



Centre for Environment
Fisheries & Aquaculture
Science



Cefas

Edible crab (*Cancer pagurus*)

Cefas Stock Status Report 2019

October 2020



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Cefas Stock Status report 2019: Edible crab (*Cancer pagurus*)

Background

Cefas has published reports describing the status of the edible crab (*Cancer pagurus*) stocks around the UK since 2012. It is planned to re-run the assessment every 2 years. This report details the main findings of the assessments and provides background information describing how the assessments are undertaken, the data that are required, and description of the uncertainties associated with these assessments.

Biology

Edible crab can be found from Scandinavia to Portugal. Stock boundaries for edible crab remain poorly understood and both sexes move quite widely at times; females in particular have been shown to travel large distances in relation to spawning activity. Egg carrying females are largely inactive over the winter brooding period but the eggs hatch in the spring and summer. After around five weeks in the plankton, the crab larvae settle on the seabed. Growth is dependent on the frequency of moulting as well as the increase in size on each moulting occasion and it typically takes about four or five years for a juvenile crab to grow to commercial size. Mating activity peaks in the summer when the female has moulted with spawning occurring in the late autumn or winter.

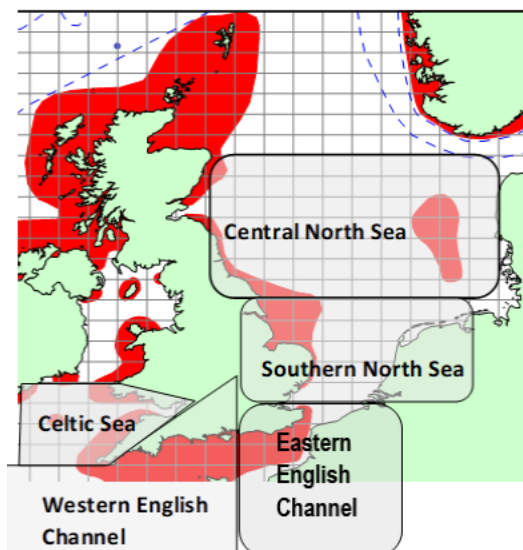


Figure 1. – The CFU's used for the assessment regions.

Fishery Unit Definitions

There are five Crab Fishery Units (CFU) that have been defined for England. These units are based upon the understanding of larval distributions and development, hydrographic conditions and distribution of the fisheries. Each CFU encompasses waters covered by international, national and local legislation which may be different within each region. For this round of assessments Cefas only had sufficient data to successfully cover four of the CFU's. Those CFU's are presented in Figure 1.

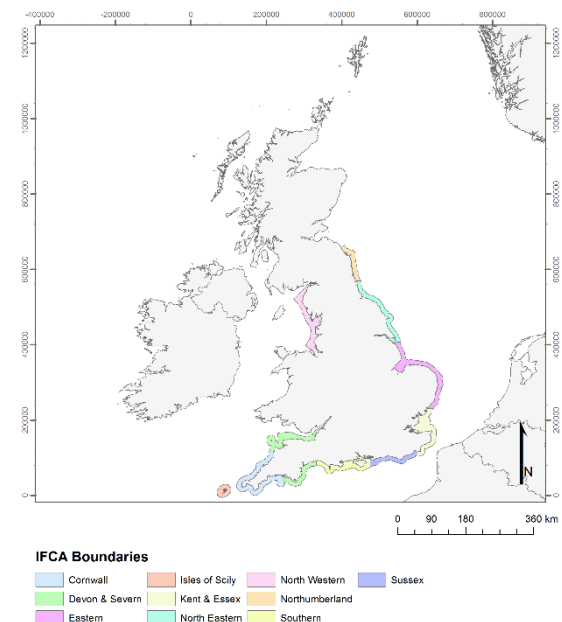


Figure 2. – The IFCA boundaries.

Fishery management jurisdiction is organised on two different scales around England. Beyond 6 nautical miles, Defra and the MMO are responsible for managing crab fisheries whereas from the coast out to 6 nautical miles, responsibility lies with the Inshore Fisheries and Conservation Authorities (IFCAs). There are 10 IFCAs within England, and their regions extend from the coast out to 6nm (see Figure 2). The CFU and IFCA boundaries do not match, which can make interpretation of the results for each management unit challenging. However, given that one functional area is based on species biology and the other is based on governmental logistics, differences between boundaries are to be expected.

Data sources used

Landings come from the official MMO data records and there have been changes in the way the MMO (and its predecessors) have gathered landings data. For larger vessels landings and effort are taken from the mandatory EU logbooks. Prior to 2006, records of landings from smaller vessels (<10m) were gathered by local officers. Since a change in legislation in 2006, sales note returns from merchants are used to support the landings declarations. Between 2006 and 2008, MMO landings data were also supplemented by self-reported records of landings from the Monthly Shellfish Activity Return (MSAR) forms. In the 2017 assessment Cefas combined MSAR data and MMO landings for the <10m fleet.

Fishing effort is derived from MSARs for <=10m vessels and EU logbooks for >10m vessels. There is no requirement for potting fisheries to record the number of pots being fished, so in this report effort is measured as days fished.

Changes to reporting systems over time have predominantly improved the data quality but mean that landings and effort series cannot be viewed as coherent records through time.

Scientific officers visit ports to measure individual animals from catches and determine the ratio of landings by sex. Samples are also received from IFCA's in some regions, and these length samples are combined with Cefas' and scaled up to represent the total landings of crabs.

Overall Landings trends

Figure 3 presents the total official landings data that is used within the assessments. The data pertains to all English and Welsh vessels landing anywhere, and all landings into England and Wales from GB registered vessels. The overall landings appear relatively consistent between 2006 until 2011 but have been increasing thereafter. The spring of 2018 saw extreme cold weather throughout the country and crab began to appear in pots very late in the season.

Figure 4 presents the landings per rectangle for 2018, and Figure 5 presents the average landings per rectangle from 2013 to 2018. These plots show that although the overall landings appear to be increasing, the area

from which the animals are being caught is decreasing.

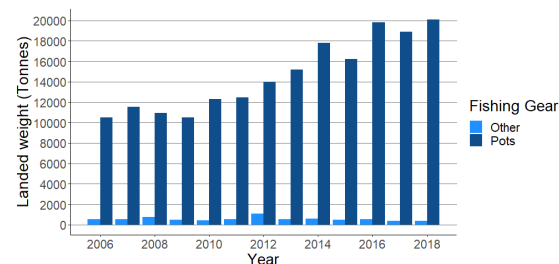


Figure 3 – The official landings for UK E&W.

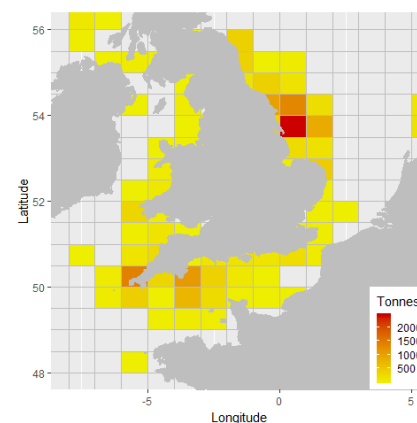


Figure 4 – Landings per ICES rectangle for 2018.

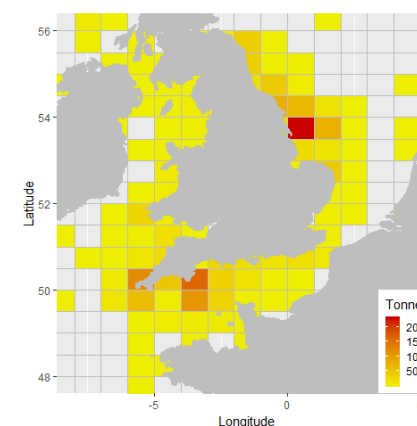


Figure 5 – Average landings per ICES rectangle from 2013 to 2018.

Assessment Methodology

Within European waters, most major stocks are assessed using methods which monitor the change in numbers over time for animals born in a particular year. This is possible because most finfish have bony structures which retain annual growth rings. Crustaceans shed their shell each time they moult and do not retain structures that can be

easily used to determine their age, so an alternative assessment method has to be employed. The methodology used in this assessment follows the change in shape of the length-frequency (numbers at length) from one year to the next. As animals get older, they grow and die, the interplay of these two vital functions dictating how many animals at a given size there are in the population. Armed with knowledge of the growth rate of animals and the rate of natural death (M) assumed to be 0.2, the shape of the length-frequency curve can be used to infer the rate at which the fishery is removing individuals.

For further details of the Length Cohort Analysis approach see the full stock assessment report.

Reference point definition

A stock assessment result can indicate what the exploitation rate might be and how big the stock might be, but this is of limited use to fishery managers as they try to decide whether these rates are appropriate. The production of reference points aims to give managers benchmarks to see whether the management structure is being effective and whether fishing rates are above or below these points.

Reference points can be determined to achieve a number of different management objectives. For instance managers could simply want to ensure that the fishery was unlikely to collapse the stock, or alternatively managers could want the fishery to derive maximum long-term profit from the stock. Within the European Community framework, the current management objective is to achieve fishing rates likely to deliver Maximum Sustainable Yield (MSY) from fisheries. This means the maximum landings that can be regularly taken without causing stock collapse. For crustacean fisheries scientists cannot directly calculate this rate and so rely upon alternative ways to estimate it.

This assessment uses 35% of virgin Spawner per Recruit (SpR) as the MSY level proxy, and this is commonly used around the world to estimate the fishing rate likely to deliver MSY. A second point termed a limit reference point has also been calculated and having fisheries operating beyond this level is considered to carry higher risk to the production of further generations. This value is defined as 15% of virgin SpR.

Uncertainty

Fishery stock assessments are never perfect and assessment models will never exactly replicate reality. Scientific data collection (in this case landed numbers at length) are taken from a relatively small number of landings and then scaled up to represent the whole landings, a process which cannot be exactly correct but should be broadly representative of the population as a whole. Not all landings will be recorded as there are exemptions from reporting requirements for small scale fisheries and recreational catches.

An assessment model is an attempt to simplify the real world into a few key structures and functions, so the assumptions made in the process will cause the modelled system to depart from reality. These fishery stock assessments capture the main processes and data streams so that the final estimate of fishing rate and/or stock size is broadly correct.

For these assessments the key uncertainties come from:

- the scientific understanding of growth and natural death rates
- the representativeness of the landings used to collect length samples
- the assumptions within the assessment model of
 - a) The population being at equilibrium (constant recruitment).
 - b) The spatial coverage of the population is constant, and all size ranges are equally available to the fishery.
 - c) Fishery statistics are complete and accurate.

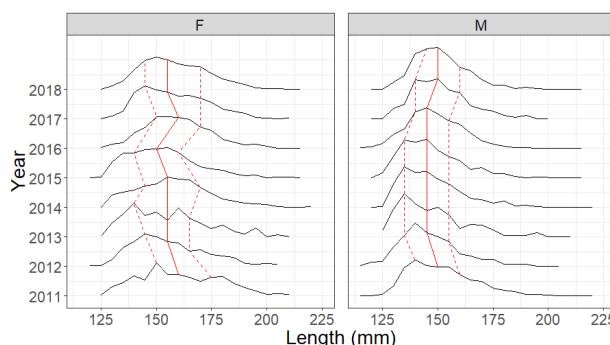
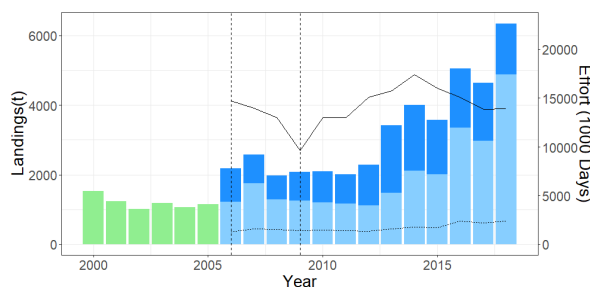
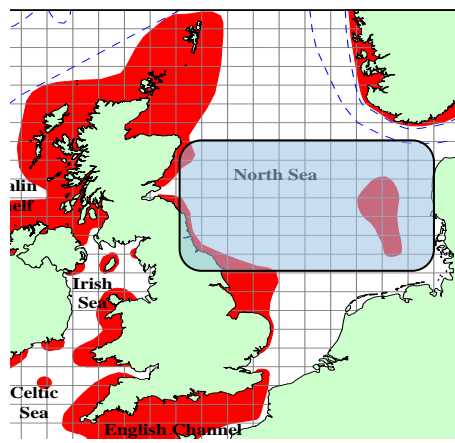
Cefas has a research program which continually searches to improve our understanding of processes governing population dynamics and there are currently projects focussing on growth and mortality rates. We are also working with the MMO to ensure that landings statistics are as complete and accurate as possible and working with the IFCA's to ensure maximum efficiency and best practice in data collection.

Given the uncertainty in the input data and assessment model it is acknowledged that the precise value of any estimate of fishing mortality of stock size is uncertain but has sufficient reliability to indicate rates on a high-medium-low scale.

Cefas Stock Status 2019: Edible crab (*Cancer pagurus*) in the Central North Sea

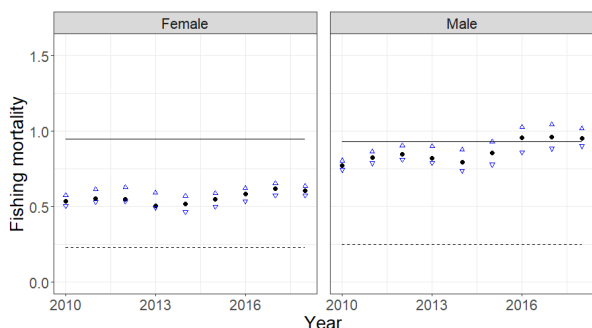
Sustainability Status

Minimum Landing Size	At the MLS, around 99% of males and 86% of females should be sexually mature.
Discarding	High discard survival assumed to be > 90%.
Stock size	Approaching target for males and above the target for females.
Exploitation rate	Moderate, below maximum reference point limit for females, males are at the limit



a) Landings (bars) and effort (lines) for the $\leq 10m$ fleet (dark blue/solid line) and the $>10m$ fleet (light blue/dashed line). Landings data for 2000 to 2005 have been combined for both fleets due changes in data reporting (green): **Note: Changes in recording levels in 2006 and 2009**

b) Size distributions of landings for the last 8 years. Solid red line represents the annual median and the dashed lines represent 25th and 75th percentiles



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



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

Exploitation level of Edible Crab in the Central North Sea is high on males and moderate on females and, although likely to be sustainable is above the level required for Maximum Sustainable Yield. Exploitation has increased on males in recent years and now sits around the maximum reference point limit. The estimates of spawning stock biomass are at the target level for females and approaching the target level for males. The status of the stock has not changed since the last assessment in 2017. Anecdotal information suggests a recent expansion of fishing activity in both pot numbers and distribution. These factors are likely to be partially responsible for the large increase in landings which the model interprets as an increase in spawning stock. The spawning stock status should therefore be treated with caution.

Sampling levels

Table 1. Sample numbers used in the CNS assessment for the last three years, collected by Cefas and IFCA

Year	Number of crabs	Number of samples	Sampled wt. (kg)
2016	8,456	104	4,574
2017	5,389	57	2,119
2018	5,934	54	2,184

Fishery overview and developments

Table 2. Number of potting vessels per year, split into vessels with a length of 10m and under, and over 10m.

	2013	2014	2015	2016	2017	2018
Fleet size <=10m / 10+ m	292/47	315/54	312/54	291 / 78	252 / 70	293 / 79

Reported landings and fishing effort increased substantially following the introduction of Buyers and Sellers legislation and the Restrictive Shellfish License Scheme in 2006. Since this period fishing activity data are thought to be generally more reliable but the integrity of the time series, especially fishing effort, is uncertain.

As well as the more traditional fisheries off Yorkshire and Northumberland, a fishery off the Danish coast prosecuted by large nomadic English vessels has developed over the last decade. The fishery in this area has increased in range with the decline of trawling, as operators target grounds beyond 6nm. Data from the Danish coast fishery are not included in this assessment.

Increased landings and animal sizes have been noted on the quayside within the NEIFCA district. Some technology creep has occurred as either vessels or hauling equipment has been upgraded to improve efficiency. There has also been some transition to higher capacity vessels capable of handling substantially larger numbers of pots. The inshore fishery has seen an increase in pots hauled and pots set across the NEIFCA range. Market systems can influence the landings composition with seasonal restrictions on landing males, females and specific size ranges, in periods associated with poor meat yield.

- EC legislation sets a minimum landing size of 130mm for crabs in the North Sea south of 56°N and 140mm North of 56°N. It also restricts the proportion of the crab landings which is detached claws caught by pots or creels to less than 1% by weight of total catch. A by-catch limit of no more than 75kg per day of crab claws taken by other gear types can be landed.
- National legislation restricts the number of shellfish licences available (in England and Wales) and also prohibits landing of berried and soft crabs.
- Local IFCA legislation varies and is detailed in the table below.

Table 3. Regional byelaws on Central North Sea crab fisheries.

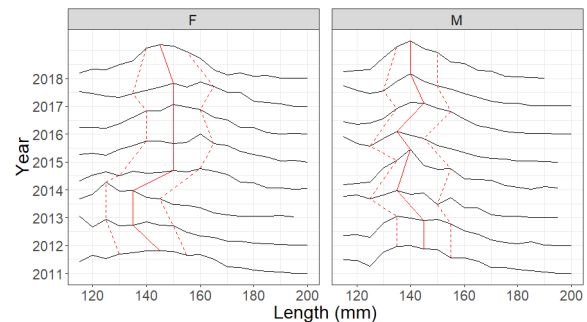
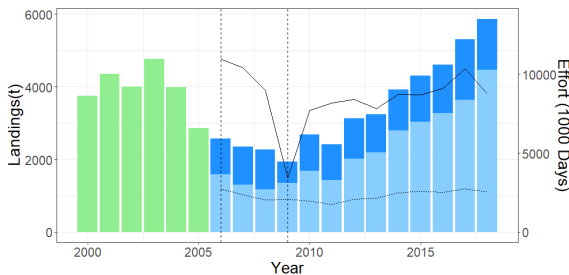
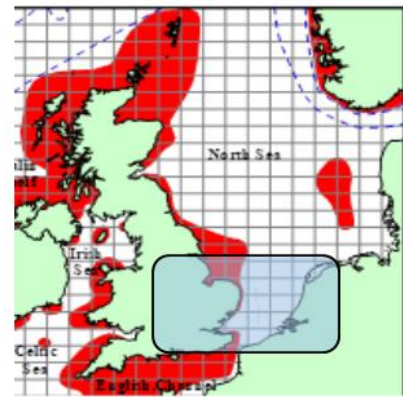
Type of Byelaw	Northumberland IFCA	North Eastern IFCA
Shellfish permits	Yes	Yes*
Minimum Landing Size	Yes – 130mm	Yes – 140mm
Maximum Pot Limit	Yes - 800	No
Escape Gaps	No	Yes*
Maximum Vessel Length	Yes -12m	Yes – 12.5m (Area B), 14m (Area A)
Towed Gear Restrictions	No	No
Prohibits the Use of Crab for Bait	Yes	Yes
Prohibits the Removal of Parts of Crabs	Yes	Yes

*Only applicable within the previous North Eastern Sea Fisheries Committee District

Cefas Stock Status 2019: Edible crab (*Cancer pagurus*) in the Southern North Sea

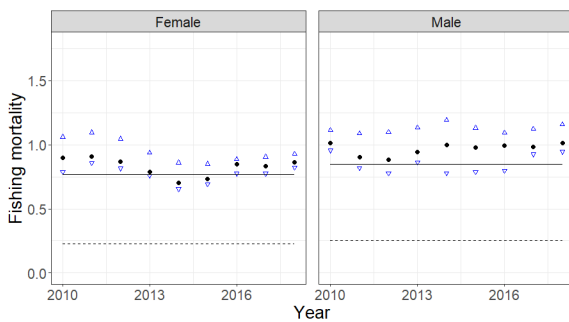
Sustainability Status

Minimum Landing Size	<i>At the MLS's applied in this region around 96-99% of males and 60-86% of females should be sexually mature.</i>
Discarding	<i>High discard survival assumed to be > 90%.</i>
Stock size	<i>Between minimum reference point limit and target for males and females.</i>
Exploitation rate	<i>High. Above the maximum reference point limit for males and females.</i>



a) Landings (bars) and effort (lines) for the $\leq 10\text{m}$ fleet (dark blue/solid line) and the $> 10\text{m}$ fleet (light blue/dashed line). Landings for 2000 to 2005 have been combined. **Note: changes in recording of landings occurred in 2006 and 2009.**

b) Size distributions of landings for the last 8 years. Solid red line represents the annual median and the dashed lines represent 25th and 75th percentiles



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



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

Exploitation level of Edible Crab in the Southern North Sea is high for both sexes and, although stable, is above the level required for Maximum Sustainable Yield. The spawning stock biomass is between the reference target and limit for both males and females, increasing in recent years for both sexes. The status of the stock has not changed since the last assessment in 2017. Anecdotal information suggests a recent expansion of fishing activity in both pot numbers and distribution. These factors are likely to be partially responsible for the large increase in landings which the model interprets as an increase in spawning stock. The spawning stock status should therefore be treated with caution.

Sampling levels

Table 1. Sample numbers collected for SNS during the last three years by Cefas and IFCA's.

Year	Number of crabs	Number of samples	Sampled wt. (kg)
2016	12,057	98	4,272
2017	8,053	70	2,498
2018	6,368	46	1,640

Fishery overview and developments

Table 2. Number of potting vessels per year, split into vessels with a length of 10m and under, and over 10m.

	2013	2014	2015	2016	2017	2018
Fleet size < 10m / 10+ m	199 / 58	173 / 52	189 / 56	206 / 58	206 / 69	204 / 60

Marked variability in annual reported fishing effort and changes to procedures for acquiring fishing effort have changed over time and integrity of the fishing effort time series is highly uncertain. Landings data since 2009 are missing those landings which did not generate sales notes (as each sale was <25kg). As such data from Monthly Shellfish Activity Returns (MSARS, required as part of the Shellfish Restrictive Licence Scheme) have been used in conjunction with official landings data to fill in the gaps.

This stock supports three distinct fisheries, the Holderness fishery off Yorkshire, and two Norfolk fisheries. There are strong seasonal fluctuations in the fisheries with the spring fishery (March – May) seeing the highest catch rates.

The components of the Norfolk fishery are typified by small beach-launched vessels and larger harbour-based vessels, the former being more restricted in their activity by weather. There is a difference in the preferred size of crab by processing division. Big processors preferring larger crab (>125mm) during late winter whereas the smaller processors will take all sizes. In spring- early summer there is more demand for MLS (115mm) crab for tourist/day-tripper market (bite size crab). Through the summer, processors tend to take all sizes as the availability of crab reduces (owing to the biology of the animals).

Within the NEIFCA district a large size distribution has been recorded on the quayside with animals over 200mm carapace width not uncommon. Some technology creep has occurred as either vessels or hauling equipment has been upgraded to improve efficiency. There has been considerable upgrading within the fleet with some operators moving towards higher capacity vessels, operating in the more lightly exploited grounds further offshore. Market systems can influence the landings composition with seasonal restrictions on landing males, females and specific size ranges, in periods associated with poor meat yield.

Fishery Management measures

- EC legislation sets a minimum landing size of 130mm for crabs in the North Sea south of 56°N. It also restricts the proportion of the crab landings which is detached claws caught by pots or creels to less than 1% by weight of total catch. A by-catch limit of no more than 75kg per day of crab claws taken by other gear types can be landed.
- National legislation restricts the number of shellfish licences available (in England and Wales) and also prohibits landing of berried and soft crabs.
- A derogation to the EC legislation sets an MLS of 115mm in the Eastern IFCA area. Local IFCA legislation varies and is detailed in the table below.

Table 3. Regional byelaws on Southern North Sea crab fisheries.

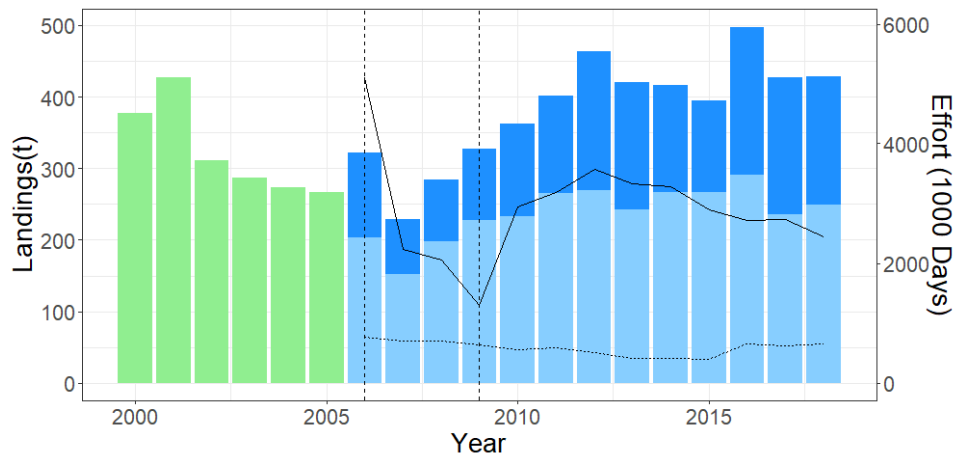
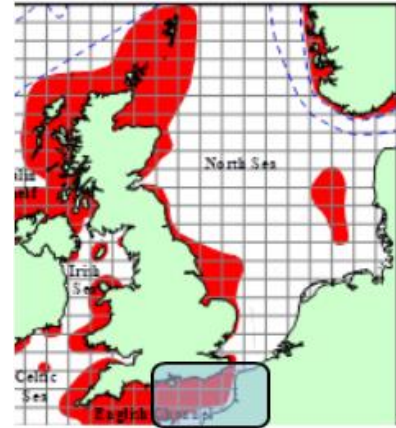
Title of Byelaw	North Eastern	Eastern	Kent & Essex
Shellfish permits	Yes*	Yes*	Yes**
Minimum Landing Size	Yes – 140mm	Yes – 115mm	Yes – 130mm
Maximum Pot Limit	No	No	No
Escape Gaps	Yes*	Yes*	Yes
Maximum Vessel Length	Yes – 12.5m (Area B), 14m (Area A)	No	Yes - 17M
Towed Gear Restrictions	No	Yes	No
Prohibits the Use of Crab for Bait	Yes	Yes	Yes
Prohibits the Removal of Parts of Crabs	Yes	Yes	Yes

*Only applicable within the previous North Eastern Sea Fisheries Committee District ** Only applicable in some areas of District

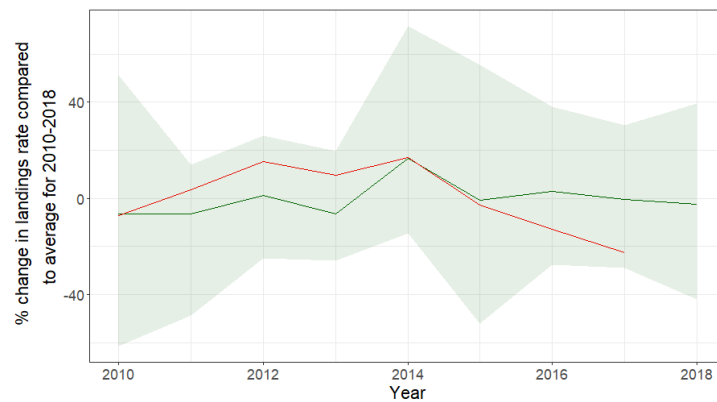
Cefas Stock Status 2019: Edible crab (*Cancer pagurus*) in the Eastern English Channel

Sustainability Status

Minimum Landing Size	<i>At the MLS's applied in this region around 96-99% of males and 60-86% of females should be sexually mature.</i>
Discarding	<i>High discard survival assumed to be > 90%.</i>
Stock size	<i>Unknown</i>
Exploitation rate	<i>Unknown</i>



a) Landings (bars) and effort (lines) for the $\leq 10\text{m}$ fleet (dark blue/solid line) and the $> 10\text{m}$ fleet (light blue/dashed line). Landings for 2000 to 2005 have been combined over fleets. Note: Changes in recording levels in 2006 and 2009



b) Time series of mean standardised landings rate, calculated as the change in annual landings per unit effort (LPUE, effort is pot hauls) from the mean LPUE of the time series. Red is the personal logbook data of a single over 15m vessel, green is aggregated monthly shellfish activity return (MSAR) data for $\leq 10\text{m}$ vessels reporting landings for all years in the East English Channel (coloured area represents 25th and 75th percentiles for $\leq 10\text{m}$ fleet).

The status of the stock of Edible Crab in the Eastern English Channel is currently unknown. A length-based assessment was not feasible due to insufficient data. Landings per fishing day have large uncertainty boundaries but appear stable for the years 2010 – 2018 for the $\leq 10\text{m}$ fleet. No reference points have been calculated

Sampling levels

Table 1. Sample numbers collected for EEC during the last three years by Cefas and IFCA.

Year	Number of crabs	Number of samples	Sampled wt. (kg)
2016	234	6	131
2017	2,057	17	1,006
2018	1,458	10	784

Fishery overview and developments

Table 2. Number of potting vessels per year, split into vessels with a length of 10m and under, and over 10m.

	2013	2014	2015	2016	2017	2018
Fleet size < 10m / 10+ m	100 / 9	95 / 7	126 / 12	111 / 14	112 / 14	115 / 13

Recorded landings have fluctuated widely generally in line with recorded effort. A peak of around 500t in 2016 was followed by a gradual decline, the largest decline was in 2006 where the landings fell to around 250t. From 2006, recorded landings increased gradually and plateaued at around 450t since 2013 (with a spike in 2016). Improved reporting following the introduction of RSLs (Restrictive shellfish licencing scheme) requiring submission of monthly shellfish returns by fishers (MSAR) in 2006, is possible but is not particularly apparent in this region. By combining the official landings data with the MSAR data for the present assessment, for the years 2010-2018, the magnitude of the landings and effort are likely to be more accurate.

The potting fleet is mainly made up of vessels =<10m length in the Eastern English Channel stock (107 vessels reported landings in 2018), with only 13 vessels over 10m length with reported landings in 2018. However, these 13 vessels landed around two thirds of the total crab landings into EEC ports in 2018. A large fishery occurs during late summer to autumn, when fishers target mature female crabs as they carry out their ontogenic migration westward through the channel towards spawning grounds.

Fishery Management measures

- European Commission (EC) and UK Minimum Landing Sizes (MLS) of 130mm carapace width (CW) apply north of 51° N. South of this latitude an EC and UK MLS of 140mm CW is enforced.
- Sussex IFCA have a shellfish permit scheme in place. This stipulates that no vessels larger than 14m in length can fish in the district and limits potting effort by restricting the number of pots (specifically crab or lobster pots) at 300 within 3nm from the coast and 600 pots from 3-6nm.

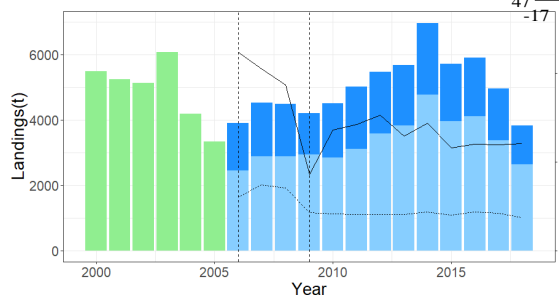
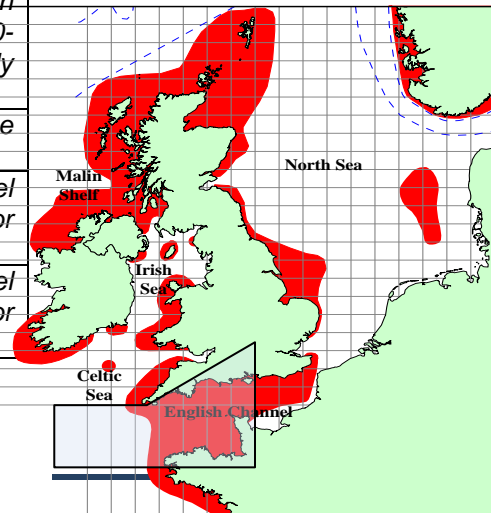
Title of Byelaw	Southern	Sussex	Kent and Essex
Shellfish Permits	No	Yes	No
Minimum Landing Size	No	Yes – 140mm	Yes – 130mm
Maximum Pot Limit	No	Yes-300<3m, 600<6m	No
Escape Gaps	No	Yes	Yes
Maximum Vessel Length	Yes – 12m	Yes – 14m	Yes – 17m
Towed Gear Restrictions	No	No	No
Prohibits the Use of Crab for Bait	No	No	Yes
Prohibits the Removal of Parts of Crabs	No	No	Yes

Table 3. Regional byelaws on Eastern English Channel crab fisheries.

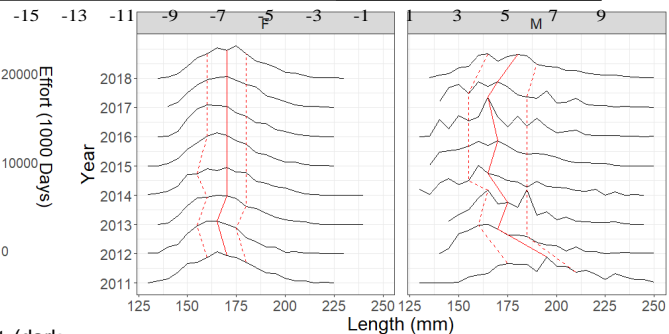
Cefas Stock Status 2019: Edible crab (*Cancer pagurus*) in the Western English Channel

Sustainability Status

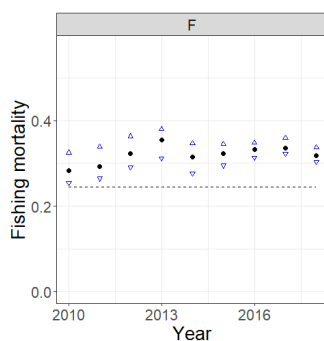
Minimum Landing Size	At the MLS's applied in this region around 96-99% of males and 60-86% of females should be sexually mature.
Discarding	High discard survival assumed to be > 90%.
Stock size	High, around the target level required to achieve MSY for females.
Exploitation rate	Moderate, around target level required to achieve MSY for females.



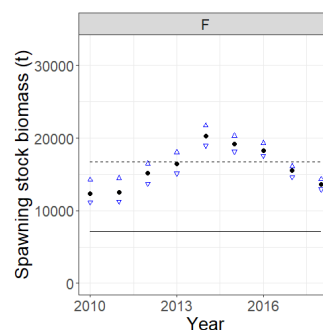
a) Landings (bars) and effort (lines) for the $\leq 10\text{m}$ fleet (dark blue/solid line) and the $> 10\text{m}$ fleet (light blue/dashed line). Landings for 2000 to 2005 have been combined over fleets. Note: Changes in recording levels in 2006 and 2009.



b) Size distributions of landings for the last 8 years. Solid red line represents the annual median and the dashed lines represent 25th and 75th percentiles.



c) Fishing mortality time series with FMSY target (dashed) and maximum reference point limit (solid). Maximum reference point limits lie outside the scale. Males not included due to relatively low landings.



d) Time series of biomass estimates and MSY target (dashed) and minimum reference point limit (solid). Males not included due to relatively low landings.

The exploitation levels of Edible Crab in the Western English Channel are close to the levels required to produce Maximum Sustainable Yield. The status of the stock is moderate to good with spawning stocks close to the level required to produce Maximum Sustainable Yield for females. There are insufficient data on male crabs to undertake an assessment on this portion of the stock. The status of the female portion of the stock has not changed since the last assessment in 2017.

Sampling levels

Table 1. Sample numbers collected for WEC during the last three years by Cefas and IFCAs.

Year	Number of crabs	Number of samples	Sampled wt. (kg)
2016	7,311	56	3,598
2017	6,900	51	3,729
2018	7,182	42	3,836

Fishery overview and developments

Table 2. Number of potting vessels per year, split into vessels with a length of 10m and under, and over 10m.

	2013	2014	2015	2016	2017	2018
Fleet size < 10m / 10+ m	321 / 78	329 / 70	323 / 78	344 / 76	321 / 76	345 / 82

Landings increased for several years, reaching a peak in 2014 followed by a steady decrease. There is some evidence to suggest an influence of the Restrictive Shellfish License Scheme and Buyers and Sellers legislation since which fishing activity data has been generally more reliable. Fishing effort appears to have generally stabilised over the time series however between 2006 and 2008 there was a change in the way official fishery data were recorded leading to a sharp decrease in records, particularly effort. In the current assessment MSAR data have been combined with landings data to improve data quality, these data are combined for 2010 – 2018. For the period of 2006 – 2009 and 2010 – 2018 the landings and effort data are considered to be a more accurate magnitude and therefore the integrity of the time series is potentially compromised.

The EU Western Waters Regime places a limit upon the number of kilowatt days that the >15m potting fleet can use within ICES area VII. From 2013 active management has been introduced leading to reductions in the number of days fished within this stock area. There may have also been a loss in effort (and therefore also catch) towards the end of 2013 because of the very bad weather in the run up to Christmas which is traditionally an important fishery.

Since 2008 there has been an increase in the vessel numbers and pots used in the Lyme Bay area since the Lyme Bay Statutory Instrument came into being however it is not clear if this represents new activity or a relocation of activity from neighbouring areas.

In large areas of the Devon and Severn IFCA district there is little opportunity to increase the area covered or number of pots on the ground due to the potential for gear conflicts with the mobile fishing.

Fishery Management measures

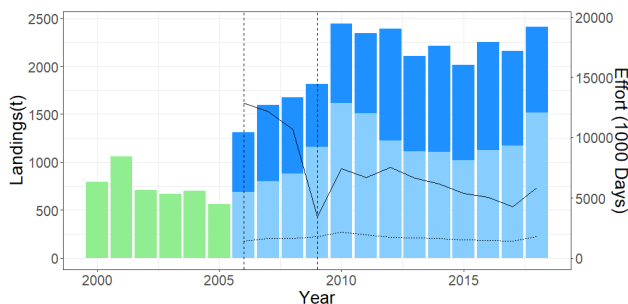
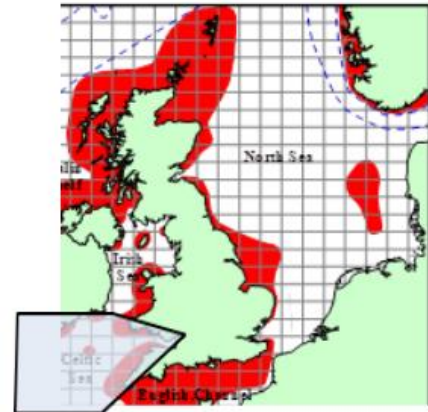
- EC and UK minimum landing size of 140mm applies, but off Devon and Cornwall UK law stipulates an MLS of 150 for females and 160mm for males. It also restricts the proportion of the crab landings which is detached claws caught by pots or creels to less than 1% by weight of total catch. A by-catch limit of no more than 75kg per day of crab claws taken by other gear types can be landed.
- National legislation restricts the number of shellfish licences available (in England and Wales) and also prohibits landing of berried and soft crabs.
- Cornwall IFCA applies an MLS of 150mm for females and 160mm for males. Local IFCA legislation varies and is detailed in the table below.
- There are mid-channel potting agreements in place in this region.

Title of Byelaw	Southern	Devon & Severn	Cornwall	Isles of Scilly
Shellfish Permits	No	Yes	Yes	Yes
Minimum Landing Size	No	Yes – 150mm (females), 160mm (male)	Yes – 150mm (females), 160mm (male)	No
Maximum Pot Limit	No	No	No	No
Escape Gaps	No	Yes	Yes	No
Maximum Vessel Length	Yes – 12m	Yes – 15.24m	Yes – 16.46m	Yes – 11m
Towed Gear Restrictions	No	Inshore Potting Agreement Area	No	Yes
Prohibits the Use of Crab for Bait	No	No	No	No
Prohibits the Removal of Parts of Crabs	No	Yes	Yes	No

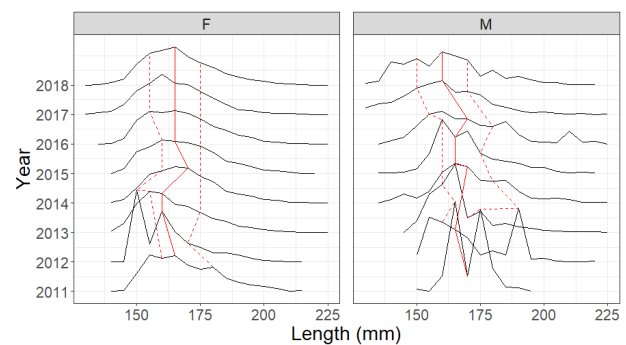
Cefas Stock Status 2019: Edible crab (*Cancer pagurus*) in the Celtic Sea

Sustainability Status

Minimum Landing Size	<i>At the MLS's used in this region around 100% of males and 94-98% of females should be sexually mature.</i>
Discarding	<i>High discard survival assumed to be > 90%.</i>
Stock size	<i>Below Maximum Sustainable Yield level but above minimum reference point limit for Females</i>
Exploitation rate	<i>Moderate. Close to target level generating Maximum Sustainable Yield</i>



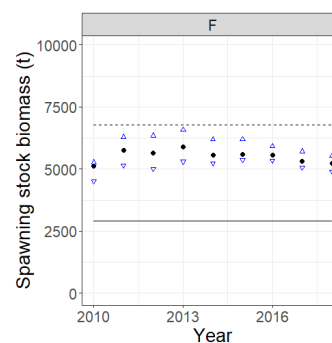
a) Landings (bars) and effort (lines) for the $\leq 10\text{m}$ fleet (dark blue/solid line) and the $>10\text{m}$ fleet (light blue/dashed line). Landings for 2000 to 2005 have been combined over fleets. Note: Changes in recording levels in 2006 and 2009



b) Size distributions of landings for the last 8 years. Solid red line represents the annual median and the dashed lines represent 25th and 75th percentiles



c) Fishing mortality time series with FMSY target (dashed) and maximum reference point limit (solid). Maximum reference point limit lies outside the scale in this case. Males not included due to relatively low landings.



d) Time series of biomass estimates and MSY target (dashed) and minimum reference point limit (solid). Males not included due to relatively low landings.

Exploitation levels of Edible Crab in the Celtic Sea are moderate for females and likely to be sustainable but above the target MSY level. The status of the stock of female is approaching the level associated with Maximum Sustainable Yield. There are insufficient data on male crabs to undertake an assessment on this portion of the stock. The status of the female portion of the stock has not changed since the last assessment in 2017.

Sampling levels

Table 1. Sample numbers collected for CS during the last three years by Cefas and IFCA.

Year	Number of crabs	Number of samples	Sampled wt. (kg)
2016	6,307	61	4,197
2017	4,600	36	2,811
2018	3,626	31	2,386

Fishery overview and developments

Table 2. Number of potting vessels per year, split into vessels with a length of 10m and under, and over 10m.

	2013	2014	2015	2016	2017	2018
Fleet size < 10m / 10+ m	218 / 41	224 / 34	229 / 34	216 / 37	215 / 40	189 / 39

Reported landings and fishing effort increased substantially following the introduction of Buyers and Sellers legislation and the Restrictive Shellfish License Scheme in 2006. Since this period fishing activity data are thought to be generally more reliable but the integrity of the time series, especially fishing effort, is uncertain. Landings have been relatively stable since 2010.

The very low level of landings for males presents the assessment methodology with significant problems in determining exploitation level and stocks size for males. In particular it means that any MSY levels for males and females are not comparable. The relative lack of males in the landings is likely to result from the males occurring on ground not covered by the fishery (either in space or time) and therefore this portion of the stock is offered a degree of protection. As it is the size of the female portion of the stock which mainly governs the potential to produce further generations, it is considered appropriate to characterise the status and exploitation rate of this stock on the fishery statistics for females.

The level of effort in the Devon and Severn IFCA district is reported to have remained consistent. The potting fisheries on the district's North Coast are seasonal with boats switching target species. In the winter/spring they target whelks until around April when the water temperature increases, and they target lobsters. Crabs are the main target through the autumn although they also form a bycatch in the summer lobster fishery. The ground targeted in the autumn is the optimal crab ground and is associated with movement of the females at this time of the year – they are likely to have mated and are very actively feeding. Males may be present on this ground at other times of the year when the fishery is absent.

Fishery Management measures

- EC and UK minimum landing sizes of 140mm apply to ICES divisions VIIIf (Region 2 south of 56° N, except ICES Divisions VIIId, e, f, and ICES Divisions IVb, c: 130 mm), but off Devon and Cornwall UK law stipulates an MLS of 160mm for males. EC law also restricts the proportion of the crab landings which is detached claws caught by pots or creels to less than 1% by weight of total catch. A by-catch limit of no more than 75kg per day of crab claws taken by other gear types can be landed.
- National legislation restricts the number of shellfish licences available (in England and Wales) and also prohibits landing of berried and soft crabs.
- Cornwall IFCA applies a 150mm MLS for female crabs and 160mm for males. Local IFCA legislation varies and is detailed in the table below.

Title of Byelaw	Devon & Severn	Cornwall
Shellfish Permits	Yes	Yes
Minimum Landing Size	Yes – 150mm (females), 160mm (male)	Yes – 150mm (females), 160mm (male)
Maximum Pot Limit	Yes	No
Escape Gaps	Yes	Yes
Maximum Vessel Length	Yes - 15.24M	Yes - 16.46m
Towed Gear Restrictions	Inshore Potting Agreement Area	No
Prohibits the Use of Crab for Bait	No	No
Prohibits the Removal of Parts of Crabs	Yes	Yes

Table 1. Regional byelaws on Celtic Sea crab fisheries

Glossary

Cefas	Centre for Environment, Fisheries and Aquaculture Science.
IFCA	Inshore Fisheries and Conservation Authority.
F	Fishing Mortality.
FMSY	The fishing effort which will produce Maximum Sustainable Yield.
M	Natural Mortality.
MCZ	Marine Conservation Zone
MMO	Marine Management Organisation
MSY	Maximum Sustainable Yield, the maximum landings which can be regularly taken while avoiding stock collapse.
SAC	Special Area of Conservation
SpR	Spawner per Recruit