



BROWN CRAB

A photograph of a white fishing boat on the sea at sunset, with many birds flying in the sky. A blue line graph is overlaid on the image, showing market trends. The graph has several data points with percentages: 68%, 44%, 21%, 11%, 35%, 81%, 37%, 52%, 32%, 86%, 15%, and 68%. A Euro symbol (€) is also visible.

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European Market Observatory for
Fisheries and Aquaculture Products

COVID-19 IMPACT ON THE SUPPLY CHAIN

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SUMMARY

This study aims to provide an understanding of the brown crab (*Cancer pagurus*) supply chain and establish the status for the sector both prior to and during the COVID-19 pandemic. It also aims to give insight into how stakeholders in the nations that catch the most brown crab were affected by the COVID-19 pandemic, and their course of action in dealing with the consequences. The study is based on publicly available literature, research, news articles, and available data. Stakeholders in Norway, the UK, Ireland, and France were contacted and asked to contribute to the study. The main data source for this study concerning catches of brown crab was the FAO, while data from EUMOFA (based on EUROSTAT and IHS Markit – Global Trade Atlas) and Statistics Norway were used when analysing the international trade flows.

Brown crab, also known as edible crab, is a benthic species that lives on a wide range of seafloors: sand, gravel, and rock, at depths of 6 to 100 metres. It is found in the Eastern Atlantic, from northern Morocco, extending along the Atlantic coast of Europe, to the British Isles and northern Norway.

In 2019, the FAO reported a total global catch of 50.480 tonnes of brown crab. The majority of this (60%) was caught by the UK. Other major catching nations are Ireland, Norway, and France. Together these four nations have accounted for 94% of total catches since 2010. In terms of first sales, large parts of the edible crab industry consist of fishers selling catches to processors and exporters through temporary or long-term contracts. The brown crab may be sold live or processed into products ranging from boiled whole (sold chilled or frozen), crab meat, or other value-added products.

The COVID-19 pandemic represented a shock for the brown crab sector in 2020. The pandemic disrupted the supply chain, tested the robustness of the sector, and forced innovation. The effect of the pandemic hit stakeholders differently depending on their business model. Processors who had diversified sales to both retail and HoReCa were better equipped to keep up sales when one market disappeared, as opposed to those who only sold to the HoReCa sector. Many processors also had the advantage of being able to build inventory and postpone sales. The effect of the COVID-19 pandemic differed between nations. In the UK, many fishers refrained from fishing crab as prices were too low to cover costs. In addition, weather conditions caused a poor fishing season. On the other hand, Norwegian and French crab fishers were shielded from the full impact of COVID-19 as the largest Norwegian processor continued buying crab from fishers and demand during the peak season in France remained consistent.

In addition to the COVID-19 pandemic, the issue of cadmium restrictions on live brown crab exported to China has been, and still is, affecting the sector. Market access has been reduced for all exporters, except for crab caught and exported from the Netherlands. Many stakeholders reported that exports to China would increase if the cadmium testing regime were eased.

LIST OF ACRONYMS

CN	Combined Nomenclature
HS	Harmonised Standard
EU	European Union
FAO	Food and Agriculture Organisation of the United Nations
HoReCa	Hotel, Restaurant, Café
MAC	Market Advisory Council
MCRS	Minimum Conservation Reference Size

0 SCOPE AND CONTENT

0.1 Study scope

This study was suggested by the Market Advisory Council (MAC). The MAC drew attention to the need for specific studies to assess the significant impact of the COVID-19 pandemic on the entire seafood supply chain, and in particular on the brown crab (*Cancer pagurus*) supply chain. In this context, it was also necessary to evaluate possible mitigation measures to develop a strategy to cope with such global crises in the future.

This study thus aims to provide an understanding of the brown crab value chain and establish the status for the sector both prior to and during the COVID-19 pandemic. This study also aims to give insight into how stakeholders in brown crab catching nations were affected by the COVID-19 pandemic and their course of action in dealing with the consequences.

0.2 Methodology

The study is based on publicly available literature, research, news articles and data sources. Stakeholders in Norway, the UK, Ireland, and France were contacted and asked to contribute to the study. Five interviews were conducted, leading to contributions of both general and specific insight regarding production, trade, and market outlets.

Despite involvement from the MAC, it has proven difficult to find stakeholders willing to participate in this study. This study is subject to inherent limitations with results and recommendations shaped by the input of the interviews.

0.2.1 Brexit

This report analyses data for the years 2010-2020. The UK formally left the EU on 31st January 2020 and entered a transition period that lasted until 31st December 2020. Starting from February 2020, trade data reported by the UK are not available in EUROSTAT. For the sake of consistency, the UK is excluded from the EU aggregate and treated as an extra-EU country throughout the whole period in all analyses in this report.

The IHS Markit – Global Trade Atlas has been therefore used as the source for data on UK imports and exports,

0.3 Data

The main data source for this study concerning catches of brown crab is the FAO, while data from EUMOFA (based on EUROSTAT and IHS Markit – Global Trade Atlas) and Statistics Norway are used when analysing the international trade flows.

The EUMOFA international trade database includes volumes and values of imports and exports of fishery and aquaculture products from almost 100 reporting countries. EUROSTAT (Comext) data is available through EUMOFA and monitors monthly trade flows within the EU and between EU Member States and third countries. Although both EUROSTAT-COMEXT and IHS data are comprehensive, it must be highlighted that imports and exports of goods are reported in line with the Harmonised System¹ (HS) and

¹ World Customs Organization <http://www.wcoomd.org/en/topics/nomenclature/overview/what-is-the-harmonized-system.aspx>

Brown crab: COVID-19 impact on the supply chain

the Combined Nomenclature² (CN), which do not include detailed information on brown crab products. Data on international trade flows between Member States, and between Member States and third countries, are publicly available at MCS³ level on the EUMOFA website.

The codes used for the analysis of brown crab exports from the EU, UK, and Norway during the time scope of this study are listed below. The bolded codes are currently in use for trade of brown crab, while the non-bolded codes are historical and no longer in use.

	HS-8	Description
EU and the UK	0306 14 30	Frozen crabs " <i>Cancer pagurus</i> ", even smoked, whether in shell or not, incl. crabs in shell, cooked by steaming or by boiling in water.
	0306 33 10	Crabs " <i>Cancer pagurus</i> ", whether in shell or not, live, fresh or chilled.
	0306 14 08	Crabs, with the exception of red king crab (<i>Paralithodes camtschaticus</i>) and snow crab (<i>Chionoecetes opilio</i>), frozen.
	0306 24 30	Crabs of the species <i>Cancer pagurus</i> , not frozen. Used until 2016, when it was split into H8 codes 0306 33 10 and 0306 93 10.
Norway	0306 33 91	Crabs, with the exception of red king crab (<i>Paralithodes camtschaticus</i>) and snow crab (<i>Chionoecetes opilio</i>), live.
	0306 33 99	Crabs, with the exception of red king crab (<i>Paralithodes camtschaticus</i>) and snow crab (<i>Chionoecetes opilio</i>), fresh or chilled.
	0306 93 09	Crabs, with the exception of red king crab (<i>Paralithodes camtschaticus</i>) and snow crab (<i>Chionoecetes opilio</i>), dried, smoked, salted or in brine.
	0306 14 09	Crabs, with the exception of red king crab (<i>Paralithodes camtschaticus</i>), frozen. Used until 2015, when it changed to 0306 14 08 (snow crab removed).
	0360 24 08	Crabs, with the exception of red king crab (<i>Paralithodes camtschaticus</i>) and snow crab (<i>Chionoecetes opilio</i>) not frozen.

² Council Regulation (EEC) No 2658/87 of 23 July 1987 on the tariff and statistical nomenclature and on the Common Customs Tariff. https://ec.europa.eu/taxation_customs/business/calculation-customs-duties/what-is-common-customs-tariff/combined-nomenclature_en

³ Main Commercial Species are EUMOFA aggregates of CN and HS codes as part of the harmonisation rules. Read more about EUMOFA data management methodologies (<https://www.eumofa.eu/supply-balance-and-other-methodologies>) and harmonisation correlation tables (<https://www.eumofa.eu/harmonisation>).

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HS-8		Description
		Used until 2017 when it was split to 0306 33 91, 0306 33 99, and 0306 93 09.
	0360 24 09	Crabs, with the exception of red king crab (<i>Paralithodes camtschaticus</i>), not frozen. Used until 2015 when it was split to 0360 24 08.

Monitoring the international trade of brown crab is challenging, as products are exported under codes which only reflect the preservation states of the products: live and/or fresh/chilled, frozen, dried, salted, smoked or in brine. All these categories include whole crab, claws and meat and are presented as an aggregated net weight. Corresponding data must therefore be interpreted with care, as they do not reflect the product composition and the difference in value. For example, a tonne of crab traded under the HS-8 code 0306 33 10 could contain mainly live crab or mostly crab claws and meat. If most of one trade flow includes live crab, the weight does not reflect the amount of crab meat which is consumed, which is much lower as shells and innards are discarded. Similarly, if one trade flow mainly includes claws and meat, the amount of crab needed to produce the product is higher than the product weight indicated.

The uncertainty regarding the product composition also makes price analysis misleading as the price per kg of crab meat, claws, and other form of processed crab is higher than whole crab. Variances in unit price could reflect demand, the type of product purchased, or a combination of the two. Results regarding price should therefore be treated with extreme caution. As data on the international trade of crab products are aggregated based on their preservation and presentation state, it is not possible to implement analysis regarding prices.

In 2017, a revision of the HS nomenclature led to separation of data for live, fresh, or chilled crab, and other preservation states of crab (excluding frozen products), which prior to 2017 were combined into one trade number.

In Norway, trade data prior to 2015 only singled out the red king crab (*Paralithodes camtschaticus*), while all other crab species were reported under the codes HS 0306 14 09 (frozen) and 0360 24 09 (not frozen). Snow crab (*Chionoecetes opilio*) was given an individual code in 2015. With the exception of red king crab and snow crab, which are currently exported under their own codes, crab exports from Norway primarily contain brown crab. Although it cannot be established that the Norwegian crab export under the relevant trade codes are exclusively brown crab after 2015, the export of any other crab species can be considered minor.

Trade data for Norwegian crab distinguish between live crab and fresh or chilled crab, while EU trade data does not. To create aggregated and comparable statistics, the Norwegian trade data regarding live crab and fresh or chilled crab were manually combined.

As brown crab catches are limited to coastal countries in Europe, all exports must at one point originate from these nations. Trade data for the most part reflects this, with some exceptions. The sixth largest exporter in 2020 in terms of volume and value was South Korea, reporting exports of 832 tonnes. Although this could be re-export, exports to South Korea are only 46,3 tonnes. The most likely explanation is that South Korea is reporting trade of other crab species under the brown crab code. South Korean import data confirms this suspicion. In 2019 South Korea reported brown crab imports of 26.000 tonnes. The same year, the global aggregated volume of brown crab exports was 23.731 tonnes. Given that it is impossible for South Korean imports to exceed global exports, it is highly likely that species other than brown crab are included in the import statistics. Reported brown crab exports and imports from South Korea are therefore excluded.

Brown crab: COVID-19 impact on the supply chain

The four largest catching nations, namely the UK, Ireland, Norway, and France, together accounted for 96% of all catches in 2019. When considering exports, only data from the four major catching nations are used. This is done to avoid double-counting crabs which are exported to intermediary nations (hubs) for re-export.

1 BROWN CRAB

Brown crab (*Cancer pagurus*) also known as edible crab, is a benthic species that lives on a wide range of seafloors: sand, gravel, and rock, at depths of 6 to 100 metres, but most commonly between 6 and 40 metres⁴.

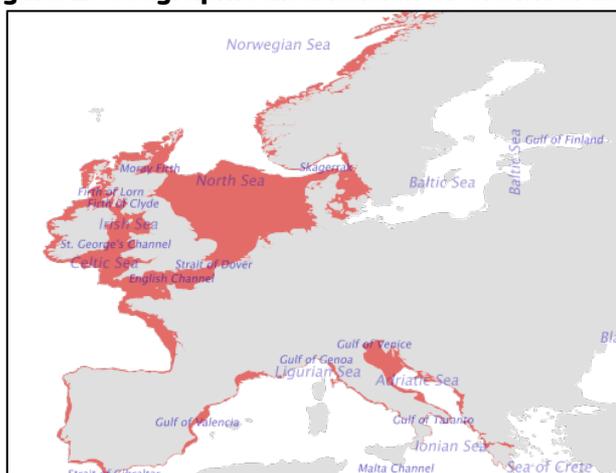
Brown crab is found in the Eastern Atlantic, from northern Morocco, along the Atlantic coast of Europe, to the British Isles and northern Norway (about 70° N). There have also been reports of brown crab being observed along the north coast of the Mediterranean (Marseille, Naples, Greece), although these are mostly old reports with no current reports recording catches in this area⁵.

Figure 1: Brown crab (*Cancer pagurus*)



Source: FAO

Figure 2: Geographic distribution of *brown crab*



Source: FAO

1.1 Biology

Brown crabs have a heavy, oval shaped body and can easily be identified by their “piecrust” edge and black-tipped pincers⁶. The carapace (the hard upper shell of a crustacean) can reach a maximum length of 20 cm and a maximum width of 30 cm, though most commonly has a width of under 24 cm⁷. Adult brown crabs may vary in colour, being primarily reddish brown with patches of yellowish brown, while

⁴ <http://www.fao.org/fishery/species/2627/en>

⁵ *Ibidem*

⁶ Neal, K.J. & Wilson, E. 2008. *Cancer pagurus* Edible crab. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 11-02-2021]. Available from: <https://www.marlin.ac.uk/species/detail/1179>

⁷ <http://www.fao.org/fishery/species/2627/en>

juveniles may have a more purplish colour. The “legs” (pereopods) are covered in tufts of stiff hairs in rows, and the last segment of the walking legs (dactyls) end in spine-like tips⁸.

Brown crabs grow by moulting, a process in which they crawl out of their exoskeletons, allowing the body to take up water and increase in size before the new shell hardens. The water absorbed will later be replaced by tissue, constituting the actual growth. Moulting happens in the warm season, with the frequency of exoskeleton shedding decreasing with age.

Mating takes place in late autumn and early winter shortly after the female has moulted. The male stands over the female to form a protective cage while she is moulting, and internal fertilisation takes place before the new carapace hardens. Females carry eggs under their abdomen (berried) for five to nine months, releasing the larva in late spring or early summer. While the females are berried they do not feed but dig pits in which they reside. Fishing activities are therefore unlikely to catch berried females or affect larval supply⁹, although some bycatch from bottom trawling might still occur. When young crabs reach juvenile stage in the late summer/early autumn, they settle in intertidal zones¹⁰ where they remain for roughly three years until the carapace grows to a width of 6-7 cm, after which they move to subtidal areas¹¹. Sexual maturity is reached after about 10 years, and on average a brown crab has a lifespan of 30 years¹².

Brown crabs are omnivores, scavengers, and active predators. Their main diets are bivalves, smaller crustaceans, barnacles, and snails¹³. Their omnivore diet contributes to keeping the seafloor free from organic debris.

1.2 Fishery and resource management

The period of highest catches is from June to November, with some regional variance. Brown crab is usually caught with baited traps, called pots, but may also be bycaught in trawl fisheries and gillnet fisheries¹⁴. Commercial crab fishing is usually undertaken by day boats or vivier vessels. The latter are used for more offshore fishing and contain water tanks to hold live crab¹⁵. After being caught, crabs may be 'nicked': fracturing the apodemes (attachment site for muscles), to immobilize the claws to prevent cannibalism and fighting during storage¹⁶. This is especially common for catches done by vivier vessels.

Commercial fishers primarily use pots, a closed basket with baited soft-eye side-entry ports. These pots have a low impact on the environment and are very selective, limiting the bycatch of other species¹⁷. Instances where crab pots have not been collected, due to equipment failure or human error, has led to the term “ghost fishing” as crabs are trapped in the pot and starve to death, becoming bait for other scavengers. In Norway, crab pots are required to have escape hatches which are held closed by a cotton thread which dissolves after a certain time in water to allow the catch to escape¹⁸.

Brown crab fisheries are not managed by quotas or a total allowable catch (TAC) which has raised sustainability concerns in fishery nations and the EU, according to stakeholders. In Ireland, a brown crab

⁸ Neal, K.J. & Wilson, E. 2008. *Cancer pagurus* Edible crab. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 11-02-2021]. Available from: <https://www.marlin.ac.uk/species/detail/1179>

⁹ <https://www.marlin.ac.uk/species/detail/1179>

¹⁰ An area which is above water level at low tide and under water at high tide.

¹¹ An area which is below the intertidal zone (see previous footnote), and is continuously covered by water.

¹² https://www.mcsuk.org/downloads/seachampions/205-2012_Crab%20Festival_F.pdf

¹³ Woll A, Bakke S., van der Meer G., Krabben (2021), Kolonfon Forlag AS

¹⁴ <http://www.fao.org/fishery/species/2627/en>

¹⁵ <https://fishingnews.co.uk/features/carvela-new-stromness-vivier-crabber-proving-its-fishing-credentials-west-of-orkney/>

¹⁶ <https://www.sciencedirect.com/science/article/abs/pii/S002220112002182>

¹⁷ <https://thefishsite.com/articles/brown-crab-a-guide-to-handling-and-quality>

¹⁸ <https://www.fiskeridir.no/Fritidsfiske/Reiskap/Teiner>

fishery improvement project (FIP) has been created to increase the transparency and sustainability of the sector¹⁹.

Regulation (EU) No 2019/1241²⁰ sets minimum conservation reference size (MCRS) at 140 mm, measured as the maximum width of the carapace measured perpendicular to the antero-posterior midline of the carapace²¹. A few geographical exceptions are noted for the MCRS ranging from 70 mm to 115 mm²². For brown crabs caught in pots or creels, a maximum of 1% by weight of the total catch may consist of detached claws. For brown crabs caught with any other fishing gear, a maximum of 75 kg of detached crab claws may be landed²³.

The UK is the largest catch nation of brown crabs. England has five defined Crab Fishery Units which each encompass water covered by international, national, and local legislation which may vary within each region²⁴. The MCRS in England varies from 115 mm to 160 mm for male crabs^{25,26}. In Scotland, the MCRS is 150 mm, with the exception of Shetland where it is 140 mm²⁷.

Prior to Brexit, Norway was the largest non-EU catch nation of brown crab. The Norwegian MCRS ranges from 110 mm to 130 mm along the coast²⁸. The Norwegian crab fishing fleet is dominated by vessels below 11 m, consisting mostly of small-scale operations fishing for other species in addition to crabs²⁹. In 2018, more than 400 boats registered landings of brown crab in Norway³⁰. Non-commercial fishers may set up to 20 pots per person or per vessel, and can sell catch up to, but not exceeding, NOK 50.000 (EUR 4.671³¹) per year³².

¹⁹ <http://irishbrowncrabfip.ie/>

²⁰ [Regulation \(EU\) No 2019/1241 of 20 June 2019 on the conservation of fisheries resources and the protection of marine ecosystems through technical measures.](#)

²¹ <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019R1241&from=EN>

²² In ICES divisions 6a and 7a a minimum conservation reference size of total length of 70 mm and a carapace length of 20 mm shall apply. In an area in ICES divisions 4b and 4c limited by a point at 53°28'22" N, 0°09'24" E, on the coast of England, a straight line joining this point with 53°28'22" N, 0°22'24" E, the 6-mile boundary of the United Kingdom, and a straight line connecting a point at 51°54'06" N, 1°30'30" E, with a point on the coast of England at 51°55'48" N, 1°17'00" E, a minimum conservation reference size of 115 mm shall apply.

²³ <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019R1241&from=EN>

²⁴

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/974752/Crab_assessments_2019_March_21_update.pdf

²⁵ <https://www.gov.uk/government/publications/minimum-conservation-reference-sizes-mcrs/minimum-conservation-reference-sizes-mcrs-in-uk-waters>

²⁶

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/974752/Crab_assessments_2019_March_21_update.pdf

²⁷ <https://www.gov.scot/publications/landing-controls-for-crab-and-lobster/>

²⁸ <https://www.fiskeridir.no/Fritidsfiske/Artar/Krabbefiske>

²⁹ <https://www.hi.no/en/hi/temasider/species/edible-crab>

³⁰ *Ibidem*

³¹ With the average ECB exchange rate for 2020 of 0.09342 EUR/NOK

³² <https://www.fiskeridir.no/Fritidsfiske/Artar/Krabbefiske>

2 THE SUPPLY CHAIN OF BROWN CRAB

2.1 Catch

According to the FAO, brown crab is only caught by European countries and all catches are registered in FAO fishing area number 27 in the Northeast Atlantic Ocean. In 2019, the FAO reported a total catch of 50.480 tonnes, a decrease of 5% compared to 2018. Yearly catch volumes fluctuate but there is a general increasing trend: since 2010, catches of brown crab have experienced a year-over-year increase of 8%.

The UK is by far the largest catching nation, catching around 60% of total global volume between 2015 and 2019. The UK is followed by Ireland, Norway and France. Together, these four countries have accounted for roughly 94% of the catches since 2010.

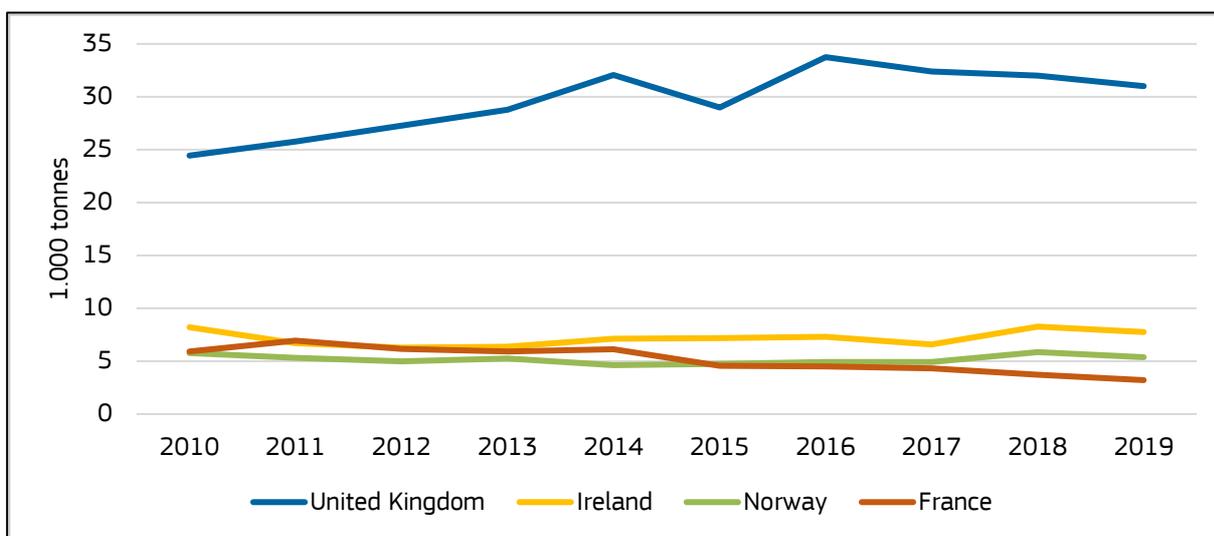
UK catches increased by 27% between 2010 and 2019 and have increased sevenfold since 1950. Catches in Ireland and Norway have remained stable over the last 10 years, with Irish catches fluctuating between 6.260 tonnes and 8.261 tonnes and Norwegian catches between 4.742 tonnes and 5.852 tonnes.

Table 1: Catches of *Cancer pagurus* by country (tonnes)

Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
United Kingdom	24.457	25.763	27.273	28.778	32.063	28.986	33.761	32.410	32.018	31.004
Ireland	8.210	6.691	6.269	6.378	7.118	7.191	7.285	6.577	8.261	7.744
Norway	5.773	5.319	4.981	5.241	4.629	4.743	4.926	4.924	5.852	5.365
France	5.916	6.950	6.141	5.925	6.132	4.565	4.490	4.324	3.706	3.193
Netherlands	394	444	470	554	580	519	577	596	572	1.028
Channel Islands	1.179	1.193	1.252	1.173	1.233	996	1.073	984	944	696
Isle of Man	459	554	495	453	519	477	534	967	629	435
Sweden	213	204	204	223	212	224	208	251	271	275
Denmark	61	74	81	69	79	138	292	233	329	259
Belgium	95	104	272	271	272	330	305	280	258	240
Germany	135	144	114	115	107	169	186	158	149	158
Spain	61	65	86	82	49	67	66	61	70	72
Portugal	1	1	2	1	2	3	2	16	11	12
Total	46.954	47.506	47.640	49.263	52.995	48.408	53.705	51.781	53.070	50.480

* Due to rounding there might be small variations between the totals and the sum of data.

Source: FAO

Figure 3: Catches of brown crab by main fishery nations (1.000 tonnes)

Source: FAO

2.2 Landings

Brown crab fishing is not regulated by quotas, and catches are not as closely monitored as other species. This leads to discrepancies in catch and landing data. As landing data for Ireland is unavailable for 2018, total landings in 2018 and 2019 are not comparable. For 2020, only UK and Norway data are available, and are analysed in chapter 3.1.1.

In terms of first sales, large parts of the edible crab industry consist of fishers selling catches to processors and exporters through temporary or long-term contracts, and there are also some examples of vertically integrated undertakings (where the same organisation manages several parts of the supply chain). Consequently, data on first sales are lacking, as much of the landings are sold directly and therefore not registered as first sales. These data are therefore not analysed in this chapter.

Table 2: Landings of brown crab by country (tonnes)

Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
United Kingdom	22.691	24.372	25.630	25.881	29.723	26.467	29.478	27.304	25.571	26.124
Ireland	6.706	5.314	6.075	5.745	5.782	6.304	7.686	6.713		7.301
Norway	5.714	5.317	4.981	5.240	4.629	4.743	4.898	4.863	5.779	5.280
France	4.315	6.683	6.178	5.797	5.822	4.196	4.155	3.943	3.293	2.959
Netherlands	1.922	2.194	977	711	1.314	2.715	522	1.269	2.521	540
Denmark	73	83	99	72	84	259	353		313	267
Sweden	114	127	113	103	86	99	76	113	93	141
Belgium	88	98	94	76	98	151	108	101	80	65
Spain	73	70	85	85	47	67	66	59	68	62
Portugal	1	1	1	1	1	2	3	6	3	6
Germany	2	19	7	5	1	3	3	70	9	6
Total	41.698	44.278	44.238	43.715	47.589	45.005	47.345	44.441	37.729	42.753

* Due to rounding there might be small variations between the totals and the sum of data.

Source: EUROSTAT

2.3 Processing

Brown crab may be sold live, or the crab may be processed into products ranging from boiled whole and sold chilled or frozen, crab meat, or other value-added products.

Live crabs are commonly transported either packed in Styrofoam boxes or in vivier tanks³³. Trucks are used for transportation between catch nations and other nations in Europe, while airfreight is used for exports to overseas markets, predominantly in Asia. Airplanes may or may not contain vivier tanks, and trucks may be standard or be specially designed vivier trucks. Vivier trucks can hold up to 12 tonnes³⁴ of live crab and contain water tanks that keep the crab alive and fresh. Although crabs can be stored live in vivier tanks for longer periods than in Styrofoam boxes, mortality rates increase with time and long storage periods should be avoided.

As crabs are highly perishable once killed, they must be boiled shortly after being euthanised. After boiling they can be chilled, frozen, or further processed. Following an initial cooking step, crabs are cleaned, cooled, and packaged³⁵. A second heating step is added for pasteurisation (typically 70 °C for 2 min for picked meat or 90 °C for 10 min for whole crab)³⁶. The product may then be frozen or chilled.

Crab claws are often sold as separate products and are pre-boiled. Claws are usually scored, where the shell contains cuts to break apart the shell more easily and obtain the meat. Claws may also be sold as cocktail claws which consist of the last segment of the claw with the shell removed, except for the tip which may be used as a handle for dipping the meat in sauce.

Meat from brown crab is either white or brown. White meat originates from muscle tissue derived from the purse, claws, and legs, while brown meat is derived from the hepatopancreas³⁷ and gonads inside the carapace. Crab meat may be sold in various combinations of white meat where the origin of the meat is specified (legs, claws, or purse) or as a mixture of all white meat. Crab meat may also be sold as pure brown meat, or as a combination of both brown and white meat. 'Dressed crabs' are also a popular item where the crab shell is stuffed with crab meat and sometimes topped with a claw. These products are typically sold frozen or chilled to the retail sector.

Crabs are processed with a mix of automated and manual labour. The majority of crab purses go through a spin-sheller machine which extracts the crab meat through centrifugal force, creating a favourable meat texture. The majority of toes (the ends of the legs) and legs have their meat blown out using machines that first cut the end off and then use air pressure to blow out the meat. If the filling in the legs is poor, manual extraction is undertaken. Crab meat may also be used as an ingredient in value-added products such as crab cakes, pates, or pastes³⁸.

Processing is for the most part done in the landing country, primarily through automated processes. Products whose meat quality is not suitable for automated processing may be sent abroad, typically to Asian countries such as Vietnam, for manual processing before being reimported as boiled or frozen. A challenge in the brown crab industry, and especially processing, is the filling degree in the crab. After the crab has moulted, they are known as softshell crabs, filled with water and with little meat. Whilst the colouring and hardness of the shell - in addition to crab weight and strength - are indicators for filling degree, guaranteeing the quality of the crab is challenging. Only about 20% of landed brown crabs in

³³ Water tanks designed to keep shellfish alive during transportation

³⁴ <https://mcbridefishing.ie/products.html>

³⁵ Condon-Abanto S., Arroyo C., Alvarez I., Brunton N., Whyte P., Lyng J.G. An assessment of the application of ultrasound in the processing of ready-to-eat whole brown crab (*Cancer pagurus*) *Ultrason*.

³⁶ McDermott, A.; Whyte, P.; Brunton, N.; Lyng, J.; Bolton, D.J. Increasing the Yield of Irish Brown Crab (*Cancer pagurus*) during Processing without Adversely Affecting Shelf-Life. *Foods* 2018, 7, 99. <https://doi.org/10.3390/foods7070099>

³⁷ Digestive gland

³⁸ <https://www.seafish.org/document/?id=4B914136-D687-46A1-BD0D-A0BC1EA3E19E>

Norway are fully filled with white meat, liver, and roe, and in general the filling degree in Norwegian crabs is lower than crabs caught around the British Isles³⁹. The difference in filling degree is likely due to the different marine environments such as water depth, currents, and temperature. Some processes use transillumination machines or scanners to determine the filling degree. On average, the yield of raw material (live crab) to processed product is about 40%. The crabs may be cooked and thereby pasteurised by a processor in the country of origin before possibly further processing in another location⁴⁰.

2.4 International trade

This chapter aims to establish the status quo of brown crab exports. The discrepancies between export volumes and values when comparing 2020 to previous years are discussed in the chapter on market changes (see § 3.1.3). For a premise on how to interpret data and analyses on trade flows of brown crab, please see § 0.2 and § 0.3.

2.4.1 Exports

The United Kingdom is the largest exporter of brown crab both in volume and value, making up 68% of total export volume and 55% of total export value in 2020. In the same year, Ireland exported 20% of the total volume and covered 34% of the value. France and Norway both covered 6% of total exports, with France covering 6% of value and Norway 5%.

In 2020, the highest unit price was achieved by Ireland at 11,31 EUR/kg, a 37% increase from 8,26 EUR/kg in 2019. France had the second highest unit price in 2020 with 6,15 EUR/kg, a 13% decrease from 7,05 EUR/kg in 2019. Norway and the UK achieved similar unit prices of 5,28 EUR/kg and 5,39 EUR/kg, a decrease of 16% and 21% respectively since 2019.

Table 3: Total exports of brown crab* from major catch nations (volume in tonnes, value in EUR 1.000)

Country	2017		2018		2019		2020	
	Volume	Value	Volume	Value	Volume	Value	Volume	Value
United Kingdom	10.663	55.136	13.117	89.141	13.682	93.550	9.827	52.921
Ireland	5.576	32.980	5.007	41.246	5.403	44.619	2.878	32.547
France	1.444	8.026	1.230	7.889	1.047	7.383	885	5.446
Norway	759	4.316	883	5.879	798	5.111	858	4.614
Total	18.443	100.459	20.237	144.155	20.930	150.663	14.448	95.528

*Includes all product types, whether live, whole chilled/ frozen, claws chilled/frozen, or meat chilled/frozen/processed.

** Due to rounding there might be small variations between the totals and the sum of data.

Source: EUMOFA elaboration of IHS MARKIT

In 2020, brown crab exports were dominated by live and fresh/chilled products, which accounted for 54% of export volume and 41% of value, and frozen crab, which made up 35% of export volume and 48% of export value. Other preservation types made up the remaining exports, accounting for 12% of export volume and 11% of the total value. The explanation behind the difference in export volumes and values between preservation states may be found in the product compositions of the exports.

³⁹ Woll A, Bakke S., van der Meer G., Krabben (2021), Kolonfon Forlag AS

⁴⁰ *Ibidem*

Brown crab: COVID-19 impact on the supply chain

Frozen brown crab products achieved the highest unit price of 9,09 EUR/kg, a 15% increase from the price of 7,91 EUR/kg in 2019. All other states of preservation experienced a decrease in unit prices. Live, fresh, and chilled brown crab achieved a unit price of 5,09 EUR/kg, a decrease of 24% from 6,74 EUR/kg in 2019, while the price was 6,45 EUR/kg in 2018 and rose by 5% to 2019. With a unit price at 6,18 EUR/kg in 2020, brown crab of other preservation states experienced a 9% decrease from 2019.

The lower price of live, fresh, and chilled products could be due to the fact that live/whole crabs are sold at lower prices per kg compared to processed meat, which are more often sold as frozen or other, pulling down the average unit price.

Table 4: Total exports of brown crab* by preservation state (volume in tonnes, value in EUR 1.000) from major catch nations

Country	2017		2018		2019		2020	
	Volume	Value	Volume	Value	Volume	Value	Volume	Value
Live, fresh, chilled	8.812	42.538	9.480	61.108	11.229	75.700	7.744	39.428
Frozen	8.069	48.926	9.336	72.572	8.112	64.176	5.038	45.810
Other	1.563	8.996	1.421	10.475	1.589	10.787	1.665	10.290
Total	18.443	100.459	20.237	144.155	20.930	150.663	14.448	95.528

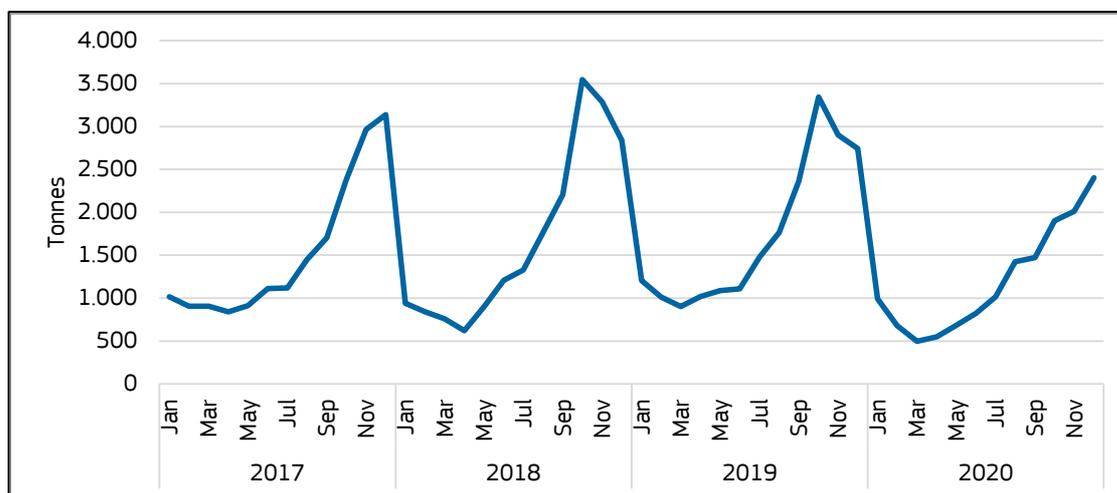
*Includes all product types, whether live, whole chilled/ frozen, claws chilled/frozen, or meat chilled/frozen/processed.

** Due to rounding there might be small variations between the totals and the sum of data.

Source: EUMOFA elaboration of EUROSTAT, IHS MARKIT, and Statistics Norway

A clear seasonality can be seen in export patterns, with peak periods in the late part of the year, from September to December. The peaks in exports reflect the seasonality of brown crab catches, with peak fishing season from April/June to November, depending on fishing area.

Figure 4: Total exports of brown crab* by month and year (tonnes) from major catch nations



*Includes all product types, whether live, whole chilled/ frozen, claws chilled/frozen, or meat chilled/frozen/processed.

Source: EUMOFA elaboration of EUROSTAT, IHS MARKIT, and Statistics Norway

UK

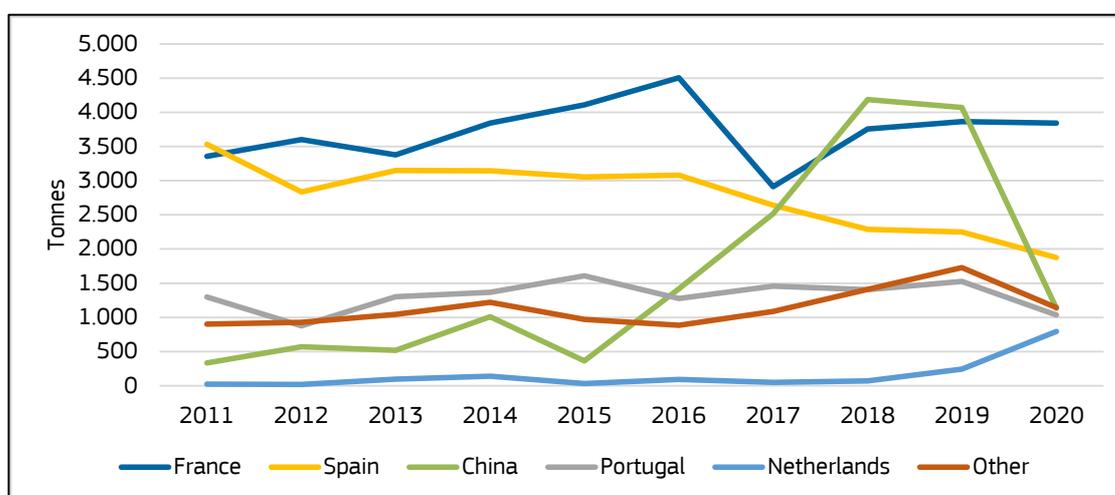
France and Spain have traditionally been the largest export markets for UK brown crab. Exports to China started to grow in 2016, reaching a peak of 4.187 tonnes in 2018 when they surpassed exports to all

other destinations. One year later, in 2019, exports to China dropped due to China's tightening restrictions on brown crab import⁴¹.

The majority (63% in 2020) of British exports are live crab and fresh/chilled crab both with shell and without. Frozen crab, both whole and not in shell, made up 32% of British exports in 2020.

Following concerns about access to the EU market, of which the UK is no longer a part, many Scottish exporters diversified into the Chinese market. However, following restricted market access to China, the Scottish Government has introduced a support package for its crab exporters and measures such as funding to attend international trade shows and facilitation of meet-the-buyer events in order to create export opportunities to more countries⁴². If re-entry to China becomes possible, stakeholders reported that they believed much of their exports would shift from Europe to China, where prices are higher.

Figure 5: UK exports of brown crab* to main destinations (volume in tonnes)



*Includes all product types, whether live, whole frozen, claws, or meat
Source: EUMOFA elaboration of IHS Markit

Ireland

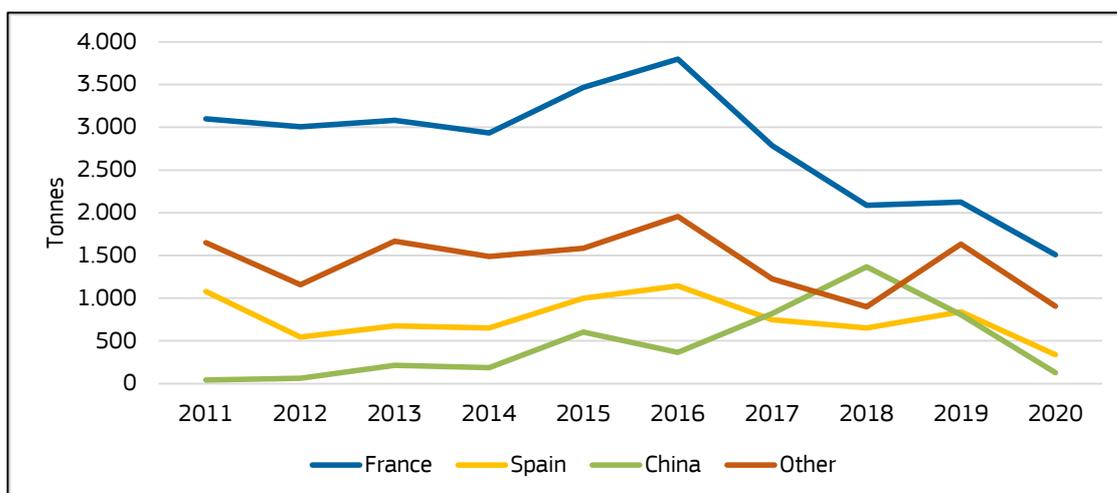
In 2020, Ireland reported 2,878 tonnes of brown crab exports. Both currently and historically, the majority of Irish brown crab exports go to France. In 2020, Ireland reported brown crab exports of 1,508 tonnes to France, representing 52% of the total export volume of this species. However, from the peak of 3,796 tonnes in 2016, this is a decline of 60%. Overall, the total export volume of brown crab from Ireland has decreased by 60% since the peak of 7,266 tonnes in 2016. During the same time span, the value of imports has decreased by 10%.

In 2020, 61% of brown crab exports from Ireland were frozen, either whole or processed. 27% of exports were live or fresh/chilled either whole or meat, and the remaining 12% was crab of other preservation.

⁴¹ See chapter 3.3

⁴² <https://www.seafoodsource.com/news/premium/food-safety-health/scottish-live-crab-exporters-feel-the-pinch-of-chinese-cadmium-crackdown>

Figure 6: Irish exports of brown crab* to main destinations (tonnes)



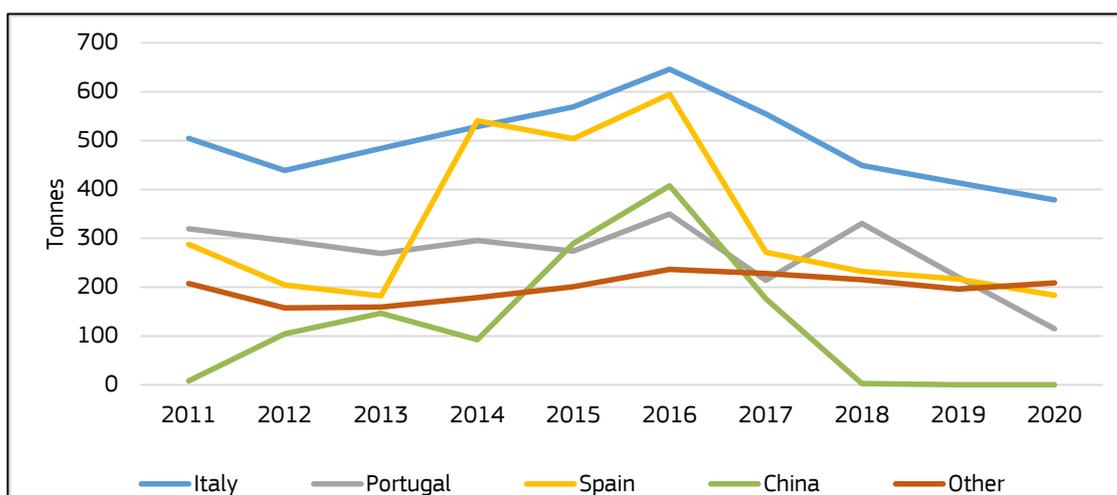
*Includes all product types, whether live, whole chilled/ frozen, claws chilled/frozen, or meat chilled/frozen/processed.
Source: EUMOFA elaboration of EUROSTAT

France

Almost all French brown crab exports were destined for European countries in 2020. Italy was the main destination, accounting for 43% of export volume and 39% of export value in 2020. Spain followed, receiving 21% of total export volume in 2020, but only 14% of value. On the other hand, exports to Portugal made up 13% of the export volume, but 15% of the export value. In 2017, French exports of brown crab to China plummeted as cadmium concentrations were found to be too high⁴³.

The majority (85%) of French brown crab exports in 2020 were live or fresh/chilled whole or meat followed by frozen crab, whole or meat at 11%, and the remaining 4% made up of other types of preservation.

Figure 7: French exports of brown crab* to main destinations (tonnes)



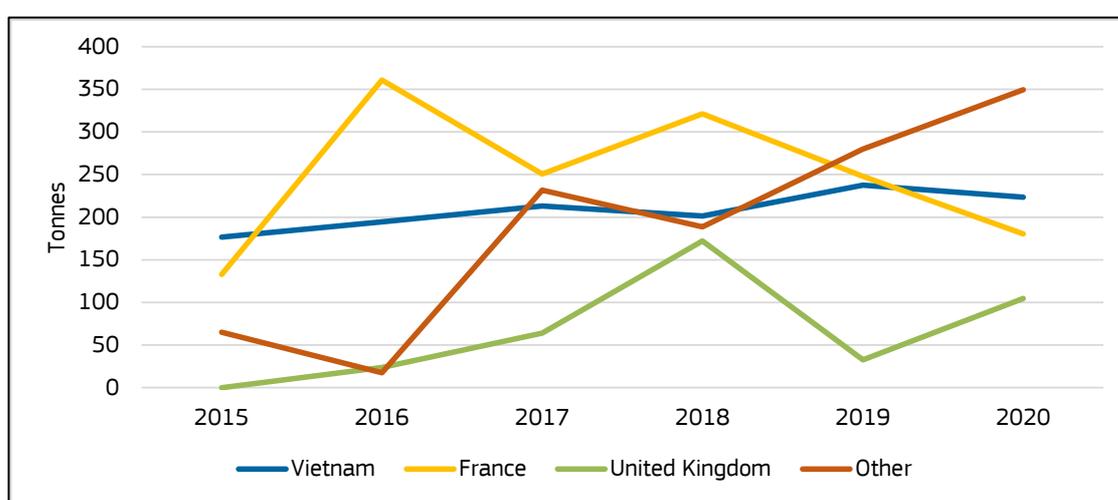
*Includes all product types, whether live, whole chilled/ frozen, claws chilled/frozen, or meat chilled/frozen/processed.
Source: EUMOFA elaboration of EUROSTAT

⁴³ See chapter 3.2

Norway

In 2020, Norway exported a total of 858 tonnes of brown crab. Of this, 26% of the total volume was destined for Vietnam. According to stakeholders, brown crab exports to Vietnam are destined for processing before being reimported to Norway, which explains the low value of these exports. 21% of export volume went to France, covering 29% of total value, and 12% of export volume and value went to the UK. Industry stakeholders estimated that 60-70% of the brown crab exports from Norway to European countries goes to the HoReCa sector. Some of the volume going to HoReCa is also destined for secondary processing before being sold. The remaining export goes to retail or is delivered to hubs (e.g. the Netherlands) for further exports. Currently, Norway is banned from exporting brown crab to China, but some crab from Norway is likely to end up in China, for example boiled crab exported through the UK.

Figure 8: Norwegian exports of brown crab* to main destinations (tonnes)



*Includes all product types, whether live, whole chilled/ frozen, claws chilled/frozen, or meat chilled/frozen/processed.
Source: Statistics Norway

2.5 Consumption

Brown crab is the most consumed crab species in Europe, where it is available as live, fresh, frozen, and processed products⁴⁴. Unfortunately, there is no available data for brown crab consumption. To determine the main importing nations, export statistics for the major catch nations (the UK, Ireland, France, and Norway) are used.

Looking at destination countries of the exports analysed above, it can be assumed that consumption of brown crab is highest in France, Spain, Portugal, and China. France and Norway both have high catch volumes, but exports are relatively low, pointing to high domestic consumption. Within the Norwegian market, stakeholders estimate that 70% of crab products go to the domestic retail sector. In France, an estimated 70% of catches are sold by direct contracts to retailers and wholesalers. The wholesalers may then in turn sell the crab to HoReCa or fishmongers.

In 2020, the main destination for brown crab exports by the major catch nations was France, covering 38% of total export volume and 44% of total export value, followed by Spain and Portugal which received

⁴⁴ <https://www.cbi.eu/market-information/fish-seafood/crab/market-potential>

17% and 10% of the export volume respectively, with values making up 16% and 9% of total value. 9% of total export volume was destined for China, making up 8% of total export value.

Table 5: Main destinations for brown crab exports* by major catch nations (volume in tonnes, value in EUR 1.000)

	2017		2018		2019		2020	
	Volume	Value	Volume	Value	Volume	Value	Volume	Value
France	5.950	34.548	6.166	47.969	6.236	52.058	5.531	41.663
Spain	3.659	15.555	3.189	19.215	3.320	20.276	2.426	14.824
Portugal	1.956	8.829	1.964	11.552	2.184	12.864	1.433	8.869
China	3.512	23.191	5.558	46.250	4.950	41.797	1.302	7.590
Other	3.367	18.335	3.360	19.169	4.240	23.669	3.756	22.582
Total	18.443	100.459	20.237	144.155	20.930	150.663	14.448	95.528

*Includes all product types, whether live, whole chilled/ frozen, claws chilled/frozen, or meat chilled/frozen/processed.

** Due to rounding there might be small variations between the totals and the sum of data.

Source: EUMOFA elaboration of EUROSTAT, IHS Markit, and Statistics Norway

French consumption of brown crab is seasonal with peak periods throughout June to December, usually related to special occasions such as holidays, family gatherings, and Christmas⁴⁵. Consumption habits vary throughout the country and are more important in coastal areas and in northern France. In Norway, brown crab is commonly enjoyed socially during the summer and autumn months, especially in coastal areas. No clear seasonality can be observed in the British consumption of brown crab.

Consumer perception of brown crab varies throughout countries. In nations such as Norway, France, and Spain, crab is viewed as a fresh product and enjoyed socially. Although the brown crab is the most consumed shellfish in the UK, the total consumption is low compared to other countries. As households in the UK do not have the knowledge on acquiring, cooking or preparing live and whole crab; most at-home consumption consists of prepared/preserved crab (e.g. crab meat, dressed crab, crab cakes, soups, etc). Live crabs in the UK are usually sold to the HoReCa sector which cooks and prepare them for customers. In France, brown crabs are typically sold live to be prepared at home, although cooked whole or half crabs and claws are increasing in popularity. In Norway, brown crab can be purchased live from fishmongers or prepared from retail.

According to stakeholders, during the COVID-19 pandemic consumers have become more aware of the options available locally/domestically and, both in support of local businesses and to experiment with diverse ingredients in home cooking, the domestic purchase of crabs increased. Whether this trend will continue is uncertain. The greatest barrier in the UK for increased brown crab consumption, is the availability of crab to the consumer. As fishmongers are becoming scarcer and retailers are closing fresh fish counters, it is becoming difficult for the consumer to be aware of the product and even harder to find it. Although several producers have begun online sales and provide home delivery, it is still difficult to do this for live products. As access to the Chinese market for brown crab exports has become difficult (see chapter 3.3), Dungeness crab (*Metacarcinus magister/ Cancer magister*) from Canada and mud crab (*Scylla serrata*) from South Asian suppliers, including Bangladesh, have become alternative products in China, although brown crab is still considered a more premium product compared to mud crab⁴⁶. Chinese consumers are said to favour female crabs.

⁴⁵ <https://www.seafish.org/document/?id=4B914136-D687-46A1-BD0D-A0BC1EA3E19E>

⁴⁶ <https://www.seafoodsource.com/news/premium/food-safety-health/enhanced-food-safety-inspections-bite-into-market-for-chinese-demand-for-irish-uk-sourced-brown-crab>

3 MARKET CHANGES

3.1 COVID-19

COVID-19 is the name given to the infectious disease caused by the most recently discovered coronavirus (SARS-CoV-2), unknown before its outbreak in Wuhan, China, in December 2019⁴⁷. During the first months of 2020, the disease spread around the world, and it was classified as a pandemic by the World Health Organization (WHO) on 11th March 2020.

In March and April 2020, the number of new COVID-19 infections rose in Europe, and lockdowns were implemented with restrictions on travel, closing of restaurants, cafés, offices, and schools. The number of infections in Europe declined between May and the beginning of July 2020 but began to rise again in mid-July. Since then, the number of COVID-19 infections have risen and fallen and restrictions have been adjusted accordingly. Near the end of 2020, vaccines against COVID-19 were ready for clinical trials, and national vaccination programs began to be implemented.

The impact of COVID-19 was felt by all brown crab stakeholders, but the effect differed depending on the business model. Industry stakeholders reported that the price dropped between 20%-40%.

Live and fresh crab to Asia is normally transported as belly freight⁴⁸, but as passenger planes were grounded, the price of transport increased up to sixfold. Some exporters switched to transport by cargo planes and did not experience major disruptions in their deliveries.

In several countries, processors began offering products online and home delivery services to directly reach consumers. Stakeholders in the UK reported an increase in domestic sales during the pandemic period as customers cooked more at home and became more interested in locally produced species. In addition, several national communication campaigns promoted the purchase of domestic products, including shellfish. Stakeholders have yet to determine whether increased domestic consumption will continue as restrictions are lifted.

In the UK, restaurants were closed for most of 2020 and the initial months of 2021, and both sales of live crab and processed crab suffered as demand from HoReCa disappeared. Many crabs destined for the live market were processed and set in storage, although some were still exported to Europe as prices remained stable.

3.1.1 Landings

Landing data on brown crab for 2020 are only available for the UK and Norway.

In the UK, many fishers refrained from fishing crab as prices were too low to cover costs. In addition, weather conditions caused a poor fishing season. UK landings of brown crab⁴⁹ were down by 20% in 2020, compared to 2019. During the fishing season from June to November, landings were down by between 4% and 28% compared to the year before.

Overall in 2020, Norwegian landings of brown crab were down by 12%. During the main fishing season (June to November), landings were on average lower than in previous years, with the exception of September, where in 2020 landings were 1% higher than in 2019. November had the largest discrepancy, with a 51% lower catch in 2020 than the previous year.

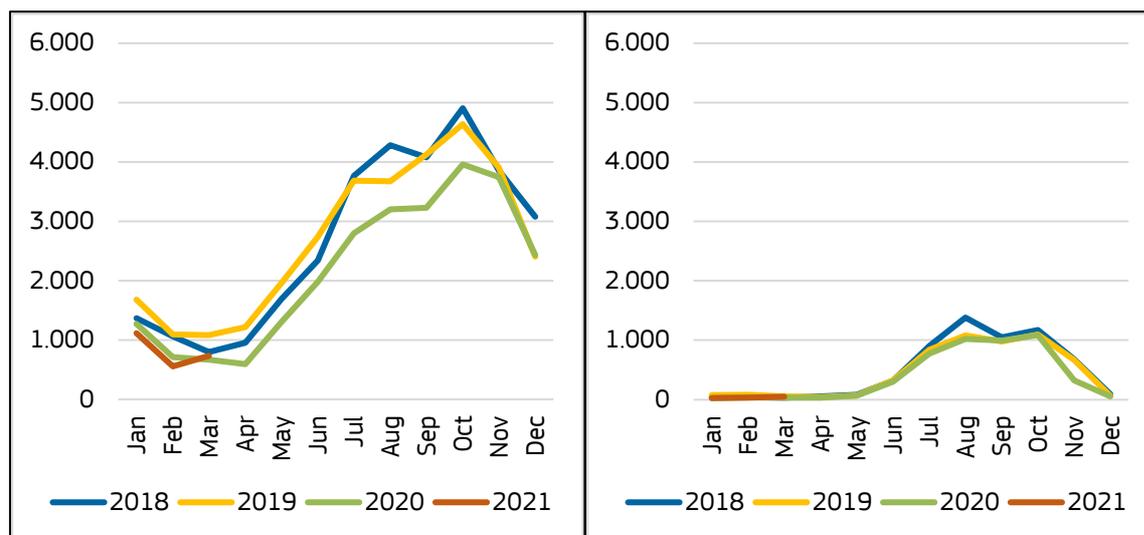
⁴⁷ <https://www.who.int/emergencies/diseases/novel-coronavirus-2019>

⁴⁸ Transportation of goods via passenger aircraft in the lower deck of the aircraft, the "belly" of the plane.

⁴⁹ Data for UK brown crab landings may include some other crab species.

Norwegian crab fishers were shielded from the full impact of COVID-19 as the largest Norwegian processor continued buying crab from fishers and continued its processing activities as usual. Although prices during the first half of 2020 dropped by 20%-40% (the same level as was seen during the 2008 financial crisis), the processor decided to build inventory and refused to sell at heavily discounted prices. Customers were allowed to postpone their purchase and the brown crab was stored in freezer units by the producer. Customers from the HoReCa segment did not have a demand for brown crab until the reopening of the sector during the summer of 2020. By mid-summer, the entire inventory was sold out at relatively normal prices.

Figure 9: Landings of brown crab in the UK (left) and Norway (right) in tonnes



Source: GOV.UK and Directorate of Fisheries (Norway)

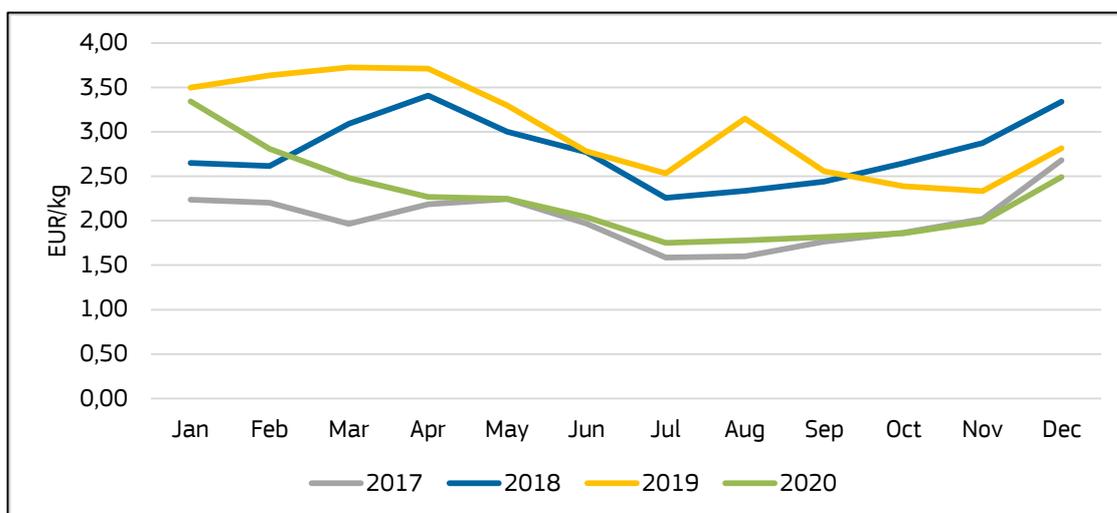
Although no landing data are available for France, stakeholders report that the French brown crab sector was not severely impacted by the COVID-19 pandemic. The period affected by strict lockdown measures (March to May) is a low season for crab fishing and only a few fishing trips were conducted in the Channel. To avoid a drop in prices by landing too high volumes, the French stakeholders organised a rotation to ensure volumes landed did not exceed demand. However, when the fishing season started in June in the Celtic Sea, along the western English coast, the lockdown was over, and restaurants began to open creating demand for brown crabs.

3.1.2 First sales

The majority of brown crab from targeted fisheries are sold via contracts and therefore not registered as first sales. However, bycatch of brown crab may be sold at auction and is registered as first sales data.

In 2020, a total of 12,529 tonnes of brown crab were registered at the first sales stage in the UK. This was a decrease of 19% since 2019. Throughout 2020, first-sales prices for brown crab were lower than in 2019. The weighted average first sales price for 2020 was 2,24 EUR/kg, 26% lower than the average price of 3,04 EUR/kg in 2019.

Figure 10 First sales prices of brown crab in the UK (EUR/kg)

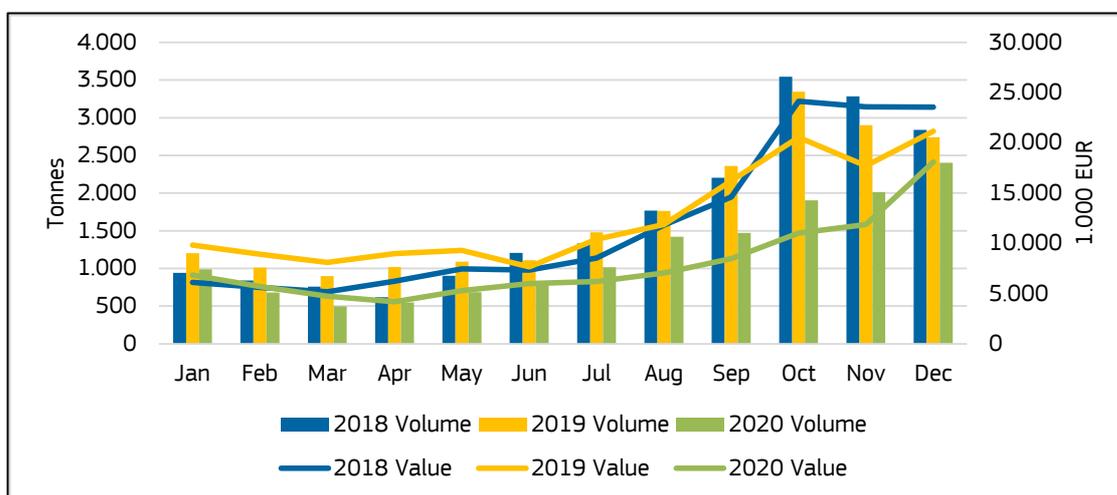


Source: EUMOFA

3.1.3 International trade

The peak season for exports, which usually runs from September to December, did not reach the same peaks in 2020 as in previous years. On average the volume of brown crab exports by the major catch nations was down by 31% from 2019 to 2020, and down by 29% since 2018. The average of export value was down by 37% compared to 2019.

Figure 11: Total exports of brown crab* from major catch nations by volume (left, tonnes) and value (1.000 EUR, right)



*Includes all product types, whether live, whole chilled/ frozen, claws chilled/frozen, or meat chilled/frozen/processed.

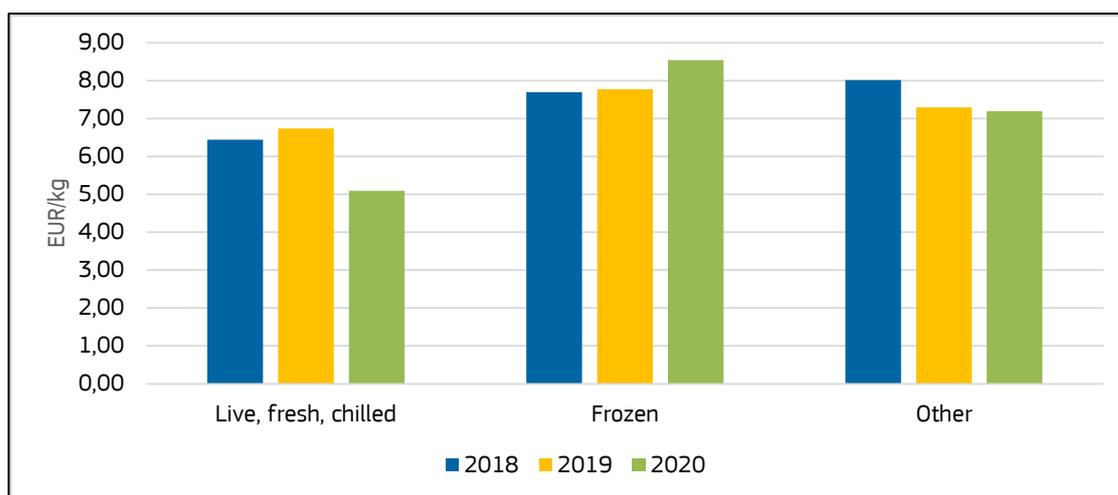
Source: EUMOFA elaboration of EUROSTAT, IHS MARKIT, and Statistics Norway

The price trend for live, fresh, and chilled brown crab has been positive since 2017; for example, it rose by 34% from 2017 to 2018 and by 5% from 2018 to 2019. However, the price for live, fresh and chilled brown crab decreased by 24% between 2019 and 2020 (falling from 6,74 EUR/kg in 2019 to 5,09 EUR/kg in 2020). The deviation from the positive trend is likely due to the COVID-19 outbreak. Indeed, live crabs

are typically destined for the HoReCa sector, and demand for this product decreased when restrictions were introduced, and prices were pushed down.

The unit price of frozen brown crab products increased by 10% from 2019 to 2020. This follows a positive trend of increasing unit price since 2017. The increase in unit price for frozen crab products could be a result of more crab being processed into meat and frozen, which is sold at a higher price than whole crab.

Figure 12: Average unit price (EUR/kg) of brown crab* exports from major catching nations



**Includes all product types, whether live, whole, claws, or meat.*

Source: EUMOFA elaboration of EUROSTAT, IHS MARKIT, and Statistics Norway

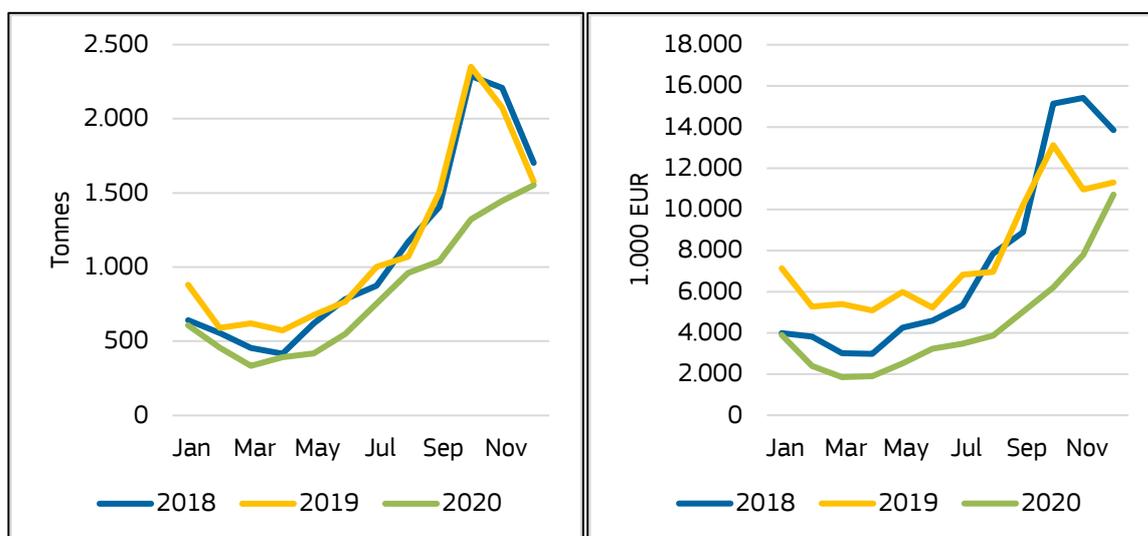
UK

A significantly lower volume of crab was exported from the UK during the peak season from September to December 2020, 29% and 30% lower than the same period in 2019 and 2018, respectively. The value of exports at this time was 35% and 44% lower compared to the same period in 2019 and 2018, respectively. For the entirety of 2020, the volume of British exports was 28% lower than in 2019, while the export value decreased by 43%.

The largest reduction in export volume was seen for brown crab destined for China, which was 72% lower in 2020 compared with 2019, falling from 4.072 tonnes to 1.134 tonnes. According to stakeholders, this could be because of increased cadmium testing in China and/or reduction in Chinese demand due to fear of finding COVID-19 on imported seafood.

It is interesting to note that in total, British exports of brown crab to the Netherlands increased by 225% from 2019 to 2020, and by 1045% from 2018 to 2020. This could be a result either of the Netherlands continuing to function as a hub during the pandemic, or of the easier access to the Chinese market by sending brown crab via the Netherlands (ref chapter 3.3).

Figure 13: Total UK exports of brown crab* in tonnes (left) and 1.000 EUR (right)



**As reported by exporter nations*

***Includes all product types, whether live, whole chilled/ frozen, claws chilled/frozen, or meat chilled/frozen/processed.*

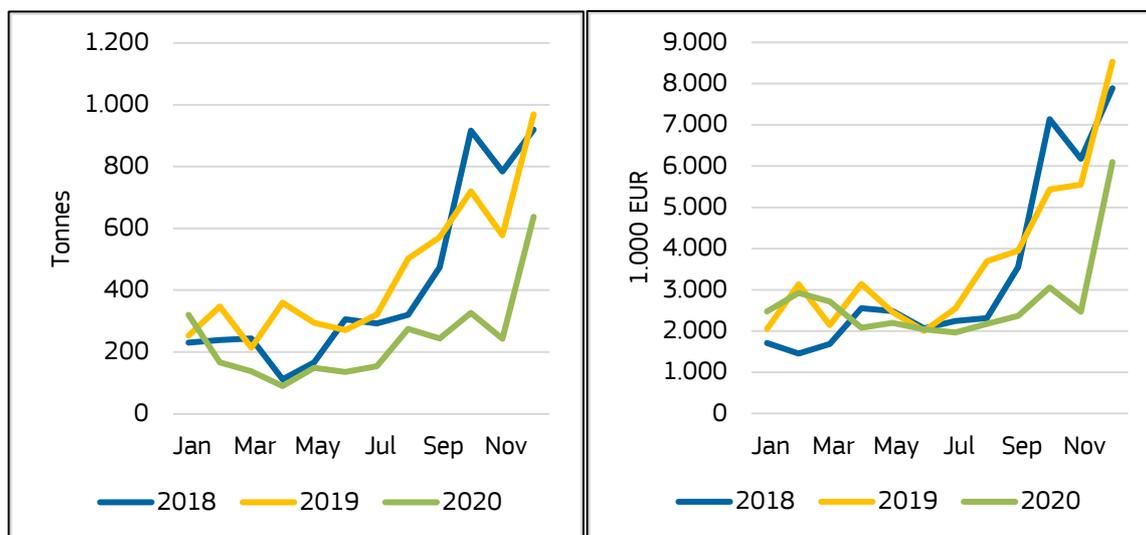
Source: IHS MARKIT

Ireland

With the exception of January, exports were lower in each month of 2020 compared to the previous two years. During the peak season for brown crab exports (September-December), the total exported volume was 49% lower than in the previous year, and 53% lower than in the same period in 2018. The value of exports during the high season in 2020 were 35% and 44% lower than in 2019 and 2018 respectively.

During the low season for brown crab exports (January-August), the value of exports in 2020 was only 12% lower than in 2019, but 13% higher compared to 2018. The volume of exports during the low season in 2020 was lower than the previous two years, 44% and 25% compared with 2019 and 2018 respectively. This could point to a larger part of the exports consisting of processed meats which sell at a higher price per kilo compared to whole crab.

Irish brown crab exports reached a total of 2.878 tonnes in 2020, a decrease of 47% compared with the total export volume of 5.404 tonnes in 2019. In total, the value of exports decreased by 27% during the same time period.

Figure 14: Total Irish exports of brown crab* in tonnes (left) and 1.000 EUR (right)

*Includes all product types, whether live, whole chilled/frozen, claws chilled/frozen, or meat chilled/frozen/processed.

Source: EUROSTAT

Netherlands

The Netherlands exported 3.593 tonnes of brown crab in 2020 at a value of EUR 3 million. As the Netherlands is not a major fishing nation of brown crab, the increase in export, especially post 2018, is likely due to re-export of crab originally imported from other countries. Indeed, the major catching nations reported a total of 1.030 tonnes of brown crab exports to the Netherlands in 2020, an increase of 104% since 2019 and 1063% since 2018. The majority of these came from the UK, which covered 77% of the exported volume to the Netherlands.

The majority of Netherlands brown crab exports is destined for China, constituting 92% of both export volume and value in 2020. Exports to the second most significant destination, Belgium, made up 3% of volume and value in 2020. The increased market share of exports to China rose from near nothing in 2016 to 3.288 tonnes in 2020.

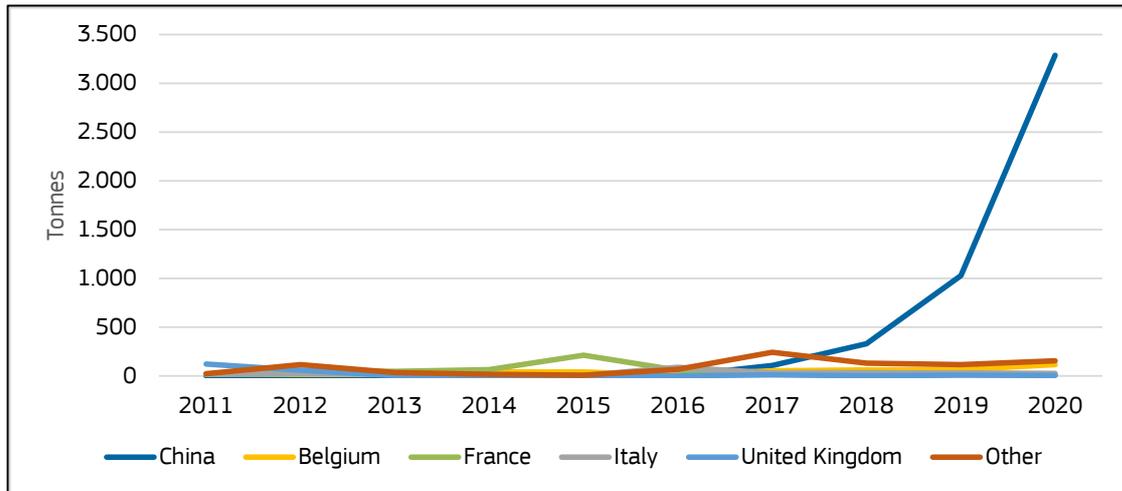
China's increased restrictions on cadmium testing⁵⁰ made it difficult for the UK to export brown crab to China. As the Netherlands were still allowed to export to China without the same stringent cadmium testing regimes, the UK crab exported crab to China via the Netherlands for a short while. This could explain the rise in Dutch crab exports in the end of 2019. Demand for brown crab likely decreased near the end of January 2020, as China went into lockdown.

As Europe went into lockdown, the Netherlands' main airport, Schiphol, remained a viable hub for export, likely also contributing to the increased exports of brown crab from the Netherlands in 2020. The spike in July can be attributed to higher exports of live, fresh, and chilled brown crab, in addition to other products.

In 2020, brown crabs which are dried, salted, smoked, in brine, cooked by steaming or by boiling in water, covered 41% of exports volume from the Netherlands, and 39% of the value. Frozen crab covered 38% and 36% of the export volume and value respectively, and live and fresh/chilled crab constituted the remaining exports.

⁵⁰ See more in chapter 3.2.

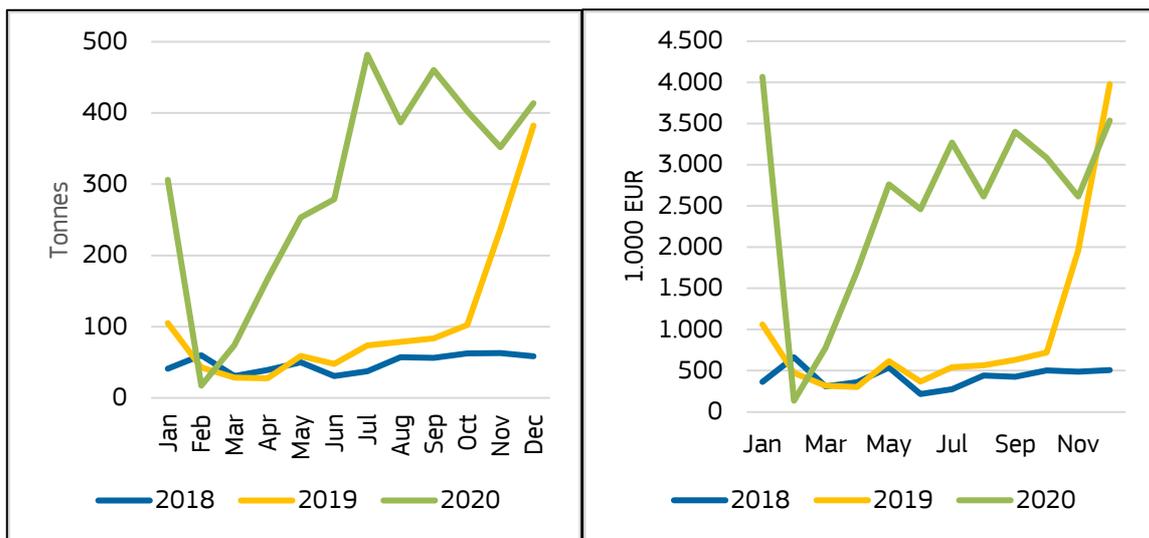
Figure 15: Dutch exports of brown crab* to main destinations (tonnes)



*Includes all product types, whether live, whole chilled/ frozen, claws chilled/frozen, or meat chilled/frozen/processed.
Source: EUMOFA elaboration of EUROSTAT

Figure 16: Total Dutch exports of brown crab* in tonnes (left) and 1.000 EUR (right)

*Includes all product types, whether live, whole chilled/ frozen, claws chilled/frozen, or meat chilled/frozen/processed.



Source: EUMOFA elaboration of EUROSTAT

3.2 Cadmium

Brown meat contains higher quantities of cadmium than white meat, as the brown meat contains the crab's digestive organ - the hepatopancreas - which accumulates cadmium⁵¹. Cadmium is a nonessential heavy metal which can promote significant adverse health effects in humans and animals⁵². The EU has established a maximum cadmium level for white meat for safe consumption at 0.5 mg/kg. In Norway, the official safety advice is to not exceed 40 grams of meat of crabs caught in the south, and 12 grams of meat from crabs caught in the north^{53,54}. In general, consumption of white meat is considered safe while caution is urged when consuming brown meat, especially for children and pregnant women.

In 2019, China imposed increased control measures on the import of live brown crab. This has reduced market access for all exporters, with the exception of crab caught and exported from the Netherlands. Chinese standards and testing regimes cover all edible parts of the crab (including brown meat which contains higher levels of cadmium). In contrast, EU regulations only cover white meat⁵⁵. China previously banned brown crab imports in 2015, shortly after the market was opened, before lifting the ban the following year⁵⁶. Although brown crab contains cadmium, the Chinese testing regime is subject to the political climate between trading countries, according to stakeholders. Currently, the understanding of Chinese importers is that brown crabs should come from a designated area in Dutch waters, not from Ireland or the UK⁵⁷. This helps to explain the increase in imports from the Netherlands, and the decrease of imports from the UK, Ireland, Norway, Portugal, and Spain. Stakeholders report that the mortality of crabs is high during the testing period in China, which may take several days, leading to significant economic loss. This is a barrier for stakeholders interested in exporting brown crab to China.

The Chinese embargo on French brown crab exports in 2017 due to high cadmium levels did not impact the French market to the same degree as other exporting nations. As France reduced their exports to China, the UK filled the gap and increased their exports of brown crab to China. As a consequence, exports to France and other EU markets decreased, which increased prices of brown crab in France. A French stakeholder reported that because of this, the Chinese trade embargo on French brown crab was beneficial to their business.

To meet with the Chinese standard for cadmium testing, Ireland's Sea Fisheries Protection Authority (SFPA) introduced a health certification regulatory regime which includes results from pre-consignment testing. However, the validity of these tests was questioned following accusations of crab exports with cadmium levels above official Chinese levels⁵⁸.

⁵¹

https://ec.europa.eu/food/sites/food/files/safety/docs/cs_contaminants_catalogue_information_note_cons_brown_crab_en.pdf

⁵² Ariano, Andrea & Lo Voi, Andrea & D'Ambola, Massimiliano & Marrone, Raffaele & Cacace, D. & Severino, Lorella. (2015). Levels of Cadmium in White and Brown Meat of Warty Crab (*Eriphia verrucosa*). *Journal of Food Protection*. 78. 2253-2256. 10.4315/0362-028X.JFP-15-214.

⁵³ Crabs in northern waters are found to contain more cadmium, most likely because cooler water temperatures make crabs to grow more slowly, allowing cadmium to build up to higher levels.

⁵⁴

https://www.matportalen.no/uonskedestoffer_i_mat/tema/miljogifter/hvorfor_er_det_saa_mye_mer_kadmium_i_krabbe_fra_nord_og_hvor_mye_krabbe_kan_du_spise_hver_uke#:~:text=Kadmiumet%20i%20krabben%20sitter%20i,at%20det%20er%20et%20problem.&text=Mattilsynet%20advarer%20i%20dag%20mot,spis%20selvfanger%20krabbe%20fra%20salten

⁵⁵ <https://www.seafoodsource.com/news/premium/food-safety-health/scottish-live-crab-exporters-feel-the-pinch-of-chinese-cadmium-crackdown?private=true>

⁵⁶ <https://www.shetnews.co.uk/2020/02/05/chinese-market-for-crab-and-salmon-suffers-sudden-decline/>

⁵⁷ <https://www.seafoodsource.com/news/premium/food-safety-health/enhanced-food-safety-inspections-bite-into-market-for-chinese-demand-for-irish-uk-sourced-brown-crab>

⁵⁸ <https://www.seafoodsource.com/news/premium/food-safety-health/irish-memo-casts-doubt-on-validity-of-cadmium-testing-for-china-bound-crabs?private=true>

3.3 Brexit

According to stakeholders, exports from the UK could experience delays of 36-48 hours on the border following the end of the transition period prior to January 2021. With a live delicate product such as crab this was very difficult to manage and many exporters refrained from exporting in this timeframe. At the time of interviewing stakeholders, delays of up to 5 hours could be expected. Live brown crab exported by truck from the UK is mostly destined for fish markets. As fish markets typically only operate at certain times of the day (most commonly in the early morning), missing the delivery time results in much longer storage periods. The rate of mortality increases with the storage time and avoiding delays in deliveries is critical both for animal welfare and profits.

If re-entry to China becomes possible, stakeholders find it likely that much of the exports will shift from Europe to China where prices are higher. This might also incentivise more fishers to catch crab. In addition, the bureaucracy of exporting to the EU post-Brexit provides a higher administrative workload including many certificates and paperwork, relative to exporting to China where just one certificate is needed.

4 CONCLUDING REMARKS

The COVID-19 pandemic represented a shock for the brown crab sector in 2020. The pandemic disrupted the supply chain, tested the robustness of the sector, and forced innovation. The effect of the pandemic hit stakeholders differently depending on their business model.

Brown crab is a seasonal product with the majority of fishing taking place from May to November. As COVID-19 restrictions were eased in many nations during the summer of 2020, sales to the HoReCa sector were still feasible. However, it is still apparent that stakeholders whose business mainly consisted of sale of live crab were hit the hardest by the COVID-19 pandemic, especially with the periodical closure of the HoReCa segment. As live crab is a very time-sensitive product, alternative market outlets were difficult to access. Although stakeholders reported increased domestic demand as consumer focus turned to locally sourced produce, this did not compensate the closure of HoReCa.

Processors who had diversified sales to both retail and HoReCa were better equipped to keep up sales when one market disappeared as opposed to those who only sold crabs to HoReCa. Stakeholders who were able to obtain liquidity, either through their own means or through governmental channels, and to build and access freezing storage, had a large advantage when the pandemic hit. Some producers allowed customers to postpone their purchases, building inventory, in order to sell the inventory at normal prices later. This strategy, which was especially prominent in Norway, shielded fishers from the full impact of the pandemic.

Domestic market potential, especially in the UK, is large, but lack of knowledge on how to prepare brown crab hinders demand. In addition, potential consumers have difficulty accessing the product as more fish counters in retail stores close and fewer fishmongers can be found. Stakeholders have innovated their businesses, with many expanding their selection of processed products and value-added products. In addition to online sales and home delivery, many stakeholders have increased their promotion of local products.

The Chinese market for brown crab is large, but currently relatively unexploited. All stakeholders expressed a desire to export to this market, but the current cadmium testing restrictions make this unprofitable.



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