WORKING GROUP ON THE BIOLOGY AND LIFE HISTORY OF CRABS (WGCRAB; outputs from 2019 meeting)

VOLUME 3 | ISSUE 32

ICES SCIENTIFIC REPORTS

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ICES INTERNATIONAL COUNCIL FOR THE EXPLORATION OF THE SEA
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ISSN number: 2618-1371

ICES Scientific Reports

Volume 3 | Issue 32

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Recommended format for purpose of citation:

ICES. 2021. Working Group on the Biology and Life History of Crabs (WGCRAB; outputs from 2019 meeting). ICES Scientific Reports. 3:32. 68 pp. https://doi.org/10.17895/ices.pub.8003

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Contents

i Executive summary

The Working Group on the Biology and Life History of Crabs (WGCRAB) is focused on the main exploited crab and lobster species in North-West Europe and North-East America to deliver stocks status and new knowledge on ecology and biology.

In this report, the working group presents the data and results which were available to develop the main methods to produce robust stock diagnostics. The report details where the data are missing and what work needs to be put in place to achieve this. Depending on the country, the administrative rules, resources available to follow the fisheries in place and the data available are different. This has led to different ways to analyse data and produce diagnostics on stocks status. Development of indices with long time-series have been used to follow stocks in some countries. Other countries produce stock diagnostics every three years from specific models using the data recorded during the three year period. The data available by country are variable and it is not standardized in a way to develop the same methodology approaches at a large stock scale. Many fleets targeting crabs are made of small vessels (less 10 meters) where data on activities are scattered without data collection taking place in different national programs. For most countries, the management rules in place provide a way to control ongoing trap fisheries The control of effort and the access of the fisheries are key to manage the main stocks in particular those with quotas.

There have been several studies on biology and ecology of crabs and lobsters but it is considered that more work needs to be performed on growth or migration, for example to establish the impact of climate change. Few studies have been focused on diseases but some biomass fluctuations should be studied looking at this aspect. Further work will be oriented to have diagnostics at stock scale when stocks are shared by fleets involving different countries.

ii Expert group information

Expert group name	Working Group on the Biology and Life History of Crabs (WGCRAB)
Expert group cycle	Multiannual
Year cycle started	2017
Reporting year in cycle	3/3
Chair	Martial Laurans, France
Meeting venue(s) and dates	3–6 November 2017, Brest, France, 12 participants
	3–6 November 2018, Saint Hélier, Jersey, 14 participants
	4–8 November 2019, Tromsø, Norway, 13 participants

1 Summary of Achievements

1.1 France, lobster (*Homarus gammarus*) and brown crab (edible crab) stocks

From fisherman declarations (logbook and fishing sheet), new approach has been developed with a new way to select the data and a new model to estimate abundance index. All fishing regions have been studied with a time-series of 10 years or more.

1.2 Isle of Man, lobster (*Homarus gammarus*) and brown crab (edible crab) stocks

In order to get more accurate data, some vessels around Isle of Man have been equipped with electronic logbook associated with environmental sensors fixed in some pots. From these new data, many data on the spatial distribution of the species and the seasonal variations have been recorded. In parallel, some tests are performed to automatize sampling of size for lobster and brown crab from automatic analyses of pictures. No assessment at present.

http://fisheries-conservation.bangor.ac.uk/iom/documents/71.pdf

1.3 Scotland, lobster (*Homarus gammarus*) and brown crab (*Edible crab*) stocks

Assessments have been performed inside of 12 management regions. The stock assessments for lobster and brown crab continue to be based on LCAs for 3-year periods. From current fishery data, no long term index can be developed, it is why some analyses to estimate abundance index have been developed from independent dredge surveys where brown crab is an untargeted species. Due the protocol used, the abundance index and the spatial distribution seem robust.

https://data.marine.gov.scot/dataset/crab-and-lobster-fisheries-scotland-results-stock-assessments-2013-2015

1.4 Norway, king crab (*Paralithodes camtschaticus*) and snow crab (*Chionoecetes opilio*) and brown crab (edible crab) stocks

Brown crab stock continue to be assessed from reference fleet data. Some vessels along the coast record many data which are used to follow the long term trend of several index of the brown crab stock.

Bakke, Snorre; Buhl-Mortensen, Lene; Buhl-Mortensen, Pal, 2019. Some observations of *Cancer pagurus*, Linnaeus 1758 (Decapoda, Brachy-Ura) in deep water. Crustanea, Volume: 92 Issue: 1 Pages: 95-105 .

Bakke, Snorre; Larssen, Wenche E; Woll, Astrid K, 2018. Size at maturity and molting probability across latitude in female *Cancer pagurus*. Fisheries Research, Volume: 205 Pages: 43-51

The king crab stock is followed thanks to trawl surveys independent data and a global model with a fitted Bayesian development is applied. On the snow crab, further activities are put in

place to better understand the increase of the spatial distribution in the Barents Sea. First trap surveys have supplied useful data.

Significant work has been carried out by a Phd regarding contaminants in brown crab. Focus on Cadnium level has been studied to understand the origin and the spatial distinction between regions. Some other works have been performed too on lobster and nephrops.

Wiech, Martin; Vik, Eirin; Duinker, Arne, 2017. Effects of cooking and freezing practices on the distribution of cadmium in different tissues of the brown crab (*Cancer pagurus*), 2017. Food Control, Volume: 75 Pages: 14-20

1.5 England, lobster (*Homarus gammarus*) and brown crab (*Edible crab*) stocks

As in Scotland, assessment stocks are based on LCA for 3 year periods for lobster and brown crab. Several management regions are defined along the coast in North Sea, Western and Eastern Channel and Celtic Sea. Currently, works are in place to develop new automatic tools to get more data of size structure in region with information. In the same way, a project using video systems try to bring data to estimate catpturability of lobster.

https://www.gov.uk/government/publications/crab-and-lobster-stock-assessment-2017

1.6 Canada, snow crab (*Chionoecetes opilio*) stocks

From many sources of data, index are estimated to follow the state of the stocks. Using environmental data, some forecast are estimated for the recruitment. Recently, new procedures have been developed to propose precautionary approaches.

Mullowney, D., Baker, K., Pedersen, E., and Osborne, D. 2018. Basis for A Precautionary Approach and Decision Making Framework for the Newfoundland and Labrador Snow Crab (*Chionoecetes opilio*) Fishery. DFO Can. Sci. Advis. Sec. Res. Doc. 2018/054. iv + 66 p.

2 Final report on the terms of reference

2.1 Norwegian edible crab (*Cancer pagurus*) stock

ToR a) Landing, discard, effort and catch data

The fishery

After a peak in 2007 with 8500 tonnes, total landings of edible crab in Norway have reached a stable level and fluctuated mostly between 4600 and 5800 tonnes (Figure 1). Edible crab is fished along most of the Norwegian coast, from the Skagerrak area in the southeast to the Troms area in the north. However, landings of edible crab vary strongly among the regions, and mid-Norway, specifically the areas between Møre-Romsdal and Helgelandskysten (statistical areas 6 and 7), have developed into the main fishing areas since the early 2000s.

The fishing fleet is dominated by small-scale vessels; of 352 vessels reporting more than 100 kg of edible crab landings in 2018, 95% were below 11 m vessel length, and only 1 vessel was larger than 15 m. Access to the fishery is currently unrestricted and largely unregulated, except for a minimum size limit (11 cm and 13 cm carapace width (CW), respectively, south and north of 59°30' N). To reduce by-catch of European lobster, escape openings for lobster are required in all but a few regions. In addition, a significant recreational fishery targets edible crab. No information on recreational landings are available, although it can be assumed that they are sizeable compared to the commercial fishery.

Reference fleet

Stock and catch data for Norwegian edible crab is provided by a reference fleet of crab fishers. The number of participating crab fishers has varied from 5 to 25 fishermen in the period 2001 to 2019. The reference fleet provides data on landings and discard rates (unstandardized), size (carapace width) and sex ratio, and discards of females with external roe, soft shell crabs, crabs below minimum size limit, and for other reasons (damaged crabs, crab with black spots or missing limbs.). In 2017, measurements of 5165 individual crabs were registered.

Despite substantial variation and uncertainty caused by the low participation rate in some years, the time-series of reference fleet offers important insights into stock status and development of the fishery for an otherwise strongly data-limited fishery. Since 2015, reporting of the reference fleet has been reduced to a biannual cycle to increase instead the number of fishermen reporting from all statistical areas and, thus, the data quality.

Stock status

Due to the limited data availability, no analytical assessment or reference point exist for the Norwegian stock of edible crab. However, catch sizes (Figure 2) and CPUE (Figure 3) as registered by the reference fleet show no major changes over time. This picture is consistent with the stable to positive trend in total landings of the commercial fishery. Considering that the fishery is open-access and, thus, self-regulated, the available information indicates a robust status of the stock and a sustainable fishing pressure.

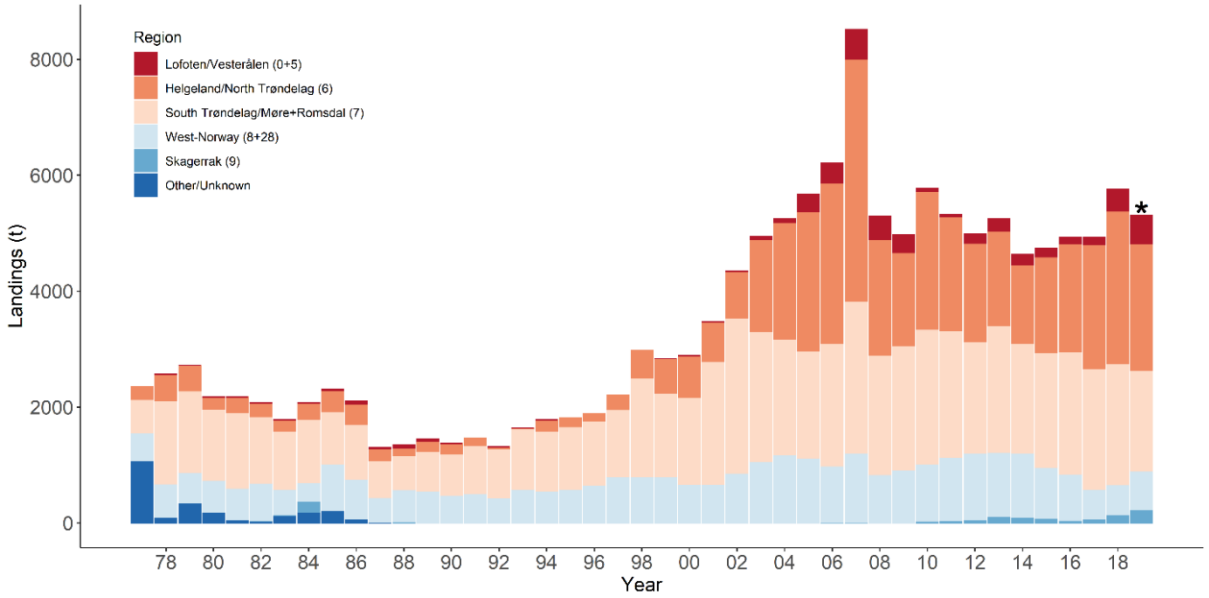


Figure 1. Total Norwegian landings of *Cancer pagurus* per region (statistical area) for the years 1977 to 2019 (*until December) based on landing slips.

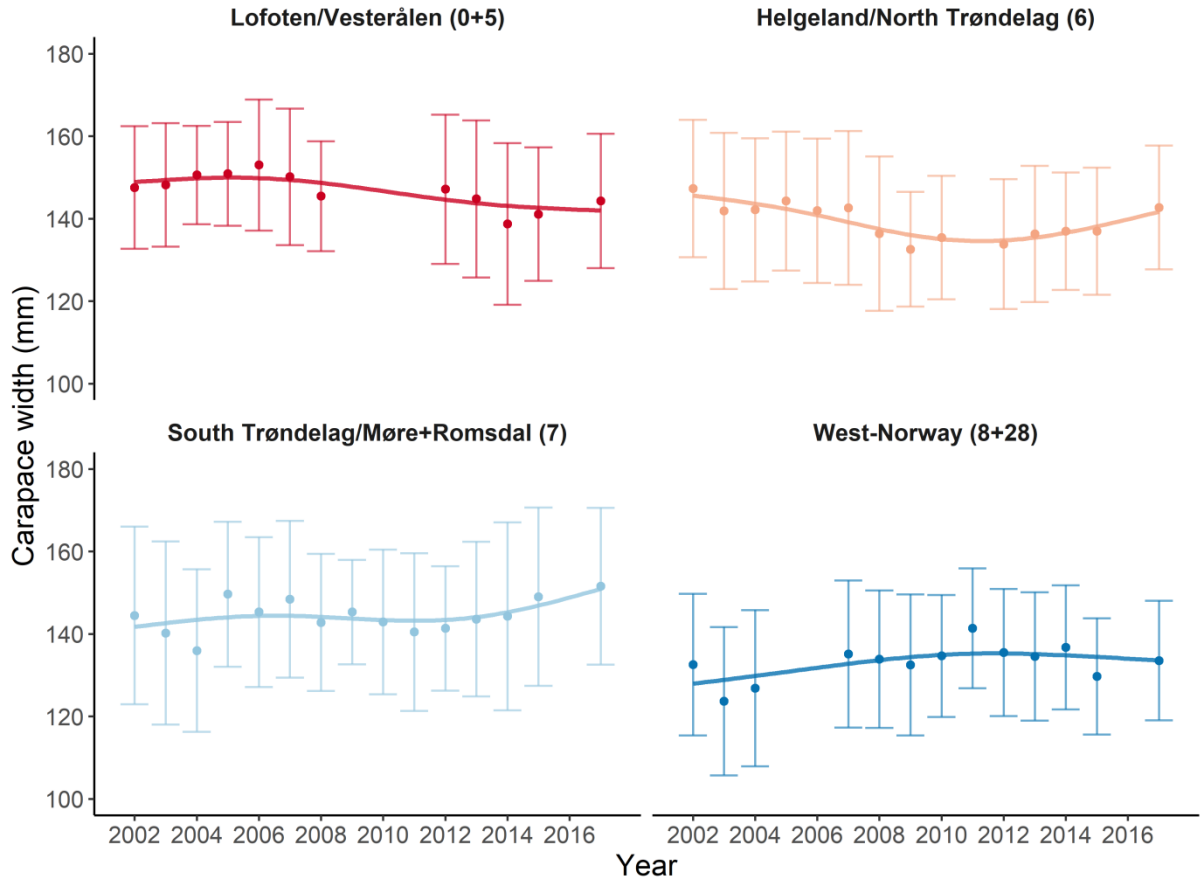


Figure 2. Annual mean carapace width (dots) of edible crab and corresponding standard deviation (error bars) as registered by the reference fleet in the four major fishing regions (representing 5 statistical areas) between 2002 and 2017. Solid lines show trends based on GAM smoothing functions.

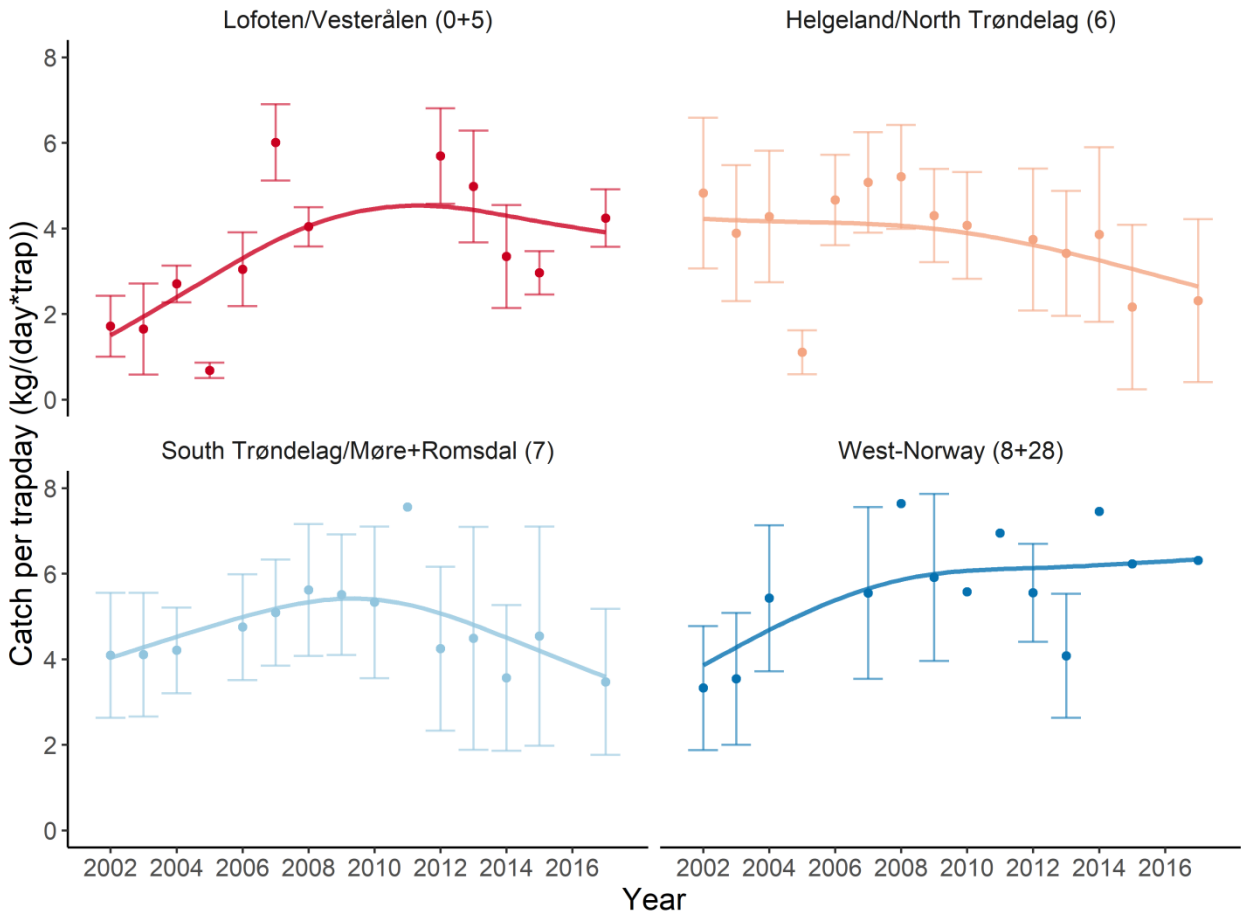


Figure 3. Annual mean catch per trapday (kg per days soaking and trap) (dots) of edible crab and corresponding standard deviation (error bars) as registered by the reference fleet in the four major fishing regions (representing 6 statistical areas) between 2002 and 2017. Solid lines show trends based on GAM smoothing functions.

2.2 Scotland edible crab (*Cancer pagurus*) stock

ToR a) Landing, discard, effort and catch data

Total Scottish landings of brown crab fluctuated between 9500 and 12 300 tonnes from 2009 to 2018 (Table 1). The principal fishing areas for brown crab in Scotland are Orkney, East Coast, Hebrides and South Minch (Figure 4); landings from these areas accounted for over 60% of the total in 2018. Landings from the offshore areas of Sule and Papa increased sharply in the 1990s when the fishery expanded, but have decreased in the last years. Landings from Orkney and East Coast showed an increasing trend in recent years (Figure 5). The majority of crabs fished in Scottish waters are landed in the third and fourth quarters of the year.

Table 1. Annual Brown crab landings (tonnes) into Scotland by creel fishery assessment unit from 2009–2018. Data from Fisheries Management database.

Assessment unit	Year									
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Clyde	99.4	139.3	137	182.8	159.3	189.6	180.2	181.1	321.4	337.2
East Coast	778.6	1029.0	1091.3	1213.9	1271.3	1305.9	1200.2	1608.7	1768.1	1743.5
Hebrides	1822.3	1885.8	2433.3	1996.5	2130.2	2667.2	2218.2	2391.3	1819.7	1414.4
Mallaig	8.5	12.9	21.3	69.6	6.7	17.5	10.7	25.8	8.3	24.3
North Coast	568.3	681.9	428.7	514.2	571.2	537.8	1015.7	1046.1	869.3	592.6
Orkney	1155.6	1462.1	1746.6	1693.7	1906.2	1958.8	2037.9	2462.9	2444.1	2064.9
Papa	1002.0	878.2	884.2	828.2	936.3	1239.4	929.8	888.4	786.4	617.5
Shetland	390.2	334.4	419	478.4	604.9	666.1	457.5	282	474.7	550.6
South East	308.0	345.7	356.7	447.1	469.9	396.2	457.4	619.6	633.2	582.2
South Minch	1000.7	1651.3	1632.4	1094.4	869.8	1191.6	692.5	982.2	1040.6	1152.0
Sule	1981.8	1928.9	2275.5	1611.2	1491.6	1703.6	1629.9	1298.4	950.3	687.3
Ullapool	192.1	245.4	244.9	687.2	439.0	400.9	207.6	318.1	439.5	434.6
Outside Assess. Units	158.7	261.9	188.2	74.7	34.3	31.5	51.4	36.6	44.4	176.7
Total	9466.1	10856.7	11859.1	10891.9	10890.6	12306.0	11089.0	12141.2	11599.9	10377.8

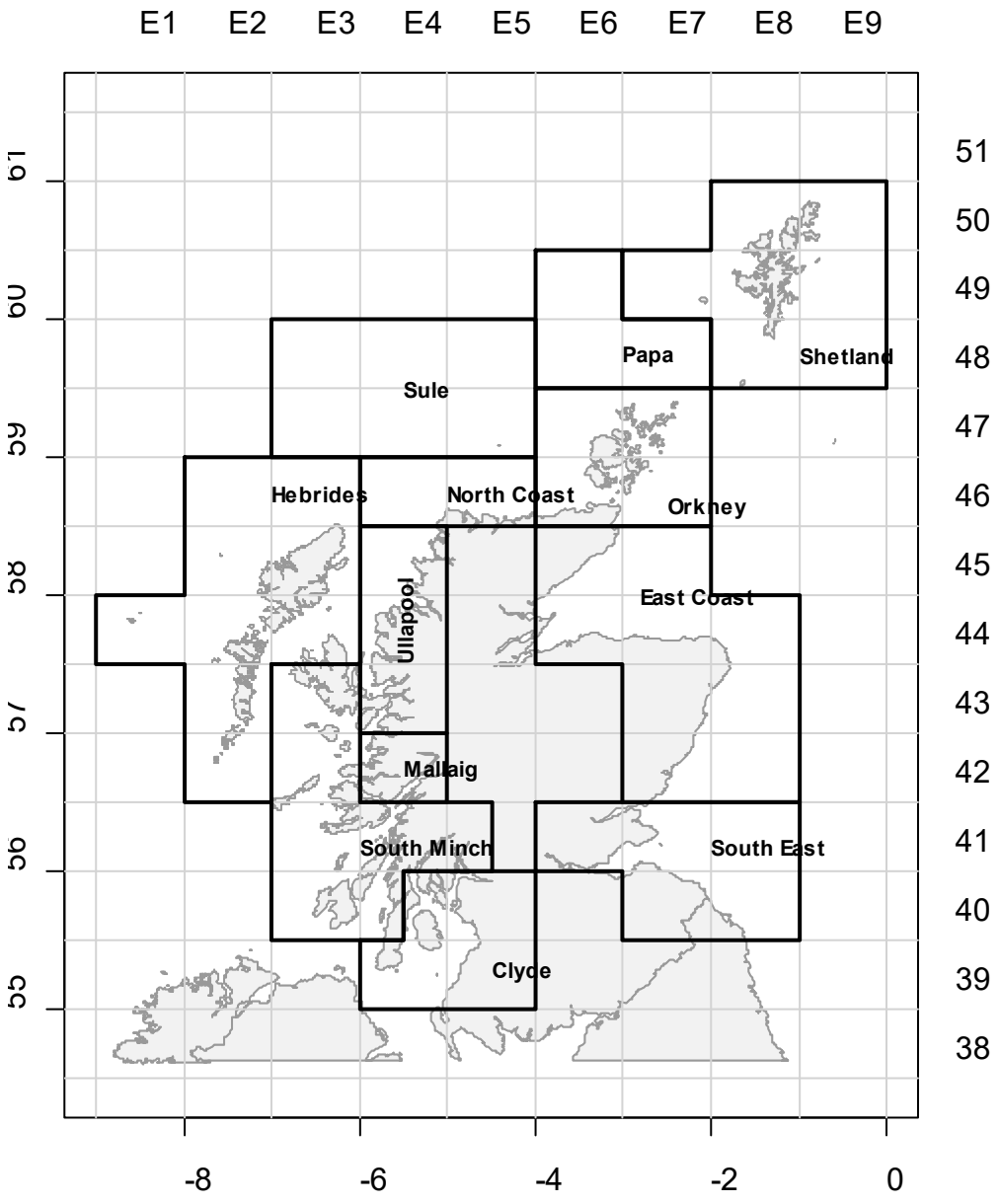


Figure 4. Crab and lobster creel fishery assessment units in Scotland.

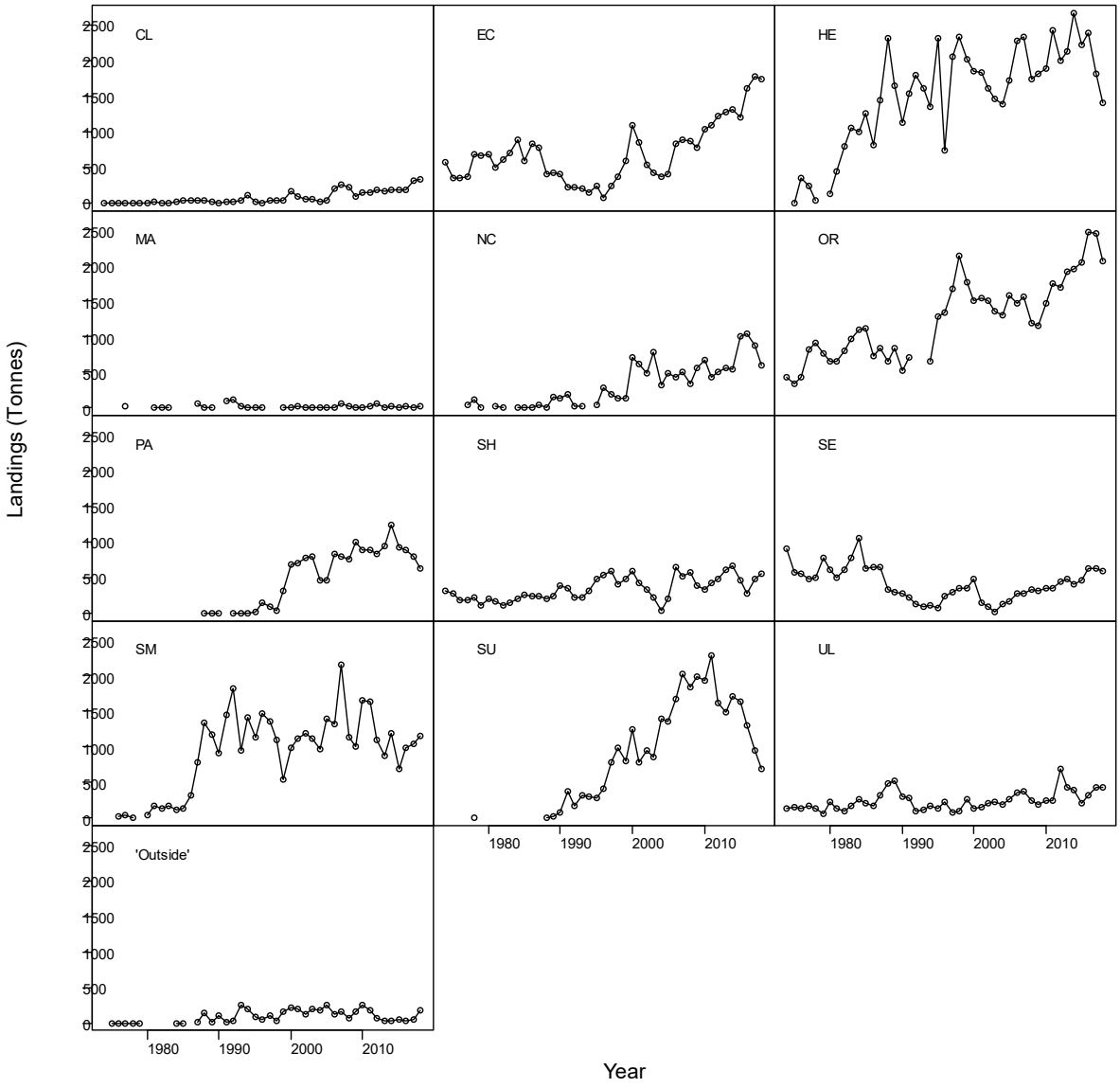


Figure 5. Annual brown crab landings (tonnes) into Scotland by fishery assessment unit. 'Outside' relates to brown crab landed outside the creel assessment units; see Figure 1 for area locations.

ToR b) Length-based indicators of brown crab in Scotland

Stock assessments based on LCAs for the period 2013–2015 were carried out for nine of the twelve assessment units, providing estimates of fishing mortality in relation to the F_{MSY} proxies. No assessments were performed for Mallaig and Ullapool as the sampling data collected were considered insufficient to run LCAs. In Shetland, fishing mortality for females were deemed inconclusive due to inconsistent results obtained when using different biological parameters estimated for Shetland and elsewhere. Of the nine assessed areas, eight were fished above the F_{MSY} proxy to some extent (Table 2). Fishing mortality was estimated to be above FMSY for both males and females in Clyde, East Coast, North Coast, Orkney, South East, South Minch and Sule. In the Hebrides, fishing mortality for males was at FMSY while females were fished above FMSY. In Papa, recent fishing mortality was around FMSY or lower. Overall, assessment results for the period 2013–2015 showed that brown crab in most of the assessment units in Scotland were fished close to or above the F_{MSY} proxy. In many of the assessment units, a higher yield and biomass per recruit in the long term could potentially be obtained by reducing the level of fishing mortality (effort).

Table 2. Brown crab stock status, relationship between F and FMSY proxy for 2006–2008, 2009–2012 and 2013–2015.

Assessment period		F (Fishing Mortality) 2006-2008	F (Fishing Mortality) 2009-2012	F (Fishing Mortality) 2013-15	
Clyde	Males	✗	?	✗	Above F_{MSY}
	Females	✗	?	✗	Above F_{MSY}
Hebrides	Males	✗	✓	o	At F_{MSY}
	Females	✗	✗	✗	Above F_{MSY}
North Coast	Males	✗	✓	✗	Above F_{MSY}
	Females	✗	✓	✗	Above F_{MSY}
Papa	Males	?	✓	✓	Below F_{MSY}
	Females	?	✓	o	At F_{MSY}
Shetland	Males	?	?	✗	Above F_{MSY}
	Females	?	?	?	Unknown
Sule	Males	✗	o	✗	Above F_{MSY}
	Females	o	✗	✗	Above F_{MSY}
East Coast	Males	✗	✗	✗	Above F_{MSY}
	Females	✗	✗	✗	Above F_{MSY}
Mallaig	Males	?	?	?	Unknown
	Females	?	?	?	Unknown
Orkney	Males	✗	✗	✗	Above F_{MSY}
	Females	✗	✗	✗	Above F_{MSY}
South East	Males	✗	✗	✗	Above F_{MSY}
	Females	✗	✗	✗	Above F_{MSY}
South Minch	Males	✗	✗	✗	Above F_{MSY}
	Females	✗	✗	✗	Above F_{MSY}
Ullapool	Males	?	?	?	Unknown
	Fe-	?	?	?	Unknown

ToR e) Use of survey data to assess the distribution of brown crab in the East of Scotland

Brown crab (*Cancer pagurus*) is a widely distributed crustacean that occurs around the British coastline supporting important commercial fisheries. The habitat preferences of brown crab around Scotland are poorly documented and for the purposes of stock assessment, the species is considered data-poor. Based on an analysis of dredge and trawl surveys taking place in the North Sea (2008–2018), the spatial distribution of brown crab was described and abundance and recruitment indices for the species were developed. Geostatistical methods and generalized additive models (GAMs) were used to model catch rates in relation to a number of explanatory variables (depth, distance to the coast, sediment type and year). The dredge and trawl abundance indexes were correlated showing a similar trend of increasing catch rates in the early years of the time-series up to 2016 and a subsequent reduction. The recruitment index showed a gradual increase in captured juvenile crabs up to 2014 followed by a steep decrease with 2018 being the lowest value estimated. The derivation of robust indicators of stock abundance will contribute to the stock assessment of this species and enable the provision of improved fisheries management advice for brown crab around Scotland.

2.3 Scotland Lobster (*Hommarus gamarus*) stock

ToR a) Landing, discard, effort and catch data

Total Scottish landings of lobster fluctuated between 950 and 1200 tonnes from 2009 to 2018 (Table 3). The total tonnage of lobster landed in Scotland has consistently been much lower than that of crabs. However, reported lobster landings have increased substantially over the last years. Historically the majority of landings of lobster in Scotland have been from the Hebrides, Orkney and South Minch, with the South East and East Coast areas becoming increasingly important in more recent years (Figure 6). Landings from these areas accounted for around 87% of the total in 2018. Small quantities of lobster were landed from grounds outside the assessment areas, including ICES rectangles to the west of South Minch, to the south of Clyde and just outside the South East and East Coast areas. The majority of lobsters fished in Scottish waters are landed in the third and fourth quarters of the year.

Table 3. Annual Lobster landings (tonnes) into Scotland by creel fishery assessment unit from 2009–2018. Data from Fisheries Management database.

Assessment unit	Year									
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Clyde	17.4	24.8	26.3	24.7	23.5	46.2	35.4	40.4	47.4	35.6
East Coast	163.9	207.3	279.3	265.5	214.9	226.1	227.8	254.8	347.6	351.9
Hebrides	142.5	155.8	141.7	139.0	97.3	148.6	114.7	127	133.1	171.4
Mallaig	0.4	0.9	1.2	12.7	0.6	1.0	0.5	0.9	1.4	1.9
North Coast	12.0	14.3	15.4	10.0	10.0	10.7	13.3	14.5	16.1	11.3
Orkney	160.3	170.8	177.8	155.5	117.4	163.6	113.9	117.1	113.9	98.3
Papa	10.4	10.3	6.4	5.7	5.7	7.8	3.2	2.9	3.1	1.3
Shetland	25.7	29.8	29.2	36.8	35.9	39.7	40.7	52.6	55.6	39.1
South East	257.3	277.8	374.6	334.4	387.8	409.2	348.8	367.3	326.0	323.1
South Minch	99.8	112.0	89.9	84.7	75.2	101.3	78.7	96.4	102.1	105.5
Sule	4.0	3.4	3.6	2.1	0.6	0.7	0.6	0.4	0.8	0.7
Ullapool	12.3	18.7	10.8	11.6	15.1	16.7	14.4	14.2	18.4	20.7
Outside Assess. Units	46.8	74.4	62.9	49.7	41.8	36.3	50.4	61.9	48.4	51.5
Total	953.0	1100.3	1219.1	1132.5	1025.9	1207.8	1042.4	1150.4	1214.0	1212.3

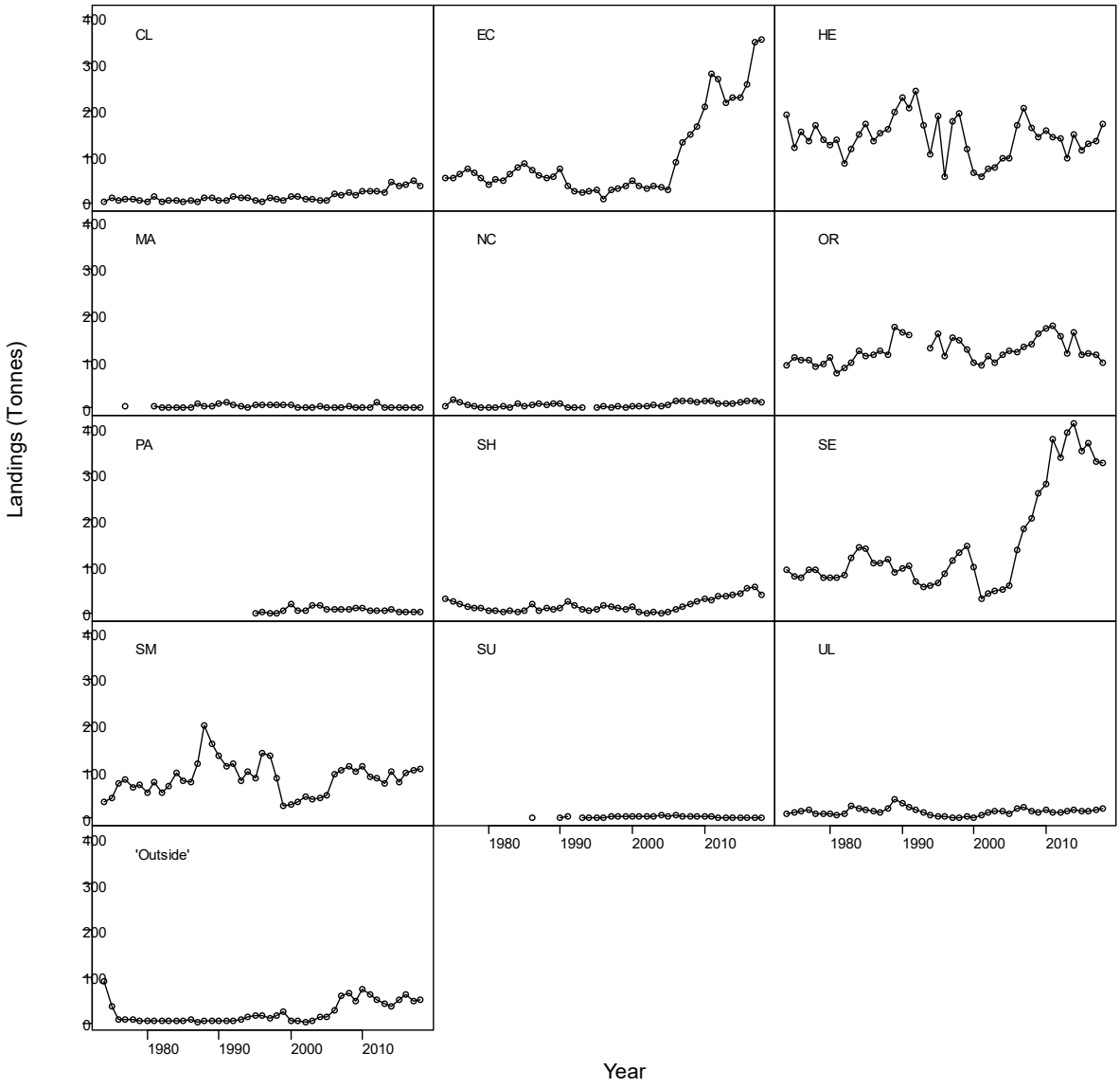


Figure 6. Annual lobster landings (tonnes) into Scotland by fishery assessment unit. 'Outside' relates to lobster landed outside the creel assessment units; see Figure 1 for area locations.

ToR b) Length-based indicators of lobster in Scotland

Stock assessments based on LCAs for the period 2013–2015 were carried out for eight of the twelve assessment units, providing estimates of fishing mortality in relation to the F_{MSY} proxies (Table 4). Sampling data were considered to be insufficient (low numbers and infrequent sampling) for running assessments in Mallaig, North Coast, Sule and Ullapool. Lobsters in all the assessed areas were fished above the F_{MSY} proxy to some extent, particularly males. Fishing mortality was estimated to be above F_{MSY} for both males and females in Clyde, East Coast, South East, Shetland and South Minch. In the Hebrides, Orkney and Papa, fishing mortality for females was at F_{MSY} or below while males were fished above F_{MSY}. Overall, assessment results for the period 2013–2015 show that lobster in most of the assessment units in Scotland were fished close to or

above the F_{MSY} proxy. A higher yield and biomass per recruit in the long term could potentially be obtained in all assessment units by reducing the level of fishing mortality (effort).

Table 4. Lobster stock status, relationship between F and FMSY proxy for 2006–2008, 2009–2012 and 2013–2015.

Assessment period		F (Fishing Mortality) 2006-2008	F (Fishing Mortality) 2009-2012	F (Fishing Mortality) 2013-15	
Clyde	Males	✗	✗	✗	Above F_{MSY}
	Females	✗	✗	✗	Above F_{MSY}
Hebrides	Males	✗	✗	✗	Above F_{MSY}
	Females	✓	✓	✓	Below F_{MSY}
North Coast	Males	?	?	?	Unknown
	Females	?	?	?	Unknown
Papa	Males	?	✗	✗	Above F_{MSY}
	Females	?	✓	✓	Below F_{MSY}
Shetland	Males	?	✓	✗	Above F_{MSY}
	Females	?	✗	✗	Above F_{MSY}
Sule	Males	?	?	?	Unknown
	Females	?	?	?	Unknown
East Coast	Males	✗	✗	✗	Above F_{MSY}
	Females	✗	✗	✗	Above F_{MSY}
Mallaig	Males	?	?	?	Unknown
	Females	?	?	?	Unknown
Orkney	Males	✗	✗	✗	Above F_{MSY}
	Females	✓	o	o	At F_{MSY}
South East	Males	✓	✗	✗	Above F_{MSY}
	Females	✗	✗	✗	Above F_{MSY}
South Minch	Males	?	✗	✗	Above F_{MSY}
	Females	?	✗	✗	Above F_{MSY}
Ullapool	Males	✗	?	?	Unknown
	Fe-	✓	?	?	Unknown

2.4 Ireland edible crab (*Cancer pagurus*) stock

ToR a) Landing, discard, effort and catch data

Irish vessels fish for crab in ICES Areas IV, VI and VII. In 2010 the WG agreed a series of assessment units covering fisheries exploited by vessels from UK, Ireland, France, Norway and Sweden. Four of these assessment units, (Malin, SW Ireland, SE Ireland/Celtic Sea, N Irish Sea) surround the Irish coast and Irish inshore vessels fish in all four units. Landings (tonnes) into Ireland from 2005 to 2018 for these four assessment units and adjacent assessment units by Irish vessels are shown in Table 5. These landings are collated from the operational landings database.

The quality of the landings data from the official national databases are variable and may at times reflect changes in the efficacy of recording rather than the crab fishery itself. Landings data for 2019 is incomplete at this time and therefore has not been included.

Table 5. Landings (tonnes) by assessment unit of *Cancer pagurus* by Irish vessels from 2005 to 2018. Data is based on operational data from logbooks and does not include landings from under 10metre vessels. ('Outside' refers to landings caught from outside the assessment units agreed upon at WGCRAB 2010 and 'Not Recorded' refers to landings where the ICES Rectangle was not recorded.)

Assessment Unit	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Central North Sea	2726.4	1550.6					6.1	79.9			13.8	1319.1	1239.8	1044.8
Clyde						2.6								
Eastern Channel											1.6		0.54	
Hebrides			0.9			850.2								
Malin	403.1	1436.1	3177.2	4462.8	8931.2	6029.7	3146.2	2631.0	3788.4	3359.2	2906.3	4946.8	5236.0	4333.4
N. Irish Sea		0.5	147.8				34.7	43.4	25.7	35.5	17.0	23.4	19.9	44.9
North Coast						249.9								
Norway Sweden 09												0.04		
Orkney														
Outside			614.0	28.0		692.7	2.0	2.0		5.4	19.7	3.3	2.5	15.2
Papa														
SE Ireland/Celtic Sea	143.3	585.4	595.2			110.8	296.5	220.2	118.7	176.0	223.4	569.0	552.3	525.0
Shetland													0.48	
South Minch						157.7					31.8			
Southern North Sea							979.7	1182.1		1389.2				
Sule						855.2								
SW Ireland	42.1	23.0	114.3	807.1	843.2	554.2	339.6	520.3	365.1	536.4	472.5	734.5	631.6	829.4
Western Channel			0.8				35.4			13.3				0.246
Not Recorded											4.1			
Total	3314.9	3595.6	4650.2	5297.9	9774.4	9503.0	4840.2	4678.9	4297.9	5515.0	3690.3	7595.9	7683.1	6792.6

Size distribution data was collected from the Malin, SW Ireland and SE Ireland/Celtic Sea assessment units during 2016, 2017 and 2018. Measurements of Brown Crab from both at sea and port sampling around the coast of Ireland totalled 9949 in 2016; 10 138 in 2017 and 5540 in 2018. In 2016 the majority (46%) of brown crab measured were caught from the SW Ireland assessment unit, while in 2017 and 2018 the largest proportions of brown crab measured were from Malin, 65.38% and 64.96%, respectively. The majority of crab measured were female (67%+) for all three years in both catch and landings sampling.

The size range of Female and Male brown crab from 4 assessments units is shown in Table 6 with the modal sizes being displayed in Table 7.

No assessment methods are currently being utilised by Ireland on the four stocks/assessment units around the Irish coast.

Table 6. Size range of both Female and Male Brown Crab from the four main assessment units around the Irish coast in 2016, 2017 and 2018.

Year	Celtic Sea/SE Ireland		Irish Sea		Malin		SW Ireland	
	Female	Male	Female	Male	Female	Male	Female	Male
2016	38-186	59-185	53-220	52-243	57-245	58-265	41-215	10-207
2017	53-215	55-231	61-110	60-115	35-235	36-220	56-207	64-197
2018	99-183	112-191			48-200	15-217	61-211	60-210

Table 7. Modal sizes of Female and Male Brown Crab from the four main assessment units around the Irish coast in 2016, 2017 and 2018.

Year	Celtic Sea/SE Ireland		Irish Sea		Malin		SW Ireland	
	Female	Male	Female	Male	Female	Male	Female	Male
2016	148 (n=610)	131 (n=241)	113 (n=474)	83 (n=508)	160 (n=2715)	110 (n=930)	160 (n=2898)	140 (n=1634)
2017	148 (n=1547)	134 (n=459)	88 (n=51)	94 (n=60)	160 (n=5114)	130 (n=1514)	90 (n=684)	98 (n=613)
2018	173(n=49)	148 (n=28)			160 (n=2364)	120 (n=1235)	162 (n=1313)	165 (n=551)

2.5 England edible crab (*Cancer pagurus*) and lobster (*Homarus gammarus*) stocks

The fisheries for edible crab *Cancer pagurus* and European lobster *Homarus gammarus* are both inshore pot fisheries which mostly consist of small under 10 metre vessels, particularly for lobster (Figure 7). Management of both fisheries are by technical measures only, consisting of a minimum size limit of 130mm for crab and 87 mm for lobster and a ban on landing berried females or v-notched lobsters. There are also regional management measures implemented and enforced by local Inshore Fisheries Conservation Authorities (IFCA's) within their district up to the 6 nautical mile limit. These include pot limits, escape gaps, maximum vessel size and increased minimum landing sizes.

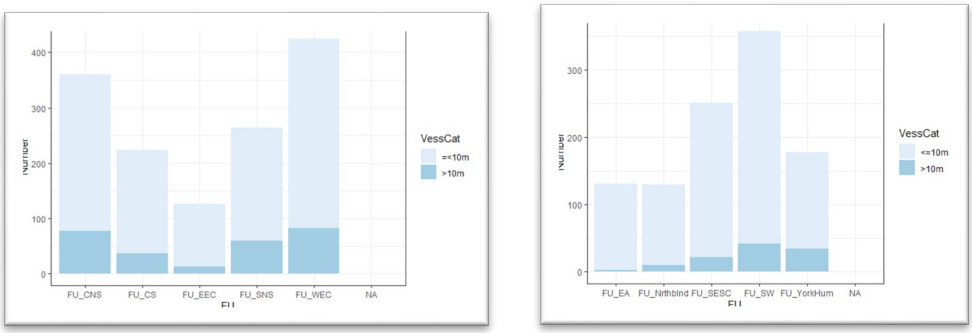
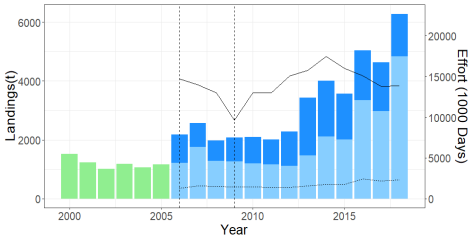


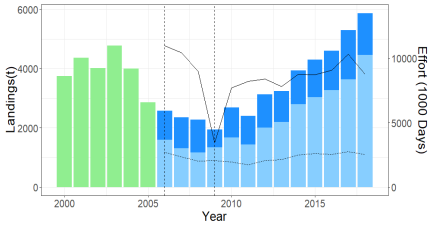
Figure 7. Vessel size crab (Left) and Vessel size lobster (Right).

ToR a) Landing, discard, effort and catch data of brown crab

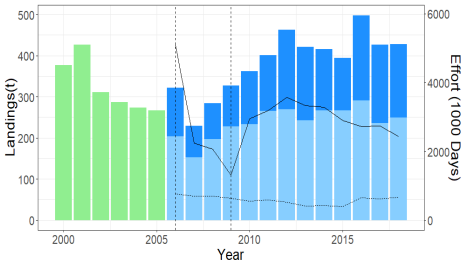
Trends in crab landings are highly regional. Step changes are due to changes in data reporting during the time-series (Figure 8). In the North Sea landings of crab have been increasing in recent years whilst effort has remained constant or decreased. This could be an artefact of an increasing number of large vessels fishing offshore with more pots. Effort data are reported as days fished, which does not give a complete picture, particularly when number of pots set daily by individual vessels within a fishery can differ by an order of magnitude. Days fished in the Channel and Celtic Sea has not increased since 2012, but landings have decreased in the Western Channel since 2016.



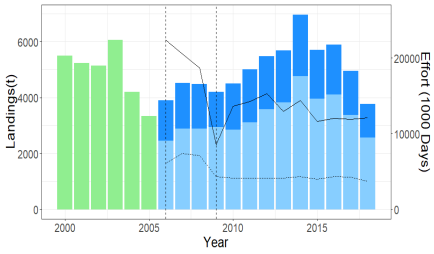
2a) Central North Sea



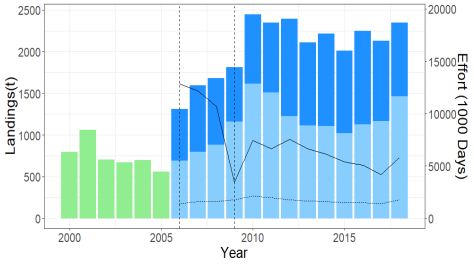
2b) Southern North Sea



2c) Eastern Channel



2d) Western Channel

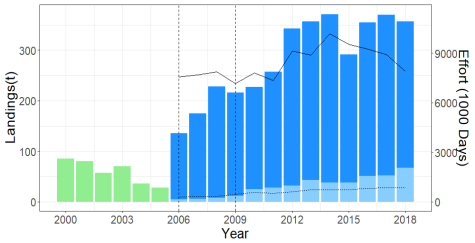


2e) Celtic Sea

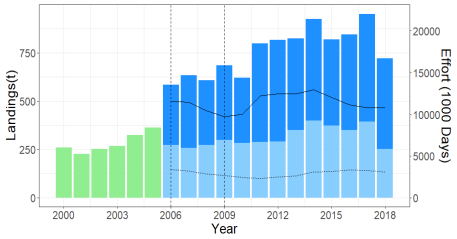
Figure 8. England landings and fishing effort: Edible crab.

ToR a) Landing, discard, effort and catch data of lobster

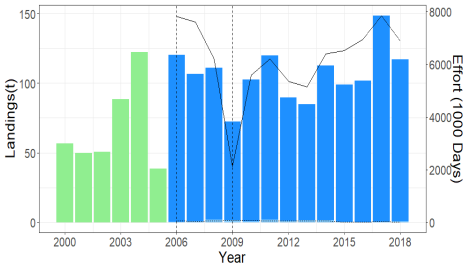
Landings of lobster have remained reasonably steady for the last decade in all regions apart from the Southeast South Coast, where landings have declined since 2015 (Figure 9). Days fished has increased in East Anglia, with a drop in 2018. Elsewhere effort has decreased or remained steady. There could be an increase in vessel size and number of pots set to some extent within the lobster fishery but it is not evident with the data available.



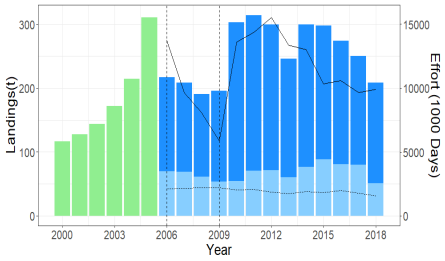
3a) Northumberland and Durham



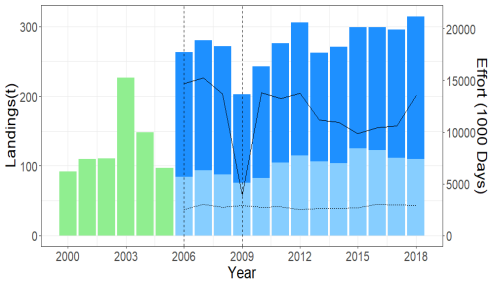
3b) Yorkshire Humber



3c) East Anglia



3d) Southeast South Coast



3e) Southwest

Figure 9. England landings and fishing effort: Lobster.

ToR b) Length-based indicators of lobster and brown crab in England

Bi-annual stock summaries are produced with estimate sustainability based on the results of Length-Based Cohort Analyses and Yield Per Recruit assessments. Fishing mortality and spawning stock biomass estimates are calculated and presented in relation to reference points: Target reference is a maximum sustainable yield proxy of 35% virgin spawner per recruit (SPR) and the limit is 15% SPR. In the assessment models natural mortality is assumed to be 20% for crab and 15% for lobster.

Assessments have not yet been published for crab and lobster in 2018 but will be available online once quality control has been completed. Future work that could improve assessments will aim to explore models less sensitive to regional minimum landing size, provide more accurate estimates of growth parameters and natural mortality, and explore animal behaviour to obtain more insight into pot selectivity.

2.6 Norwegian Snow crab (*Chionoecetes opilio*) stock

ToR a) Landing, discard, effort and catch data of snow crab

Regulations:
The snow crab (*Chionoecetes opilio*) stock has since 1996 increased rapidly both in distribution and abundance in the Barents Sea. It is now expected that the snow crab inhabits large parts of the Russian exclusive economic zone, the entire Loophole (international waters in the central Barents Sea) and increasing parts of the Svalbard Fishery Protection Zone (Svalbard FPZ).

The fishery for snow crab commenced in 2012, and the main fishing area is in the central part of the Barents Sea. The fishery is an offshore fishery, and the fleet consists of large vessels between 40 and 70m with on-board processing. The vessels probably operate between 1000 and 2000 pots every day. Snow crab in the Barents Sea fishery are exclusively harvested using conical pots deployed in strings connected to longline. The minimum legal size for male snow crab in the Barents Sea is 100 mm carapace width (CW). All undersized snow crabs and females must be returned to the sea. The management regulations in the Svalbard Fisheries Protection Zone and Norwegian EEZ are as follows: minimum legal size of 100 mm CW; maximum of 12 000 pots deployed per vessel; maximum soak time for pots of three weeks; mandatory use of pot gear only; the fishery is closed and all pots must be removed from the seabed from June to September; and a maximum of 20% post moult crab caught (Norwegian Fisheries Directorate (www.fiskeridir.no), 2018).

The fishery:
A small fishery was initiated in 2012, and the total landings from the Barents Sea peaked in 2016 with a total of 16 000 tons, all landed in Norwegian harbours (Figure 10). In the beginning, Norwegian, EU vessels and Russian vessels fished in the central parts of the Barents Sea (Figure 11). From 2017 new regulations caused that only Norwegian vessels can fish on the Norwegian continental shelf and Russian fishing vessels fish on their shelf. Both Norwegian and Russian governments introduced a TAC from 2017. The two last years (2018 and 2019) around 12 000 tones snow crab were landed by Norwegian and Russian fleet from the Barents Sea in total.

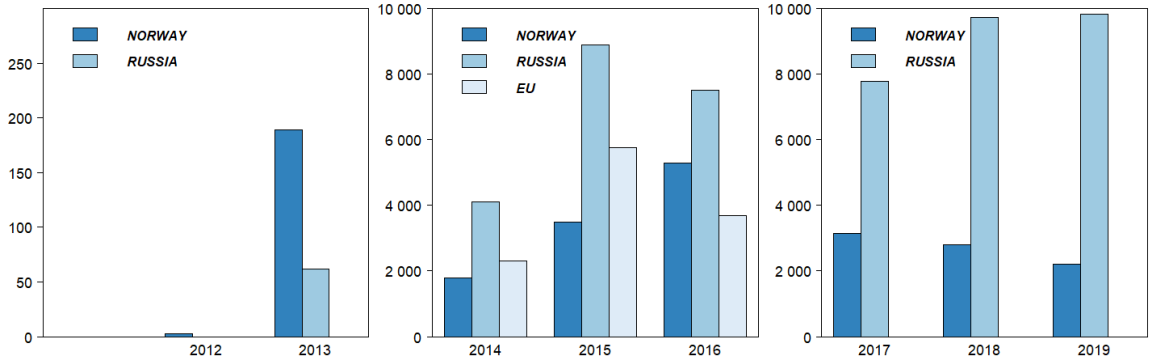


Figure 10. Overview of landings of snow crab from the Barents Sea in the period 2012 to 2019.

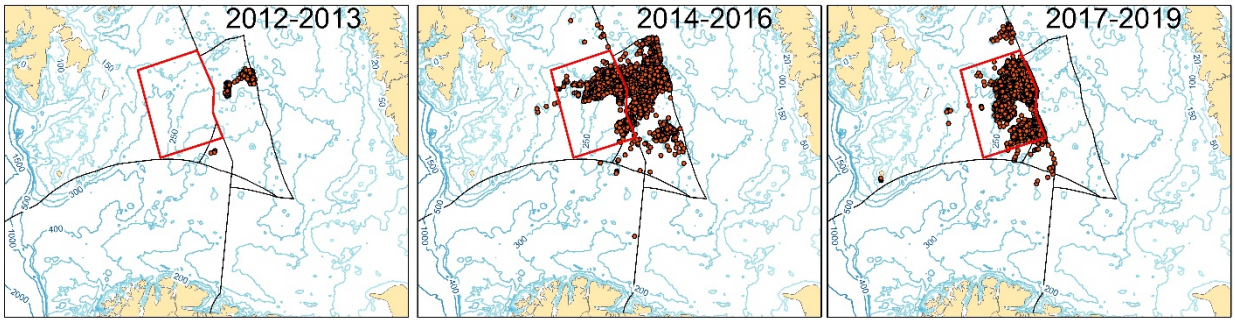


Figure 11. Showing fishery activity from Norwegian vessels in the period 2012 to 2019 in the Barents Sea.

Management goals:
The snow crab will be managed with the goal of sustainable harvesting based on the knowledge on how the species affect each other in the ecosystem. This will be achieved by balancing two sub goals; maximizing long-term catch yield and minimize the risk of unwanted ecosystem effects.

2.7 Canadian Snow crab (*Chionoecetes opilio*) stock

ToR a) Landing, discard, effort and catch data of snow crab

This report focuses on snow crab distributed throughout Atlantic Canada in Divisions of the Northwest Atlantic Fisheries Organization (NAFO, Figure 12) [2HJ3KLNOP4RSTVWX]. Within the snow crab stock range there are four Department of Fisheries and Oceans (DFO) Regions, defined in Table 8.

No information is available for Divisions 4VWX for this report because no stock assessment publication available yet.

Table 8. NAFO Divisions, DFO Regions, and associated Geographical Terminology incorporated within the stock range of Atlantic Canadian snow crab.

NAFO Divisions	Region	Geographical Terminology
2H,2J,3K,3L,3N,3O,3P,4R	Newfoundland & Labrador	Newfoundland & Labrador Shelf
4S	Quebec	Northern Gulf of St. Lawrence
4T	Gulf	Southern Gulf of St. Lawrence
4VWX	Maritimes	Eastern Scotian Shelf

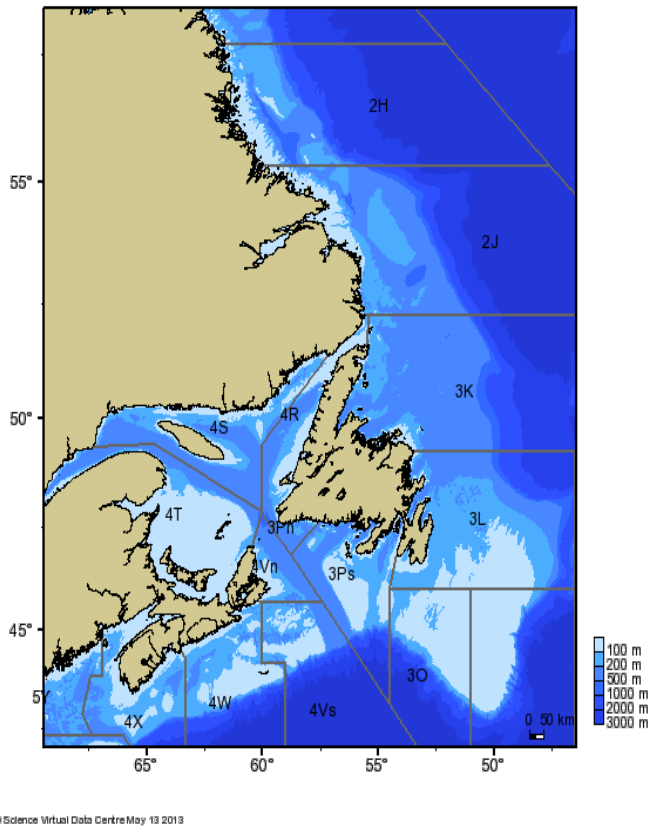


Figure 12. Map of Atlantic Canada showing NAFO Divisions.

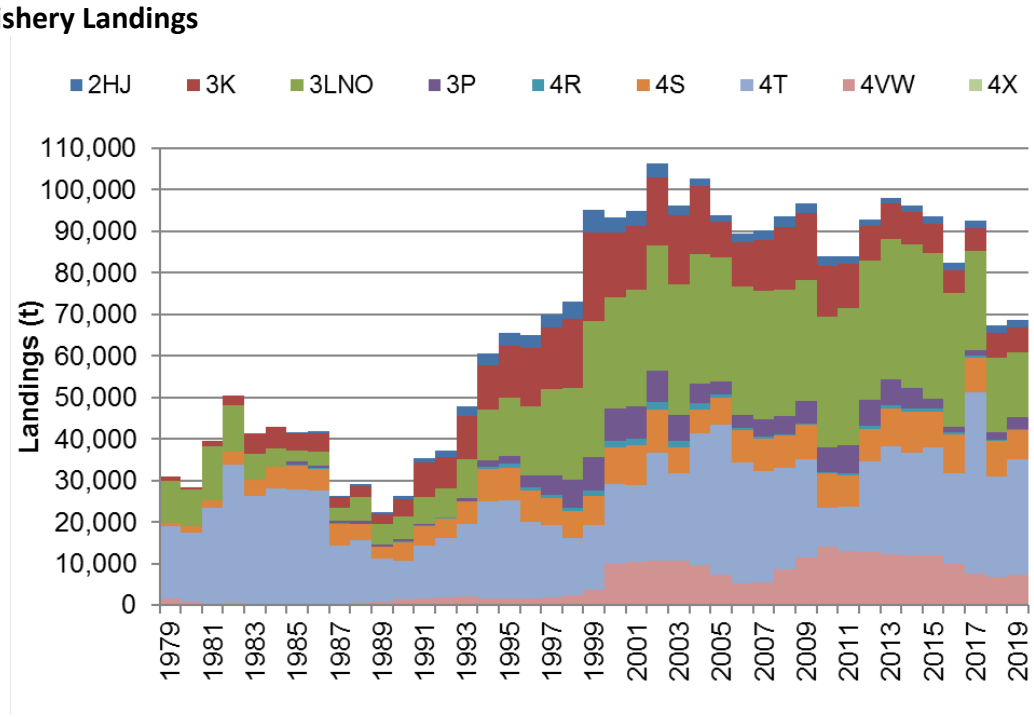


Figure 13. Landings of Atlantic Canadian snow crab by NAFO Division.

All Regions have obligatory dockside monitoring of landings implemented in management of the fishery. The two largest Regions of supply are the Newfoundland & Labrador and Gulf Regions. Landings of snow crab in Atlantic Canada have approximated 67 000–69 000 t in the past two years, following levels of >80 000 t from 1999 to 2017 (Figure 13). The recent decrease in landings is most attributable to NAFO Divisions 3LNO in the Newfoundland and Labrador Region.

ToR b) CPUE indicators of snow crab in Canada

Fishery CPUE in the Newfoundland and Labrador Region (NAFO Divisions 2HJ3KLNOP4R) was at a historic low in 2019 (Figure 14), reflecting broad-scale trends throughout most of the Region.

Figure 14. Fishery CPUE in the Newfoundland and Labrador Region. Source – DFO, 2019a.

Fishery CPUE in the Southern Gulf of St. Lawrence (NAFO Division 4T) has remained near or above historic norms in all areas in recent years (Figure 15).

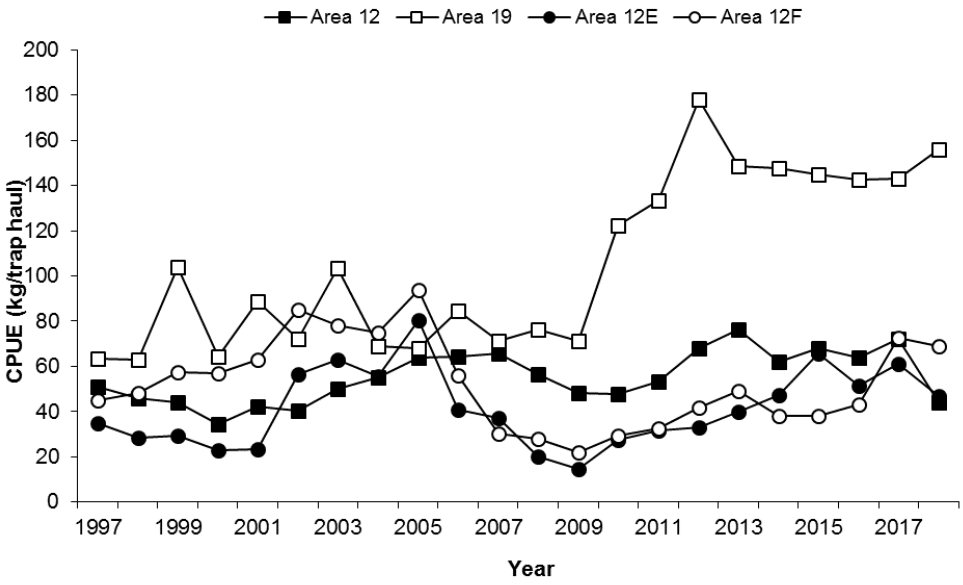


Figure 15. Fishery CPUE in the Gulf Region. Source – DFO, 2019b.

Fishery CPUE in the Northern Gulf of St. Lawrence (NAFO Division 4S) in the Quebec Region has remained near the long-term average in recent years (Figure 16).

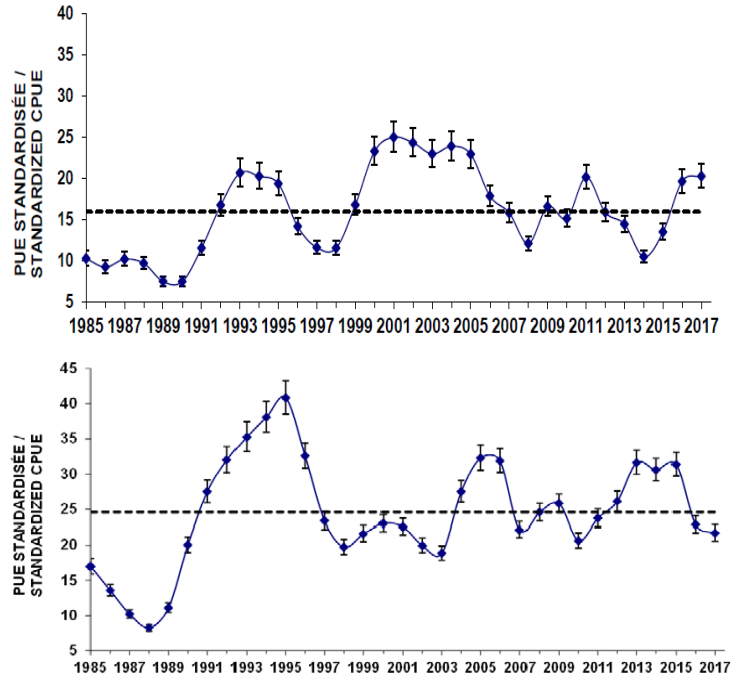


Figure 16. Fishery CPUE in the major fishing areas (Area 17 above and area 16 below) of the Quebec Region. Source – DFO, 2019c.

ToR b) Biomass indicators of snow crab in Canada

Trawl survey indices of exploitable (>94 mm Carapace Width) snow crab indicate the biomass is at or near historic lows throughout the Newfoundland and Labrador Region, although increases occurred in the Southern Divisions (3LNOPs) in 2018 (Figure 17).

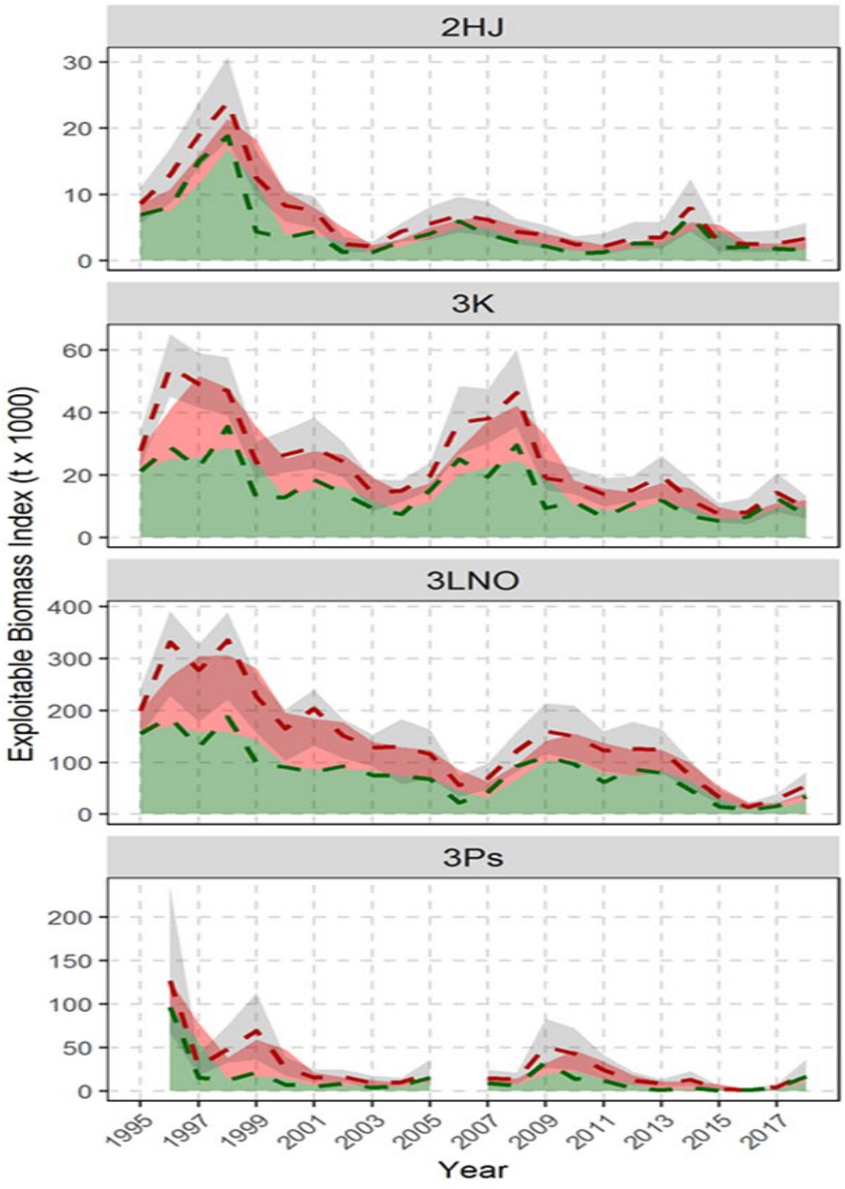


Figure 17. Trawl survey indices of biomass of exploitable snow crab by Assessment Division in the Newfound-land and Labrador Region. Source – DFO, 2019a.

Trawl survey indices of exploitable (>94 mm Carapace Width) snow crab indicate the biomass is near historic highs in the Southern Gulf of St. Lawrence, comprised predominately of recently recruited crab (Figure 18).

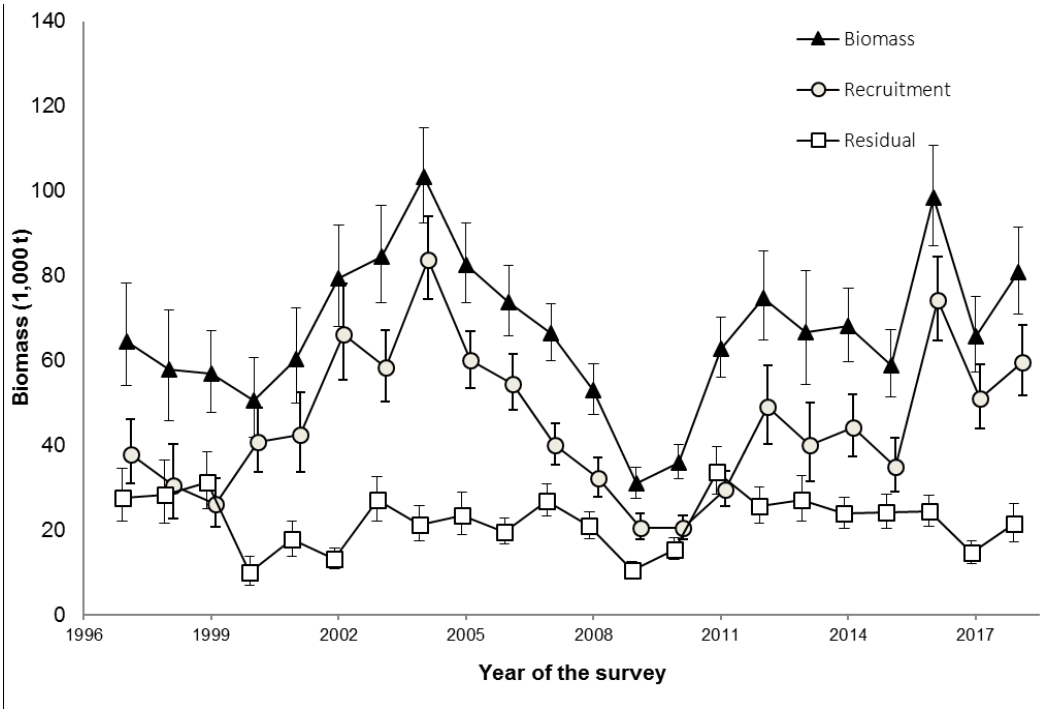


Figure 18. Trawl survey index of biomass of exploitable snow crab in the Gulf Region. Source – DFO, 2019b.

Trap survey indices of exploitable (>94 mm Carapace Width) snow crab in the major fishing areas of the Northern Gulf of St. Lawrence indicate the biomass is near the long-term average (Figure 19).

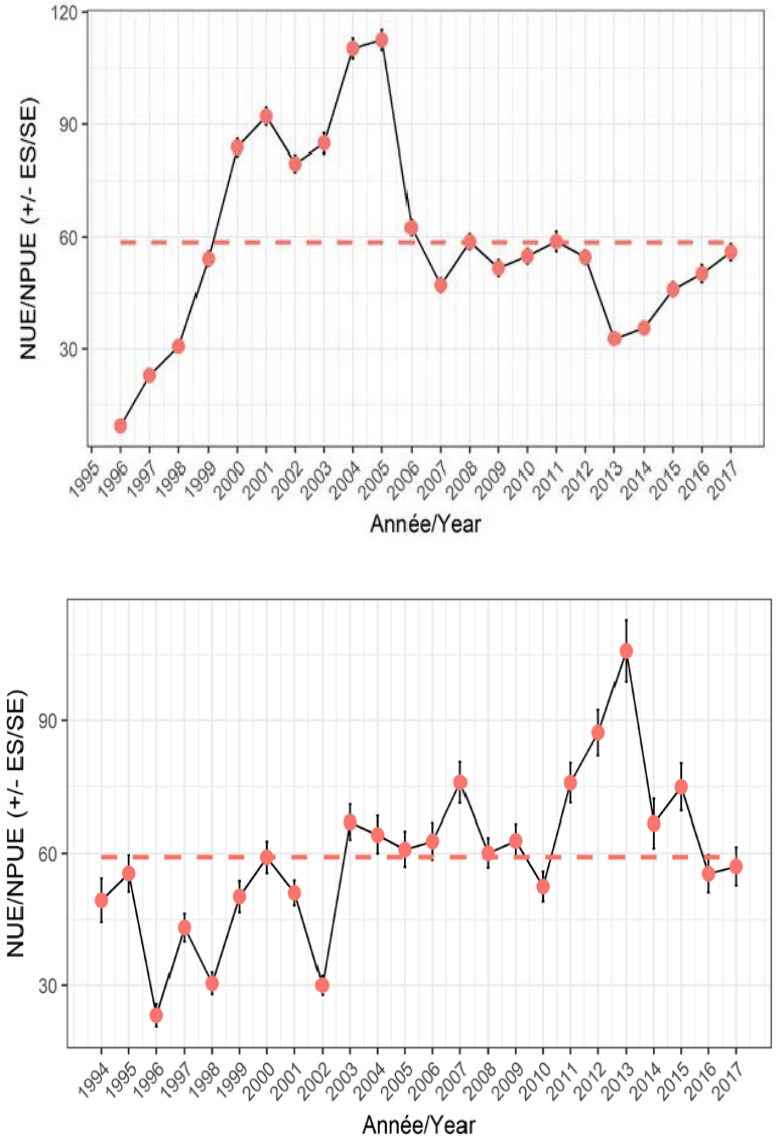


Figure 19. Trap survey indices of biomass of exploitable snow crab in the major fishing areas (Area 17 above and area 16 below) of the Quebec Region. Source – DFO, 2019c.

In the Southern Gulf of St. Lawrence, the exploitable biomass is predicted to remain unchanged, at a high level, in 2019 (Figure 20).

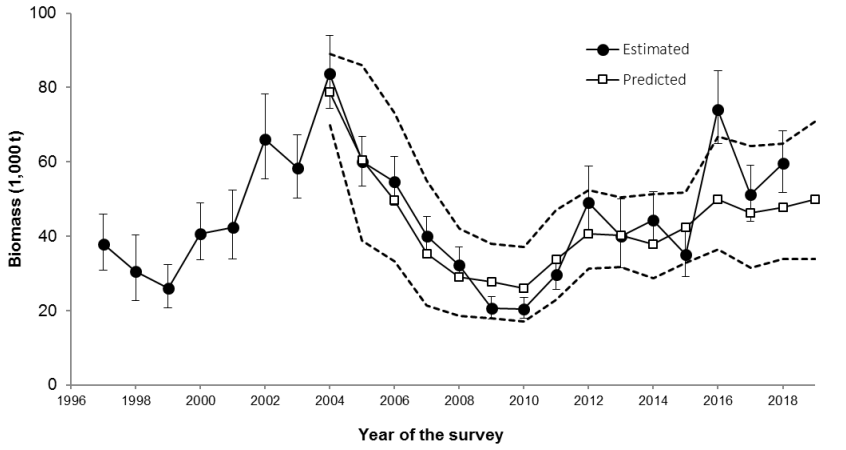


Figure 20. Observed and predicted exploitable biomass indices for the Gulf Region. Source – DFO, 2019b.

ToR b) Recautionary approach indicators of snow crab in Canada

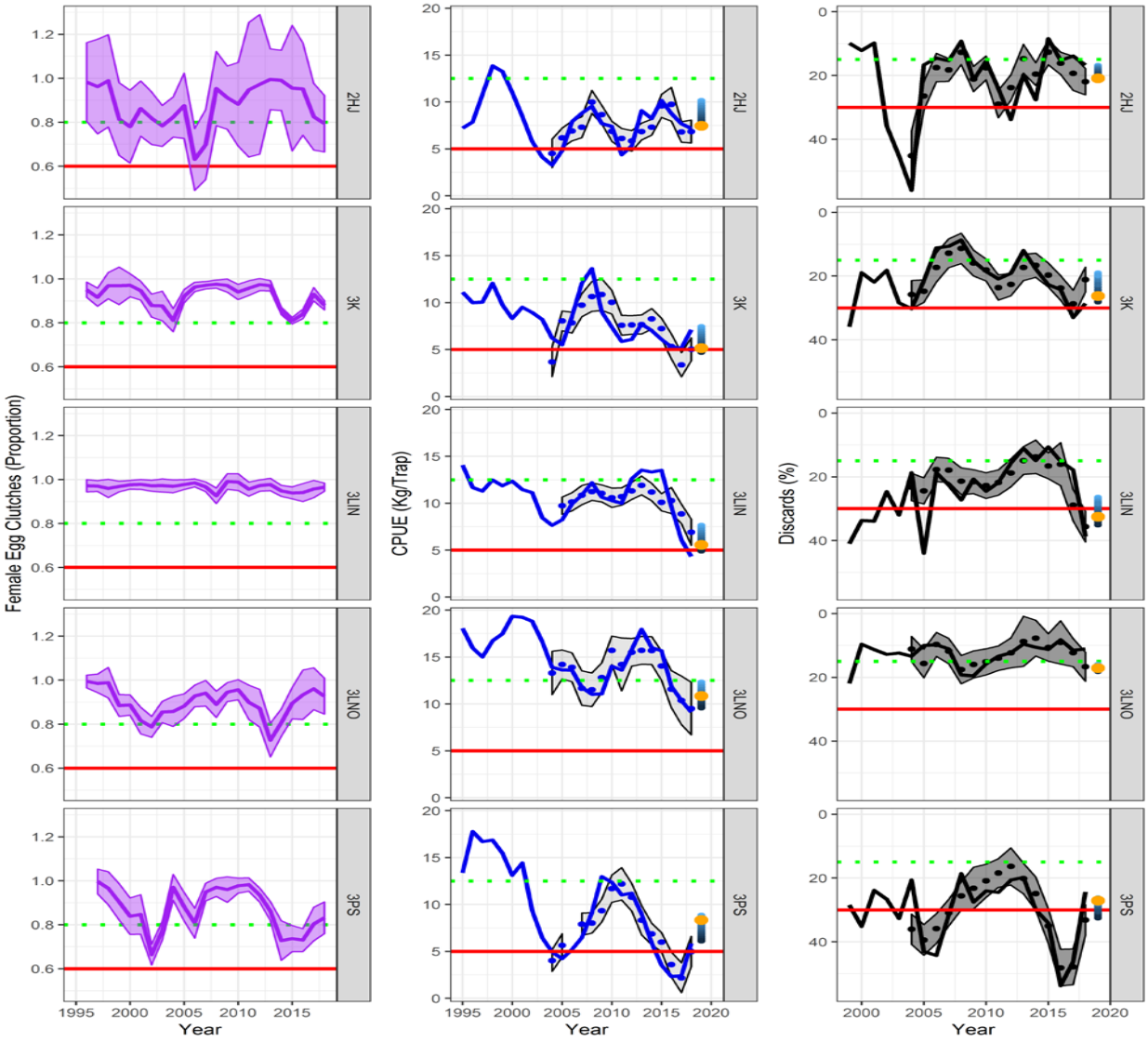


Figure 21. The Precautionary Approach framework used in the Assessment of the Newfoundland and Labra-dor snow crab resource. Source – DFO, 2019a.

The two Regions that comprise the majority of landings, Newfoundland & Labrador and the Gulf, have implemented Precautionary Approach frameworks that include stock status projections in assessment of the resource and provision of management advice. In the Newfoundland & Labrador Region, the framework has yet to be formally adopted into management of the resource, with upper stock reference points remaining provisional and Harvest Control Rules under refinement. The assessment framework indicates the majority of mature females in the stock are carrying full clutches of viable eggs and projects fishery CPUE to be in the cautious zone in all Divisions in 2019, assuming status quo exploitation rates (Figure 21). Assessment Division 3L Inshore is projected to be in the critical zone for discards.

References

DFO. 2019a. Assessment of Newfoundland and Labrador (Divisions 2HJ3KLNOP4R) Snow Crab. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2019/041.

DFO. 2019b. Assessment of snow crab (*Chionoecetes opilio*) in the southern Gulf of St. Lawrence (Areas 12, 19, 12E and 12F) to 2018 and advice for the 2019 fishery. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2019/010.

DFO. 2019c. Assessment of the Estuary and Northern Gulf of St. Lawrence (Areas 13 to 17, 12A, 12B, 12C and 16A) Snow Crab Stocks in 2018. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2019/047.

2.8 French Lobster (*Homarus gammarus*) stock

ToR a) Landing, discard, effort and catch data of lobster

The French lobster fishery is mainly link to the use of pot as gear, more than 85%, the other part come from gillnetters and in a lower case from trawlers. This fishery is located in shallow water (0–50 meters) along the French coast (western and eastern channel and Bay of Biscay) on rocky grounds. The annual landing are really seasonal with a peak in May and June. The legal size is 87 mm Lc. The two main rules in this fishery concern the access of the fishery with a maximum number of vessel inside of each fishing area control with licences and a limited number of pot per fishermen on board. Moreover, the pot needs to respect some characteristics of size and parlour pot are ban excepted in some specific areas.

The last decade, the annual landings fluctuated from 500 to 750 tons (Figure 22). The two last years, the landings reached the maximum values of the last 20 years. The increased trend need to observe with caution is due to improve of declaration system of fishing data. In fact, today close to 100% of the fishermen declare their production and their fishing activity on a daily base with fishing sheets. We can really indicate that a strong change occurred between 2009 and 2010 which allows to conclude that the global increase is less strong due to under declaration and less performant system before 2009. Recently the number of vessel involve in the fishery is closed to 1000 but the number of vessel with an economical dependence to the lobster (annual catch >= 500 kg) is around 300.

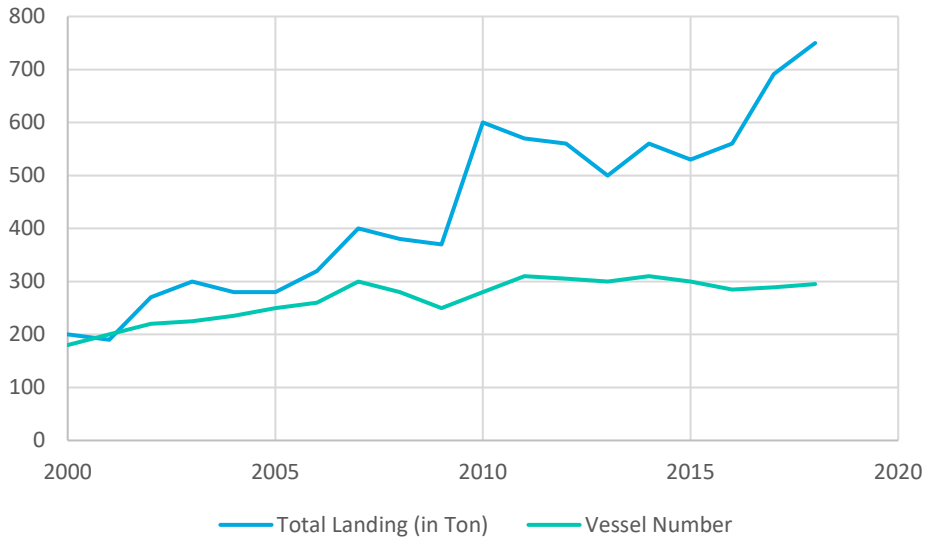


Figure 22. French landing of lobster and number of vessel target lobster (more than 500 kilogram per year).

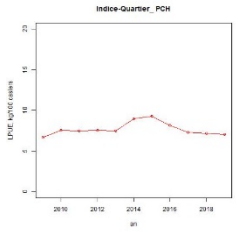
ToR b) CPUE indicators of lobster in France

The total production and effort are estimated from the daily fishing sheets. Today the quality of the data is considered as high to propose some analyses. For the main vessels in each fishing areas, daily data are stored in the national bases. From these data, LPUE are estimated on daily base per vessel which are using to propose a global LPUE index by fishing areas. A GLM model are deployed to produce the indices.

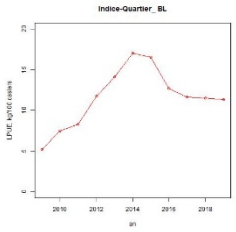
The general trend for the main lobster areas seems to show two situations (Figure 23). First, in the east par of the English Channel from Saint Malo to Boulogne (PCH, BL and SM) the LPUE index have in-creased between 2014 and 2016 with a trend which stay quite stable on the decade. For the Boulogne area, the global trend indicate a real increase of the LPUE index. West of these areas and in the south Brittany, all the index trend increase steadily. The global situation is considered as good even if no Length-based indicators are yet estimated. The data available seem to indicate that the size structures are quite stable.

Eastern Channel

Cherbourg Quarter

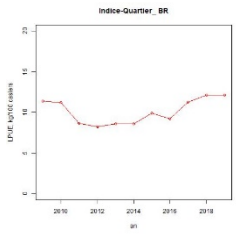


Boulogne Quarter

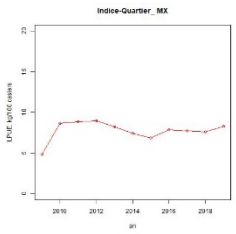


Western Channel- North Brittany Areas

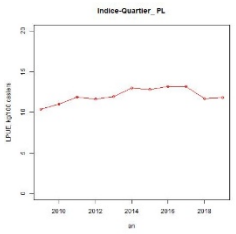
Brest Quarter



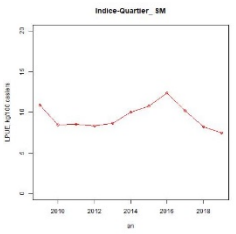
Morlaix Quarter



Paimpol Quarter

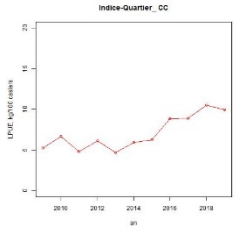


Saint Malo Quarter



Bay of Biscay – South Brittany Areas

Concarneau Quarter



Croisic Quarter

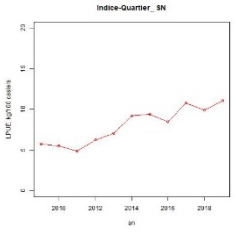


Figure 23. LPUE index more fishing lobster area.

2.9 French brown crab (*Cancer pagurus*) stock

ToR a) Landing, discard, effort and catch data of brown crab

As for the French lobster fishery, the main gear used to catch brown crab is pot. The potter fleet follows the same rules to access to the resource as the lobster French fleet: licences and limited number of pots par vessel. This fleet is composed by offshore potters which perform trips between 7 to 10 days (in the center of western English Channel and the off the bay of Biscay) and coastal potters along the French coast. The gillnet fleet land now closed to 20% of the total landings as non target species in the monkfish fishery.

During a long time the French brown crab landings was around 5000 to 6000 tons. In the last 4 years, an important decrease is noted with a landings under 4000 tons in 2018 (Figure 24). The decrease of the landings is mainly observed in the potter fleet. In the same period, no change has been noted in the global fishing effort or in the spatial distribution of the fleet. The decrease of the landings started in coastal water before to reach offshore areas.

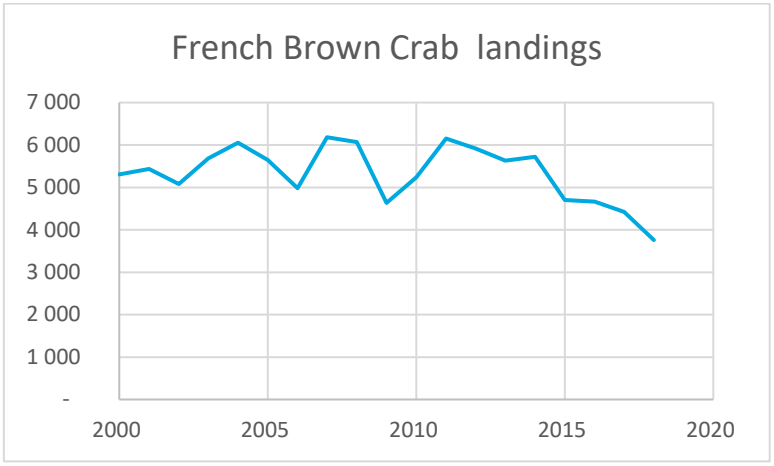


Figure 24. French brown crab landings (ton).

ToR b) CPUE indicators of brown crab in France

From the data of the coastal potter, the trend from different areas is quite clear with a decrease of the lPUE index for 4 or 5 years now (Figure 25). In other areas, where so few vessel data are available to develop a LPUE index, the trend of single vessel is equivalent.

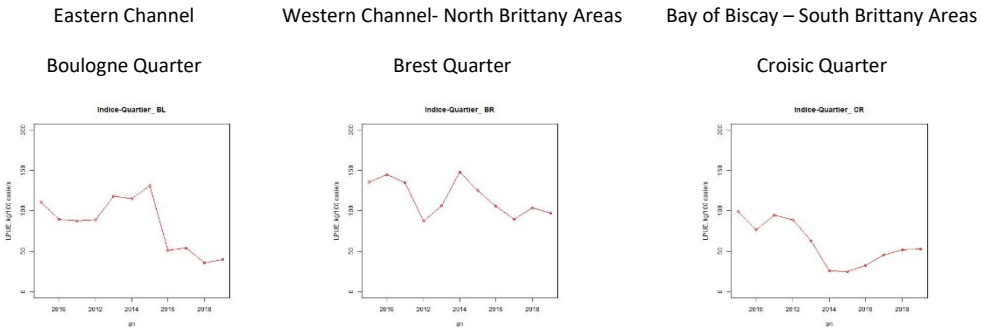


Figure 25. LPUE index trend from coastal vessels.

From the offshore potter fleet, the LPUE index trend seems to be equivalent even if the decrease seem to be more recent (Figure 26). After many year with an LPUE index really stable with some annual fluctuation with no real trend, the recent change has to be noted.

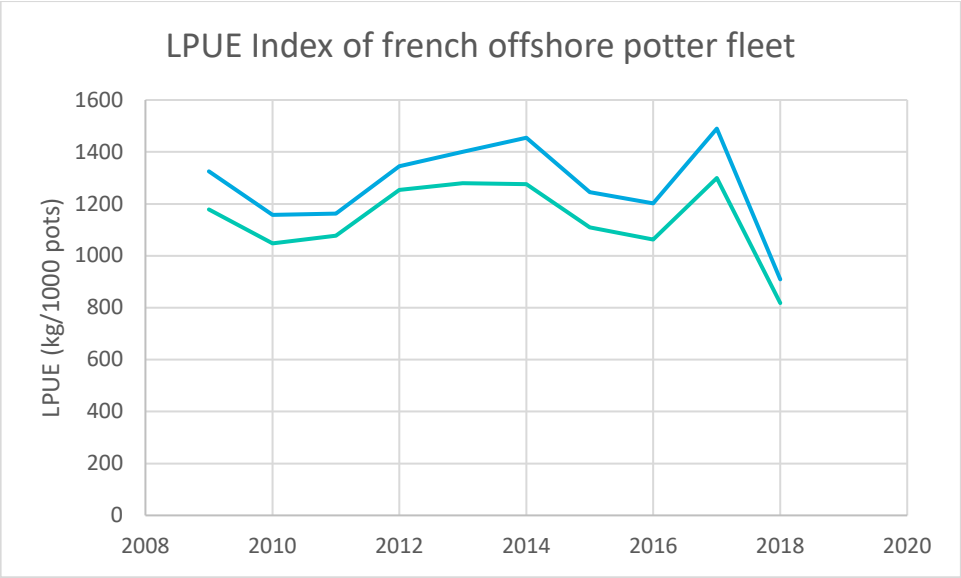


Figure 26. LPUE index in Western English Channel and Bay of Biscay from the offshore potter fleet data.

No size structure model has been developed yet. With data available is quite difficile to ex-plain the current decrease of the LPUE index. In the recent years, no change has been noted in the total fishing effort as for the spatial distribution of the fishing activities. Using the ecological move-ment for brown crab from shallow water when juvenile to deep areas when they reach maturity could permit to indicate that the change should come from a recruitment de-crease. This situation would have been observed first in coastal fishery and later offshore.

We need to understand now which elements in the environmental factors which can explain this situation and develop an approach in order to be able to build an annual recruitment index.

Annex 1: List of participants

WGCRAB 2019 meeting

Name	Institute	Country	Email
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WGCRAB 2018 meeting

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WGCRAB 2017 meeting

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Annex 2: WGCRAB Resolution

2016/MA2/SSGEPD08 The **Working Group on the Biology and Life History of Crabs** (WGCRAB), chaired by Martial Laurans, France, will work on ToRs and generate deliverables as listed in the Table below.

	Meeting dates	Venue	Reporting details	Comments (change in Chair, etc.)
Year 2017	7–9 November	Brest, France	Interim report by 15 December 2017	
Year 2018	6–8 November	Jersey	Interim report by 10 December	
Year 2019	4–8 November	Tromsø, Norway	Final report by 10 December to SCICOM	

ToR descriptors

ToR	Description	Background	Science Plan codes	Duration	Expected Deliverables
a	Compile data on landings, discards, effort and catch rates (CPUE) and provide standardised CPUE, size frequency and research survey data for the important crab and lobster (Homarus) fisheries in the ICES area, and Atlantic Canada and Greenland. Maps will be produced to synthesise the data. One part of these data will be provide to the ICES Data Centre.	The fisheries for crabs and lobster are socio-economically important and trans-national in Europe and Canada with the demise of fin fisheries in some regions.		3 years	Landing, discard, effort and catch data on listed species, from each country. WG report chapter
b	Evaluate assessment of the status of crab and lobster (Homarus) stocks including use of indicators, empirical assessment, analytical assessment in relation to data sources and data quality, development and suitability of reference points for management.	Management of stocks in Europe is primarily by technical measures only and in most countries there are generally no management instruments to control fishing effort. Knowledge of the population dynamics of these species is still weak. These stocks may be at risk from over-fishing due to the lack of control of fishing effort, and hence an evaluation of the sustainability of these fisheries is necessary.		3 years	Report on evaluation of alternative assessment methods.
c	Review the impact of climate divers (temperature, ocean acidification, changes associated climate change and disease) on important crab and lobster species within the ICES, Atlantic Canada and West Greenland. Studying the effects	WGCRAB will investigate the relative importance of fishing and environment on crab and lobster recruitment. Furthermore there is a growing concern in the WG about the consequences of future climate		3 years	Highlight important issues to be basis for research on effect of climate changes on important crab stocks. Each year a specific point will be delivered on the main

	resulting from changes in decreasing pH which can be considered under ocean acidification. Specific parts will be achieve to work on the different subjects.	change for important crab species in our region. Observed increases in sea water temperatures have already entailed expanded distribution areas of some species in the northeast Atlantic. However, a rise in the seawater pH would probably be the most serious consequences of the climate change on crustaceans such as crabs. These issues will be dealt with by the WGCRAB in future.	knowledges and results for the production of WG report chapter (2019). In reflection, a paper on the review of the main results could be expected.
d	Review research and new knowledge on vital crab and lobster population biology parameters;	Several stock parameters are important for analytical assessments. Biological information is therefore required to provide standardised indices and for use in analytical assessments. Crab stock parameters may change due to size selective and single sex fisheries, through by-catch in other fisheries or through the impact of other seabed uses, such as gravel extraction. Since important crab stocks in Europe are managed without fishery independent data it may be an option to investigate any useful stock parameter indicators for assessment purposes.	Updated knowledge on crucial stock parameters for important crab stocks.

Summary of the Work Plan

Year 1	Annual standard outputs for a, b. Continue analysis for ToR d, e. Tentative plan for ToR c.
Year 2	Annual standard outputs for a, b. Continue analysis for ToR d, e. Complete evaluation of useful assessment methods to assess crab and lobster species in ICES areas. Complete request to ACOM and SCICOM (being both an assessment, advice and working group).
Year 3	Annual standard outputs for a, b. Combine analysis, research and report ToR d and e.

Supporting information

Priority	High. The fisheries for crabs and lobster are socio-economically important and trans-national in Europe and Canada with the demise of fin fisheries in some regions. Management of stocks in Europe is primarily by technical measures only and in most countries there are generally no management instruments to control fishing effort. Knowledge of the population dynamics of these species is still weak. These stocks may be at risk from over-fishing due to the lack of control on fishing effort, and hence an evaluation of the sustainability of these fisheries is necessary. The activity of the Group is therefore considered to be of high priority in particular if it's activity can move towards resource assessment without losing biological inputs.
Resource requirements	The research programmes which provide the main input to this group are already underway, and resources are already committed. The additional resource required to undertake additional activities in the framework of this group is negligible..
Participants	The Group is normally attended by some 10–15 members and guests.
Secretariat facilities	None.

Financial	No financial implications.
Linkages to ACOM and groups under ACOM	There are no obvious direct linkages today, but if the EG will produce stock assessments in future WGCRAB will have linkages to several EGs under ACOM.
Linkages to other committees or groups	The EG aims to be able to give advises on how to exploit important crab stocks in the ICES area and is therefore related to EGs such as WGCRAN and the ICES/NAFO NIPAG.
Linkages to other organizations	

Annex 3: Updated tables: fishery and survey data

Table 1a. Stock summary for Cancern Pagurus in England, Scotland, Ireland, France and Norway.

Cancer pagurus

	Ireland	Scotland	England	Jersey Channel Islands	France	Norway
Number of stocks in which national fleet is active	4	12	6	1		1
Stock areas (cross reference to map)	Malin	Clyde	Central North Sea	Western Channel	Eastern Channel	Whole Norwegian coast, Swedish border to Troms
	Celtic sea	East Coast	Southern North Sea		Western Channel	
	Irish sea	Hebrides	Eastern Channel		Celtic Sea	
		Mallaig	Western Channel			
		North Coast	Celtic Sea			
		Orkney				
		Papa				
		Shetland				
		South East				
		South Minch				
		Sule				
		Ullapool				
Indicator			Irish Sea			
Landings	1990-2018	1974-2018	1983-2016	1996-2018	1985-2018	1914-2018
Effort	1990-2018		1983-2016	2007-2018	1985-2018	
LPUE	1990-2018		1983-2016	2007-2018	1985-2018	2001-2018
DPUE	1990-2018		No		No	2001-2018
Size frequency data	1990-2018	1974-2018	1983-2013 (for most assessement units)	2004-2014	1985-2018	2001-2018
Others						

Analytical assessment methods						No
LCA	No	Yes	Yes (length based VPA excluding Irish Sea)	No	No	No
Production	No	No		No	One test	No
Change in ratio	No	Yes		Yes		No
Depletion methods	No	No		No		No
Others			LPUE selected log-book vessels	Index LPUE from se-lected logbook vessels	Index LPUE from selected logbook vessels	No
Data sources						
Surveys			1989 (EC & WA), 1993 (NS) + Various non targeted		No	No
Larval	2002	No				
Juvenile index /biomass	Index	No			Study now	
Adult index/biomass	Biomass	No				
Non target surveys	Scallop dredge	Scallop dredge				
Commercial						
Observer/self repor-ting/reference fleet	Observer/ref fleet	Observer	Selected logbook ves-sels from 1985		Selected logbook vessels from 1985	reference fleet
Size frequency data	Yes	Yes	Yes	since 2018	Yes	Yes
Logbooks	Yes	Yes (EU logbooks)	Yes	Yes	Yes	Yes
Tag returns	Yes	Yes	Yes	No	Yes	No
VMS	Yes	Yes (boats > 12m)	Yes (Commercial in-confidence)	No	Yes (Commercial inconfi-dence)	No
Electronic logbooks	No	No	No	No	From 2013	No
Others					National logbooks for ves-sels under 12 m	
Biological parameters						
M	0,2	0,1	0.1 and 0.2 assumed feasible scenarios	No	0,2	No
Growth data	k = 0.1-0.2	K_m=0.197 ; $Linf_m$=220; K_f=0.172 ; $Linf_f$=220;	k=0.191 (female), 0.196 (male). Linf 240mm CW	No	0.1-0.2	No

Fecundity			a=0.0187 and b=0.0268, f=ae^{bl}	No		No
Size at maturity	125 - 140	130 - 150	Regional 89-105 (male), 110-126 (female)	No	130 for female, less for male	Females: L50 112 (mature), external roe: 130 mm or larger
Others		Terminal F=0.5				
Analytical assessment outputs						
Biomass	Yes	Yes	Yes	No	No	No
Spawning stock	No	No	Yes	No	No	No
Recruitment	No	No	No	No	No	No
Fishing mortality	Yes	Yes	Yes	No	No	No

Table 1b. Stock summary for *Chionooecetes opilio* in Canada, Greenland, Norway, Russia and France.

Chionoecetes opilio	**Canada - Newfoundland**	**Canada Southern Gulf**	**Greenland**	**Norway**	**Russia**	**France**
Number of stocks in which national fleet is active		4	6			
Stock areas (cross reference to map)	NAFO 2H, 2J, 3K, 3L, 3N, 3O, 3Ps, 4R	Eastern Canada, Southern Gulf of St., Lawrence	West coast	Barents Sea	Barents Sea	3PS
Indicator						
Landings	1979-2018	1979-2018	1996 - 2018	2013-	2013-2014	1996-2018
Effort	1979-2018	1979-2018	2003 - 2018	No	2013-2014	1996-2018

LPUE/CPUE	1979-2018	1979-2018	2000 - 2018	No	2013-2014	1996-2015, few diffculties recently
DPUE		Not estimated but possible to do				
Size frequency data	1979-2018	1989-2018	1997 - 2018	2004-	2004-2014	Yes, few data
Others	1979-2018	1989-2018	1997 - 2018		2004-2014	
Analytical assessment methods						
LCA	No	No	No			No
Production	Yes	No	No		Yes	No
Change in ratio	No	No	Yes			Yes
Depletion methods	Yes	Yes 1985-1989	No			No
Others	Stratified Random Biomass Estimatation	Yes 1989-2018 (Trawl survey)	Yes		Yes 2004-2014 (Trawl survey)	Yes
Data sources						
Surveys		Yes 1989-2018 (Trawl survey)	Yes 1997 - 2018		Yes 2004-2014	No
Larval	No	Sporadically	No	No	No	No
Juvenile index /biomass	Yes	Yes (Abudance estimates)	Index	yes 2018 / Trap	Yes	No
Adult index/biomass	Yes	Yes (abundance & Biomass estimates)	index	yes 2018 / Trap	Yes	No
Non target surveys	Yes	September groundfish trawl survey		No	Yes	
Commercial						
Observer/self reporting/reference fleet	Yes	At sea observer at the cxoverage of approximately 20% of total sea days	Fleet	No	Yes	Yes
Size frequency data	Yes	Yes	No	No	Yes	Yes, few data
Logbooks	Yes	Yes	Yes	No	No	Yes
Tag returns	Yes	Between 1985 and 2000	Yes	No	No	No
VMS	Yes	Yes	No	No	Yes	No

Electronic logbooks	No	No	No	No	Yes	No
Others	Dockside Monitored Landings					
Biological parameters						
M	Yes	0.47 (2013)	0,2	No	No	No
Growth data	Yes	Yes	Yes	No	Yes	No
Fecundity	Yes	Yes (until 2010)	Yes	No	Yes	No
Size at maturity	Yes		52 - 150 mm CW	No	Yes	No
Others	Environment (Temperature)					
Analytical assessment outputs						
Biomass	Yes	Yes	Yes		No	No
Spawning stock	No	Yes			No	No
Recruitment	Yes	Yes	Yes		No	No
Fishing mortality	Yes	Yes			No	No

Table 1c. Stock summary for *Paralithodes camtschaticus* in Norway and Russia.

Paralithodes camtschaticus

	Norway	Russia
Number of stocks in which national fleet is active		
Stock areas (cross reference to map)	ICES Aera 03	ICES Area Ib Russian coast of South-East of Barents Sea
Indicator		
Landings	1994-2018	1994-2018
Effort	1994-2018	1994-2018
LPUE		1994-2018
DPUE		
Size frequency data	Yes	Yes
Others		
Analytical assessment methods		
LCA		
Production	2011-2018	
Change in ratio		
Depletion methods		2010-2014
Others		CSA (2006-2013)
Data sources		
Surveys		
Larval		
Juvenile index /biomass		Yes
Adult index/biomass	Annual	Yes
Non target surveys		Yes
Commercial		

Observer/self reporting/reference fleet		Yes
Size frequency data		Yes
Logbooks	Yes	No
Tag returns		Yes
VMS	Yes	Yes
Electronic logbooks	No	Yes
Others		
Biological parameters		
M	0,2	0,08961
Growth data	Increment and moulting frequency	Yes
Fecundity	Yes	Yes
Size at maturity	Yes	Yes
Others		
Analytical assessment outputs		
Biomass	Yes	Yes
Spawning stock	Yes	No
Recruitment	Yes	Yes
Fishing mortality	Yes	Yes

Table 1d. Stock summary for *Maja brachdactyla* in England, Scotland, France, Ireland, Jersey.

Maja brachdactyla

	England	Scotland	France	Ireland	Jersey Channel Islands
Number of stocks in which national fleet is active				2	1
Stock areas (cross reference to map)				SW Ireland	Western Channel
				Malin	
Indicator					
Landings	1983-2018	2006-2018	1973-2018	2004-2018	1996-2018
Effort	Targetted potting and netting effort not available	No	Targetted potting and netting effort not available	No	2007-2018
LPUE	No	No	No	No	2007-2018
DPUE	No	No	No	No	
Size frequency data	Yes. At least recent i.e. 2004-2013 maybe much longer series	No	Few data from some periods	Data from some target studies, 1985, 2000, 2003-2007 and 2009	2004-2018
Others	No	No		No	
Analytical assessment methods					
LCA	No	No	No	No	No
Production	No	No	No	No	No
Change in ratio	No	No	No	No	Yes
Depletion methods	No	No	No	No	No
Others	No	No	No	No	no
Data sources					

Surveys			Yes (1986-1996)	Yes (1985, 2003 & 2009)	
Larval	No	No	YES	No	
Juvenile index /biomass	Possibly	No	No	No	
Adult index/biomass			Yes		yes 2004-2018
Non target surveys					
Commercial					
Observer/self reporting/reference fleet	No	No	No	Data for some years; 2003 & 2009	No
Size frequency data	Yes	No	Few data from some periods	Data for some years; 2003 & 2009	No
Logbooks	No	No	Yes	Yes from reference fleet	Yes
Tag returns	No	No	No	No	No
VMS	No	No	Yes	Yes (2005 - 2007)	No
Electronic logbooks	No	No	For some vessels	No	No
Others	No	No	Recruitment Study	No	No
Biological parameters					
M			No	No	No
Growth data			Few data from some periods	No	No
Fecundity			Few data from some periods	No	No
Size at maturity			No	No	No
Others					No
Analytical assessment outputs					No
Biomass	No	No	No	No	No
Spawning stock	No	No	No	No	No
Recruitment	No	No	No	No	No
Fishing mortality	No	No	No	No	No

Table 1e .Stock summary for *Homarus gammarus* in England, Scotland, France, Ireland, Jersey.

Homarus gammarus

	Scotland	France	Ireland	Jersey Channel Islands	England
Number of stocks in which national fleet is active	12		4	1	5
Stock areas (cross reference to map)	Clyde	Western Channel	Malin	Western Channel	Northumberland Durham
	East Coast	Bay of Biscay	SW Ireland		Yorkshire Humber
	Hebrides		SE Ireland		East Anglia
	Mallaig		N Irish Sea		Southeast and South coast
	North Coast				Southwest
	Orkney				
	Papa				
	Shetland				
	South East				
	South Minch				
	Sule				
	Ullapool				
Indicator					
Landings	1974-2018	2000-2018	1995-2018	1996-2018	1983-2018
Effort		Yes		2007-2018	1983-2018
LPUE		Yes	1995-2004	2007-2018	Yes
DPUE		No			No
Size frequency data	1974-2018	Yes	1995-2018	2004-2018	
Others					
Analytical assessment methods					

LCA	Yes	Yes	No	No	Yes (length based VPA)
Production	No	Yes	No	No	No
Change in ratio	Yes	No	No	Yes	No
Depletion methods	No	No	No	No	
Others				Index LPUE from selected logbook vessels	LPUE selected logbook vessels
Data sources					
Surveys					
Larval	No	YES	No		No
Juvenile index /biomass	No	Studysince 2018	No	Yes Index and CL (2 per year, very small - 180 pot lifts)	No
Adult index/biomass	No	Yes	No	Yes Index and CL (2 per year, very small - 180 pot lifts)	No
Non target surveys	No		No		No
Commercial					
Observer/self reporting/reference fleet	Observer	Yes	Yes	ref fleet	Selected logbook vessels from 1985
Size frequency data	Yes	Yes	Yes	no	
Logbooks	Yes (EU logbooks)	Yes	Yes (EU & some regional areas for some years)	yes	
Tag returns	No	Yes	Yes	no	
VMS	Yes (boats > 12m)	Few data	Yes (boats > 12m)	no	Yes
Electronic logbooks	No	No	No	no	No
Others				1 off volunteer survey of CL and berried proportions	
Biological parameters					
M	0,1	0,2	0.1-0.2	No	0,15

Growth data	K_m=0.11 ; $Linf_m$=173.4; K_f=0.13 ; $Linf_f$=150;	k arround 0,25	k=0.12; Linf=172	No	
Fecundity		Yes		No	
Size at maturity	~80 mm	L50, from 93 to 104	L50 95mm	No	
Others	Terminal F=0.5				
Analytical assessment outputs					
Biomass	Yes	Yes from few areas	No	No	Yes
Spawning stock	No	Yes from few areas	No	No	Yes
Recruitment	No	Yes from few areas	No	No	No
Fishing mortality	Yes	Yes from few areas	No	No	Yes

Table 2a. Management measures table for *Cancer pagurus* in England, Scotland, Ireland, Jersey, France, Norway.

	Central North Sea	Southern North Sea	Eastern Channel	Western Channel	Celtic Sea	Irish Sea	Norwegian coast	Scotland	Eastern Channel	Western Channel	Celtic Sea	Bay of Biscay	Ireland	Jersey, Channel Islands
Management measure	UK	UK	UK	UK	UK	UK	Norway	UK	FR	FR	FR			
Licensing	MSAR/EU	MSAR/EU	MSAR/EU	MSAR/EU	MSAR/EU	MSAR/EU	No	MSAR/EU	Yes	Yes	Yes	Yes	Yes	yes
Limited Entry	Yes for <10m	Yes for <10m	Yes for <10m	Yes for <10m	Yes for <10m	Yes for <10m	No	Yes for <10m	Yes	Yes	Yes	Yes	No	Yes 3-12nm (Granville Bay Treaty Area permit - capped Numbers) No for 0-3nm limit of territorial waters
Closed seasons	No	Generally No but regional ban on white footed crab Nov-June	No	No	No	No	No	No	No	No	No	No	No	No

Days at sea	No	No	No	No	?	No	No	No Under EU Regulations the annual fishing effort of UK vessels over 15 m participating in the brown crab fishery is restricted to 702,292 KW days in ICES areas V and VI and 543,366 KW days in ICES are VII.	No	No Under EU Regulations the annual fishing effort of UK vessels over 15 m participating in the brown crab fishery are restricted but never the annual effort has reached the maximum.	No	No	ICES Area V, VI Vessels >15m, are limited to 465,000 kw.days; ICEAS Area VII, Vessels >15m are limited to 40,960kw.days; ICES Area VII (Biologically Sensitive Area), Vessels >10m are limited to 63,198 kw.days	No
Closed areas	No	No	No	No	Lundy	No	No	Fishing with creels is prohibited in certain areas (Article 5 of The Inshore (Prohibition of Fishing Methods) (Scotland) Order 2004).	No	Yes	Lundy	Yes	No	No
Others														Closed area to

														parlour pots
Minimum size	130mm CW (140mm north of 56N)	115 and 130mm CW	130mm in Southern Bight and 140mm CW	Various/regional 140mm - 150mm(CRH) 140-160mm (CRC)	Various/regional 130mm - 150mm(CRH) 130-160mm (CRC)	Various/regional 130mm - 140mm(CRH) 130-140mm (CRC)	110mm CW Swedish border-59 30 N, 130mm CW northwards	150mm CW (except Shetland where 140mm CW applies)	140 mm CW	140 mm CW, 150 mm CW in Bay of Granville	140 mm CW	130 mm South of 48°	130mm Area VII, Area VI south of 56ºN; 140mm Area VIIf, e, d (Channel), Area IV and VI north of 56ºN	150mm
Maximum size	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Berried female legislation	Yes	Yes	Yes	Yes	Yes	Yes	No but release	Yes	No	No	No	No	No	No
Soft crabs	Yes	Yes	Yes	Yes	Yes	Yes	No but release	Yes	Yes	Yes	Yes	Yes	No	Yes
Single sex fishery	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Claws or parts	Claws <1% by wt. or <75kg for other gears. No parts regional	Claws <1% by wt. or <75kg for other gears. No parts regional	Claws <1% by wt. or <75kg for other gears	Claws <1% by wt. or <75kg for other gears. No parts regional	Claws <1% by wt. or <75kg for other gears. No parts regional	Claws <1% by wt. or <75kg for other gears	Not sufficient information	Claws <1% by wt. or <75kg for other gears. No parts regional	Claws <1% by wt for potters or a quotas of 75kg by trip for other gears.	Claws <1% by wt for potters or a quotas of 75kg by trip for other gears.	Claws <1% by wt for potters or a quotas of 75kg by trip for other gears.	Claws <1% by wt for potters or a quotas of 75kg by trip for other gears.	Claws <1% of total catch weight	Claws <1% by wt. or <75kg for other gears
Use as bait	Regional	Regional	No	No	No	No		Regional	No	No	No	No	Yes	
Vessel size	Regional <12 and 16m inside 6nm	Regional <16 and 17m	Regional <14 and 17m	Regional <11, 15.24 and 16.46m	Regional <14, 15.2 and 16.46m and 21m	Regional <12, 13.7, 14, 15 and 21m	< 21.35 m inside 4nm	Regional	No	No	No	No	No	In certain zones or areas
Vessel power	No	No	No	No	No	No	No		No	No	No	No	No	In certain zones or areas

VMS	>15m	>15m	>15m	>15m	>15m	>15m	>15m	>12m	>12m	>12m	>12m	>12m	>12m	>12m
Log book returns	Yes	Yes	Yes	Yes	Yes	Yes	>15 m	Yes	Yes	Yes	Yes	Yes	EU logbooks	Yes
Others							logbooks from reference fleet		National log book for vessel under 12 m	National log book for vessel under 12 m	National log book for vessel under 12 m	National log book for vessel under 12 m	Fishing activity reports for some vessels as part of the Sentinel Vessel Programme	National logbook for under 10m vessels, EC Logbook for over 10m. E logs for over 12m
									National VMS system for some vessels under 12 m	National VMS system for some vessels under 12 m	National VMS system for some vessels under 12 m	National VMS system for some vessels under 12 m		
							No limits for commercial fishery, max 20 per recreational fisher	No						
Trap limits	Yes	No	Regional	No	No	No	No	No	Yes, Regional and National. Max 1200	Yes, Regional and National. Max 1200 traps	Yes, Regional and National. Max 1200	Yes, Regional and National. Max 1200	No	Yes

									traps per vessel and max 250 traps per fisherman.	per vessel and max 250 traps per fisherman.	traps per vessel and max 250 traps per fisherman.	traps per vessel and max 250 traps per fisherman.		
Trap size	No	No	No	No	No	No	Yes, for lobster, regional	No	No	No	No	No	No	No
Entrance size								No	yes, rigid and minimum of 14 cm diameters	yes, rigid and minimum of 14 cm diameters	yes, rigid and minimum of 14 cm diameters	yes, rigid and minimum of 14 cm diameters	No	Yes
Escape vents	No	Regional and gear specific Yes	Regional and gear specific Yes	Regional and gear specific Yes	Regional and gear specific Yes	Regional	Yes	Regional	No	No	No	No	No	Yes
Biodegradable panels	No	No	No	No	No	No	no	No	No	No	No	No	No	No
Marked gear	Regional	Regional	Regional	Regional	Regional	Regional	yes	Regional	National Regional	National Regional	National Regional	National Regional	No	Yes

Table 2b. Management measures table for *Chionoecetes opilio* in Canada, Greenland, Norway, Russia and France.

	West coast of Green-land	Newfoundland	Sourthern Gulf	SouthNova Scotia	Barent Sea	Barents Sea
Management measure	Greenland	Canada	Canada	France, Saint Pierre et Miquelon	Norway	Russia
Licensing	Yes	Yes	Yes	No	Yes	No
Limited Entry	Yes for < 75 Brt	Yes (no new licences available)	Yes	Yes	No	No
Closed seasons	No	Yes	Yes	Yes	Yes (15 June to 15 September)	No
Days at sea	No	No	No	Yes	No	No
Closed areas	Yes	Yes	Yes		No	No
Others		Dockside Monitored Landings, Soft-shell protocols, Trip Limits	Soft crab control			
				95 mm CW		
Minimum size	100 mm CW	95mm CW	95mm CW	No	100 mm CW	No
Maximum size	No	No	No	Yes - prohibation to land females	No	No
Berried female legislation	Yes - prohibation to land females	Yes - prohibation to land females	Yes - prohibation to land females	Yes	Yes	No
Soft crabs	Yes - prohibation to land soft crab	Yes - prohibation to land soft crab	Yes - prohibation to land soft crab		20 % softshell crab allowed	
Single sex fishery	Yes, male only	Yes, male only	Yes, male only	no	Yes, male only	Yes
Claws or parts	no	no	No	No	No	No
Use as bait	Squid	Squid / Herring	Mackerel, Herring, Squid	Squid	No	Herring
Vessel size	Regional <10m	Various fleet sectors (<40', 40-64'11", 65-89'11")	65 fts or less	No		49.6-54.8 m
Vessel power	No	No	No	No		700-1700 hps
VMS		Yes	Yes	No	Yes	Yes
Log book returns	Yes	Yes	Yes	Yes	Yes	No

Others		Observer Coverage	100% dock side landing monitoring & at-sea observer coverage at approximately 20%			
				Yes		
Trap limits	No	Yes	Yes (the number varies depending on the area from 50 to 150/ licence), Area 19 has total trap number at 1699	Yes	yes (12000 max)	No
Trap size	Yes (meshsize 1400mm)	Yes (135mm)	Yes (volume should not exceed 2 cubic meter) and maximum and minimum mesh sizes at 65 and 75 mm	Yes	No	No
Escape vents	No	No	No but see below	No	No	No
Biodegradable panels	No	Yes	Biodegradable twine	No	No	
Marked gear	Regional / overseas trade	Yes	Yes		Yes	

Table 2c. Management measures table for *Paralithodes camtschaticus* in Norway and Russia.

Management measure	Barents Sea Norway	Barents Sea Russia
Licensing	Yes	Yes
Limited Entry	Yes	Yes
Closed seasons	No	Yes
Days at sea	No	No
Closed areas	No	Yes
Others		
Minimum size	130mm CL	150mm
Maximum size	No	No
Berried female legislation	No	Yes - prohibation to land females
Soft crabs		
Single sex fishery	No	Yes, only males
Claws or parts	No	Sections by different weight
Use as bait	Herring	Herring
Vessel size	6-22 m	49.6-54.8 m
Vessel power		700-1700 hps
VMS	Yes	Yes
Log book returns	Yes	No
Others		
Trap limits	Yes	Yes
Trap size	Yes	Yes
Escape vents	Yes	No
Biodegradable panels	No	Yes
Marked gear	Yes	No

Table 2d. Management measures table for *Maja brachdactyla* in England, Scotland, France, Ireland, Jersey.

Management measure	UK	France	Ireland	Jersey, Channel Islands
	All			
Management measure	E&W			
Licensing	Yes	Yes	Yes	yes
Limited Entry	<10m	Yes	No	Yes 3-12nm (Granville Bay Treaty Area permit -capped Numbers) No for 0-3nm limit of territorial waters
Closed seasons	No	No	No	Yes for soft shell
Days at sea	>15m in Celtic Sea	No	ICES Area V, VI Vessels >15m, are limited to 465,000 kw.days; ICEAS Area VII, Vessels >15m are limited to 40,960kw.days; ICES Area VII (Biologically Sensitive Area), Vessels >10m are limited to 63,198 kw.days	No
Closed areas	No	Yes	No	No
Others		No licence for trawlers and dredgers		Closed area to parlour pots, closed seasonal areas to static nets
Minimum size	120mm CL females; 130mm for males	120 mm CL, male and female	125 mm CL Females; 130mm CL for Males	120mm
Maximum size	No	No	No	No
Berried female legislation	No	No	No	No
Soft crabs	No	No	No	Yes
Single sex fishery	No	No	No	No
Others				Must be retained whole

Vessel size	Regional	No	No	In certain zones or areas
Vessel power	No	No	No	In certain zones or areas
VMS	>15m	>12m	>12m	>12m
Log book returns	Yes	Yes	Yes for >12m	Yes
Others		National log book for vessel under 12 m	Sentinel Vessel Programme Data	National logbook for under 10m vessels, EC Logbook for over 10m. E logs for over 12m
Trap limits	Regional	Yes	No	Yes
Trap size	No	No	No	No
Escape vents	Regional and gear specific	No	No	Yes
Biodegradable panels	No	No	No	No
Others	No	yes, rigid and minimum of 14 cm diameters	No	
Marked gear	Regional	Yes for pots	No	yes
Gillnet limits		Yes	No	yes
Gillnet mesh		Yes	No	yes

Table 2e. Management measures table for *Homarus gammarus* in England, Scotland, France, Ireland, Jersey.

Management measure	Scotland	France	Norway	Ireland	Jersey, Channel Islands	England
Licensing	MSAR/EU	Yes	Yes?	Yes	Yes	Yes
Limited Entry	Yes for <10m	Yes	Yes?	No	Yes 3-12nm (Granville Bay Treaty Area permit -capped Numbers) No for 0-3nm limit of territorial waters	Yes
Closed seasons	No	No	Yes?	No	No	No
Days at sea	No	No	?	No	No	No
Closed areas	Fishing with creels is prohibited in certain areas (Article 5 of The Inshore (Prohibition of Fishing Methods) (Scotland) Order 2004).	Yes	Yes?	No	No	MCZ restrictions (regional)
Others					Closed area to parlour pots	
Minimum size	90mm CL (Shetland Islands, Orkney Islands, Outer Hebrides and West Coast from Cape Wrath to 55°N) 87mm CL rest of Scotland	87 mm CL, male and female. 90 mm CL in Estern Channel	250mm	87mm CL for both sexes	87mm CL	87mm CL national, 90mm within 6 miles of coast (Devon, Cornwall, Isle of Scilly)
Maximum size	Yes - for famales only 145mm CL in all areas except Shetland and Orkney where 155mm CL applies	No	Yes, 320 mm in some south region	127mm CL (since Jan 2015)	No	No
Berried female legislation	No	No	Yes	No	No	Yes (regional)
Soft crabs	No	No	?	No	Yes	Yes
Single sex fishery	No	No	Yes	No	No	No

Claws or parts	It is illegal to land 'V'-notched lobsters, or animals that have been mutilated in any way. Lobsters can only be retained on board or landed whole.	No	?	It is illegal to land 'V-notched' or mutilated lobster. Lobsters can only be retained on board or landed whole.	Must be retained whole	Limits on percentage/ quanitity caught (regional)
Use as bait	No	No	?	No	No	
Vessel size	No	No	?	No	In certain zones or areas	Yes (regional)
Vessel power	No	No		No	In certain zones or areas	
VMS	>12m	>12m		>12m	>12m	>12m
Log book returns	Yes	Yes	No?	No	Yes	Yes
Others		National log book for vessel under 12 m		Sentinel Vessel Programme data	National logbook for under 10m vessels, EC Logbook for over 10m. E logs for over 12m	
Trap limits	No	Yes	Yes	No	Yes	Yes (regional)
Trap size	No	No		No	No	No
Escape vents	No	Yes in some fishing areas	Yes	No	Yes	Yes (regional)
Biodegradable panels	No	No	Yes	No	No	No
Marked gear	Regional	Yes for pots		No	Yes	Yes (regional)
Entrance size	No	yes, rigid and minimum of 14 cm diameters		No	Yes- parlours	No
Parlour pot	No	Regional Legislation			Prohibited in some areas	No

Table 3a. Landings (tones) of *Cancer pagurus* in England, Scotland, France, Norway, Ireland and Jersey.

Site	England	Scotland	France	Norway	Ireland	Jersey, Channel Islands
Year						
1990		4 282	6 076	1 374		
1991		5 485	5 310	1 462		
1992		4 648	5 583	1 316		
1993		3 820	5 896	1 641		
1994		4 759	6 086	1 781		
1995		6 092	6 823	1 806		
1996		5 528	6 527	1 889		495
1997		7 470	7 000	2 205		523
1998		8 021	6 490	2 984		521
1999		7 437	6 087	2 836		473
2000	12 363	9 650	5 182	2 890		440
2001	13 013	8 458	5 513	3 478		447
2002	11 973	7 874	5 963	4 344		524
2003	13 349	7 525	6 327	4 944		540
2004	10 825	6 761	7 813	5 248	11 662	541
2005	8 484	8 332	6 259	5 671	7 911	438
2006	11 043	10 430	5 423	6 205	8 779	349
2007	12 074	11 919	6 178	8 514	6 486	412
2008	11 697	9 336	6 416	5 295	6 737	481
2009	11 001	9 466	4 353	4 970	10 934	361
2010	11 902	10 857	5 487	5 774	11 394	409
2011	12 089	11 859	5 690	5 319	6 964	478
2012	13 844	10 892	5 990	4 981	6 195	507
2013	13 804	10 891	5 570	5 242	5 755	436
2014	16 330	12 306	5901	4 629	7 257	386
2015	15600	11089	4 500	4 743	5 159	305

2016	17650	12 141	4 500	4 926	7 596	310
2017	17020	11 599	4 400	4 924	7 685	300
2018	18570	10 377	3 800	5 758	6 798	290
2019				4730*		

Table 3b. Landings (tones) of *Chionooecetes opilio* in Canada, Greenland, Norway, Russia and France.

Site	Canada	Greenland	Norway	Russia	France
Year					
1990	26 233				
1991	35 295				
1992	37 232				
1993	47 819				
1994	60 662				
1995	65 505	997			
1996	65 505	563			189
1997	71 388	3 214			368
1998	75 236	2 094			354
1999	95 381	4 982			589
2000	93 411	10 521			550
2001	95 241	15 139			485
2002	106 547	11 174			139
2003	96 360	7 179			83
2004	102 776	6 295			159
2005	95 996	4 213			157
2006	89 271	3 305			191
2007	90 280	2 189			166

2008	93 166	2 354			123
2009	96 635	3 191			169
2010	83 393	2 363			236
2011	83 979	2 015			242
2012	92 760	1 983			325
2013	98 089	2 162	189	62	251
2014	95 532	2 157	1 800	4 104	100
2015	93 000	2 021	3 485	8895	28
2016	82 000	1 506	5 290	7 520	5
2017	92 500		3153	7780	21
2018	68 000		2 804	9 728	86
2019			3 775	9 840	123

Table 3c. Landings (tones) of *Paralithodes camtschaticus* in Norway and Russia.

Site	Norway	Russia
Year		
1990		
1991		
1992		
1993		
1994	11 000	22
1995	11 000	9
1996	15 000	24
1997	15 000	63
1998	25 000	90
1999	37 500	143
2000	37 500	113
2001	100 000	300

2002	100 000	900
2003	200 000	1 950
2004	280 000	1 105
2005	280 000	3 021
2006	300 000	9 389
2007	300 000	9 953
2008	596 000	8 823
2009	1 185	6 142
2010	900	3 787
2011	1 200	3 698
2012	1 000	5 209
2013	1 000	5 531
2014	1 100	5 995
2015	1 300	6 380
2016	2 202	8 300
2017	1 688	9 285
2018	1 977	9 197

Table 3d. Landings (tones) of *Maja Brachdactyla* in France, Ireland, Jersey.

Site	France	Ireland	Scotland	Jersey, Channel Islands
Year				
1990				
1991				
1992				
1993				
1994				
1995				
1996				383
1997				162
1998				160
1999				175
2000	3286,3			172
2001	3707,3			236
2002	3 999			270
2003	4 283			233
2004	4 070	180		223
2005	4 085	141		163
2006	4 453	153	0,7	129
2007	4 574	70	0,1	106
2008	4 467	153	3,1	179
2009	4 641	443	6,0	177
2010	4 083	415	3,1	173
2011	3 924	290	1,2	148
2012	3 491	818	1,7	110
2013	4 058	229	0,2	81
2014	4 734	113		87
2015	4794	26		95

2016	5822	21	121	
2017	6579	18		
2018	7171	15		

Table 3e. Landings (tones) of *Homaus gammarus* in England, Scotland, Ireland, France, Jersey, Norway.

Site	England	Scotland	Ireland	France	Jersey, Channel Islands	Norway
Year						
1990		769				33
1991		687				31
1992		513				28
1993		369				28
1994		457				30
1995		565				34
1996		453			164	30
1997		653			166	35
1998		638			157	45
1999		509			153	59
2000	786	411		191	128	52
2001	776	289		180	130	40
2002	832	341		294	157	42
2003	1 008	353		348	167	52
2004	921	404	853	339	167	52
2005	910	409	635	324	139	58
2006	1 587	711	625	388	131	62
2007	1 700	890	308	475	155	57
2008	1 695	915	498	444	163	44
2009	1 640	953	431	329	177	50

2010	1 531	1 100	477	600	225	59
2011	1 845	1 219	735	570	268	58
2012	1 888	1 132	249	560	249	62
2013	1 821	1 026	374	500	225	58
2014	2 020	1 208	585	560	237	42
2015	1765	1 042	103	530	256	46
2016	1830	1 150	107	560	241	52
2017	1955	1 214	111	691	245	
2018	1680	1212	101	750	196	