches of fleets from third countries.

In the Canary Islands, social distancing and confinement measures have not resulted in the closure of local fish markets, while trade has been affected by border closures and significant declines in the availability and increases in the cost. These impacts have created further challenges for the sale of fresh fish products, even where demand still exists domestically. In addition, in this context, it is possible to suppose that it could be an opportunity to promote the value of artisanal fleet fishing products, and to temporarily recover loss market niches due to lack of competitiveness. In the same way, this confinement has made impossible for citizens to practice their recreational fishing activity, since it has been considered and regularized as a leisure sport, being totally prohibited. A different case has been that of the fishing charters vessels, which have seen their activity limited during much of the pandemic, but once they reactivated their businesses they remained without the necessary influx of clients to carry out their normal activity, since the majority of their customers have been tourists [11]. So, the aim of this paper is to assess the initial impacts of the COVID-19 pandemic on the Canary Islands local fishing sector (artisanal fisheries and fishmonger), including the recreational tackle shops and charters.

2. Material and methods

The effects evaluation of the Covid-19 pandemic on the small-scale fishery at the Canary Islands was carried out through online and telephone surveys between July and September 2020. The survey was addressed to estimate the economic repercussions caused on the local fishing sector during social confinement, non-essential activities closure, and movement restrictions due to the declaration of Health Alert Status (HAS) by the Government of Spain [12] on March 14th, 2020. The survey was focused on fishermen (artisanal and recreational), fishmongers and recreational tackle shops that were working prior to that date.

An online snowball recruitment-style survey model [13] was used to assess the situation of the fishing sector in the Canary Islands. As already described by [14] for the Ontario fisheries sector, this assessment method is gaining traction with increasing research proving its validity [15,16]. Even so, we agree with [14], that the scope of this type of survey is limited, so we must consider our results as exploratory and preliminary and not make inferences from the results obtained to the entire population of the fishing sector of the Canary Islands. In the same way, an evaluation was carried out to check the evolution of recreational fishing licenses in the archipelago, to see if the current pandemic has had any effect on them. The data were obtained from the General Directorate of Fisheries of the Government of the Canary Islands.

The questionnaire was designed in a brief way with a total of 13 questions for artisanal fisheries, 7 for fishmonger, and 10 and 11 questions for tackle shops and charters, respectively (see [Supplementary Materials](#)). Data from artisanal fishermen come from 9 fishing associations (36% of fishing associations/cooperatives of the Canary Islands), where 91.67% of survey participants were vessel owners, 15 from fishing charters (35.7% of the Canary Islands fishing charters) and 26 from fishmonger from Canarian archipelago.

2.1. Survey design

The survey was composed by 3 thematic blocks, in order to structure and analyse different segments of the local fishing sector and their dependence on each other. The questionnaire was designed following the recommendations of FAO [17].

2.2. Employee analysis

In order to know the impact of the HAS by the pandemic on the local fishing sector, it was mainly sought to analyse whether the closure of non-essential economic activities was caused by unemployment in the fishing sector, through temporary employment regulation (ERTE in

Spanish) or layoff (ERE in Spanish). In addition, it was requested that, in the event of an activity closure, detail the time during the closure was effective. These labour regulations (ERTE or ERE) refer to self-employed workers or company workers too. The responses of this block try to measure the impact of COVID-19 on employment in the local fishing sector.

2.3. Supply/demand relationship

This question block was addressed to detect the impacts of confinement and closing/limitations on hotels and restaurant services have had on fresh fish demand, but also its effects on the relationship between supply from the small-scale fishery and the demand in local fresh fish markets and supermarkets. This block also assesses the effect of HAS on the recreational tackle shops and recreational fishing charters, that were considered as non-essential activities.

2.4. Analysis of the company's activity

The HAS limited the activity of companies related with the fishing word that were considered as non-essential (i.e., fishing charters and tackle shops), and the objective of this block of questions was to obtain information on the economic losses during closure, but also if when they were reopening their sales increased or decreased in relation the same period of 2019, and if prices were modified (up/down). On the other hand, there was also requested if companies that were not closed (i.e., supermarkets) had problems to obtain fresh fish or other fishing products, directly by fishermen or fishmongers, and if this also affected the prices of these products.

2.5. Statistical analysis

In social research, it is common to work with variables or qualitative data, by means of which a group of individuals are classified into two or more mutually exclusive categories. When the intention is to compare two or more groups of subjects with respect to a categorical variable, data are usually submitted as double-entry tables that are called contingency tables.

The surveys contain questions common to the four groups surveyed, so to analyse if there were differences between the answers offered by each one, the Chi-square test of independence was applied. This test evaluates if there exists a relationship between two categorical variables, comparing the frequencies observed in the sample with the expected frequencies if there was no relationship between the two categorical variables. Null (H_0) and alternative (H_1) hypotheses are detailed below:

H_0 : the variables are independent, so there was no relationship between the two categorical variables. Knowing the value of one variable does not help to predict the value of the other variable.

H_1 : the variables are dependent, so there was a relationship between the two categorical variables. Knowing the value of one variable helps to predict the value of the other variable.

The Chi-square test analysis, as well as its corresponding graphic representations, were performed using the *vcd* package [18] developed for the R software [19].

To make inferences about the population, measures of statistical significance were provided to certify that the results found were not attributed to chance. The Pearson residuals measure the departure of each cell from independence, and they were calculated as following:

$$r_{ij} = \frac{O_{ij} - E_{ij}}{\sqrt{E_{ij}}}$$

where subscripts i and j represent the rows and columns of the contingency table respectively, O_{ij} is the observed frequency and E_{ij} represents

the value fitted under the model. When data do not fit a model, examination of the Pearson residuals often helps to diagnose where the model has failed.

3. Results

A total of 87 surveys were obtained, of which 27.58% were answered by artisanal fishermen or representatives of artisanal fishermen's associations, 28.74% by fishmonger, 26.44% by tackle shops, and 17.24% by fishing charter.

Figs. 1–5 show the results obtained combining a mosaic plot (to visualize each contingency table) with its corresponding result of the Chi-square test of independence. Each mosaic plot with coloured cases shows where the observed frequencies deviate from the expected frequencies, if the variables were independent. The red cases mean that the observed frequencies were smaller than the expected frequencies, whereas the blue cases mean that the observed frequencies were larger than the expected frequencies.

It can be noted a strong positive association between fishermen and fishmonger respondents and the option "None" for answer, while for tackle shops and charter groups it is the only category with a negative association (Fig. 1). All respondents from the tackle shops and charter groups were forced to cease their activity for different periods; most tackle shops were closed for 1–2 months, while fishing charter went out of business for 2–3 months. In addition, only 30% of the fishermen and 8% of fishmongers stopped working (from mid-March to end-May).

Regarding employment regulation (Fig. 2), the most notable results were those referring to ERTE; fishing charters embraced the ERTE as the main measure of employment regulation (60%), following by recreational tackle shops (52.2%) while this was the option least adopted by artisanal fishermen and fishmongers.

Fishmongers have not observed noticeable economic losses during the confinement when compared with a similar period in previous years or in previous months, declaring most respondents an increase in their income (Figs. 3–4). About 93% of fishing charters declared having suffered economic losses over 50%, however when they were asked if they had suffered changes in their income, 67% of respondents refused to answer (Figs. 3–4). The 70% of recreational tackle shops respondents reported losses over more than 25%, while 54% of artisanal fishermen reported economic losses greater than 50% (Fig. 3). The differences between the frequencies observed versus those expected in the N/A option regarding economic losses were because only members of fishermen's group declined to answer this question (Fig. 3). Regarding changes in income, more than 80% of artisanal fishermen such as

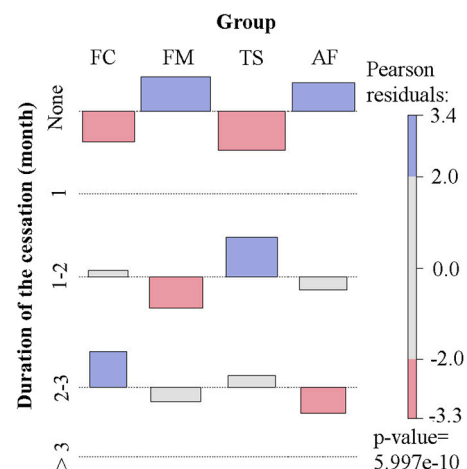


Fig. 1. Duration of closure activity. (FC, fishing charter; FM, fishmongers; TS, tackle Shops; AF, artisanal fishermen). (For interpretation of the references to colour in this figure, the reader is referred to the web version of this article.)

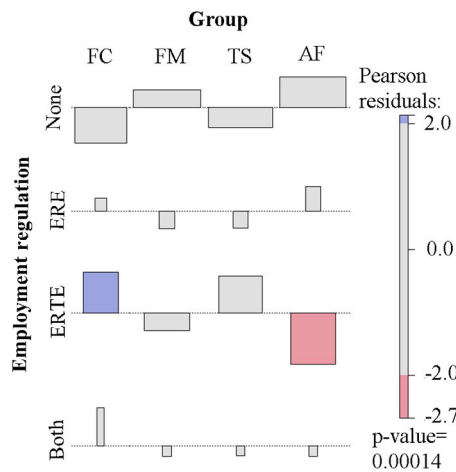


Fig. 2. Employment regulation measures adopted during the HAS. (FC, fishing charter; FM, fishmongers; TS, tackle Shops; AF, artisanal fishermen). (For interpretation of the references to colour in this figure, the reader is referred to the web version of this article.)

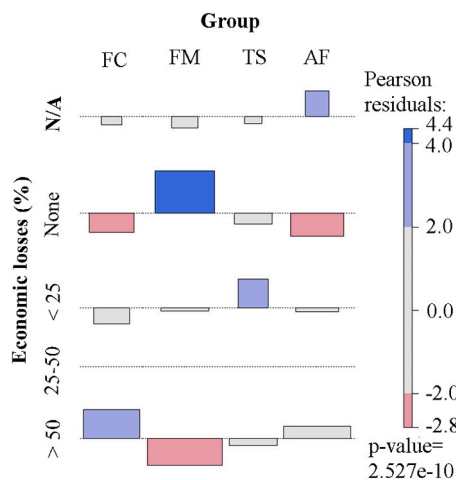


Fig. 3. Estimate of economic losses compared to a previous period. (FC, fishing charter; FM, fishmongers; TS, tackle Shops; AF, artisanal fishermen). (For interpretation of the references to colour in this figure, the reader is referred to the web version of this article.)

recreational tackle shops surveyed indicated that these declined compared to a similar period prior to HAS (Fig. 4).

Relative to changes in prices, the strong positive association observed between this variable and artisanal fisherman (Fig. 5) was because it was the only group where some respondents declined to answer, although the most common response from fishermen was that there was a drop in prices. In the rest of the groups, the responses were more distributed, and the proportion of each option was more similar between groups, as shown in the contingency table (Fig. 5). In this case, most of the respondents (79%) indicated that there was no variation in prices.

Overall, considering the *p*-values obtained (Figs. 1–5), we can conclude that chosen variables turned out to be dependent: duration of cessation activity, employment regulation, economic losses, changes in prices and income changes depends on the respondent groups.

About 74% of fishmongers also declared that their marketing lines were altered because of the impact that HAS had on fish distributors. Most fishermen have not reported differences in their captures per unit of effort in relation to a similar period of the year before; however, the 90% of respondents indicated that their captures were reduced.

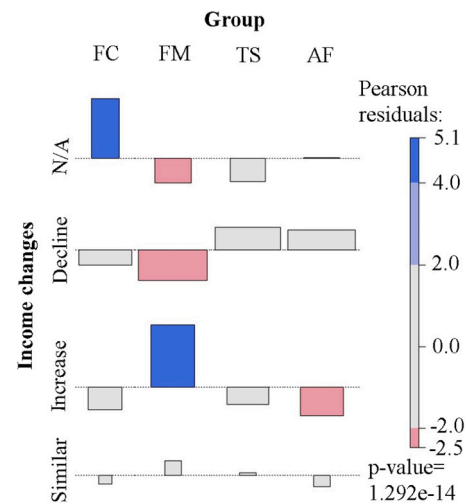


Fig. 4. Estimate of income changes compared to a previous period. (FC, fishing charter; FM, fishmongers; TS, tackle Shops; AF, artisanal fishermen). (For interpretation of the references to colour in this figure, the reader is referred to the web version of this article.)

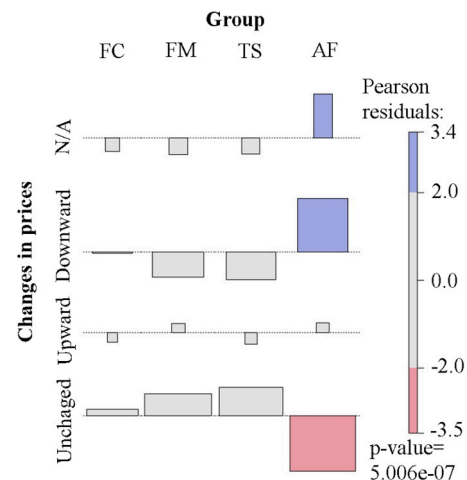


Fig. 5. Changes in prices to adapt them to the new demand situation. (FC, fishing charter; FM, fishmongers; TS, tackle Shops; AF, artisanal fishermen). (For interpretation of the references to colour in this figure, the reader is referred to the web version of this article.)

Fishermen reduced the selling price of fresh fish in about 0.50€/Kg from January 2020 to April 2020, and in about 1.00 €/Kg from January 2020 to December 2020 (reduced by 14.6% on average from January to September 2020). Restaurants, bars, and retailing represent the 64.9% of the recipients of fresh fish from the small-scale fishery, while the other 35.1% was commercialized through fishmongers and supermarkets. Although the second ones were considered as essentials during HAS, particularly the commercialization and supply of middle-sized pelagic fish, as chub mackerel (*Scomber colias*), was more affected due not only the reduction of the demand, but because the high volumes of captures that normally were distributed and sell in markets of different islands, that was more difficult for limitations imposed during HAS to movements and transport.

The number of weekly charter fishing trips decreased according to 73.3% of the surveyed staff, although 60% also stated that catch yields per fishing day had not been affected during the confinement, maintaining this trend after the end of the HAS. After that, the recreational tackle shops were reopened and 82.6% of traders reported that their sales increased considerably, mainly in equipment to perform shore

angling (69.6%). Among the products most demanded by anglers were reels, nylon, buoys, hooks, and other fishing tools, followed by spearguns, masks and fins used by spearfishermen.

To assess the impact of the pandemic on recreational fishing, the number of licenses granted has also been considered; since these licenses are valid for three years in the Canary Islands, the analyses cover the 2018–2020 period. The total number of active licenses at the end of 2020 was 104,828 and throughout that year, 39,620 recreational fishing licenses have been granted, being, in proportion, 8% and 6% higher than 2018 (31,407 licenses) and 2019 (33,801), respectively (Fig. 6). The effects of the pandemic can be clearly seen in the drastic decrease in the number of licenses during the months of March and April, coinciding with the strictest part of the isolation, obtaining only 39 fishing licenses in April, a practically negligible number compared to the licenses obtained in the same months of years 2018 and 2019. In the same way, an increase was observed during the months between May and July, being June the month with the highest number of registered licenses in the full period (three years), with 7,085, almost the double of those obtained during the same period of the years 2018 and 2019 and coinciding with the end of confinement (Fig. 6).

4. Discussion

To our knowledge, this study contributed to obtaining a perspective on the impact of COVID-19 pandemic on the fishing organization of the Canary Islands. Both, the professional and recreational fishing sectors have been affected by this pandemic, but in an unequal manner. Although, the closure of non-essential activities due to HAS has produced an important decline in the islands economy (the GDP drop in the archipelago has been estimated to be over the 20%; [20]), particularly for its negative effects on the touristic industry. The drop of the demand of imported fishing products in the Canarian market was about 30% in relation to 2019, with falls over the 60% in April and May (Mr. J. Sola, Decoexsa Ltd., Pers. Comm.). This drop of demand also impacted on the local fresh fish markets due to the closure of hotels, restaurants and other services, particularly during the social confinement (14th March–21th May), but also due to the negative effects of the pandemic on the touristic industry of the islands. However, in this context artisanal fishing has shown a greater economic resilience than those fishing activities related with recreational fishing (i.e.: fishing charters).

Thirty percent of the Canarian artisanal fishing vessels stopped their activity during confinement, due to their strong dependence on fresh fish demand from restaurants and other similar establishments.

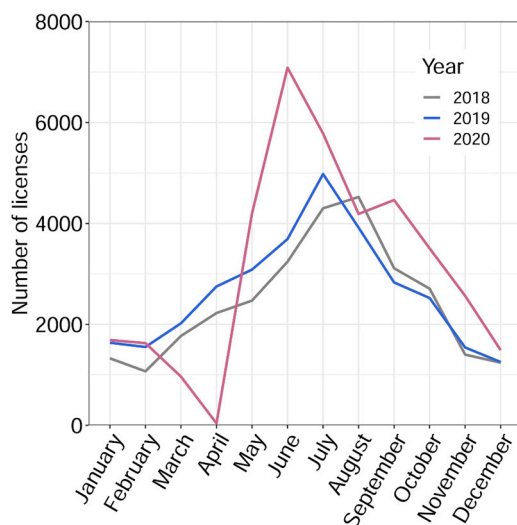


Fig. 6. Monthly evolution of recreational fishing licenses between 2018 and 2020 in the Canary Islands.

According to the opinion of fishermen this provoked an income loss of about the 40% on average during the confinement period, but the majority of vessels continued their activities during the pandemic, with very limited effects on direct employment (the ISM -Marine Social Institute- indicated that, from March to June 2020, only 48 fishermen - 3% - of a total population of 1600, requested the extraordinary benefit of cessation of activity -ERTE). This situation was similar to that described for some Caribbean and Pacific small-scales fisheries of Mexico, where 48% of fishermen stopped fishing during confinement, and 41% that continued working reduced their catches by around 30–80% [21].

Fishmongers' activity has been apparently not affected by the pandemic, even though a minority of companies have had to make temporary closures because their volume of transactions (supply/demand relationship) dropped considerably, making it impossible to keep the service open. This was described by [22] as a pragmatic approach of local-scale vulnerability and for planning appropriate adaptations within the context of multiple interacting exposure to the reduction in demand and dependence to the touristic sector [23]. That is, the multilateral capacity to operate in scenarios with limited capacity [24]. Even so, the majority of local fish markets remained open during confinement, without a significant reduction in the prices of fishing products, but with a part of them (21.7%) using the ERTE as an instrument to reduce the number of workers employed and consequently, the costs. In this context, 72% of fishmongers indicated an increase of their monthly income in relation to the previous year, despite that they needed to change their marketing lines during HAS.

Regardless that price per kilogram of fish of demanded species slightly decreased during the confinement, as occurred in the general context described by [25], and mainly because momentary overproduction due to closure of hotels and restaurants, its effects in the economical balance of the local fresh fish markets of the islands was apparently negligible, despite the 16.4% of fish price decreasing. According to [26], around 68 million euros of net profit were looser in relation to 2019 in the country as a whole, although the most impacted fisheries were those of the Mediterranean and northwest coast of the Iberian Peninsula. In these two last fishing grounds the decreasing in sales was about 40% (between March 14 and the end of May), with losses estimated at 34 million euros and a price drop of about 37%. It is possible that the reported lower price reductions of fresh fishing products of the Canary Islands were probably related to the already limited productivity of small-scale fishing fleets due to overfishing [9], that all captures (except those of tuna species) are consumed by the local population of the islands, and/or the capacity of local markets to quickly adjust their offer to demand, controlling the prices, and passing it cost to fishermen. Price reduction of fishing products during the pandemic has been reported in other countries, where fishermen has reduced their catches by not being able to sell their products due to lack of merchants or storage space [21,27], modifying their market to online sales systems or door-to-door sales [21,28–31].

On the other hand, because of the decree of the Spain Government [12], activities associated with recreational fishing (i.e. tackle shops) were seriously affected during confinement. However, immediately after the confinement ended the number of recreational fishing licenses showed a significant increase (in June 2020 were granted 7.085 fishing licences, almost twice than given in June of 2018 or 2019), so in 2020 the number of active licences were 104,828, more than in the ten previous years. A similar effect was also described by [32] who reported that The Pennsylvania Fish and Boat Commission sold 150,000 fishing licences more than the previous year, due to the boom in the population to engage in outdoor activities. In this way, immediately after the confinement ended (June–August) occurred an important increase of demand for reels, nylon, buoys, hooks, and other fishing tools, followed by spearguns, masks and fins used by spearfishermen. However, and despite that fishing tackle shops increased sales by over 60% in relation to the similar period of the year before, only 4.4% of these shops declared not to have had economic losses. Similar economic losses also

has been reported in other areas, where post-confinement measures (cancellation of fishing tournaments, prohibition of operating fishing charters, or prohibition of fishing or temporary suspension of the licenses sales for non-residents) affected negatively in the recreational companies [33]. Nevertheless, the post-confinement increase in selling of tackle shops seems to be a worldwide effect of the pandemic, and international companies, such as "Angling Direct" (United Kingdom), that closed its 36 physical shops in the UK during HAS, has increased its online sales by 27% (reaching profits up to 59.16 million euros) in relation to the year 2019 [34].

Probably, the significant increase in the number of recreational fishing licences in the Canaries were influenced not only by the possibility to carry out this outdoors activity, but to obtain fresh and quality food in a simple way. A similar effect was observed after the financial crisis of 2008, when unemployment in the archipelago was over 250.000 people [35], and the number of active fishing licences was close to 100.000, because many people used fishing as a source of food and/or incomes. Another face of the pandemic in the recreational fishing sector was the fishing charter companies, whose reduction of tourists has made keeping the vessels operating normally economically unfeasible.

As a conclusion, we must recognize the limitations of online snowball-style surveys [36], so the data obtained refers to our sample population, without intending to extrapolate to the entire fishing sector of the Canary Islands. Therefore, the information obtained in this study is shown as exploratory in order to know and identify the experiences, perspectives and consequences generated by the HAS. Even without extrapolating these results for the entire fishing sector, this assessment is useful to understand the effects of this pandemic and provide preliminary results to administrations or organizations that assess the consequences and generate opportunities after COVID-19 pandemic. In general terms, all the fisheries sectors related with fishing (artisanal or recreational) in the Canary Islands had been affected in some way by the COVID-19 Pandemic, but in different intensity, according to their consideration as essential services during HAS or its dependence on the touristic industry in the archipelago.

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CRedit authorship contribution statement

AGM: Conceptualization, Methodology, Interviews, Data curation, Writing – review & editing. **LCM:** Conceptualization, Methodology, Data curation, Software and Writing. **DJA:** Conceptualization, Methodology, Interviews, Data curation and Writing. **AER:** Interviews, Data curation and Writing. **RNG:** Interviews, Data curation and Writing. **ASL:** Data curation, Software and Writing. **ASP:** Data curation. **JJC:** Conceptualization, Supervision, Writing – review & editing.

Declarations of interest

None.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.marpol.2021.104712.

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