

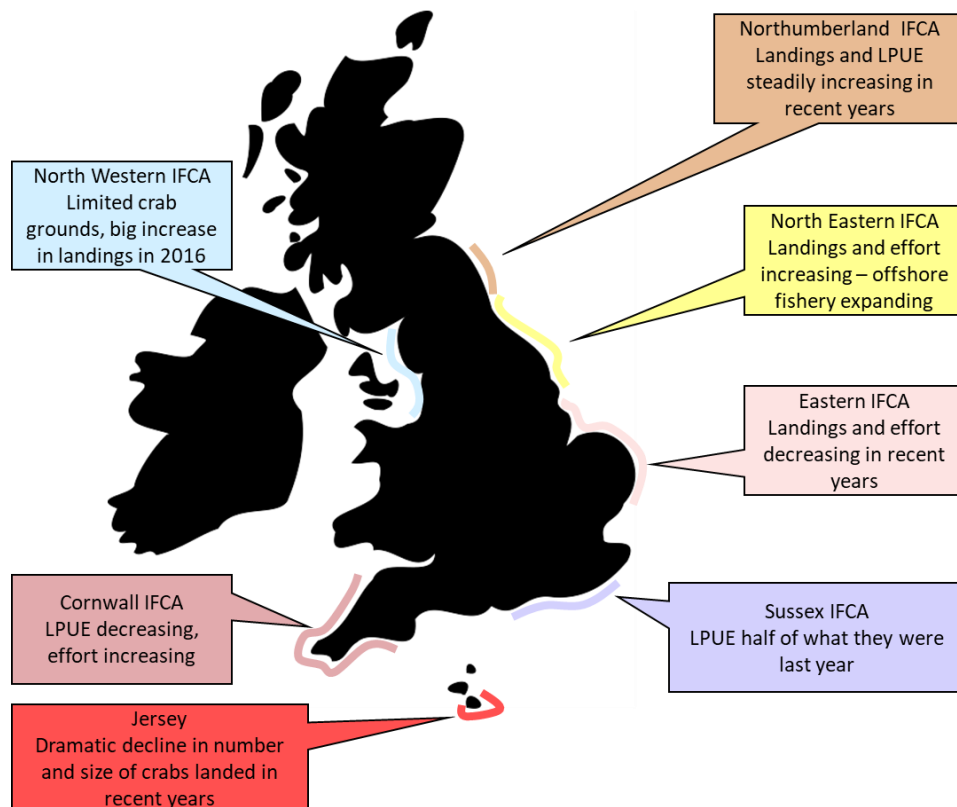
Briefing Notes - Brown Edible Crab fisheries in England and Jersey

Compiled in advance of the meeting on 23rd October, 2019:

***Cancer pagurus* – A meeting to plan what comes next in understanding populations of exploited brown crab in the UK.**

This Document contains material from:

1. Jersey Department of the Environment
2. Cornwall IFCA
3. Sussex IFCA
4. Eastern IFCA
5. North Eastern IFCA
6. Northumberland IFCA
7. North Western IFCA

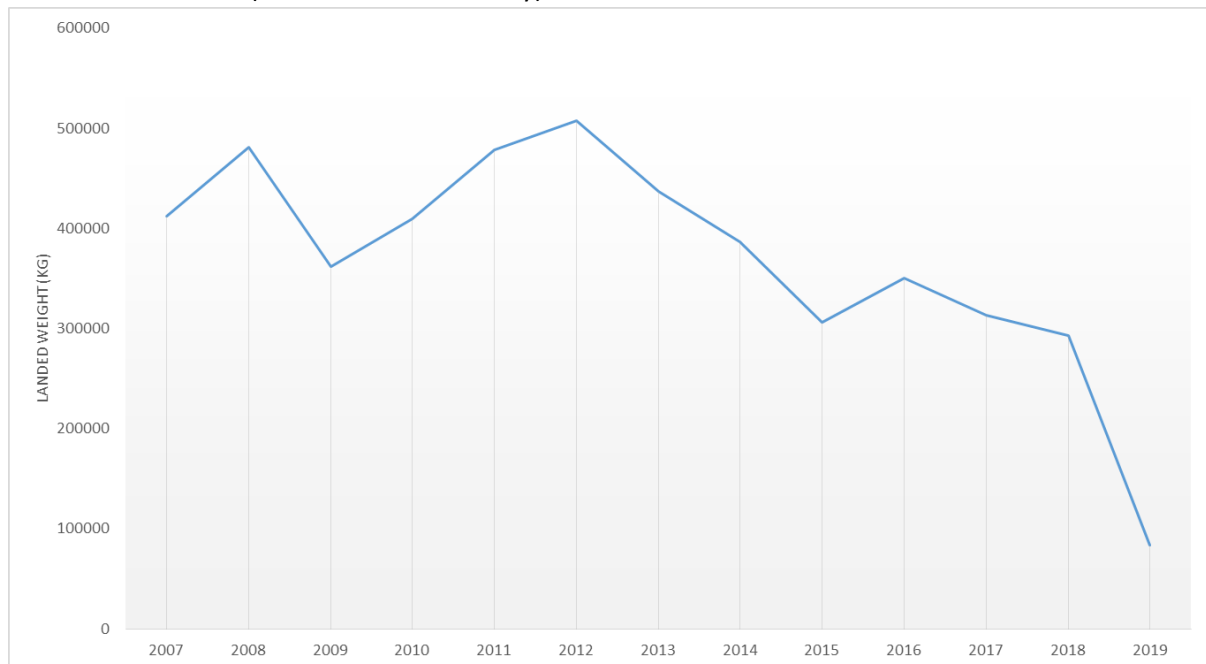


Jersey Brown Crab update.

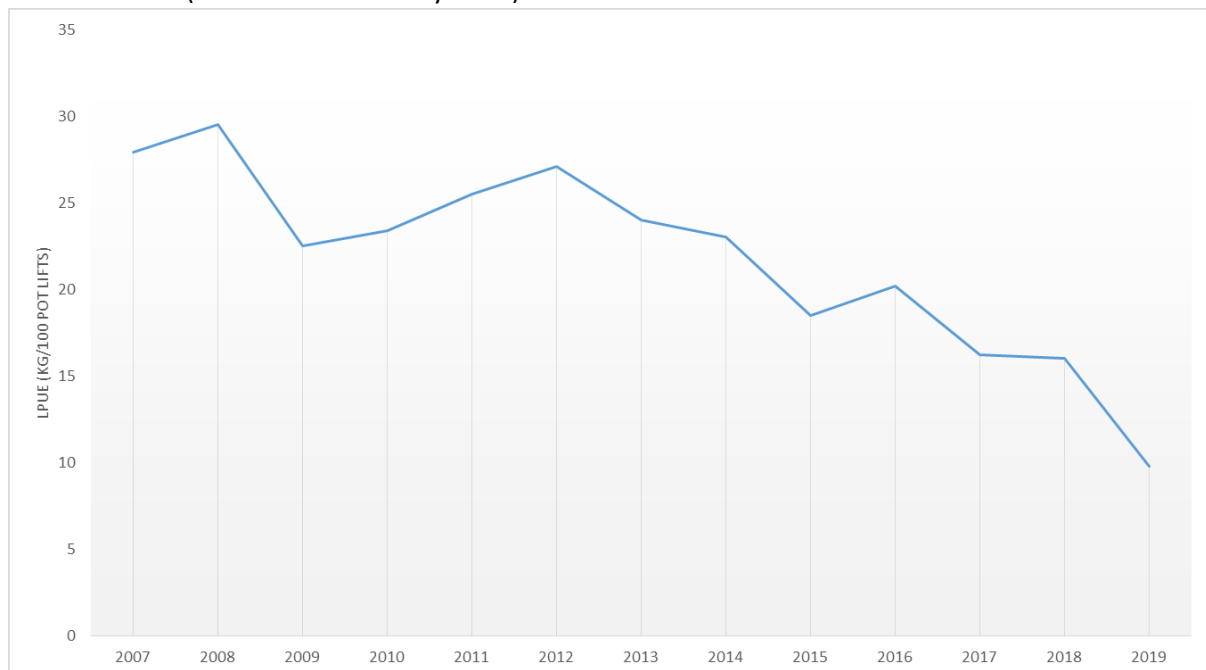
Commercial landings ranged from 400 to 500 tonnes annually between 2007 and 2014

However catches have been declining fairly consistently since 2014 with 2018 standing at 292 tonnes and the first half of 2019 has only delivering 83 tonnes (projected 150-200 tonnes by year end)

ANNUAL LANDINGS (2019 = Jan to June only)

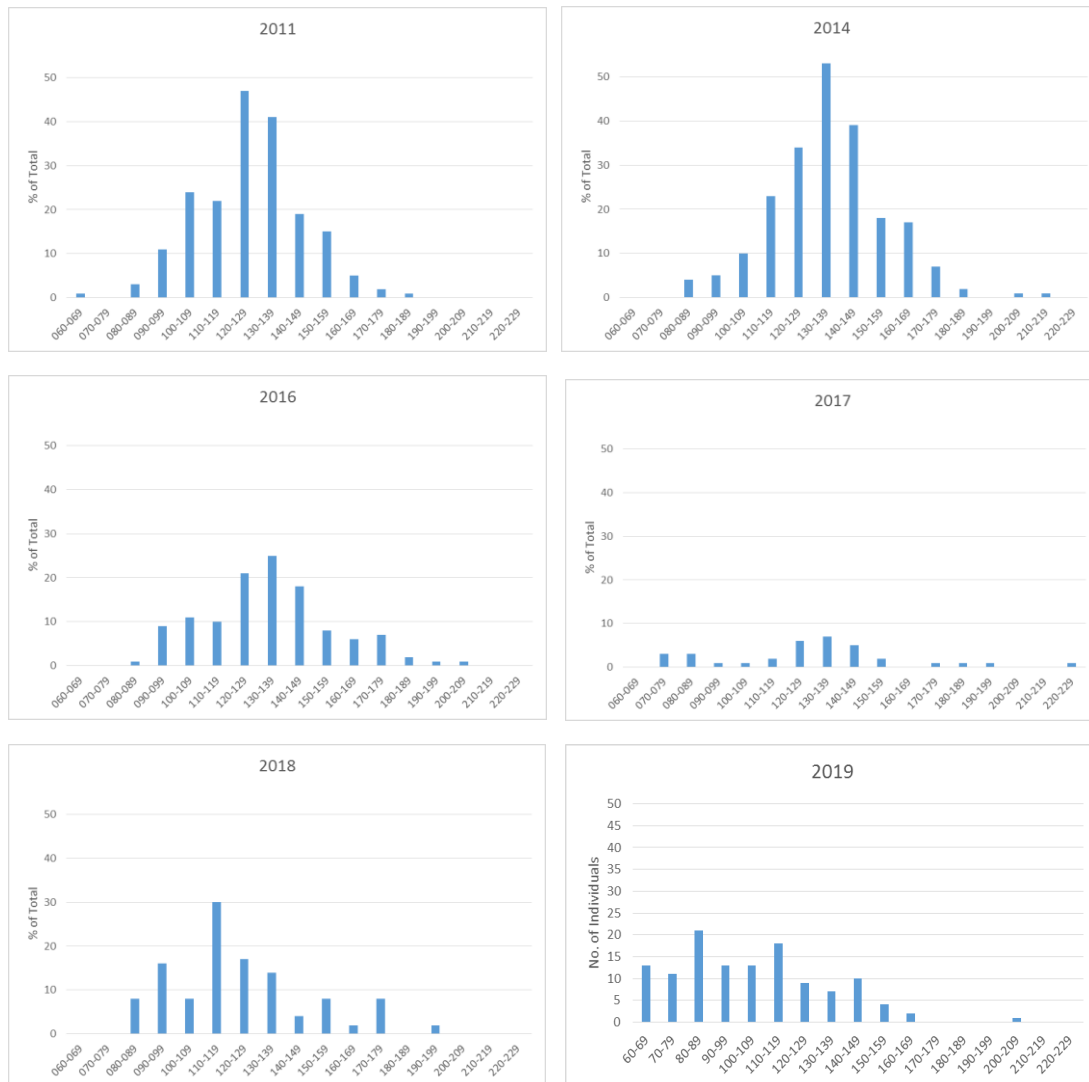


ANNUAL LPUE (MLS increase in early 2019)



Jersey marine resources carry out annual potting surveys in May / June each year. 150 pot lifts are carried out across three sites using modified tight netted parlour pots.

Over the years both the number and size distribution of Brown crabs has changed dramatically:



In a response to this Jersey has recently taken the following measures

- MLS increased from 140mm to 150mm
- Ban on landing of soft shelled crab
- Max 1% of catch may be detached claws (all metiers)

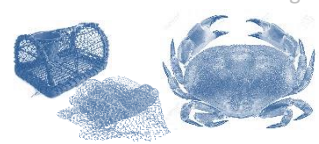
Pending Measures

- Further reduction to pot caps, circa 15% reduction across fleet (boat length and license type dependent).
- New open gear (no parlour pot) zones
- All pots to have escape gaps
- Recreational bag limits

Cornwall IFCA Monthly Shellfish Permit Statistics Analysis

Edible crab (*Cancer pagurus*) Pot and Net Fisheries

Summary Statistics 2016-2018



Data from Cornwall IFCA's shellfish permit returns has been analysed and presented as 'landings per unit effort' (LPUE). This has been calculated by dividing the weight of shellfish removed from the fishery by the total length of nets hauled, or number of pot hauls, used. Therefore **LPUE in the net fishery is the average weight of retained edible crabs from every 100m of nets hauled (100m_Nh) in a defined area and time**, and **LPUE in the pot fishery is the average weight of retained edible crabs from every 100 pot hauls (100Ph), in a defined area and time**. Data is collected for male and female edible crabs, however in this summary data has been combined. The method is outlined in 'Data Handling Method, Summary Statistics 2016-2018'.

Summary

In the Cornwall IFCA District edible crab (*Cancer pagurus*) is mainly targeted in a pot fishery, and retained as a by-catch in bottom set entangling nets. In all three years the total reported weight of crabs removed by the net fishery represented around 2% of the total edible crab reportedly removed from the District (Table 1).

Overall landings per unit effort (LPUE) in both the net fishery and pot fishery declined from 2016 to 2018 (Table 1). In all three analysis areas LPUE in the pot fishery was generally higher offshore (Fig.6, 8 and 10). In the net fishery there was more variation between the inshore and offshore, and in seasonality (Fig. 14 to 19).

North Coast; both inshore and offshore potting LPUE decreased in 2018 (Fig. 5 and 6) when quarterly LPUE was also consistently lower than the previous two years (Fig. 7). In the net fishery in 2018 LPUE was lower at the start and end of the year than in previous years (Fig.15), with fluctuations in LPUE both inshore and offshore (Fig.14).

West Coast; offshore had the highest LPUE in the pot fishery (Fig. 4 and 8) and the lowest LPUE in the net fishery across the reporting period (Fig.16). Inshore netting LPUE increased from 2016 to 2018 (Fig.16) with LPUE higher in every quarter in 2018 than in previous years (Fig. 17).

South Coast; potting LPUE in quarter two was lower in 2018 than in previous years (Fig. 11), with both inshore and offshore LPUE in the potting and netting fisheries declining slightly from 2017 to 2018 (Fig.10 and 18).

Annual Data

Table 1: Total kg of edible crabs (*Cancer pagurus*) reportedly removed from the Cornwall IFCA District in 2016 to 2018 from both the pot and net fisheries, total gear hauled, and resultant calculated LPUE (kg/100Ph, or kg/100m_Nh).

		2016	2017	2018
Pots	Total Gear Hauled	2,149,992	2,012,495	2,048,872
	Total Landed (kg)	1,641,558	1,642,165	1,424,739
	LPUE (kg/100Ph)	76.35	81.60	69.54
Nets	Total Gear Hauled (m)	7,432,718	6,684,300	8,359,890
	Total Landed (kg)	42,654	31,438	34,564
	LPUE (kg/100m_Nh)	0.57	0.47	0.41

Difference in LPUE since 2016 baseline

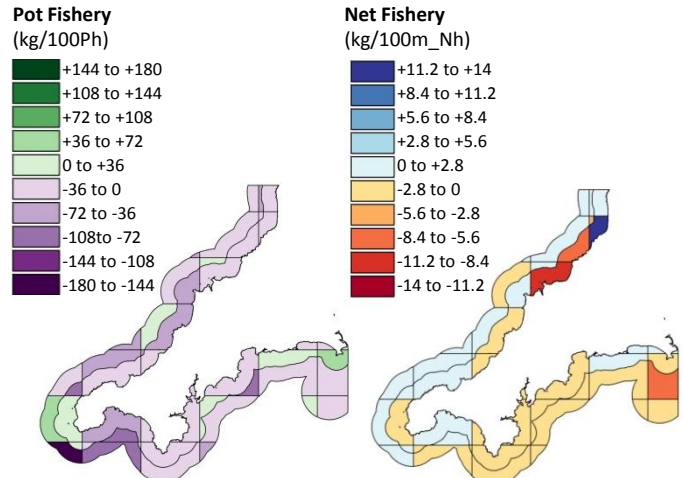
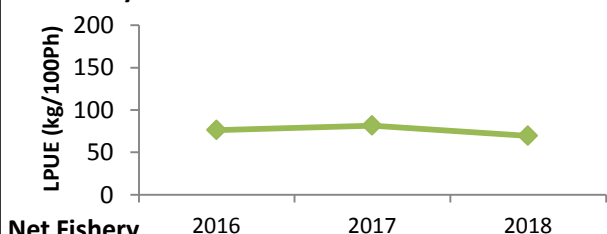


Figure 1: The difference in edible crab (*Cancer pagurus*) annual LPUE (kg/100Ph and kg/100m_Nh) in the pot and net fisheries, in belted statistical areas between 2016 and 2018. Thematically mapped in 36kg/100Ph ranges (pot fishery), and 2.8kg/100m_Nh ranges (net fishery) where positive values indicate an increase in LPUE and negative values a decrease.

Pot Fishery



Net Fishery

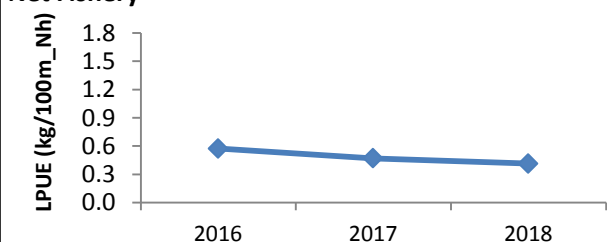


Figure 2: Annual LPUE in the pot fishery (kg/100Ph, top) and annual LPUE in the net fishery (kg/100m_Nh, bottom) of edible crab (*Cancer pagurus*) in the Cornwall IFCA District in 2016 to 2018

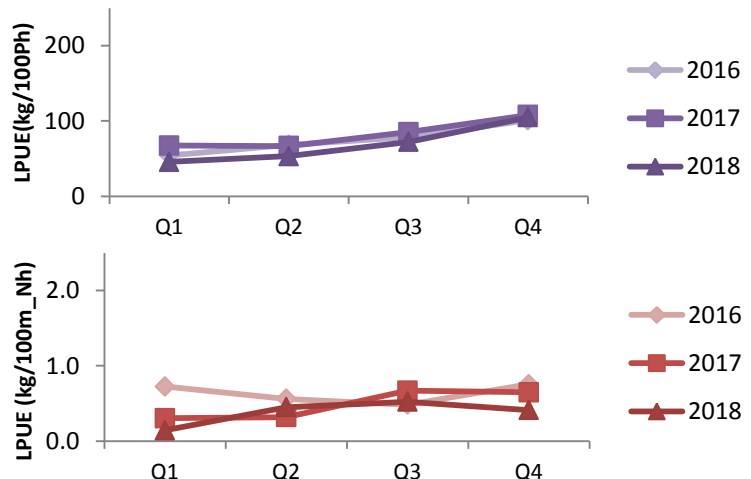
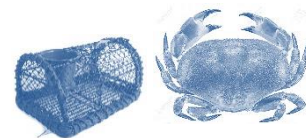


Figure 3: LPUE by calendar year quarter* in the pot fishery (kg/100Ph, top) and the net fishery (kg/100m_Nh, bottom) of edible crab (*Cancer pagurus*) in the Cornwall IFCA District in 2016 to 2018

* Calendar year quarters split as Q1(January to March), Q2 (April to June), Q3 (July to September) and Q4 (October to December)

**Annual LPUE**

(kg/100Ph)

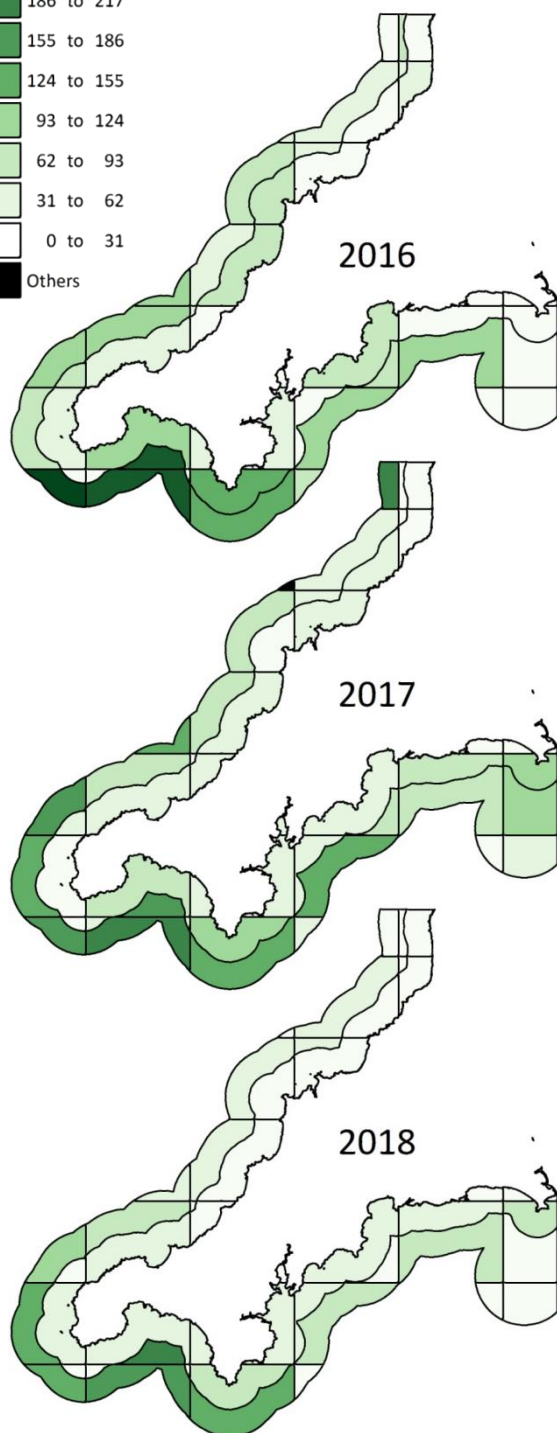
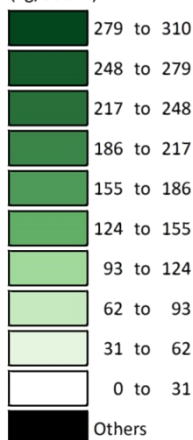


Figure 4: Thematic mapping of annual potting LPUE (kg/100Ph) of edible crab (*Cancer pagurus*) in belted statistical areas in 31kg/100Ph increments. 'Others' refers to a value of 390kg/100Ph in 30E48B (offshore of Padstow) in 2017.

Difference in Annual LPUE

(kg/100Ph)

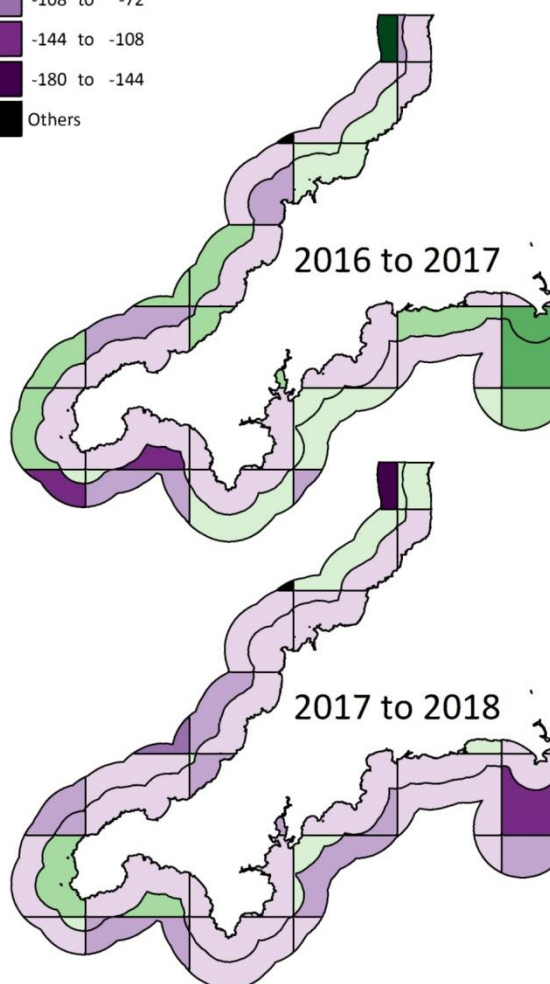
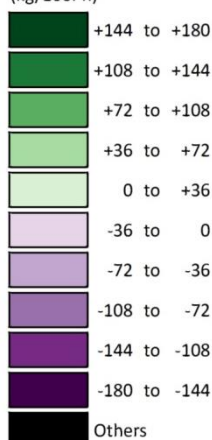
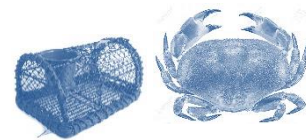


Figure 5: Thematic mapping of the difference in annual potting LPUE (kg/100Ph) of edible crab (*Cancer pagurus*) in belted statistical areas in ranges of 36kg/100Ph where a positive value i.e. increased LPUE is green and a negative value i.e. a reduction in LPUE is purple. 'Others' refers to a value of +333Kg/100Ph in 30E48B (offshore of Padstow) in '2016 to 2017', and -390kg/100Ph in the same area in '2017 to 2018'.

Cornwall IFCA Monthly Shellfish Permit Statistics Analysis

Edible crab (*Cancer pagurus*) Pot Fishery

Summary Statistics 2016-2018



North Coast

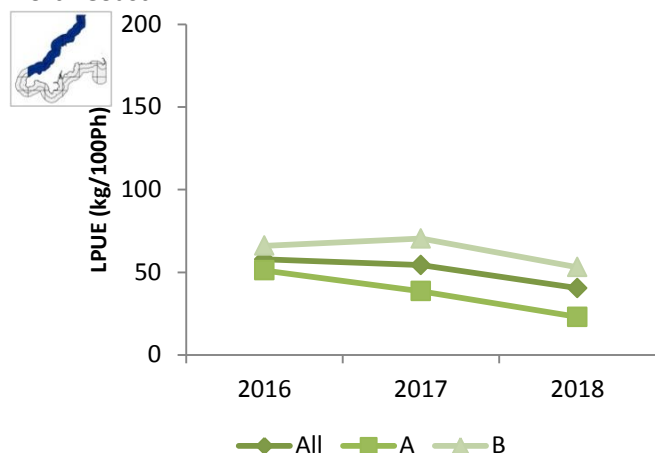


Figure 6: Annual LPUE (kg/100Ph) of edible crab (*Cancer pagurus*) on the 'North Coast' in 2016 to 2018 (diamonds), further split by band A (inshore 0-3nm, squares) and B (offshore 3-6nm, triangles).

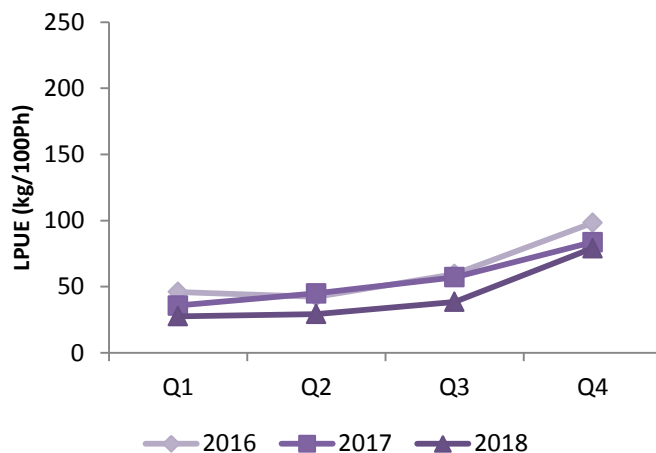


Figure 7: LPUE (kg/100Ph) by calendar year quarter*of edible crab (*Cancer pagurus*) on the 'North Coast' in 2016 (diamonds), 2017 (squares) and 2018 (triangles).

West Coast

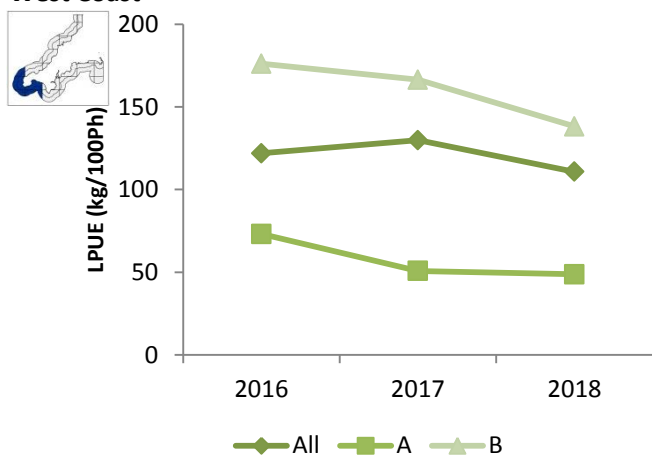


Figure 8: Annual LPUE (kg/100Ph) of edible crab (*Cancer pagurus*) on the 'West Coast' in 2016 to 2018 (diamonds), further split by band A (inshore 0-3nm, squares) and B (offshore 3-6nm, triangles).

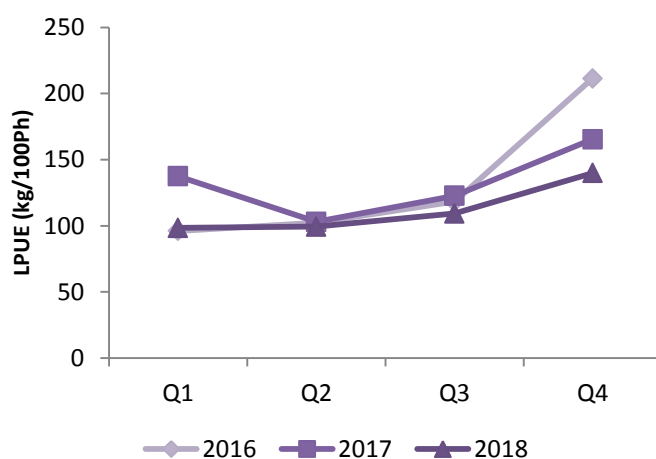


Figure 9: LPUE (kg/100Ph) by calendar year quarter*of edible crab (*Cancer pagurus*) on the 'West Coast' in 2016 (diamonds), 2017 (squares) and 2018 (triangles).

South Coast

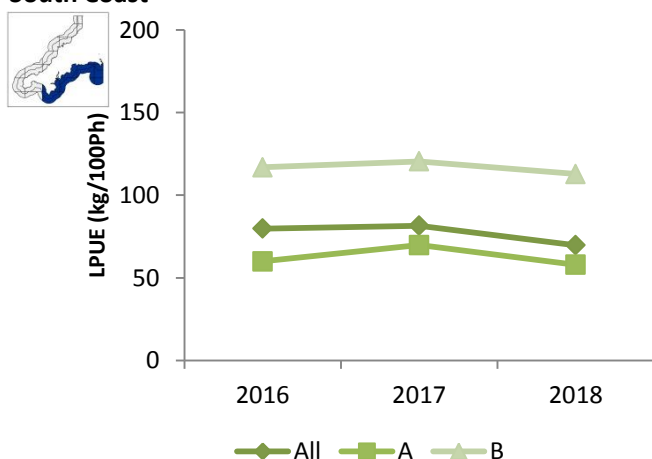


Figure 10: Annual LPUE (kg/100Ph) of edible crab (*Cancer pagurus*) on the 'South Coast' in 2016 to 2018 (diamonds), further split by band A (inshore 0-3nm, squares) and B (offshore 3-6nm, triangles).

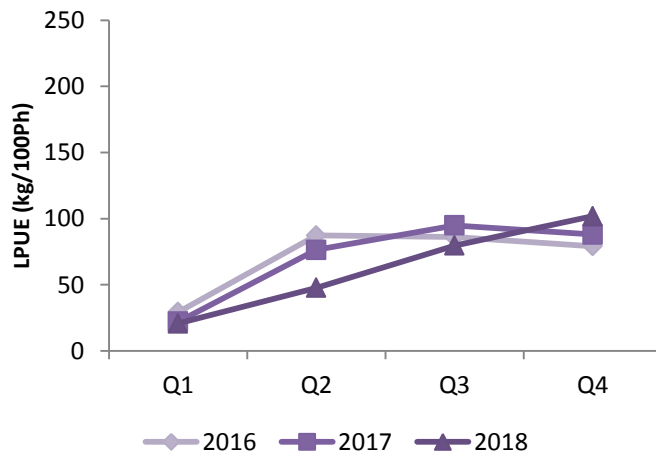


Figure 11: LPUE (kg/100Ph) by calendar year quarter*of edible crab (*Cancer pagurus*) on the 'South Coast' in 2016 (diamonds), 2017 (squares) and 2018 (triangles).

**Annual LPUE**

(kg/100m_Nh)

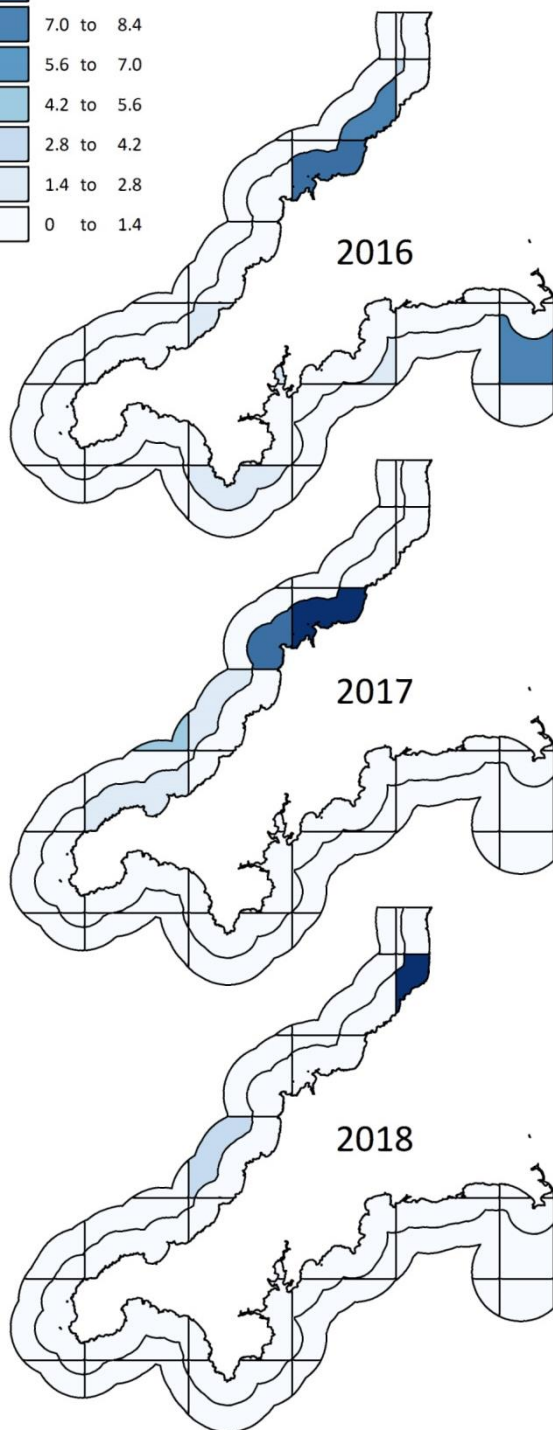
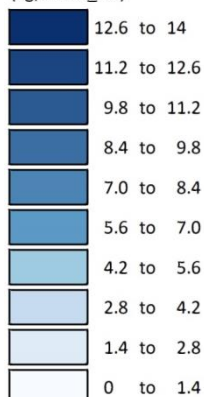


Figure 12: Thematic mapping of annual netting LPUE (kg/100m_Nh) of edible crab (*Cancer pagurus*) in belted statistical areas in 1.4kg/100m_Nh increments.

Difference in Annual LPUE

(kg/100m_Nh)

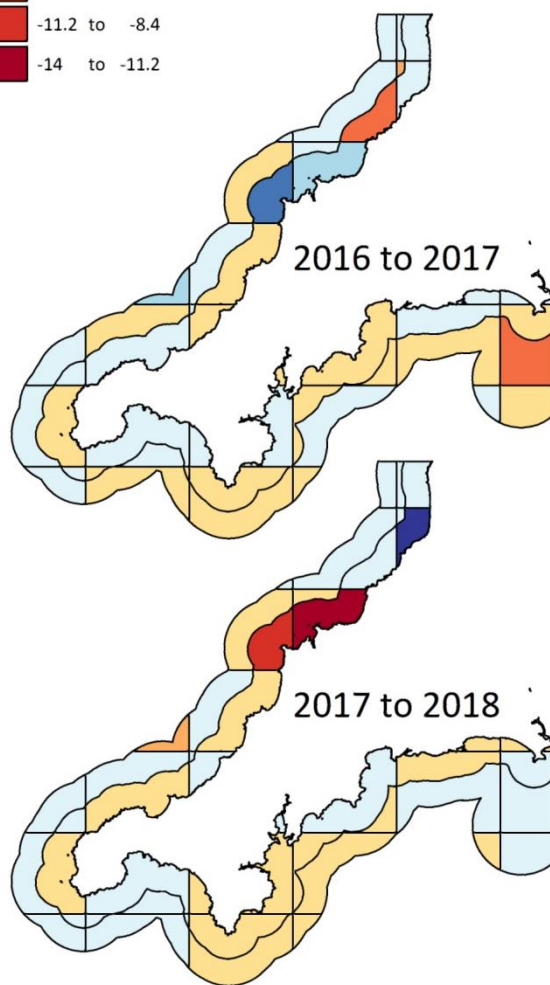
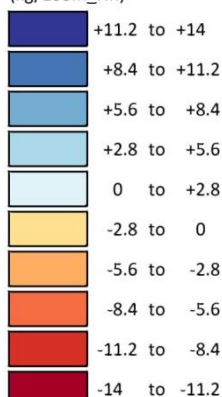


Figure 13: Thematic mapping of the difference in annual netting LPUE (kg/100m_Nh) of edible crab (*Cancer pagurus*) in belted statistical areas in ranges of 2.8kg/100m_Nh where a positive value i.e. increased LPUE is blue and a negative value i.e. a reduction in LPUE is red.

Cornwall IFCA Monthly Shellfish Permit Statistics Analysis

Edible crab (*Cancer pagurus*) Net Fishery

Summary Statistics 2016-2018



North Coast

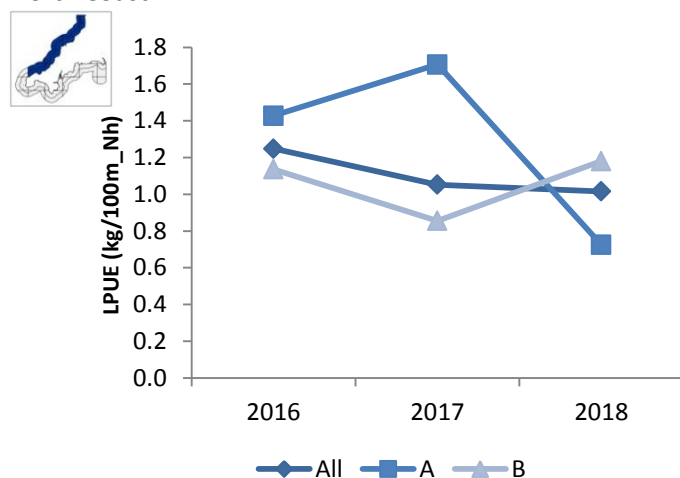


Figure 14: Annual LPUE (kg/100m_Nh) of edible crab (*Cancer pagurus*) on the 'North Coast' in 2016 to 2018 (diamonds), further split by band A (inshore 0-3nm, squares) and B (offshore 3-6nm, triangles).

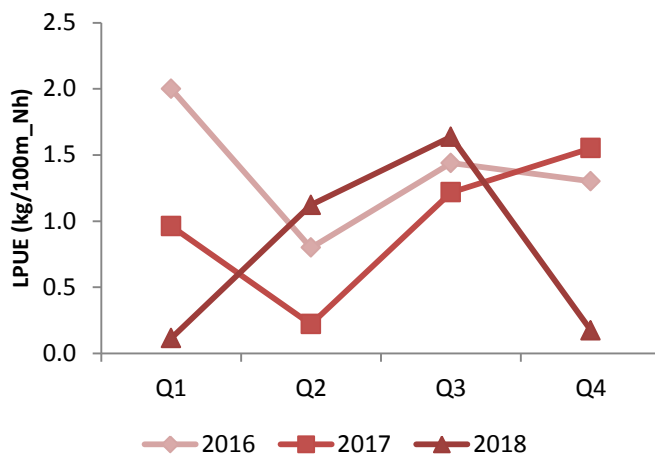


Figure 15: LPUE (kg/100m_Nh) by calendar year quarter*of edible crab (*Cancer pagurus*) on the 'North Coast' in 2016 (diamonds), 2017 (squares) and 2018 (triangles).

West Coast

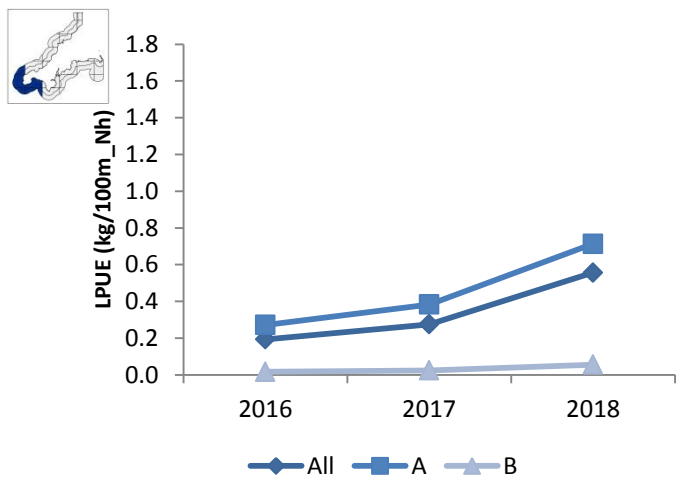


Figure 16: Annual LPUE (kg/100m_Nh) of edible crab (*Cancer pagurus*) on the 'West Coast' in 2016 to 2018 (diamonds), further split by band A (inshore 0-3nm, squares) and B (offshore 3-6nm, triangles).

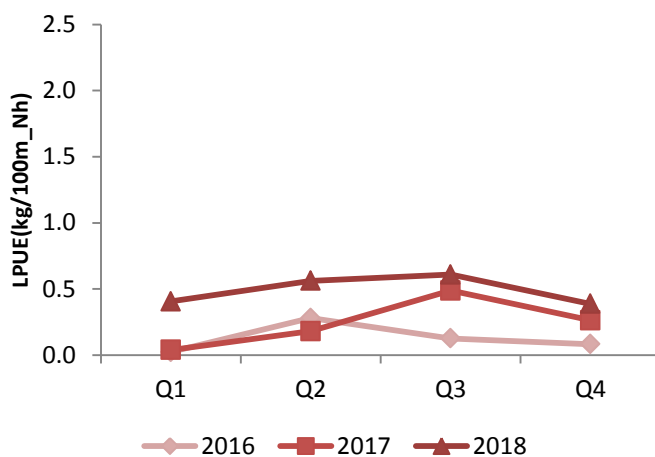


Figure 17: LPUE (kg/100m_Nh) by calendar year quarter*of edible crab (*Cancer pagurus*) on the 'West Coast' in 2016 (diamonds), 2017 (squares) and 2018 (triangles).

South Coast

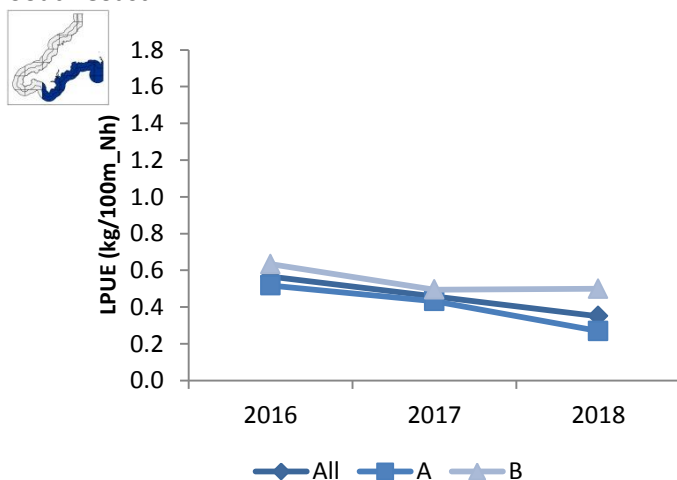


Figure 18: Annual LPUE (kg/100m_Nh) of edible crab (*Cancer pagurus*) on the 'South Coast' in 2016 to 2018 (diamonds), further split by band A (inshore 0-3nm, squares) and B (offshore 3-6nm, triangles).

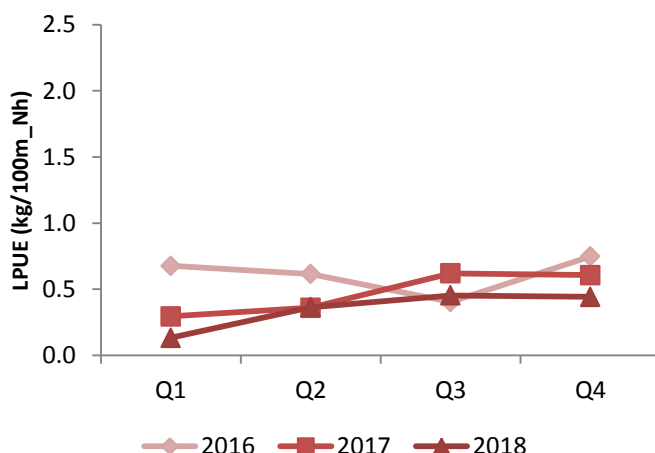


Figure 19: LPUE (kg/100m_Nh) by calendar year quarter*of edible crab (*Cancer pagurus*) on the 'South Coast' in 2016 (diamonds), 2017 (squares) and 2018 (triangles).

* Calendar year quarters split as Q1(January to March), Q2 (April to June), Q3 (July to September) and Q4 (October to December)

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Sussex IFCA Shellfish Permit Catch Returns Data Summary

October 2016 to September 2017

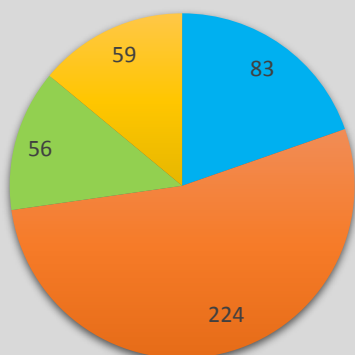
The Sussex Inshore Fisheries and Conservation Authority's purpose is to develop sustainable inshore fisheries whilst providing appropriate protection for the marine environment and the fisheries resources it supports.

In 2016 the Authority introduced a comprehensive suite of management measures for pot and trap shellfish fisheries under the Shellfish Permit Byelaw. The new inshore controls built upon existing measures such as minimum sizes and introduced effort limitation, better selectivity for juvenile stock and protection of berried lobsters. The Byelaw effort and gear restrictions enable effective controls on the impacts of fishing activity on the District's shellfish populations and help achieve more productive and sustainable fisheries through improved stock management.

The Sussex IFCA Shellfish Permit Byelaw requires all permit holders to provide shellfish catch and fishing effort information to support inshore shellfish fisheries. This catch returns data is a vital part of shellfisheries' management and will help the IFCA to gather the evidence needed to make future management decisions. The Authority understands that permit data may also be of interest to permit holders, providing a better understanding of the fishery in the context of their own detailed knowledge. Trends such as seasonality of different fisheries and catch rates might be of particular interest for future planning.

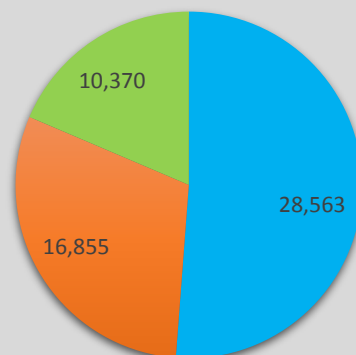
Overview:

- Since October 2016, 70% of the total 161 permits have been assigned to commercial fishermen, with 30% to recreational fishers.
- However, 99% of the total numbers of tags have gone to commercial fishermen.



■ Whelk Pots ■ Lobster/Crab Pots ■ Cuttlefish Pots ■ Prawn Pots

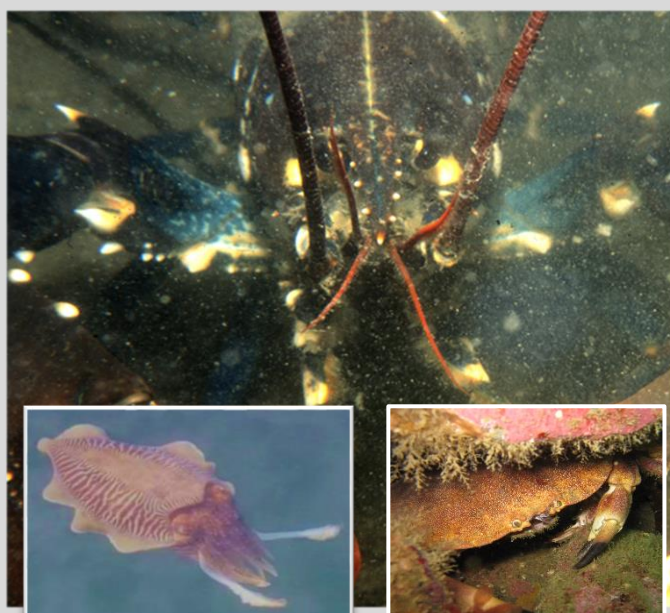
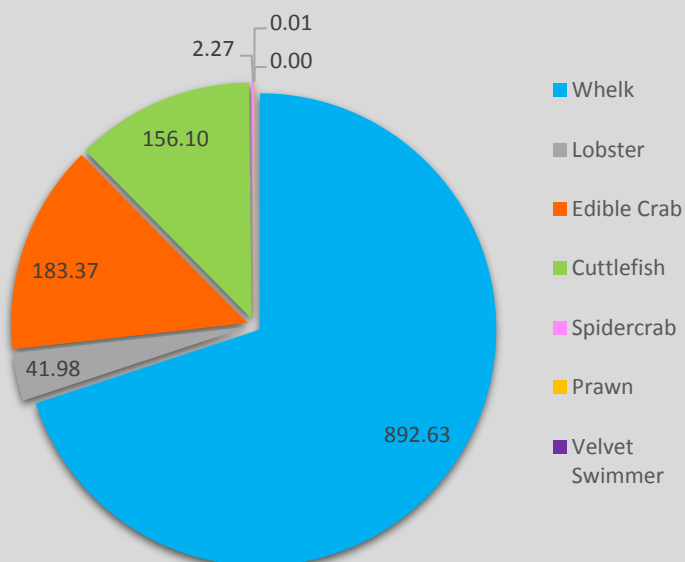
Total tags issued to recreational fishers 2016–2017



■ Whelk Pots ■ Lobster/Crab Pots ■ Cuttlefish Pots

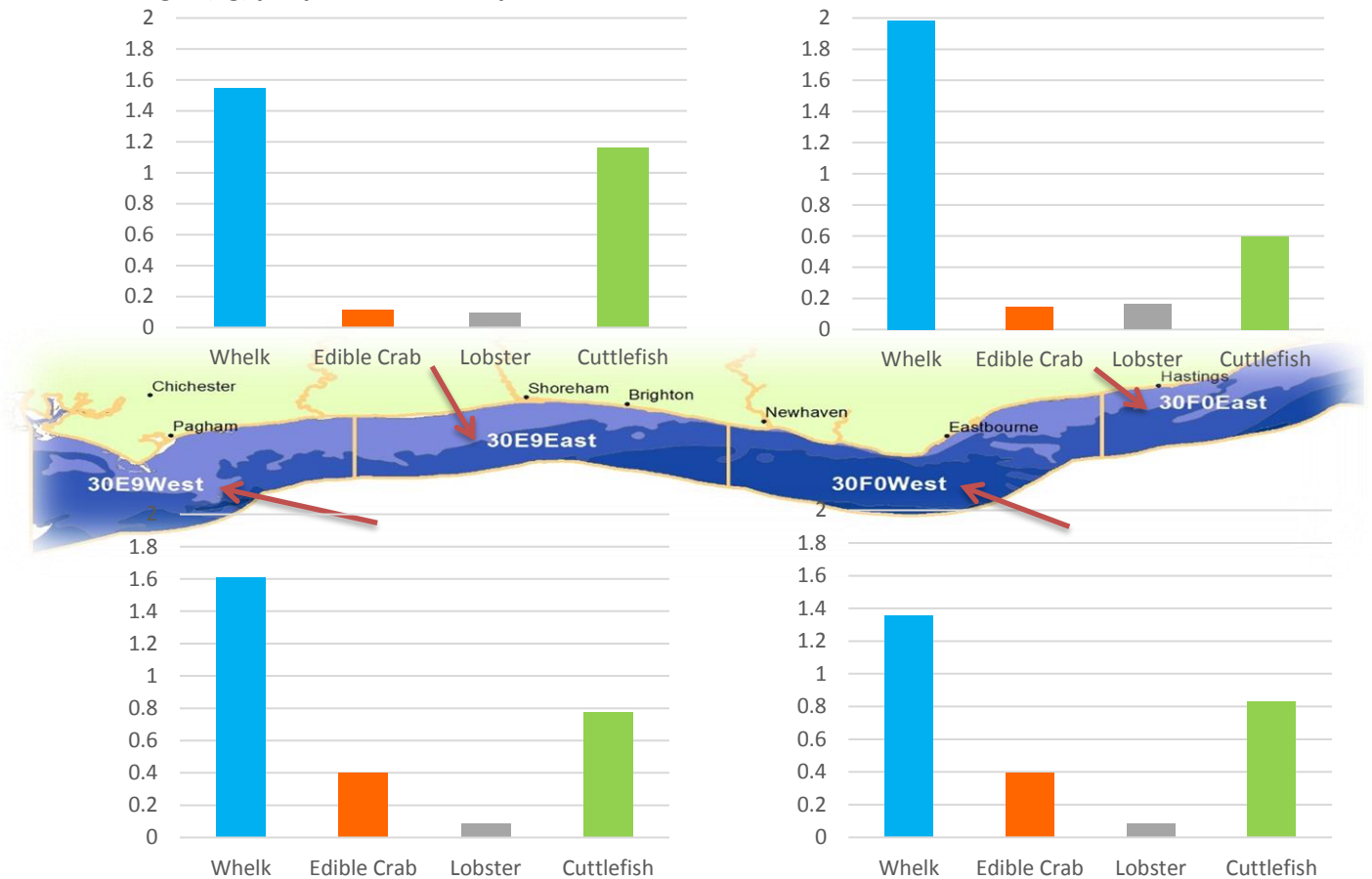
Total tags issued to commercial fishers 2016–2017

Total weight (tonnes) of each species landed 2016 – 2017



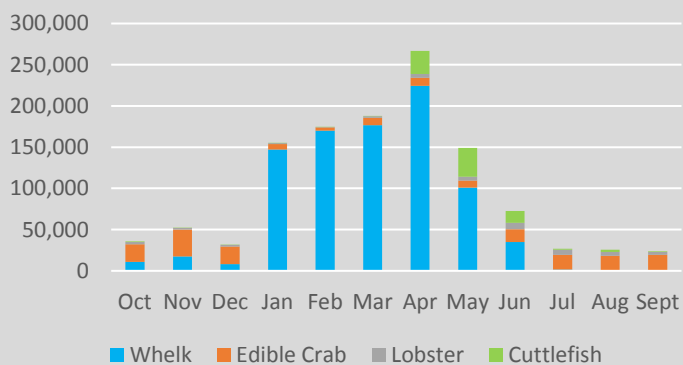
- A total of 1,276 tonne of shellfish was reported being landed on catch returns between October 2016 and September 2017.
- The four-main species landed were whelks (70%), edible crab (14%), cuttlefish (12%) and lobster (3%).
- Very few spider crabs or prawns and no velvet swimming crabs were reported as being landed.

Mean weight (kg) per pot of shellfish species in the Sussex IFCA areas 30E9West, 30E9East, 30F0West and 30F0East

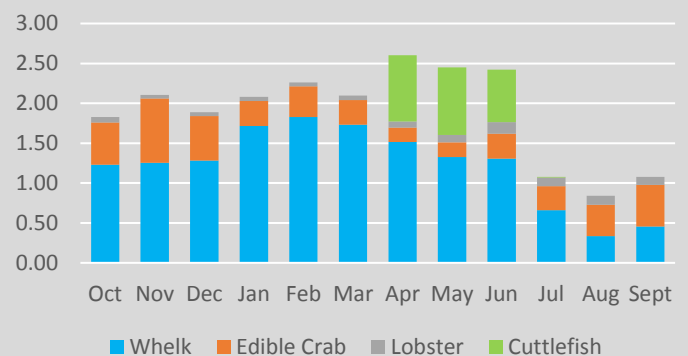


- The weights of species per pot, or catch per unit effort (CPUE), is similar in each area of the District.
- CPUE for whelks is greatest in area 30F0East, edible crab 30E9West, lobster 30F0East and cuttlefish 30E9East.
- There is an increase in CPUE during July and August for whelks.
- CPUE is greatest for edible crab in October to December.
- CPUE for lobster was highest in June to August.
- The cuttlefish season is clearly shown in May, June and July with no catches reported outside these 3 months.

Total weight (kg) of shellfish species landed in all areas by month 2016 - 2017



Average weight (kg) per pot of shellfish species landed in all areas by month 2016 - 2017



Catch data submitted will enable Sussex IFCA and others to better understand the seasonality of the shellfish fisheries and changes over longer time periods. The data will also help to understand the changes in catches and the status of stocks in response to the levels of fishing effort within the fisheries.

Sussex IFCA Shellfish Permit Catch Returns Data Summary

2018

The Sussex Inshore Fisheries and Conservation Authority's purpose is to develop sustainable inshore fisheries whilst providing appropriate protection for the marine environment and the fisheries resources it supports.

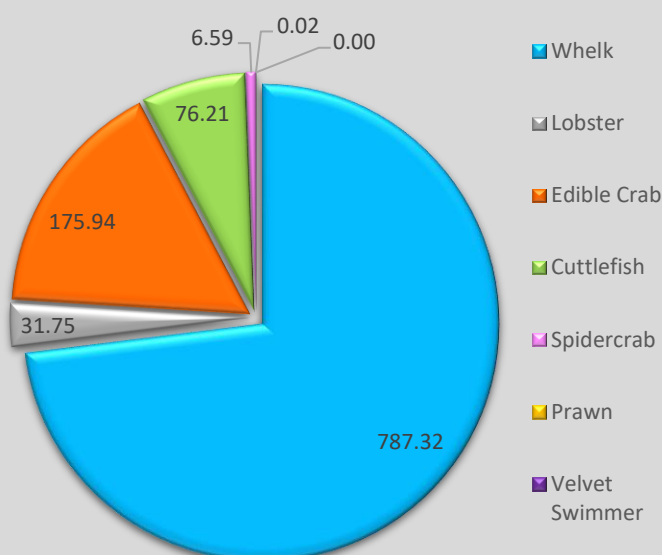
In 2016 the Authority introduced a comprehensive suite of management measures for pot and trap shellfish fisheries under the Shellfish Permit Byelaw. The new inshore controls built upon existing measures such as minimum sizes and introduced effort limitation, better selectivity for juvenile stock and protection of berried lobsters. The Byelaw effort and gear restrictions enable effective controls on the impacts of fishing activity on the District's shellfish populations and help achieve more productive and sustainable fisheries through improved stock management.

The Sussex IFCA Shellfish Permit Byelaw requires all permit holders to provide shellfish catch and fishing effort information to support inshore shellfish fisheries. This catch returns data is a vital part of shellfisheries' management and will help the IFCA to gather the evidence needed to make future management decisions. The Authority understands that permit data may also be of interest to permit holders, providing a better understanding of the fishery in the context of their own detailed knowledge. Trends such as seasonality of different fisheries and catch rates might be of particular interest for future planning.

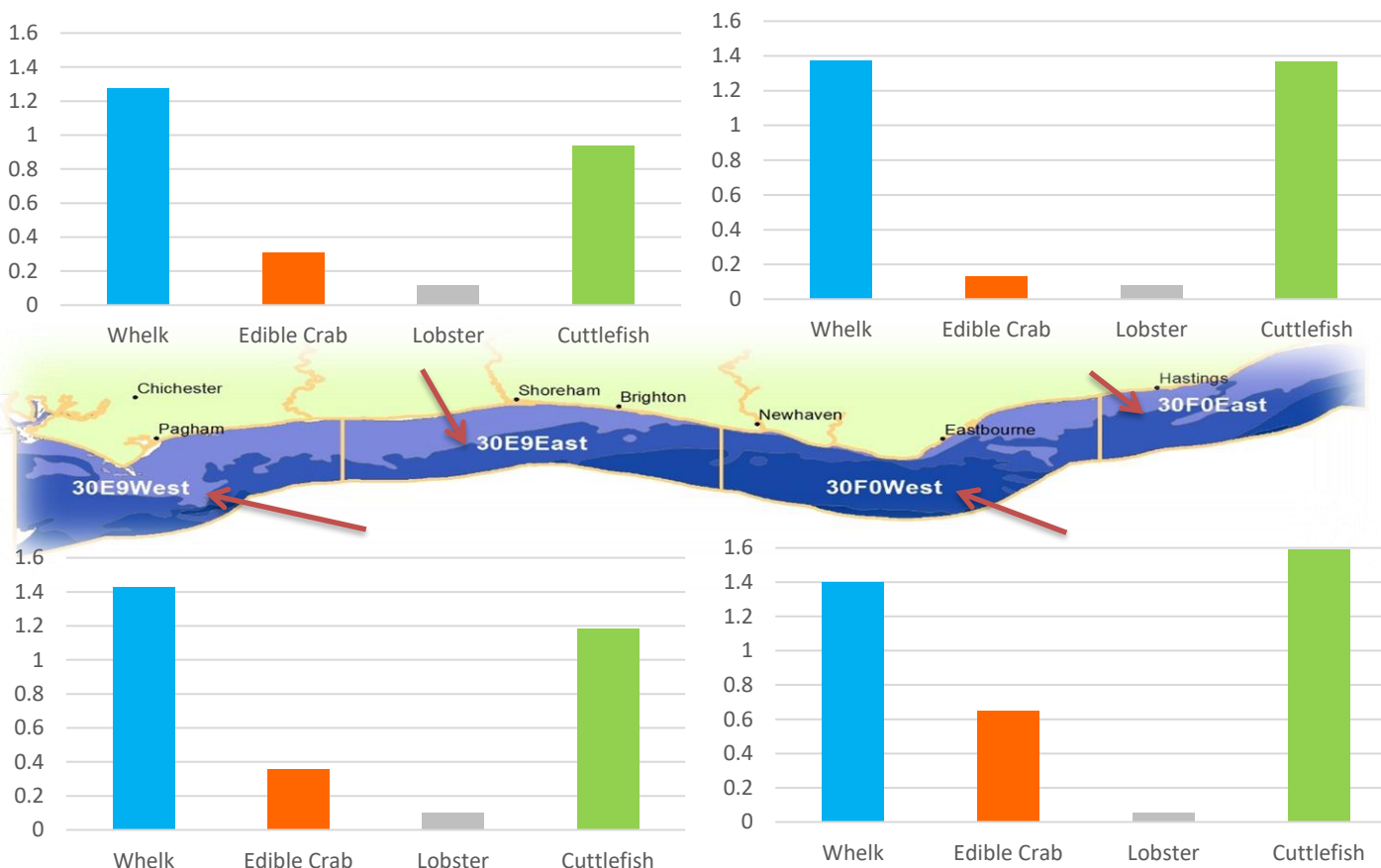
Overview:

- Since October 2016, (the introduction of the Shellfish Permit Byelaw) to the end of December 2018, 63% of the total 190 permits have been assigned to commercial fishermen, with 37% to recreational.
- 10% of these permits expired in 2017 and were not renewed during 2018.
- There were 51 active recreational permits and 120 active commercial permits during 2018.
- A total of 1078 tonnes of shellfish was reported being landed on catch returns in 2018.
- The four-main species landed from the seven included under the shellfish permit byelaw, were whelks (73%), edible crab (16%), cuttlefish (7%) and lobster (3%).
- Very few spider crabs or prawns and no velvet swimming crabs were reported as being landed.
- The weight of species per pot, or catch per unit effort (CPUE), is similar in each area of the District.
- CPUE for whelks is greatest in area 30E9west, edible crab 30F0west, lobster 30E9East and cuttlefish 30F0west.
- CPUE is greatest for edible crab in the late Autumn to early Winter months.
- CPUE for lobster was highest in June and July.

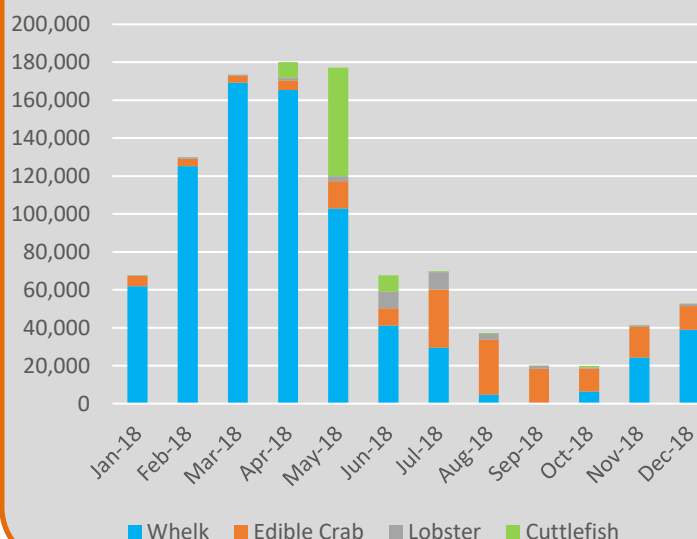
Total (tonnes) landed per species 2018



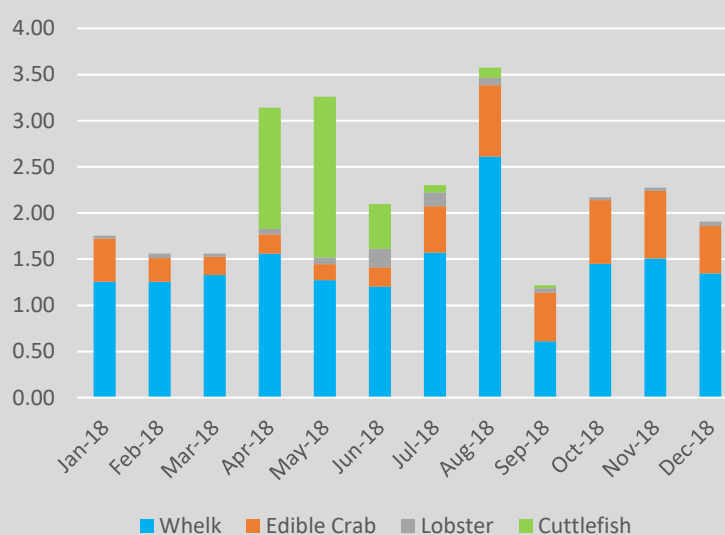
Average weight (kg) per pot of shellfish species in the Sussex IFCA areas 30E9West, 30E9East, 30F0West and 30F0East



Total weight (kg) landed of species caught each month 2018



Mean weight per pot (kg.pot) of species caught each month in 2018

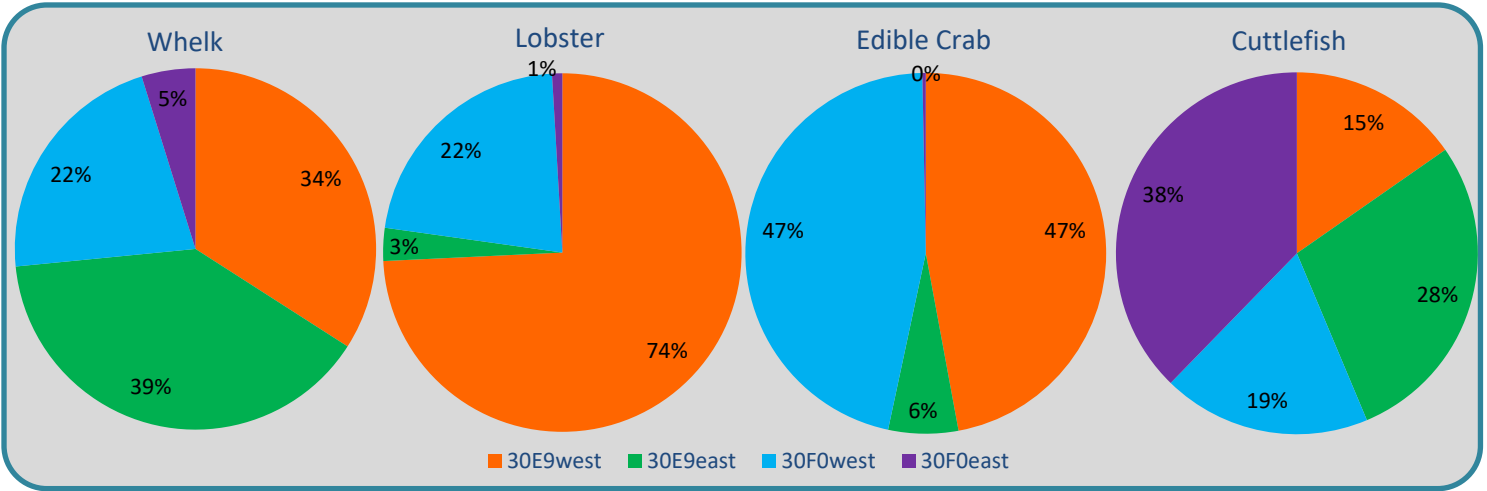


Whelk and Cuttlefish

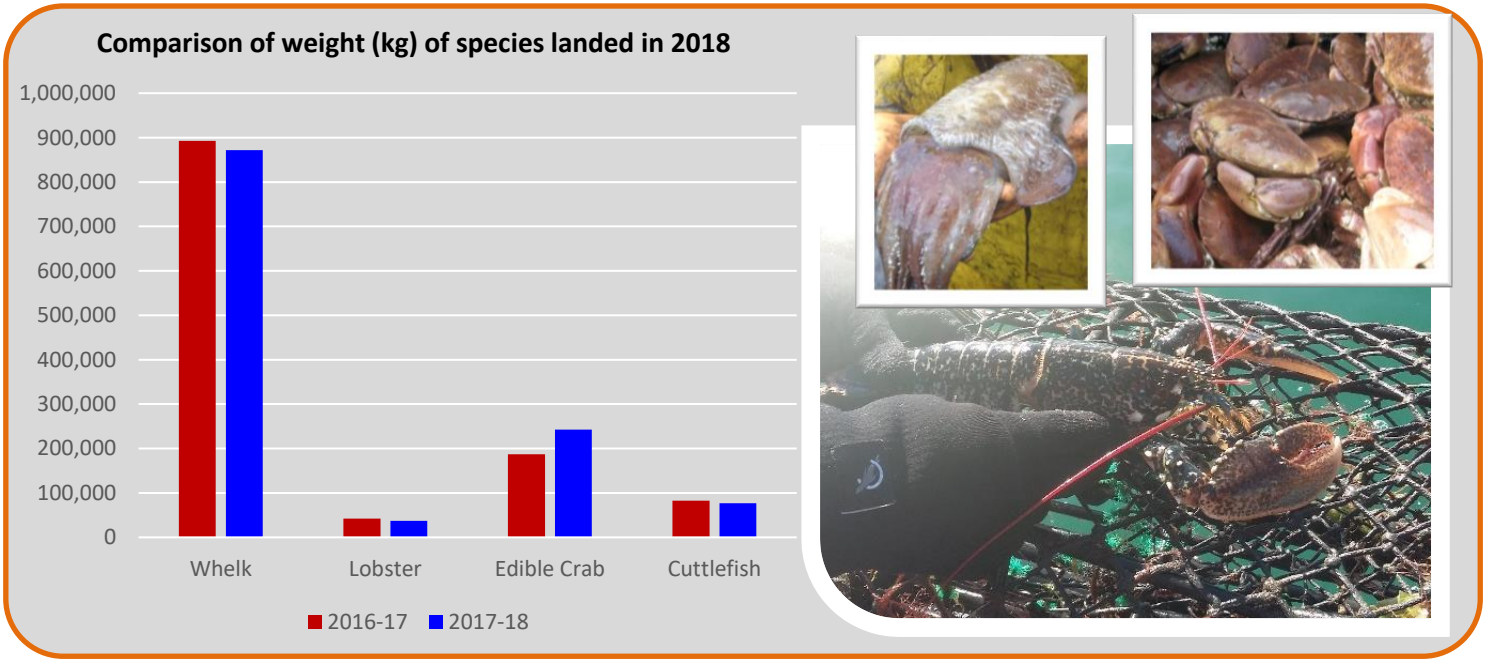
- Whelk and cuttlefish landings within the District vary both spatially and seasonally. Whelk seasonal variances are seen during the summer months when there is a rise in sea temperatures which causes the whelks to move to deeper, cooler waters. The cuttlefish season only lasts between April and June, when they move into the shallower coastal waters to breed.
- There was an increase in CPUE in August for whelks, as more whelks were caught per pot however, less pots were hauled.
- 71% of the total weight of whelks landed in 2018 was landed between February and May, with 43% landed in March and in April.
- The catch data reveals that 7% of whelks landed were caught from areas 30E9west and 30E9east (Western part of the District). Since October 2016, 72% of all whelks landed were caught from these same two areas.

- 75% of total weight of cuttlefish landed in 2018 was landed in May.
- The catch data reveals that 38% of cuttlefish landed were caught from area 30F0east. Since October 2016, 31% of all cuttlefish landed were caught from area 30F0west, 29% 30F0east, 23% 30E9east and 17% 30E9west.

Percentage distribution of shellfish species landed in the Sussex IFCA areas 30E9West, 30E9East, 30F0West and 30F0East 2018



- The catch data reveals that 68% of the total weight of edible crab landed in 2018 occurred between July and November, with 34% in July/August.
- 93% of total weight of edible crab were caught from areas 30E9west and 30F0west, with less than 1% from 30F0east. Since October 2016, 56% has been caught from 30E9west and 41% from 30F0west.
- The highest landings of lobsters occurred in June and July, with 56% of the total weight landed being in these two months alone.
- 74% of the total weight of lobsters were caught from area 30E9west and 22% caught from 30F0west. Since October 2016, 65% has been caught from area 30E9west and 31% from 30F0west.



Catch data submitted will enable Sussex IFCA and others to better understand the seasonality of the shellfish fisheries and changes over longer time periods. The data will also help to understand the changes in catches and the status of stocks in response to the levels of fishing effort within the fisheries.

Fishery report for the Eastern IFCA district

Eastern IFCA utilise a multi-metric approach to crustacean stock assessments including LPUE and Length Converted Catch Curve (LCCC) models. LPUE measures overall stock sustainability, resilience and recoverability whereas LCCC is used to assess how the fishery effects stock structure, population dynamics and age (size) classes. Fishing mortality estimates (F) derived from the LCCC model consider the frequency of sizes to estimate the depletion over time of individuals, represented as mortality rate. LPUE looks at the fishery effect over the whole stock, assessing whether or not the stock as a whole can sustain current harvest levels. Our annual stock assessment (Bridges, T.J., 2018) has identified that the Edible crab fishery is likely to be operating just beyond maximum sustainable yield. Length Converted Catch Curve (LCCC) results currently indicate that mortality estimates are above recommended indicators. Larger numbers of small individuals with a rapid decline with increasing size (age) suggests high mortality of early recruits. Long term LPUE results suggest that the stock currently recovers from annual depletion with recruits maintaining LPUE, however a steady declining trend has become evident since 2016 potentially indicating that more individuals are being fished than are able to replenish the stock. Reductions in LPUE may be attributable to natural variation or over exploitation of the stock. We will keep a close eye on this pattern in the annual assessment for 2019.

The district wide analysis identified that overall the trend in landings, effort and LPUE has decreased since 2016, however there was variability in individual ICES statistical rectangles. Decreases in both landings and effort were observed in each rectangle with the exception of ICES statistical rectangle 34F0. In contrast, LPUE has risen in individual ICES rectangles, with the exception of ICES statistical rectangles 34F1 and 35F0 which demonstrated a drop in LPUE and a plateau respectively. This is the result of landings and effort data being more representative of individual fishing grounds and providing a finer resolution of exploitation in each of the ICES rectangles. ICES statistical rectangle 34F1 is the most heavily fished ICES rectangle within the Eastern IFCA district, supporting the inshore north Norfolk crabbing fleet with vessels also frequenting the area from other locations. Cromer Shoal Chalk Beds MCZ is also located predominantly within this rectangle, in which the chalk supports a significant population of both Edible crab and lobster. It is also thought to be an important nursery ground for edible crab. The MSAR data indicates that effort has been steadily decreasing across the dataset period with a more marked drop between 2017 and 2018. Following a peak in 2016, landings began to decrease in 2017 by approximately 100 tonnes. Between 2017 and 2018 the drop in landings was far more significant matching the steeper decrease in effort. LPUE decreased between 2017 and 2018 but not as steeply as landings and effort. ICES rectangles 35F0 and 35F1 contain the offshore fishing grounds frequented by the larger vessels with the capacity to exploit more distant grounds. Effort peaked in 35F0 in 2016 whilst landings fell and since 2016 both effort and landings have decreased steadily. Landings in 35F1 climbed steadily between 2015 and 2017, decreasing significantly in 2018. Effort climbed between 2015 and 2016 concurrent with landings, however effort plateaued between 2016 and 2017 whilst landings continued to climb. There was a very steep decrease in effort in

2018 and this was matched by a significant decrease in landings. LPUE in 35FO decreased between 2015 and 2017 and has since plateaued between 2017 and 2018. LPUE in 35F1 decreased very slightly between 2015-2016 but has climbed significantly between 2016 and 2018. Our analysis indicates that reduced LPUE is more pronounced in the inshore element of the fishery than the offshore.

References

Bridges, T.J., 2018. Crustacean Stock assessment 2018. *Eastern Inshore Fisheries and Conservation Authority*.

Appendix 1

Importantly, to caveat the landings and effort data for 2018, as with previous years of data reporting for the crustacean stock assessment, there is a cut-off point of March in which to collate all current data and compile the stock assessment for the year of reporting. As a result, a small number of MSARs will not have been returned and entered into the database by this date, therefore landings and effort data can be expected to rise not significantly whilst final forms are returned.

Landings and effort district wide - 2015-2018

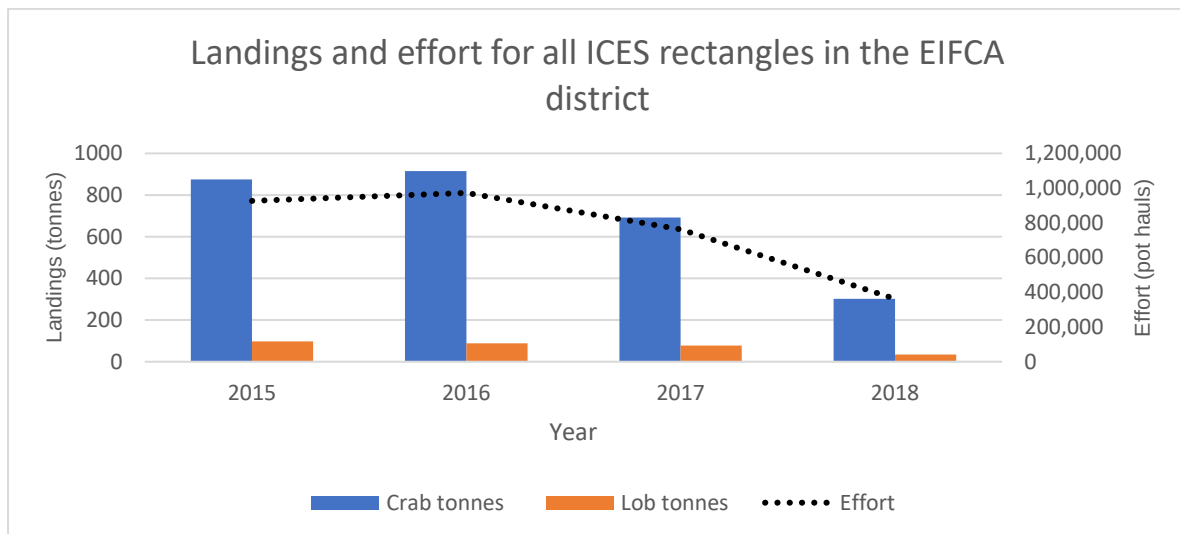


Figure 1. Landings and effort (dashed line) by species between 2015-2018.

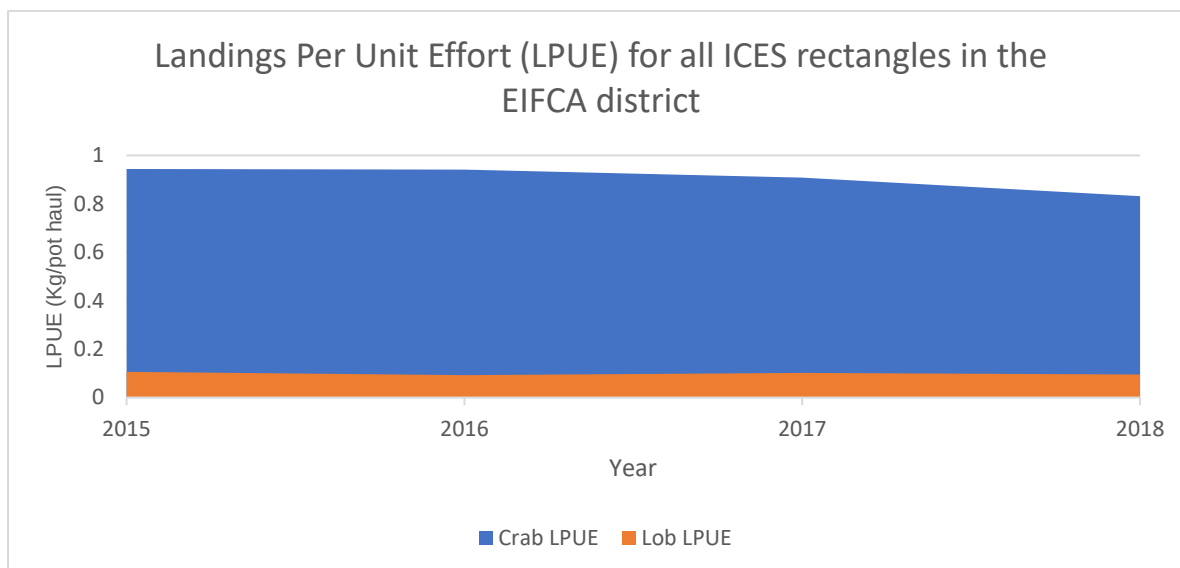


Figure 2. Annual LPUE by species between 2015-2018 for all ICES statistical rectangles in the Eastern IFCA district

LPUE (pot hauls) has remained relatively stable throughout the dataset period, for both *C. pagurus*. Effort when fishing for crab has decreased slightly across the reported data period from a peak of 0.944Kg/pot in 2015 to 0.832Kg/pot in 2018. The average mean is 0.906Kg/pot).

Landings and effort data by ICES rectangle within the district 2015-2018

An individual assessment of ICES rectangles provides an insight into the productivity of fishing grounds within the district. Patterns differ from those seen in the district wide analysis and are outlined below.

Summary statistics of ICES Rectangle 32F1

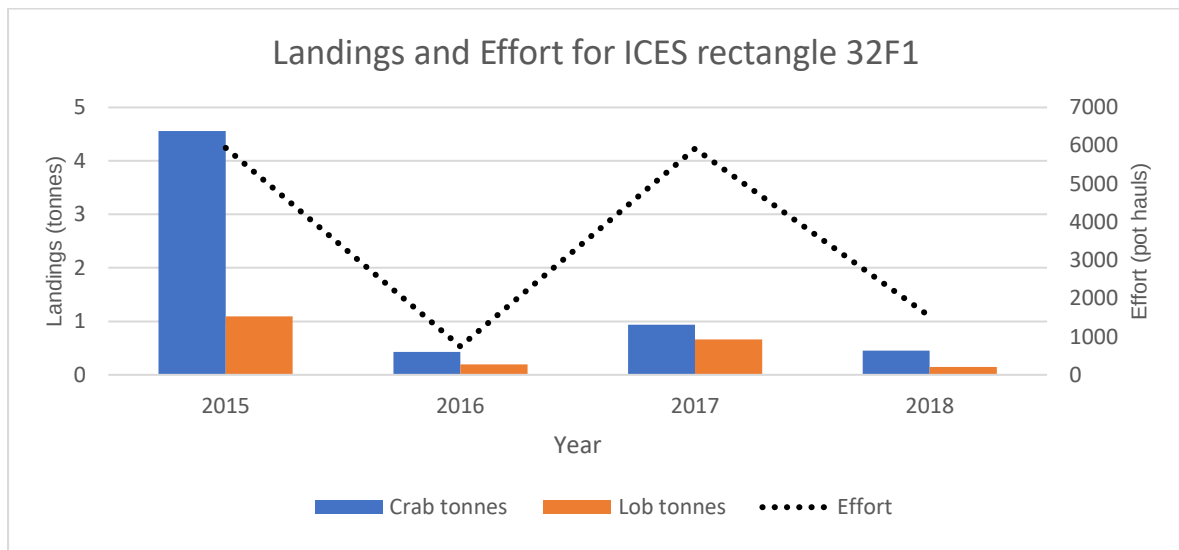


Figure 3. Landings and effort (dashed line) by species between 2015-2018.

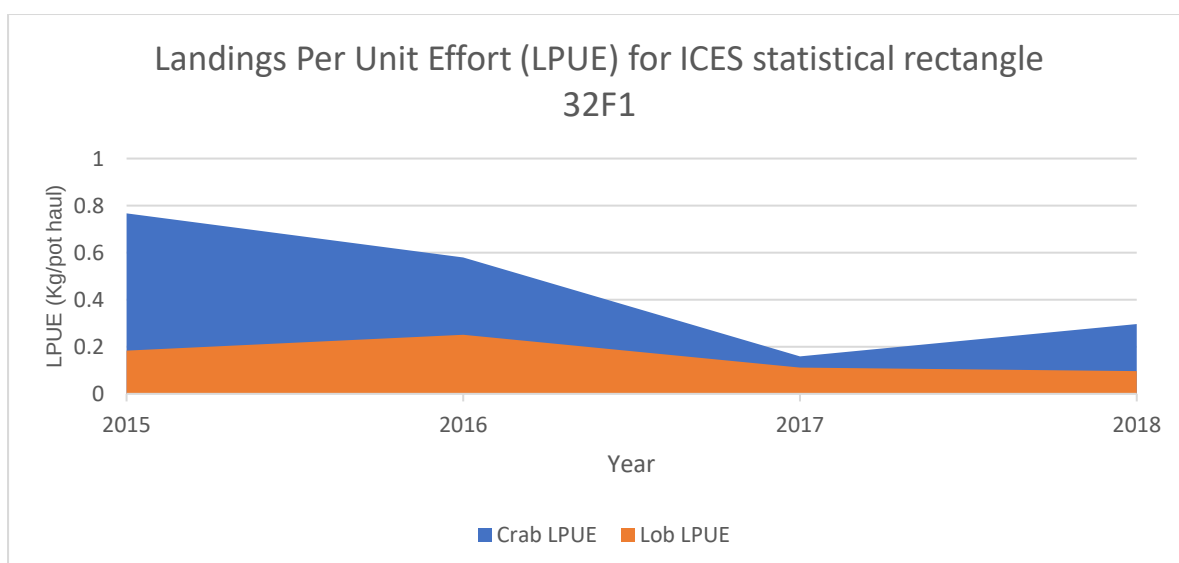


Figure 4. Annual LPUE by species between 2015-2018 for ICES statistical rectangle 32F1.

LPUE for *C. pagurus* in 2015 was highest at 0.767Kg/pot when both landings and effort were at their highest for the reported dataset. This trend declined in 2016 to 0.579Kg/pot as both effort and landings declined steeply. In 2017, effort rose sharply to similar levels seen in the 2015 fishery however landings remained low producing an LPUE of 0.159Kg/pot. In 2018 effort again dropped as landings have remained low, increasing the LPUE from 0.159Kg/pot to 0.297Kg/pot, a figure closer to the dataset average of 0.451Kg/pot.

Summary statistics of ICES Rectangle 33F1

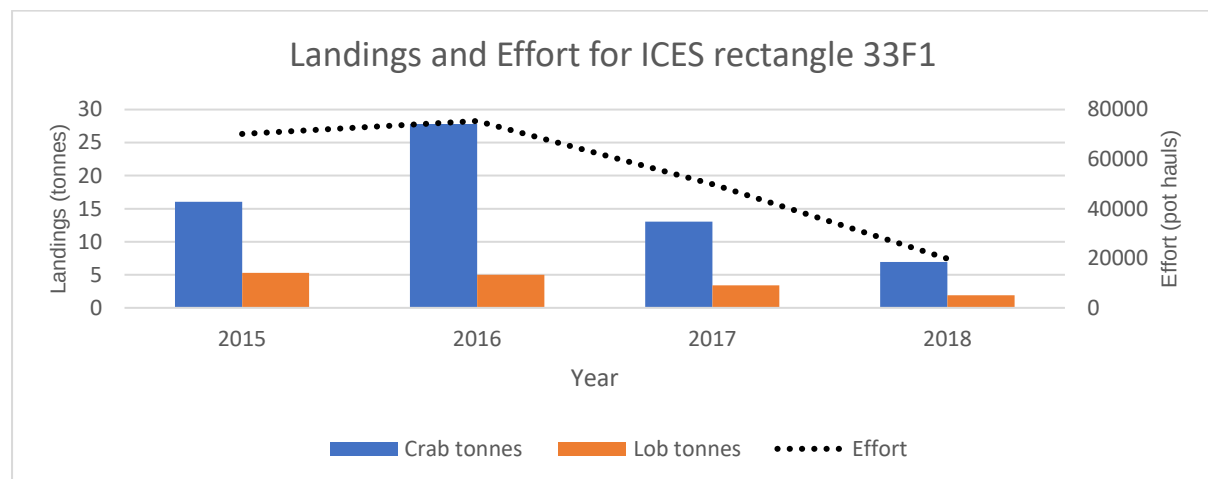


Figure 5. Landings and effort (dashed line) by species between 2015-2018.

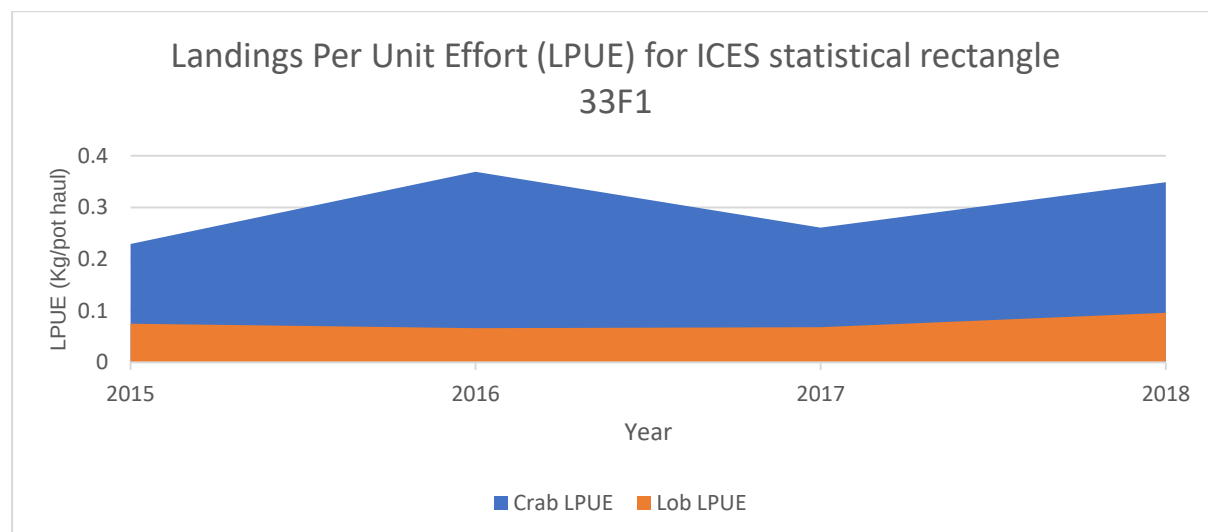


Figure 6. Annual LPUE by species between 2015-2018 for ICES statistical rectangle 33F1.

LPUE for *C. pagurus* has fluctuated across the dataset period with a peak in 2016 of 0.369Kg/pot when both landings and effort were at the highest. Landings and effort have been decreasing since 2016 and in 2017. Results in the 2018 fishery show that

both landings and effort remain low, however LPUE has risen from 0.261Kg/pot to 0.349Kg/pot.

Summary statistics of ICES Rectangle 34F0

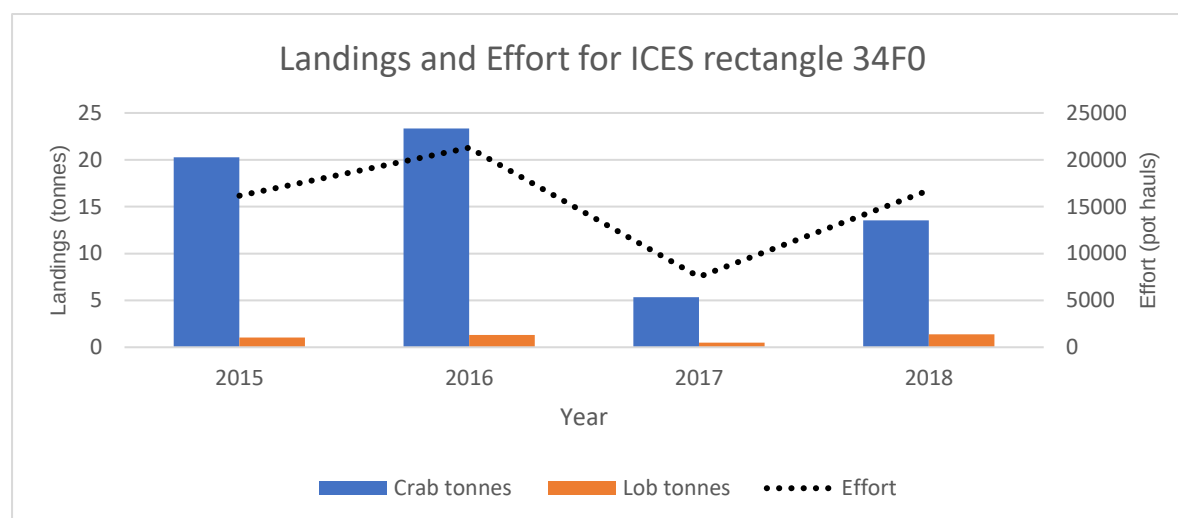


Figure 7. Landings and effort (dashed line) by species between 2015-2018.

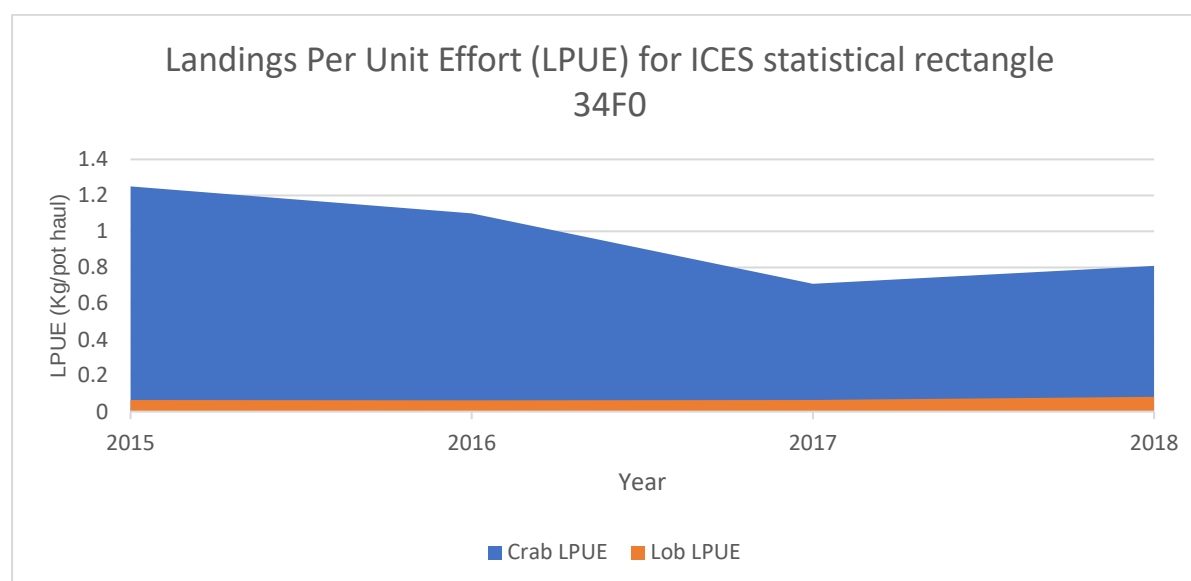


Figure 8. Annual LPUE by species between 2015-2018 for ICES statistical rectangle 34F0.

LPUE for *C. pagurus* showed a decreasing trend between 2015 and 2017 from 1.25Kg/pot to 0.709Kg/pot whilst landings and effort peaked in 2016. Both landings and effort decreased significantly in 2017 and this is represented by a drop of LPUE to 0.709Kg/pot. Landings and effort increased significantly in 2018 reflecting an increase in LPUE to 0.809Kg/pot for the fishery which is approaching the average mean of 0.967Kg/pot.

Summary statistics of ICES Rectangle 34F1

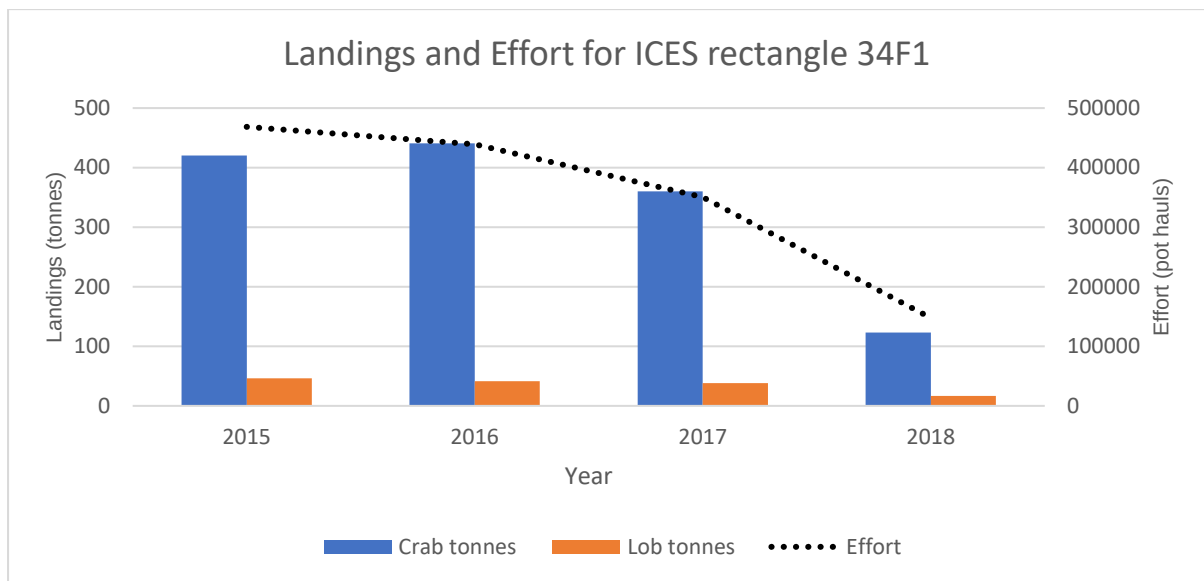


Figure 9. Landings and effort (dashed line) by species between 2015-2018.

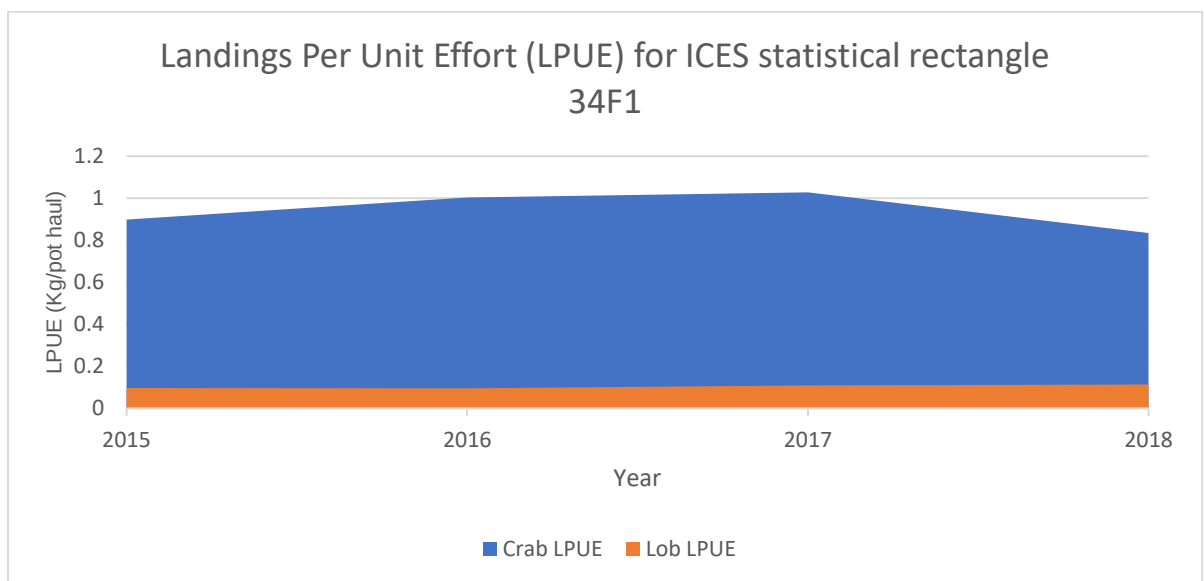


Figure 10. Annual LPUE by species between 2015-2018 for ICES statistical rectangle 34F1.

LPUE continued to rise from 2015 through 2016 and 2017 to a peak of 1.028Kg/pot whilst effort and landings were dropping. LPUE dropped in 2018 to 0.835Kg/pot. The mean for crab was 0.941Kg/pot.

Summary statistics of ICES Rectangle 35F0

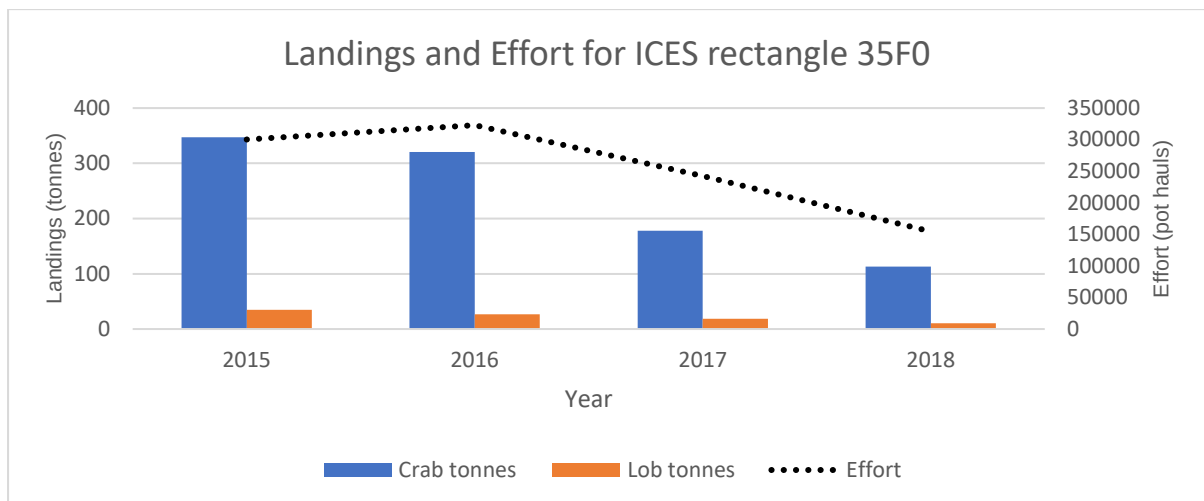


Figure 11. Landings and effort (dashed line) by species between 2015-2018.

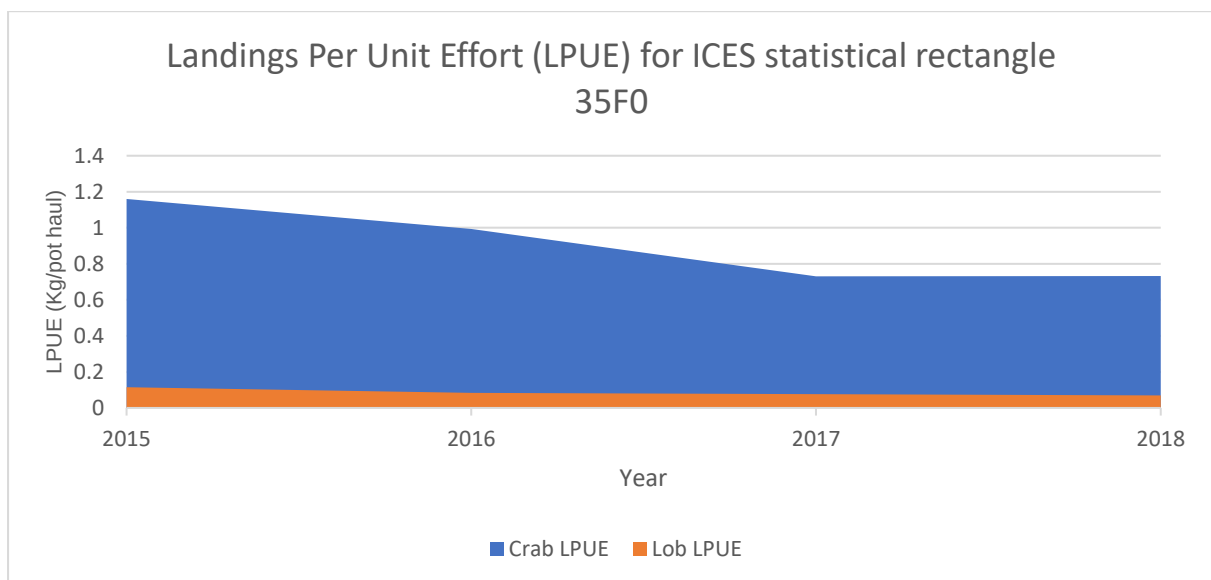


Figure 12. Annual LPUE by species between 2015-2018 for ICES statistical rectangle 35F0.

LPUE for *C. pagurus* dropped from 1.16Kg/pot in 2015 to 0.73Kg/pot in 2017, plateauing in the 2018 fishery. Average mean was 0.904Kg/pot.

Summary statistics of ICES Rectangle 35F1

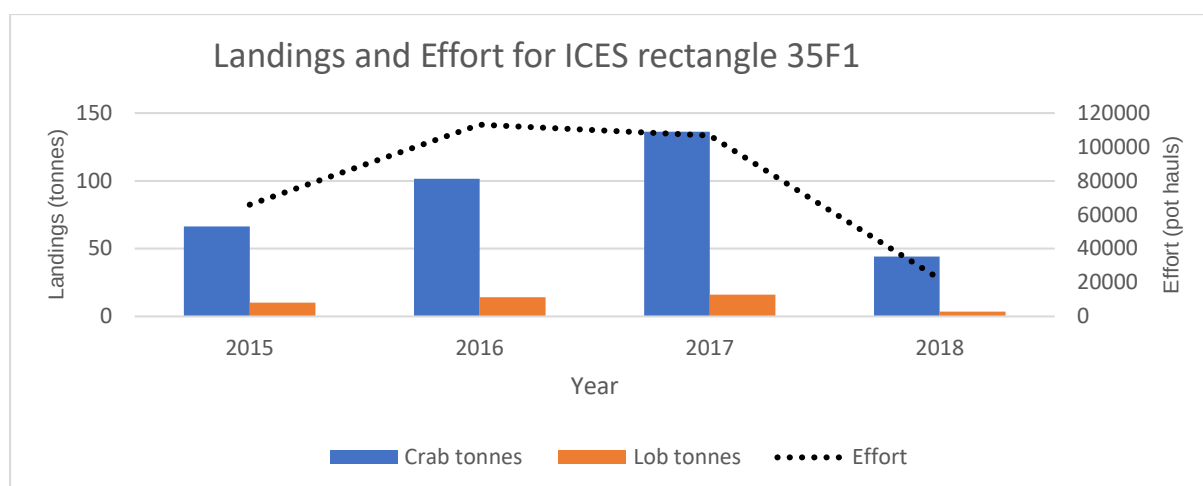


Figure 13. Landings and effort (dashed line) by species between 2015-2018.

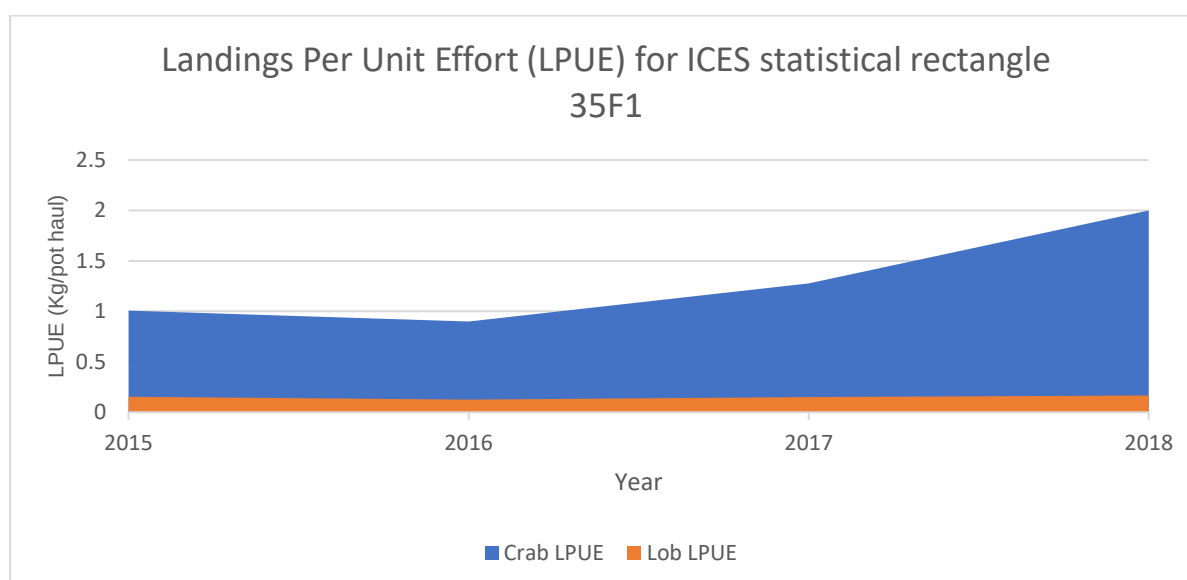


Figure 14. Annual LPUE by species between 2015-2018 for ICES statistical rectangle 35F1.

LPUE for *C. pagurus* was 1.007Kg/pot in 2015 when landings and effort were lowest. Landings and effort increased significantly in 2016 however LPUE reduced further to 0.9Kg/pot. LPUE began to climb following 2016, reaching 1.277Kg/pot in 2017 whilst effort began to drop slightly, and landings reached a peak for the dataset. LPUE has continued to climb in 2018, reaching a peak of 2Kg/pot whilst results for 2018 suggest that landings and effort have decreased significantly. Average mean 1.296Kg/pot for crab across the dataset.

Briefing note – North Eastern IFCA

Crab Fishery Science Meeting 23 November 2019

The pot fishery for edible crab and lobsters is the most ubiquitous and socio-economically important fishery in the NEIFCA district. Current monitoring includes the collation and quality assurance of catch returns, monthly quayside sampling at ports and fishery independent potting surveys undertaken from the Authority's research vessel.

Management within the district includes a dedicated potting permit scheme, vessel size restrictions, maximum pot size, mandatory escape gaps and a minimum conservation reference size of 140mm for edible crab. Work to develop an effort limitation scheme is also ongoing.

Landings of edible crab into the ports of Bridlington, Scarborough, Whitby and Hartlepool were 3,850 tonnes in 2018, with a first sale value of £7.86m. A further 2,901 tonnes were landed into Grimsby, the vast majority of which is thought to have originated from outside the 6NM limit. Prior to 2012, annual landings into Grimsby were typically in the region of 500 tonnes but have increased steadily since then.

There is an increasing trend in pot caught landings into ports within the district (Figure 1), much of which can be attributed to increased landings of edible crab (Figure 2). There is a growing body of evidence, however, suggesting that this is due to expansion of the fishery outside the 6NM limit. For instance, the proportion of crab landed into the district believed to have been captured within 6NM has reduced from around 50% to 25% in recent years (Figure 3).

Reported numbers of pots set/hailed and landings per unit effort within the district have remained relatively stable (Figure 4), which would further indicate that increases in landings are being captured beyond 6NM. Analysis of the number of pots set/hailed beyond the 6NM limit and subsequent LPUE calculations may be able to determine if the increase in landings can be attributed to an increase in effort or if abundance has actually increased, however, this may be difficult given current reporting requirements.

A significant factor contributing to the growth of the shellfish fisheries in the region is believed to be increased demand from Asian markets, particularly China in the case of edible crabs. Linked to this has been increased demand for whelks, which are captured almost exclusively outside the 6NM limit in the NEIFCA region. There is growing concern that poor quality crab that would previously have been discarded is being landed and sold cheaply as bait for whelk pots.

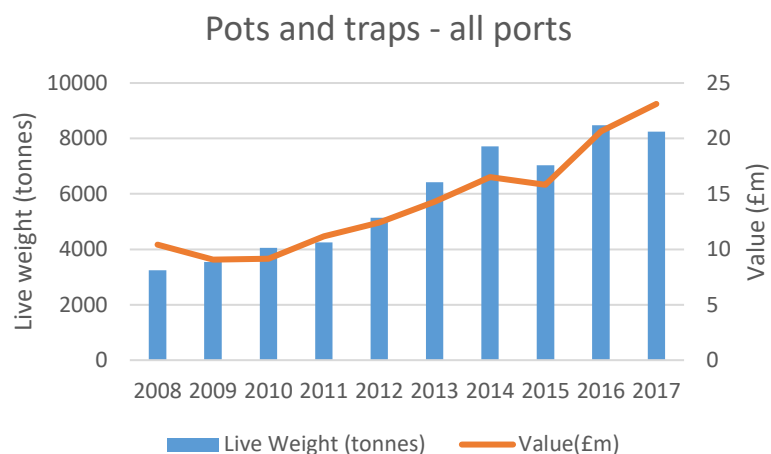


Figure 1. Landings into all ports in the NEIFCA district captured by pots and traps for the period 2008-2017 and their first sale value. (Source: MMO annual statistics)

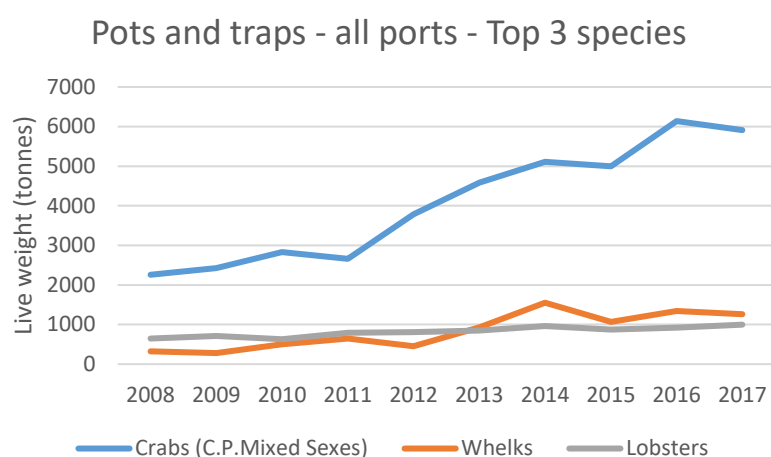


Figure 2. Landings into all ports in the NEIFCA district captured by pots and traps for the period 2008-2017 and their first sale value. N.B. Live weight for crabs in 2008 includes values for both edible (*Cancer pagurus*) and velvet (*Necora puber*) crabs. 2009 velvet crab landings were 78 tonnes and have decreased over time to 26 tonnes in 2017. (Source: MMO annual statistics)

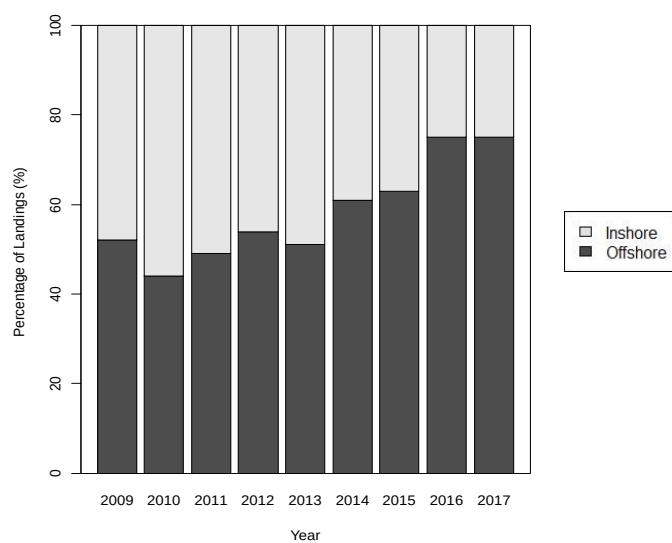


Figure 3. Relative contribution (%) of landings captured within the district (inshore) and beyond 6NM (offshore).

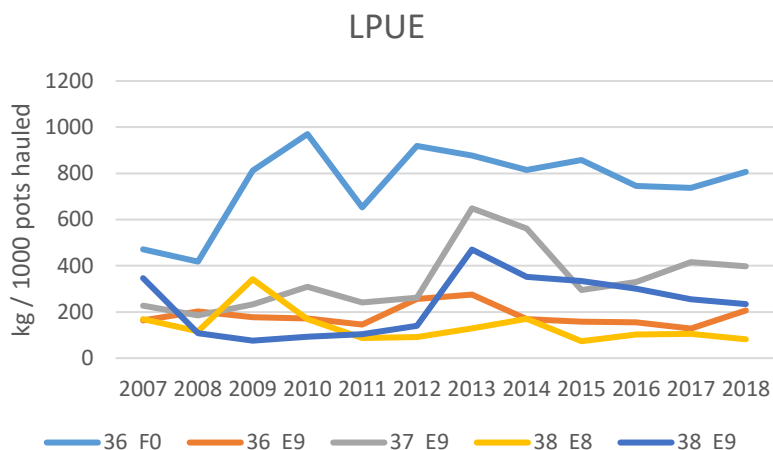


Figure 4. Landings per unit effort (kilograms per 1000 pots hauled) for edible crab captured in the 5 main ICES statistical rectangles encompassing the NEIFCA district for the period 2007 to 2018. (Source: NEIFCA data)

Northumberland IFCA Brown Crab: trends in the fishery



Background

The potting fishery in the Northumberland IFCA district is a multispecies fishery targeting predominantly European lobster (*Homarus gammarus*), brown crab (*Cancer pagurus*), velvet crab (*Necora puber*) and prawns (*Nephrops norvegicus*). Target species are fished using pots, which are fished in “fleets” of 20–40. Pots are baited and deployed, and typically left to soak for one to two days. Potting vessels in the district are between 4 and 12 m in length, with 85% of vessels under 10m in length.

Lobster forms the most economically valuable part of the catch, thus is preferentially targeted by fishers, particularly during peak lobster season, July-October). Brown crab tends to be a bycatch species of this fishery; however, a proportion of the fleet will preferentially target this species outside of peak lobster season.

Landings trends

Data is taken from Northumberland IFCA monthly permit returns, details of these returns include landed weight of all species, average number of pots hauled per month and area fished. There was a change in reporting in 2011, therefore previous years are not comparable and data from 2011 onwards have been used.

Brown crab landings have increased overall since 2011. There was a 30% increase in landing from 2015 to 2016, with a slight decrease of 2.7% between 2016 and 2018 (Figure 1).

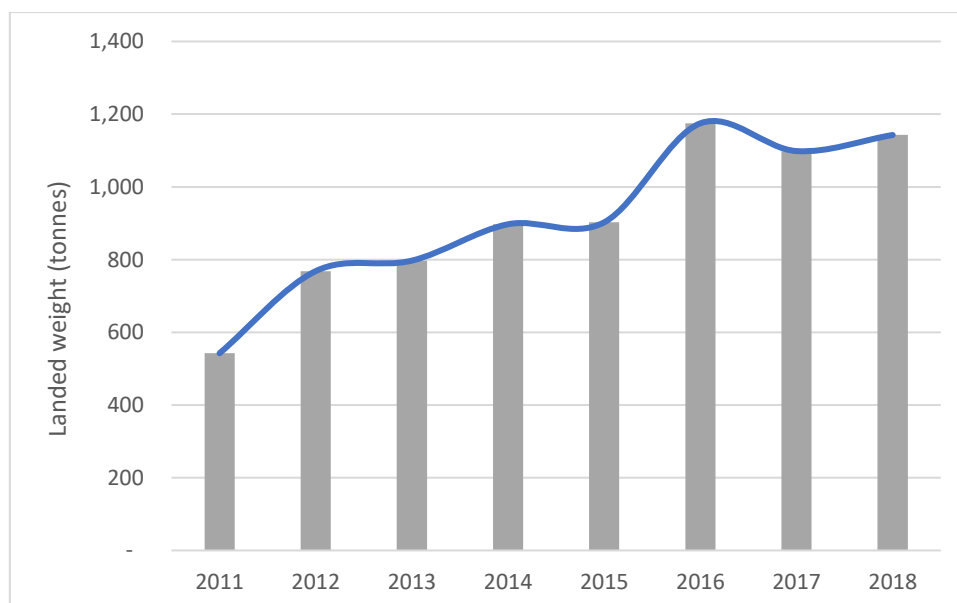


Figure 1 Brown crab landings from Northumberland IFCA permit returns from 2011-2018.

Effort trends

Effort has been inferred from information from the monthly permit returns. Fishers report the average number of pots hauled per day and the number of days fished that month, by multiplying these we have inferred the number of pots hauled per month.

Effort has increased steadily since 2011 and has remained relatively stable. A peak in effort was observed in 2016 of 3.1 million pots hauled, before slightly decreasing to 2.9 million pots hauled in 2018 (Figure 2).

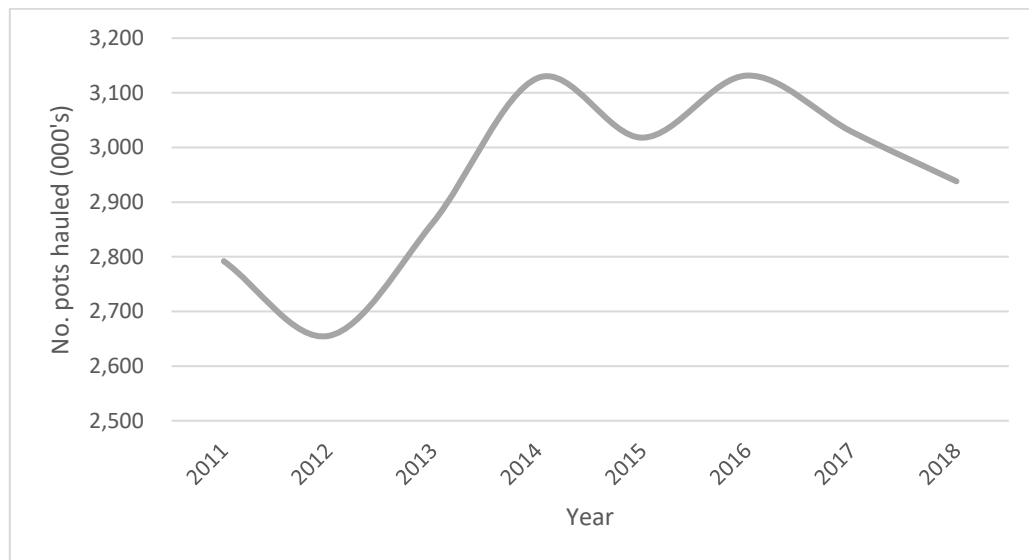


Figure 2 Effort trends in the pot fishery from 2011-2018. Average number of pots hauled per day x number of days fished per month and totalled for the year.

LPUE

Landings per Unit Effort (LPUE) have increased overall from 2011 to 2018 ($r^2=0.84$). LPUE has steadily increased from 2011, with the biggest jump occurring between 2015 and 2016, during which an increase of 10.3kg/100 pots hauled (Figure 3). From 2016 to 2018, there was a 6.2% decrease in effort and a 2.7% decrease in landings of brown crab.

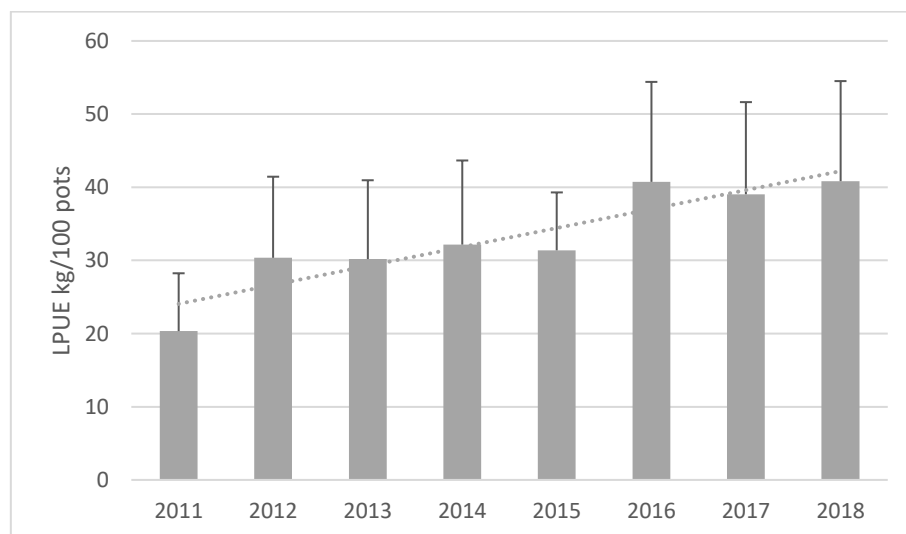


Figure 3 LPUE for the brown crab fishery. LPUE calculated by the weight of landed brown crab (kg) per 100 pots hauled.

Price per kilo

Brown crab is one of the most commercially important species within the NIFCA district, with only landings of Norway lobster (*Nephrops norvegicus*) and European lobster (*Homarus gammarus*) valued higher in 2018. Due to its lower market value brown crab is not as economically valuable as lobster, however it does provide an important source of income to many fishermen throughout the year.

In 2018, brown crab landed from potting within the NIFCA district was valued at £1.05 million, with a further £3,500 landed as bycatch in other fisheries. Historically, the value per kilogram (£/kg) has remained relatively stable, however since 2016 there has been an increase of £0.48/kg to the approximate £1.65/kg in 2018 (Figure 4). This rise in value is likely the reason why, despite a reported 2.7% decline in landed weight since 2016 (Figure 1), the value of the fishery has risen by 37% in the same period (Figure 5).

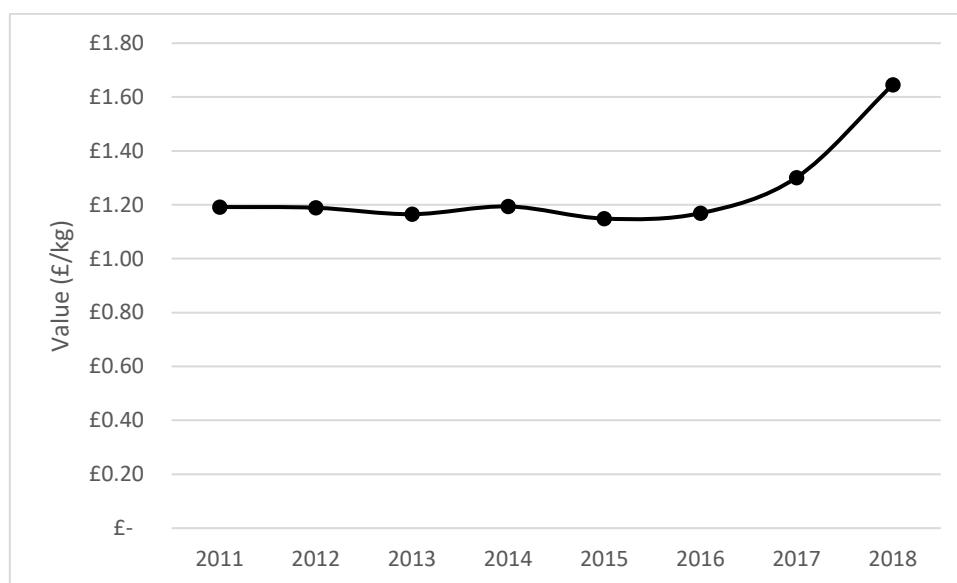


Figure 4 First sale value of brown crab (£/kg) at ports within the NIFCA district between 2009 and 2018 (MMO Landings Data, 2018).

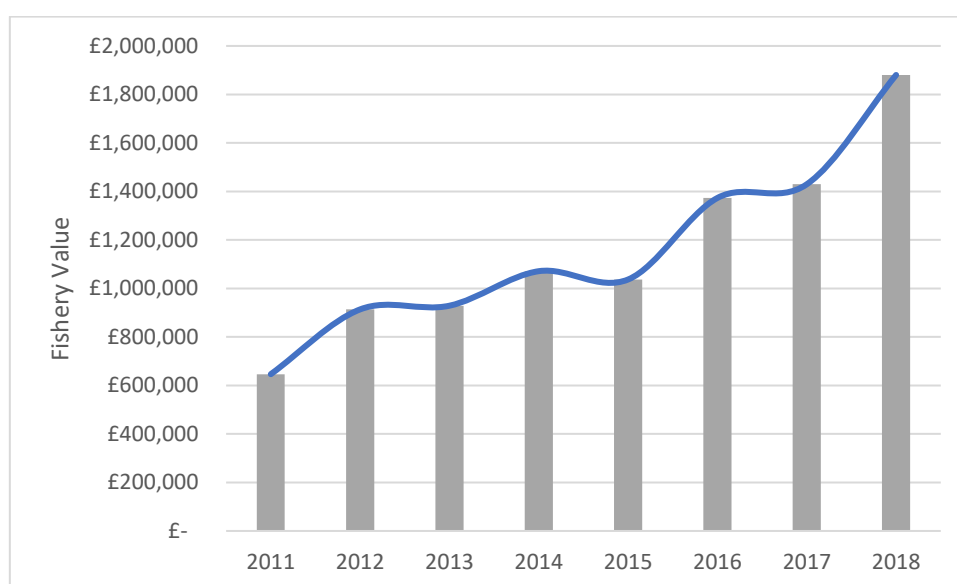


Figure 5 Value of fishery based on permit returns and the average £/kg from MMO Landings data (2018).

Brown Crab Fishing Activity NWIFCA - 4th October 2019

NWIFCA produced a report in 2018 (provided) analysing crab and lobster data to 2016 showing fluctuations in the NW crab fishery, but also providing possible explanations for why this is so and highlighting gaps and issues in the data.

NWIFCA scientists do have concerns over the use of brown crab for bait, especially in whelk fishing which is likely to see an increase in coming years in the District. These concerns are being addressed by the IFCA lead Whelk Working Group which should link into any work carried out into national brown crab fisheries.

The NW District supports only limited crab fishing due to the nature of its ground which is vastly made up of soft sediments; natural rocky ground is only found in inshore areas in the north of the District (Cumbria) and to a minor degree in more southerly areas.

However due to the high number of cabling landing to shore and the requirement for rock armouring to keep it buried, along with construction of wind turbines requiring rock scour protection etc, artificial rocky reef areas have resulted in increased crab and lobster ground, within and outside of the NWIFCA District. Landings from both areas can be made to NW ports.

NWIFCA is in the process of bringing in a new Potting Permit Byelaw for all fisheries using pots or traps across the District whether of a commercial or recreational nature. Within the permit conditions of this new byelaw, currently out to formal consultation, there is a requirement for monthly landings data, on a spatial scale to be determined by the NWIFCA.

The implementation of this byelaw will provide a suite of management measures intended to give NWIFCA the powers to not only monitor inshore fishing activity in far more detail than carried out before, but also to adapt and react to findings to manage the fisheries sustainably - eg. pot limitations, specifying gear, changes to MLS etc. Ultimately if proven necessary the NWIFCA could limit the number of permits issued although this could prove to be severely problematic when fishers have Shellfish Entitlement attached to their vessel licences.

Mandy Knott

4th October 2019



Brown Crab and European Lobster Fisheries in the NWIFCA District

The Use of Returns Data to Inform Management

Alex Aitken

8th January 2018

Summary

Under the Marine and Coastal Access Act 2009 the NWIFCA has the duty to:

- (a) seek to ensure that the exploitation of sea fisheries resources is carried out in a sustainable way,
- (b) seek to balance the social and economic benefits of exploiting the sea fisheries resources of the district with the need to protect the marine environment from, or promote its recovery from, the effects of such exploitation, and
- (c) seek to balance the different needs of persons engaged in the exploitation of sea fisheries resources in the district.

To do so successfully, knowledge of the number of fishers, effort and landings is required. Potting fisheries targeting brown crab and European lobster operate from ports within the NWIFCA district. Fishing activity may take place both inside and outside of the NWIFCA district. This report aims to describe these fisheries to inform future management.

From 2006-2016, the amount of fishers submitting Monthly Shellfish Activity Returns (MSARs) forms has increased overall. Landings and effort data from these forms indicate that:

- i. overall effort has decreased from 2006-2014;
- ii. lobster landings have fluctuated but increased overall from 2006-2016;
- iii. crab landings have increased significantly from 2006-2016.

Effort can be compared to landings up to March 2014, but not after, due to some omissions in landings data. Between 2006 and 2014 lobster landings generally follow effort; the amount of effort put into the fishery is likely to depend on market demand and time spent on other fishing methods. Crab landings fluctuated significantly between 2006 and 2016, as the fishery primarily targets lobster, and crab are mainly bycatch and sold as markets are favourable.

This report cannot draw conclusions about the sustainability of the potting fisheries in the North West but can make a start in informing management about the levels and patterns of activity. Further work is recommended to understand drivers behind changes in activity and landings, and stock/population size and structure, and to explore how the fishery will adapt to other influences and pressures exerted on this industry.

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1. Introduction

In the UK edible crab (*Cancer pagurus*) and European lobster (*Homarus gammarus*) are two of the most important commercial species in terms of both weight of landed catch and value. In 2015, 29,100 tonnes of brown crab and 3,100 tonnes of lobster were landed into the UK worth £39.2 million and £32.1 million respectively (MMO, UK Fisheries Statistics 2015). In 2015, 46 tonnes of brown crab and 20 tonnes of lobster were landed into ports in the NWIFCA district worth £21,000 and £194,000 respectively (MMO, UK Fisheries Statistics 2015).

Within the NWIFCA district potting mainly takes place in Cumbria where there is suitable habitat for the target species. The main ports include Whitehaven, Workington, Ravenglass, Maryport, Barrow and Fleetwood with some landings into Harrington and Haverigg. The potting fleet is relatively small in comparison to other parts of the UK; fishers here are diverse in their fishing methods often spending part of the year potting and part of the year netting. The main potting seasons are spring and summer (April to September). Fishers tend to set pots at the start of the season, work them throughout the season and then bring them all in over winter, as leaving gear out in unfavourable conditions can result in damage or loss. The majority of the north western fleet are in the <10m category, and as such are not required to fill out logbooks or have a Vessel Monitoring System (VMS) on board.

In order to ensure that the exploitation of these fisheries is carried out in a sustainable way it is important to improve understanding of fishing activity in terms of both the health of the stock and the social and economic aspect of this fishery. In a time where fishing practices are subject to pressures including increased management measures and competition for space with other users of the sea, it is important to support and encourage diversification, including the use of static gear. Knowledge of current and historic levels of activity can highlight changes in the structure of the fleet that may occur in the future.

This report aims to give an insight into the crab and lobster fisheries within the NWIFCA district providing spatial and temporal information on effort and landings. In addition, it aims to highlight how this data can be used to inform future management.

In order to do so the report aims to:

1. Increase knowledge on the background and structure of the potting fishery in the district.
2. Understand the effort currently put into the potting fishery and whether this has changed over time.
3. Explore the amount of crab and lobster landed into ports in the district and whether this has changed over time.

These aims are implemented through the following objectives:

1. To review fishing activity and target species and analyse the distribution of fishers in the potting sector across the district.
2. To analyse effort in terms of the number of pot hauls over time.
3. To analyse the amount of landings of crab and lobster over time.

2. Background information on the fisheries

2.1 Gear type and description of fishing activity

Static gear is used to target crab and lobster; where pots are placed in the water in sets of around 10 to 20. Fishers will usually have many strings of pots that can be set in different locations. The pots are baited to attract the target species into chambers through one or more entrances. Pots are left for a 'soak time' of up to 5 days but usually 24-48 hours. They are then hauled, the contents removed and the pots reset. Any catches that are not legal or desirable to land are returned to the sea. Due to the nature of this fishery mortality is low and discards have a high chance of survival (Jennings and Kaiser, 1998).

Brown crab and European lobster fisheries are managed nationally through shellfish licencing schemes, under EU regulation on Minimum Conservation Reference Size (MCRS), and regionally through IFCA byelaws (Table 1). There is also a national Statutory Instrument (SI) which has prohibited the landing of berried lobsters (Table 1).

Table 1 Current regulations relating to NWIFCA crustacean fisheries. North West Sea Fisheries Committee (NWSFC) byelaws are enforced in the old NWSFC district only; Cumbria Sea Fisheries Committee (CSFC) byelaws are enforced in the old CSFC district only.

Regulation	Effect	Intent
MMO Vessel Licencing shellfish permit	Prohibits the commercial fishing of shellfish without the correct permit.	Limits entry into, and therefore effort on, the fishery.
EU Council Regulation 850/98	Prohibits landing organisms below the legal MCRS 130 mm CW ¹ for brown crab, 87 mm CL ² for European lobster.	Prevents removal of organisms from the fishery before sexual maturity is reached.
Statutory Instrument: The Lobsters and Crawfish (Prohibition of Fishing and Landing) (Amendment) (England) Order 2017 No. 899	Prohibits fishing for, and the landing of, lobsters and crawfish which are carrying eggs ("berried" lobsters and crawfish) or are bearing a V notch or mutilated in such a manner as to obscure a V notch.	For the conservation of and protection of juvenile organisms through protection of brood stock.
NWSFC Byelaw 30	Limits the recreational catch of brown crab and European lobster and the number of pots one person can fish per day for those without a National Shellfish Licence.	Limits effort and landings that are not monitored to protect and conserve shellfish stocks.
NWSFC Byelaw 31	Prohibits the taking of a European lobster bearing a V notch or mutilated in such a manner as to obscure a V notch.	For the protection of brood stock.
CSFC Byelaw 8	Prohibits the removal of egg-bearing (berried) European lobster.	To protect ripe females thereby enhancing the biomass of the stock.

CSFC Byelaw 25	Requires that an escape gap is fitted to any pot, creel or trap used for the purpose of fishing for sea fish or crustacea.	To allow small immature lobsters and crabs that have not had a chance to breed to escape and thereby enhance the biomass of the stock.
CSFC Byelaw 26	Limits the recreational catch of brown crab and European lobster and the number of pots one person can fish per day for those without a National Shellfish Licence.	Limits effort and landings that are not monitored to protect and conserve shellfish stocks.

¹ carapace width.

² carapace length.

2.2 Preferred habitat

Potting fisheries mainly take place within the north of the district where the habitat is rockier and comprises the preferred habitat of crab and lobster. *C. pagurus* is found on rocky habitat but has been described as 'preferring the edges' of this ground type as it is also found on sand and mud. *H. gammarus* is found on a narrower range of habitats preferring mainly rocky ground (Brown and Bennett, 1980).

The increase in construction of windfarms and associated use of rock armouring for scour protection and cable burial along with pipeline rock armouring along the coast has changed some coastal, inshore and offshore habitat from sand or mud to rock, thus increasing available niche habitat for this species.

2.3 Life cycle

C. pagurus and *H. gammarus* are not able to grow linearly like most animals as they have a hard outer shell (exoskeleton) which does not grow with them. They must shed this hard exoskeleton and grow a new one, so they grow in increments. To shed an exoskeleton the individual will absorb seawater and swell up, this expands the old shell causing it to separate. As they lose their exoskeleton they become 'soft-shelled', and at this point they are very vulnerable to predation and it can take several weeks for a new outer shell to grow and harden. *C. pagurus* and *H. gammarus* are very difficult to age individually as they lose any age determining structures with every moult (Cefas, 2011).

Brown crabs mate through copulation in spring and summer. Mating occurs shortly after a female has moulted and females carry eggs under the abdomen and are known as 'berried' for this time (Tallack, 2007). They do not feed and remain sheltered under rocks or in pits dug in the sediment to avoid predation (Tallack, 2007). Larvae are released in late spring/early summer and exist in the plankton (Nichols, 1982). Juveniles settle in the intertidal zone in late summer to grow. Males usually remain in the intertidal and inshore areas whereas females migrate inshore to mate and move offshore again for the rest of the year (Woll, 2006).

European lobster females become reproductively active after around five years. Mating occurs throughout the year through copulation shortly after a female has moulted (Cefas, 2014). Females carry eggs attached to pleopods (legs mainly used for swimming but sometimes used for brooding eggs or catching food) on the abdomen and are known as 'berried' for this time, which usually lasts 10-11 months. Spawning usually occurs in summer and larvae are released into the water column. Juveniles bury into sediment where they remain for around two years, rarely moving (Cefas, 2014).

Survival rate of the pelagic larval stages of both *C. pagurus* and *H. gammarus* is low due to high predation while they are in this vulnerable life stage (Brown and Bennett, 1980).

3. Methods of Data Analysis

To fish commercially for crab and lobster a National Shellfish Licence is required for which monthly Shellfish Activity Returns Forms (MSARs) must be completed and returned. The forms detail: vessel information, number of days fished, number of pot hauls, weight of crab, lobster and any other species landed and area fished (Appendix 1). Forms are completed monthly by fishers and sent to the MMO, and the IFCA receives a carbon copy. NWIFCA holds forms dating from 2006, when reporting requirements changed and MSAR returns forms became compulsory. However until now it has not been possible to collate and analyse the information they contain. Previously activity data had solely been taken from patrol vessel sightings, which give a good overview of where activity occurs but no detail behind it. Sightings data from 2007 – 2016 have been mapped and provided at Appendix 2 as a useful illustration of targeted areas in Cumbria.

Data were digitised for analysis using Excel. A table was produced to compare the number of returns, number of active fishers (number of returns minus nil returns), and the sum of the number of days actively fished per year. There are inherent problems with using historical returns data, including errors or omissions in recording, loss of physical data, errors in digitising and changes to reporting methods. Each of these problems was encountered with these data. Some forms were missing details including landing port, number of pot hauls and area fished. Forms were missing for January 2007 and multiple months in 2010 and 2011. From 2014 to 2016, it was only possible to analyse landings data, as effort data were not available for all fishers; therefore landings and effort cannot be compared accurately after March 2014. When collating data from the MSAR returns, where there were any omissions, data were requested from the MMO and added to the NWIFCA MSAR database.

While MSAR forms contain information about areas fished in the form of ICES sub-rectangles, the rectangles reported cover areas both in the NWIFCA district and beyond 6 nm. It is therefore not possible to distinguish between potting activity occurring within the district and activity occurring beyond the district boundary. All analysis is conducted on data collected from fishers who land catches into the district; they may have fished outside of the district boundary. However it is worth understanding the amounts of crab and lobster landed into the district, the effort put in by local fishers, and whether this has changed over time.

Every effort has been made to be transparent about the problems with the data and this report highlights the uses of the available data and how this can inform management in the future despite the problems.

3.1 Objective 1: Distribution of fishers

The numbers of potting vessels, their distribution and any changes over time is shown in Table 3. The number of vessels submitting active and nil returns were summed per port per year to calculate the number of vessels that submit returns. The number of nil returns was subtracted from this total to give the number of active vessels at each port in the district per year.

3.2 Objective 2: Effort over time

The number of pot hauls per fisher per month was summed to estimate effort per month. Effort data for the whole fleet was only available from January 2006 – March 2014; therefore effort has been analysed for this period only. A graph showing effort over time from January 2006 – March 2014 is produced at Figure 1.

3.3 Objective 3: Landings over time

The amounts of crab and lobster landings (kg) were summed to give the amount of crab and lobster landed by the fishery per month. A graph was produced to show these landings from 2006-2016. For January 2006-March 2014 data are taken from MSAR forms; from March 2014-December 2016 some omissions in data meant total effort information was unavailable.

4. Results

4.1 Objective 1: Distribution of fishers

The number of vessels submitting returns had increased from 2006-2016; the number fluctuated from 2008 – 2012 but increased from 2012-2016. The number of vessels actively fishing follows a similar trend with fluctuations from 2006-2012 and an increase thereafter. Effort in terms of number of pot hauls and the sum of days fished, and landings of crab and lobster have decreased overall (Table 2). From 2006-2013 the sum of days fished decreased by 27.0% and the number of pot hauls decreased by 27.4%.

Table 2 Summary of vessels, active vessels, number of days fished and landings per year in the NWIFCA district 2006-2016.

Year	Number of vessels submitting returns	Number of active vessels	Sum of days fished^c
2006	36	23	1123
2007^a	32	20	937
2008	28	23	1090
2009	33	25	813
2010^b	19	15	742
2011^b	24	16	689
2012	30	19	873
2013	33	22	819
2014^c	34	22	786
2015^c	39	21	690
2016^c	42	27	814

^a Missing returns for January

^b Missing returns for Barrow and Fleetwood in 2010, and for Barrow in 2011

^c Missing returns for one fisher in the district from March 2014

The distribution of vessels submitting returns has remained stable from 2006-2016. Ports including Fleetwood and Whitehaven have increased in number whereas Maryport and Harrington have decreased (Table 3). The number of active vessels has decreased slightly in all but three ports; however the number of active vessels fluctuated year on year and no port has exhibited a steady decline in active vessels. No returns were available for Barrow in 2010 and 2011, and Fleetwood in 2010.

Table 3 The number of vessels submitting returns and the number of active vessels (in brackets) per port from 2006-2016. Blanks indicate no returns for that port in the year.

Port	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Barrow	4 (4)	5 (5)	3 (3)	5 (4)			2 (1)	3 (2)	4 (2)	5 (2)	5 (3)
Fleetwood	4 (2)	3 (2)	3 (2)	5 (2)		2 (1)	6 (5)	9 (3)	7 (5)	8 (5)	8 (5)
Harrington	3 (2)	3 (2)	3 (2)	3 (1)	1 (1)	2 (2)	3 (2)	3 (3)	1 (1)	1 (1)	1 (1)
Haverigg							1 (1)	1 (1)	1 (1)	1 (1)	1 (1)
Maryport	6 (2)	6 (2)	5 (3)	5 (4)	5 (3)	6 (2)	5 (2)	5 (4)	5 (3)	5 (2)	4 (3)
Morecambe	1 (1)			1 (1)							
Ravenglass	3 (2)	3 (2)	3 (3)	3 (3)	2 (2)	2 (2)	2 (2)	1 (1)	2 (2)	2 (2)	3 (3)
Whitehaven	7 (4)	6 (4)	5 (4)	6 (4)	6 (4)	7 (5)	6 (2)	2 (0)	8 (3)	9 (3)	10 (3)
Workington	6 (5)	5 (3)	6 (4)	5 (3)	5 (1)	5 (4)	4 (3)	5 (3)	6 (5)	5 (4)	5 (4)

4.2 Objective 2: Effort over time

Effort shows annual fluctuations as more pot hauls occur in the summer months than the winter months (Figure 1). Despite these fluctuations the overall annual effort decreased from 2006-2014 from just over 106,000 pot hauls per year to 77,000 (Figure 1). In the summer of 2010, pot hauls were lower than in the previous or following years with a maximum number of 13,000 in August.

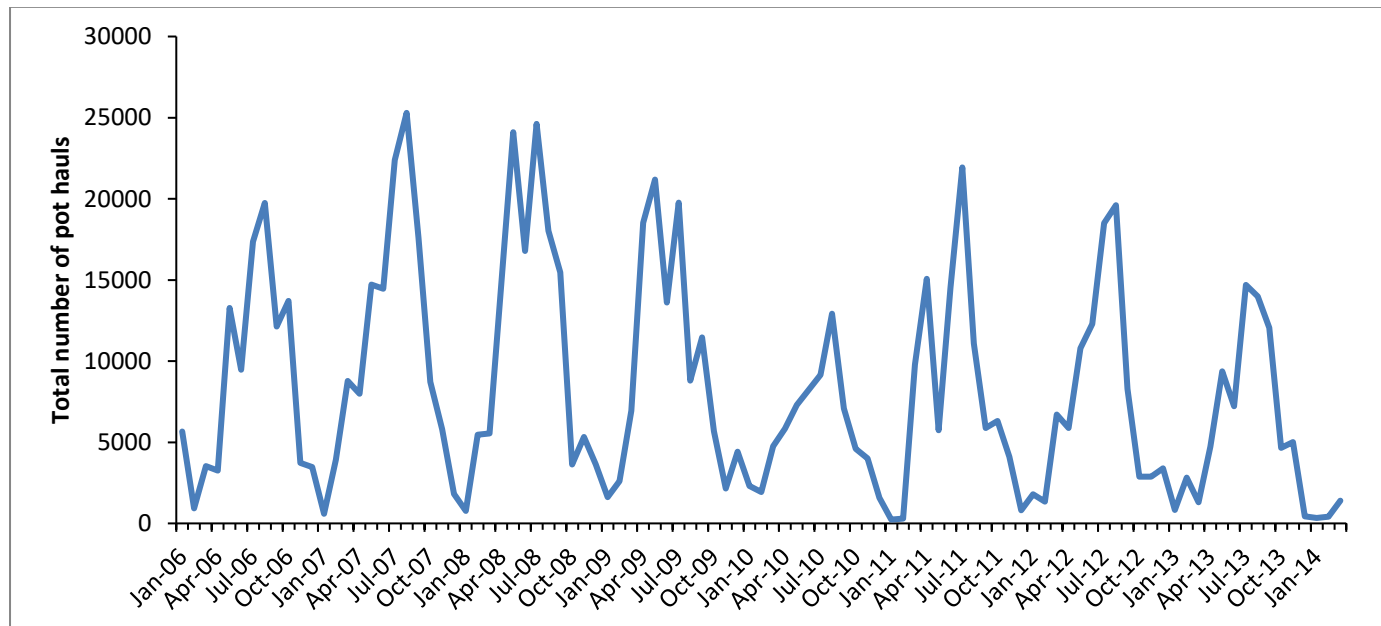


Figure 1 Total number of pot hauls per fisher per month (2006-2014) from MSAR forms.

4.3 Objective 3: Landings over time

Effort increases in the summer and decreases in the winter. This temporal pattern is echoed in the landings with more crab and lobster landed from May to September each year (Figure 2). Lobster landings remained steady from 2006-2008, decreased from 2008-2011, increased in 2014 and 2015, and then decreased in 2016. There was a large amount of crab landed into the district in 2006; this decreased to 2008 and remained steady until 2013. Crab landings then increased in 2014 and 2015 with almost double landed in 2016 than had been landed in each of the previous 10 years (Figure 2).

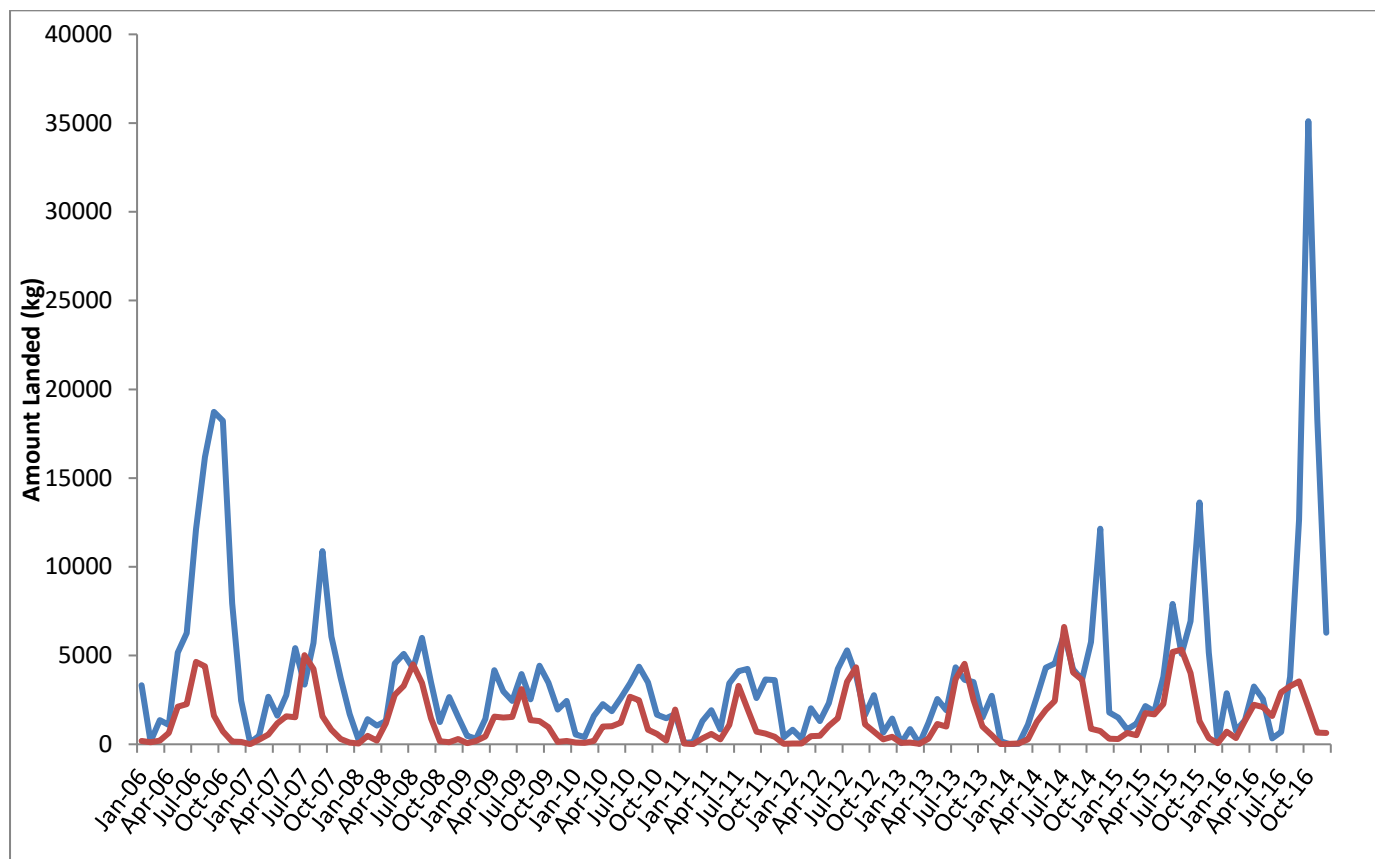


Figure 2 Total monthly lobster (red) and crab (blue) landings into the NWIFCA district (2006-2016) from returns data.

5. Discussion

The limitations inherent in MSARs data and the geographic reporting areas do not allow for specific analysis of activity within the NWIFCA District. This creates issues with extrapolating meaningful management information from returns data alone. However the information is a starting point towards further work in increasing knowledge of the fisheries.

5.1 Objective 1: Distribution of fishers

This information helps to understand the number and distribution of fishers in the potting sector in the northwest and can show if, or when, vessels have left the fleet. If vessels leave the fleet it is useful to know from where, and if future management measures are put in place it is useful to know who and where may be affected. This breakdown shows the number of licenced vessels at each port in the district. As vessels are required to submit nil returns, the number of vessels actively potting can also be ascertained. The overall number of vessels engaged in the fishery is low; this could be due to a lack of infrastructure to support landings (Gray et al., 2016).

The number of active vessels in Fleetwood increased from two to five from 2006 to 2016, which may be due to developments in the local coastal marine area. At Rossall, a sewage outfall pipeline stretching 5.2 km out to sea is buried with rock armouring. This creates suitable habitat for crustacea which has led to an increase in lobster and crab populations which support a fishery close to the port of Fleetwood. Ongoing developments, including construction of a storm drain and an outfall associated with a gas storage development, may again increase suitable habitat for crab and lobster in this area, thus increasing suitable potting ground. This effect has also been described around windfarms, with scour protection at the base of turbines and rock armouring along cable routes increasing suitable habitat for target species.

Information from local fishery officers and communication with fishers may explain the lack of returns in Barrow for 2010 and 2011. Four or five licenced vessels fished from Barrow in 2009. However most vessels were sold or laid up in 2009/10 and the owners/skippers started working on the offshore wind turbine transfer vessels and therefore stopped submitting MSAR forms. Such changes in vocation are common as offshore developments increase and may be a factor in the future health of the fishery. Changes in the number of vessels submitting returns at each port could be due to vessels changing their landing port between 2006 and 2016. One vessel changed from submitting landings into Barrow to Haverigg in 2012.

Further study through fisher engagement is recommended to understand the drivers behind changes in the number of vessels submitting returns and the number of active vessels in the fleet each month.

5.2 Objective 2: Effort over time

By reviewing effort over time, temporal patterns and fluctuations can be analysed. Results show seasonal patterns in activity where more pot hauls occur in the summer months and activity declines to only a handful of boats in the winter months. This seasonality in activity is due to both behaviour of the target species and adverse weather conditions.

European lobster generally moult in late spring and shelter until their shells have hardened in late summer (Pawson, 1995), coinciding with peak catches of lobster (Figure 2). Lobsters are targeted during this time and weather conditions allow pots to be placed in shallow water as risk of damage is reduced. As gear is set and left out for prolonged periods of time it can be damaged in adverse weather conditions. In winter months

an increase in windy and stormy conditions can cause damage or loss of static gear. Fishers tend to work pots by setting them at the start of the season (April/May), then hauling and resetting them throughout the season (until September/October).

Pot hauls per year decreased by 27.4% in from 2006-2013; however the number of fishers actively potting has not decreased overall from 2006-2016 (Table 3). Number of days fished per year decreased by 27.0% from 2006-2013 (Table 2) which may explain the decrease in the number of pot hauls and therefore effort put into the fishery. Some fishers spend part of their time potting and part of their time on other fishing activities such as netting. The decrease in effort could be explained by a shift in activity to another method of fishing for more time of the year, such as setting nets to catch species such as bass. However, in recent years there have been pressures exerted on other types of fishing activity. For example in 2016 and 2017 EU bass regulations have put pressures on the netting sector which is set to continue into 2018 and could cause more fishers to turn to potting in the future.

Decrease in effort could also be attributed to a change in vocation for a period of time. Fishing vessels in the northwest have been recruited as guard vessels on wind farms. Since 2005 offshore windfarms have been constructed in the north east Irish Sea with extensions to existing windfarms continuing (Gray et al., 2016). Anecdotal evidence suggests at least four skippers took up this work opportunity in 2010 which could account for the fall in pot hauls recorded for that year.

5.3 Objective 3: Landings over time

The amount of lobster landed remained relatively steady from 2006-2013; the slight decrease observed from 2006-2013 could be attributed to the decrease in effort in terms of the number of pot hauls described over this time. As many fishers split time between fishing methods, a decrease in potting activity and therefore lobster landings, could be attributed to fishers spending more time on other methods such as netting. The increase in landings from 2014-2016 cannot be compared with potting effort due to limitations with the returns data.

The decrease in the amount of crab landed into the district from 2006 could be explained by market demand. Landing crab became unprofitable when demand dropped; fishers voluntarily increased the size of crab landed from 130mm to 140mm with the aim of improving this demand. However a processing facility in Cumbria ceased processing crab, resulting in logistical difficulties in transporting crab from Cumbrian ports to Fleetwood or other plants. There was a large increase in crab landings from 2013–2016, landed in the winter months from October to December of 2014, 2015 and 2016. Due to omissions in data from 2014, it was not possible to compare the number of pot hauls for 2014-2016 with this increase in crab landings to understand whether a rise in potting effort corresponded with this increase. Officers report one vessel increasing activity, obtaining more pots, and catching more crab during this time. Anecdotally, crabs can be more active under certain conditions, influenced by temperature and weather/sea conditions. This heightened activity means they are more likely to enter pots and traps. Abiotic conditions may have stimulated an increase in crab movement at the end of 2016 causing the increased catch recorded. The market for brown crab as bait may also have increased; diversification in fishing activity has led to an increase in potting for whelk, for which brown crab is popular bait.

6. Conclusion

This report makes use of the data available to the NWIFCA to describe fisheries of which limited knowledge existed. At present, the fisheries are limited by low first sale prices, lack of infrastructure and other opportunities offering greater returns. However, restrictions on other fishing activity plus an increase in rocky ground due to infrastructure developments in the Irish Sea could lead to an increase in potting activity in the future. New technologies and more efficient vessels may make it easier to increase fishing effort. While this has not been the case up to 2014, it is a consideration for the future. Any information describing these fisheries is valuable to management in the upcoming review of potting byelaws within the NWIFCA district.

Further engagement with fishers and stakeholders could be used to help understand drivers behind change reported in effort and landings. Fisher engagement will also help to provide the necessary data on activities, effort and landings to distinguish activity outside of the 6nm from fisheries within the NWIFCA District. Patrol vessel sightings data should also be used. Further information on the areas fished could show hotspots of activity and whether this has changed with the increase in developments in the Irish Sea. Landings and effort data combined over time, and metrics such as landings-per-unit-effort (LPUE) analysis can allow inferences to be made on the health of the stocks. Caution must always be utilised as many other variables such as pot size and animal behaviour could affect results.

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Appendix 1 Redacted copy of an MSAR form

Please send this copy to your nearest fishery office

Monthly shellfish activity return

Port of landing [REDACTED]

Month AUGUST

Year 2017

Name of vessel [REDACTED]

Vess. Reg. / PLN [REDACTED]

1	2	3		4			5	6	7	8
Day	Area	Gear Pots/Nets Section (2B)		Edible Crabs (kgs)			Spider Crab (kgs)	Lobster (kgs)	Other (kgs)	Remarks
		Set	Hauled	Cocks	Hens	Mixed				
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
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24										
25										
26										
27										
28										
29										
30										
31										
Monthly Total										

ICES rectangle mainly fished in [REDACTED]

• I have read the Data Protection statement contained in the Notes for Guidance

Submitted by:

Name in
BLOCK letters

[REDACTED]

Date

24 8 17

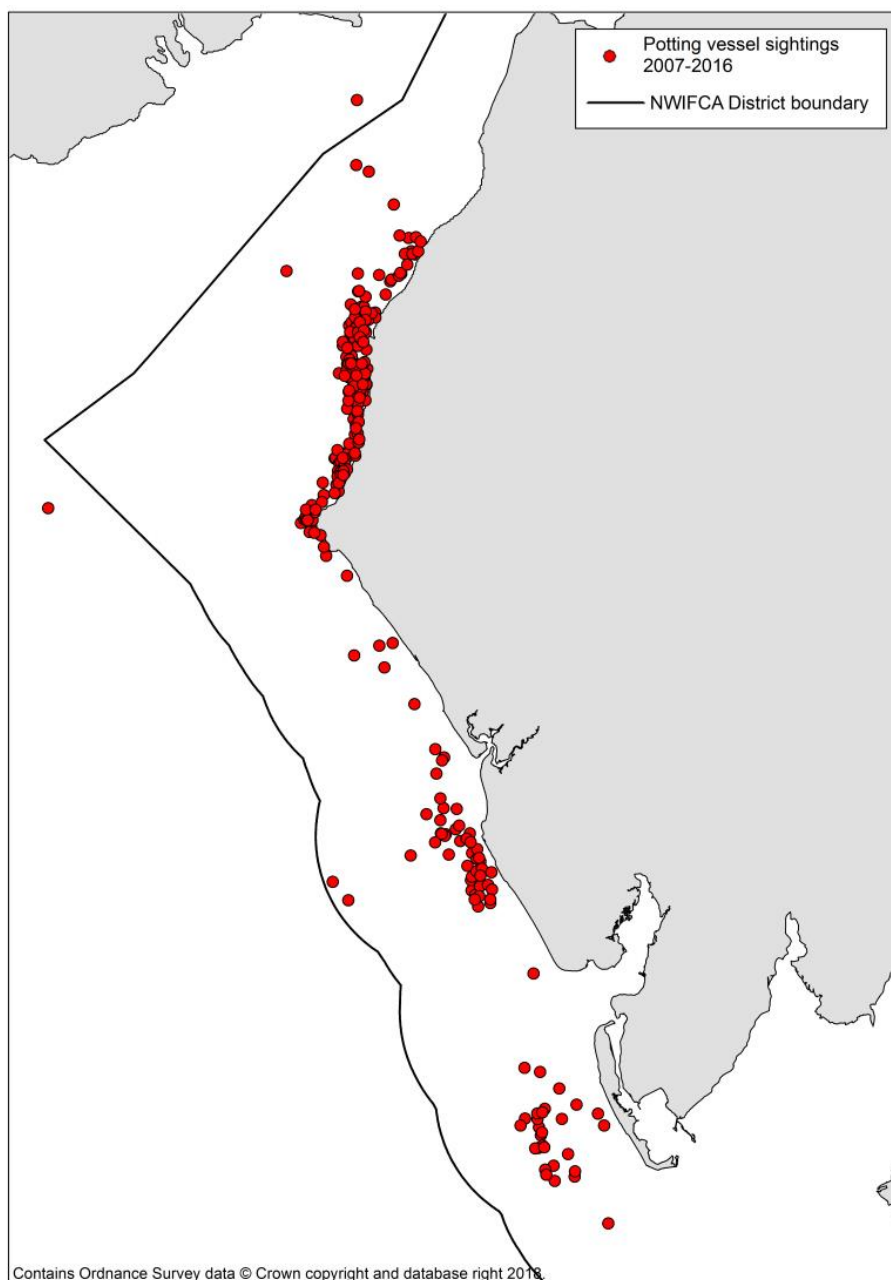
Signed

MSAR 1 (Rev. 1/07)

Local SFC

NFA / NAW

Appendix 2 Map illustrating the number and location of sightings of potting vessels recorded from 2007-2016 in Cumbria.



The NWIFCA patrol vessel records sightings of all fishing vessels fishing or steaming when out on patrol. Sightings have recorded potting activity close to the shore, where rocky ground, preferred habitat of crab and lobster, can be found. Most potting activity has been recorded close to the coastline from Maryport south to St Bees Head, just south of Ravenglass Estuary and west of Walney Island. Only one sighting has been recorded outside of the district. However this does not mean there is no potting activity taking place here, as the patrol vessel mainly targets the area within 6 nm with few sightings of any fishing activity beyond the boundary. Potting activity sightings are all recorded off the Cumbrian coast; this is where the majority of potting activity takes place but the lack of sightings south of Morecambe Bay may also be a result of patrol effort bias. The patrol vessel is based in Whitehaven and has made few trips to the south of the district which could account for the lack of sightings in the south.

Recorded sightings are useful to understand where fishing activity is taking place within the district but must be used and viewed with caution as there are drawbacks. Sightings are just a snapshot of activity in time and therefore no further analysis can be performed to understand effort or landings. Additionally, some sightings have been recorded as general potting activity with no discrimination between potting for crab and lobster or for whelks.

