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## Research article

## Impact of the COVID-19 crisis: Analysis of the fishing and shellfishing sectors performance in Galicia (Spain)

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## ARTICLE INFO

**Keywords:**  
 COVID-19  
 Fishing  
 Shellfishing  
 Galicia  
 Spain

## ABSTRACT

The COVID-19 crisis has had consequences in every area of the Spanish economy. The fisheries and shellfishing sectors in Galicia have been significantly affected due to the measures taken to curb the pandemic. In particular, the closure of the HORECA channel and the confinement of the population have adversely affected the production of fresh fish and shellfish. In this study, a three-stage analysis of the management of the pandemic in Spain has been carried out (confinement, “new normality” and closure of the HORECA channel). The direct and indirect effects of the pandemic have been considered, as well as other factors independent of it, which usually influence production. The results show a decrease in catches, revenue and average price (euros/kg) at first sale of Galician fish and shellfish products over the three study periods, with an incidence level that varies between phases, species, fleet segments and sectors.

## 1. Introduction

The Spanish economy has been strongly affected by the COVID-19 crisis. The impact of coronavirus disease 2019 has gone beyond the health field to the economic and social sphere, given the measures adopted by the central and regional governments to curb the pandemic (Pak et al., 2020). These measures have resulted in the restriction of people movements and the paralysis of a large part of economic activities (López and Rodó, 2020; Royo, 2020). As a result of the temporary cessation of non-essential activities in the Spanish economy, the European Central Bank forecasts negative GDP growth of −11% for this country in 2020 (European Commission, and Directorate-General for Economic and Financial Affairs, 2020).

The adoption of these measures responds to the application of Article 10 of Royal Decree 463/2020 under the provisions of Organic Law 4/1981, which considers health crises as a justified cause for declaring a state of alarm (Henríquez et al., 2020). Thus, in Spain, since March 14, 2020, economic activity was suspended except for those sectors providing security services and performing functions of “supplying the population and the essential services themselves” (Real Decreto 463/2020, 2020). The state of alarm situation lasted for three months, until the risk of expansion of the pandemic was minimized (Codagnone et al., 2020). Its termination was decided by each of the Spanish regions to

which the corresponding competences were transferred. In the case of the region of Galicia, the regional government ordered the termination of the State of Alarm on June 15, 2020 (Orden SND/520/202, 2020).

After a period without restrictions both for the mobility of the population and for the performance of economic activities, the worsening of the health situation due to the COVID-19 led to the declaration of a second state of alarm in Spain. In the case of the Galician region, the activities considered as non-essential suffered a discriminated paralysis from November 7 to December 3, 2020 (Rodríguez-Antón and Alonso-Almeida, 2020).

The Galician fishing and shellfishing sectors were legally considered essential activities by the central government, so they were authorized to maintain their activity without restrictions during the two periods of application of the state of alarm. However, given the reduction in sales, part of the Galician fishing fleet, especially the small-scale segment, decided to limit its activity, while shellfishing activities were practically paralysed in Galicia. It is important to point out that the Galician fishing and shellfishing sectors have great importance in the Galician economy, much more so than in other Spanish coastal regions (Garza-Gil et al., 2017; Piñeiro-Antelo et al., 2019; Surís-Regueiro and Santiago, 2018). In 2016, both industries directly generate 16,559 full-time jobs and €525 million of GVA (Galician Institute of Statistics database (IGE), 2020).

Given the importance of the fishing and shellfishing sectors in

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Galicia, numerous studies have analyzed the problems that have affected this industry. Some of the most relevant issues related to the performance of this sector are poaching (Ballesteros and Rodríguez-Rodríguez, 2019; Ballesteros et al., 2020), oil spills (Caballero-Miguez and Fernández-González, 2015; Domínguez and Loureiro, 2013; Garza-Gil et al., 2006; García Negro et al., 2009; Surís-Regueiro et al., 2007) and conflicts between fishing and other activities (Fernández et al., 2016; Fernández-González et al., 2020; Perez de Oliveira, 2013; Pita and Freire, 2016). However, studies on the consequences of coronavirus disease 2019 are scarce.

The aim of this paper is to analyse the consequences of the economic crisis derived from the COVID-19 in the Galician fishing and shellfishing sectors, establishing three periods of study. These three temporal phases analyzed correspond to the first state of alarm, which involves the confinement of the population and the paralysation of “new normality” without restrictions to any of the Spanish productive sectors (June 16th - November 6th) and, finally, a period of reduced population movement and closure of the HORECA channel in the municipalities with a higher incidence of COVID-19, and limitation of capacity and opening hours in the remaining municipalities (November 7th - December 3rd). Moreover, fishery production is subject to high variability caused by a multiplicity of factors (biological, climatic or institutional) that cannot be ignored in the evaluation of the effects of COVID-19. For this reason, these factors have been included in the analysis. In addition, special consideration will be given to the evolution of the HORECA sector, since it is one of the main distribution channels of the fishing and shellfishing production in Galicia (Rodríguez and Ramudo, 2015; Santiago and Surís-Regueiro, 2018).

## 2. Galician fishing and shellfishing sector

Galicia is one of the main maritime regions in Spain, which is also the most important fish and shellfish producing country in the EU (Claret et al., 2012; Garza-Gil et al., 2017; Vázquez-Rowe et al., 2011). Within the group of European regions that are highly dependent on fishing, Galicia occupies the first position (Salz and Macfadyen, 2007; Surís-Regueiro and Santiago, 2014). The Spanish fishing fleet landed 908,162 tons in 2017, which represented 16.73% of the EU total, and 304,785 tons of the Spanish total landings corresponded to Galicia (European Commission, 2020b).

The Galician fishing fleet is the most important regional fleet in the EU (8.3% of the total European gross tonnage [GT] and 38.7% of the total Spanish GT), and it operates in national, European, international, and some non-EU countries waters (Afundación, 2019). In 2020, according to the fishing vessels registration of the Galician regional Government (Xunta de Galicia, 2020a), the fleet consists of 4313 vessels, with a total capacity of 129,009 GT and 255,682 kW (kW). The classification of the Galician fishing fleet distinguishes three major groups of vessels according to their harvesting zone: small-scale fishing fleet (Spanish waters of the Cantabrian-Northwest fishing ground), offshore fishing fleet (non-Spanish EU waters), and large-scale fishing fleet (international waters and waters of third countries engaged with the EU in fishing agreements) (Ministerio de Agricultura, 2020a). The small-scale fishing fleet is the most numerous with 96% of the vessels. However, it only represents 33% of the total capacity of the Galician fleet in terms of GT. The reason for this is the predominance of small-scale vessels, especially in the minor gears modality (3841 vessels). Other fishing methods used in the small-scale fishing fleet are purse seining (152 vessels), bottom trawling (54 vessels), surface longlining (52 vessels), bottom longlining (20 vessels) and gillnetting (24 vessels), with an estimated number of crew members of 8798 (Xunta de Galicia, 2020a).

The offshore fishing fleet consists of 71 vessels, representing 15.7% of the total tonnage, and it includes 48 bottom longliners and 23 trawlers. This fleet operates, mostly, in the NEAFC Regulatory Area, specifically in the Grand Sole fishing grounds. The estimated total

employment is 861 people. Finally, the large-scale fishing fleet is composed of 99 vessels that accumulate 51.7% of the total GT owing to their large size. This fleet operates in fishing grounds spread around the world, which include the waters of Norway (2 cod trawlers), the NAFO area (15 freezer trawlers), the Southwest Atlantic (Argentina and the Falkland Islands) and Northwest Africa (Morocco, Mauritania, Senegal, Cape Verde and Guinea Bissau) (13 freezer trawlers). There are also 68 surface longliners specialized in catching swordfish and a freezer purse seiner catching tuna, all of them operating both in the Atlantic and in various areas of the Indian and the Pacific Oceans. The large-scale fishing fleet employs an estimated number of crew members of 1058 people (Xunta de Galicia, 2020a).

European hake (*Merluccius merluccius*, Merlucciidae) is by far the main species landed, in terms of value, by the Galician fleet. This fact makes Spain the largest market in the world for this species (Amigo-Dobaño and Garza-Gil, 2011). There exist 65 fish markets located in the different fishing ports of the Galician coast, where first sale of fish and shellfish takes place (Afundación, 2019). Furthermore, the freezing, canning and marketing subsectors complete the fish and seafood production chain in Galicia (Sobrinho Heredia and Oanta, 2019).

## 3. Methodology

### 3.1. Phases description

The study of the evolution of catches and revenue in the Galician fishing and shellfishing sector during the COVID-19 pandemic has been divided into three phases. The first phase (March 14–June 15, 2020) began with the declaration of the first state of alarm (Real Decreto 463/2020, 2020), in which the population is confined and non-essential economic activities are paralysed. Fishing and shellfishing were two of the activities considered essential and, therefore, authorized by the Spanish Central Government to continue their activity (Real Decreto 463/2020, 2020). However, the HORECA sector had to cease its business, blocking one of the most important distribution channels in the sector (EUMOFA, 2020b). This was a damage to the fishing and shellfishing industry, even more serious in the latter case, since the shellfish sector decided to almost completely paralyse its activity because its main commercial channel was not active (Consellería do mar, 2020a).

The second phase (June 16–November 6, 2020) was characterized by an improvement in the epidemiological situation in Spain, allowing the central government to end the state of alarm. In this way, a scenario of “new normality” was established, and all the productive sectors could restart their activity (Orden SND/520/202, 2020; Resolución del DOG n° 115 de 2020/6/13 Diario Oficial de Galicia, 2020). This measure resulted in the reopening of the HORECA channel, allowing the revitalisation of shellfish farming and the improvement of income in the fisheries sector. However, the start of a second wave of the pandemic resulted in the declaration of a new state of alarm on 25 October, which was extended until May 2021 (Real Decreto 926/2020, 2020; Real Decreto 956/2020, 2020). This measure ended the situation of “new normality” that characterized this second phase.

During the third phase (November 7–December 3, 2020), the Galician regional government, using the powers granted by the central government (Real Decreto 926/2020, 2020), adapted the national declaration of the state of alarm to its territory (Decreto 178/2020, 2020; Decreto 179/2020, 2020). The fishing and shellfishing sectors were able to continue their activity because they were considered as key industries for food supply (Orden del DOG n° 223-Bis, 2020). In contrast, the discriminated closure of the HORECA sector was declared and its activity was ceased in 60 municipalities with a high incidence of COVID-19 (the main cities and 53 other municipalities, representing 60% of the Galician population). The stoppage of activity in this sector lasted approximately one month (November 7–December 3, 2020) (Decreto 202/2020, 2020). This second closure of the HORECA channel caused the demand for fish and shellfish to fall once again.

### 3.2. Data

The data used in this study were obtained from the fish and shellfish database of the Galician regional government. This database, *Pesca de Galicia*, publishes daily data on the catches, revenue and average price of first sale of a total of 286 species in the 65 fish markets of Galicia. For this analysis, all the species of fish or shellfish from all the Galician fish markets were selected (Xunta de Galicia, 2020c).

Once the three study phases had been established, between 2015 and 2020, the average volume of the main species landed in all the fish markets of Galicia was determined for the six-year period. Then, the top ten species of fish and shellfish caught between 2015 and 2020 were selected for a comparison between production in 2020 and the average production in 2015–2019. For each phase, catches, revenue and average price of first sale were analyzed for the species in 2020 and for the average 2015–2019. In addition, the variation percentages between the two periods were calculated for each of these magnitudes.

On the other hand, another analysis of the fish and shellfish species in the three phases of the pandemic has been carried out. In this case, according to their average price per kg, the species have been classified by quartiles. Both the time range (2020–2015) and the variables (catches, revenue and average price of first sale) are the same as in the previous analysis described.

## 4. Results

### 4.1. First phase (March 14th – June 15th)

During the first state of alarm, the fish and shellfish landings decreased its volume by 19.49%, its first sale revenue by 26.63% and its first sale average price by 8.87% compared to the average of the period 2015–2019. In view of this situation, the Galician regional government estimated that the economic losses during this phase were: €25 million at first sale level, about €60 million for the lack of activity, and more than €500 million for the whole maritime industry (EUMOFA, 2020a). The economic impact of the pandemic on Galician fishing and shellfishing sectors was not even mitigated by the large drop in the spot price of crude oil, which directly affects the price of marine fuel. Until September 2020, its price was down 30% compared with the same period of 2019 (EUMOFA, 2020b).

In this phase, the HORECA channel was closed, negatively affecting the commercialisation of fish and shellfish species. It is important to point out that the damage was even more severe in the higher value products, which are preferably marketed by this channel. Therefore, the demand for this type of products decreased during those three months. In contrast, the demand for more affordable products, traditionally with a higher percentage of sales for domestic consumption, suffered a smaller decrease (Revista Mar 600, 2020). These products are agglutinated in quartile two and three, while those in the last quartile are of very low quality and are normally not destined for domestic consumption or the HORECA channel, but for industrial uses.

Another consequence of the closure of HORECA was the temporary reduction of activity in the fisheries and shellfish sectors. In order to alleviate the negative consequences of the temporary business slowdown, the central government enabled wage indemnity for producers with a reduction of 75% or more of their revenue. In this first phase, 3266 applications were submitted in Galicia, distributed as follows: Vilagarcía (1422), Vigo (967) and A Coruña (877). Shellfishing sector was the most affected, with 2454 applications, almost tripling the number of requests for fishing sector (Revista Mar 603, 2020).

#### 4.1.1. Fishing sector

Regarding the impact of COVID-19 on fishing, small-scale and offshore fishing fleets have performed worse than large-scale fishing fleet (EUMOFA, 2020b). The explanation for this lies in the fact that small-scale and deep-sea vessels land fresh fish; whereas large-scale

vessels land frozen fish that does not need to be marketed immediately. This characteristic of the large-scale fishing fleet has benefited it since during the first state of alarm in Spain, the production of frozen fish increased by 24% and its revenue by 28% compared to 2019 (Industria Conservera 140, 2020). In the case of small-scale fishing, the activity has been reduced, trying to adapt to the decrease in demand (European Commission, 2020a). As a result, the drop in prices in the ports with small-scale fishing fleets was pronounced (Revista Mar 600, 2020).

The main ten fish species caught by the Galician fleet at this first stage are shown in Table 1. Eight of them decreased both in catch volume and in revenue. The most pronounced declines are those of the Atlantic chub mackerel (*Scomber colias*, Scombridae) and the bogue (*Boops boops*, Sparidae). This can be largely attributed to the biology of these species, which were less abundant this year (Xunta de Galicia, 2020b). The abundance and catches of Atlantic chub mackerel have increased in recent years, but with oscillations (Villamor et al., 2017).

On the contrary, European pilchard (*Sardina pilchardus*, Clupeidae) considerably increased the volume of catches, because the Spanish-Portuguese shared quota rised by 76.9% with respect to 2019 (Resolución de 24 de abril de 2020, 2020; Resolución de 30 de junio de 2020, 2020). This increment was possible by a slight recovery in the European pilchard biomass detected by ICES (ICES (International Council for the Exploration), 2020b). As far as Spain is concerned, this means that it could increase its European pilchard catches to 6400 tons (Ministerio de Agricultura, 2020b).

Another species that also increases its catch volume, although to a lesser extent, is Atlantic mackerel (*Scomber scombrus*, Scombridae). The reason for this is the 71% increase in the fishing quota compared to 2019, as TACs and swaps were increased (European Commission, 2020b). Although in this phase there was a slight increase in the volume of catches in relation to the previous campaign, the heavy increase in catches of this species was postponed until the third phase of this study since, in view of the fall in market prices, shipowners reduced the daily catch limit until the Christmas season (Revista Mar 601, 2020).

#### 4.1.2. Shellfishing sector

The shellfish catches suffered a much greater reduction than the fish catches during confinement. The explanation for this is that the HORECA channel, which had stopped its activity, is the main sales channel for shellfish products. As a result of the severe drop in demand, the prices of shellfishing products fell by 96% in the first month of the state of alarm (Consellería do mar, 2020b). Faced with this scenario, most shellfish producers chose not to continue with their activity and their various associations proposed to the government to declare the obligatory cessation of their activity in order to benefit from government COVID-19 subsidies (Revista Mar 601, 2020).

The low level of shellfish activity meant that prices in the first two quartiles remained constant because supply adjusted to existing demand, which was reduced by the closure of the HORECA channel. However, in the third quartile of shellfish products, the average price per kg increases. This is because this quartile includes species destined for the canning industry whose demand did not decrease. In fact, until June 2020, the production of canned products in Spain increased by 15% and its turnover by 16% compared to 2019 (Industria Conservera 140, 2020). In the case of quartile four, the weak demand for these lower value products did not allow that drop in production were offset by significant price increases.

At this phase, only one of the ten main shellfish species increased in catch volume and revenue (Table 2). This species is the northern shortfin squid (*Illex illecebrosus*, Ommastrephidae), which is currently experiencing high variability in its abundance. The distribution and abundance of cephalopods in Galician waters have been described as strongly influenced by oceanographic phenomena, in particular the upwelling (Rocha et al., 1999). The remaining nine species suffered strong declines with respect to the 2015–2019 period, due to both the paralysis of the

**Table 1**

Catches, revenue and average price (euros/kilogram) of first sale of fish catches in Galicia. First phase (March 14th – June 15th).

		March 14th - June 15th (2020)			March 14th - June 15th (2015–2019)			Variation in catches. Revenue and average price (2015–2019)/2020			
		Catch (Kg)	Revenue (€)	Average price (€/kg)	Average catch (Kg) (2019–2015)	Average revenue (€) (2019–2015)	Average price (€/kg)	Catch	Revenue	Average price (€/kg)	
Most caught species	European hake ( <i>Merluccius merluccius</i> , Merlucciidae)	7,327,046.84	21,899,286.54	2.99	8,221,440.18	30,014,516.57	3.65	-10.88%	-27.04%	-18.13%	
	Atlantic mackerel ( <i>Scomber scombrus</i> , Scombridae)	8,004,830.69	8,297,773.51	1.04	7,344,591.32	7,408,349.57	1.01	8.99%	12.01%	2.77%	
	Blue whiting ( <i>Micromesistius poutassou</i> , Gadidae)	5,954,970.67	3,038,911.18	0.51	6,023,670.76	4,052,181.06	0.67	-1.14%	-25.01%	-24.14%	
	Atlantic horse mackerel ( <i>Trachurus trachurus</i> , Carangidae)	4,233,730.19	4,157,465.66	0.98	5,191,563.14	4,796,489.57	0.92	-18.45%	-13.32%	6.29%	
	Atlantic chub mackerel ( <i>Scomber colias</i> , Scombridae)	615,647.73	374,626.05	0.61	4,283,548.34	2,767,285.53	0.65	-85.63%	-86.46%	-5.81%	
	Bogue ( <i>Boops boops</i> , Sparidae)	777,534.20	349,836.25	0.45	2,461,041.98	1,061,065.67	0.43	-68.41%	-67.03%	4.36%	
	Blackbellied angler ( <i>Lophius budegassa</i> , Lophiidae)	2,061,474.99	7,908,002.53	3.84	2,128,112.78	10,699,588.25	5.03	-3.13%	-26.09%	-23.70%	
	Megrim ( <i>Lepidorhombus whiffiagonis</i> , Scophthalmidae)	1,664,974.67	6,458,852.13	3.88	2,035,911.01	7,675,318.63	3.77	-18.22%	-15.85%	2.90%	
	European pilchard ( <i>Sardina pilchardus</i> , Clupeidae)	1,607,125.99	2,164,391.35	1.35	815,365.40	1,068,164.82	1.31	97.11%	102.63%	2.80%	
	Atlantic pomfret ( <i>Brama brama</i> , Bramidae)	579,678.50	1,355,297.64	2.34	619,441.52	1,508,534.39	2.44	-6.42%	-10.16%	-4.00%	
	Rest of Fish	3,496,048.41	12,340,089.54	3.53	5,228,085.33	17,401,666.33	3.33	-33.13%	-29.09%	6.05%	
	Total Fish	36,323,062.88	68,344,532.38	3.50	44,352,771.75	88,453,160.39	4.25	-18.10%	-22.73%	-17.67%	
	Quartiles	Q1	854,400.82	6,680,099.76	8.63	1,545,207.27	11,474,597.72	10.12	-44.71%	-41.78%	-14.68%
		Q2	12,517,298.14	40,539,378.22	3.08	12,946,425.34	49,616,677.57	3.83	-3.31%	-18.29%	-19.56%
Q3		3,150,670.26	4,775,008.76	1.55	3,352,684.59	6,165,862.53	2.08	-6.03%	-22.56%	-25.53%	
Q4		19,800,693.66	16,350,045.64	0.56	26,508,454.54	21,196,022.57	0.94	-25.30%	-22.86%	-40.29%	

shellfishing sector after the HORECA channel closure and other biophysical factors that explain the differences between species.

The meteorological factor is one of those biophysical factors that regularly and unevenly affect shellfish production. In particular, rainfall causes salinity fluctuations that alters the vital parameters and distribution of bivalve molluscs (Pourmozaffar et al., 2019). The heavy rainfall in the winter of 2020 produced a significant drop of the water salinity level that mainly affected bivalves, especially pullet carpet shell (*Venerupis pullastra*, Veneridae) and common cockle (*Cerastoderma edule*, Cardiidae). For this reason, the mortality rate in the main common cockle bank of Galicia increased to 67% (La Voz de Galicia, 2020a). The razor shell (*Ensis magnus*, Pharidae) and the Japanese carpet shell (*Ruditapes philippinarium*, Veneridae), more resistant to this type of change, decreased their production to a lesser extent.

#### 4.2. Second phase (June 16th - November 6th)

During the “new normality” phase, total fish and shellfish landings fell by 16.15% in volume and 13.99% in first sales revenue with respect to the average for 2015–2019. On the other hand, the average first sale price increased by 2.57%.

The opening of the HORECA channel during this period had a positive effect on the fisheries and shellfish sectors in Galicia. The percentages of variation in the catches and revenue of the higher priced species, included in the first quartiles of fish and shellfish, increased. At the same time, there is a decrease in average prices per kg. This contrasts with the

reduction in catches and revenue in most other quartiles of fish and shellfish products. Even so, the effect of the reopening of the hospitality industry was less than expected as a result of the partial capacity restrictions on catering establishments and the lower level of attendance.

##### 4.2.1. Fishing sector

As previously mentioned, European pilchard catches grew in 2020 owing to the increase in the joint quota with Portugal. Despite the slight increase in catches in this second period, there is a notable drop in turnover and an even greater decrease in the average price per kg. compared to the 2015–2019 period (Table 3). The explanation for this is that the COVID-19 forced to cancel all the saint festivities associated with the highest peak in annual European pilchard consumption (EUMOFA, 2020a).

The most striking data from this period is that of the European anchovy (*Engraulis encrasicolus*, Engraulidae), which triples its capture. This is explained by two main factors. The first one is the biological factor, since its biomass increased by 44% with respect to 2019 (ICES International Council for the Exploration, 2020a). European anchovy has been characterized as a highly variable species in terms of abundance, with a recovered stock after the Bay of Biscay fishery was closed between 2006 and 2010 (Santos et al., 2013). This species has a very irregular catch history in Galicia, and it is only fished in Galician waters in years when its biomass is high. Otherwise, its capture is restricted to Cantabrian waters (Fernández-González et al., 2019). The second one is a market factor. The decline in demand, caused by the closure of the



**Table 2**

Catches, revenue and average price (euros/kilogram) of first sale of shellfish catches in Galicia. First phase (March 14th – June 15th).

		March 14th - June 15th (2020)			March 14th - June 15th (2015–2019)			Variation in catches. Revenue and average price (2015–2019)/2020			
		Catch (Kg)	Revenue (€)	Average price (€/Kg)	Average catch (Kg)	Average revenue (€)	Average price (€/Kg)	Catch	Revenue	Average price (€/Kg)	
Most caught species	Japanese carpet Shell ( <i>Ruditapes philippinarum</i> , Veneridae)	371,956.86	3,383,475.13	9.10	589,408.86	5,244,666.84	8.68	-36.89%	-35.49%	4.79%	
	Common octopus ( <i>Octopus vulgaris</i> , Octopodidae)	277,059.28	1,989,236.87	7.18	397,531.11	2,915,240.47	7.71	-30.31%	-31.76%	-6.85%	
	Common cockle ( <i>Cerastoderma edule</i> , Cardiidae)	103,013.79	821,907.61	7.98	254,288.09	1,409,532.54	5.71	-59.49%	-41.69%	39.66%	
	Northern shortfin squid ( <i>Illex illecebrosus</i> , Ommastrephidae)	240,037.88	761,130.44	3.17	214,884.97	485,861.00	2.41	11.71%	56.66%	31.54%	
	Sea urchin ( <i>Paracentrotus lividus</i> , Parechinidae)	146,116.05	930,469.49	6.37	214,221.91	1,129,396.13	5.37	-31.79%	-17.61%	18.71%	
	Common cuttlefish ( <i>Sepia officinalis</i> , Sepiidae)	170,305.32	1,253,166.22	7.36	189,112.53	1,229,026.97	6.60	-9.94%	1.96%	11.48%	
	Lesser Flying Squid ( <i>Todaropsis eblanae</i> , Ommastrephidae)	80,037.65	235,981.14	2.95	192,316.60	423,786.56	2.39	-58.38%	-44.32%	23.43%	
	Curled octopus ( <i>Eledone cirrhosa</i> , Octopodidae)	82,795.52	197,517.75	2.39	173,962.93	283,516.38	1.86	-52.41%	-30.33%	28.77%	
	Pullet carpet Shell ( <i>Venerupis pullastra</i> , Veneridae)	53,328.45	850,826.44	15.95	162,183.07	2,392,862.17	14.74	-67.12%	-64.44%	8.18%	
	Razor Shell ( <i>Ensis magnus</i> , Pharidae)	75,624.05	485,619.29	6.42	135,896.87	11,09,149.58	8.15	-44.35%	-56.22%	-21.21%	
	Rest of Shellfish	636,161.67	3,564,674.39	10.49	1,014,558.16	7,798,862.14	10.82	-37.30%	-54.29%	-3.08%	
	Total Shellfish	2,236,436.52	14,474,004.77	9.92	3,538,365.09	24,421,900.79	10.14	-36.79%	-40.73%	-2.17%	
	Quartiles	Q1	146,823.70	2,840,478.76	28.02	343,910.63	7,109,093.09	28.34	-57.31%	-60.04%	-1.14%
		Q2	1,251,199.56	9,805,782.69	7.63	1,802,606.53	14,161,024.82	7.62	-30.59%	-30.76%	0.03%
Q3		428,872.23	1,368,803.00	4.08	606,542.91	2,157,057.48	3.53	-29.29%	-36.54%	15.59%	
Q4		409,541.03	458,940.32	1.08	785,305.02	994,725.41	1.06	-47.85%	-53.86%	2.72%	

HORECA channel, resulted in the Cantabrian fishing sector reducing catches to avoid a large drop in the price of the species. While in June 2019 80% of the quota had already been caught, in the same period of 2020 it was reduced to less than 60% (Revista Mar 603, 2020). Since the European anchovy is a species whose migration takes place from the east to the west of the Cantabrian Sea, this meant that the Galician fleet was able to catch more anchovies.

Moreover, the large increase in European anchovy catches in Galicia resulted in a 35% decrease in the average price per kg. at the first sale. Most of the European anchovy production is destined for the canning industry, which requires large specimens. However, the small size of the specimens caught was not valid, in most cases, to supply the national canning industry (Revista Mar 603, 2020). The alternative was to export the surplus catches to Italy and Morocco. But, because of the COVID-19 pandemic, the borders were closed and this was not possible. The increase in the supply on the domestic market brought down the price of this species (EUMOFA, 2020a; La Voz de Galicia, 2020c).

There is another species that shows a relative improvement in the tons caught in the second phase of the pandemic. The increase in Atlantic horse mackerel (*Trachurus trachurus*, Carangidae) catches is due to the approval, by the European Commission, of the increase in fishing quotas for Spain through the quotas retained in 2019. Thus, since August 2020, Spain can fish 7944 tons more Atlantic horse mackerel than those first stipulated for 2020 (Commission implementing regulation (EU) 2020/1155, 2020).

#### 4.2.2. Shellfishing sector

Despite the reopening of the hospitality industry in this period, the performance of the shellfish sector is well below that of previous years, which only improves for two species: Japanese carpet shell and northern shortfin squid (Table 4). This is because Japanese carpet shell is a species resistant to the salinity variation produced by winter rains and northern shortfin squid is a species with high variability in terms of abundance.

Among the species whose records are worsening is the common cockle, whose decrease in production is attributable to three main factors. The first factor is the decrease in quota, which is reduced by 10–7 kg/day for shellfishermen. This decrease is attributable to the low demand for common cockles as a result of the pandemic. Although the largest buyer of this species in 2020 is the canning industry, its purchases are not as plentiful as in previous years, as consumers prefer lower-priced canned foods. The second factor is the closure of the main fish farm for this species because of the high levels of toxin detected. The closure began on September 28, 2020 and continued throughout this second phase (Confraría de Pescadores de Noia, 2020). On the other hand, the effects of the drop in salinity caused by winter rains on common cockle production are prolonged during this phase, as is the case with pullet carpet shell and banded carpet shell, whose production decreases by more than 30%.

The decreasing production of common octopus (*Octopus vulgaris*, Octopodidae) is in line with the general trend of the year and continues throughout the third phase of this analysis. Its causes are still unknown. Among the hypotheses being considered are the variations observed in

**Table 3**

Catches, revenue and average price (euros/kilogram) of first sale of fish catches in Galicia. Second phase (June 16th – November 6th).

		June 16th - November 6th (2020)			June 16th - November 6th (2015–2019)			Variation in catches. Revenue and average price (2015–2019)/2020		
		Catch (Kg)	Revenue (€)	Average price (€/Kg)	Average catch (Kg)	Average revenue (€)	Average price (€/Kg)	Catch	Revenue	Average price (€/Kg)
Most caught species	Atlantic horse mackerel ( <i>Trachurus trachurus</i> , Carangidae)	2,222,3012.79	16,653,392.82	0.75	18,539,810.94	12,861,098.25	0.71	19.87%	29.49%	5.63%
	Atlantic chub mackerel ( <i>Scomber colias</i> , Scombridae)	3,339,184.98	2,033,513.30	0.61	20,351,815.04	8,613,222.28	0.47	-83.59%	-76.39%	29.79%
	European hake ( <i>Merluccius merluccius</i> , Merlucciidae)	9,293,866.69	35,777,738.72	3.85	11,938,106.15	50,394,891.60	4.22	-22.15%	-29.01%	-8.77%
	Blue whiting ( <i>Micromesistius poutassou</i> , Gadidae)	9,299,725.64	5,815,230.38	0.63	8,249,172.53	5,764,834.43	0.72	12.74%	0.87%	-12.50%
	Blackbellied angler ( <i>Lophius budegassa</i> , Lophiidae)	2,749,474.19	14,046,306.51	5.11	2,822,849.78	16,168,480.99	5.73	-2.60%	-13.13%	-10.82%
	Megrim ( <i>Lepidorhombus whiffiagonis</i> , Scophthalmidae)	2,551,287.55	9,570,691.75	3.75	2,748,135.25	11,360,593.93	4.13	-7.16%	-15.76%	-9.20%
	European pilchard ( <i>Sardina pilchardus</i> , Clupeidae)	2,378,604.69	3,651,845.03	1.54	2,326,131.56	4,636,253.89	2.03	2.26%	-21.23%	-24.14%
	European anchovy ( <i>Engraulis encrasicolus</i> , Engraulidae)	6,233,031.35	6,850,973.08	1.10	1,494,005.71	2,307,075.59	1.71	317.20%	196.95%	-35.67%
	Bogue ( <i>Boops boops</i> , Sparidae)	1,082,768.50	388,469.16	0.36	2,096,218.75	758,174.87	0.34	-48.35%	-48.76%	5.88%
	Albacore ( <i>Thunnus alalunga</i> , Scombridae)	1,662,135.40	6,309,446.42	3.80	1,863,844.76	7,521,782.13	4.06	-10.82%	-16.12%	-6.40%
	Rest of Fish	7,548,578.18	25,945,174.00	4.22	8,291,267.96	26,272,221.53	4.52	-8.96%	-1.24%	-6.64%
	Total Fish	68,361,669.96	127,042,781.17	4.09	80,721,358.43	146,658,629.50	4.37	-15.31%	-13.38%	-6.41%
Quartiles	Q1	4,498,743.93	28,815,400.67	10.49	3,673,060.23	26,058,063.05	10.85	22.48%	10.58%	-3.31%
	Q2	15,521,392.83	57,251,387.19	3.42	18,362,196.70	76,620,289.80	3.80	-15.47%	-25.28%	-10.05%
	Q3	4,823,875.38	7,965,713.18	1.74	6,246,847.30	12,376,169.54	2.07	-22.78%	-35.64%	-15.66%
	Q4	43,517,657.82	33,010,280.13	0.80	52,439,254.20	31,604,107.10	0.88	-17.01%	4.45%	-8.92%

oceanographic conditions and water temperature, and the increase in the population of Atlantic mackerel and whiting, natural predators of the common octopus (La Voz de Galicia, 2020e). The same applies to the lesser flying squid (*Todaropsis eblanae*, Ommastrephidae), whose production has decreased throughout the year.

#### 4.3. Third phase (November 7th - December 3rd)

In this phase, total fish and shellfish landings fell by 17.67% in volume and 13.54% in revenue at first sale with respect to the average 2015–2019. In addition, the average price at first sale increased by 5.02%. The effect of the new closure of the HORECA channel in the municipalities with a higher incidence of COVID-19 and the limitation of capacity and opening hours in the remaining municipalities, can be clearly seen in the evolution of the first quartile of fishing pro However, in the case of seafood products, the negative effect of the closure of the hospitality industry is less than in the first phase This is because, unlike the first state of alarm, the shellfishing sector did not stop its activity during this phase. The much shorter scheduled duration of this HORECA closure, just before the Christmas period when revenues are raised at the highest levels of the year, encouraged shellfishermen to maintain activity.

#### 4.3.1. Fishing sector

During this phase, the effect of the Christmas season, which usually leads to an increase in production and turnover in the fishing sector, was not noticeable. Only two of the top 10 fish species raised their catches, in both cases resulting from an increase in quotas. This benefited both the offshore fishing fleet and the small-scale fishing fleet (Table 5). As far as the offshore fishing fleet is concerned, blackbellied angler (*Lophius budegassa*, Lophiidae) is the species that increased its quota due to swaps with France, Belgium and the Netherlands (Council Regulation (EU) 2020/123, 2020; Ministerio de Agricultura, 2020c). However, the new closure of the hospitality industry reduced the demand for this species, leading to a decrease in price and total revenue. As far as the small-scale fishing fleet is concerned, the Atlantic mackerel doubled its landings in this period following a 41% increase in the Spanish quota for this species. In addition, a quota swap with the Netherlands obtained 1700 tons more of Atlantic mackerel for 2020 (Council Regulation (EU) 2020/123, 2020; Resolución de 8 de abril de 2020, 2020). The initial quota was distributed among the Cantabrian-Northwest regions and, subsequently, the swap was assigned among them according to the same distribution criteria.

On the contrary, the great decrease in the captures volume of the Atlantic chub mackerel, with respect to the captures average of the 4 previous years, can be explained by the lower abundance of this species for biological causes, since it is a species with a high variability (Xunta

**Table 4**

Catches, revenue and average price (euros/kilogram) of first sale of shellfish catches in Galicia. Second phase (June 16th – November 6th).

		June 16th - November 6th (2020)			June 16th - November 6th (2015–2019)			Variation in catches. Revenue and average price (2015–2019)/2020		
		Catch (Kg)	Revenue (€)	Average price (€/Kg)	Average catch (Kg)	Average revenue (€)	Average price (€/Kg)	Catch	Revenue	Average price (€/Kg)
Most caught species	Common cockle ( <i>Cerastoderma edule</i> , Cardiidae)	717,386.27	4,964,182.68	6.92	1,287,589.03	8,099,640.57	6.23	-44.28%	-38.71%	11.08%
	Japanese carpet shell ( <i>Ruditapes philippinarum</i> , Veneridae)	1,228,108.92	11,915,155.91	9.70	1,183,394.93	10,065,068.33	8.39	3.78%	18.38%	15.61%
	Common octopus ( <i>Octopus vulgaris</i> , Octopodidae)	185,403.35	1,640,931.63	8.85	874,403.85	6,559,347.68	7.58	-78.80%	-74.98%	16.75%
	Pullet carpet shell ( <i>Venerupis pullastra</i> , Veneridae)	256,879.36	4,547,399.57	17.70	380,590.43	5,198,414.19	13.93	-32.51%	-12.52%	27.06%
	Razor shell ( <i>Ensis magnus</i> , Pharidae)	265,926.15	2,447,935.41	9.21	271,260.16	2,669,099.89	9.81	-1.97%	-8.29%	-6.12%
	Lesser Flying squid ( <i>Todaropsis eblanae</i> , Ommastrephidae)	30,414.65	89,512.17	2.94	252,633.61	538,815.33	2.55	-87.96%	-83.39%	15.29%
	Banded carpet shell ( <i>Venerupis rhomboides</i> , Veneridae)	127,275.15	1,341,544.22	10.54	193,530.50	1,706,862.00	8.95	-34.24%	-21.40%	17.77%
	Northern shortfin squid ( <i>Illex illecebrosus</i> , Ommastrephidae)	175,375.31	580,354.97	3.31	167,826.44	412,248.46	2.62	4.50%	40.78%	26.34%
	Gooseneck barnacle ( <i>Pollicipes pollicipes</i> , Pollicipedidae)	129,869.21	3,913,009.88	30.13	167,442.54	4,127,670.08	24.72	-22.44%	-5.20%	21.89%
	Grooved carpet shell ( <i>Ruditapes decussatus</i> , Veneridae)	110,398.94	2,757,366.17	24.98	148,629.69	4,089,765.58	27.98	-25.72%	-32.58%	-10.72%
Rest of Shellfish	932,230.98	7,597,504.87	9.08	1,043,324.04	7,444,504.05	10.48	-10.65%	2.06%	-13.36%	
Total Shellfish	41,59,268.29	41,794,897.48	9.54	5,970,625.24	50,911,436.16	10.59	-30.34%	-17.91%	-9.92%	
Quartiles	Q1	742,492.00	15,255,185.80	24.31	638,075.69	13,699,519.82	28.80	16.36%	11.36%	-15.57%
	Q2	2,787,796.97	24,871,438.71	9.20	3,815,819.91	32,111,579.90	8.90	-26.94%	-22.55%	3.32%
	Q3	422,299.87	1,475,330.05	4.09	1,041,379.75	4,415,738.85	3.52	-59.45%	-66.59%	16.15%
	Q4	206,679.45	192,942.92	1.03	475,349.89	684,597.58	1.13	-56.52%	-71.82%	-8.28%

de Galicia, 2020b).

#### 4.3.2. Shellfishing sector

As far as the shellfishing sector is concerned, the increase in several species is remarkable, the most notable being the northern shortfin squid (Table 6). In 2020, the production of this species almost doubled compared to the average value of catches in the previous four years (Xunta de Galicia, 2020c). This phenomenon is linked to the strong variations in the annual abundance of this species, since it is a species very sensitive to environmental changes (NOAA Fisheries, 2020).

On the other hand, the increase in the production of queen scallop (*Aequipecten operculares*, Pectinidae) is a consequence of the increase in the permits to exploit this species. This is since the Galician Fisheries Ministry granted temporary permits to king scallop (*Pecten maximus*, Pectinidae) fishers to collect queen scallop, being common the fishing gear for both species. The king scallop is a high-priced seafood, mainly commercialized by the HORECA channel. Therefore, the closure of the catering business in the pandemic seriously affected its demand, increasing its stock by 20% compared to 2019. In order not to saturate the market, the shellfishers chose to stop catching this seafood and focus their activity on a lower-priced bivalve such as the scallop fishers (La Voz de Galicia, 2020b).

The Atlantic spinous spider crab (*Maja brachydactyla*, Majidae) also experienced a significant increase in production and, to a lesser extent, in revenue, given that the price fell by almost 12%. The increase in the volume captured corresponds to a probable increase in its biomass after

the interruption in production during the first state of alarm, which had an effect similar to a fishery closure.

On the contrary, the species with a more pronounced decrease in their captures were the lesser flying squid, the octopus and the cockle. The first two species followed the trend maintained throughout the year, whose possible causes were described in phase two. On the other hand, the cockle continued to be affected by the presence of toxins in Galician waters which, as specified above, forced the closure of the most important cockle extraction banks. This closure was extended until December 30th, 2020 (INTECMAR, 2020). In addition, the heavy autumn rains caused a drop in the level of water salinity that raised the cockle mortality rate (La Voz de Galicia, 2020d). On the other hand, the new closure of the hospitality industry had a negative effect on the demand for this species (EUMOFA, 2020b; FAO, 2020).

## 5. Conclusions

The impact of the COVID-19 on the Galician fishing and shellfishing sectors has been significant in the three periods analyzed. The inter-annual comparison carried out has shown appreciable differences in terms of catches, revenue and average price at first sale. Each one of the phases of study (confinement, new normality and closure of the HORECA channel) presents some differentiating characteristics determining a diverse performance for the fishing and shellfishing sectors. Although in the first two stages the shellfishing sector suffers a greater fall in volume and turnover than the fishing sector, in the third period



Table 5

Catches, revenue and average price (euros/kilogram) of first sale of fish catches in Galicia. Third phase (November 7th – December 3rd).

		November 7th - December 3rd (2020)			November 7th - December 3rd (2015–2019)			Variation in catches. Revenue and average price (2015–2019)/2020			
		Catch (Kg)	Revenue (€)	Average price (€/Kg)	Average catch (Kg)	Average revenue (€)	Average price (€/Kg)	Catch	Revenue	Average price (€/Kg)	
Most caught species	Atlantic horse mackerel ( <i>Trachurus trachurus</i> , Carangidae)	1,856,037.90	1,750,123.17	0.94	2,476,671.78	1,731,671.64	0.70	-25.06%	1.07%	34.67%	
	European hake ( <i>Merluccius merluccius</i> , Merlucciidae)	1,778,813.72	8,277,949.04	4.65	2,330,544.90	10,220,365.34	4.43	-23.67%	-19.01%	4.97%	
	Blue whiting ( <i>Micromesistius poutassou</i> , Gadidae)	1,375,768.74	1,267,373.92	0.92	1,425,022.31	1,227,610.10	0.90	-3.46%	3.24%	2.22%	
	Atlantic chub mackerel ( <i>Scomber colias</i> , Scombridae)	312,583.96	164,247.48	0.53	815,155.03	389,891.47	0.60	-61.65%	-57.87%	-12.25%	
	Blackbellied angler ( <i>Lophius budegassa</i> , Lophiidae)	698,790.85	3,211,886.03	4.60	631,885.76	3,832,369.31	6.09	10.59%	-16.19%	-24.47%	
	Megrim ( <i>Lepidorhombus whiffiagonis</i> , Scophthalmidae)	415,278.25	1,868,825.67	4.50	458,129.59	2,309,716.57	5.07	-9.35%	-19.09%	-11.17%	
	Bogue ( <i>Boops boops</i> , Sparidae)	386,792.54	147,143.64	0.38	404,955.53	127,298.75	0.33	-4.49%	15.59%	15.85%	
	Atlantic pomfret ( <i>Brama brama</i> , Bramidae)	173,140.35	427,781.50	2.47	206,406.83	470,525.97	2.43	-16.12%	-9.08%	1.48%	
	Swordfish ( <i>Xiphias gladius</i> , Xiphiidae)	130,237.00	799,915.72	6.14	175,342.70	1,003,185.62	5.74	-25.72%	-20.26%	7.01%	
	Atlantic mackerel ( <i>Scomber scombrus</i> , Scombridae)	227,421.14	293,366.35	1.29	112,044.95	154,253.41	1.40	102.97%	90.18%	-7.73%	
	Rest of Fish	1,073,363.48	4,068,970.95	6.55	1,249,561.61	4,494,659.27	8.06	-14.10%	-9.47%	-18.77%	
	Total Fish	8,428,227.93	22,277,583.47	6.26	10,285,721.00	25,961,547.45	7.64	-18.06%	-14.19%	-18.03%	
	Quartiles	Q1	301,180.07	2,565,651.64	18.32	1,017,679.13	6,880,188.80	22.90	-70.41%	-62.71%	-20.00%
		Q2	3,199,176.13	14,655,106.80	3.87	3,075,842.59	13,650,005.65	3.99	4.01%	7.36%	-3.15%
Q3		649,199.96	1,343,710.53	2.19	611,544.71	1,422,343.04	2.70	6.16%	-5.53%	-18.84%	
Q4		4,278,671.77	3,713,114.50	0.80	5,580,654.57	4,009,009.97	0.98	-23.33%	-7.38%	-18.46%	

this trend is reversed due to the Christmas season. When the analysis of the COVID-19 impact is focused on the main target species, great differences between them can be noticed. The confluence of direct and indirect effects of the pandemic with other factors explain these variations.

Firstly, we can observe the direct effects of the pandemic in the closure of the hospitality industry, which acted as a brake on the marketing of higher value products, and in the border closures, which meant the interruption of exports and imports of all types of seafood products. Second, there exist indirect effects of the pandemic on the preferences of consumers, who bought more frozen or canned products during the confinement period, and on the fishing and shellfishing sector, that adopted strategies such as changing the target species or delaying the time of capture to deal with the economic effects induced by the pandemic (Aldaco et al., 2020). Finally, other factors, completely independent of the pandemic, are observed throughout the studied time series. These aspects, of a biological, oceanographic and meteorological nature, are superimposed to the pandemic direct and indirect effects and determine the differences observed in the behavior of the diverse species and sectors.

The highest incidence of COVID-19 is observed in the fishing and shellfishing products included in the quartile with the highest average price, which are the most commercialized through the HORECA channel. Therefore, its closure had a strong impact on these products in the first and third phases of the study. On the other hand, the period of new normality meant a partial recovery of the fishing and shellfishing

sectors, but without reaching the same performance of previous years. The fleet segment most affected in the three periods is the small-scale fishing fleet, which captures shellfish (with a higher average price than fish) in much greater proportion than the offshore fishing fleet, which mostly lands fresh fish. On the other hand, the large-scale fishing fleet, which lands exclusively frozen products, has hardly been directly affected by the pandemic.

The COVID-19 pandemic has created an unprecedented situation in all areas of the economy. In the specific case of fishing and shellfishing, which are themselves subject to a high variability because of multiple factors, the pandemic introduces a new distorting element, whose study opens up a wide field of research. This work represents a contribution in this line, circumscribed to a geographical area with a high economic dependence on fishing and shellfishing. At the present time, the pandemic situation persists, and greater economic effects on these activities are foreseeable. Further studies will be needed to update the results obtained in this article.

The results derived from the analysis in this paper provide interesting insights for decision-makers. As demonstrated in this study, there exists a high variability in the results (catch, revenue, average price) for the different sectors and species during the COVID-19 pandemic. This shows the need for differentiated management for each species according to their specific characteristics, since the incidence of the pandemic varies between sectors and species. Decision-makers must be aware of this complexity, which requires flexibility in the measures adopted and rapid response capacity. It is important that decision-makers include

**Table 6**

Catches, revenue and average price (euros/kilogram) of first sale of shellfish catches in Galicia. Third phase (November 7th – December 3rd).

		June 16th - November 6th (2020)			June 16th - November 6th (2015–2019)			Variation in catches. Revenue and average price (2015–2019)/2020		
		Catch (Kg)	Revenue (€)	Average price (€/Kg)	Average catch (Kg)	Average revenue (€)	Average price (€/Kg)	Catch	Revenue	Average price (€/Kg)
Most caught species	Common cockle ( <i>Cerastoderma edule</i> , Cardiidae)	211,327.08	1,239,915.83	5.87	581,603.55	2,829,557.92	4.72	-63.66%	-56.18%	24.47%
	Japanese carpet shell ( <i>Ruditapes philippinarum</i> , Veneridae)	216,899.86	2,107,647.43	9.72	254,831.63	2,143,014.76	8.36	-14.89%	-1.65%	16.27%
	Common octopus ( <i>Octopus vulgaris</i> , Octopodidae)	113,063.54	912,358.14	8.07	224,324.30	1,611,527.80	7.54	-49.60%	-43.39%	7.06%
	Northern shortfin squid ( <i>Illex illecebrosus</i> , Ommastrephidae)	335,707.69	673,718.48	2.01	117,001.49	263,600.15	2.35	186.93%	155.58%	-14.47%
	Atlantic spinous spider crab ( <i>Maja brachydactyla</i> , Majidae)	261,369.07	2,018,402.07	7.72	157,550.49	1,310,817.26	8.76	65.90%	53.98%	-11.87%
	Lesser Flying Squid ( <i>Todaropsis eblanae</i> , Ommastrephidae)	16,556.75	33,657.43	2.03	132,220.42	253,974.87	2.20	-87.48%	-86.75%	-7.73%
	Pullet carpet shell ( <i>Venerupis pullastra</i> , Veneridae)	74,529.94	1,317,597.29	17.68	99,867.05	1,520,456.95	15.45	-25.37%	-13.34%	14.45%
	Sea urchin ( <i>Paracentrotus lividus</i> , Parechinidae)	90,678.70	720,456.05	7.95	77,119.41	508,175.73	7.13	17.58%	41.77%	11.56%
	Queen scallop ( <i>Aequipecten opercularis</i> , Pectinidae)	93,393.45	271,860.92	2.91	58,437.22	188,873.69	3.37	59.82%	43.94%	-13.65%
	Banded carpet shell ( <i>Venerupis rhomboides</i> , Veneridae)	33,884.80	364,621.90	10.76	56,523.25	499,234.31	9.74	-40.05%	-26.96%	10.43%
	Rest of Shellfish	291,711.56	2,889,745.35	10.99	304,889.35	3,189,668.36	12.53	-4.32%	-9.40%	-12.34%
	Total Shellfish	1,739,122.44	12,549,980.89	10.39	2,064,368.16	14,318,901.81	11.51	-15.76%	-12.35%	-9.70%
	Quartiles	Q1	183,244.79	3,513,113.70	27.60	161,655.62	3,249,000.73	31.12	13.36%	8.13%
Q2		786,707.57	6,613,656.98	8.44	778,001.52	6,539,335.63	8.81	1.12%	1.14%	-4.24%
Q3		378,024.44	1,661,308.11	4.35	800,587.51	3,904,228.92	4.54	-52.78%	-57.45%	-4.34%
Q4		391,145.64	761,902.10	1.27	324,123.51	626,336.54	1.55	20.68%	21.64%	-18.09%

stakeholders in the process of management, decision-making and design of the institutional framework applied to natural resources. The constant need to collect information of various kinds makes it essential to ensure a fluid and uninterrupted collaboration.

#### Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

#### Acknowledgments

The authors would like to thank Juan Carlos López Rodríguez for his contributions to this article. This study was possible thanks to the financial support from Xunta de Galicia (ED431C2018/48 and ED431E2018/07) and from the Ministry of Economy and Competitiveness (RTI2018-099225-B-100). Also, Raquel Fernández-González thanks for financial support of the Postdoctoral Program Xunta de Galicia under grant ED481B2018/095 and Raisa Pérez-Vas gratefully acknowledges funding under grant ED481A-2018/341 from the Programa Predoctoral Xunta de Galicia.

#### References

- Afundación (Ed.), 2019. *A Economía Galega. Informe 2018, first ed.*, Afundación Obra Social ABANCA, Santiago de Compostela.
- Aldaco, R., Hoehn, D., Laso, J., Margallo, M., Ruiz-Salmón, J., Cristobal, J., Kahhat, R., Villanueva-Rey, P., Bala, A., Batlle-Bayer, L., Fullana-i-Palmer, P., Irabien, A., Vazquez-Rowe, I., 2020. Food waste management during the COVID-19 outbreak: a holistic climate, economic and nutritional approach. *Sci. Total Environ.* 742, 140524.
- Amigo-Dobaño, L., Garza-Gil, M.D., 2011. Analysis of the *Merluccius merluccius* market chain. Estimated results for production in Galicia. *Int. Bus. Econ. Res. J.* 2, 1–8.
- Ballesteros, H.M., Rodríguez-Rodríguez, G., 2019. Economic crisis and poaching: advice on anti-poaching management from the Galician shellfish sector. *Deviant Behav.* 40, 1508–1521. <https://doi.org/10.1080/01639625.2018.1525804>.
- Ballesteros, H.M., Rodríguez-Rodríguez, G., Ferreiro-Seoane, F.J., Martínez-Cabrera, H., 2020. The fewer insider poachers, the more normative compliance: clues for managing poaching in the shellfish sector. *Deviant Behav.* 1–15. <https://doi.org/10.1080/01639625.2020.1854635>.
- Caballero-Miguez, G., Fernández-González, R., 2015. Institutional analysis, allocation of liabilities and third-party enforcement via courts: the case of the prestige oil spill. *Mar. Policy* 55, 90–101. <https://doi.org/10.1016/j.marpol.2015.01.003>.
- Claret, A., Guerrero, L., Aguirre, E., Rincón, L., Hernández, M.D., Martínez, I., Benito Peleteiro, J., Grau, A., Rodríguez-Rodríguez, C., 2012. Consumer preferences for sea fish using conjoint analysis: exploratory study of the importance of country of origin, obtaining method, storage conditions and purchasing price. *Food Qual. Prefer.* 26, 259–266. <https://doi.org/10.1016/j.foodqual.2012.05.006>.
- Codagnone, C., Bogliacino, F., Gómez, C., Charris, R., Montealegre, F., Liva, G., Lupiáñez-Villanueva, F., Folkvord, F., Veltri, G.A., 2020. Assessing concerns for the economic consequence of the COVID-19 response and mental health problems associated with economic vulnerability and negative economic shock in Italy, Spain, and the United Kingdom. *PLoS One* 15, 1–16. <https://doi.org/10.1371/journal.pone.0240876>.

- Commission implementing regulation (EU) 2020/1155, 2020. Official Journal of the European Union, European Unión, 30 July 2020. [https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32020R1155&lang1=EN&from=ES&lang3=choose&lang2=choose&\\_csrf=a653251f-b2b6-4e1c-a904-862067d37aed](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32020R1155&lang1=EN&from=ES&lang3=choose&lang2=choose&_csrf=a653251f-b2b6-4e1c-a904-862067d37aed). (Accessed 29 December 2020).
- Confraría de Pescadores de Noia (2020). Notificación de resolución de prohibición con carácter cautelar. <http://www.cofradianoia.es/attachments/article/465/peche%20cautelar.pdf>, 2020 (accessed 30 December 2020).
- Consellería do mar, 2020a. Xunta de Galicia. El plan de reactivación del sector marítimo-pesquero de Galicia frente al coronavirus supondrá una inyección global de 77 millones de euros en 2020. [https://mar.xunta.gal/es/noticia?id=nova\\_estandar49716.html](https://mar.xunta.gal/es/noticia?id=nova_estandar49716.html). (Accessed 2 December 2020).
- Consellería do mar, 2020b. Fondo Europeo Marítimo e da Pesca. <https://femp.xunta.gal/es/noticias/galicia-pondra-disposicion-del-marisqueo-pie-mas-de-5-millones-de-euros-de-apoyo-la>. (Accessed 7 January 2021).
- Council Regulation (EU) 2020/123, 2020. Official Journal of the European Union, European Unión, 27 January 2020. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32020R0123>. (Accessed 28 December 2020).
- Decreto 178/2020, 2020. Diario Oficial de Galicia, Santiago de Compostela, España, 30 de octubre de 2020. [https://www.xunta.gal/dog/Publicados/exceptional/2020/20201030/2474/AnuncioC3B0-301020-1\\_es.html#:~:text=DECRETO%20178%2F2020%2C%20de%2030,de%20alarma%20declarado%20por%20el](https://www.xunta.gal/dog/Publicados/exceptional/2020/20201030/2474/AnuncioC3B0-301020-1_es.html#:~:text=DECRETO%20178%2F2020%2C%20de%2030,de%20alarma%20declarado%20por%20el). (Accessed 29 December 2020).
- Decreto 179/2020, 2020. Diario Oficial de Galicia, Santiago de Compostela, España, 4 de noviembre de 2020. [https://www.xunta.gal/dog/Publicados/exceptional/2020/20201104/2476/AnuncioC3B0-041120-1\\_es.html](https://www.xunta.gal/dog/Publicados/exceptional/2020/20201104/2476/AnuncioC3B0-041120-1_es.html). (Accessed 29 December 2020).
- Decreto 202/2020, 2020. Diario Oficial de Galicia, Santiago de Compostela, España, 3 de diciembre de 2020. [https://www.xunta.gal/dog/Publicados/exceptional/2020/20201203/2508/AnuncioC3B0-031220-1\\_es.html](https://www.xunta.gal/dog/Publicados/exceptional/2020/20201203/2508/AnuncioC3B0-031220-1_es.html). (Accessed 31 December 2020).
- Domínguez, R., Loureiro, M., 2013. Environmental accidents and stigmatized fish prices: evidence from the Prestige oil spill in Galicia. *Econ. Agrar. y Recur. Nat.* 13, 103–126. <https://doi.org/10.22004/ag.econ.162311>.
- EUMOPA, 2020a. Covid update. <https://www.eumopa.eu/es/covid-19>. (Accessed 7 January 2021).
- EUMOPA, 2020b. The EU Fish Market: 2020 Edition. European Market Observatory for Fisheries and Aquaculture Products, Brussels.
- European Commission, 2020a. Comunicación de la Comisión al parlamento europeo y al consejo "Hacia una pesca más sostenible en la UE: Estado de la cuestión y orientaciones para 2021". [https://ec.europa.eu/info/sites/info/files/contribution-consello-galego-de-pesca-xunta-de-galicia-consultation-on-fishing-opportunities-2021\\_es.pdf](https://ec.europa.eu/info/sites/info/files/contribution-consello-galego-de-pesca-xunta-de-galicia-consultation-on-fishing-opportunities-2021_es.pdf). (Accessed 7 January 2021).
- European Commission, 2020b. Fisheries. Fishing quotas. [https://ec.europa.eu/fisheries/cfp/fishing\\_rules/tacs\\_en](https://ec.europa.eu/fisheries/cfp/fishing_rules/tacs_en). (Accessed 30 December 2020).
- European Commission, & Directorate-General for Economic and Financial Affairs, 2020. European Economic Forecast Summer 2020 (Interim) (Vol. 8014), Belgium Publications Office of the European Union Brussels.
- FAO, 2020. How is COVID-19 affecting the fisheries and aquaculture food systems. <http://www.fao.org/publications/card/es/c/CA8637EN>. (Accessed 30 December 2020).
- Fernández, E., Álvarez-Salgado, X.A., Beiras, R., Ovejero, A., Méndez, G., 2016. Coexistence of urban uses and shellfish production in an upwelling-driven, highly productive marine environment: the case of the Ría de Vigo (Galicia, Spain). *Reg. Stud. Mar. Sci.* 8, 362–370. <https://doi.org/10.1016/j.rmsa.2016.04.002>.
- Fernández-González, R., Pérez-Pérez, M., Lemos Nobre, A., Garza-Gil, M.D., 2019. Evolution and trends in a Spanish fishery of anchovies. In: Tavidze, A. (Ed.), *Prog. Econ. Res. Nova Science Publishers Inc., New York*, pp. 191–217.
- Fernández-González, R., Pérez-Pérez, M.I., Varela Lafuente, M.M., 2020. An institutional analysis of Galician turbot aquaculture: property rights system, legal framework and resistance to institutional change. *Ocean Coast. Manag.* 194, 105281. <https://doi.org/10.1016/j.ocecoaman.2020.105281>.
- Galician Institute of Statistics database (IGE), 2020. Marco Input-output de Galicia 2016. <http://www.ige.eu/Shiny/MIOGAL/>.
- García Negro, M.C., Villasante, S., Carballo Penela, A., Rodríguez Rodríguez, G., 2009. Estimating the economic impact of the prestige oil spill on the death coast (NW Spain) fisheries. *Mar. Policy* 33, 8–23. <https://doi.org/10.1016/j.marpol.2008.03.011>.
- Garza-Gil, M.D., Prada-Blanco, A., Vázquez-Rodríguez, M.X., 2006. Estimating the short-term economic damages from the Prestige oil spill in the Galician fisheries and tourism. *Ecol. Econ.* 58, 842–849. <https://doi.org/10.1016/j.ecolecon.2005.09.009>.
- Garza-Gil, M.D., Surís-Regueiro, J.C., Varela-Lafuente, M.M., 2017. Using input-output methods to assess the effects of fishing and aquaculture on a regional economy: the case of Galicia, Spain. *Mar. Policy* 85, 48–53. <https://doi.org/10.1016/j.marpol.2017.08.003>.
- Henríquez, J., Gonzalo-Almorox, E., García-Goni, M., Paolucci, F., 2020. The first months of the COVID-19 pandemic in Spain. *Health Policy Technol.* 9, 560–574. <https://doi.org/10.1016/j.hlpt.2020.08.013>.
- ICES (International Council for the Exploration), Anchovy (*Engraulis encrasicolus*) in Subarea 8 (Bay of Biscay) (vol. 27.8). [http://www.ices.dk/sites/pub/PublicationReports/StockAnnexes/2017/ane.27.8\\_SA.pdf](http://www.ices.dk/sites/pub/PublicationReports/StockAnnexes/2017/ane.27.8_SA.pdf), 2020a (accessed 29 December 2020).
- ICES (International Council for the Exploration), 2020b. Sardine (*Sardina pilchardus*). <http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2020/2020/pil.27.8c9a.pdf>. (Accessed 8 January 2021).
- Industria Conservera 140, 2020. El consumo en hogares de productos de la pesca y la acuicultura durante el primer semestre del año 2020. <http://www.anfaco.es/es/categorias.php?var1=Edici%F3n%20Digital%20&nar1=737&var2=Edici%F3n%20Digital%20&nar2=737&vez=1&metatitle=> (Accessed 11 January 2021).
- INTECMAR, 2020. Notificación de resolución de levantamiento de peche cautelar. [http://www.intecmar.gal/pdfs/zonas\\_1601.pdf](http://www.intecmar.gal/pdfs/zonas_1601.pdf). (Accessed 30 December 2020).
- La Voz de Galicia, 2020a. El 67% de las reservas de berberecho de Noia han succumbido a las riadas. [https://www.lavozdegalicia.es/noticia/barbanza/noia/2020/01/22/67-reservas-berberecho-noia-succumbido-riadas/0003\\_202001B22C1992.htm](https://www.lavozdegalicia.es/noticia/barbanza/noia/2020/01/22/67-reservas-berberecho-noia-succumbido-riadas/0003_202001B22C1992.htm). (Accessed 27 December 2020).
- La Voz de Galicia, 2020b. El mercado se quedará sin vieira gallega fresca estas Navidades. [https://www.lavozdegalicia.es/noticia/maritima/2020/12/02/mercado-a-quedara-vieira-gallega-fresca-navidades/0003\\_202012G2P31991.htm](https://www.lavozdegalicia.es/noticia/maritima/2020/12/02/mercado-a-quedara-vieira-gallega-fresca-navidades/0003_202012G2P31991.htm). (Accessed 29 December 2020).
- La Voz de Galicia, 2020c. El precio de la anchoa se devaluó un 40% por el cierre de fronteras. [https://www.lavozdegalicia.es/noticia/barbanza/2020/06/01/precio-anchoa-devaluó-40-cierre-fronteras/0003\\_202006B1C1992.htm](https://www.lavozdegalicia.es/noticia/barbanza/2020/06/01/precio-anchoa-devaluó-40-cierre-fronteras/0003_202006B1C1992.htm). (Accessed 29 December 2020).
- La Voz de Galicia, 2020d. Nuevo varapalo a la campaña del berberecho de Noia: El exceso de agua dulce obliga a cerrar su banco más importante. [https://www.lavozdegalicia.es/noticia/barbanza/noia/2020/12/22/nuevo-varapalo-campana-berberecho-noia-exceso-agua-dulce-obliga-cerrar-banco-importante/0003\\_202012B22C3996.htm](https://www.lavozdegalicia.es/noticia/barbanza/noia/2020/12/22/nuevo-varapalo-campana-berberecho-noia-exceso-agua-dulce-obliga-cerrar-banco-importante/0003_202012B22C3996.htm). (Accessed 30 December 2020).
- La Voz de Galicia, 2020e. Nunca se pescó menos pulpo en Galicia, pero ¿por qué? [https://www.lavozdegalicia.es/noticia/maritima/2020/08/26/nunca-pesco-pulpo-galicia/0003\\_202008G2P20991.htm](https://www.lavozdegalicia.es/noticia/maritima/2020/08/26/nunca-pesco-pulpo-galicia/0003_202008G2P20991.htm). (Accessed 30 December 2020).
- López, L., Rodó, X., 2020. The end of social confinement and COVID-19 re-emergence risk. *Nat. Hum. Behav.* 4, 746–755. <https://doi.org/10.1038/s41562-020-0908-8>.
- Ministerio de Agricultura, 2020a. Pesca y Alimentación, Estadísticas pesqueras. <https://www.mapa.gob.es/es/estadistica/temas/estadisticas-pesqueras/>. (Accessed 27 December 2020).
- Ministerio de Agricultura, 2020b. Pesca y Alimentación, Sala de prensa. El Ministerio de Agricultura, Pesca y Alimentación incrementa las posibilidades de pesca de sardina ibérica para la flota española. <https://www.mapa.gob.es/es/prensa/ultimas-noticias/el-ministerio-de-agricultura-pesca-y-alimentacion/c3%b3n-incrementa-las-posibilidades-de-pesca-de-sardina-ib%3Arica-para-la-flota-espa%3Cb1ola-tcm:30-540068>. (Accessed 27 December 2020).
- Ministerio de Agricultura, 2020c. Pesca y Alimentación, Sala de prensa. <https://www.mapa.gob.es/es/prensa/ultimas-noticias/espa%3Cb1a-logra-duplicar-la-cuota-de-rape-de-gran-sol-en-2020-gracias-a-los-acuerdos-alcanzados-con-francia-b%3A9lca-y-pa%3Adses-bajos/tcm:30-543067>. (Accessed 29 December 2020).
- NOAA Fisheries, 2020. Species directory. Shortfin squid. <https://www.fisheries.noaa.gov/species/shortfin-squid>. (Accessed 27 December 2020).
- Orden del DOG n° 223-Bis, 2020. Diario Oficial de Galicia, Santiago de Compostela, España, 4 de noviembre de 2020. [https://www.xunta.gal/dog/Publicados/exceptional/2020/20201104/2476/AnuncioC3K1-041120-2\\_es.html](https://www.xunta.gal/dog/Publicados/exceptional/2020/20201104/2476/AnuncioC3K1-041120-2_es.html). (Accessed 13 November 2020).
- Orden SND/520/202, 2020. Boletín Oficial del Estado, Madrid, España, 13 de junio de 2020. BOE núm 166. <https://www.boe.es/buscar/act.php?id=BOE-A-2020-6088#:~:text=Orden%20SND%2F520%2F2020%2C,la%20transici%C3%B3n%20hacia%20una%20nueva>. (Accessed 6 November 2020).
- Pak, A., Adegboye, O.A., Adekunle, A.I., Rahman, K.M., McBryde, E.S., Eisen, D.P., 2020. Economic consequences of the COVID-19 outbreak: the need for epidemic preparedness. *Front. Public Health* 8, 19. <https://doi.org/10.3389/fpubh.2020.00241>.
- Perez de Oliveira, L., 2013. Fishers as advocates of marine protected areas: a case study from Galicia (NW Spain). *Mar. Policy* 41, 95–102. <https://doi.org/10.1016/j.marpol.2012.12.024>.
- Piñero-Antelo, M. de los Á., Villa, F.R. Durán, Santos, X.M., 2019. ODA in Galicia (Spain). The importance of the fisheries sector and the cultural priority. *Mar. Policy* 107, 103455. <https://doi.org/10.1016/j.marpol.2019.02.027>.
- Pita, P., Freire, J., 2016. Assessing the impact of spear fishing by using competitions records and underwater visual censuses. *Sci. Mar.* 80, 27–38. <https://doi.org/10.3989/scimar.04352.15A>.
- Pourmozaffar, S., Jahromi, S.T., Rameshi, H., Sadeghi, A., Bagheri, T., Behzadi, S., Gozari, M., Zahedi, M.R., Lazarjani, S.A., 2019. The role of salinity in physiological responses of bivalves. *Rev. Aquac.* 1–19.
- Real Decreto 463/2020, 2020. Boletín Oficial del Estado, Madrid, España, 14 de marzo de 2020. BOE núm 67. <https://www.boe.es/buscar/act.php?id=BOE-A-2020-3692>. (Accessed 4 November 2020).
- Real Decreto 926/2020, 2020. Boletín Oficial del Estado, Madrid, España, 25 de octubre de 2020. BOE núm 282. [https://www.boe.es/diario\\_boe/txt.php?id=BOE-A-2020-12898](https://www.boe.es/diario_boe/txt.php?id=BOE-A-2020-12898). (Accessed 13 November 2020).
- Real Decreto 956/2020, 2020. Boletín Oficial del Estado, Madrid, España, 25 de octubre de 2020. BOE núm 282. <https://www.boe.es/buscar/doc.php?id=BOE-A-2020-13494>. (Accessed 27 December 2020).
- Resolución de 24 de abril de 2020, 2020. Boletín Oficial del Estado, Madrid, España, 10 de mayo de 2020 BOE núm 112. [https://www.boe.es/diario\\_boe/txt.php?id=BOE-A-2019-6960](https://www.boe.es/diario_boe/txt.php?id=BOE-A-2019-6960). (Accessed 24 December 2020).
- Resolución de 30 de junio de 2020, 2020. Boletín Oficial del Estado, Madrid, España, 9 de julio de 2020 BOE núm 188. [https://www.boe.es/diario\\_boe/txt.php?id=BOE-A-2020-7544](https://www.boe.es/diario_boe/txt.php?id=BOE-A-2020-7544). (Accessed 24 December 2020).
- Resolución de 8 de abril de 2020, 2020. Boletín Oficial del Estado, Madrid, España, 23 de abril de 2020 BOE núm 113. [https://www.boe.es/diario\\_boe/txt.php?id=BOE-A-2020-4589](https://www.boe.es/diario_boe/txt.php?id=BOE-A-2020-4589). (Accessed 26 December 2020).
- Resolución del DOG n° 115 de 2020/6/13 Diario Oficial de Galicia, 2020. Santiago de Compostela, España, 13 de junio de 2020. DOG núm 115. [https://www.xunta.gal/dog/Publicados/2020/20200613/AnuncioC2K1-120620-1\\_es.html](https://www.xunta.gal/dog/Publicados/2020/20200613/AnuncioC2K1-120620-1_es.html). (Accessed 12 November 2020).

- Revista Mar 600, 2020. La pandemia total. Ministerio de Inclusión, Seguridad Social y Migraciones. <http://www.seg-social.es/wps/portal/wss/internet/HerramientasWeb/2131/2440/5e223c46-2c46-4995-b1c6-f9201efa6ca2>. (Accessed 8 January 2021).
- Revista Mar 601, 2020. Costera de la xarda. Ministerio de Inclusión, Seguridad Social y Migraciones. <http://www.seg-social.es/wps/portal/wss/internet/HerramientasWeb/2131/2440/5e223c46-2c46-4995-b1c6-f9201efa6ca2>. (Accessed 8 January 2021).
- Revista Mar 603, 2020. Ministerio de Inclusión, Seguridad Social y Migraciones. <http://www.seg-social.es/wps/portal/wss/internet/HerramientasWeb/2131/2440/5e223c46-2c46-4995-b1c6-f9201efa6ca2>. (Accessed 8 January 2021).
- Rocha, F., Guerra, A., Prego, R., Piatkowski, U., 1999. Cephalopod paralarvae and upwelling conditions off Galician waters (NW Spain). *J. Plankton Res.* 21, 21–33.
- Rodríguez, G.R., Ramudo, R.B., 2015. Market differences between wild and farmed major European Marine fish species. Evidence from the Spanish seafood market. *Turkish J. Fish. Aquat. Sci.* 15, 713–725. [https://doi.org/10.4194/1303-2712-v15\\_3\\_15](https://doi.org/10.4194/1303-2712-v15_3_15).
- Rodríguez-Antón, J.M., Alonso-Almeida, M. del M., 2020. COVID-19 impacts and recovery strategies: the case of the hospitality industry in Spain. *Sustainability* 12, 8599. <https://doi.org/10.3390/su12208599>.
- Royo, S., 2020. Responding to COVID-19: the case of Spain. *Eur. Policy Anal.* 6, 180–190. <https://doi.org/10.1002/epa2.1099>.
- Salz, P., Macfadyen, G., 2007. *Regional Dependency on Fisheries*, first ed. European Parliament, Brussels.
- Santiago, J.L., Surís-Regueiro, J.C., 2018. An applied method for assessing socioeconomic impacts of European fisheries quota-based management. *Fish. Res.* 206, 150–162. <https://doi.org/10.1016/j.fishres.2018.05.010>.
- Santos, M.B., González-Quirós, R., Riveiro, I., Iglesias, M., Louzao, M., Pierce, G.J., 2013. Characterization of the pelagic fish community of the north-western and northern Spanish shelf waters. *J. Fish Biol.* 83, 716–738.
- Sobrinho Heredia, J.M., Oanta, G.A., 2019. The legal impact of the common fisheries policy on the Galician fisheries sector. *Ocean Coast. Manag.* 167, 87–99. <https://doi.org/10.1016/j.ocecoaman.2018.10.011>.
- Surís-Regueiro, J.C., Santiago, J.L., 2014. Characterization of fisheries dependence in Galicia (Spain). *Mar. Policy* 47, 99–109. <https://doi.org/10.1016/j.marpol.2014.02.006>.
- Surís-Regueiro, J.C., Santiago, J.L., 2018. Assessment of socioeconomic impacts through physical multipliers: the case of fishing activity in Galicia (Spain). *Ecol. Econ.* 147, 276–297. <https://doi.org/10.1016/j.ecolecon.2018.01.020>.
- Surís-Regueiro, J.C., Garza-Gil, M.D., Varela-Lafuente, M.M., 2007. The Prestige oil spill and its economic impact on the Galician fishing sector. *Disasters* 31, 201–215. <https://doi.org/10.1111/j.1467-7717.2007.01004.x>.
- Vázquez-Rowe, I., Iribarren, D., Hospido, A., Moreira, M.T., Feijoo, G., 2011. Computation of operational and environmental benchmarks within selected Galician fishing fleets. *J. Ind. Ecol.* 15, 776–795. <https://doi.org/10.1111/j.1530-9290.2011.00360.x>.
- Villamor, B., Carrera, P., Castro, J., Ramos, F., Velasco, F., Sobrinho, I., Navarro, M.R., Gancedo, R., Hernandez, C., Marín, M., Blanco, M., Tornero, J., Burgo, C., 2017. The Chub Mackerel (*Scomber colias*) in the Atlantic Spanish Waters (ICES Divisions 8.c and 9.a): biological, fishery and survey data. In: Working Document to WG-WIDE 2017.
- Xunta de Galicia, 2020a. Rexistro de buques pesqueiros. <https://www.pescadegalicia.gal/rexibuque/>. (Accessed 19 December 2020).
- Xunta de Galicia, 2020b. Anuario de Pesca de Galicia 2019. <https://www.pescadegalicia.gal/Publicaciones/AnuarioPesca2019/index.htm>. (Accessed 21 December 2020).
- Xunta de Galicia, 2020c. Estatísticas: Primeira venda de produtos frescos. Venda nas lonxas. <https://www.pescadegalicia.gal/estadisticas/>. (Accessed 21 December 2020).