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ECOSYSTEM PROCESSES AND DYNAMICS STEERING GROUP

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Interim Report of the Working Group on the Biology and Life History of Crabs (WGCRAB)

8-10 November 2017

Brest, France

ICES International Council for the Exploration of the Sea
CIEM Conseil International pour l'Exploration de la Mer

International Council for the Exploration of the Sea
Conseil International pour l'Exploration de la Mer

H. C. Andersens Boulevard 44–46
DK-1553 Copenhagen V
Denmark
Telephone (+45) 33 38 67 00
Telefax (+45) 33 93 42 15
www.ices.dk
info@ices.dk

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Contents

Executive summary

The Working Group on the Biology and Life History of Crabs (WGCRAB) met at Ifremer, Brest, France, on 8–10 November 2017. The meeting was attended by 12 participants, representing 6 countries. This working group is focusing on several species, among others: the European lobster (*Homarus gammarus*), the edible crab (*Cancer pagurus*), the spider crab (*Maja brachydactylus*), the king crab (*Paralithodes camtschaticus*) and the snow crab (*Chionoecetes opilio*). For all of these species, each member country presented the available data and reported on the work needed to compile the data sets. Several countries have not collected the same level or quality of data. For some countries, information on the effort data are incomplete and for other countries, some of the data on the size structure are low too. There was an overall discussion on the current strategy of each country to suggest improvements of each national collection practices.

Furthermore, the status of each stock was presented and discussed among groups participants. These discussions help to assess the different methodologies employed to perform the assessment and the choices to communicate the results to stakeholders. The methodologies are mainly driven by the data available and the ongoing knowledge on the biology of species for each stock. In some instances, the quality of the effort data was low, therefore, no index based on abundance was developed. This approach is currently being applied by the Scottish or English fisheries. At the control areas, for the French data, the size structure data is only available for few fleet and do not permit to develop a size structure model. Where the size structure model is applied, the assessment gives reference points as Fmsy, Bmsy and Blim and a classical diagnosis on the stock where it is indicated over, under or well exploited. For each Scottish and English stocks, this approach is performed and a diagnosis table sum up the results with associated colours (red, green and blue). The aim is to communicate clearly the data to several stakeholders (e.g. fishermen, managers, advisors? etc...). In this way, the assessment approach is closed to works on the fishes. Many discussions of the working group focus on the assumptions due the crustacean biology and the impact as a result of uncertainties. Some of the stocks, where time-series are modelled for different indices, it is important to have enough year of data to understand the dynamic of the stock and the impact of the fishing effort. It is important to consider that an index only based on abundance is not enough to make scientific assessments. Therefore, the possibilities of having several indexes available can help to bring a global understanding of the stock status. The main difficulty and the main discussion in the working group was on the way to propose reference points and to agree on relevant thresholds. The Canadian snow crab is often taken as example, as a way to propose management options after a synthesis of all the available results.

Three main ToRs were covered during the annual meeting. The first ToR is to propose the same grid of reading to communicate all stock status from a classical assessment approach or from an index time-series approach. The goal is to fix reference points and to communicate the process to stakeholders. National reports on ongoing work are available in Annexes to this report.

The work presented on the biology focused on heavy metal in the edible crab in the Norway region, on the lobster size maturity at the European level and on the new

knowledge on the Hyas Crab spp. in Newfoundland. Other presentations focused on disease of the snow crab and the way to understand the population dynamics.

1 Administrative details

Working Group name

Working Group on the Biology and Life History of Crabs (WGCRAB)

Year of Appointment within current cycle

2017

Reporting year within current cycle (1, 2 or 3)

1

Chair(s)

Martial Laurans, France

Meeting dates

8–10 November 2017

Meeting venue

Brest, France

2 Terms of Reference

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 sets will be provided to the ICES Data Centre.

b) Evaluate assessment of the status of crab and lobster (*Homarus* sp.) 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.

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 resulting from changes in decreasing pH (defined as ocean acidification). Specific parts will be achieve to work on the different subjects.

d) Review research and new knowledge on vital crab and lobster population biology parameters.

3 Summary of 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.

4 List of Outcomes and Achievements of the WG in this delivery period

For the lobster, some studies are focused on the reproductive biology in France and Orkney. Looking at the results, it was proposed to compile at European level the difference or not on lobster biology from France to Norway including all the results. The aim is to write a paper where a global state of the art will be considered. During the year 2018, some video-conference meetings will be organised to work intersessionally on this subject.

In England, annual final results on the diagnosis of the different stocks are summarized in stock sheets. The stock assessment report format includes: Introduction, fishery description, assessment methods and uncertainty; followed by a 2-page section per region. The intention is to make this material available and understandable for a wider audience (not just fisheries scientists). We need to reflect on the way to use this approach for others stocks.

The ambition is to describe precisely the way or the standard method to use and to develop for abundance index from CPUE data. What type of data has to be used and what types of model are recommended to produce index which gives a good trend of a stock. Much work has been done in the SeaBass group. WGCRAB could look into the methodology that was selected.

5 Progress report on ToRs and workplan

ToR a): all the data on catch, effort or discard have been presented for each country with a sum up of the management rules in place. All these data allow to have a well view of the crab fisheries in ICES area. For the lobster, only the European fishery is considered for the moment. In future, it will be interesting to integrate in the group scientists from Canada or US for the American lobster. At this level, we can see the difference between the country to get data from their different fleets. For the vessels higher than 12 meters in European water, the logbooks are the main way to get all the data to describe the fishing activity. The situation is not the same for the vessels less 12 meters where data are good in some countries using national fishing sheet or using specific sampling to get activity data. Nevertheless, in other countries only total landings are available without any other information on vessel activities. In this country, there are some ideas to put in place to get the data organised in a template that is comparable. The main data on the stocks assessed are updated in excel sheets.

How to improve the data available to follow the stocks. In Isle of Man, an on-board camera has been developed in order to take specific pictures of individual caught. The aim is to estimate the size structure developing a software which could analysed each pictures. The first results are quite good and the work is always in progress. In Scotland, there are ideas to get the daily data from the small coastal vessels in order to have enough quality data to calculate CPUE.

Depending on the data sets available, the estimation of CPUE are not always possible. To develop such index, it is necessary to get effort data. As example, in France, Greenland, Newfoundland or Norway, there are enough good quality data to estimate time-series. For the other countries, the effort data available are too poor or absent. For these countries, discussions or projects are in place as in Scotland in order to progress to get effort data.

Some questions touched upon the way to develop abundance index from the CPUE data available.

ToR b): when assessments are done, the results are presented with all the discussions on the assumptions and the data used. Scotland and UK used a size structure model. There are two main assumptions: first, considering a stable recruitment and a size structure data which is an average over 3 years. This method is applied for lobster and edible crab in national management areas. Using this method, the assessment supply reference point as Fmsy.

For the other countries, times series of index are only used to describe the fishery. As in Newfoundland, several times series (from trawl or trap survey, observers on board) are available to get the more robust information on the stock. In this situation, it is really the trend of the series, which are considered to propose a diagnosis on the stock. After that, the managers adapt the values of the quota.

For some stocks, we need to work in order to propose an assessment where the data of all countries are considered. At the moment, only national assessment are performed, except for the lobster in the Granville Baie area, where some dedicated work is done. From 2018, an assessment at the Western Channel level could be produced for the edible crab. It will be a first stage to continue in the direction to have more structured assessments.

ToR c): the main fisheries data have shown some results is the link between the biomass fluctuations of the stock and the environmental conditions is the snow crab around Newfoundland. The sea bottom temperature seems to influence recruitment success of this specie. For the other fisheries, there are few studies conducted that tend to suggest that some trends may be impacted by environmental fluctuations. The increase of the abundance of lobster in France or the decrease of snow crab in some fjord in Greenland need to be analyse considering the environmental conditions. Except for Newfoundland, where recruitment surveys are in place, elsewhere such data need to be implemented to test if the climate change influence the biomass of the other stocks. In the Barents Sea, the recent presence of a snow crab stock have raised several questions on environmental condition to provide further explanations of the presence of this specie.

ToR d) several areas of work are in progress on the species targeted by fisherman. It is the case of the lobster with results on the reproductive biology or on the ecology. For the snow crab, a study focuses on the spatial distribution of the bitter crab disease and the impact of the environmental fluctuations. The cadmium effects are often described as a problem for the edible crab due to the level reaches in some individuals. Currently, a Phd student is undertaking research to understand if some elements (either form the environment or from anthropologic sources) can explain the cadmium levels observed in the specie. Data from trawl surveys conducted in the Barents sea to collect information on the distribution of the snow crab, some works is in progress to understand the quick increase of the biomass of this stock.

6 Revisions to the work plan and justification

No change to the current ToRs. There are ongoing discussions regarding the way to integrate the data in the ICES database.

7 Next meetings

Next meeting will take place on Jersey Island, on 6–8 November 2018.

Annex 1: List of participants

Name	Country	Email
AnnDorte Burmeister	Greenland	anndorte@natur.gl
Darrell Mulloway	Newfoundland (DFO)	darrell.mullowney@dfo-mpo.gc.ca
Ann Merete Hjelset	Norway (IMR)	ann.merete.hjelset@imr.no
Carlos Mesquita	Scotland (Marine Lab)	c.mesquita@marlab.ac.uk
Jack Emmerson	England (University Bangor)	j.emmerson@bangor.ac.uk
Matthew Coleman	Orkney Sustainable Fisheries	matt@orkneysustainablefisheries.co.uk
Ann Lisbeth Agnalt	Norway (IMR)	ann-lisbeth.agnalt@imr.no
Paul Chambers	Jersey	P.Chambers@gov.je
Rosslyn Mcyntyre	England (Cefas)	rosslyn.mcintyre@cefas.co.uk
Laurans Martial	France (Ifremer)	Martial.laurans@ifremer.fr
Jan Sundet	Norway (IMR)	jan.h.sundet@hi.no
Martin Wiech	(NIFES, Bergen, Norvège)	Martin.Wiech@hi.no

Annex 2: Agenda

Tuesday, November the 7th

09.30-13.00 ***TOR a***. Compiling data on landings, discards, effort and catch- rates (CPUE) and provide standardized CPUE, size frequency and research survey data for the important crab and lobster fisheries in the ICES area.

Lobster *- Presentations*

Martial Laurans (France), Carlos Mesquita (Scotland), Paul Chambers (Jersey)

Agnalt Ann-Lisabeth (Norway), New regulations in the Norway lobster fishery, includes registration of all fishers on the net (recreational and commercial).

14.00 – 18:00 ***TOR a***. Continued ***Crab*** – *presentations*

Snow Crab

Ann Dorte Burmeister (Groenland)

Mullowney Darrell (Newfoundland)

Hjelset Ann Merete Norway in Barent Sea ?

King Crab

Jan Sundet

Wednesday November the 8

09.00 – 13.00 ***TOR a cont.***

Visio Conference – *presentations*

ROSSLYN (CEFAS), Lobster and Edible Crab

Jack EMMERSON, Innovation in Data-capture Technique for Static Gear Fisheries

Matthew Coleman (Spawning potential of Lobster in Orkney Island)

14.00- 16.00

TOR a. Compiling data on landings, discards, effort and catch- rates (CPUE) and provide standardized CPUE, size frequency and research survey data for the important crab and lobster fisheries in the ICES area.

Edible crab

Hjelset Ann Merete (Norway), Carlos Mesquita (Scotland), Martial Laurans (France)

Spider crab

Martial Laurans (France)

> ***TOR b and d***. Evaluate assessments of the status of crab stocks, identify gaps in assessment programs, and review the application of biological and management. Review the impact of climate divers on important crab and lobster species within the ICES,

Mullowney Darrell, Bitter Crab Disease in Newfoundland and Labrador Snow Crab: Efficacy of visual monitoring and anticipated impacts under ocean warming (ToR C). *Mullowney Darrell*

Martial Laurans, What about our French Super Females

Discussion around the biology of the European Lobster. How we can make an overall review of the size at mautrity along its distribution range ?

Discussion around model to develop abundance indice.

Thursday, November the 3

09.00 – 13.00

> ***TOR b and d***. Evaluate assessments of the status of crab stocks, identify gaps in assessment programs, and review the application of biological and management. Review the impact of climate divers on important crab and lobster species within the ICES,

Mullowney Darrell, An alternative approach to reference points: Developing a precautionary approach for Newfoundland and Labrador snow crab

Martial Laurans, Reflection around an european networks for recrutment

11.00 – 13.00 ***TOR e.*** Review research and new knowledge of vital crab population biology parameter.

Mullowney Darrell, Development of a monitoring program for Hyas Crab spp. in Newfoundland

Martin (Cadmium Level of edible crab in Norway water)

Cadmium in Brown Crab along the Norwegian Coast

ICES WG Crab 6-10 Nov 2017, IFREMER, Brest, France, Martin Wiech

The Brown crab *Cancer pagurus* is appreciated seafood in several European countries and its fishery is of importance. However, findings of high levels of cadmium have risen concern about food safety. Along the Norwegian coast, a spatial increase in cadmium levels from Salten region (Northern Norway, 67°N) and northwards has been identified. Earlier studies including sediment measurements concluded that it is unlikely that an anthropogenic point source is responsible for the high cadmium levels.

In a study on the effect of cooking and freezing procedures on the distribution of Cd within the crab, a strong effect of cooking and freezing was found, causing a leakage of cadmium from hepatopancreas to claw meat.

Evidence for a high potential of brown crab to accumulate cadmium has been found in a lab trial, where cadmium from food and water was traced in brown crab to compare the relative importance of the uptake routes. No depuration of cadmium was observed, indicating a high accumulation potential. Furthermore, the dietary uptake was predicted to contribute much more to the overall cadmium accumulation in crab in Northern Norway

The findings in crabs sampled in the North and the South of the Norwegian coast during one year, revealed that the influence of physiological factors on cadmium levels is not very pronounced in comparison to the large differences between crabs from the North and the South. However, the total trace elemental composition was influenced by factors like season and condition and cooking was shown to also have an impact on other metals than Cd.

A study in shore crab showed that they do not have the same spatial pattern in Cd concentrations along the Norwegian coast as brown crab. This further indicates, that anthropogenic contamination is rather unlikely to be the reason for the high values of Cd in brown crab.

A risk assessment revealed that it is safe to consume crab claw meat regardless of the origin of the crab. The consumption of whole crabs including brown meat can lead to an intake of cadmium above the tolerable weekly intake. In general, brown meat should be consumed parsimoniously and a legal maximum limit for cadmium in brown meat and mixtures of brown meat and white meat should be considered.

Current Status of the Crab and Lobster Fisheries in the UK

Rosslyn McIntyre, Robin Masefield

Centre for the Environment, Fisheries and Aquaculture Science
United Kingdom

Assessment Methodology

- Length cohort analysis
- Outputs: Spawning stock biomass, fishing mortality

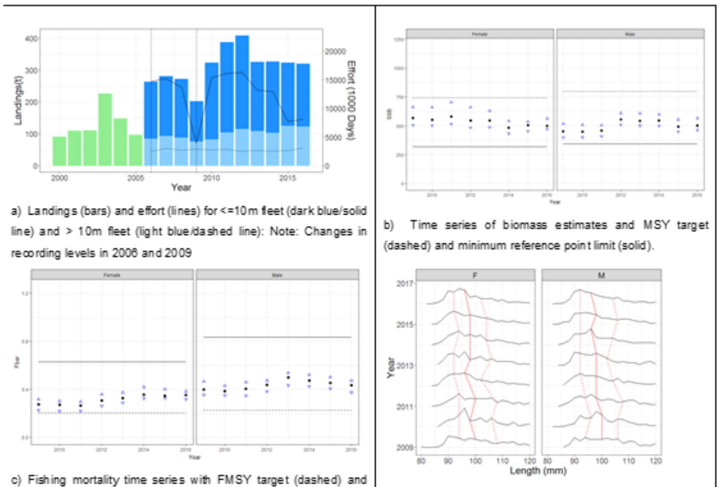
Outputs are measured against reference points- maximum sustainable yield (MSY) proxy. Natural mortality assumed (crab 20%, lobster 15%)

Stock assessment report format: Introduction, describes fishery assessment methods and uncertainty, then 2-page section per region. Easy to decipher to encourage people to read (not just fisheries scientists!).

Cefas Stock Status 2016: European lobster (Homarus gammarus) in the Southwest

Sustainability Status

Minimum Landing Size	*At the MLS's applied in this region between 99-100% of the males and 86-92% of the females should be mature*
Discarding	*High discard survival assumed to be > 90%*
Stock size	*Above minimum reference point limit but below MSY target*
Exploitation rate	*Moderate. Above rates consistent with MSY but below maximum reference point limit. Stable or decreasing over the past 3 years*



a) Landings (bars) and effort (lines) for <=10m fleet (dark blue/solid line) and > 10m fleet (light blue/dashed line): Note: Changes in recording levels in 2006 and 2009

b) Time series of biomass estimates and MSY target (dashed) and minimum reference point limit (solid).

c) Fishing mortality time series with FMSY target (dashed) and maximum reference point limit (solid).

d) Size distributions for the last 8 years:

The status of the stock of lobster in the Southwest area is moderate; Spawning biomass levels are between the minimum reference point limit and the level associated with MSY and are reasonably stable. The exploitation level is between MSY target level and the maximum reference point limit for both sexes and has decreased for males since 2013. The status of the stock in relation to the fishing rate reference points has not changed since the last assessment in 2014.

Lobster and Crab Regulations: (Jersey Territorial Waters)

Minimum Landing Size

Lobster: 87 mm carapace length
Brown Crab: 14 cm shell width
Spider Crab: 12 cm shell length
Lady Crab: 6.5 cm shell width

Underwater Fishing

Lobsters may not be taken by snorkelling or diving.
Crabs may be taken diving and snorkelling.

Other Restrictions

Soft-shelled spider crabs must not be taken or stored.
Default closed season for fishing spider crabs = 1 Sept to 15 Oct.
Lobsters must be retained whole on board. Claws cannot be landed separately.
Max 1% of crabs taken from pots may be landed as detached claws.

Licencing Regulations

Commercial fishing boats in Jersey waters require a fishing licence issued by Jersey authorities.
Jersey shellfish boats require a separate shellfish licence.
Non-shellfish commercial boats are restricted to 15 lobsters and 25 crabs per day. This doubles on a Sunday.
French boats fishing within the Bay of Granville portion of Jersey's waters require a licence issued by the appropriate fishing authority.

Recreational Regulations

Recreational fishermen must adhere to the size rules but there are no bag or pots limits and no tagging or catch returns required.
Shellfish/fish landed from a boat may not be sold without a valid fishing licence.

Vessel Monitoring

Commercial vessels over 12m must have operational VMS fitted.
Vessels over 15m must have AIS operational and transmitting in Jersey waters.

Commercial Landing Data

Landed catch weight (in kg) must be recorded daily for all species along with the gear type and effort deployed. Zero catches must also be recorded.
Fishing data must be submitted individually for one of six geographic zones covering the Bay of Granville area.
Potting effort is recorded in terms of pot lifts for: Creels; D Pots; Ink-wells; and Parlour Pots.

Gear Regulations

Stock status of brown crab in Scotland

Total Scottish landings of brown crab fluctuated between 9,300 and 12,300 tonnes from 2008 to 2016 (Table 1). The principal fishing areas for brown crab in Scotland are Orkney, Hebrides, Sule, East Coast, North Coast, Papa and South Minch; landings from these areas accounted for around 88% of the total in 2016. Landings from the offshore areas of Sule and Papa have increased sharply in the 1990s when the fishery expanded, but seem to have stabilized in Papa and decreased in Sule in the last three years. Landings from Orkney, East Coast and Hebrides show an increasing trend in recent years. The majority of crabs fished in Scottish waters are landed in the third and fourth quarters of the year. 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 3). 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).

Stock status of lobster in Scotland

Total Scottish landings of lobster fluctuated between 900 and 1,200 tonnes from 2007 to 2016 (Table 2). 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. Landings from these areas accounted for around 85% of the total. 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. 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

1.1 Greenlandic stock of Snow crab (*Chionoecetes opilio*)

1.1.1 *ToR a and b_* Stock Summary of snow crab in Greenland waters

Regulations

Snow crabs are distributed along the West coast of Greenland and are commercially exploited primarily from Disko Bay in the North (up to 71° 30N) to Paamiut in the South (60° 45N). Commercial fishing for snow crab began primarily in inshore areas (within basis-line) in the mid-1990s and from 1999, also included offshore areas (outside basis-line).

Since 2004, the crab resource in Greenland has been managed in 6 areas (from North to South - Upernavik, Uummannaq-Disko Bay, Sisimiut, Maniitsoq-Kangaamiut, Nuuk-Paamiut and Narsaq-Qaqortoq, Figure 1). The fishing fleet is made up of two components; small vessels (less than 75 GRT), which have exclusive rights for fishing inshore within the basis-line as well as offshore. Small vessels are, however, restricted to fishing in only two management areas during the year. Large vessels (greater than 75 GRT) may only fish in all offshore areas (outside the basis-line), but not within the "Crab Boxes". Quota restrictions have been imposed to each of the 6 management area since 1995 and individual quotas to vessels larger > 75 GRT, but have only limited the catch in 2004. Management decisions allow increasing quota in each of the six management area, when the catch achieved the first fixed quota. Unused quota from larger vessels is re-allocated to the inshore fleet (small vessels < 75 GRT). Basically, there is now quota restriction for the small vessel. The fishery is regulated by prohibitions to land females and undersized males (<100 mm CW), logbooks for all vessels larger than 10 meters and closure of the fishery north of 64°N for 3 months (1 January to 31 March).

Objective of recommendations in Greenland

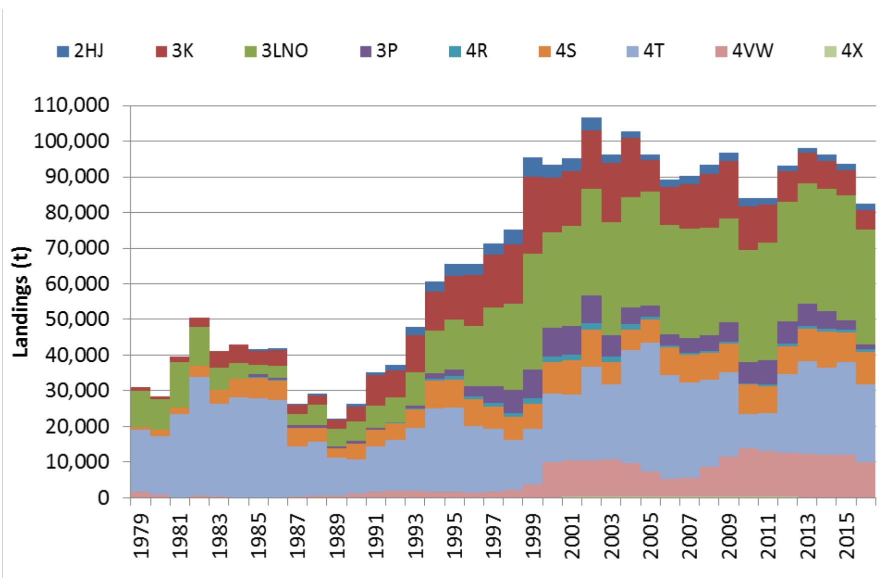
There are no specific long-term management objectives for the snow crab resource in West Greenland, however since 2004 the main objective of recommendations from GINR has been to stop the decline in biomass of the crab resource in the different management areas. The recommendations are not expected to result in increased stock biomass in the short term, but only stop the current decline. If a rebuilding of the stock to achieve a higher exploitable biomass and better catch rates is the objective, then the recommended catches should be further reduced to allow the stock to grow.

The fishery

The historical development of the crab fishery in Greenland is shown in Figure 25 and Table 14. Landings increased from approx. 1,000 tons in 1995 to a peak of approx. 15,000 tons (Quota 30,000 tons) in 2001. Since landings as well as quota has been markedly reduced. From 2001 to 2007 total catch declined by approx. 89% to 2,189. In the subsequent years landings has been stable at approx 2.100 tons and total landings was 2.200 tons in 2016.

	Newfoundland and Labrador						Gulf of St. Lawrence			Maritimes					Overall
	2HJ	3K	3LNO	3Ps	4R3Pn	Total NL	4S	4T	Total GSL	4X	4VsW	4Vn	4VW	Total MAR	
1979		849	10,315	13		11,177	645	17,397	18,042		669	1,007	1,676	1,676	30,895
1980		581	8,833			9,414	1,578	16,531	18,109		413	414	827	827	28,350
1981		1,303	12,855	38		14,196	1,802	23,284	25,086		103	86	189	189	39,471
1982		2,443	11,041	14		13,498	3,040	33,362	36,402		315	249	564	564	50,464
1983		4,898	6,211	4		11,113	3,789	26,070	29,859		183	123	306	306	41,278
1984		5,031	4,524			9,555	5,079	28,099	33,178		93	46	139	139	42,872
1985	332	4,001	2,645	705	291	7,974	5,818	27,731	33,549		63	14	77	77	41,600
1986	468	4,277	3,506	584	133	8,968	5,367	27,359	32,726		98	25	123	123	41,817
1987	232	2,678	3,133	587	50	6,680	5,255	14,016	19,271		241	120	361	361	26,312
1988	456	2,681	5,646	723	82	9,588	3,873	15,026	18,899		370	256	626	626	29,113
1989	483	2,346	4,954	528	15	8,326	2,622	10,632	13,254		444	255	699	699	22,279
1990	602	4,309	5,472	597	46	11,026	4,496	9,491	13,987		929	291	1,220	1,220	26,233
1991	1,003	8,353	6,449	309	48	16,162	4,743	12,826	17,569		1,210	354	1,564	1,564	35,295
1992	1,494	7,543	6,992	170	238	16,437	4,566	14,437	19,003		1,338	454	1,792	1,792	37,232
1993	2,267	10,463	9,222	829	141	22,922	5,325	17,562	22,887		1,432	578	2,010	2,010	47,819
1994	2,971	10,724	12,050	1,538	634	27,917	7,830	23,324	31,154	17	1,179	395	1,574	1,591	60,662
1995	3,189	12,326	14,021	1,929	869	32,334	7,879	23,727	31,606	11	1,126	428	1,554	1,565	65,505
1996	3,102	14,210	16,843	2,974	838	37,967	7,416	18,626	26,042	4	1,124	368	1,492	1,496	65,505
1997	3,183	14,796	22,145	4,675	927	45,726	6,274	17,655	23,929	42	1,157	534	1,691	1,733	71,388
1998	4,098	16,839	24,019	6,624	1,060	52,640	6,447	13,864	20,311	70	1,558	657	2,215	2,285	75,236
1999	5,428	21,386	32,726	7,905	1,597	69,042	7,104	15,517	22,621	119	2,700	899	3,599	3,718	95,381
2000	3,673	15,390	26,773	7,887	1,627	55,350	8,947	19,183	28,130	213	8,701	1,017	9,718	9,931	93,411
2001	3,738	15,288	28,166	7,839	1,683	56,714	9,611	18,426	28,037	376	9,048	1,066	10,114	10,490	95,241
2002	3,521	16,352	30,036	7,637	1,851	59,397	10,372	26,171	36,543	221	8,891	1,495	10,386	10,607	106,547
2003	2,532	16,502	31,638	6,113	1,562	58,347	6,233	21,163	27,396	289	8,836	1,492	10,328	10,617	96,360
2004	1,925	16,460	31,029	4,720	1,462	55,596	5,790	31,675	37,465	289	8,022	1,405	9,426	9,715	102,776
2005	1,576	8,679	31,959	3,173	859	46,246	6,382	36,165	42,547	424	6,407	551	6,958	7,382	96,175
2006	2,139	10,712	30,743	3,105	539	47,238	7,776	29,076	36,852	308	4,486	484	4,970	5,278	89,368
2007	2,523	12,271	30,890	3,962	562	50,208	7,797	26,867	34,664	320	4,942	233	5,175	5,495	90,367
2008	2,555	15,068	30,198	4,522	381	52,724	7,586	24,458	32,044	220	8,253	227	8,480	8,700	93,468
2009	2,387	16,184	29,033	5,559	288	53,451	8,266	23,642	31,908	230	10,645	578	11,223	11,452	96,811
2010	2,131	12,420	31,419	6,026	218	52,214	8,208	9,549	17,757	230	13,150	577	13,727	13,957	83,928
2011	1,931	10,744	32,912	6,717	637	52,941	7,490	10,708	18,198	346	12,135	536	12,671	13,017	84,156
2012	1,606	8,390	33,608	6,208	783	50,595	7,866	21,956	29,822	344	11,733	595	12,328	12,673	93,090
2013	1,379	8,520	33,891	6,048	914	50,752	9,078	26,049	35,127	118	11,309	783	12,092	12,210	98,089
2014	1,736	7,828	34,499	4,904	850	49,817	9,930	24,439	34,369	79	11,267	778	12,045	12,124	96,310
2015	1,769	7,182	34,945	2,540	776	47,212	8,569	25,911	34,480	82	11,302	620	11,922	12,004	93,696
2016	1,679	5,551	32,317	1,188	694	41,429	9,226	21,725	30,951	142	9,606	290	9,896	10,038	82,418

Atlantic Canada Snow Crab Landings (t) Table for ICES Report



Atlantic Canada Snow Crab Stock Status (up to 2016)

An overall supposition on current and expected status of the snow crab stock in Atlantic Canada is difficult due to regional differences in stock trajectory. The stock covers a large spatial area, spanning throughout Atlantic Canada. It is managed by four separate regions of DFO and the fishery is prosecuted by harvesters from five Provinces of the country.

The fishery for snow crab in Atlantic Canada expanded considerably following the collapse of groundfish stocks throughout the region in the early 1990s. The snow crab fishery has been very large in recent decades, with annual landings exceeding 75,000 t for the past twenty years. In 2016, an estimated 82,500 t was taken. The largest aggregations of snow crab on the Grand Bank of Newfoundland and Labrador (Divisions 3LNO) and in the southern Gulf of St. Lawrence (Division 4T). Both areas experienced modest decreases in landings in 2016, contributing to the overall slight declines for the fishery as a whole in 2016. 2017 landings information is not yet available but landings were significantly reduced in Divisions 3LNO and significantly increased in Division 4T.

In Newfoundland and Labrador (NL - Divisions 2HJ3KLNOP4R) and the Eastern Scotian Shelf (Divisions 4VWX) the overall exploitable biomass is at or near its lowest observed levels since surveys began. Conversely, in the Southern Gulf of St. Lawrence (Division 4T) the exploitable biomass doubled in 2016 and is near its highest observed level. The exploitable biomass in the northern Gulf of St. Lawrence (Division 4S) is near its long-term average.

The immediate outlook in major areas of NL and Maritimes is poor, but mid-term prospects appear to be improving. The immediate outlook in the Southern Gulf of St. Lawrence is very positive while mid-term prospects appear moderate. In the Northern Gulf, the immediate outlook remains positive while mid-term prospects appear to be diminishing.

In the long-term, although ocean climate indices have been fluctuating the overall trend in Atlantic Canada ocean temperatures is increasing. Some recent cold conditions in some areas have only returned the Cold Intermediate Layer coverage (i.e. analog for snow crab habitat indices) to about long-term average levels, inferring forthcoming recruitment and biomass potential is overall lower than has been experienced for the past two decades.

In all regions of Atlantic Canada the resource continues to be well-managed; generally, fluctuations in biomass and recruitment are consistent with fluctuations in the environmental conditions and reproductive capacity of the stock is well protected from the male-only exploitation strategy.

Landings with in each of the management areas have vary over time (Figure 26) and in 2016 80% of total landings were taken in Management area Sisimiut and Nuuk-Paamiut, whereas the contribution from the other management area very limited.

The total fishing effort (trap hauls) has declined by 91% since 2001 (from 3,416 to 319 thousand trap hauls during 2001-2012) (Figure 26). The decline in fishing effort has been mostly due to a declining number of participants in the fishery.

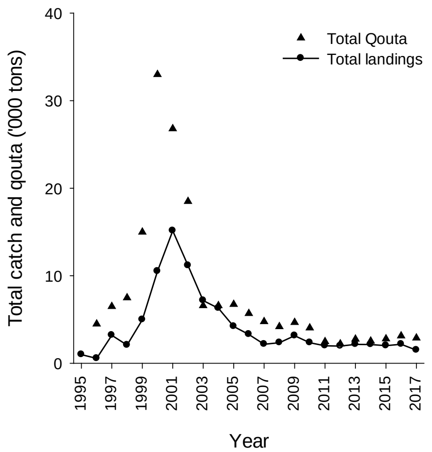


Fig. 25. Total catch and quota size from 1995-2017.
Data from 2017 is preliminary and incomplete.

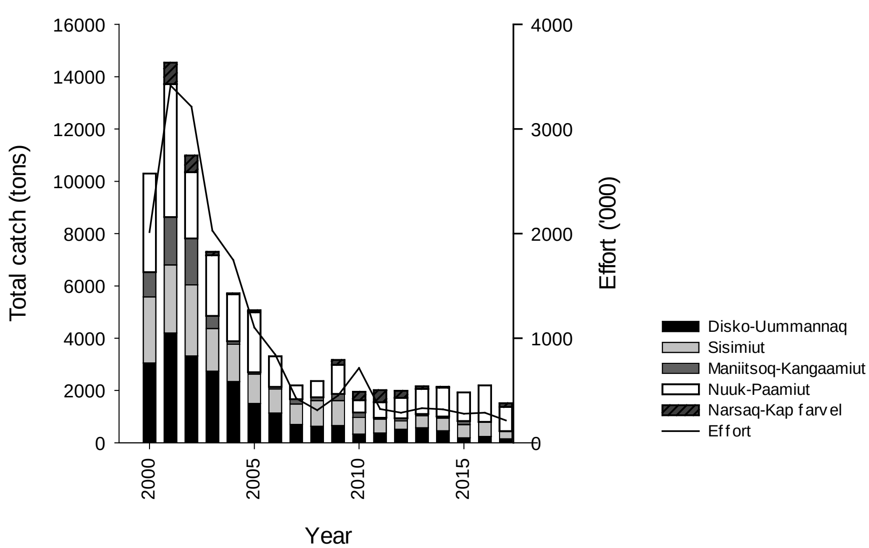


Fig. 26. Snow crab landings in the four most important management areas of West Greenland 2000-2017 and used total effort. Data for 2017 are preliminary and incomplete.

Stock status

The accumulated biomass available to the fishery in 2018 is highly variable according to the stocks indices. Generally, in 2017, stocks in each management area along the west coast of Greenland were characterized a low level in the management areas of Disko Bay inshore and Sisimiut offshore, but as stable commercial biomass in management area of Sisimiut inshore and Nuuk-Paamiut offshore. Recommendations for 2018 are status quo in terms of TAC in all areas. In Sisimiut management area the offshore site was recommend close until the stock rebuild.

Management area Uummannaq – Disko Bay

Landings declined by 88% from 4,202 t in 2001 to 188 t in 2015, while effort decreased by 96% (Fig. xa and table xx). The exploitable biomass has been declining the past 3 years in Disko Bay inshore, but have been stable offshore at a low level. Recruitment has decreased since 2011 and is expected to be low over the next several years. In the Northern part of the management area recruitment decreased significant over the past five years.

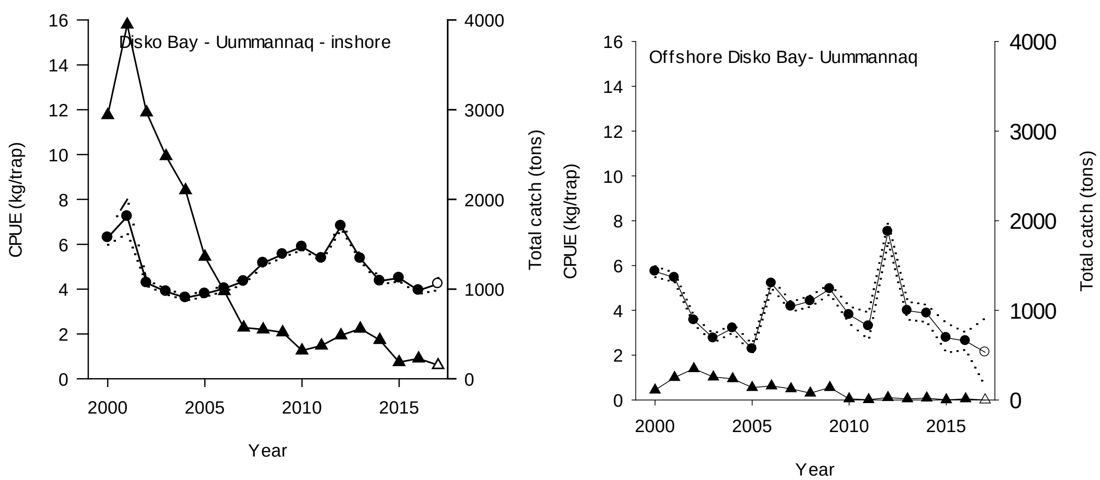


Figure xa. Standardised CPUE index and total catch based on logbook information inshore Uummannaq-Disko Bay Area from 2000-2017. Data for 2017 is preliminary and incomplete. (● is standardized CPUE, ▲ total catch and dotted line lower and upper confidence limits).

Management area Sisimiut (inshore and offshore)

Inshore landings declined from 1,111 t in 2004 to 360 t in 2016 (TAC 300 t in 20156, while effort decreased by 93% (Fig. xb and table xx) CPUE have been some what stable since 2014. Offshore landings declined significantly from 2,275 tons to approx. 200 tonnes a year since 2015 and CPUE remain relatively high as a result of a huge decline in effort in the same period. The exploitable inshore biomass declined significantly inshore as well as offshore from 2009 to 2011, increased in 2012 and have remain stable as a level close to its serial mean in Sisimiut inshore, but remain low in Sisimiut offshore, except for an increase in biomass in 2015 (Figure xc). Recruitment decreased in 2009, as was especially for the offshore site reflected by the abrupt decrease in exploitable biomass while landings increased little (Fig. xd). Inshore, recruitment incread continuous since 2015 level and recruitment is expected to be fair in near future, but longer-term prospects remain uncertain.

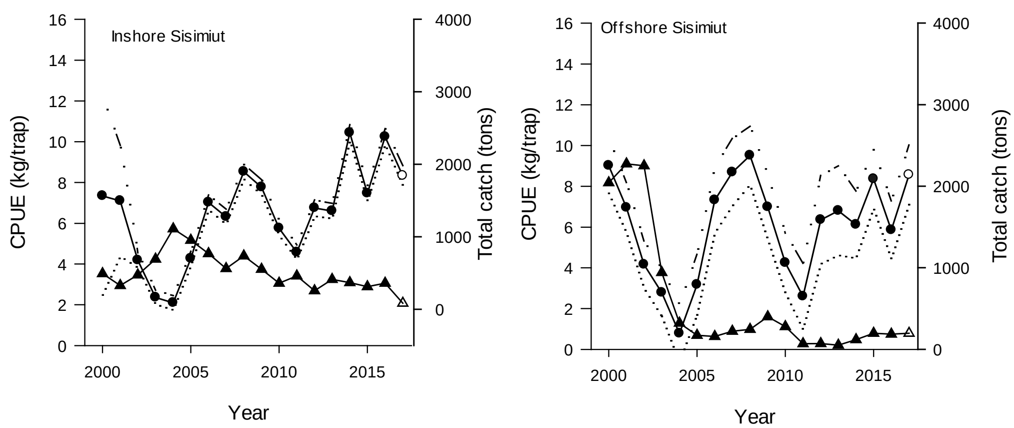


Figure Xb. Standardised CPUE index and total catch based on logbook information inshore and offshore Sisimiut from 2000-2017. Data for 2017 is preliminary and incomplete. (● is standardized CPUE, ▲ total catch and dotted line lower and upper confidence limits).

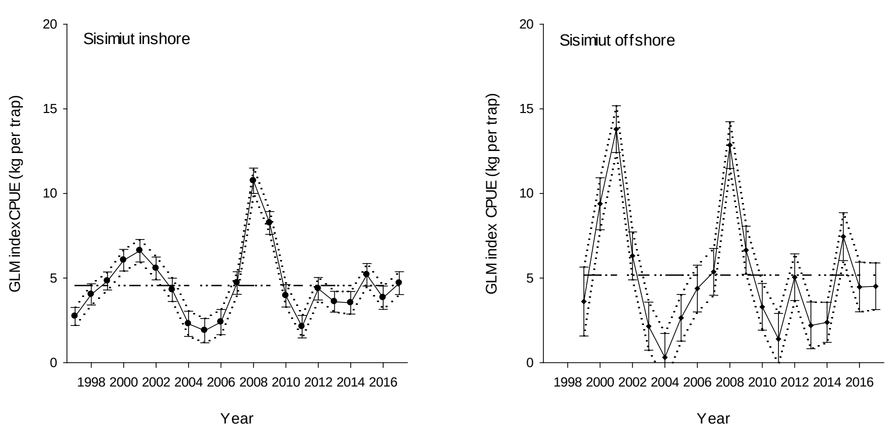


Figure xc. Annual trends in exploitable biomass (kg/trap ± S.E.) of legal-size males (≥100mm CW) from trap surveys in Sisimiut in- and offshore from 2000 to 2017. ●: CPUE (kg/trap) and dotted line is lower and upper confidence limits.

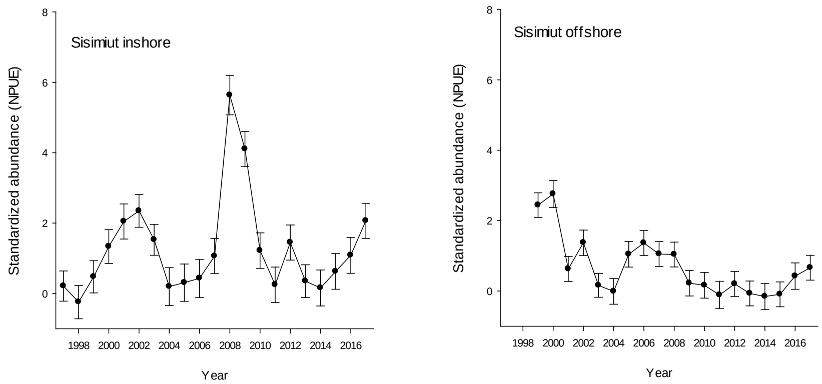


Figure xd. Recruitment index (ADO-1: 82.2 – 100 mm CW) of adolescents males from the annual trap survey in the inshore and offshore sites of Sisimiut management area, 2000 – 2017.

Managemnet area Maniitsoq - Kangaamiut

Landings and effort have steadily declined since 2002 to a historical low level in 2016 (11 tonnes). No biological survey is conducted in that management area.

Management area Nuuk-Paamiut (inshore and offshore)

Landings declined by 91% from 5,077 t in 2001 to 470 t in 2010, while effort decreased by 92% (Figure xe and table xx). Since landings have increasing, especially in the offshore area. The exploitable biomass is considered stable in both inshore and offshore areas. No biological survey is conducted in that management area.

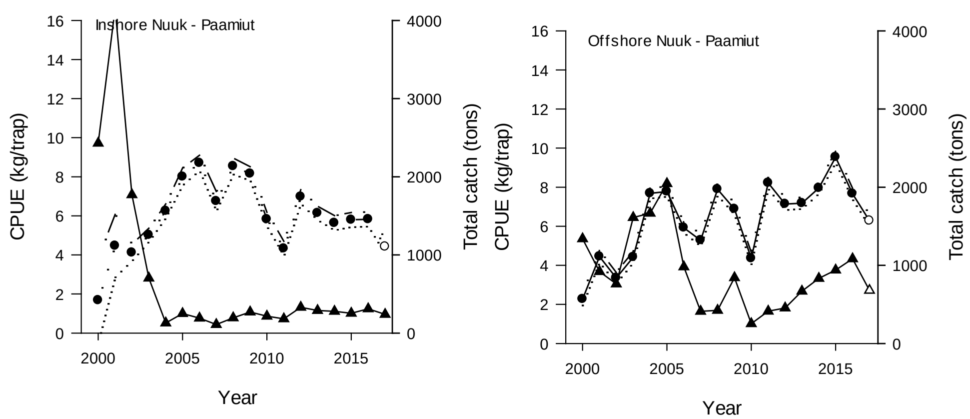


Figure xe. Standardised CPUE index and total catch based on logbook information inshore and offshore Nuuk-Paamiut from 2000-2017. Data for 2017 is preliminary and incomplete. (● is standardized CPUE, ▲ total catch and dotted line lower and upper confidence limits).

Managemnet area Qaqortoq – Kap Farvel

Landings and effort have steadily increased since 2009 from 187 tons to 450 tons in 2011, followed by a significant drop in landings to 268 tons in 2012 (table xx). Since 2014, there have been no fishing activity for snow crab in this management area. No biological survey is conducted in that management area.

Table xx. Catch, quota, effort and CPUE in the 6 management areas 2000 to 2017 (2017 is preliminary data)

Management Area	Year	Total catch (tons)	Quota	Number of issued permits	Number of active vessels	Inshore catch (tons)	Inshore CPUE (kg/trap)	Inshore effort ('000)	Offshore catch (tons)	Offshore CPUE (kg/trap)	Offshore effort ('000)
	2000	3,052	--	--	--	2,940	4.8	613	112	5.5	20
	2001	4,202	--	--	--	3,950	3.1	1,274	252	3.6	70
Uummannaq-Diskobugt	**2002**	3,319	--	--	--	2,970	3.3	900	349	3.0	116
	2003	2,739	--	--	67	2,482	3.7	679	257	2.6	97
	2004	2,341	--	--	48	2,103	3.3	630	238	3.6	65
	2005	1,500	1718	43	36	1,361	3.5	392	139	3.7	38
	2006	1,134	1600	43	31	977	4.1	239	157	6.3	25
	2007	698	1530	39	24	572	4.2	137	126	5.1	25
	2008	628	1400	25	11	550	5.0	110	78	5.1	15
	2009	657	700	22	15	518	5.4	97	139	5.5	25
	2010	329	600	19	11	315	5.4	58	14	4.6	3
	2011	376	500	5	13	371	4.8	77	5	3.8	1
	2012	513	500	15	12	485	5.2	93	28	7.5	4
	2013	573	600	14	22	559	4.2	134	14	4.4	3
	2014	457	600	9	12	433	3.2	136	23	4.3	5
	2015	188	600	27	9	185	2.3	80	3	2.8	1
	2016	240	600	37	18	227	4.0	57	13	3.6	4
	2017*	153	525	20	12	152	4.9	31	1	1.9	1
	2000	2,534	--	--	--	491	2.8	175	2,043	6.4	319
	2001	2,602	--	--	--	327	2.9	113	2,275	4.6	495
Sisimiut	**2002**	2,724	--	--	--	473	4.6	103	2,251	3.5	643
	2003	1,633	--		49	692	3.7	187	941	3.1	304
	2004	1,432	--		34	1,111	3.9	285	321	4.9	65
	2005	1,125	900	12	23	953	6.7	143	172	6.4	27
	2006	926	750	12	15	768	8.9	86	158	11.1	14
	2007	783	850	9	15	562	7.3	77	221	12.8	17
	2008	980	700+300	11	13	736	10.2	72	244	13.1	19
	2009	952	500+300	21	28	552	9.2	60	400	7.6	53
	2010	638	800	19	22	359	7.0	51	279	5.5	51
	2011	527	500	14	18	459	6.1	75	68	6.5	10
	2012	324	300	9	12	254	9.1	28	70	8.4	8
	2013	463	150+300	9	12	412	8.2	50	51	8.2	6
	2014	486	500	9	8	367	12.4	30	119	9.7	12
	2015	508	500	12	10	312	8.5	37	196	10.4	19
	2016	544	650	14	14	359	12.1	30	185	9.0	21
	2017*	280	525	15	10	83	10.2	8	197	10.9	18
	2000	944	--	--	--	563	4.3	131	381	7.6	50
	2001	1,835	--	--	--	1009	3.7	273	826	5.0	165
Maniitsoq-Kangaamiut	**2002**	1,775	--	--	--	1032	3.8	272	743	2.7	275
	2003	485	--	--	18	40	3.5	12	445	2.8	160
	2004	116	--	--	13	92	3.2	29	24	2.1	11
	2005	73	200 (inshore)	12	10	64	4.4	15	9	3.6	2
	2006	72	100 (inshore)	16	7	61	4.3	14	11	4.3	3
	2007	187	300	11	4	14	3.0	5	173	10.2	17
	2008	130	300	13	12	25	6.3	4	105	9.0	12
	2009	259	250	21	17	108	6.2	17	151	5.9	25
	2010	189	300	18	9	98	4.6	21	91	5.1	18
	2011	52	300	7	6	50	9.6	5	2	5.5	0
	2012	100	300	13	12	77	6.8	11	23	5.4	4
	2013	63	300	12	9	25	8.1	3	38	10.8	4
	2014	56	100	14	4	41	16.0	3	15	8.1	2
	2015	132	100	11	4	66	7.0	9	66	17.9	4
	2016	11	100	5	3	11	5.0	2.2	0	1.2	1
	2017*	15	225	7	5	3	3.4	1	12	8.1	1
	2000	3,769	--	--	--	2,430	5.3	458	1,339	5.4	248
	2001	5,077	--	--	--	4,157	5.3	784	920	3.8	242
Nuuk-Paamiut	**2002**	2,531	--	--	--	1,770	2.8	632	761	2.8	272
	2003	2,315	--	--	48	704	3.4	207	1,611	4.2	385
	2004	1,795	--	--	46	129	4.5	29	1,666	8.5	196
	2005	2,295	--	26	44	250	5.6	45	2,045	6.9	296
	2006	1,173	1,800	24	35	192	7.6	25	981	5.8	169
	2007	521	1,600	25	19	110	7.5	15	411	7.3	56
	2008	618	1,600	24	9	194	7.2	27	424	9.1	46
	2009	1,111	700+300	31	22	270	7.5	36	841	7.3	115
	2010	470	1000	22	24	216	6.2	35	254	6.3	40
	2011	595	700	18	20	182	5.3	34	413	9.5	43
	2012	784	700	22	27	329	8.1	41	455	8.5	54
	2013	959	1000	21	18	289	7.4	39	670	5.6	120
	2014	1,111	250+950	23	15	279	7.7	36	833	9.4	89
	2015	1,193	1200	27	15	253	7.8	32	940	10.3	91
	2016	1394	1400	36	18	310	6.7	46	1084	8.5	128
	2017*	920	1,200	39	17	240	5.7	42	680	6.9	98
	2000	2	--	--	--	0	--	--	2	--	--
	2001	822	--	--	--	822	--	--	0	--	--
Narsaq-Qaqortoq	**2002**	643	--	--	--	642	--	--	1	--	--
	2003	133	--	--	12	123	--	--	10	--	--
	2004	34	--	--	10	32	3.9	8	2	1.0	1
	2005	76	--	7	6	76	8.3	9	--	--	--
	2006	--	--	3	--	--	--	--	--	--	--
	2007	--	--	4	--	--	--	--	--	--	--
	2008	--		0	--	--	--	--	--	--	--
	2009	187	?	12	5	187	9.2	20	--	--	--
	2010	326	450	15	7	319	6.8	47	7	8.7	1
	2011	465	430	8	8	464	6.9	67	1	4.8	0
	2012	268	430	8	6	266	5.9	45	2	6.2	0
	2013	104	430	7	5	104	7.8	13	0.2	5.2	0.04
	2014	31	200	5	3	31	11.6	2.7	--	--	--
	2015	--	200	4	0	--	--	--	--	--	--
	2016	--	200	3	0	--	--	--	--	--	--
	2017*	146	225	14	4	144	10	15	2	7.02	0

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 1: Annual Brown crab landings (tonnes) into Scotland by creel fishery assessment unit from 2007 – 2016. Data from Fisheries Management database

Assessment unit	**Year**									
	2007	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Clyde	250.3	213.7	99.4	139.3	137	182.8	159.3	189.6	180.2	181.1
East Coast	884.2	866.9	778.6	1029.0	1091.3	1213.9	1271.3	1305.9	1200.2	1608.7
Hebrides	2340.0	1738.4	1822.3	1885.8	2433.3	1996.5	2130.2	2667.2	2218.2	2391.3
Mallaig	67.0	32.4	8.5	12.9	21.3	69.6	6.7	17.5	10.7	25.8
North Coast	513.8	348.7	568.3	681.9	428.7	514.2	571.2	537.8	1015.7	1046.1
Orkney	1555.4	1187.3	1155.6	1462.1	1746.6	1693.7	1906.2	1958.8	2037.9	2462.9
Papa	798.0	764.1	1002.0	878.2	884.2	828.2	936.3	1239.4	929.8	888.4
Shetland	522.4	566.9	390.2	334.4	419	478.4	604.9	666.1	457.5	282
South East	281.8	325.5	308.0	345.7	356.7	447.1	469.9	396.2	457.4	619.6
South Minch	2149.6	1141.0	1000.7	1651.3	1632.4	1094.4	869.8	1191.6	692.5	982.2
Sule	2026.1	1836.2	1981.8	1928.9	2275.5	1611.2	1491.6	1703.6	1629.9	1298.4
Ullapool	376.0	241.9	192.1	245.4	244.9	687.2	439.0	400.9	207.6	318.1
Outside Assess. Units	154.1	73.1	158.7	261.9	188.2	74.7	34.3	31.5	51.4	36.6
Total	**11918.7**	**9336.1**	**9466.1**	**10856.7**	**11859.1**	**10891.9**	**10890.6**	**12306.0**	**11089.0**	**12141.2**

Table 2: Annual Lobster landings (tonnes) into Scotland by creel fishery assessment unit from 2007 – 2016. Data from Fisheries Management database

Assessment unit	**Year**									
	2007	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Clyde	16.8	22.2	17.4	24.8	26.3	24.7	23.5	46.2	35.4	40.4
East Coast	129.8	147.5	163.9	207.3	279.3	265.5	214.9	226.1	227.8	254.8
Hebrides	203.5	161.3	142.5	155.8	141.7	139.0	97.3	148.6	114.7	127
Mallaig	1.1	3.5	0.4	0.9	1.2	12.7	0.6	1.0	0.5	0.9
North Coast	14.3	15.0	12.0	14.3	15.4	10.0	10.0	10.7	13.3	14.5
Orkney	132.7	138.6	160.3	170.8	177.8	155.5	117.4	163.6	113.9	117.1
Papa	8.4	7.0	10.4	10.3	6.4	5.7	5.7	7.8	3.2	2.9
Shetland	14.1	19.8	25.7	29.8	29.2	36.8	35.9	39.7	40.7	52.6
South East	180.5	204.3	257.3	277.8	374.6	334.4	387.8	409.2	348.8	367.3
South Minch	101.7	111.4	99.8	112.0	89.9	84.7	75.2	101.3	78.7	96.4
Sule	4.8	4.8	4.0	3.4	3.6	2.1	0.6	0.7	0.6	0.4
Ullapool	24.5	13.9	12.3	18.7	10.8	11.6	15.1	16.7	14.4	14.2
Outside Assess. Units	57.9	65.8	46.8	74.4	62.9	49.7	41.8	36.3	50.4	61.9
Total	**890.2**	**915.0**	**953.0**	**1100.3**	**1219.1**	**1132.5**	**1025.9**	**1207.8**	**1042.4**	**1150.4**

Table 3: Brown crab stock status, relationship between F and F_{MSY} proxy for 2006-08, 2009-12 and 2013-15.

Assessment period		F (Fishing Mortality) 2006-2008	2009-2012	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
	Females	?	?	?	Unknown

Table 4: Lobster stock status, relationship between F and F_{MSY} proxy for 2006-08, 2009-12 and 2013-15.

Assessment period		F (Fishing Mortality) 2006-2008	2009-2012	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
	Females	✓	?	?	Unknown

Parlour pots must have side escape gaps fitted (79 x 44 x 100 mm) and a bottom escape gap (199 x 44 x 100 mm).
Max number of commercial pots = 1000 per vessel; minimum = 200.
Number of pots allocated is determined by vessel length (XXX pots per metre).
The number of pots issued is controlled by issuing pot tags.
Commercial pots must be tagged with year and vessel name/number.
Surface buoys and other fishing gear must be clearly marked.

No Parlour Pot Zones
Les Minquiers: 256 km2
Les Écréhous (TBC 2018): 13.5 km2
Potting prohibited inside defined harbour limits.

Estimating uncertainty

Bootstrapping was introduced for 2017 assessments to give an estimation of confidence. Combinations of existing samples are picked at random which gives confidence intervals on the existing data. Raw samples are bootstrapped with replacement 500 times. The bootstrapped samples are then raised to total landings and run through the assessment (very slow, takes 20 hours to run!). Estimates of fishing mortality and spawning stock biomass use the original dataset, not mean/median of bootstraps. Bootstrap 95 percentiles = confidence intervals

Data sources

Three data sources are used:

- Time series of landings and effort data: Official landings data + Monthly Shellfish Activity Returns (MSARs) completed by fishermen (<10 metre vessels only)
- Aggregated length distribution data from market sampling programme: Cefas, supplemented by local Inshore Fisheries Conservation Authorities (IFCAs).
- CRE landings by ICES rectangle, LBE by port of landing as inshore fishery.

Data issues

Official landings data misses small landings as landings of less than 25kg can go unreported. This can be considerable with the lobster fishery as it is largely prosecuted by small vessels and has typically small landings. MSAR forms plugs the gap but quality of data is highly variable and/or missing.

Length data is insufficient in some regions- in areas where landings are small it is difficult to get opportunistic samples. Local IFCAs help by sharing their length data with us, but this is not done in all regions.

Edible crab (Cancer pagurus)

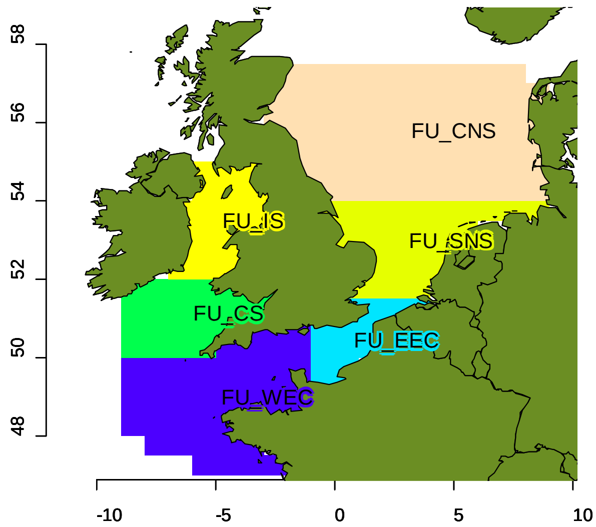
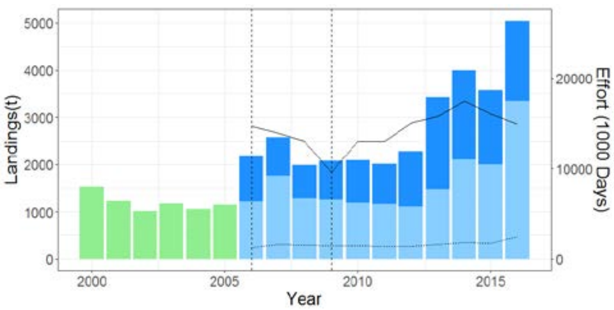
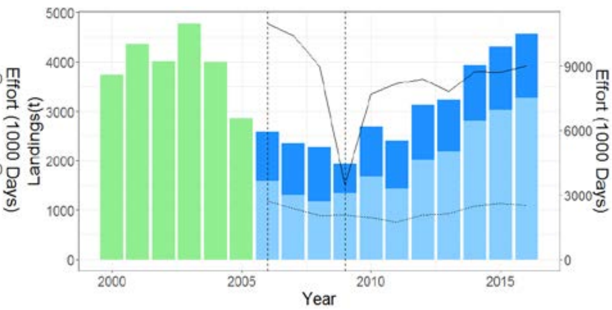


Figure 1. Crab stock assessment regions. Six assessment units- Central North Sea, Southern North Sea, Irish Sea (no assessment), Eastern Channel, Western Channel.

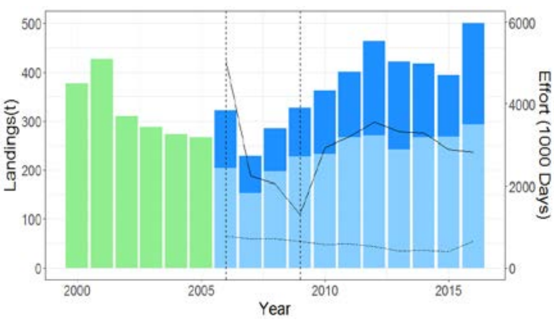
Trends of landings and fishing effort



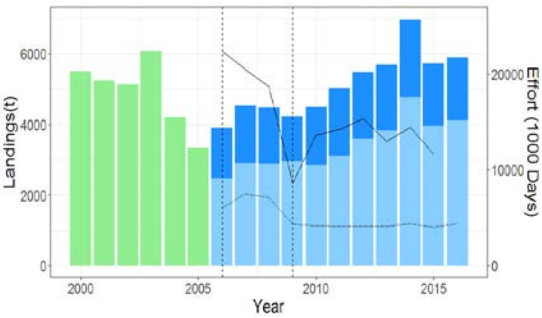
a) Northern North Sea



b) Southern North Sea



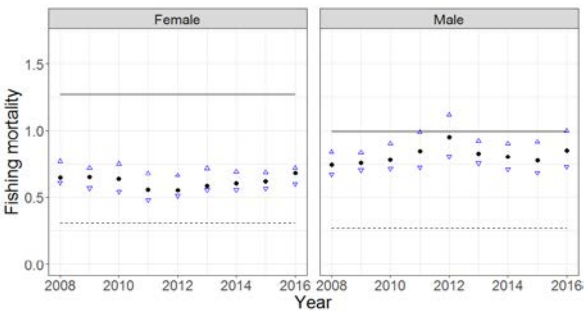
c) Eastern Channel



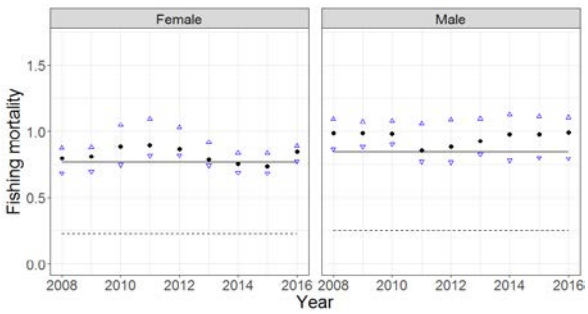
d) Western Channel

Figures 2a-d. Landings and fishing effort time series. Light blue & dashed line- over 10m; dark blue & solid line under 10m. Green bars are prior to MSAR/Buyers and sellers reporting so based solely on EU logbook returns, as such no effort reported. Dotted lines represent the years when MSAR data used in official landings. 2010 – 2016 we have combined official landings data with MSAR return data held at Cefas. 2009 data haven't yet been included, hence the dip for that year.

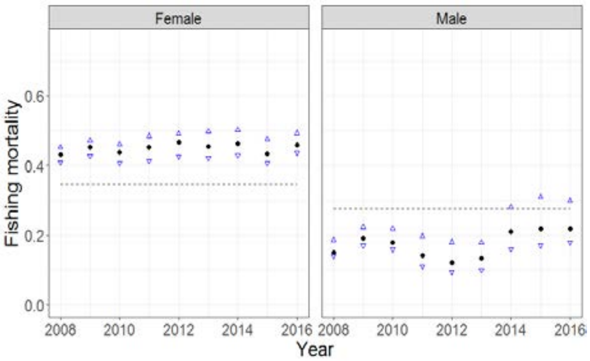
Fishing mortality is between the target and limit levels in the Northern North Sea and for males in the Western Channel. Females in the Western Channel and Celtic Sea and both sexes in the Southern North Sea are at or above the limit.



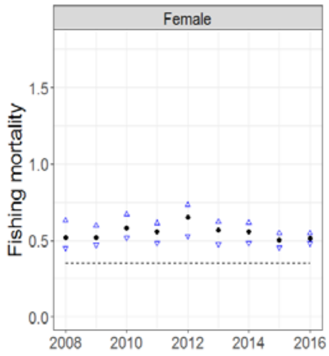
a) Northern North Sea



b) Southern North Sea



c) Western Channel



d) Celtic Sea

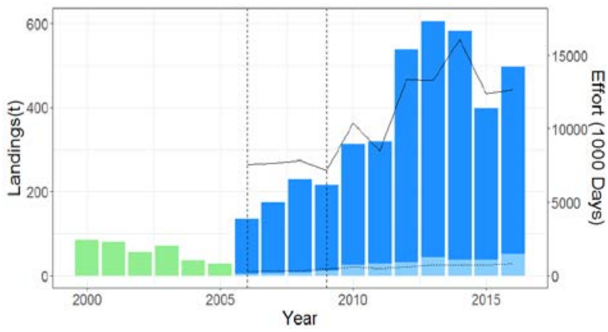
Figures 3a-d). Fishing mortality with 95% confidence intervals. Target- 35% virgin SPR (dashed line). Limit 15% virgin SPR (solid line).

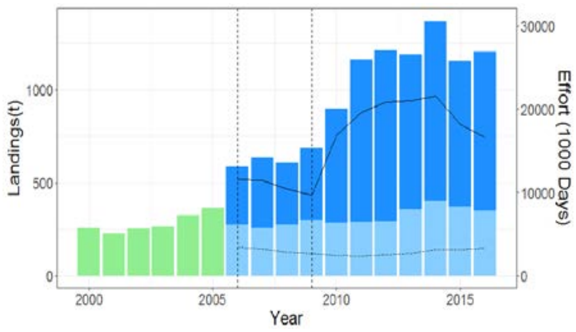
No male fishing mortality estimate was possible for the Celtic Sea due to very low landings of males and therefore was poorly sampled. It is a female dominated fishery. The Western Channel is also female dominated, hence wider confidence intervals are seen for male estimates. Data were insufficient for the Eastern Channel full assessment (massive uncertainty).

Lobster (Homarus gammarus)

Figure 4. Lobster stock assessment regions. Northwest- very small fishery so not assessed, Wales not assessed due to devolution.

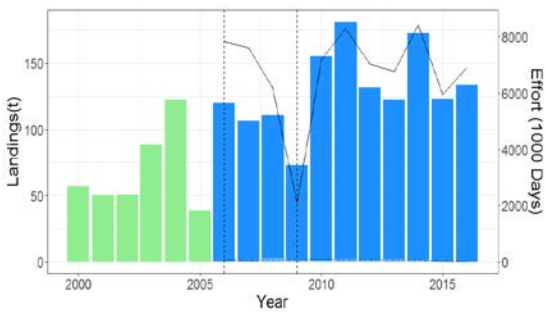
Landings and effort trends are relatively consistent between regions with landings staying stable for the last few years. Effort has remained stable or dropped in the last five years in most regions.

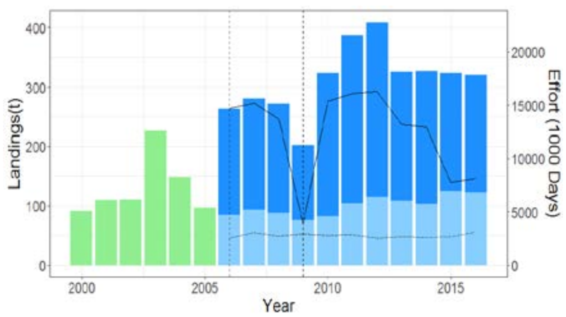




a) Northumberland

b) Yorkshire Humber



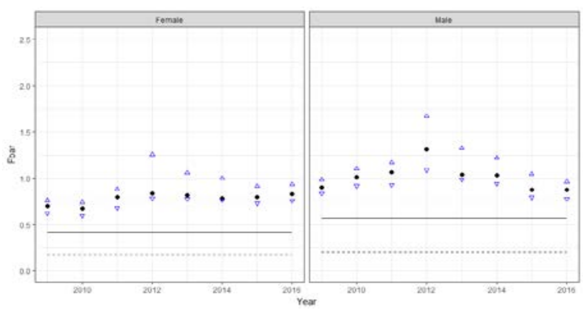


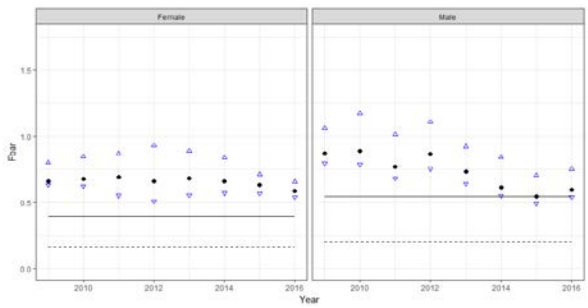
c) East Anglia

d) Southwest

Figures 5a-d. Trends of landings and fishing effort. Light blue & dashed line= over 10m; dark blue & solid line under 10m.

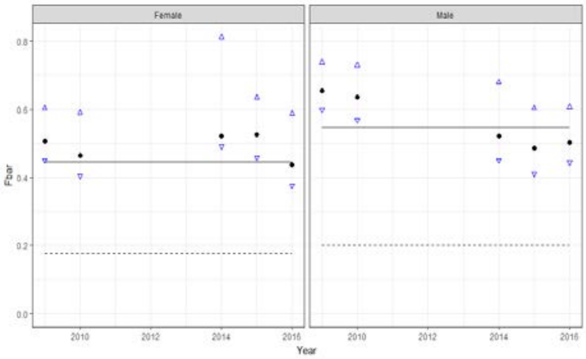
Insufficient data were available in 2011-2013 to run assessments in Southeast South Coast, and years that assessments were done have wide confidence intervals due to poor sampling relative to other areas. Data from East Anglia were not sufficient to run an assessment and outputs showed massive uncertainty. Northumberland and Yorkshire show fishing mortality above the limit in most years, whereas the Southwest fishery is between the target and limit levels.

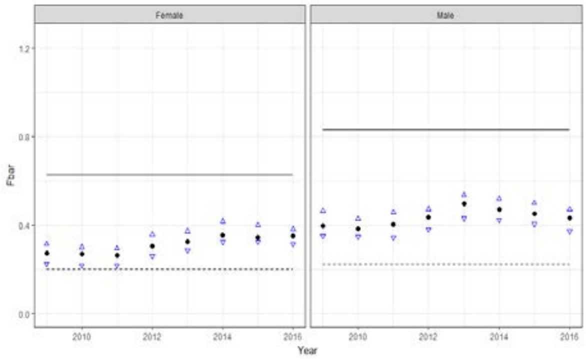




a) Northumberland

b) Yorkshire





c) Southeast South Coast

d) Southwest

Figures 6a-d. Fishing mortality. Target- 35% virgin SPR (dashed line). Limit 15% virgin SPR (solid line).