Department
for Environment
Food & Rural Affairs

Proposed Fisheries Management Plan for Crab and Lobster in English Waters

Annexes

Date: July 2023

Version: public consultation

List of Annexes

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for Environment
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Annex 1: Evidence Statement

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Contents

Introduction

This evidence statement presents the current state of understanding around brown crab (Cancer pagurus) and European lobster (Hommarus gammarus) fisheries in English waters.

In line with the policy objectives of the Fisheries Act 2020, the Evidence presented here will cover:

- Stock sustainability (in relation to MSY or a suitable proxy)
- Fishery management approaches
- Ecosystem interactions
- Economic significance
- Social significance
- Climate change (mitigation and adaptation)

A brief overview of additional data-limited species by the crab and lobster FMP is also included: velvet swimming crab (Necora puber), common spider crab (Maja brachydactyla), common prawn (Palaemon serratus) and crawfish (Palinurus elephas). Data-limited species are defined as species not subject to a formal stock assessment.

Defra would like to acknowledge the advice, evidence and support that has been provided by the Association of Inshore Fisheries and Conservation Authorities (AIFCA) and various Inshore Fisheries and Conservation Authorities (IFCAs), Centre for Environment, Fisheries and Aquaculture Science (Cefas), Environment Agency, Joint Nature Conservation Committee (JNCC), Marine Management Organisation (MMO), Natural England

(NE), Seafish, and our stakeholders, throughout the development of this Fisheries Management Plan (FMP) and the evidence that underpins it.

All of the fishery's data included within this FMP are considered to be accurate at the time of compilation and represents the best available data at the time of drafting. Fisheries data inherently is variable due to retrospective amendments and corrections to reported data meaning revisions of a dataset may differ from another. Issues can sometimes be identified via ongoing data quality and assurance checks and retrospectively amended. Moreover, the methods used to produce estimates are constantly being assessed, iterated, and improved meaning those figures requiring additional processing may vary slightly compared to other similar datasets depending on the methods in use. Assumptions have been made (for example, even distribution of landings across International Council for the Exploration of the Sea (ICES) rectangles) in order to apportion the data to the FMP area resulting in uncertainty in the absolute landings figures. In addition, fluctuations between years

may need to be interpreted with caution due to the uncertainties described above in the data sets.

Scope and Methodologies

MMO Data Extracts

The scope defined for the MMO data extracts presented in this FMP are described in one. All landings' data used within this evidence statement is publicly available through the MMO Sea fisheries annual statistics report (2021)[1] and the Data Collection Framework (DCF) Fisheries Dependent Information (FDI) data call[2].

Table 1: Scope of MMO data extracts included in the crab and lobster FMP for English waters in terms of ICES division and species code

Plan	Crabs and Lobsters in English waters
Fishery	English waters
ICES division	4b, 4c, 7a, 7d, 7e, 7f, 7g, 7h, 7j
Species (code)	Crabs (CRE) (C.P.Mixed Sexes) and Lobsters (LBE)
Data-Limited Species (code)	Crawfish (or Spiny lobster) (CRW), Velvet crab (LIO), Spider crab (*Maja spp.*) (for example SCR), and Common prawn (CPR)

1 UK sea fisheries annual statistics report 2021 - GOV.UK (www.gov.uk)

2 Fisheries Dependent Information - European Commission (europa.eu)

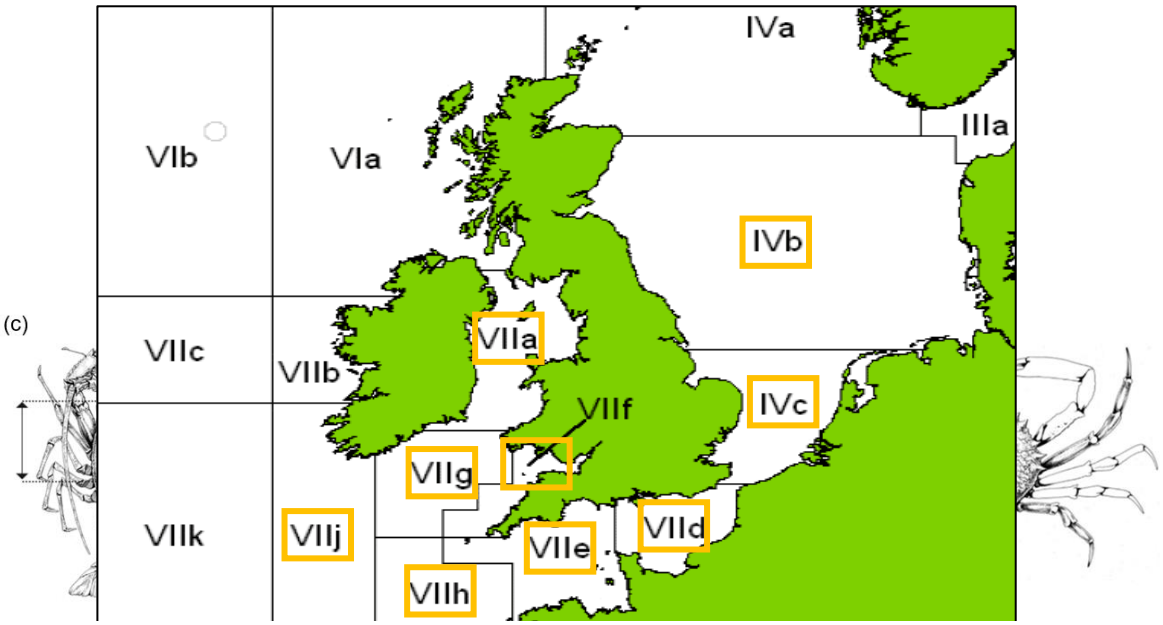

Figure 2. Species within scope of the English crab and lobster Fisheries Management Plan (FMP). This FMP focuses on (a) European lobster (Homarus gammarus) and (b) brown crab (Cancer pagurus). This FMP will also cover the following data-limited species: (c) Crawfish (Palinuris elephas), (d) Velvet crab (Necora puba), (e) Common prawn (Palaemon serratus), and (f) Spider crab (Maja spp.). Data-limited species are defined as those not subject to a formal stock assessment. Arrows denote methods of measuring Minimum Conservation Reference Sizes based on carapace length or width.

Seafish Economics Data Extracts

This report includes data collected by Seafish during the Fleet Economic Surveys and is estimated based on the methodology described in the UK Economic Fleet Estimates and Fleet Enquiry Tool as well as information shared with Seafish as part of DCF work by MMO.

Following our methodology, all economic data is collected and estimated by Seafish fleet segments which group all vessels catching different species using different gears to 33 homogeneous groups. To separate economic values by FMP area and specific species (CRE and LBE) individual vessel level economic performance and employment indicators were partitioned following these steps:

- Individual vessels landings by rectangle were partitioned to FMP area based on MMO methodology published as part of the UK commercial sea fisheries landings by Exclusive Economic Zone of capture report;

- The FMP stock/species economic dependency for each vessel in the fleet in relevant years was calculated. The calculations are based on associated species and FMP area definition calculated as part of step one;
- FMP economic dependency at vessel level is multiplied by each economic variable to obtain Gross Value Added (GVA), operating profit, net profit, and FTE (full time equivalent jobs) by FMP stock/species (assumption: all stocks/species landed by vessel are contributing to the total economic results by the same share as value landed); and;
- All results calculated at vessel level are summarised to FMP level.

Visualisations produced in chapters one-three are based on MMO data provided and partitioning of landings information produced as part of step one of the methodology.

Spatial analysis includes 2016-2021 period aggregated.

Biology of the target species

Life history

Brown Crab

The brown crab is a decapod crustacean, commonly found in lower shore, shallow sublittoral, and offshore zones to about 100m. They typically inhabit bedrock, mixed coarse grounds, and muddy sand substrates, and grow up to 25cm in length. Brown crab are nocturnal scavengers, emerging at night to predate on small crustaceans and molluscs or scavenge for detritus[3].

Brown crab can be found distributed from Norway, throughout the North Sea and English Channel, to the coast of Portugal, however, have been shown to follow more localised migration patterns. Males and immature females can be ‘nomadic’ over distances of around 20 nautical miles, whilst adult females tend have been known to undertake more distinctive migrations[4]:

3 Bennett, D.B. (1995). Factors in the life history of the edible crab (Cancer pagurus L.) that influence modelling and management. In ICES marine science symposia (Vol. 199, No. 0, pp. 89-98). Copenhagen, Denmark: ICES, 1991.

4 Bannister, C. (2009). On the management of brown crab fisheries. London: Shellfish Association of Great Britain.

- Northward along the east coast of England (from Norfolk to Yorkshire/Northumberland, and from Yorkshire to Northumberland/Scotland)[5];
- Westward from the eastern Channel towards Dorset, and from Dorset to Devon/Cornwall[6] and
- Southward from Cornwall and from northern Brittany.

The brown crab lifecycle follows two main phases:

1. A planktonic juvenile phase; and a
2. Bottom-dwelling adult phase

Larvae are released in spring and early summer and remain in the plankton for around two months before settling in the benthic environment from late summer to early autumn. Brown crab hens have the capacity to produce one to four million eggs, and larvae have an estimated 20% survival rate (although mortality during subsequent early life stages is high)[7]. Taking shelter in rocky crevices and seaweed, juveniles undergo a series of moults over approximately two months, in order to become bottom-dwelling juveniles.

Recruitment into the adult population takes place from four to six years old, with estimated age of maturity between three and five years, dependent on environmental conditions. Natural life expectancy is thought to be around 20 to 30 years; however, individuals may live for longer[8]. Males tend to have a faster growth rate than females, maturing earlier and at a smaller size[9]. Adults moult throughout summer and autumn, with females shedding their exoskeleton (shell) earlier than males. Mating occurs directly after moulting when the shell is 'soft', and females store sperm until they are ready to spawn in the winter. It has been reported in the Channel and East coast fisheries that during this time females will migrate offshore against the

5 Addison, (2004): Buckland Lecture at the SAGB Conference, London: "Science and the Management of United Kingdom Crab Fisheries" by Dr J T Addison, Cefas Lowestoft (seehttp://www.shellfish.org.uk)

6 Bannister (n4)

7 Tallack, S.M.L. (2007). The reproductive cycle and size at maturity observed in Cancer pagurus in the Shetland Islands, Scotland. Journal of the Marine Biological Association of the United Kingdom, 87, pp. 1181-1189.

8 Tully, O., Robinson, M., O'Keefe, E., Cosgrove, R., Doyle, O. and Lehane, B. (2006). The Brown Crab (Cancer pagurus L.) Fishery: Analysis of the resource in 2004 - 2005. Fisheries Resource Series (Irish Sea Fisheries Board), Vol. 4, 48pp.

9 Edwards, E. (1979). The Edible Crab and its fishery in British Waters. Surrey, England: Fishing News Books Ltd.

prevailing current to spawning sites[10,11,12]. Females carry their eggs on their abdomen ("berried") for six-nine months as they develop over the winter months[13,14].

Lobster

The European lobster (referred to from this point on as "lobster") is commonly found across the eastern Atlantic Ocean, Mediterranean Sea, and parts of the Black Sea. Lobsters are decapod crustaceans and can grow up to 60cm in length.

Lobsters hunt nocturnally and are opportunistic scavengers, however, may also prey on small crustaceans, molluscs, and polychaetes. Adults feed less in the winter as their metabolisms are slowed by lower water temperatures. Although lobsters are typically sedentary, they will move around to locate food. Their typical home range is around two km from their burrows; however, some individuals may stray up to 10km or more[15].

Moulting occurs in summer approximately once a year for adults, becoming less frequent in older animals. Mating occurs soon after the female has moulted, usually between a hard-shelled male and a soft, newly moulted female. Spawning usually occurs in the summer when the female is said to be" berried". The eggs are fertilised as they are extruded and are carried underneath the abdomen for nine-12 months[16]. Most females are expected to have a two-year reproductive cycle[17].

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10 Woolmer, A., Woo J., and Bayes J. (2013). Review of evidence for best practice in crustacean fisheries management in Wales. Report to Welsh Government Fisheries and Marine Unit.

11 Bennett, D.B. & Brown, C.G. 1983. Crab (Cancer pagurus) migrations in the English Channel. Journal of the Marine Biological Association of the United Kingdom, 63, 371-398.

12 Eaton, D., Brown, J., Addison, J. T., Milligan, S. P. and Fernand, L. J. (2003) 'Edible crab (Cancer pagurus) larvae surveys off the east coast of England: Implications for stock structure', Fisheries Research, 65, pp. 191-199.

13 Ibid.

14 Thompson, B. M., Lawler, A. R. and Bennett, D. B. (1995) 'Estimation of the spatial distribution of spawning crabs (Cancer pagurus L.) using larval surveys of the English Channel. ICES Marine Science Symposia, 199, pp. 139-150.

15 Fischer, W., G. Bianchi and W.B. Scott (1981) True Crabs. 6: FAO species identification sheets for fishery purposes. Eastern Central Atlantic (fishing areas 34, 47; in part). Canada Funds-in-Trust. Ottawa, Department of Fisheries and Oceans Canada, by arrangement with the Food and Agriculture Organization of the United Nations, 1-7

16 National Lobster Hatchery (2020) 'Biology of the European lobster, Homarus gammarus'. Available at: https://www.nationallobsterhatchery.co.uk/lobster-biology/ (assessed on 16/11/22).

17 Agnalt, A. L., Kristiansen, T. S. and Jørstad, K. E. (2007) 'Growth, reproductive cycle, and movement of berried European lobsters (Homarus gammarus) in a local stock off southwestern Norway', ICES Journal of Marine Science, 64 (2), pp. 288-297.

After the hatching, larvae are dispersed into the water column. Larval distribution depends largely on local hydrographical conditions. Larval survival rates are low due to exposure to predation in the plankton, and consequently recruitment levels are often variable. Larval stages last approximately five-10 weeks[18]. Post-larval lobsters are able to swim and seek a suitable substrate to settle into life in the benthic environment, such as gravel or coarse sand[19].

At a carapace length of around 15mm they leave their burrows and seek out rocky crevices to begin life as an adult. Lobsters are long-lived with males and females living on average 30 and 54 years, respectively. Age at size is highly variable with at least seven year-classes potentially entering the fishery at 85mm carapace Length (CL).

Data-limited species

Velvet crab

Velvet crabs (Necora Puber) are small fast-moving, swimming crabs which can grow to between three-10cm[20]. They can be commonly found around the UK coastline[21]. Velvet crabs primarily inhabit sandy or muddy seabed's but can also be found in rockpools and rocky areas[22]. This is a non-migratory species, most commonly found down to depths of 40m[23]. Spawning peaks between February to April[24], with larval stages lasting approximately one to two months. Larvae settle into the benthos around 16 to 20 weeks after hatching[25]. Velvet crabs are opportunistic feeders, preying on molluscs and crustaceans, as well as detrital material and brown algae[26].

18 Fischer (n15)

19 Fischer (n15)

20 https://www.marlin.ac.uk/species/detail/1181

21 Ibid

22 Norman, C.P. and M.B. Jones (1992) Influence of depth, season and moult stage on the diet of the velvet swimming crab Necora puber (Brachyura, Portunidae). Estuarine, Coastal and Shelf Science 34(1):71-83.

23 https://www.sealifebase.se/summary/Necora-puber.html

24 https://secure.toolkitfiles.co.uk/clients/25364/sitedata/Redesign/Key_Species/Velvet-Crab-Species-Profile.pdf

25 MarLIN (n20)

26 Norman (n22)

Spider crab

Spider crabs (Maja spp.) are the largest spider crab found in the British Isles, growing up to 20cm long[27]. It can be found distributed from the Eastern Atlantic to the Mediterranean, and around the south and west of Britain and Ireland[28]. In summer, both juveniles and adults can be found in muddy areas[29], before adults move to coarser sediments and rocky bottoms in deeper water in winter[30]. Juveniles typically inhabit the 5-15m depth range, with adults migrating to depths of >50m, where mating then occurs[31]. The spider crab follows a slow, small-scale, and non-directional movement pattern and is an omnivorous species[32].

Common prawn

The common prawn (Palaemon serratus) can usually be found in groups inhabiting rocky and muddy sediments[33], from the intertidal region to depths of 40m[34]. Distribution has been recorded around the British Isles, though has been scarcely caught on the northeast coast of Britain[35]. Higher abundances are more common in shallower waters during summer months, and in deeper water up to 40m in winter[36]. Their diet consists of phytoplankton, detritus, and benthic invertebrates[37,38]. Males reach maturity faster than females; however, females are generally larger and

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27 MarLIN - The Marine Life Information Network - Common spider crab (Maja brachydactyla)

28 Maja brachydactyla, Atlantic spinous spider crab (sealifebase.ca)

29 Bodin, N., F. Le Loc'h, C. Hily, X. Caisey, D. Latrouite and A.M. Le Guellec (2007) Variability of stable isotope signatures (δ 13 C and δ 15 N) in two spider crab populations (Maja brachydactyla) in Western Europe. Journal of Experimental Marine Biology and Ecology, 343(2):149-157.

30 MarLIN (n27)

31 Freire, J., S. Carabel, P. Verísimo, C. Bernárdez and L. Fernández (2009) Patterns of juvenile habitat use by the spider crab Maja brachydactyla as revealed by stable isotope analyses. Scientia Marina 73(1):39-49.

32 Norman (n22)

33 Palaemon serratus, Common prawn : fisheries (sealifebase.se)

34 MarLIN - The Marine Life Information Network - Common prawn (Palaemon serratus)

35 Guerao, G. & Ribero, C. (1996). Locomotor activity patterns and feeding habits in the prawn Palaemon serratus (Pennant, 1777) (Decapoda, Palaemonidae) in the Alfacs bay, Ebro delta, Spain. Crustaceana, 69(1): 101-112.

36 Haig, J., Ryan, N.M., Williams, K.F. & M.J. Kaiser (2014) A review of the Palaemon serratus fishery: biology, ecology & management. Bangor University, Fisheries and Conservation Report No. 38.

37 Forster, G. R. (1959). The biology of the prawn, Palaemon (Leander) serratus (Pennant). Journal of the Marine Biological Association of the United Kingdom, 38(3): 621-627.

38 Guerao, G. & Ribero, C. (1996). Locomotor activity patterns and feeding habits in the prawn Palaemon serratus (Pennant, 1777) (Decapoda, Palaemonidae) in the Alfacs bay, Ebro delta, Spain. Crustaceana, 69(1): 101-112.

heavier[39]. Mating occurs after the females have moulted, with fertilised eggs carried externally for around four months between temperatures of 9-11°C[40].

Crawfish

Crawfish (Palinurus elephas) – also known as spiny lobster, rock lobster, or crayfish –can grow up to 60cm in total length[41]. In UK waters, the main crawfish populations can be found on the west coast of Scotland, the southwest coasts of England and Wales, and the west coast of Ireland[42]. They typically inhabit depths of between five meters and 70m, however have previously been recorded at depths of 160m[43,44,45]. Substratum preferences include areas with many boulders and bedrock. Crawfish are more active at night, generally foraging for echinoderms, small invertebrates, or algae[46].

In the Atlantic, females move to deeper waters during egg development, and return inshore prior to hatching[47]. Sexually immature crawfish tend to travel longer, and further distances compared to more resident, sexually mature adults[48]. Mating is preceded by a pre-mating moult[49], and occurs between June and October in the Atlantic[50], with fertilised eggs retained on the abdomen of the female for eight

39 Hartnoll, R. G. (1985). Growth, sexual maturity and reproductive output. Crustacean Issues, 3: 101-128.

40 Guerao, G., & Ribero, C. (2000). Population Characteristics of the Prawn Palaemon serratus (Decapoda, Palaemonidae) in a shallow Mediterranean Bay. Crustaceana, 73(4): 459-468.

41 MarLIN - The Marine Life Information Network - European spiny lobster (Palinurus elephas)

42 Noel, P (1999) Palinurus elephas: langouste rouge. http://www.mnhn.fr/mnhn/bimm/protection/fr/Especes/Fiches/Palinuruselephas.html, 2000-07-31

43 Ansell, A. D. & Robb, L. (1977) The spiny lobster Palinurus elephas in Scottish waters. Marine Biology, 43, 63-

44 Ingle, R. (1997) Crayfishes, lobsters and crabs of Europe. An illustrated guide to common and traded species. London: Chapman and Hall

45 Noel (n42)

46 Ibid

47 Goñi, R, Reñones, O. & Quetglas, A. (2001) Dynamics of a protected Western Mediterranean population of the European spiny lobster Palinurus elephas (Fabricius, 1787) assessed by trap surveys. Marine and Freshwater Research, 52, 1577-1587

48 Follesa, M., Cuccu, D., Cannas, R., Sabatini, A., Maria Deiana, A. & Cau, A. (2009) Movement patterns of the spiny lobster Palinurus elephas (Fabricius, 1787) from a central western Mediterranean protected area. Scientia Marina, 73, 499-506.

49 Ceccaldi, H.J. & Latrouite, D (1994) The French fisheries for the European spiny lobster Palinurus elephas. Oxford: Fishing News Books.

50 Goñi, R. & Latrouite, D. (2005) Review of the biology, ecology and fisheries of Palinurus spp. species of European waters: Palinurus elephas (Fabricius, 1787) and Palinurus mauritanicus (Gruvell, 1911) Cahiers de biologie marine, 46, 127-142

months before hatching[51]. Larger females produce up to five times more eggs than smaller females[52]. Eggs hatch in early summer, and larvae drift offshore before returning after several moults to settle into the benthic environment[53].

Distribution within FMP area

Brown crab

Brown crab is commonly distributed around the UK (Figure 3); in English waters occurs across ICES subareas 7.a (Irish Sea), 7.d-h (English Channel and Celtic Sea), 4.b (Central North Sea), and 4.c (Southern North Sea). This FMP only applies to fishing activity within English waters (Figure 3).

51 Hunter, E. (1999) Biology of the European spiny lobster, Palinurus elephas (Fabricius, 1787) (Decapoda, Palinuroidea) Crustaceana, 72, 545 - 565.

52 Goñi, R., Quetglas, A. & Reñones, O. (2003) Size at maturity, fecundity and reproductive potential of a protected population of the spiny lobster Palinurus elephas (Fabricius, 1787) from the western Mediterranean. Marine Biology, 143, 583-592.

53 Noel (n42)

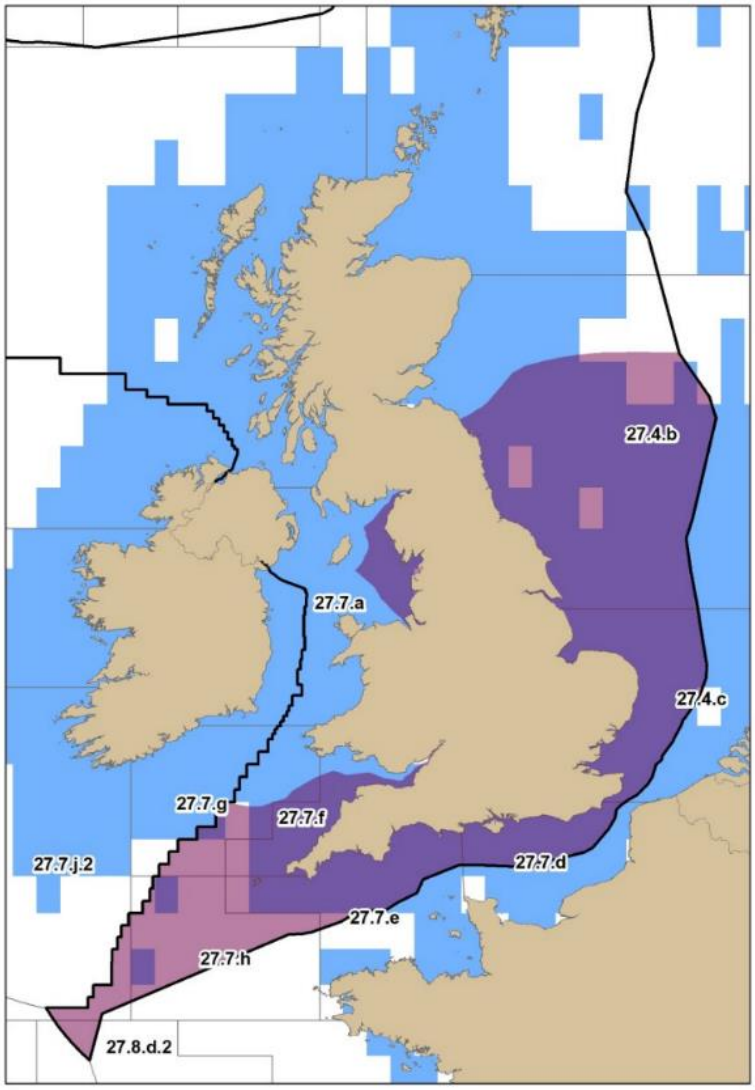


Figure 3: Recorded distribution of brown crab (Cancer pagurus) around the British Isles (blue) and the area covered by the Crab and Lobster FMP (purple). Data from Ocean Biodiversity Information System (OBIS) and Marine Life Information Network (MarLIN)

Lobster

Lobster is commonly distributed around the UK (Figure 4); in English waters occurs across ICES subareas 7.a (Irish Sea), 7.d-h (English Channel and Celtic Sea), 4.b (Central North Sea), and 4.c (Southern North Sea). This FMP only applies to fishing activity within English waters (Figure 4).

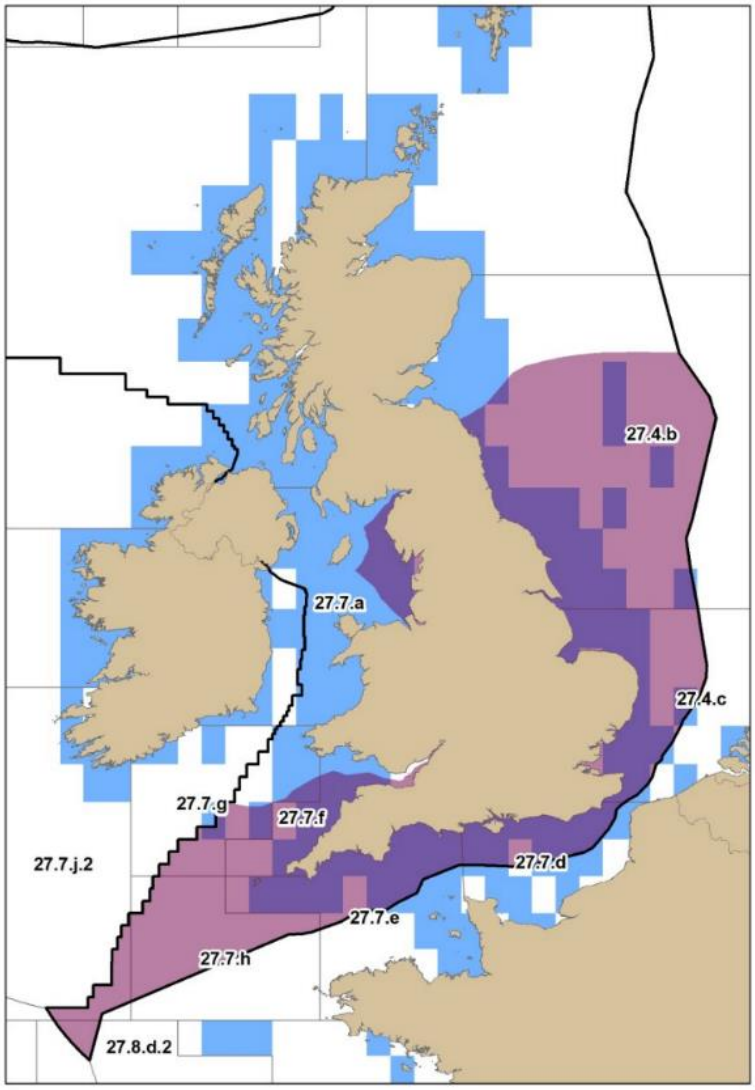


Figure 4: Recorded distribution of European lobster (Homarus gammarus) around the British Isles (blue) and the area covered by the Crab and Lobster FMP (purple). Data from the Ocean Biodiversity Information System (OBIS) and Marine Life Information Network (MarLIN)

Fleet characteristics

The scope and methodologies applied for MMO and Seafish data extraction applied in this document can be found at the beginning of this document.

Total number of vessels (UK vessels)

Brown crab

Table 2 shows the total number of vessels that caught any crab in English waters between 2016 and 2021, split by the vessels' home nation. Vessels are allocated to nations based on their ports of administration. "Islands and other" refers to the small number of vessels registered in Wales, Northern Ireland, and other potential places of registration with few vessels.

Table 2 shows that in each year from 2016-2021, over 90% of vessels involved in the crab fishery in English waters were registered in England. Scottish registered boats made up the second largest proportion of the crab fleet in each year.

Table 2: Number of vessels involved in brown crab fishery by Home Nation registered between 2016-2021 (MMO FMP evidence, 2022).

Home Nation	2016	2017	2018	2019	2020	2021
England	954	920	912	845	739	786
Scotland	34	46	43	33	34	31
Islands and other	21	19	24	26	25	20
Others	12	13	19	14	14	15
Total	**1021**	**998**	**998**	**918**	**812**	**852**

Lobster

Table 3 shows the total number of vessels that caught any lobster in English waters between 2016 and 2021, split by the vessels' home nation. Vessels are allocated to nations based on their ports of administration. "Islands and other" refers to the small number of vessels registered in Wales, Northern Ireland, and other potential places of registration with few vessels.

Table 3 shows that in each year from 2016-2021, over 90% of vessels involved in the lobster fishery in English waters were registered in England. Scottish registered boats made up the second largest proportion of the lobster fleet in each year, with more Scottish vessels than vessels from 'islands and other' and 'others' combined, in every year.

Table 3: Number of vessels involved in European lobster fishery by Home Nation registered between 2016-2021 (MMO FMP evidence, 2022)

Home Nation	2016	2017	2018	2019	2020	2021
England	917	887	880	828	757	790
Scotland	35	58	54	37	38	38
Islands and other	20	21	19	19	21	20
Others	9	7	10	10	8	9
Total	**981**	**973**	**963**	**894**	**824**	**857**

The total number of vessels fishing for brown crab and lobster in UK waters showed a gradual decline between 2016 and 2020, dropping by 209 (-20%) and 157 (-16%) respectively over this period (Figure 5). It is likely that this trend was influenced in part by the impacts of the 2020 Covid-19 pandemic.

Total number of vessels then increased slightly across both species between 2020 and 2021, by an additional 40 crab vessels (+five%) and 33 lobster vessels (+four%).

From 2016 to 2019 there were more vessels targeting brown crab than lobster, with the difference ranging from 24 to 40 vessels. Then the trend reversed in 2020, with 12 more vessels targeting lobster than crab, and five more in 2021.

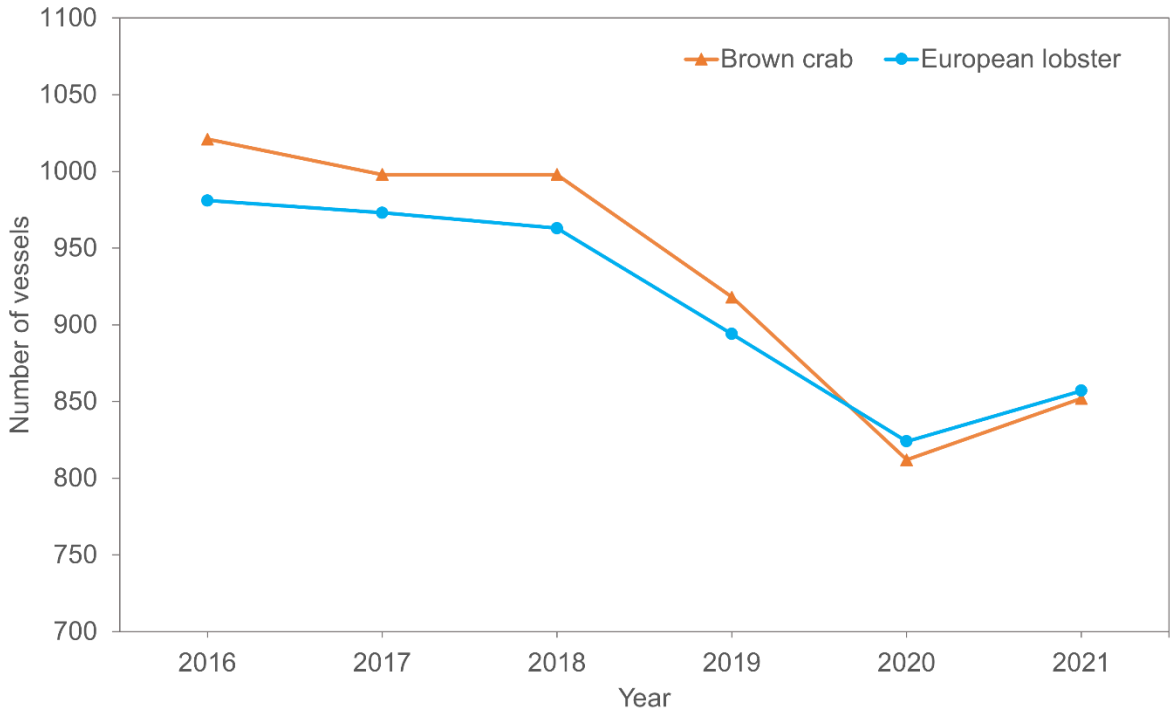


Figure 5: Total number of vessels that caught any amount of brown crab and European lobster in English waters between 2016 and 2021 from all home nations (assigned by port of registry). Note that the Y-axis does not start at zero.

Number of vessels by length (UK vessels)

Brown crab

Figure 6 shows the number of vessels that were at least 20% economically dependent on crab in each year from 2016 to 2021. Vessels are divided by size categories.

In each year from 2016 to 2021, more than 60% of vessels with at least a 20% reliance on the crab fishery in English waters were under 10m. In each year, there were more 8-10m vessels than boats of any other length. The number of under 8m vessels at least 20% reliant on the fishery declined annually from 2018, while the number of 12-18m vessels increased noticeably from 2017 to 2021.

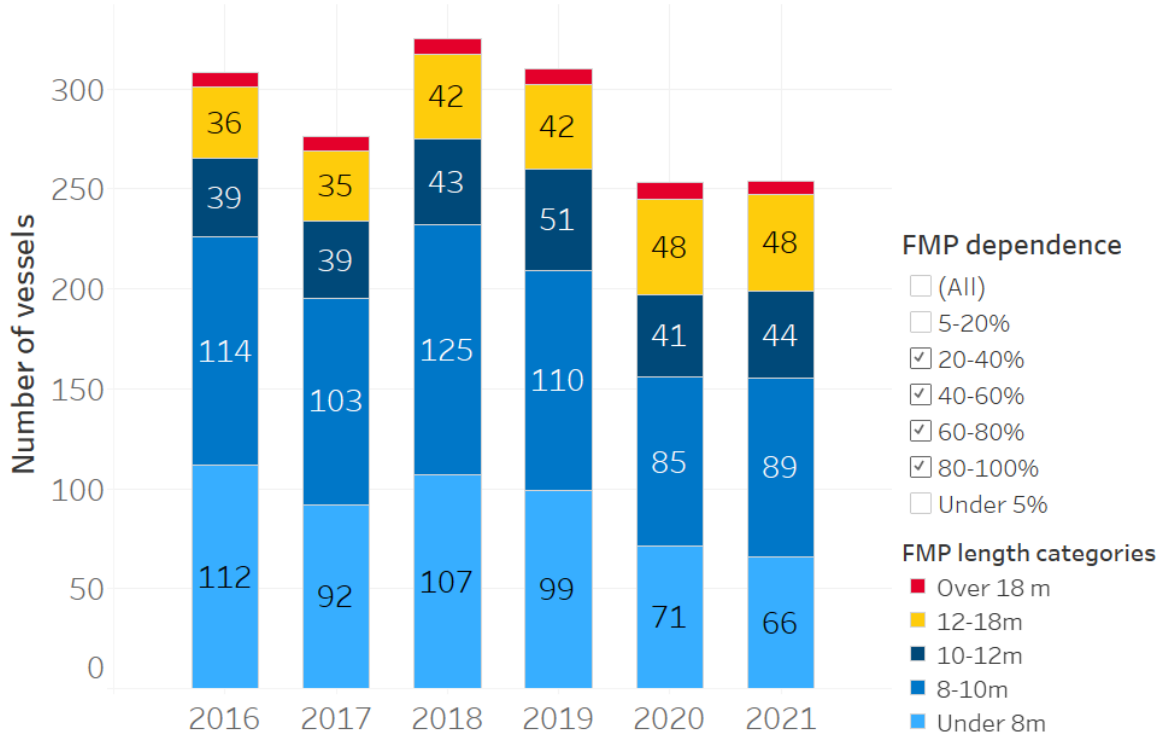


Figure 6: Number of vessels that were at least 20% economically dependent on brown crab landings, organised by vessel size categories

Figure 7 shows landings of crab to ports in England, Wales, and southern Scotland by vessel length. It is worth noting that individual vessels might be double counted in cases when the same vessels were landing lobsters in different ports during the analysed period.

Larger vessels over 12m in length primarily operated on the northeast, east and south-west coasts of England, landing at ports including Withernsea, Bridlington, Newlyn, Brixham and Plymouth. The highest tonnages of crab were also landed at ports in the southwest.

The fishery on the central south and south-east coast, including many smaller ports, was almost entirely made up of smaller vessels under 12m.

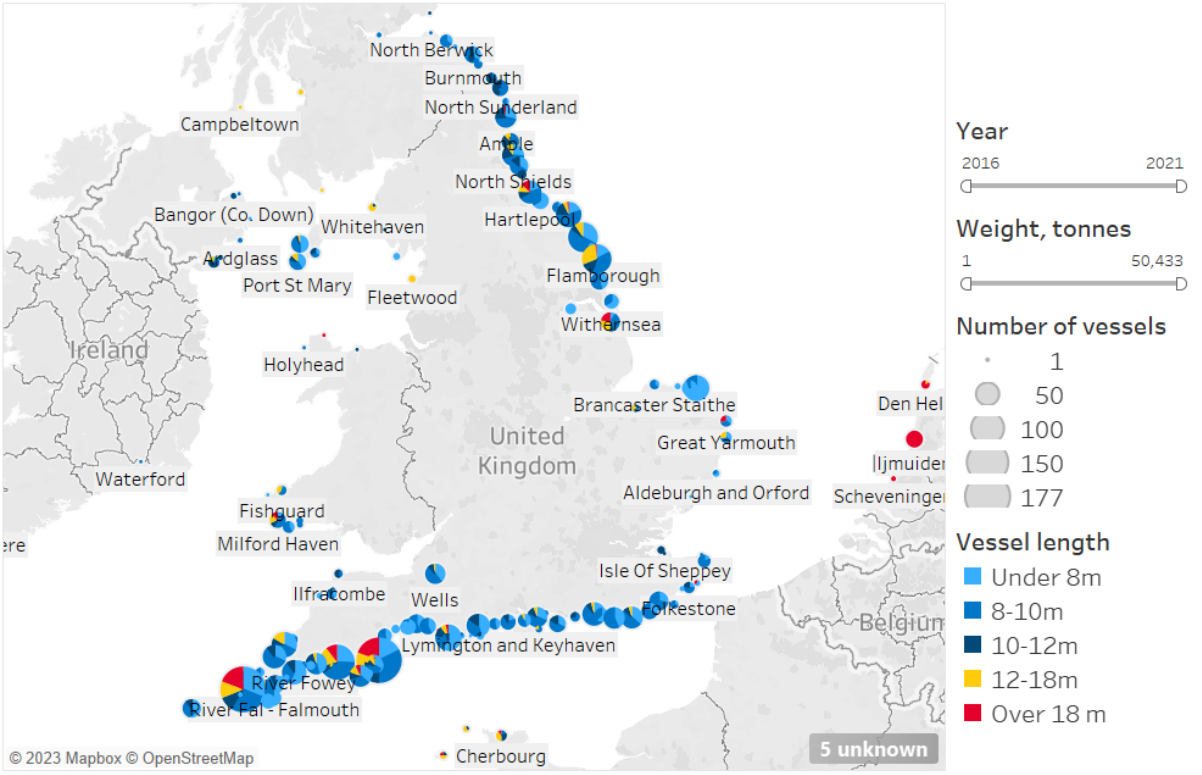


Figure 7: Number of vessels that landed any weight of brown crabs in 2016-2021 by ports of landings, with vessels divided by vessel length. Note: figures above show cumulative number of unique vessels that used relevant ports to land crabs in 2016-21. Individual vessels might be double counted in cases where the same vessels were landing crabs in different ports during the analysed period

Lobster

Figure 8 shows the number of vessels that were at least 20% economically dependent on lobster in each year from 2016 to 2021. Vessels are divided by size categories.

From the graph, it is evident that in each year more than 80% of vessels with at least a 20% reliance on the lobster fishery in English waters, were under 10m. In each year, there were more under eight meters vessels than boats of all other lengths combined.

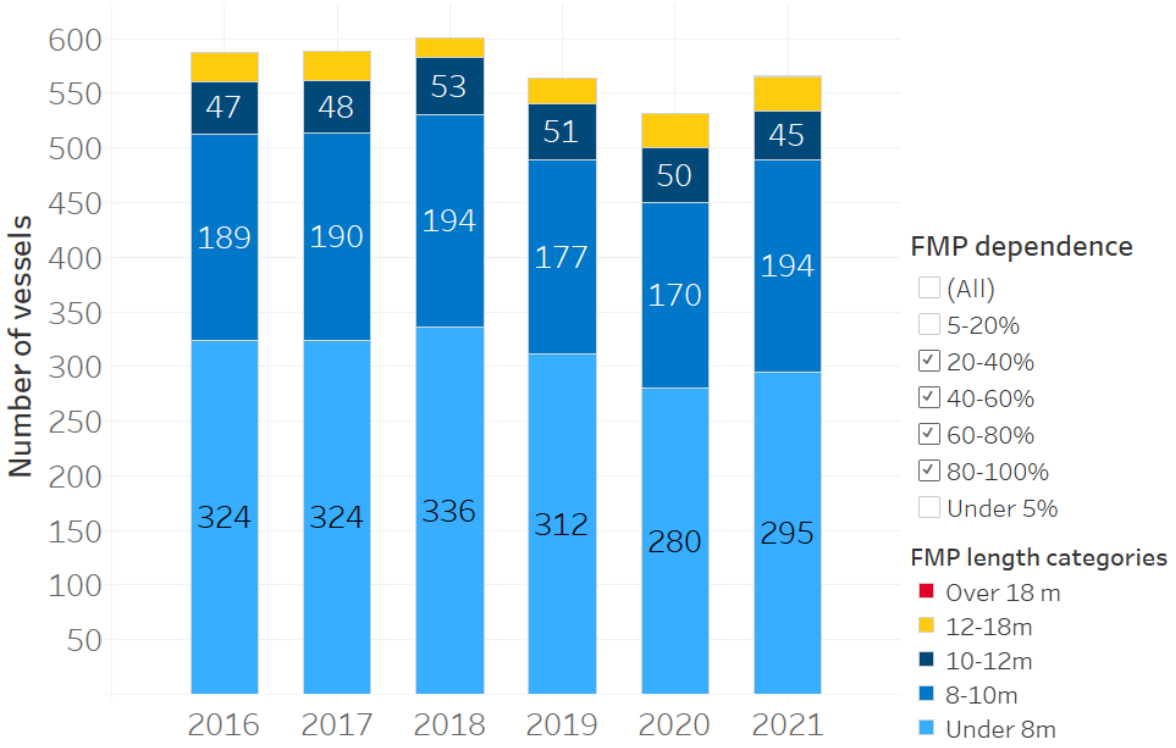


Figure 8: Number of vessels that were at least 20% economically dependent on lobster landings, organised by vessel size categories

Figure 9 shows the number of vessels that landed lobsters from the FMP at each port. It is worth noting that individual vessels might be double counted in cases when the same vessels were landing lobsters in different ports during the analysed period.

Following a similar pattern to the brown crab fishery, larger lobster fishing vessels (over 12m in length) primarily operated on the northeast and south-west coasts of England, while the central south and southeast coast fishery was almost entirely made up of smaller vessels under 12m. The highest tonnages of lobster were also landed at ports in the southwest.

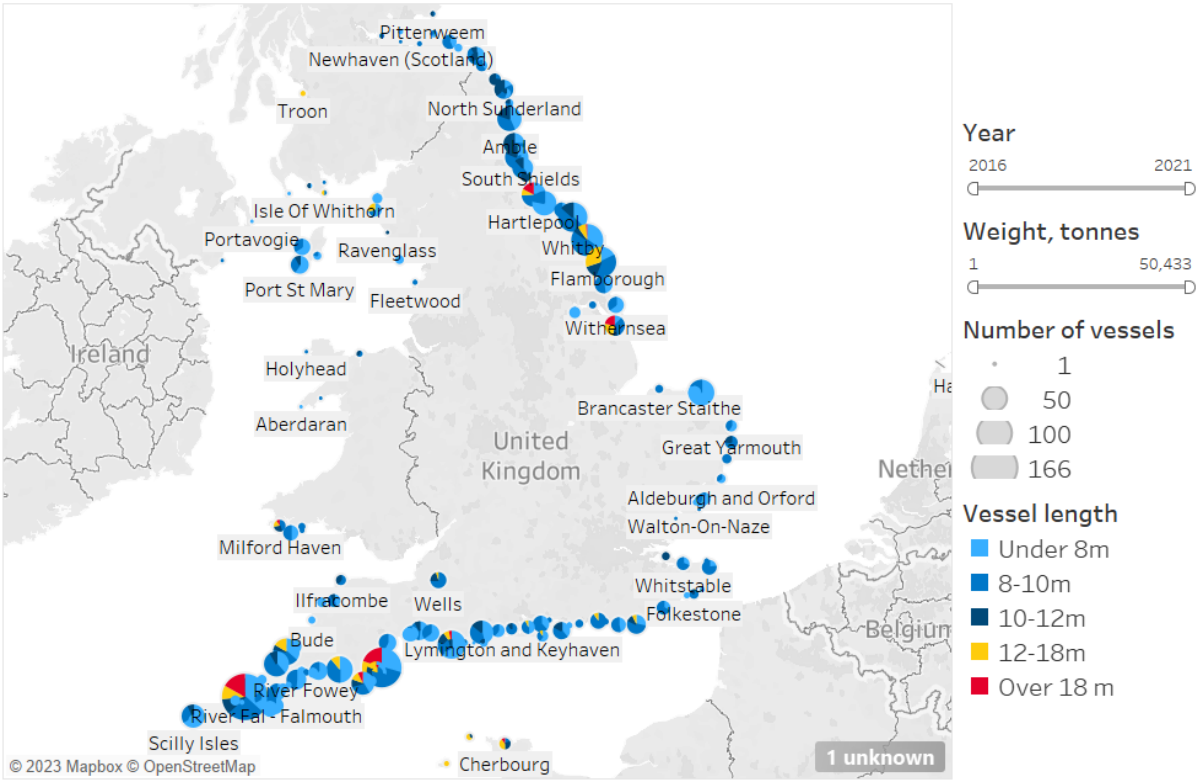


Figure 9: Number of vessels that landed any weight of lobsters in 2016-2021 by ports of landings, with vessels divided by vessel length. Note: figures above show cumulative number of unique vessels that used relevant ports to land crabs in 2016-21. Individual vessels might be double counted in cases where the same vessels were landing crabs in different ports during the analysed period

Landings

The scope and methodologies applied for MMO and Seafish data extraction applied in this document can be found at the beginning of this document.

Total landings (tonnage and value) of UK and EU vessels

Brown crab

Figure 10 shows that crab landings were relatively steady between 2016 and 2019, ranging between 13,641 and 14,877 tonnes, however, in both 2020 and 2021 landings dropped to 11,575 and 11,683 tonnes respectively (Table 4). This downturn was likely influenced by both the Covid-19 pandemic and subsequent changes in market demand.

The value of UK crab landings for the period shown gradually increased from £20.6m in 2016 to a peak of £34.2m in 2019, before falling significantly in 2020 (£20.6m). Value of landings was seen to recover considerably in 2021 (£28.4m) (Table 4). Price per weight of crab landings varied between years. Prices were on average 35% lower in 2016 and 2017 (£1384.69 and £1656.77 per tonne respectively) compared to 2018 and 2019 (£2289.70 and £2388.27 per tonne respectively). Prices were also 36% lower in 2020 (£1779.70 per tonne) compared to 2021 (£2430.88 per tonne).

Figure 10 also shows that between 2016 and 2020, EU landings were less significant, in terms of both volume and value. Peaking at 726 tonnes in 2017 before falling to 439 tonnes in 2020 (Table 4). Value of EU landings also ranged between only £1.1m to £1.7m (Table 4).

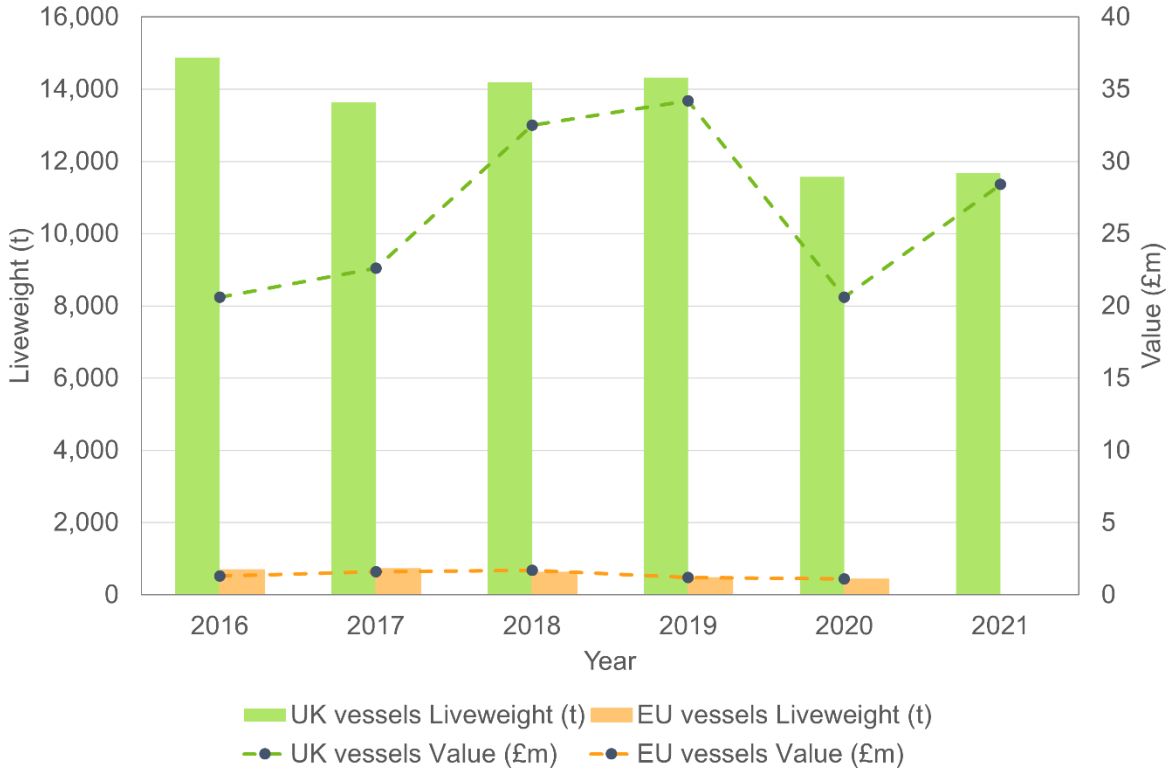


Figure 10: Weight (tonnes) and value (£m) of brown crab landed by UK and EU vessels between 2016 and 2021

Table 4: Weight (tonnes) and value (£m) of brown crab landed by the UK and EU vessels between 2016 and 2021. Landings data relates to catches from the FMP waters (see Table 1)

	2016	2017	2018	2019	2020	2021
Liveweight (t) (UK vessels)	14,877	13,641	14,194	14,320	11,575	11,683
Value (£m) (UK vessels)	20.6	22.6	32.5	34.2	20.6	28.4
Liveweight (t) (EU vessels)	691	726	625	472	439	Not available
Value (£m) (EU vessels)	1.3	1.6	1.7	1.2	1.1	Not available

Lobster

Figure 11 shows that lobster landings were around an order of magnitude lower than crabs between 2016 and 2021. Across this timeframe, lobster landings were relatively steady, but fluctuated in such a way that lower landings are observed following a year of higher landings, and vice versa.

Within this period lobster landings ranged between around 1,500 and 2,000 tonnes, with a peak of 1,919 tonnes in 2017 and a low of 1,492 tonnes in 2020 (Table 5). This downturn was likely influenced by both the Covid-19 pandemic and subsequent changes in market demand. In 2021 landings followed the cyclical trend and increased again to 1,772 tonnes (Table 5).

The value of UK lobster landings for the period shown was relatively steady between 2016 and 2019, fluctuating between around £21.9m and £24.5m (Table 5). Value of landings dropped to £20.0m in 2020, then recovered to £29.2m in 2021 at the highest price per landed weight observed across this timeframe (Table 5).

Price per landed weight of lobster landings also varied across this timeframe. Prices were on average 10% lower in 2016 and 2017 (£12,227.81 and £12,767.07 per tonne respectively) compared to 2018 and 2019 (£14,077.67 and £13,823.02 per tonne respectively). This may be partly because landings were generally higher in 2016-17 compared to 2018-19. Prices were also 30% lower in 2020 (£13,404.83 per tonne) compared to 2021 (£16,478.56 per tonne).

Figure 11 also shows that between 2016 and 2020, EU landings were far less significant, in terms of both volume and value. EU landings were relatively consistent, with a slight peak at 25 tonnes in 2018 at a value of £0.3m (Table 5).

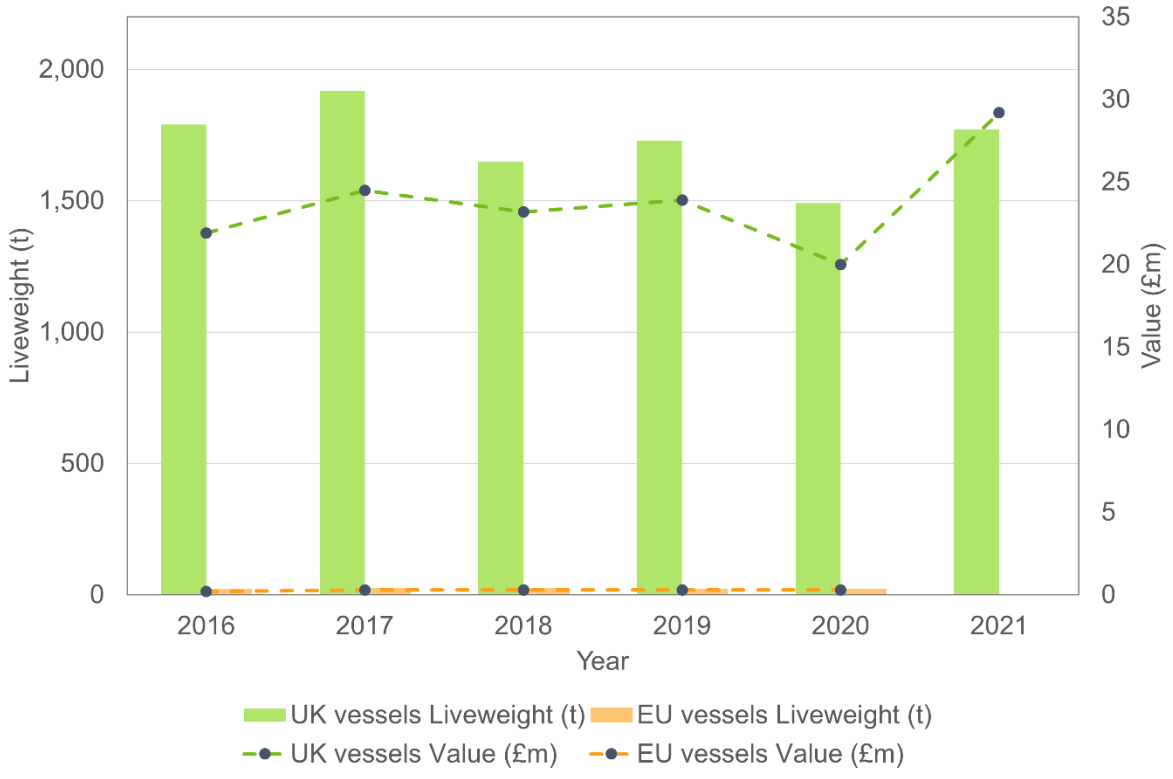


Figure 11: Weight (tonnes) and value (£) of lobster landed by UK and EU vessels between 2016 and 2021.

Table 5: Weight (tonnes) and value (£m) of European lobster landed by the UK and EU vessels between 2016 and 2021. Landings data relates to catches from the FMP waters (see Table 1)

	2016	2017	2018	2019	2020	2021
Liveweight (t) (UK vessels)	1,791	1,919	1,648	1,729	1,492	1,772
Value (£m) (UK vessels)	21.9	24.5	23.2	23.9	20.0	29.2
Liveweight (t) (EU vessels)	20	24	25	22	21	Not available

	2016	2017	2018	2019	2020	2021
Value (£m) (EU vessels)	0.2	0.3	0.3	0.3	0.3	Not available

Landings by vessel nationality (UK vessels)

Brown Crab

Table 6 shows that in the period between 2016 and 2021, between 90.1% and 95.5% of UK crab landings were made by English vessels.

Scottish vessels contributed between 3.0% and 7.9%, whilst the remainder of crab landings were split fairly evenly between vessels registered in Jersey and Guernsey, Wales, and the Isle of Man (with a small percentage from Northern Ireland).

Table 6: Volume of brown crab landings (tonnes) by vessel nationality (based on port of registry), between 2016-2021

Vessel Nationality	2016	2017	2018	2019	2020	2021
England	13,918	12,888	13,296	12,904	10,706	11,155
Wales	175	215	91	11	6	7
Scotland	452	407	655	1,129	761	480
Northern Ireland	2	4	9	10	3	4
Jersey	228	65	0	0	-	0
Guernsey	68	35	41	50	72	37
Isle of Man	35	27	102	217	27	0

Lobster

Similarly, as for crab, Table 7 shows that in the period between 2016 and 2021 between 94.7% and 96.6% of UK lobster landings were made by English vessels.

Scottish vessels contributed between 2.7% and 4.4%, whilst the remainder of lobster landings were split fairly evenly between by vessels registered in Jersey and Guernsey, Wales, and the Isle of Man.

Table 7: Volume of European lobster landings (tonnes) by vessel nationality (based on port of registry), between 2016-2021

Vessel Nationality	2016	2017	2018	2019	2020	2021
England	1,721	1,847	1,562	1,657	1,442	1,697
Wales	2	4	7	7	3	4
Scotland	55	58	72	53	41	68
Northern Ireland	0	0	0	0	0	1
Jersey	0	3	0	0	-	0
Guernsey	9	5	4	3	3	1
Isle of Man	4	3	4	8	3	0

Landings by port (UK vessels)

Brown crab

Table 8 shows that in 2021, Grimsby was the top landing port for crab, receiving 2,641 tonnes with a value of £5.4 million. With the remainder of the top 10 ports by value of crab landings consisting of ports on the east and southwest coasts of England (Table 8).

Only 2 other ports received over 1,000 tonnes of crab. These were Bridlington (over 2,000 tonnes, valued at £4.6 million), and Newlyn (£3.1 million) (Table 8).

Salcombe's landings amounted to over £two million, while Scarborough, Hartlepool and Padstow all received landings totalling over £one million. Landings at Dartmouth, Wells and along the River Dart were between £0.7 and £0.9 million at each location (Table 8).

Price per tonne varied significantly across the country, with the best prices found on the southwest coast.

Table 8: Brown crab landings from FMP by port, showing the top 10 by value (£m) in 2021. Liveweight of landings is also shown

Rank	Port of Landing	Port Nationality	Liveweight (t)	Value (£)
1	Grimsby	England	2,641	5.4
2	Bridlington	England	2,115	4.6
3	Newlyn	England	1,136	3.1
4	Salcombe	England	656	2.2
5	Scarborough	England	604	1.3
6	Hartlepool	England	467	1.2
7	Padstow	England	414	1.2
8	Dartmouth	England	271	0.9
9	Wells	England	404	0.7
10	River Dart	England	138	0.7
	TOP 10		8,846	21

Lobster

Table 9 shows that in 2021, all but two of the top 10 ports by value of lobster landings were located on the east coast.

Bridlington was the top landing port in England for lobster in 2021 by a significant distance, receiving 477 tonnes with a value of £8.2 million – more than three times the volume or value landed at any other port (Table 9).

Only 2 other ports received over 100 tonnes of lobster. These were Scarborough (133 tonnes, with a value of £2.2 million), and Whitby (110 tonnes, £1.8 million) (Table 9).

Table 9: Lobster landings by port, showing the top 10 by value (£m) in 2021. Liveweight of landings is also shown

Rank	Port of Landing	Port Nationality	Liveweight (t)	Value (£)
1	Bridlington	England	477	8.2
2	Scarborough	England	133	2.2
3	Whitby	England	110	1.8
4	Newlyn	England	94	1.6
5	Hornsea	England	77	1.2
6	Grimsby	England	80	1.2
7	Seahouses	England	43	0.7
8	Withernsea	England	40	0.6
9	Padstow	England	34	0.6
10	Holy Island	England	40	0.6
	TOP 10		1,128	19

Data-limited species

Top 10 landing ports in England for data-limited species are shown in Table 10.

Crawfish: The main ports where crawfish are landed are located in the southwest (Table 10). MMO landings statistics show that in 2021, the majority of crawfish were landed to Newquay (22.1 tonnes), with Scilly Isles, Newquay, Hayle, St Ives, Cadgwith also registering over 1 tonne of crawfish landings for that year.

Velvet crab: The UKs principal velvet crab fisheries are found in Scotland and Northern Ireland (Table 10). In 2021, nine out of the top ten English landing ports were located on the northeast or east coast, with the highest landings in 2021 recoded at Holy Island (Northumberland) (32.0 tonnes). Smaller landings of velvet crabs are also made in the southwest, with Mylor and Brixham both recording <5 tonnes in 2021.

Common Prawn: In 2021, common prawn was landed in relatively low tonnages (<four tonnes per port) (Table 10). the largest landing port was Blythe in Northumberland (3.22 tonnes), however most of the remaining top 10 landing ports recorded < two tonnes and were located along the south or southwest coast of England – from the Isle of Wight to Devon and Cornwall. Whitehaven in Cumbria was the only exception to this trend.

Spider crab: All significant fishing activity takes place in the southwest of England (Table 10). Salcombe recorded the highest landings in 2021 (44.9 tonnes), and Newquay, Newlyn, Hayle, and Cadgwith all also recorded over 20 tonnes that year.

Table 10: Landed liveweight (tonnes) of data-limited FMP species in 2021 by top 10 port of landing. This analysis relates to landings made from the entire UK Exclusive Economic Zone (EEZ), but English landing ports have been used as a proxy to represent the English fishery for these species (as per the scope of the English Crab and Lobster FMP).

Crawfish:		Velvet crab:		Common prawn:		Spider crab:	
Top 10 ports	**Weight (t)**	**Top 10 ports**	**Weight (t)**	**Top 10 ports**	**Weight (t)**	**Top 10 ports**	**Weight (t)**
Newlyn	22.1	Holy Island	32.0	Blyth	3.22	Salcombe	44.9
Scilly Isles	5.68	Amble	13.2	Exmouth	1.29	Newquay	36.8
Newquay	2.27	Bridling-ton	5.58	River Dart	0.39	Newlyn	35.7
Hayle	2.07	Sea-houses	5.23	Wey-mouth	0.38	Hayle	25.1
St Ives	1.94	Mylor	3.86	Lyme Regis	0.35	Cadgwith	21.9
Cadgwith	1.12	Brixham	2.15	White-haven	0.25	Coverack	16.7
Coverack	0.86	Blyth	1.41	Selsey	0.24	River Dart	16.0
Porthleven	0.75	North Sunder-land	1.38	Mylor	0.16	Meva-gissey	15.0
Hoylake	0.35	Craster	1.17	Ventnor	0.11	Looe	12.2
Mullion	0.26	Seaham	0.98	Bem-bridge	0.11	Helford River	10.8

Crawfish:		Velvet crab:		Common prawn:		Spider crab:	
Total	**37.36**	**Total**	**66.92**	**Total**	**6.49**	**Total**	**226.56**

Landings by ICES rectangle (UK vessels)

Brown crab

Figure 12 shows the top 10 ICES rectangles by landings of brown crab between 2016 and 2021, which reveals that the highest tonnages were landed from ICES rectangles off the northeast coast of England. In all years from 2016 to 2021, highest tonnages of brown crab were landed from rectangle 36F0 - with 3,022 tonnes landed in 2021 (26% of total landings) (

Table 11). Other rectangles off England's northeast coast from which high crab tonnages of crab were landed included 37E9, 37F0, and 36F1 (

Figure 12).

The second most significant ICES rectangles in terms of crab landings were located off the southwest coast of England, specifically 29E4 and 29E6 which saw landings of 952 and 891 tonnes respectively in 2021 (

Table ***11***). Lower but still significant landings were also recorded in 28E4 and 28E6 between 2016 and 2021 (Figure 12).

Table ***11*** reveals that in 2021, landings in several ICES rectangles were down on previous years, notably 29E4 and 29E6 in the southwest, which saw relatively higher landings of over 1,000 tonnes between 2016 and 2020. In 2021, landings were also reduced in a number of rectangles off the northeast coast, including 36F1, 37E9, 37F0, and 40E8 which all saw higher landings in previous years.

Landings also increased across this timeframe in some rectangles, including 28E4 in the southwest – which has seen a gradual increase – and 39F1 in the northeast – which has been increasing it's contributing to overall tonnages since 2019 when it began to see crab landings (

Table 11).

Table 11: Weight (tonnes) of UK fishing fleet's brown crab landings by ICES rectangle in years from 2016 to 2021. All vessels that landed any amount of brown crab in the time-period are included in the extract. Top 10 rankings are shown based on 2021 landings only

Rank	Rectangle	2016	2017	2018	2019	2020	2021
1	36F0	2,705	2,527	2,563	2,812	2,572	3,022
2	29E4	1,302	1,137	1,589	1,328	1,065	952
3	29E6	1,627	1,411	1,173	1,059	837	891
4	36F1	779	988	878	1,127	1,303	877
5	28E4	505	534	482	669	667	711
6	37E9	791	703	1,078	652	427	541
7	37F0	889	709	1,338	873	476	397
8	39F1	-	0	0	50	130	338
9	40E8	557	641	465	450	319	322
10	38E9	416	375	427	339	150	313

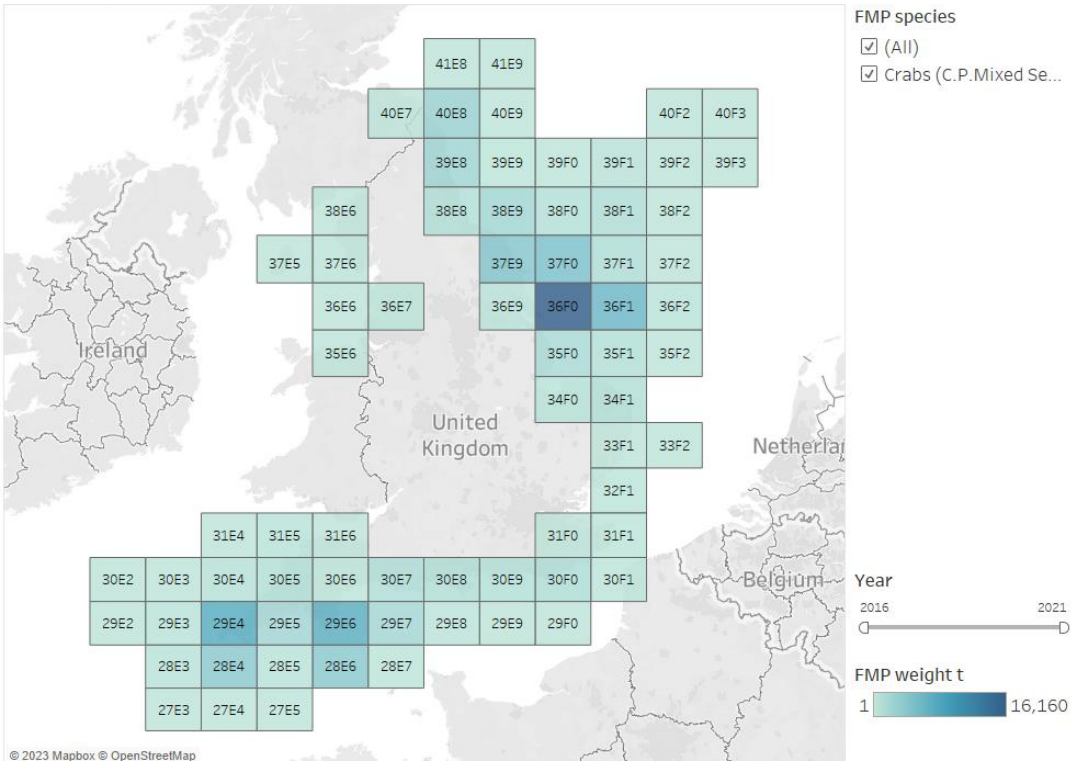


Figure 12: Spatial distribution of UK vessel's crab landings by ICES rectangle in English waters in 2016-2021. Only rectangles with cumulative FMP related weight of landings in 2016-2021 above one tonne are selected

Lobster

Outputs for lobster follow similar trends as outputs for brown crab presented above.

Figure 13 shows the top 10 ICES rectangles by landings of lobster between 2016 and 2021, which reveals that the highest tonnages were landed from ICES rectangles off the northeast coast of England. In all years except 2018 and 2019, highest tonnages of lobster were landed from rectangle 36F0 - with 523 tonnes landed in 2021 (29.5% of total landings) (Table 12). Other rectangles off England's northeast coast from which high crab tonnages of lobster were landed included 37E9, 38E8, 39E8, and 40E8 (Figure 13).

In comparison to crab, ICES rectangles off the southwest coast of England were less significant in terms of lobster landings between 2016 and 2021 (Figure 13). Only one ICES rectangle saw relatively high tonnages landed within this period, this was 29E4 – from which 146 tonnes were landed in 2021 (Table 12). Lobster landings were relatively stable (despite some periodic fluctuation) across other ICES rectangles.

Table 12 reveals that in 2021, landings in several ICES rectangles were lower than in previous years within this timeframe. Notably this includes 39E8, 38E8, 38E9, and

37F0 off the northeast of England, which all showed lower lobster landings in 2021 than had been previously observed in the period between 2016 and 2020.

Table 12: Weight (tonnes) of lobster landings by UK fishing fleet by ICES rectangle in 2018 to 2021. All vessels that landed any amount of lobster in the time-period are included in the extract. Top 10 rankings are shown based on 2021 landings only

Rank	Rectangle	2016	2017	2018	2019	2020	2021
1	36F0	413	471	304	333	349	523
2	37E9	189	210	195	232	168	203
3	29E4	93	93	127	163	141	146
4	40E8	154	169	164	154	120	140
5	39E8	121	131	123	127	108	81
6	38E8	81	111	122	106	74	65
7	38E9	90	89	89	61	40	61
8	36E9	57	53	31	45	30	58
9	37F0	76	63	51	48	50	46
10	29E6	23	33	31	41	35	43

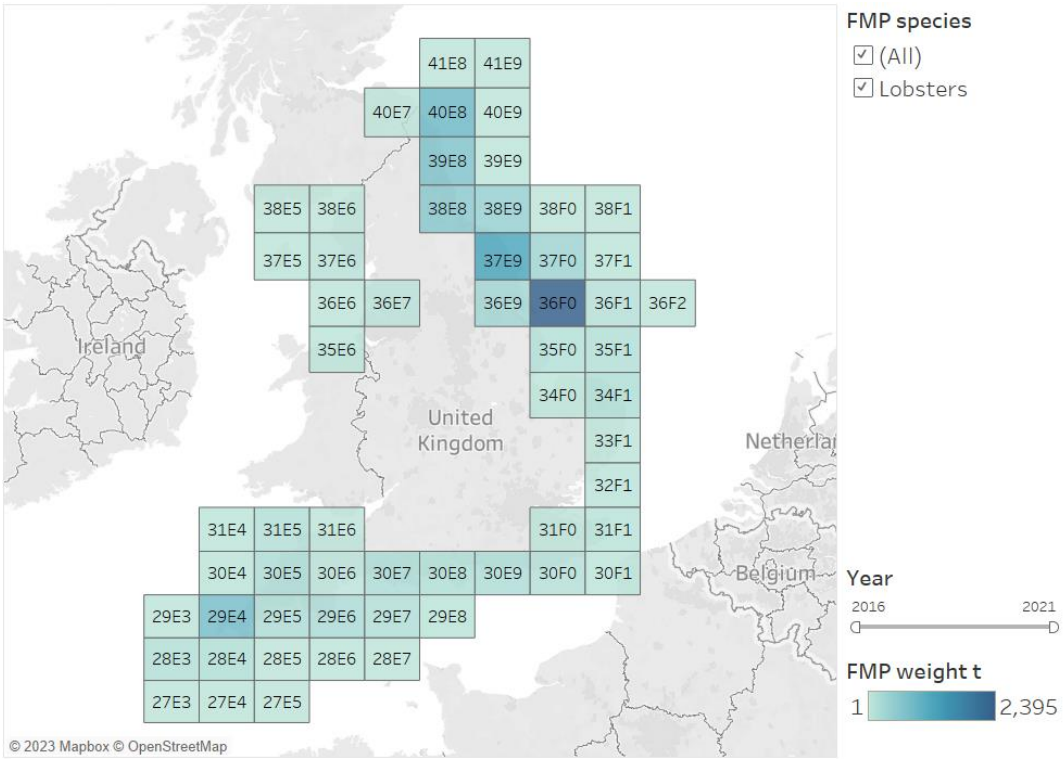


Figure 13: Spatial distribution of UK vessels' lobster landings by ICES rectangle in English waters in 2016-2021. Only rectangles with cumulative FMP related weight of landings in 2016-2021 above one tonne are selected

Landings by vessel length (UK vessels)

Brown crab

Figure 14 shows that in all years between 2016 and 2020, vessels over 10m in length landed more brown crab by both volume and value than vessels 10m and under.

Landings of under 10m vessels declined annually across this timeframe, remaining over 4,000 tonnes until 2019 before dropping more significantly to below 3,000 tonnes in 2020. The total value of crab landed by under 10m vessels increased steadily, from £6.5 to £9.0 million between 2016 and 2019, before falling to below 2016 levels in 2021 (£4.8 million) (Table ***13***).

In 2016, 2018 and 2019, over 10m vessels landed more than 10,000 tonnes of crab, and around 9,000 tonnes were landed in 2017 and 2020 (Figure 14). The value of this catch rose sharply between 2017 and 2018, from £15.1 to £23.8 million. This increasing trend slowed in 2019, when the value rose to £25.1 million, before falling significantly in 2020 to near 2016-levels (£15.8 million) (Table ***13***).

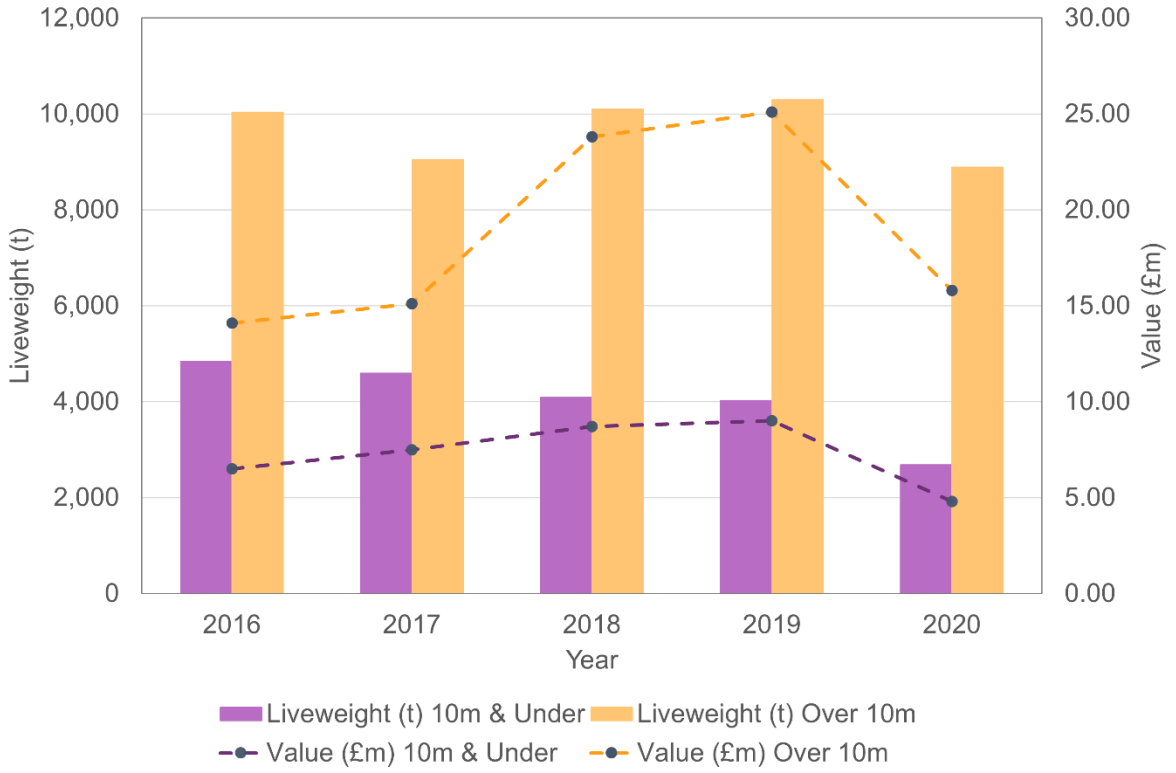


Figure 14: Weight (tonnes) and value (£m) of brown crab landed between 2016 and 2021 by vessel length category, with vessels divided into over 10m and under 10m categories

Table 13: Liveweight (tonnes) of brown crab landed by smaller (10m and under) and larger (over 10m) UK vessels from English waters in 2020.

Length Group	2016	2017	2018	2019	2020
10m & Under	4,843	4,591	4,093	4,024	2,683
Over 10m	10,035	9,050	10,101	10,296	8,892
TOTAL	14,877	13,641	14,194	14,320	11,575

Table 14: Value (£) of brown crab landed by smaller (10m and under) and larger (over 10m) UK vessels in 2020.

Length Group	2016	2017	2018	2019	2020
10m & Under	6.5	7.5	8.7	9.0	4.8
Over 10m	14.1	15.1	23.8	25.1	15.8

Length Group	2016	2017	2018	2019	2020
TOTAL	20.6	22.6	32.5	34.2	20.6

The two vessel size categories included in Figure 14 may each contain a spectrum of vessel lengths, ranging from the smallest under 8m vessels to the largest over 24m vessels. Vessel size categories can therefore be broken down further to investigate the nuanced characteristics of the fleet(s) exploiting brown crab in English wates.

Figure 15 shows that the largest proportion of brown crab landings are made by medium-sized vessels 12.01 - 15.00m in length (36.0%).

The next largest contributors are vessels in smaller (8.01 - 10.00m) and larger (18.01 - 24.00m) size categories, which both contribute similar proportions (19.0% and 17.0% respectively). This contribution is followed by 10.01 - 12.00m vessels (14.0%), 15.01 - 18.00m vessels (8.4%), and vessels 8.00m and under (5.1%). The largest vessels (over 24m) contribute the smallest proportion of crab landings (0.63%) (**Table *15***).

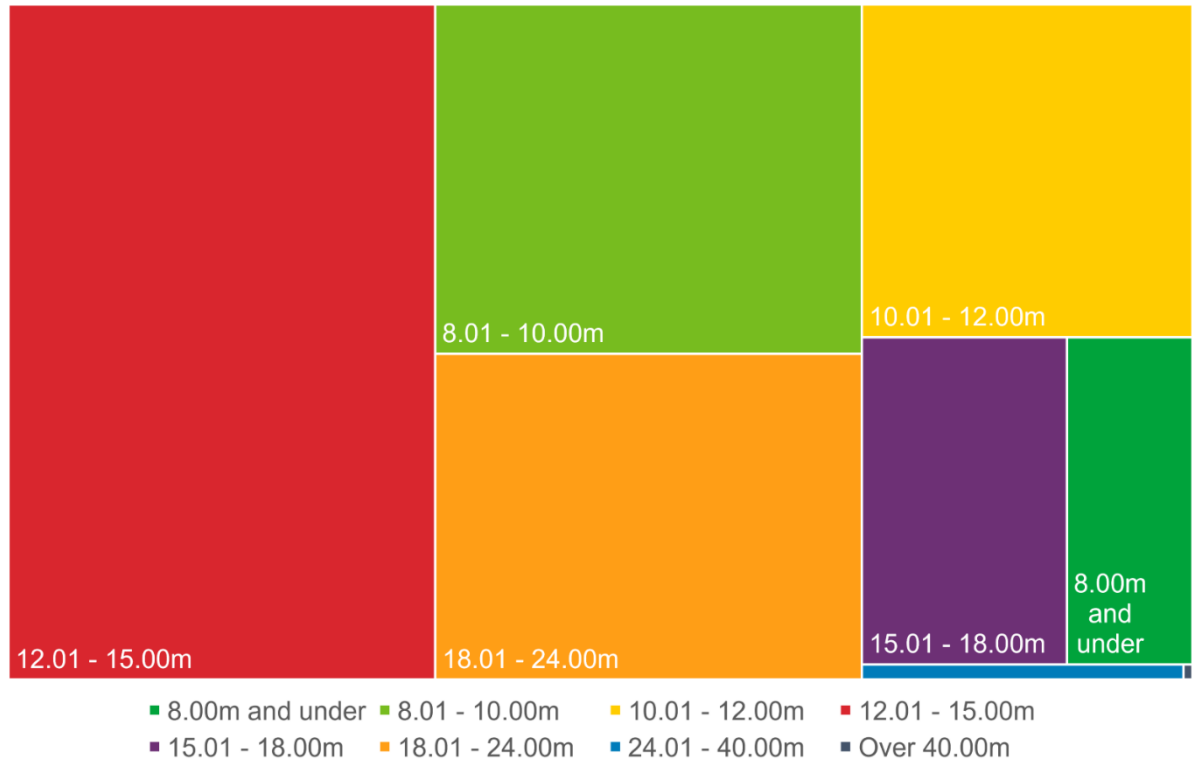


Figure 15: Weight (tonnes) of brown crab landed in 2021 by vessel length category

Table 15: Percentage (% to two significant figures) of brown crab landings by liveweight made by each vessel length category in 2021

Vessel length	Liveweight (tonnes)	%
8.00m and under	599	5.1%
8.01 - 10.00m	2,179	19.0%
10.01 - 12.00m	1,608	14.0%
12.01 - 15.00m	4,211	36.0%
15.01 - 18.00m	981	8.4%
18.01 - 24.00m	2,031	17.0%
24.01 - 40.00m	71	0.61%
Over 40.00m	2	0.02%

Figure 16 shows the spatial distribution of brown crab landings from vessels in different length categories between 2016 and 2021.

At ports where tonnages were lower within this timeframe, smaller vessels under 12m were typically responsible for the majority of landings, however at ports where landings were greater – there tends to be a great variety of vessel length categories contributing to the overall catch (Figure 16).

Landings at different ports are dominated by different length categories. Along the northeast coast of England, there are a number of key crab landing ports where the 12 – 18m length category is responsible for the majority of landings. Around Withernsea, Grimsby, and Hartlepool, larger over 18m vessels dominate (Figure 16).

A similar trend is seen in the southwest, where vessels in the 12 – 18m category are responsible for the majority of tonnages landed at ports where crab landings are highest (Figure 16).

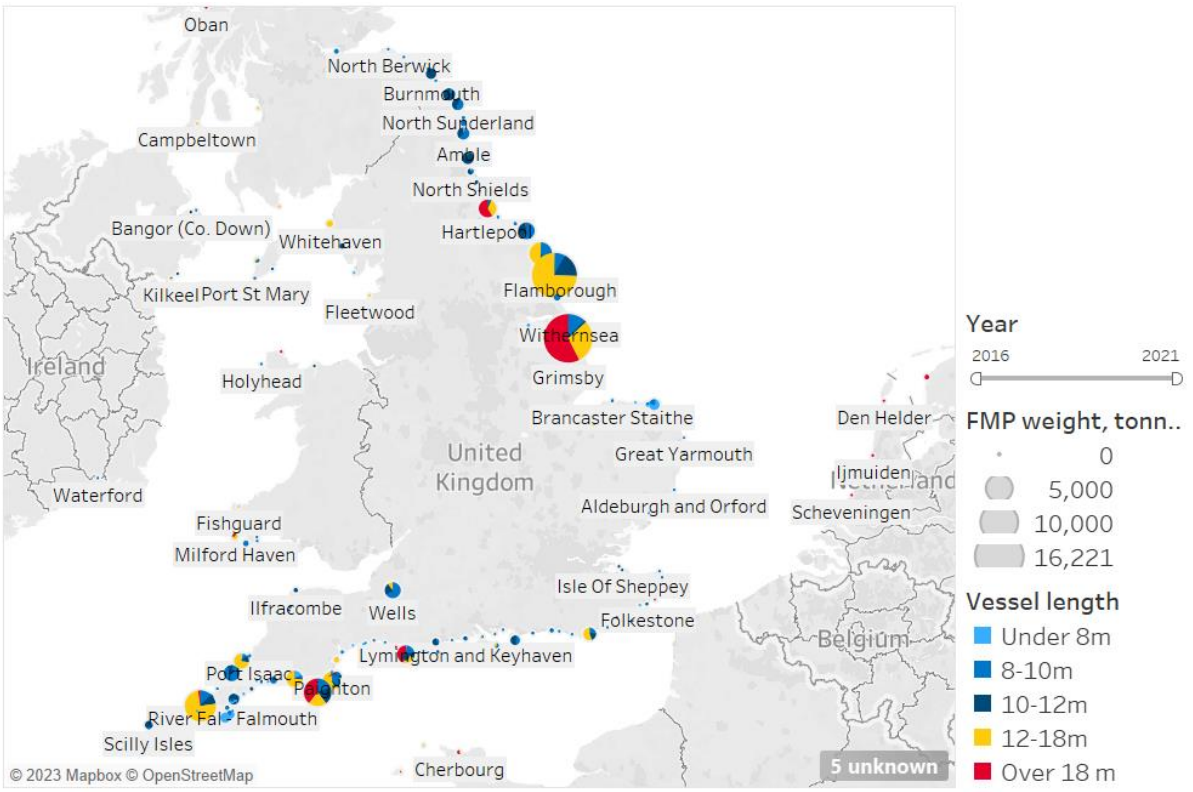


Figure 16: Spatial distribution of UK fishing fleets crab landings from English waters by ports of landings in 2016-2021

Lobster

Figure 17 shows that in all years between 2016 and 2020, vessels 10m and under in length landed more lobster by both volume and value than vessels over 10m.

Landings of smaller under 10m vessels fluctuated annually across this timeframe but showed a general decline from 1,042 tonnes in 2016 to 762 tonnes in 2020. This decline brought the landings of under 10m vessels close to those of over 10m vessels in 2020 (Figure 17). The total value of lobster landed by under 10m vessels remained relatively steady between 2017 and 2019 (fluctuating around £14 million) before falling sharply to £10.1 million in 2020 in line with the fall in landings observed that year (Figure 17).

Between 2016 and 2019, landings of over 10m vessels were relatively stable, in the order of 300 tonnes lower than those of under 10m vessels (Table ***16***). As previously mentioned, landings were similar across both vessel size categories in 2020. The value of over 10m landings was also relatively stable across this timeframe, fluctuating around £10 million (*Table **16***).

Price per landed tonne was generally higher in years when catches were lower (e.g., 2018 and 2019) across both vessel size categories.

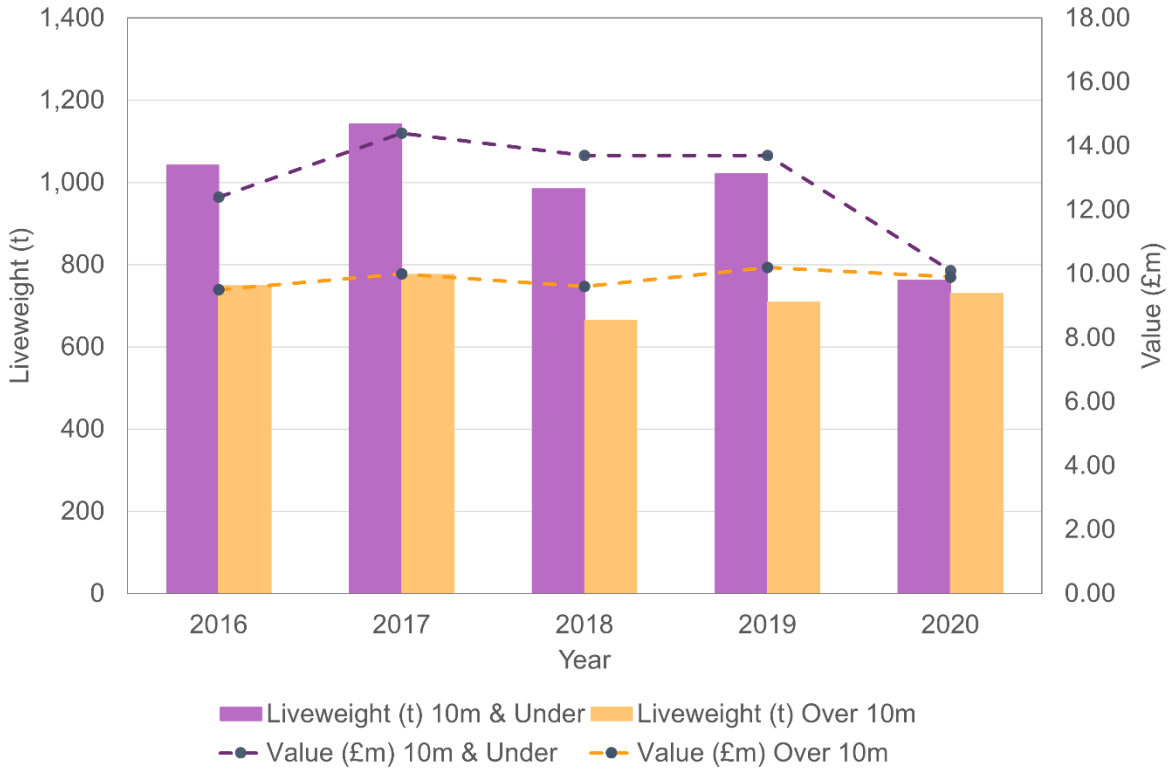


Figure 17: Weight (tonnes) and value (£) of lobster landed between 2016 and 2021 by vessel length category, with vessels divided into over 10m and under 10m categories

Table 16: Liveweight (tonnes) of European lobster landed by smaller (10m and under) and larger (over 10m) UK vessels from English waters in 2020.

Length Group	2016	2017	2018	2019	2020
10m & under	1,042	1,143	985	1,021	762
Over 10m	749	776	664	709	730
TOTAL	1,791	1,919	1,648	1,729	1,492

Table 17: Value (£) of European lobster landed by smaller (10m and under) and larger (over 10m) UK vessels in 2020.

Length Group	2016	2017	2018	2019	2020
10m & under	12.4	14.4	13.7	13.7	10.1
Over 10m	9.5	10.0	9.6	10.2	9.9

Length Group	2016	2017	2018	2019	2020
TOTAL	21.9	24.5	23.2	23.9	20.0

The two vessel size categories included in Figure 17 may each contain a spectrum of vessel lengths, ranging from the smallest under 8m vessels to the largest over 24m vessels. Vessel size categories can therefore be broken down further to investigate the nuanced characteristics of the fleet(s) exploiting lobster in English wates.

Figure 18 shows that the largest proportion of lobster landings are made by small vessels 8.01 - 10.00m in length (39.0%).

The next largest contributors are medium sized vessels in the 12.01 - 15.00m and 10.01 - 12.00m size categories, which both contribute similar proportions (20.0% and 19.0% respectively). This contribution is followed by vessels 8.00m and under (15.0%), 15.01 - 18.00m vessels (4.0%), and 18.01 - 24.00m vessels (2.7%). The largest vessels (over 24m) contribute a very small proportion of crab landings (0.06%) (Table ***18***).

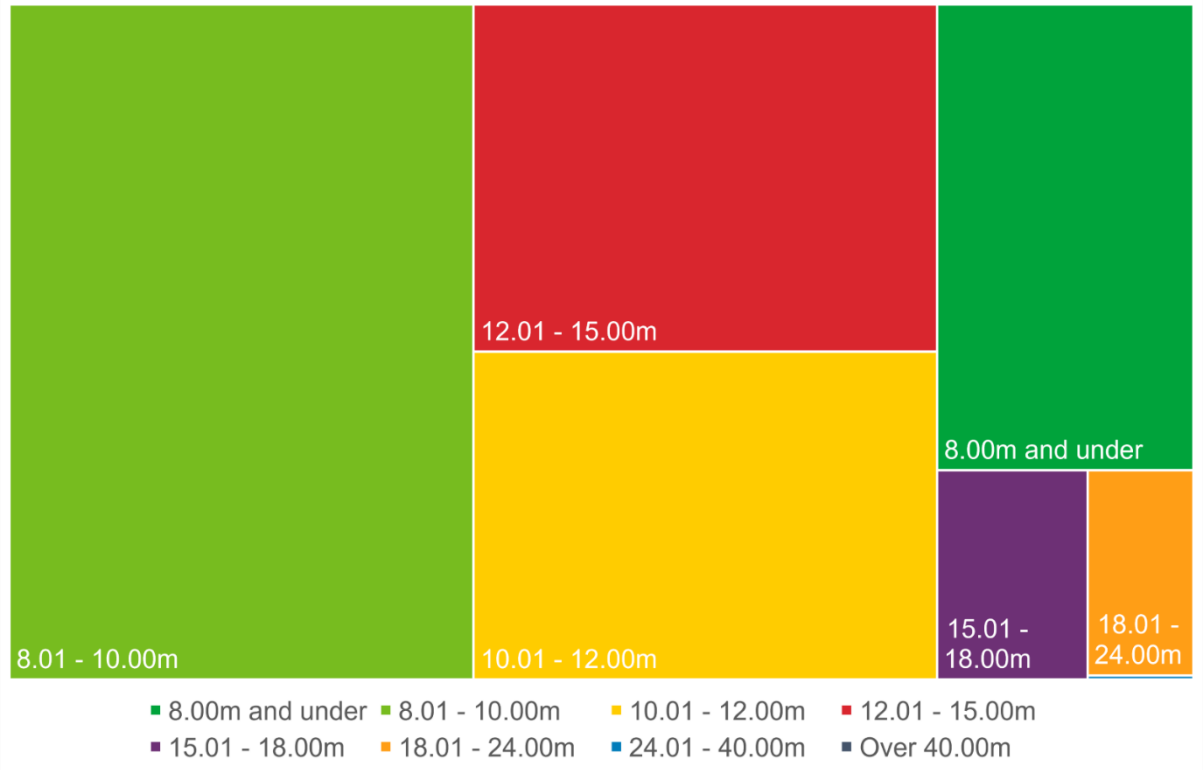


Figure 18: Weight (tonnes) of lobster landed in 2021 by vessel length category

Table 18: Percentage (% to two significant figures) of lobster landings by liveweight made by each vessel length category in 2021 (Table continues overleaf).

Vessel length	Liveweight (tonnes)	%
8.00m and under	265	15.0%
8.01 - 10.00m	695	39.0%
10.01 - 12.00m	337	19.0%
12.01 - 15.00m	357	20.0%
15.01 - 18.00m	70	4.0%
18.01 - 24.00m	48	2.7%
24.01 - 40.00m	1	0.06%
Over 40.00m	0	0.00%

In terms of the spatial distribution of landings from different vessel length categories between 2016 and 2021, similar trends were observed for both brown crab and lobster.

Figure 19 shows that ports where lobster tonnages were lower within this timeframe, smaller vessels under 12m were typically responsible for the majority of landings. At ports where landings were greater – there tends to be a great variety of vessel length categories contributing to the overall catch.

Landings at different ports are dominated by different length categories. Along the northeast coast of England around Flamborough, the 12 – 18m length category is responsible for the majority of landings. A similar trend is seen in the southwest, where vessels in the 12 – 18m category are responsible for the majority of tonnages landed at ports where lobster landings are highest (Figure 19).

Few ports received landings from vessels over 18m in length, with most landings from these larger vessels recorded in the region of Withernsea and Grimsby. Some were also recorded in the southwest (Figure 19).

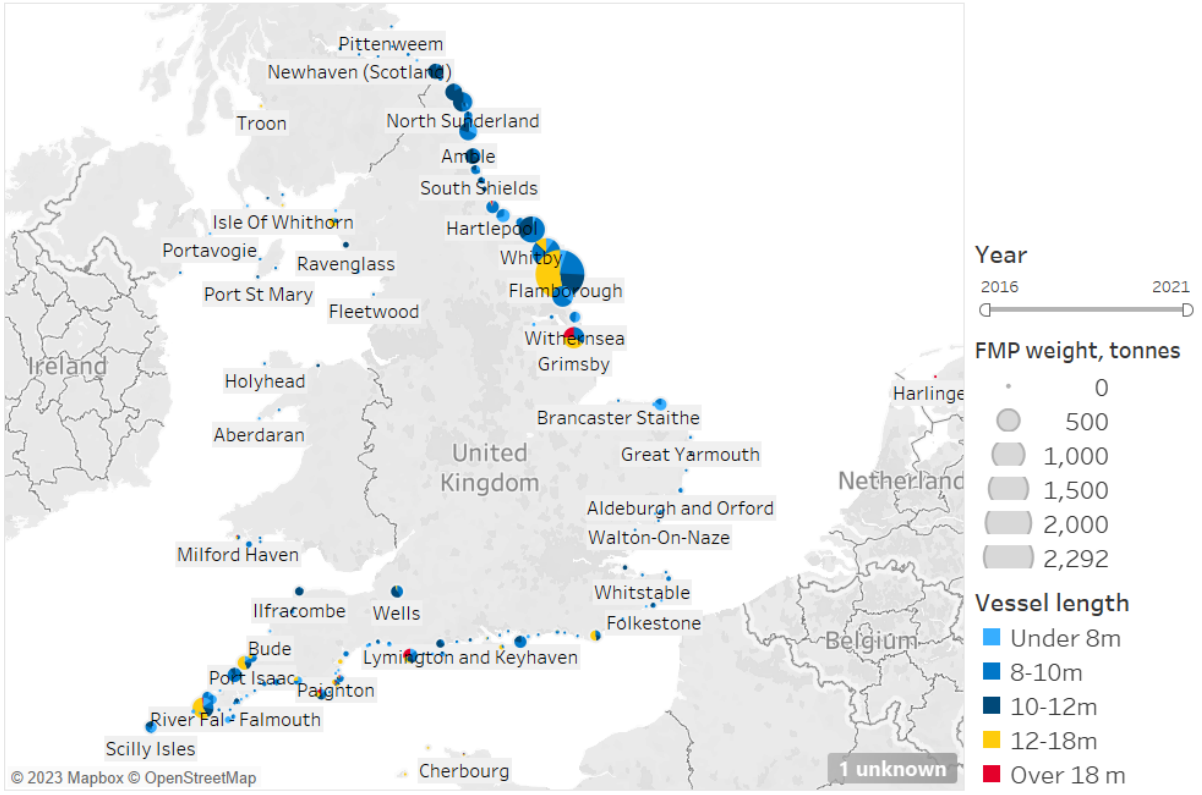


Figure 19: Spatial distribution of UK fishing fleets' lobster landings from English waters by ports of landings in 2016-2021

Seasonality of landings (UK vessels)

Brown crab

Figure 20 shows a steady rise in the volume and value of crab landings across early spring and summer, increasing from around 250 tonnes (around £0.5 million) to 1,750 tonnes (just below £four million) between February and October. A slight dip is observed in September, where landings dropped to just below 1,500 tonnes. Landings decline sharply across the autumn and winter months between October and February.

Value tends to closely track tonnages landed. Value per tonne was relatively high in May, and when tonnages are highest, the value per tonne becomes slightly lower.

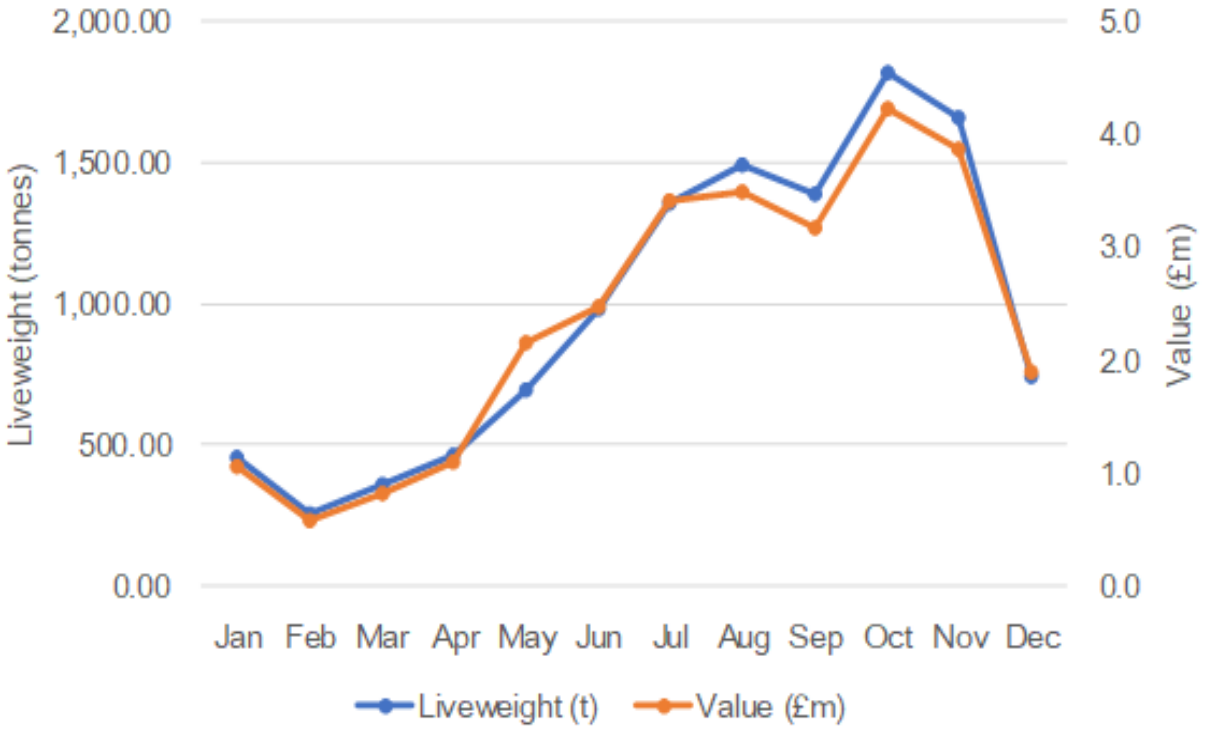
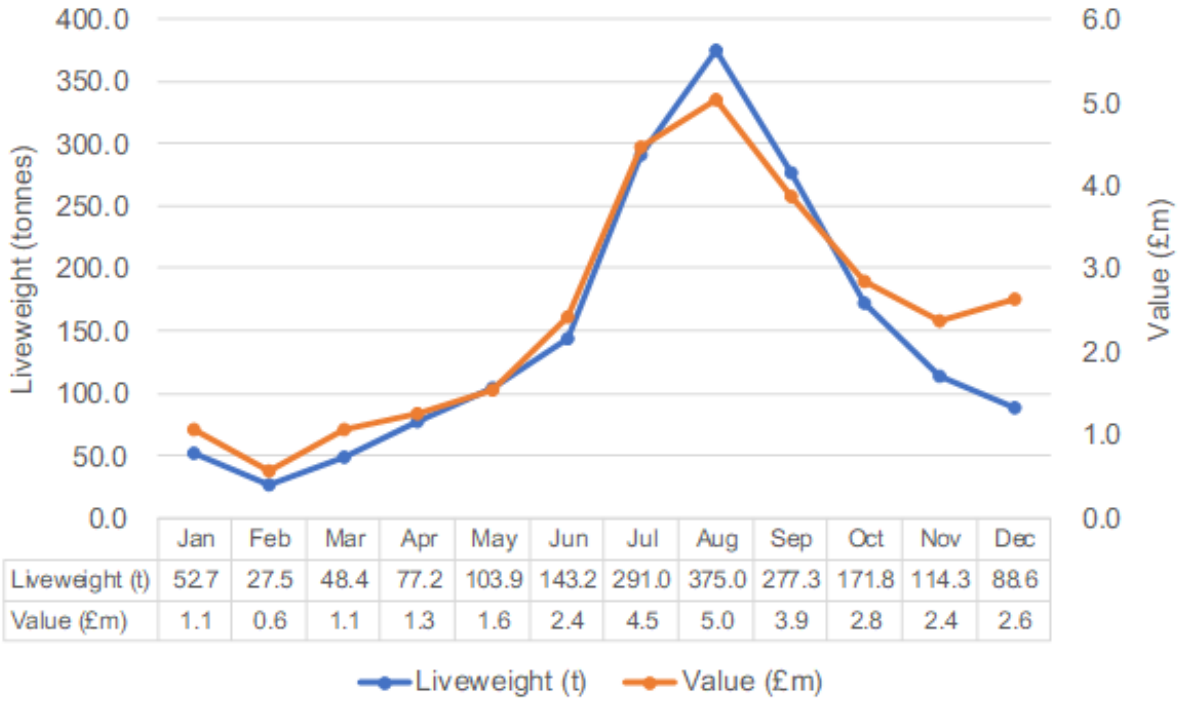


Figure 20: Seasonality of monthly brown crab landings by liveweight (tonnes) and value (£m) throughout 2021

Lobster

Figure 21 shows a steady rise in the volume and value of lobster landings across early spring and summer, increasing from 27.5 tonnes (£0.6 million) to 143.2 tonnes (£2.4 million) between February and June. A steeper increase in landings is then observed between June and August, reaching 375 tonnes at a value of £five million. Landings then decline steadily over early autumn and winter, between August and February.

Value tends to closely track tonnages landed from January to October, with a slightly lower value per tonne when tonnages are highest in August, and vice versa when tonnages are lowest from January to March. In November and December value per tonne increases significantly compared to other months – with the largest differential observed in December likely linked to increased market demand around Christmas.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Liveweight (t)	52.7	27.5	48.4	77.2	103.9	143.2	291.0	375.0	277.3	171.8	114.3	88.6
Value (£m)	1.1	0.6	1.1	1.3	1.6	2.4	4.5	5.0	3.9	2.8	2.4	2.6

Figure 21: Seasonality of monthly lobster landings by liveweight (tonnes) and value (£m) throughout 2021

Landings of data-limited species

Common prawn: Landings of common prawns were the lowest of the four data-limited species, totalling only 28.5 tonnes between 2016 and 2022 at a total value of £0.44m (Figure 22). Landings declined between 2016 and 2018, from 4.2 (worth £0.02m) to 2.6 tonnes (worth £0.04m) (Figure 22). Price per landed weight increased during this time (Figure 22). From 2018 to 2021, landings then increased steadily to 6.7 tonnes (£0.14m), before declining again to 4.3 tonnes (£0.08m) in 2022 (provisional data) (Figure 22). Between 2018 and 2022 price per landed tone remained relatively consistent and value tracked landed volumes (Figure 22).

Velvet crab: A total of 578.5 tonnes of velvet crab were landed between 2016 and 2022, with a total value of £1.03m (Figure 22). Between 2016 and 2018, velvet crab landings fluctuated within a range of 80.2 (£0.13m) and 61.5 tonnes (£0.13m). Within this timeframe, price per landed tonne was highest in 2018 when landings were lowest (Figure 22). Between 2018 and 2019, landings increased significantly to 121.7 tonnes, before falling again in 2020 back to 63.0 tonnes (£0.12m). From 2020 to 2022 landings then increased again, reaching 114.2 tonnes (£0.19m) (provisional data) (Figure 22). Velvet crabs commanded a relatively low price per landed tonne in comparison to the other three data-limited species included here (Figure 22).

Crawfish: A total of 166.4 tonnes on crawfish were landed between 2016 and 2022, with a total value of £4.22m (Figure 22). Crawfish commanded the highest price per landed tonne of all of the four data-limited species included here (Figure 22). Landings remained relatively steady between 2016 and 2019, fluctuating between 12.3 tonnes in 2018 (£0.33m) to 13.9 tonnes in 2019 (£0.37m). From 2019 to 2022, landings almost quadrupled – increasing to a high of 53.3 tonnes in 2022 (£1.3m). Value of the catch tracked this increasing trend in landings (Figure 22).

Spider crab: Spider crab showed the lowest price per landed tonne of the four data-limited species, yet the highest tonnages were landed (total of 2093.3 tonnes between 2016 and 2022, at a total value of £2.24m) (Figure 22, Figure 23). Landings increased between 2016 and 2019, from 222.7 tonnes (£0.23m) to 395.6 tonnes (£0.47m), before declining notably in 2020 – to 225.5 tonnes (£0.21m). Landings then recovered in 2021, reaching 340.8 tonnes (£0.34m), and dropped slightly again in 2022 to 311.4 tonnes (£0.30m) (Figure 22). Value of the catch tracked these fluctuations in landings trends, and price per landed tonne remained relatively consistent (Figure 23).

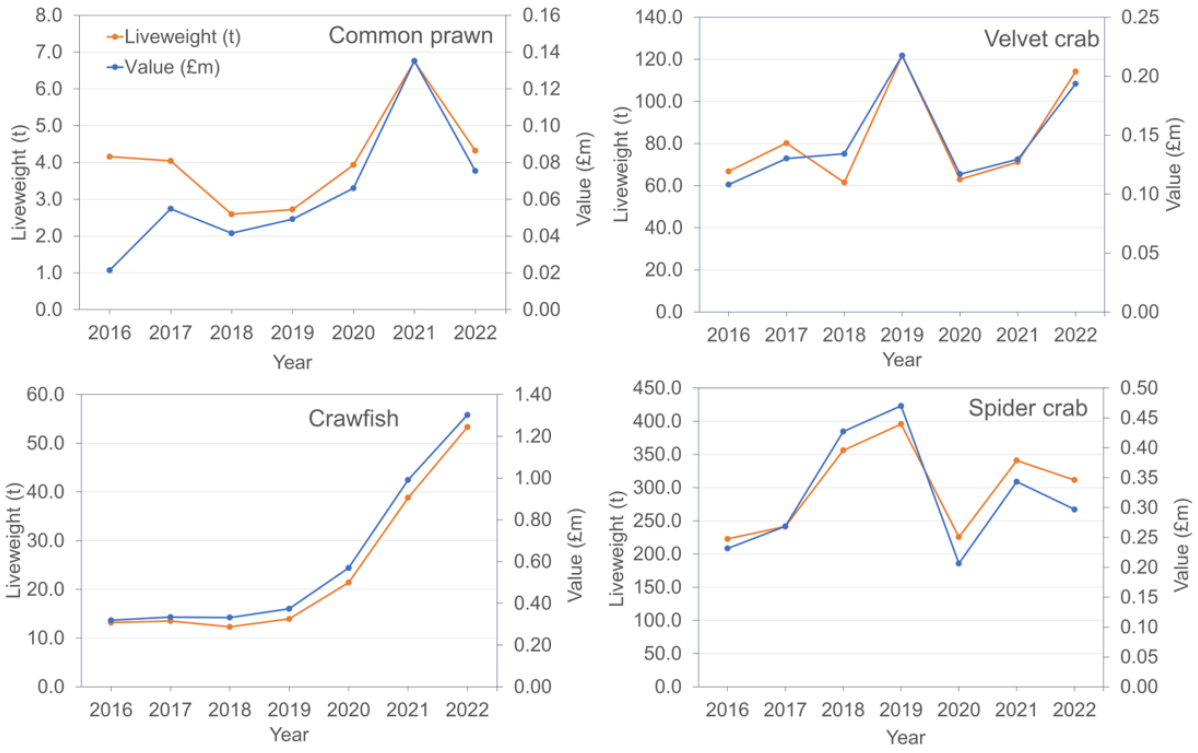


Figure 22: Landings of data-limited species under the Crab and Lobster FMP. Top left: Common prawn (Palaemon serratus), Top right: Crawfish (Palinurus elephas), Bottom left: Velvet crab (Necora puber), and Bottom right: Spider crab (Maja spp.). Landings data are sourced from MMO published datasets (accessed April 2023). It is worth noting that 2022 landings data is provisional until at this time. Note also the different scaling of y axes. The data extract covers all vessels landing into English

ports – this has been used as a proxy to represent landings within scope of the English FMP.

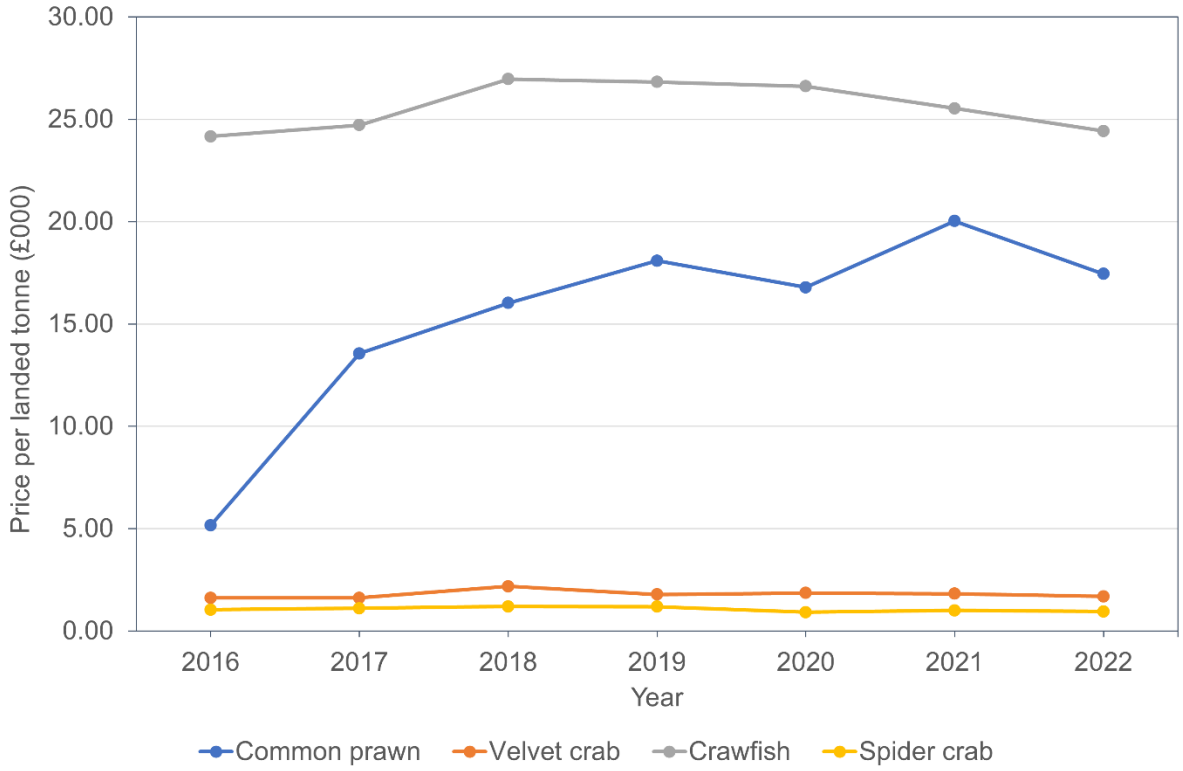


Figure 23: Price (£000) per landed tonne of data-limited species under the Crab and Lobster FMP: Common prawn (Palaemon serratus), Crawfish (Palinurus elephas), Velvet crab (Necora puber), and Spider crab (Maja spp.). Landings data are sourced from MMO published datasets (accessed April 2023). It is worth noting that 2022 landings data is provisional until at this time. The data extract covers all vessels landing into English ports – this has been used as a proxy to represent landings within scope of the English FMP.

Gear types used to catch crab and lobster (UK vessels)

The scope and methodologies applied for MMO and Seafish data extraction applied in this document can be found at the beginning of this document.

Two main shapes of trap are used to target brown crabs: the inkwell-shaped trap with a plastic funnel entrance (Figure 24), and a standard D-shaped trap with entrances on either side or on top (Figure 25). Inkwell traps and D-shaped traps with parlour sections (separate sections designed to retain catch) are both popular with larger vessels. Large vessels on the east coast of England in particular show

preference for D-shaped traps with parlour sections. However, different traps are favoured by each fisherman across different areas of the UK

Figure 24: An inkwell-shaped trap with an open top entrance (Seafish, 2023)

The D-shaped trap with two entrances (Figure ***25***) is favoured by lobster fishermen, however lobsters may also be caught as valuable bycatch in inkwell-style pots in crab fisheries (Figure ***24***). Brown crab and European lobster are generally targeted, with velvet crabs, spider crabs and crawfish mostly caught and landed as bycatch species.

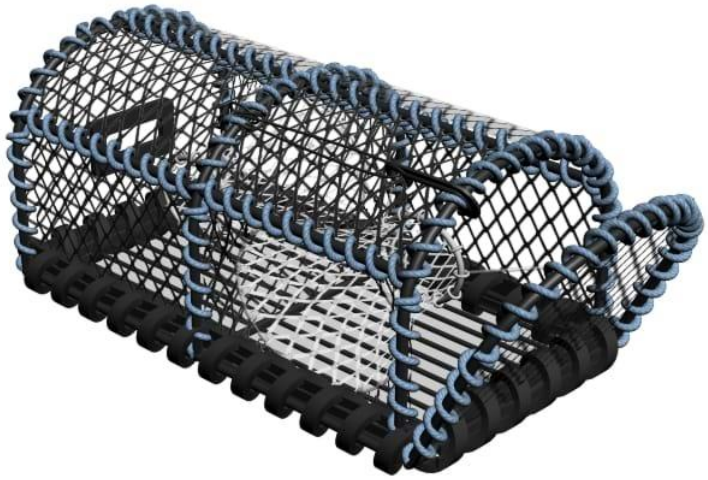


Figure 25: D-shaped creel with two entrances on either side (Seafish, 2023)

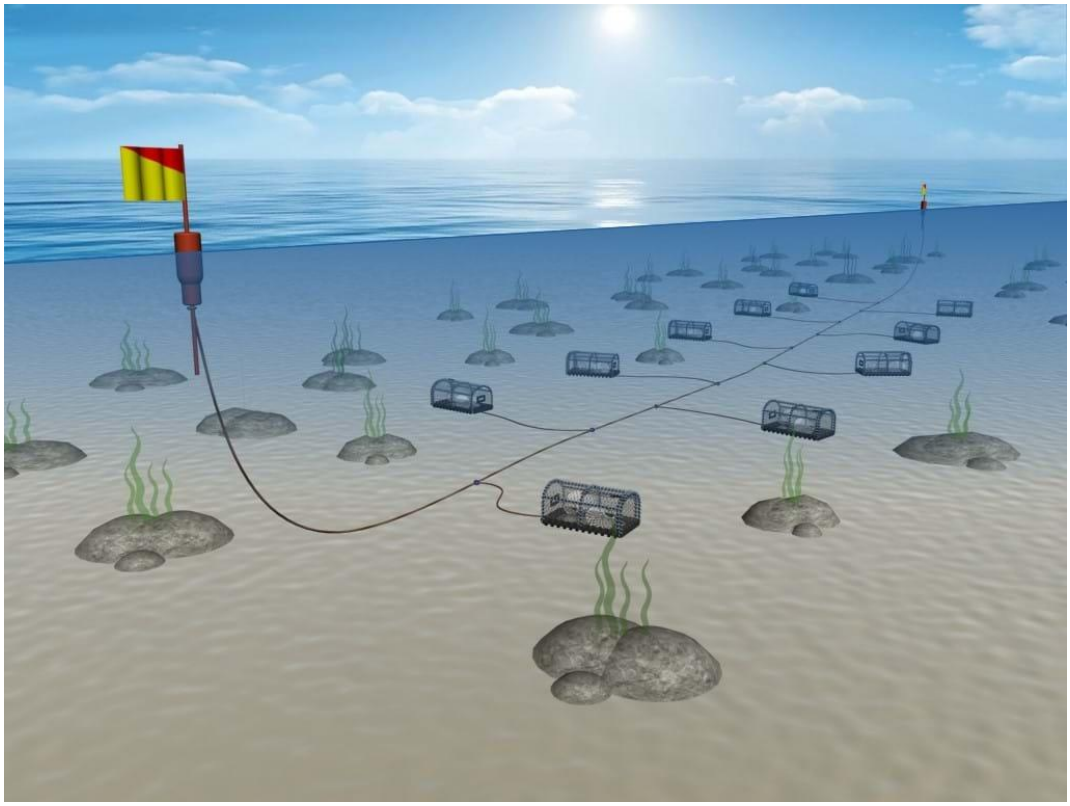


Figure 26: A fleet of creels deployed on the seabed (Seafish, 2023)

Brown crab

Table 19 shows that across all years from 2016 to 2021, catches from pots and traps made up over 97% of brown crab landings. MMO datasets also show a small volume of brown crab bycatch in drift or fixed nets, beam trawl, otter trawl, dredges, gears using hooks, and demersal trawls – the majority of which is recorded off the southwest coast of England (Figure 27).

Table 19: Brown crab landings in England by fishing gear used, between 2016 and 2021

Gear Category	2016	2017	2018	2019	2020	2021
Pots and traps	14,538	13,328	13,849	13,985	11,286	11,488
Drift and fixed nets	207	171	177	186	169	64
Beam trawl	87	94	96	105	74	77
Otter trawl	35	42	30	32	44	-
Dredge	3	6	7	7	1	0
Gears using hooks	8	0	35	4	2	-
Demersal trawls	-	-	-	-	-	50

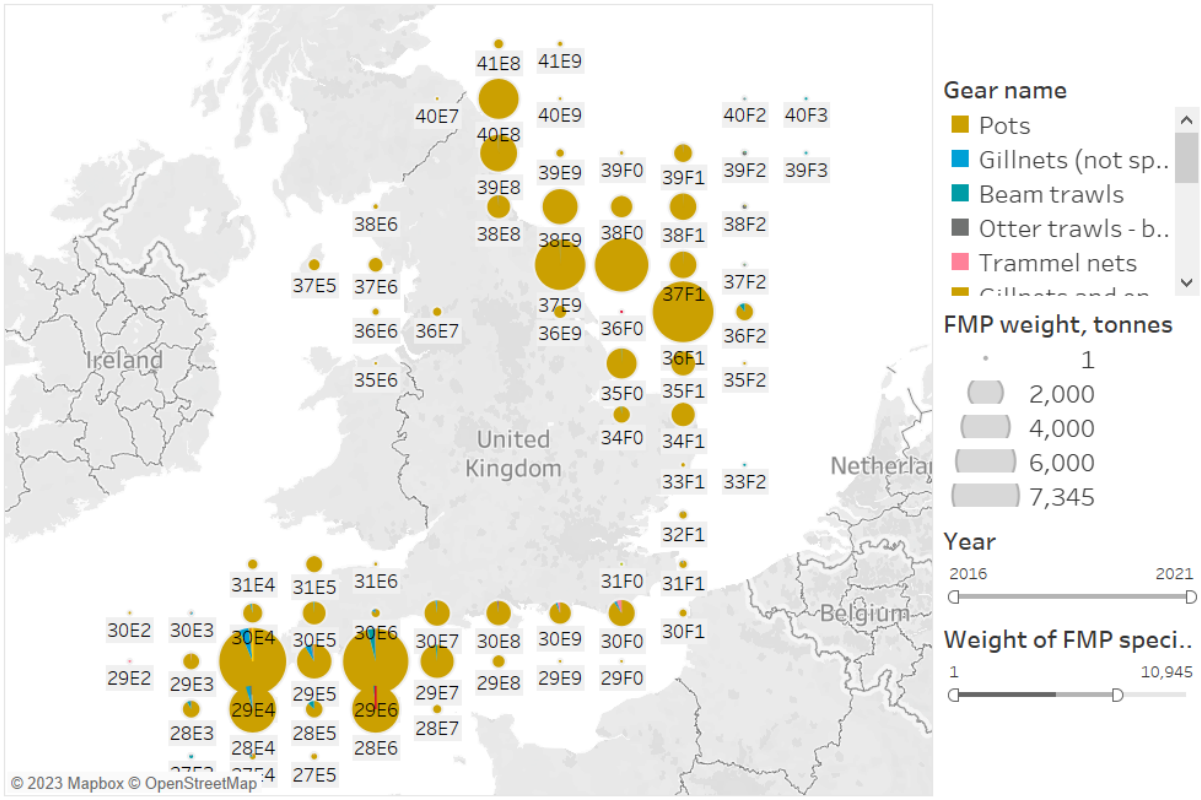


Figure 27: Spatial distribution of the UK fishing fleets crab landings by ICES rectangle, showing gears used in English waters between 2016 and 2021

Lobster

Table 20 shows that across all years from 2016 to 2021, catches from pots and traps made up around 98% of lobster landings. MMO datasets also show a small volume of lobster bycatch in drift and fixed nets, beam trawl, otter trawl, gears using hooks, and demersal trawls – the majority of which is recorded off the southwest coast of England (Figure 28).

Table 20: Lobster landings in England by fishing gear used between 2016-2021

Gear Category	2016	2017	2018	2019	2020	2021
Pots and traps	1,751	1,879	1,613	1,697	1,467	1,751
Drift and fixed nets	30	28	22	22	15	12
Otter trawl	6	10	5	5	6	-
Beam trawl	4	2	3	3	3	2

Gears using hooks	1	0	6	2	1	-
Demersal trawls	-	-	-	-	-	6

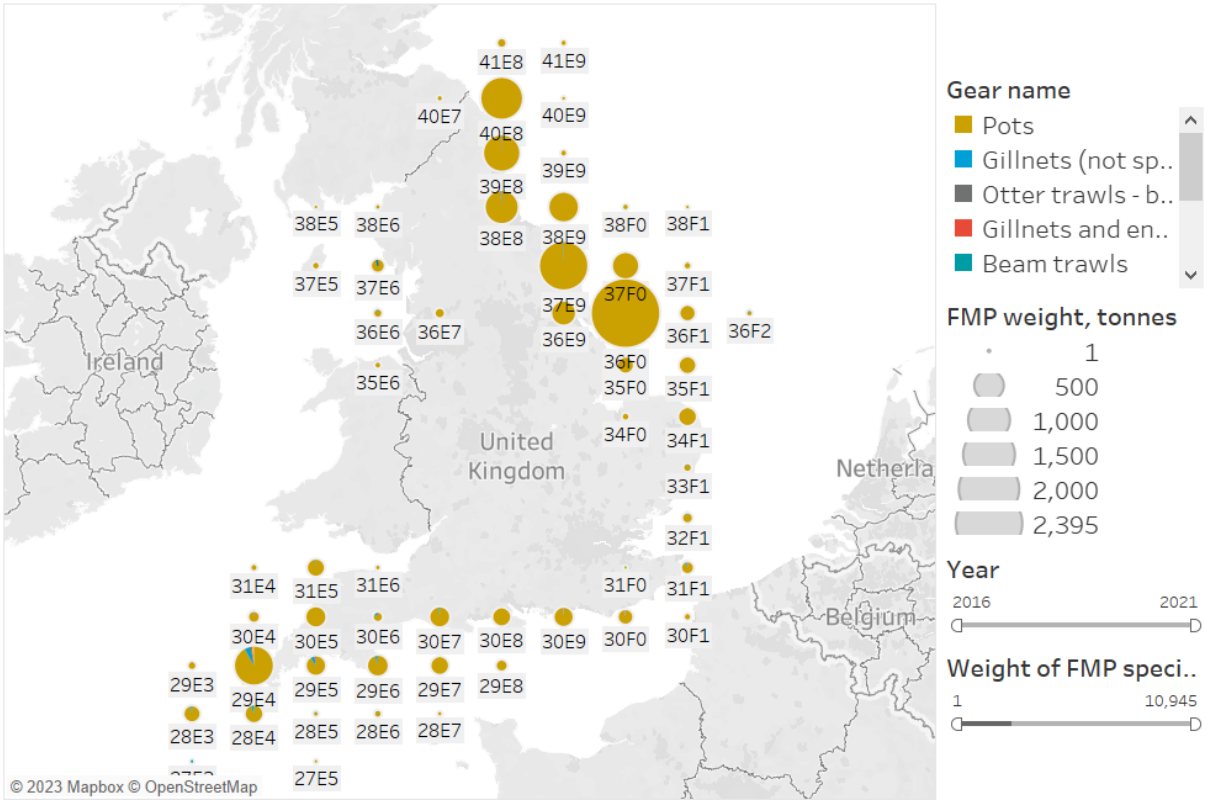


Figure 28: Spatial distribution of UK fishing fleets' lobster landings by ICES rectangle, showing gears used in English waters between 2016 and 2021

Data-limited species

Spider crab: a main target species for tangle net fisheries that are also caught and landed as bycatch by both mobile and static gear vessels.

Velvet crabs: caught in the inshore creel fishery alongside crab and lobster. Few fishermen fish solely for them, especially in English waters. They are caught almost entirely in pots and traps, predominantly by <10m vessels.

Crawfish: Roughly 40% of landings are made using pots and traps, with the remaining landings predominantly caught using tangle nets. Landings by vessels over and under 10m in length are relatively similar.

Common Prawn: generally, a targeted fishery by largely <10m pots and traps vessels. They are fished most intensely from November to February using pots

baited largely with herring. The largest landing sites are Exmouth and along the River Dart, with significant landings also at Paignton and Lyme Regis.

Key recreational fisheries

Brown crab

Recreational fisheries for crab are widespread throughout the UK, the majority of which are inshore vessels fishing seasonally. Hand diving/shore gathering catch and effort is considered low and opportunistic. Diving byelaws include bag limits.

Recreational catch of crabs has been reported by fishers using handlines and rod and lines, although the majority of recreational crab catches are through pot fishing activities. Recreational pot fishing activities are licensed within some IFCA districts, with some licences containing catch reporting requirements. Catch and effort estimates are provided by the relevant IFCAs. Regional IFCA byelaws include technical measures to manage recreational fishing (for example, minimum landing size); these are only applicable within the IFCA's areas of jurisdiction.

IFCAs have provided information on the number of recreational permits they issue for crab and in some cases other shellfish species. This information is provided below, and additional data can be obtained from the AIFCA.

Isles of Scilly IFCA

Approximately 150 people, mostly to local fishers (10% visitors), are granted a permit for recreational fishing. In terms of number of pots and effort, crab and lobster contribute to approximately 5%-10% total pot numbers throughout a restricted part of the permitted season. There is no information on numbers of commercial pots within the district, but the IFCA records numbers of recreational pots.

Northumberland IFCA

There are approximately 250 recreational permits issued for the Northumberland IFCA district per year. Activity is spread throughout the district, but fishers will target rocky intertidal or infralittoral habitats to set pots. The majority of permit holders fish from the shore with some setting pots from vessels. The main target species for this fishery is European lobster, while there are limits on other species that may be caught, including brown crab, the taking of any other species is limited.

Devon and Severn IFCA

Category Two – recreational permits are issued to recreational fishers under the Potting, Diving and Netting Permit Byelaws. There is a significant recreational pot

fishery within the district with 509 permits issued in 2022. Recreational permit restrictions exist and include gear and catch restrictions.

Recreational removal of crustacea tends to take place close to shore across the district. Some recreational removal of lobsters, through the method of hooking, takes place in North Devon.

North Eastern IFCA

There is a significant recreational fishery with ca. 2,500 permits issued. The permit allows recreational capture of lobster, brown crab, velvet crab and whelk. The permit limits recreational fishers to 10 pots or 100 metres of nets to fish for daily catch limits. Daily catch limits are restricted to two lobsters, 10 crab (total for both crab species), and 30 whelks. Additional technical measures applicable to recreational fishing are in place.

Lobster

Recreational fisheries for lobster are widespread throughout the UK, the majority of which are inshore vessels fishing seasonally. Hand diving/shore gathering catch and effort is considered low and opportunistic. Diving byelaws include bag limits.

Recreational catch of lobster has been reported by fishers using handlines and rod and lines, although the majority of recreational lobster catches are through pot fishing activities. All pot fishing activities, including recreational fishing, are licensed within all IFCA regions, with some licences containing catch reporting requirements. Catch and effort estimates are provided by the relevant IFCAs. Regional IFCA byelaws include technical measures to recreational fishing (for example minimum landing size), not applicable at national level.

IFCAs have provided information on the number of recreational permits they issue for lobster fishing and in some cases other shellfish species:

Isles of Scilly IFCA

Approximately 150 people, mostly local fishers (10% visitors), are granted a permit for recreational fishing. In terms of number of pots and effort, crab and lobster contribute to approximately 5%-10% total pot numbers throughout a restricted part of the permitted season. There is no information on numbers of commercial pots within the district, but the IFCA records numbers of recreational pots.

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Stock assessment

This section describes the current methodologies utilised to assess brown crab and European lobster stocks in English waters, and the current understanding of stock status for each species within the area covered by the FMP.

Stock boundaries

Brown crab

There are five Crab Fishery Units (CFU) that have been defined for England (Figure 29). 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.

The five Crab Fishery Units (CFU) that have been defined within English waters:

- Central North Sea
- Southern North Sea
- Eastern English Channel
- Western English Channel
- Celtic Sea

Assessments are not carried out for one additional region, the Irish Sea, due to low level of fishing effort and landings here. Some IFCAs produce assessments of brown crabs within their districts, which extend to six nautical miles off the coast. Stock boundaries for brown 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.

Lobster

There are six Lobster Fishery Units (LFU) that have been defined for England (Figure 30). These units have been based upon the distribution of the fisheries, hydrographic conditions and what is known of larval distributions and development. Each LFU encompasses waters covered by international, national, and local legislation which may be different within each region.

The six Lobster Fishery Units (LFU) that have been defined within English waters:

- Northwest
- Northumberland and Durham
- Yorkshire Humber
- East Anglia
- Southeast South Coast
- Southwest

These are based on geographically defined areas where lobster fisheries occur. Assessments are not carried out for the Northwest LFU, due to low level of fishing effort and landings from this region. Some IFCAs conduct assessments of lobsters within their districts, extending to six nautical miles off the coast.

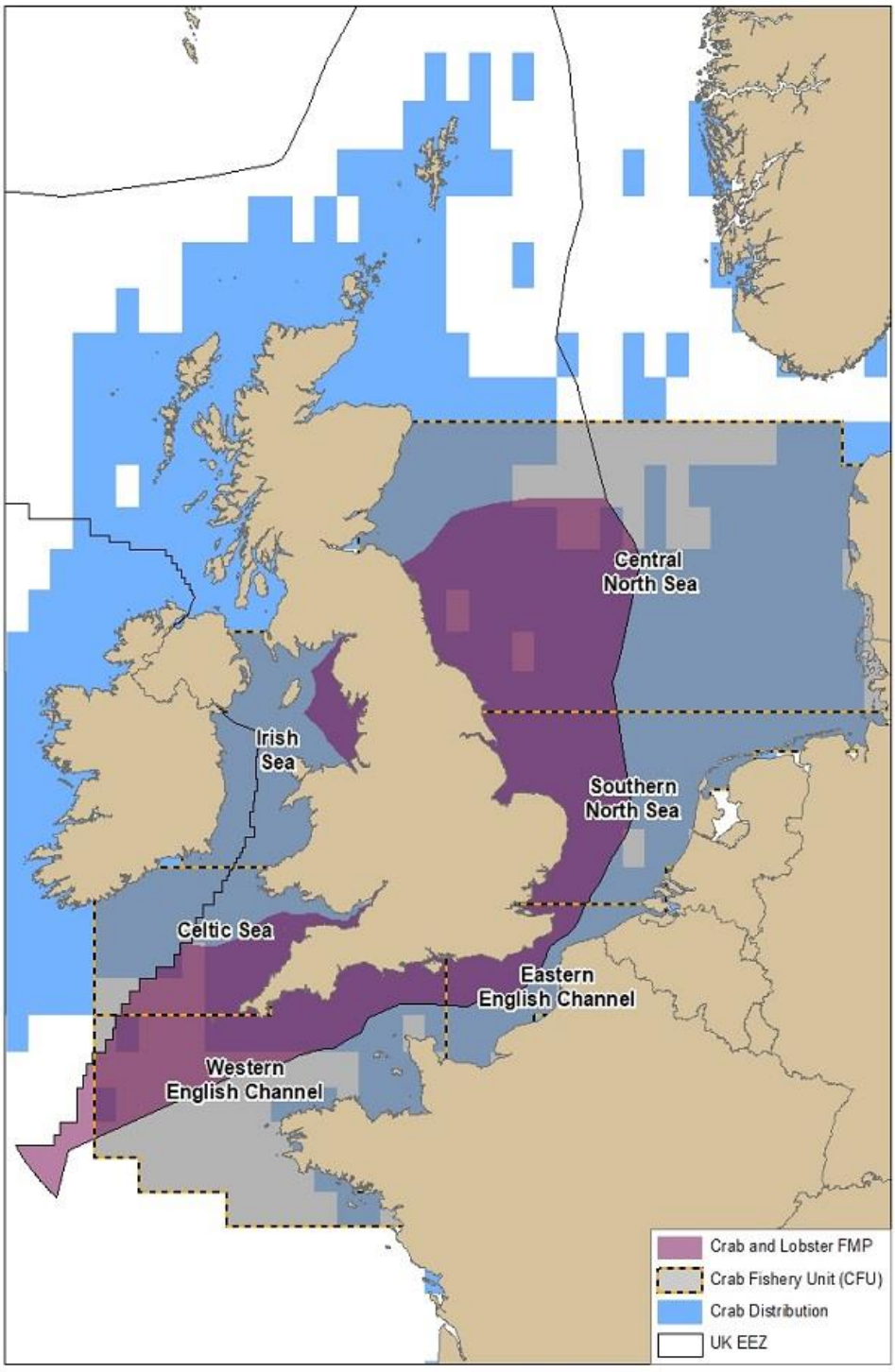

Figure 29: Map showing the Crab Fishery Units (CFU) in relation to the recorded distribution of brown crab around the British Isles, based on data supplied by the Ocean Biodiversity Information System (OBIS), and accessed from the Marine Life Information Network (MarLIN; https://www.marlin.ac.uk/). Shaded area highlights the geographical area covered by the Crab and Lobster FMP. The map is represented using the WGS 1984 Web Mercator Auxiliary Sphere coordinate system (EPSG: 3857).

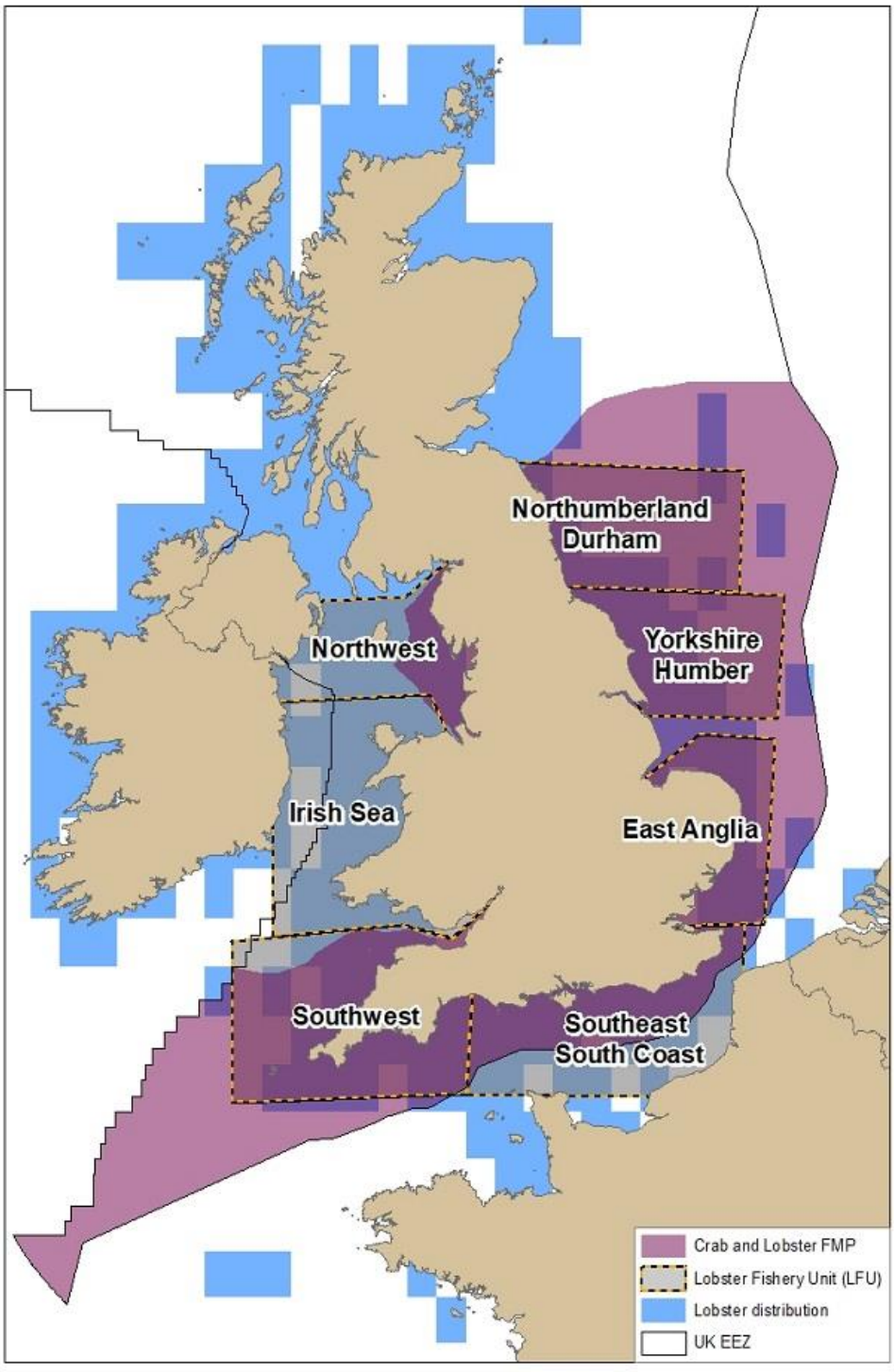

Figure 30: Map showing the Lobster Fishery Units (LFU) in relation to the recorded distribution of European Lobster around the British Isles, based on data supplied by the Ocean Biodiversity Information System (OBIS), and accessed from the Marine Life Information Network (MarLIN; https://www.marlin.ac.uk/). Shaded area highlights the geographical area covered by the Crab and Lobster FMP. The map is represented using the WGS 1984 Web Mercator Auxiliary Sphere coordinate system (EPSG: 3857).

Current assessment methodology

Both brown crab and European lobster stock assessments conducted by Cefas are based on a length cohort analysis (LCA) approach. The LCA examines the change in shape of the length-frequency (numbers of crabs at a given length) between years. This method uses the size distribution of landings from ports from each assessment area averaged over the last three years.

Parameters used in the assessment model include growth data from historical tagging studies, and maturity and egg numbers at size from regional sampling programmes[54].Natural mortality (M) is a key parameter in the assessment model and is assumed to be 20% for crab in current assessments[55], and 15% for European lobster[56].

A limitation of the length-based models is that the population is at equilibrium, meaning exploitation and year-class strength (the number of hatched larvae in a year[57]) are assumed to be constant over time[58]. It is also assumed that the population is closed with no migration or significant changes in population structure over time. However, this assumption is necessary to be able to associate the decreasing cohort numbers-at-age with natural and fishing mortality, rather than migration.

Reference points are produced alongside time series of spawning stock biomass and fishing mortality as a benchmark to determine whether current management is effective, and whether estimates of biomass and fishing rates are above, at, or below these points. Due to the difficulties in determining age of brown crab and European lobster, a proxy for Maximum Sustainable Yield (MSY) of 35% virgin spawner-per-recruit (VSpR) (F35%SpR) is used as a target. Losses to the cohort are then due to

54 Bannister, R.C.A. (2019). On the management of brown crab fisheries. Shellfish Association of Great Britain.

55 Johnson, K.F., Monnahan, C.C., McGilliard, C.R., Vert-pre, K.A., Anderson, S.C., Cunningham, C.J., Hurtado-Ferro, F., Licandeo, R.R., Muradian, M.L., Szuwalski, C.D., Valero, J.L., Whitten, A.R., and Punt, A.E. (2015). Time-varying natural mortality in fisheries stock assessment models: identifying a default approach, ICES Journal of Marine Science, 72: 137-150

56 Sheehy, M.R.J., Bannister, R.C.A., Wickins, J.F. and Shelton, P.M.J. (1999). New perspectives on the growth and longevity of the European lobster (Homarus gammarus), Canadian Journal of Fisheries and Aquaculture Science, 56: 1904-1915.

57 Thanassekos, S., Latour, R.J., and Fabrizio, M.C. (2016). An individual-based approach to year-class strength estimation, ICES Journal of Marine Science, 73: 2252-2266.

58 Zhang, C.I. and Megrey, B.A. (2010). A simple biomass-based length-cohort analysis for estimating biomass and fishing mortality, Transactions of the American Fisheries Society, 139: 911-924.

natural mortality, which includes any surrounding environmental factors and predation.

A spawner-per-recruit model simulates an ensemble of scenarios for a range of fishing mortalities, starting with zero (the virgin stock). For each scenario of increasing fishing mortality, the SpR ratio is determined and compared with VSpR. That scenario is then selected as the MSY proxy (or target) reference point that results in SpR = 35% VSpR. A limit reference point of 15% SpR is used, based on the ICES methodology for data-limited stocks. The target fishing mortality consistent with achieving MSY (F_{MSY})[59] reference point of 35% SpR is considered biologically sustainable for many stocks and relates to the proportion of the stock that reach maturity relative to the unfished number of recruits.

Summary of stock assessment(s)

Table 21 details the exploitation of crab and lobster stocks across CFUs and LFUs as of 2017 and 2019. Exploitation rate was categorised as High in the Southern North Sea CFU, where exploitation was above the maximum reference point limit for both sexes. A further three CFUs – Central North Sea, Western English Channel, and Celtic Sea – were recorded at Moderate rates. In the Eastern English Channel, exploitation rate was unknown.

Three LFUs – Northumberland and Durham, Yorkshire Humber, and East Anglia – were categorised as High due to exploitation rates being at or above maximum reference points for both sexes. The Southeast South Coast and Southwest were both categorised as Moderate.

Table 21: Exploitation rate of crabs (C. pagurus) and lobster (H. gammarus) stocks across each of the CFUs and LFUs from the latest Cefas stock status reports (published in 2019 and 2017). The status of some English crab and lobster stocks are currently unknown due to insufficient data to carry out a length-based assessment. It should be noted that the 2017 Cefas stock status report for lobster provides information for stock status in 2016.

Region	Exploitation rate 2017	Exploitation rate 2019
Crab Fishery Units		
Central North Sea	**Moderate.** Below maximum reference point limit for females, males close to limit	**Moderate.** Below maximum reference point limit for females, males are at the limit

59 https://www.ices.dk/community/Documents/Advice/Acronyms_and_terminology.pdf

Region	Exploitation rate 2017	Exploitation rate 2019
Southern North Sea	**High.** Around the maximum reference point limit for both females and males	**High.** Above the maximum reference point limit for males and females
Eastern English Channel	Unknown	Unknown
Western English Channel	**Moderate.** At a level required to achieve MSY for both males and females.	**Moderate.** Around target level required to achieve MSY for females
Celtic Sea	**Moderate.** Around level generating Maximum Sustainable Yield	**Moderate.** Close to target level generating Maximum Sustainable Yield
Lobster Fishery Units		
Northumberland and Durham	**Very high.** Beyond maximum reference point limit	**High.** Around maximum reference point limit for males, above for females
Yorkshire Humber	**Very high.** Beyond maximum reference point limit	**High.** Above the maximum reference point limit for both males and females
East Anglia	Unknown	**High.** Above minimum reference point for males and female.
Southeast South Coast	**High.** Above rates consistent with MSY but below maximum reference point limit	**Moderate.** Above rates consistent with MSY but below maximum reference point limit for males and females
Southwest	**Moderate.** Above rates consistent with MSY but below maximum reference point limit. Stable or	**Moderate.** Above rates consistent with MSY but below maximum reference

Region	Exploitation rate 2017	Exploitation rate 2019
	decreasing over the past 3 years	point limit for males and females

Brown crab

The latest assessment of brown crab showed exploitation levels in the Central North Sea are high on males and moderate on females and, although likely to be sustainable, is above the level required for MSY. The estimates of spawning stock biomass (SSB) are at or close to target level for both sexes. Anecdotal information, gathered through both members of the Crab & Lobster Management Group (CMG) and in dedicated crab and lobster FMP stakeholder engagement events, 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.

Exploitation level in the Southern North Sea is high for both sexes and, although stable, is above the level required for Maximum Sustainable Yield. The biomass level is between the reference target and limit, increasing in recent years for both sexes. As in the Central North Sea, anecdotal information suggests a recent expansion of fishing activity in both pot numbers and distribution. The spawning stock status should therefore be treated with caution.

Biomass and exploitation levels are not available for the Eastern Channel as 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 <10m fleet.

Status of the Western Channel stock is moderate for females, with exploitation levels and SSB close to the target reference point, although SSB has been declining in recent years. There is insufficient data on male crabs to undertake an assessment on this portion of the stock as it is a female dominated fishery and landings of males are low.

Levels of Exploitation and SSB in the Celtic Sea are moderate for females but above the target MSY level. Exploitation has increased and SSB decreased slightly in recent years. There is insufficient data on male crabs to undertake an assessment in this assessment unit as it is a female dominated fishery and landings of males are low.

No assessment outputs were published in the assessments for the Eastern English Channel in 2019 due to insufficient data.

Lobster

The latest assessment of lobster shows the exploitation status of the stock in Northumberland & Durham is high, at the limit reference point for males and above for females, although there is a decreasing trend for exploitation on males since 2012 (Cefas, 2020). Spawning stock biomass (SSB) level is low, around or below the minimum reference point limit.

The exploitation status of the stock in Yorkshire is above the MSY target for both sexes. Fishing pressure is particularly high on animals around the Minimum Landing Size (MLS). The biomass level of both sexes is close to the minimum reference point limit but is stable for females.

The exploitation level of the stock in East Anglia is high, above the maximum reference point limit for both sexes, although decreasing since 2017. Fishing pressure is particularly high around the MLS. The SSB level of both sexes is low, below the minimum reference point limit.

Southeast South Coast stock status level is moderate. The exploitation level is between the limit and target reference point and biomass is just above the minimum reference point limit for both sexes.

The status of lobster in the Southwest area is moderate. Exploitation rate and SSB levels are between the minimum and target reference points for both sexes and appear stable.

Ecological impacts

Seafloor disturbance

The most common method used for catching crab and lobster is through pots and traps. These static gear types are deployed and left to soak before being hauled after a period of time. There are areas across England where pot fishing overlaps with Marine Protected Areas (MPAs) aimed to protect the temperate rocky reefs ecosystem, which has been a driver to understand more around the potential impacts from potting to ensure it complies with the MPA conservation targets/goals. Impacts from pots may occur during deployment, soak time or hauling of the pot, impacting the benthos and the species inhabiting it through contact with the pot and/or from scour caused by the associated ropes.

Evidence is lacking for the short-to-long term impacts and recovery rates of the habitats that encounter pot fishing, with much research focusing on the impacts of mobile fishing gear (e.g., beam trawlers) on the environment as this is assumed to

be more detrimental. However, a recent study used underwater video to quantify the true footprint and impact caused by potting in South Devon. The results showed that of the 18 species observed on the seafloor, 14 suffered damage as the pots were hauled from the seabed. This included certain species, such as pink sea fans, ross coral, dead man's fingers, and boring sponges, which are recognised as indicators of general health in the marine environment. This emerging evidence is highlighting that potting may be more destructive than previously thought and managers must balance ecology with social and economic considerations to determine what level of impact is acceptable when developing the Crab and Lobster FMP[60]. The FMP will review existing evidence from the literature and data generated from monitoring programmes to assess the risk of pots and traps to seafloor disturbance.

Environmental impacts

Climate change

Climate change refers to long-term shifts in global temperatures and weather patterns[61]. Though climate change has been a natural and essential driver of ensuring life on earth can survive and thrive, human activity has become a primary influence of these changes since the 1800s. Today, this has resulted in significant negative impacts on ecosystem functioning, including within the global ocean. Crab and lobster stocks and fisheries are sensitive to environmental change, such as ocean warming and ocean acidification, which come as consequence of climate change. Though crustaceans are more tolerant to changes in ocean acidification than molluscs and gastropods, there is variation in the tolerance between crab species. Recent studies have highlighted the vulnerability of brown crab to environmental conditions expected by 2100[62], which could have significant economic implications to the UK crab fisheries.

However, whilst these stocks and fisheries are affected by this change, they are also one of the contributors. All fishing activity leaves a carbon footprint. The contribution of carbon emissions from crab and lobster fisheries can come from vessel emissions, as well as disruption and release of carbon stored in marine sediments

60 Gall, SC., Rodwell, LD., Clark, S., Robbins, T., Attrill, MJ., Holmes, LA., Sheehan, EV. (2020). The impact of potting for crustaceans on temperate rocky reef habitats: Implications for management. Mar Environ Res. 2020 Dec;162:105134. doi: 10.1016/j.marenvres.2020.105134. Epub 2020 Sep 6. PMID: 33032079.

61 https://www.un.org/en/climatechange/what-is-climate-change

62 Whitley, N. M., Suckling, C. C., Ciotti, B. J., Brown, J., McCarthy, I. D., Gimenez, L., & Hauton, C. (2018). Sensitivity to near-future CO2 conditions in marine crabs depends on their compensatory capacities for salinity change. Scientific Reports, 8(1), 1-13.

through the impact of fishing gear on the seafloor. In total, the UK pot and trap fishing fleet segment, comprising of 1542 vessels, produced 12.5% (101kt CO_2e) of the total carbon emissions at sea each year across the UK's fishing fleets[63]. When analysing these emissions per vessel, passive fishing methods were found to be generally less emission-intensive than active gears (for example, scallop dredgers, beam trawlers). When analysing these emissions per vessel, passive fishing methods were found to be generally less emission-intensive than active gears (for example, scallop dredgers, beam trawlers). However, a life cycle assessment of carbon emissions across the fishing fleets supply chain (for example, pre-harvest, at sea, post-harvest) highlighted that the use of bait in fleet segments using passive gears can significantly add to the carbon footprint of the fishery[64]. In an example from the US, the use of bait in the American lobster fishery contributed nearly a third of the total carbon emissions from the fisheries operations[65].

Marine pollution

Marine pollution is a significant driver of biodiversity and ecosystem change within marine habitats[66]. Across fisheries, marine pollution – including eutrophication, chemical pollution, underwater noise, and marine litter (for example, plastics and lost fishing gear) – can result in a negative impact on stock abundance and health.

Marine litter

'Marine litter' or 'marine waste' is defined as any persistent, manufactured or processed solid material discarded, disposed, or abandoned in the marine and coastal environment. An estimated 5-13 million tonnes of litter enter the oceans each year[67], predominately composed of plastic, and includes fishing gear.

A recent study assessing the quantity of marine litter on the seafloor in the North Sea found 27% of the study areas contained litter and that fishing gear was the dominating source[68]. At a global scale, it is estimated that 5.7% of all fishing nets,

63 Engelhard, GH., Harrod, OL., Pinnegar, JK. (2022). Carbon emissions in UK fisheries: recent trends, current levels, and pathways to Net Zero. Defra project – in review.

64 Ibid

65 Driscoll, J., Boyd, C., Tyedmers, P. (2015). Life cycle assessment of the Maine and southwest Nova Scotia lobster industries. Fisheries Research 172: 385-400.

66 https://ipbes.net/models-drivers-biodiversity-ecosystem-change

67 Jambeck, JR., Geyer, R., Wilcox, C. (2015). Plastic waste inputs from land to sea. Science. 347 (6223): 768-771.

68 Buhl-Mortensen, L., Buhl- Mortensen, P. (2017). Marine litter in the Nordic Seas: Distribution composition and abundance. Marine Pollution Bulletin. 125 (1-2):260-270.

8.6% of all traps, and 29% of all lines are lost each year[69]. There are two types of waste fishing gear: end of life fishing gear and lost gear. Gear losses from pots and traps are considered to be high impact to the environment, with an estimated average one pot and/or trap lost in every 14 that are used[70]. Lost pots and traps continue attracting animals as they are usually baited, leading to a circular self-baiting feedback loop, and causing unintended ghost fishing from crab and lobster industries[71].

Underwater noise

Underwater noise can come in the form of impulsive pressure waves, particle motion through the seafloor sediment, or as ambient shipping noise masking communication and hunting. A recent review highlighted that the Brown crab, European lobster, and Norway Lobster demonstrate physiological sensitivities towards underwater noise[72]. While there is now regular noise monitoring and spatial mapping across UK waters[73], there is a need to understand the implications this could have at a stock and ecosystem level.

Wider pressures

Offshore wind farms

The UK is currently a global leader for offshore wind power generation (by installed capacity)[74]. However, preservation of the environment is a critical consideration for this sector, whilst aiming to continue development to increase renewable content and ensure security for future energy supply. The long-term ecological impact of offshore wind farms (OWF) on crab and lobster fisheries remains uncertain, but recent pilots have shown little-to-no impacts on the population and population structure in the

69 Richardson, K., Hardesty, BD., Wilcox C. (2019). Estimates of fishing gear loss rates at a global scale: A literature review and meta-analysis. Fish and Fisheries. 20: 1218-1231.

70 Lively, J.A., Good, T.P. (2018). Ghost fishing, in: World Seas: An Environmental Evaluation Volume III: Ecological Issues and Environmental Impacts. pp. 183–196. 3

71 Bullimore, B.A., Newman, P.B., Kaiser, M.J., Gilbert, S.E. and Lock, K.M. (2001). A study of catches in a fleet of" ghost-fishing" pots. Fishery Bulletin, 99(2), pp.247-247.

72 Edmonds, N.J., Firmin, C.J., Goldsmith, D., Faulkner, R.C. and Wood, D.T. (2016). A review of crustacean sensitivity to high amplitude underwater noise: data needs for effective risk assessment in relation to UK commercial species. Marine Pollution Bulletin, 108(1-2), pp.5-11.

73 UK Marine Strategy (2019). Marine Strategy Part one: UK updated assessment and Good Environmental Status – gov.uk

74 https://www.gov.uk/guidance/offshore-wind-part-of-the-uks-energy-mix

short-term[75, 76]. Further research will be needed to assess the long-term responses of these species to the noise generated and the electromagnetic fields surrounding the farms[77].

In addition to ecological evidence of the effects of offshore wind farms on commercially exploited species, the success of co-location requires an understanding of the perceptions of fishers and OWF developers on key constraints and opportunities. Interviews with fishers and developers from major energy companies in South Wales and Eastern England were carried out to assess experience-based opinions on the co-location of OWFs with crab and lobster fisheries[78]. Developers expressed broad support for co-location, perceiving potential benefits to their relationship with fishers and their wider reputation. Fishers had more mixed opinions and exhibited a range of risk perception related to uncertainty around safety, gear retrieval, insurance, and liability. Clear protocols and communication between all parties involved to address these issues are essential if co-location is to be successful.

Disease

Alongside the direct impacts of climate change on crab & lobster species, there is also the indirect impacts through changes to the marine system which could affect their population structure and dynamics. Climate change has the potential to affect the spatial distribution and abundance of diseases and pathogens – for example, there has been an increased abundance in Vibro bacteria (a species of bacterial known to cause human health impacts) in the North Sea in recent decades which has been linked to ocean warming[79]. The projected levels of sea temperature rise, enhanced heatwaves and reduced salinity will only increase the persistence of Vibro species[80] in the future.

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[75] Langhamer, O., Holand, H. and Rosenqvist, G., (2016). Effects of an offshore wind farm (OWF) on the common shore crab *Carcinus maenas*: tagging pilot experiments in the lillgrund offshore wind farm (Sweden). PloS one, 11(10), p.e0165096.

[76] Roach, M., Cohen, M., Forster, R., Revil, AS., Johson, M. (2018). The effects of temporary exclusion activity due to wind farm construction on a lobster fishery suggests potential management approach. ICES, 4:1416-1426

[77] Hooper, H., Austen, M. (2014). The co-location of offshore windfarms and decapod fisheries in the UK: Constraints and opportunities, Marine Policy. Volume 43, 2014, Pages 295-300.

[78] Hooper, H., Ashley, M., Austen. M. 2015. Perceptions of fishers and developers on the co-location of offshore wind farms and decapod fisheries in the UK. Manuscript_final.pdf (plymsea.ac.uk)

79 Mieszkowska, N., Burrows, M. and Sugden, H. (2020) Impacts of climate change on intertidal habitats relevant to the coastal and marine environment around the UK. MCCIP Science Review 2020, 256–271.

80 Ibid

Whilst brown crabs already harbour a wide range of parasites and pathogens, often these infections are at low levels[81] and, therefore, at present are unlikely to have a major impact on the sustainability of fisheries[82]. Assessing the affect that climate change has on new and emerging crab diseases in England (for example, amoebic crab disease in the brown crab in the Channel recently founded by Cefas[83], and the associated implications on the stock's sustainability will be pivotal to supporting fisheries management plans.

Sentience

The Animal (Sentience) Welfare Act (2022) formally recognised that animals are sentient beings and creating an accountability mechanism to ensure that UK Ministers have due regard to their welfare needs when formulating and implementing government policy.

Defra commissioned the London School of Economics (LSE) to undertake an independent review of the evidence underpinning sentience and the welfare implications of commercial practices through the supply chain for the most commercially relevant species of decapod crustaceans and cephalopod molluscs in the UK[84]. The LSE report concluded there was strong evidence of sentience in true crabs (which includes the brown crab), but less is certain across other decapods (such as the European Lobster) as research/evidence is lacking in these species. For true crabs, there is high confidence that they meet five out of the eight criteria for sentience. The review highlighted a range of evidence gaps to support the understanding of sentience in cephalopod molluscs and decapod crustaceans.

These include further research on the impact on sentience through nicking, analgesia, chilling, stocking density and packing. Ongoing research through Humane Slaughter Association is seeking to address evidence gaps to support reliable and quick (<10 seconds) slaughter techniques in decapod crustaceans. Across all species, it was acknowledged that a greater understanding on how sentience varies across different developmental stages is also required. The development of agreed

81 Stentiford, G.D., (2008). Diseases of the European edible crab (Cancer pagurus): a review. ICES Journal of Marine Science, 65(9), pp.1578-1592.

82 Shields, Jeffrey D., "Climate change enhances disease processes in crustaceans: case studies in lobsters, crabs, and shrimps" (2019). VIMS Articles. 1791. https://scholarworks.wm.edu/vimsarticles/1791

83 Bateman, K.S., Stentiford, G.D., Kerr, R., Stone, D., Hooper, C., White P., Edwards, M., Ross, S., Hazelgrove, R., Daumich, C., Green, M.J., Ivory, D., Evans, C., Bass, D.2 2022. Amoebic Crab Disease (ACD) in edible crab (Cancer pagurus) from the English Channel, United Kingdom. In review

84 Birch, J., Burn, C., Schnell, A., Browning, H., Crump, A. (2021). Review of the evidence of sentience in cephalopod molluscs and decapod crustaceans. Sentience-in-Cephalopod-Molluscs-and-Decapod-Crustaceans-Final-Report-November-2021.pdf (lse.ac.uk)

best-practice guidelines will support the seafood sector to ensure high welfare standards are maintained/ adopted.

Economic importance

The scope and methodologies applied for MMO and Seafish data extraction applied in this document can be found at the beginning of this document.

Non-quota shellfish accounted for 15.9% of the total landings by UK vessels in 2021 at a value of £236.6 million and weight of 98,200 tonnes. Crabs, lobsters, and scallops were the dominant non-quota shellfish species landed by the UK fleet in 2021 and accounted for 71% of all non-quota shellfish landings.

Brown crab and the European Lobster are the dominant crab and lobster species landed in the UK, with over half the crabs and lobsters landed into the UK-by-UK vessels landed in England. In 2020, 12,319 tonnes of crabs with a value of £22 million, and 1,489 tonnes of lobsters with a value of £20 million, were landed into England by UK vessels. Additionally, an estimated 1,474 tonnes of brown crab, with a value of £3.2 million, and an estimated 90 tonnes of European lobster, with a value of £1.6 million, were landed by EU vessels in UK and crown dependency waters.

In 2021, 12,779 tonnes of crab were landed into England by UK vessels at a value of £31m. During the same year, 1,784 tonnes of lobster were landed into England by UK Vessels at a value of £29m (MMO, UK landings by rectangle, EEZ, port).

With the above figures, it is important to note that Covid-19 had a significant economic impact on shellfish landings, with lockdowns and associated restrictions causing considerable changes across the catching sector. The initial lockdown in 2020 had significant operational impacts on the UK catching sector. Fishers targeting shellfish (compared to pelagic or demersal species) were the most acutely affected by the lockdown due to their reliance on domestic food service, as well as international export. Comparing January-September 2019 with January-September 2020, total shellfish (both quota and non-quota) landings value fell 36%, landings weight fell 19%, and average price fell 21%[85]. At its lowest, shellfish values fell by 56% in April 2020 compared to April 2019 following the first government-imposed lockdown.

The analysis below considers only English registered vessels. Most vessels catching species associated with the FMP in English waters were English vessels (Table 2, Table 3).

In England in 2020, 590 vessels in total primarily caught the species associated with this FMP. This was the lowest number of vessels targeting these species since pre-2008 (when Seafish data collection commenced), down 50 vessels in 2019 and 188 in 2008. Much of this change has come from a decrease in the number of vessels

85 Patience, N., Motova, A., Cooper, J. (2021). Covid-19 impacts on the UK catching sector in 2020. Summary report. Seafish.

targeting lobster and crab, although the figures for crab are somewhat deceptive as a smaller fleet of bigger boats is now landing more catch than in 2008-10.

In 2020 English boats primarily catching the species associated with the FMP constituted 37% of the UK fleet targeting these species, however English vessels caught 53% of the UK fleet's total catch (by weight) of these species, amongst vessels targeting them. While England's share of the UK fleet is down from 42% in 2008, its share of the catch has increased (from 50% in 2008).

29% of active English vessels targeted the species relevant to this FMP in 2020, with this fishery now occupying a higher percentage of the fleet than at any point from 2009-2016. Almost 20% of England's total fishing income came from vessels targeting these species in 2020, a higher proportion than in any year from 2008 to 2018.

In 2020, 112 vessels in England targeted predominantly crab. This was the lowest number since pre-2008. Despite the number of vessels falling, when compared to 2008-2010, the length of the average vessel fishing for crab has increased, the fleet employs more people, and the total landings (by weight and value) are higher.

Vessels targeting lobster in England, while much more numerous, tend to be smaller, support fewer jobs, and catch significantly less than vessels targeting brown crab. 460 vessels targeted predominantly lobster in England in 2020, with an average length of 7.9m. Many of these vessels fished part-time: in 2020, vessels catching predominantly crab worked, on average, more than twice as many days at sea as those catching lobster. 460 was the lowest number of vessels fishing predominantly for lobster in England since 2014.

Data-limited species

In 2020, 7 vessels in England landed spider crabs as their main catch. This was the lowest number of vessels fishing predominantly for spider crabs in England since pre-2008. The number of vessels fishing predominantly for spider crab in England has fallen significantly from a peak of 41 in 2011. Many of the vessels targeting spider crab in recent years have fished on a part time basis.

Every year since 2013, except for 2020, at least one English vessel has landed velvet crabs as its main catch. In 2017, 5 vessels primary catch was velvet crab, although all of these vessels fished part time.

In 2020, crawfish was the main species landed by 11 vessels in England. Crawfish was the main species for at least eight vessels in all but one year between 2015 and 2020. Vessels targeting crawfish generally fished on a part time basis.

Economic dependence by fleet segment

Brown crab

Figure 31 shows total number of vessels that caught any amount of crab in English waters between 2018 and 2021 by their economic dependence on the value of crab landings in English waters. The total number of vessels declined slightly across this period however the proportions of different dependency groupings remained, overall, consistent.

In 2021, 70% of vessels landing crab in English waters were less than 20% dependent on the fishery. 45% were less than 5% dependent. Only 15% of vessels that caught crab in 2021 were more than 40% dependent on the crab fishery in English waters. This is consistent with the notion that crab is an important fishery for supporting diversification (a common fishing practice to reduce economic reliance and fishing pressure on single species), which signifies the economic importance of crab fisheries for supporting business continuity.

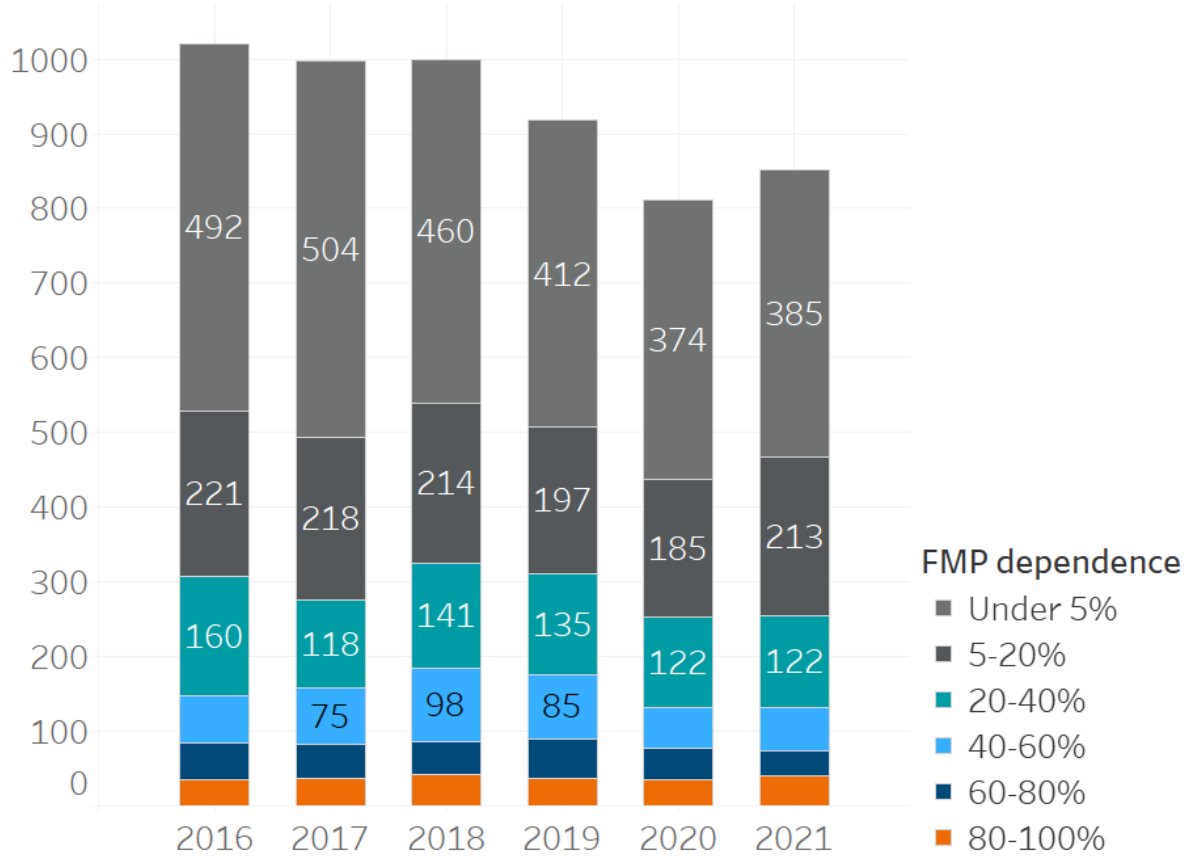

Figure 31: Total number of vessels which caught any crab in English waters from 2016 to 2021, based on their economic dependence on the crab fishery in English waters

Figure 32 shows the proportion of landings that each dependency group was responsible for between 2016 and 2021. At least 40% of landings in any year between 2016 and 2021 were made by vessels with at least a 60% dependence on the crab fishery in English waters, despite these vessels constituting only a small fraction of the total crab fleet in English waters. The highest proportion of landings contributed by vessels over 60% dependent on the fishery was 56% in 2018.

Despite around two thirds of vessels in each year between 2016 and 2021 being less than 20% dependent on the fishery (70% in 2021), in only one of these years such vessels contributed over 10% of total crab landings.

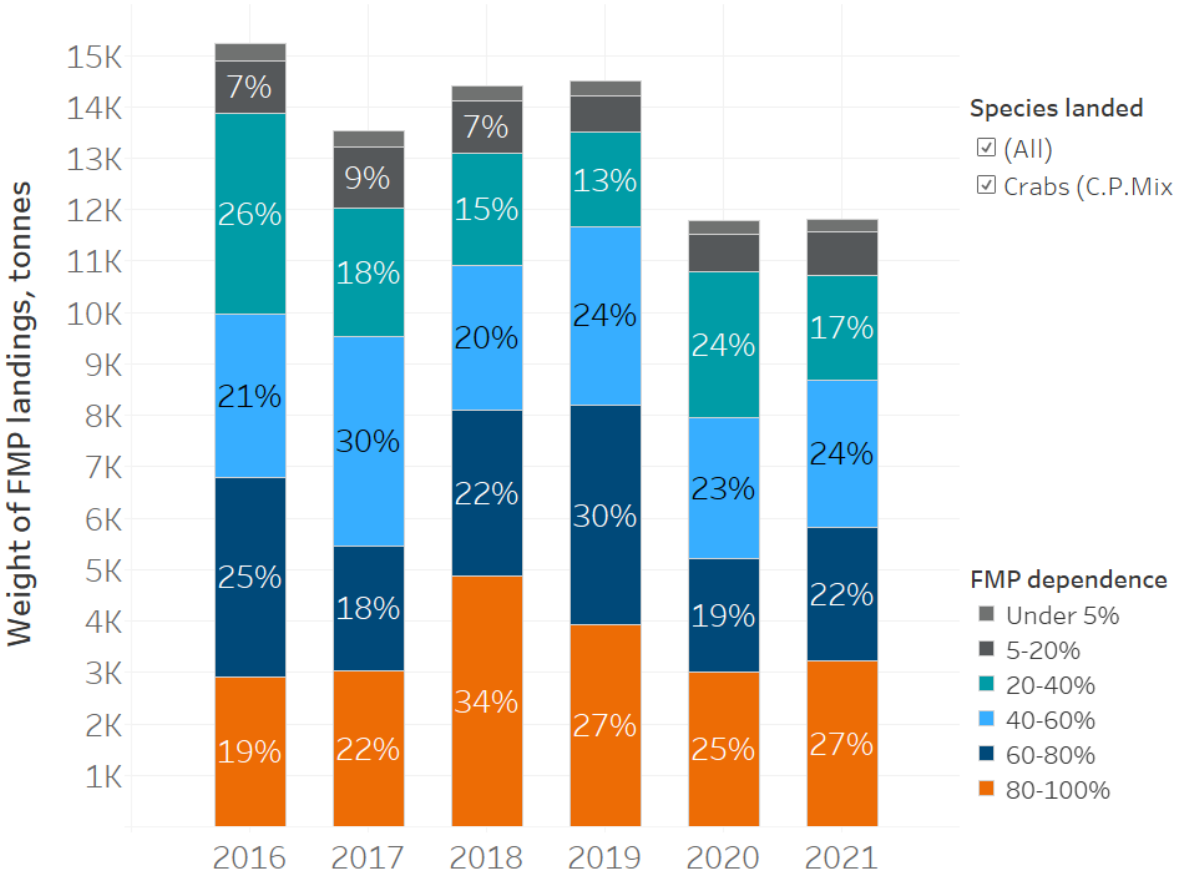

Figure 32: Total weight (tonnes) crab landings from English waters by vessels belonging to different economic dependence groups. The bars show each group's landings as a percentage of the total crab landings from the FMP in that year

Figure 33 shows the number of vessels within each size category that were at least 20% economically dependent on fishing for crab in English waters (from here on referred to as 'crab dependent') between 2016 and 2021.

The total number of crab dependent vessels declined slightly across this period. This decline was most significant with under 8m vessels. There were 112 under 8m

vessels with at least 20% dependence on the crab fishery in English waters in 2016, this reduced to 66 in 2021.

In every year from 2016 to 2021, there were more crab dependent 8-10m vessels than any other vessel length category. However, the number of 8-10m vessels declined, with over 100 in each year from 2016 to 2019, but less than 90 in 2020 and 2021.

Despite the trend of declining crab dependent vessel numbers, there were more vessels in both the 10-12m and 12-18m vessel categories in 2021 than 2016. The rise in larger vessels involved in the fishery was particularly noticeable with 12-18m vessels, with a 25% increase in the fleet from 2016 – when there were 36 – to 2021, when there were 48.

In each year between 2016 and 2021, the largest vessels (those in the over 18m category) consistently made up the smallest proportion of crab dependent vessels.

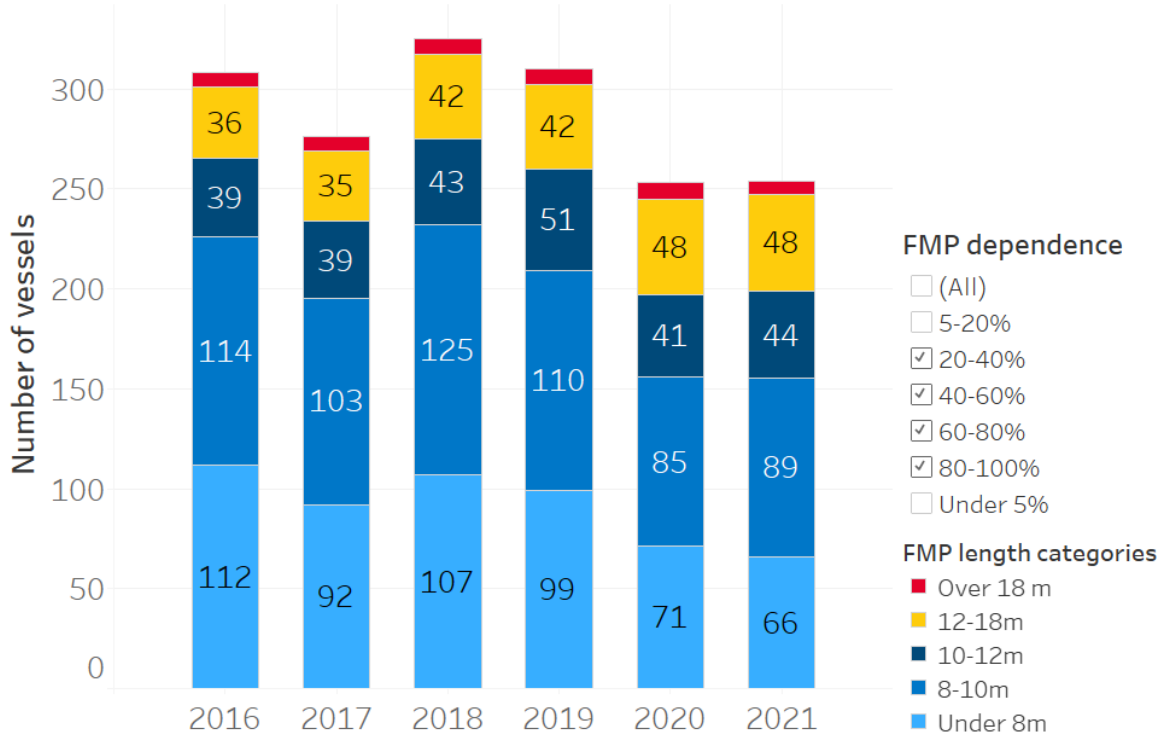

Figure 33: Number of vessels involved in crab fishery in English waters by vessel size categories, with only vessels >20% economically dependent on the FMP (crab dependent vessels) included

Lobster

Figure 34 shows total number of vessels that caught any amount of lobster in English waters between 2018 and 2021 by their economic dependence on the value of lobster landings in English waters. The total number of vessels declined slightly

across this period however the proportions of different dependency groupings remained, overall, consistent.

In 2021, just over a third of vessels (34%) landing lobster in English waters were less than 20% dependent on the fishery. 19% were less than 5% dependent. More than a quarter of vessels (26%) were more than 80% dependent on the lobster fishery in English waters. This is in contrast to the crab fishery, where only a small proportion of vessels were highly economically dependent on the fishery. The high level of economic dependence on the fishery signifies the economic importance of crab fisheries for supporting business continuity.

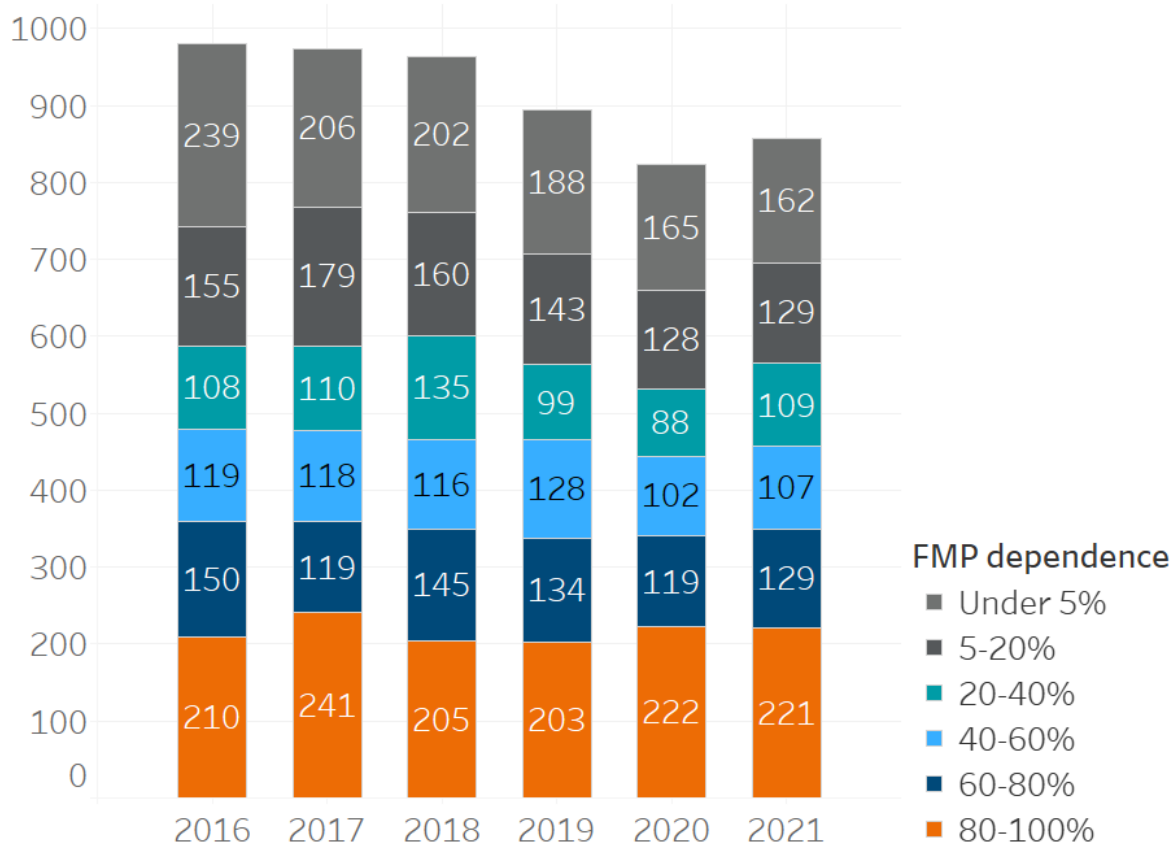

Figure 34: Total number of vessels which caught any lobster in English waters from 2016 to 2021, based on their economic dependence on the lobster fishery in English waters

Figure 35 shows the proportion of landings that each dependency group was responsible for between 2016 and 2021. At least 47% of landings in any year between 2016 and 2021 were made by vessels with at least a 60% dependence on the lobster fishery in English waters. The highest proportion of landings contributed by vessels in this group was 58% in 2016.

Despite around a third of vessels in each year between 2016 and 2021 being less than 20% dependent on the fishery, in only one of these years such vessels contributed over 10% of total lobster landings.

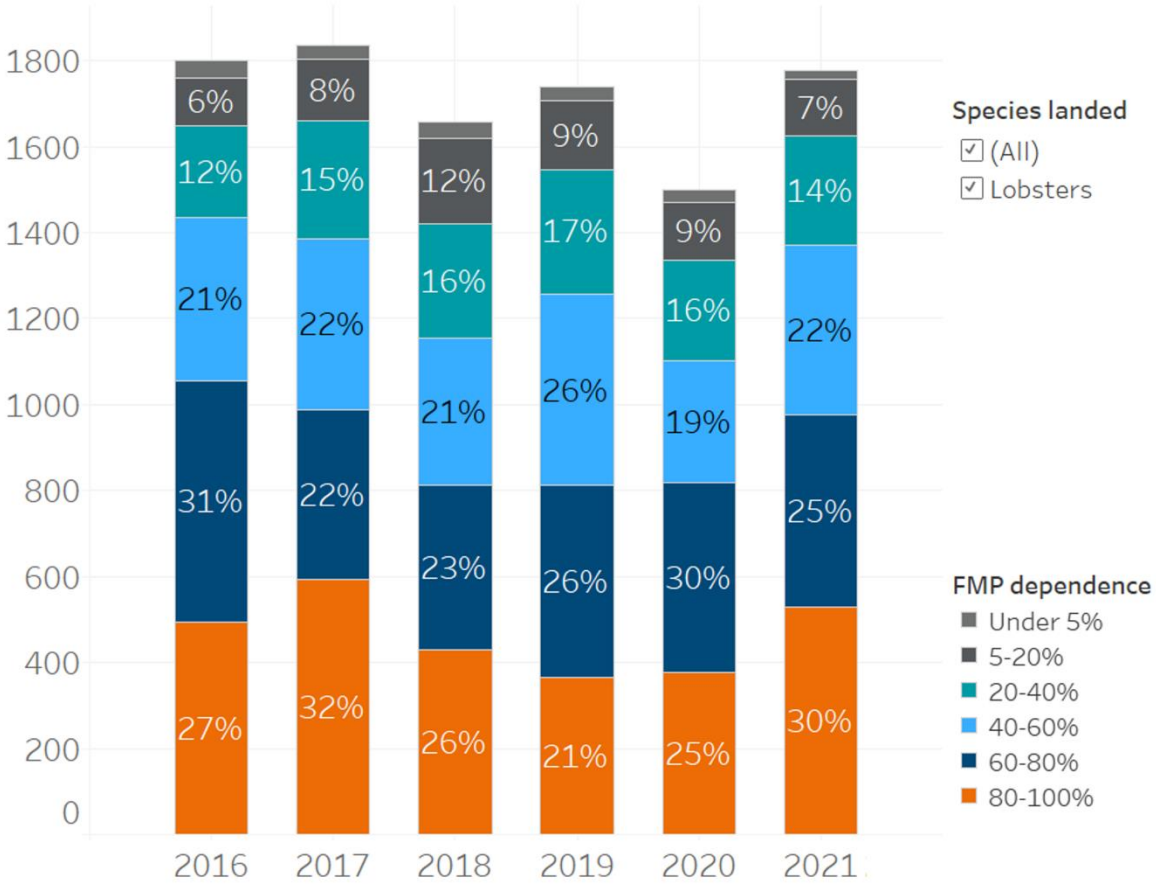

Figure 35: Total weight (tonnes) lobster landings from English waters by vessels belonging to different economic dependence groups. The bars show each group's landings as a percentage of the total lobster landings from the FMP in that year

Figure 36 shows the number of vessels within each size category that were at least 20% economically dependent on fishing for lobster in English waters (from here on referred to as 'lobster dependent') between 2016 and 2021.

There was a slight decline in the number of lobster dependent vessels from 2016 to 2021, with more in 2016, 2017 and 2018 than in 2019, 2020 and 2021. The decline was most notable with under 8m vessels.

Small vessels under 8m in length consistently made up the majority of lobster dependent vessels between 2016 and 2021, with more than 50% of lobster dependent vessels being under 8m in each year from 2016 to 2021. The most lobster dependent under 8m vessels fished in 2018, when there were 336.

8-10m vessels made up the second largest proportion of the lobster dependent fleet in each year from 2016 to 2021, with between 170 and 194 vessels in each of these years. Put together, over 75% of lobster dependent vessels were under 10m long in each year from 2016 to 2021.

Unlike with crab dependent vessels, there was not a significant rise in the number of over 10m lobster dependent vessels. The most lobster dependent vessels fished in 2018, when there were 53, and the least fished in 2021, when there were 45. There was also not a significant rise in the number of lobster dependent 12-18m vessels.

In each year between 2016 and 2021, the largest vessels (those in the over 18m category) consistently made up the smallest proportion of lobster dependent vessels, totalling 1% or less of the total vessels in each year from 2016 to 2021.

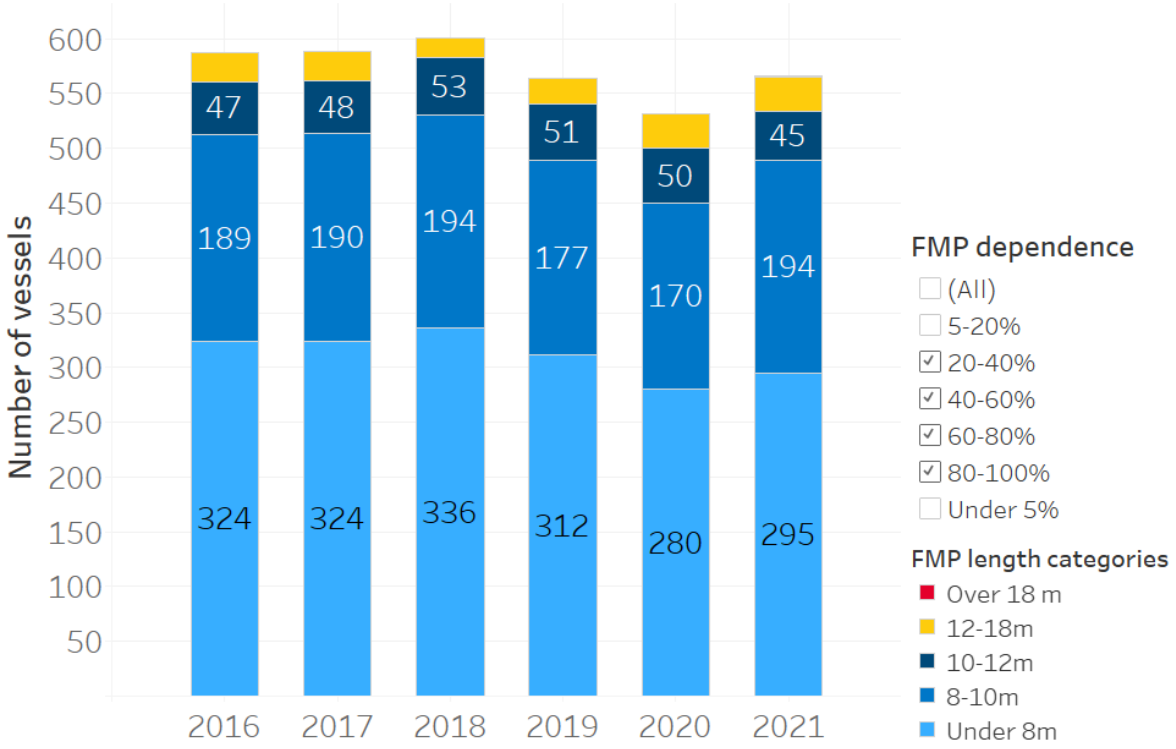

Figure 36: Number of vessels involved in lobster fishery in English waters by vessel size categories, with only vessels >20% economically dependent on the FMP (lobster dependent vessels) included

Port reliance on the species associated with the FMP

Brown crab

Figure 37 shows that between 2016 and 2021, brown crab made a significant contribution to the total landings' values of ports on the east and northeast coast of England, as well as ports on the southwest coast.

Within this timeframe, brown crab typically constituted the greatest proportion of the total value of landings at ports located on the east and northeast coast of England. Some ports in this region (for example, around Withernsea and Scarborough) report values of brown crab landings contributing around 50% of the total landings value, indicating a high level of economic reliance on brown crab fisheries in this region. In such cases, total landings value is between £50 and £100 million.

There are also a few ports in the southwest of England where brown crab constitutes over 50% of total landings value, for example located in the South Devon coastline. Total landings value at these ports tends to be lower in relation to their east coast counterparts (less than £50 million). This indicates that some ports in the southwest are also largely economically dependent on brown crab fisheries. Other ports on the south coast of Devon and Cornwall where total landings value was higher (>£150 million) also recorded a prominent contribution by brown crab, however given the high value of other species landings the percentage contribution was relatively smaller.

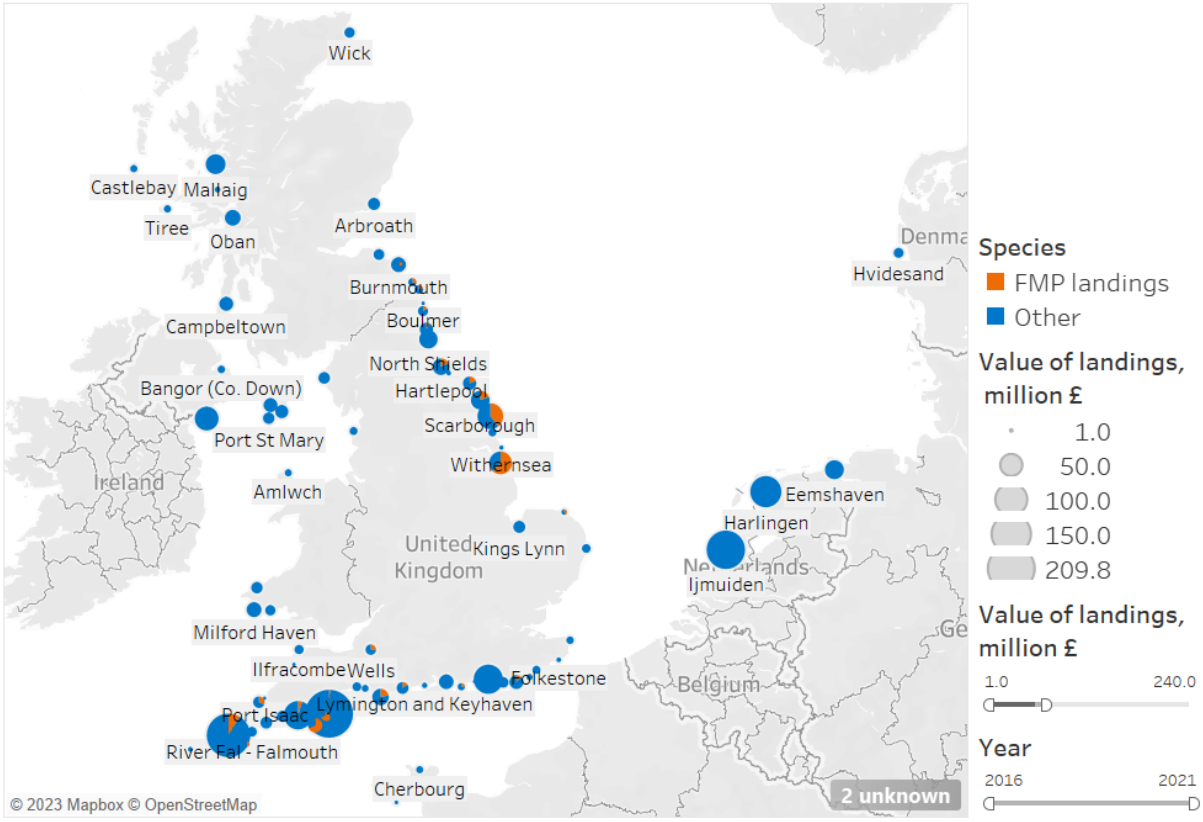

Figure 37: Value (£ million) of brown crab landings from English waters by ports as proportion of total value of landings in the relevant ports by all UK fishing vessels in 2016-2021. All values for reference period are summed up. Only ports with total landings of more than 1 tonne are shown.

Lobster

Figure 38 shows that between 2016 and 2021, lobster made a significant contribution to the total landings' values of ports mainly on the east and northeast coast of England, with some more minor contributions to ports located in the southwest.

Within this timeframe, lobster typically constituted the greatest proportion of the total value of landings at ports located on the east and northeast coast of England. Some ports in this region (for example, around Scarborough, Bridlington, and Hartlepool) report values of lobster landings contributing around 50% of the total landings value, indicating a high level of economic reliance on lobster fisheries in this region.

There are some ports along the south coast where lobster landings contribute significantly to the total landings value – for example Selsey in the central south coast, and ports around Port Isaac in northern Cornwall. Total landings value at these locations tends to be lower (<£25 million). Other ports along the south coast

also reported a lower contribution of lobster to total landings value, often in locations where this is outweighed by the higher value of other catches.

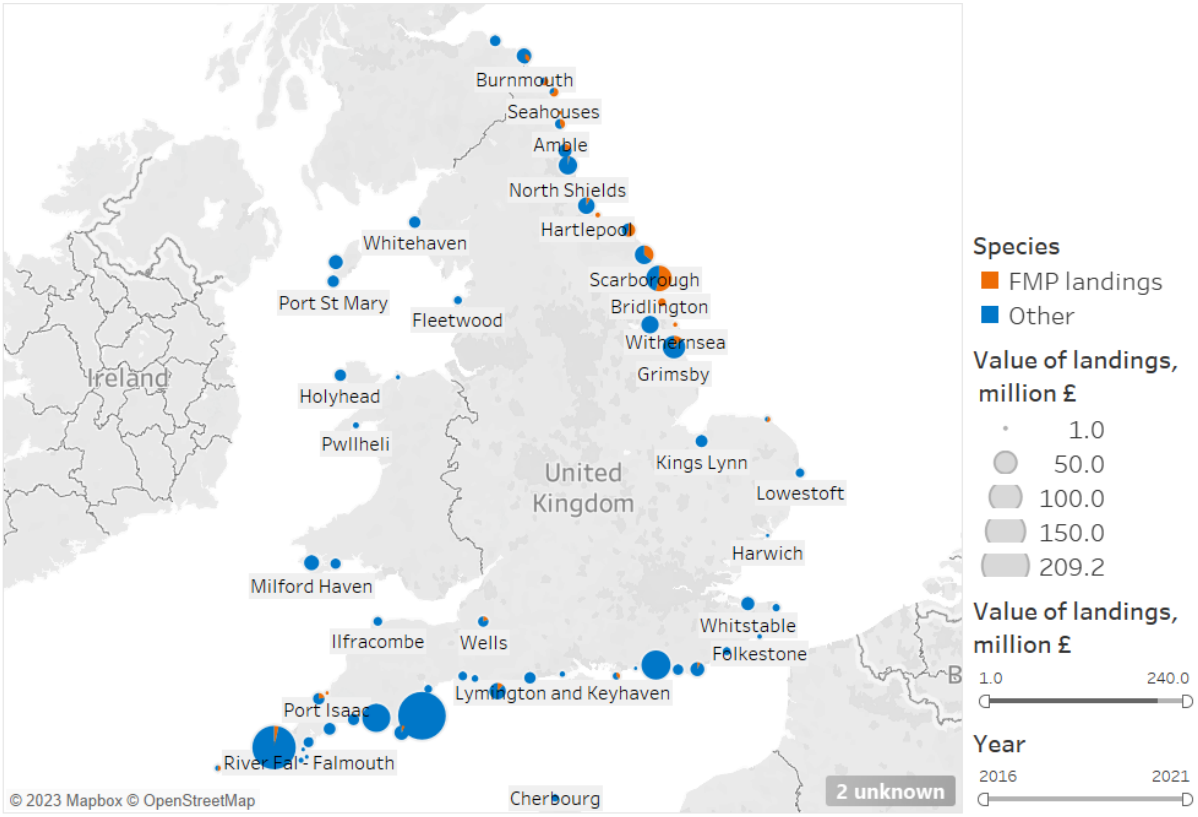

Figure 38: Value (£ million) of lobster landings from English waters by ports as proportion of total value of landings in the relevant ports by all UK fishing vessels in 2016-2021. All values for reference period are summed up. Only ports with total landings of more than 1 tonne are shown

Economic data

In this section, economic indicators have been defined as follows:

- **Economic dependence** percentage of revenue associated with value of landings of stocks/species in FMP managed area compared to total fishing income.
- **Fishing income** value of fish landed associated with FMP.
- **GVA (Gross Value Added)** a measure of the value of goods and services produced by an industry. GVA is calculated as the sum of operating profit and crew share.
- **Operating profit** the difference between total income and operating costs.
- **Net profit** the result of subtracting finance costs, depreciation, and interest costs from operating profit.

- **GVA to fishing income margin** shows the economic efficiency and profitability of operations, and evolution over time.

Factors impacting economic performance are analysed in more detail as part of Economics of the UK Fishing Fleet annual reports.

Brown crab

Table 22 and figure 39 below show the main economic performance indicators used to analyse fishing fleets as they relate to crab landings from English waters between 2016 and 2021.

Operating profit, fishing income, GVA and net profit all rose each year between 2016 and 2019, before falling back to pre-2018 levels in 2020. In 2021 all of these indicators (except net profit, for which there was no data) recovered above levels seen in any other year shown. The GVA to fishing income margin increased annually from 2018-2021. The second highest GVA to fishing income ratio in the years shown was in 2017, before a sharp fall in 2018.

Table 22: Economic performance indicators associated with crab FMP between 2016 and 2021

Home Nation	2016	2017	2018	2019	2020	2021
Fishing income (£000)	21,135	22,684	32,040	33,712	20,955	29,586
GVA (£000)	12,585	14,126	18,642	20,409	12,998	18,957
Operating profit (£000)	6,213	6,989	8,891	9,212	5,487	8,406
Net profit (£000)	4,746	5,270	6,852	7,110	2,534	No data
GVA to fishing income margin	*60%*	*62%*	*58%*	*61%*	*62%*	*64%*

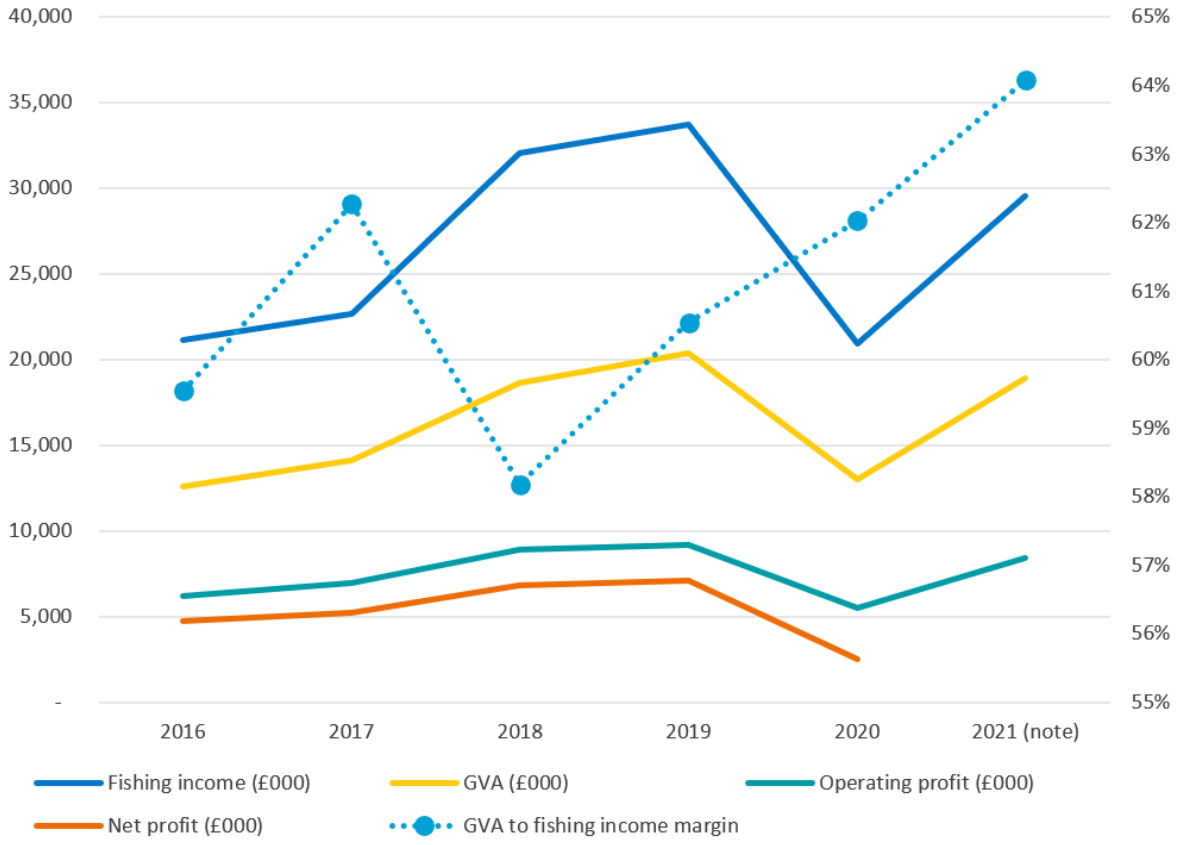

Figure 39: Economic performance indicators associated with crab landings from English waters, 2016-2021. *2021 forecast based on 2021 preliminary activity data provided by MMO and 2020 costs structure

Lobster

Table 23 and figure 40 below show the main economic performance indicators used to analyse fishing fleets as they relate to lobster landings from English waters between 2016 and 2021.

The picture for lobster is quite different to crab. Between 2016 and 2019, total fishing income and GVA increased slightly, while operating profit and net profit declined slightly. All four of these indicators declined in 2020, before fishing income, GVA and operating profit all increased in 2021 to levels higher than at any other stage between 2016 and 2021. The GVA to fishing income margin declined from 2016 to 2018, before increasing quickly between 2018 and 2021, with the increase especially rapid from 2019 to 2020.

Table 23: Economic performance indicators associated with lobster FMP between 2016 and 2021

Home Nation	2016	2017	2018	2019	2020	2021

Fishing income (£000)	21,986	23,710	23,250	24,168	20,059	29,279
GVA (£000)	13,327	14,023	13,672	14,440	12,864	19,078
Operating profit (£000)	6,854	7,155	6,752	6,691	6,064	9,137
Net profit (£000)	5,177	5,252	4,948	4,646	2,400	No data
GVA to fishing income margin	*61%*	*59%*	*59%*	*60%*	*64%*	*65%*

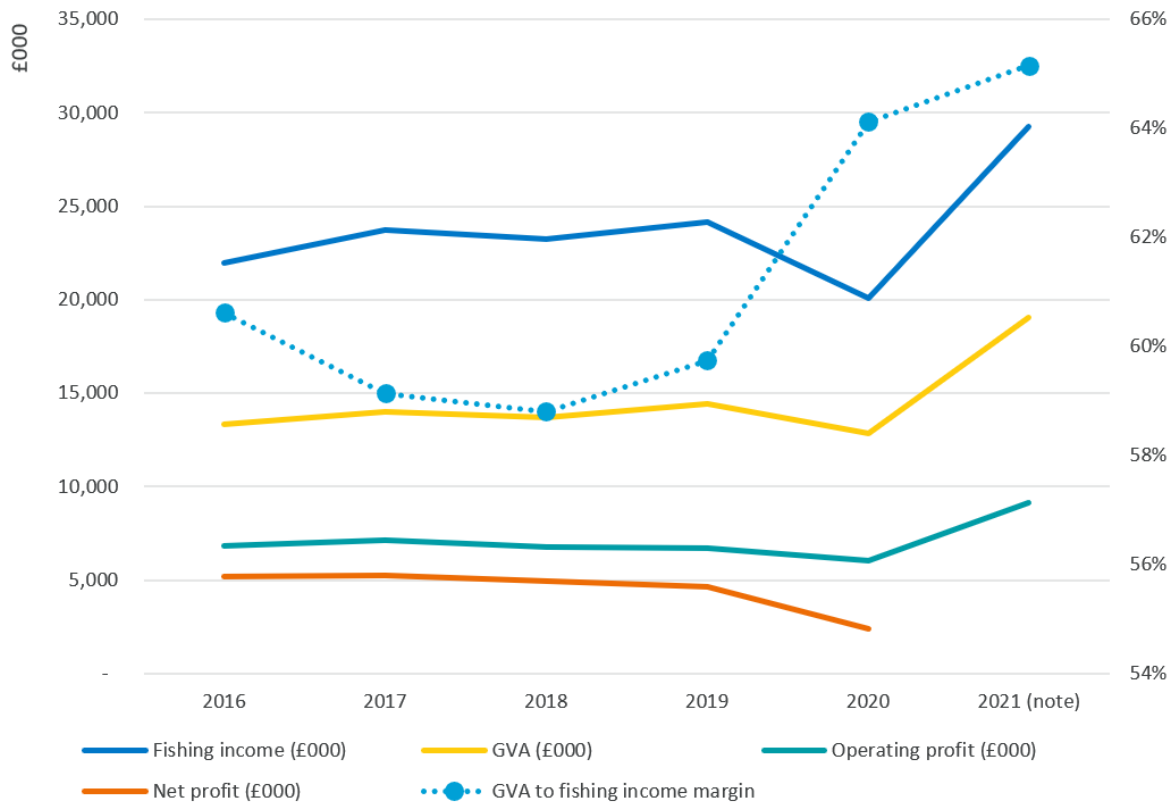

Figure 40: Economic performance indicators associated with lobster landings from English waters, 2016-2021. *2021 forecast based on 2021 preliminary activity data provided by MMO and 2020 costs structure (Seafish FMP evidence, 2022)

Economic data: monthly landings

Brown crab

Figure 41 shows the weight of crab from the FMP regulated area landed each month from January 2016 to December 2022. The evolution of the average price/tonne of crab is shown by the orange line for the same period.

Significant fluctuations in tonnages landed are observed throughout the year, with a differential of 1,500 or more tonnes between peak fishing months (~July to November) and off-peak months (~December to April).

Price also fluctuates significantly, with the highest price/kg in the off-peak months when landings are lowest. When catches are highest, price/tonne tends to be lower. Fluctuations in price/kg got bigger on an almost annual basis from 2016 to 2022, with prices reaching their highest level during the years shown, at over £3,000/tonne, during the summer fishing season in 2022. Prices for crab in any 12-month period between 2016 and 2021 fluctuated by £500/tonne in some years, and over £1,000/tonne in others.

In 2022 the average price/tonne of crab was generally higher throughout the year than at the corresponding time in any other year between 2016 and 2021.

Figure 41 also shows that there are seasonal cycles which repeat in a similar manner in each year shown. When landing tonnages are highest, price/kg tends to be lower. When catches drop significantly, prices rise. There is a trend towards higher prices in 2022.

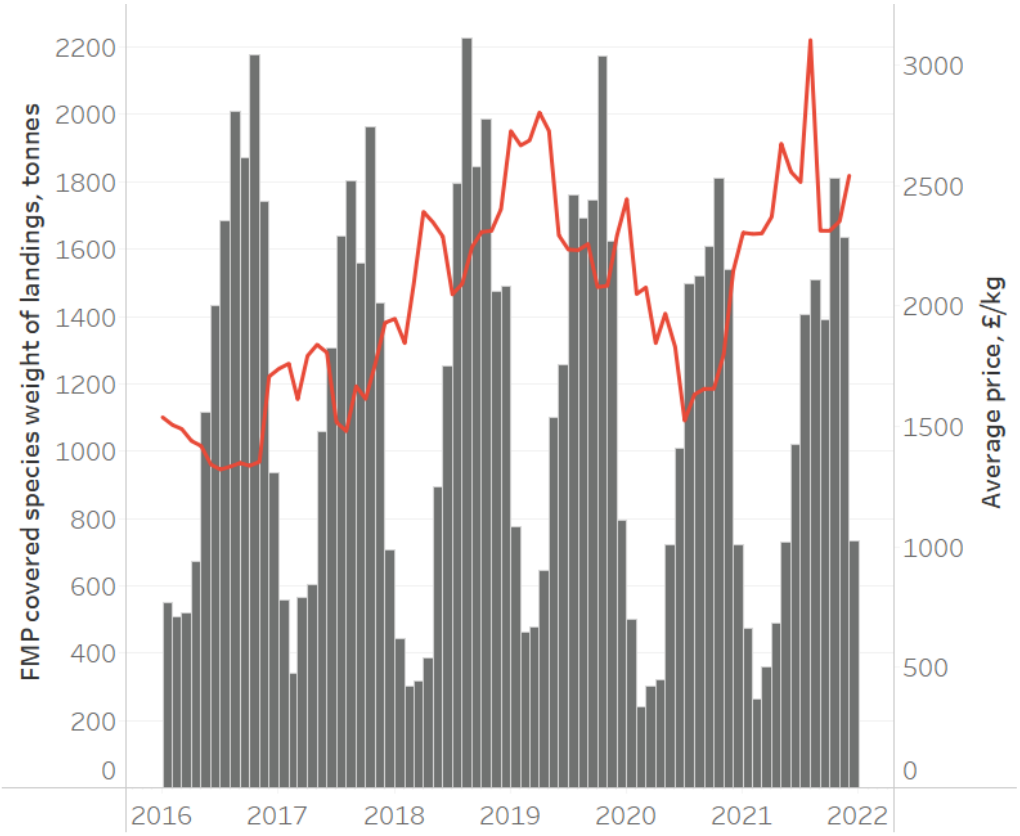

Figure 41: Weight (tonnes) of brown crab landed from FMP regulated area per month (grey bars) from January 2016 to December 2022, and average price (orange line) evolution during the same period (Seafish FMP evidence, 2022)

Lobster

Figure 42 shows the weight of lobster from the FMP regulated area landed each month from January 2016 to December 2022 (blue bars). The evolution of the average price/tonne of lobster is shown by the orange line for the same period.

Significant fluctuations in tonnages landed are observed throughout the year, with a differential of 300 or more tonnes between peak fishing months (~July to September) and off-peak months (~December to March).

Price also fluctuates significantly, with the highest price/kg in the off-peak months when landings are lowest. The price/tonne landed was generally highest in December between 2016 until 2021. When catches are highest, price/tonne tends to be lower. The highest prices obtained for lobster were generally roughly twice as high as the lowest prices in any annual cycle.

In 2022 the average price/tonne of lobster was generally higher throughout the year than at the corresponding time in any other year between 2016 and 2021. Prices reached £30,000/tonne in December 2022, having not been above £25,000/tonne in any other month between 2016 and 2021. Despite 2022 having the month with the

second highest landings during the period shown, the minimum price/tonne still eclipsed the peak fishing season prices in any other year between 2016 and 2021.

Figure 42 also shows that there are seasonal cycles which repeat in a similar manner in each year shown. When landing tonnages are highest, price/kg tends to be lower. When catches drop significantly, prices rise. There is a trend towards higher prices in 2022.

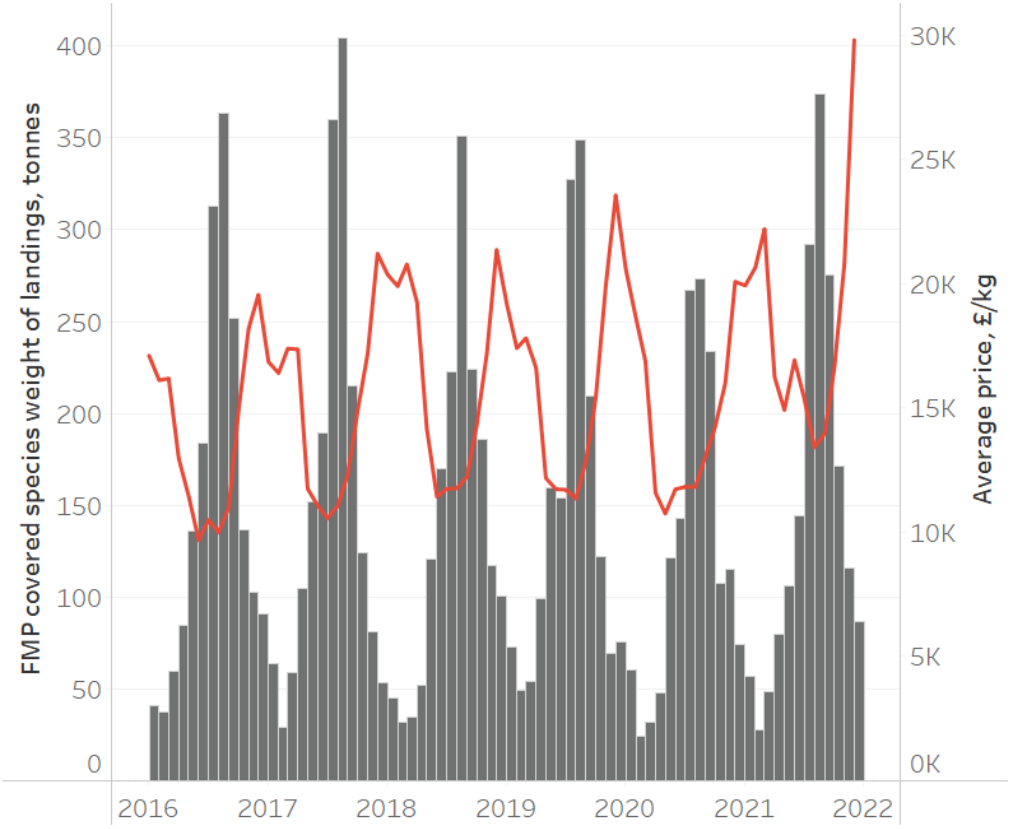

Figure 42: Weight (tonnes) of lobster landed from FMP regulated area per month (grey bars) from January 2016 to December 2022, and average price (orange line) evolution during the same period (Seafish FMP evidence, 2022)

International sales and exports

Non-quota shellfish are economically valuable for UK trade, accounting for 11.2% of all fish exports (including exports of fish products) in 2021. The 44,900 tonnes of non-quota shellfish species exported in 2021 was valued at £331.5 million, equating to around one-fifth of the income generated from total fish exports. The species with the greatest export value in 2021 were scallops (£75.7 million), crab (£67.2 million) and European lobster (£46.8 million).

The UK is a net exporter of lobsters and crabs, which are of relatively high value. In 2021, there was a lobster trade surplus of £21 million, with exports worth £48million,

and imports £27 million. In the same year, there was a crab trade surplus of £50 million, with exports worth £67 million, and imports £17 million.

Crab exports: In 2021, the UK exported 11,100 tonnes of crab, with a value of over £67 million. This represented 10% of UK fish exports (including fish products) in terms of value, and 3% by weight. The data does not allow differentiation between crab species, however around 77% of exports were to the EU, with France and Portugal being the top importers of UK crab. China imported the third most UK crab, with Ireland and Spain also accounting for more than 5% of total exports. Over 47% of all UK crab exports in 2021 were to France, however it is likely much of this will be transported onward to elsewhere in the EU. Crab exports peaked at over £100 million in 2019, when China was the biggest importer of UK crab. Although 2021 exports were up on 2020 levels, when compared to a pre-COVID average (2017-2019), crab exports are down 26%. In 2021, 48% of crab exports were classified as live/fresh, 31% as frozen, and 20% as prepared/preserved. A small quantity was unspecified.

Crab imports: The UK also imports crab, although again it's not possible to differentiate between species. In 2021, imports amounted to £17.71 million and 1,833 tonnes. Two thirds of imports were from outside the EU, with Sri Lanka, Vietnam, Indonesia, Norway, France, and Bangladesh all contributing at least 5% of imports. In both 2019 and 2020, the most crab imports were from Denmark. Less than 12% of imports were live/fresh, with 46% frozen and 41% prepared/preserved. Crab imports rose in the years up to 2019 (£28m) but fell both in 2020 (£20m) and 2021 (£18m). Crabs' imports in 2021 represented 0.5% of UK seafood imports (including fish products) in terms of value 0.2% in terms of tonnes.

Lobster exports: The UK exported more than 2,500 tonnes of lobster in 2021, amounting to £46.71 million. 66% of exports were to France, with Spain, Portugal, China and Ireland also importing at least a 5% share of the UK's total exports. Not more than 1% of the total went to any other country. Although 2021 exports were up on 2020 levels, when compared to a pre-COVID average (2017-2019), lobster exports are down 4% (significantly less than crab exports). Lobster exports in 2021 represented 4% of UK seafood exports (including fish products) in terms of value and 3% by weight. Nearly 92% of exports were to the EU and more than 96% were of live animals, with the small remaining quantity comprising frozen lobsters.

Lobster imports: In 2021, the UK also imported 1,430 tonnes of lobster, with a value of more than £26.5 million . More than 94% of imports came from outside the EU, with 83% from Canada and 11% from the USA. Over 52% of imports were of frozen lobsters, with the remainder being live.

Crawfish exports: UK crawfish exports rose year on year from 2010 to 2018, where they peaked at a value of nearly £31 million. 2021 exports totalled 1,641 tonnes, with a value of £17.76 million. More than 70% of exports were to countries outside the

EU, with 42.5% of exports going to Hong Kong. France, China, Australia, and Portugal also received at least 5% of the UK's Crawfish exports.

Crawfish imports: Crawfish imports were nearly 300 tonnes in 2021, with a value just under £8 million. 53% of imports were from Canada, with 20% from Denmark. The Bahamas was the only other country with a more than 5% share of the UK's import market. In total, 59% of imports were from non-EU countries.

Common prawn: Data does not allow differentiation by prawn species; however, the UK is a net importer of shrimps and prawns, importing a total of 84,790 tonnes in 2021 at an economic value of £623 million. The vast majority of shrimps and prawns available for domestic use are imported from India, Vietnam, Ecuador, Iceland, and Denmark, with Vietnam and India alone accounting for 40% of imports[86].

Social importance

The scope and methodologies applied for MMO and Seafish data extraction applied in this document can be found at the beginning of this document.

Employment (FTE) by fleet segment

Socio-demographic characteristics can't be differentiated at individual FMP level, however the fleet segments associated with the FMP can help us understand the potential demographic profile of employees.

This section presents employment calculated in terms of full-time job equivalents (FTEs) for pots and traps brown crab and lobster fisheries in English waters. FTEs are a standardised measure of employment calculated based on average vessel crew and effort, assuming one FTE is representing 2,000 hours of work per year. The data is differentiated following the same methodology used for the economic performance indicators (see section above). Information about social and demographic characteristics of employees is also published as part of Seafish's 2021 Employment in the UK Fishing Fleet report[87].

Brown crab

Figure 43 shows employment calculated in terms of full-time job equivalents (FTEs) for the pots and traps brown crab fishery in English waters. The total number of FTEs supported by the crab fleet fishing in English waters was, between 2016 and

86 https://www.gov.uk/government/collections/uk-sea-fisheries-annual-statistics

87 https://www.seafish.org/document/?id=7D65694D-7F4F-4BFC-ACD0-EB4D6C66A549

2021, highest in 2018 with 385 FTEs and lowest in 2017 with 261 FTEs. In 2021, 357 FTEs were supported.

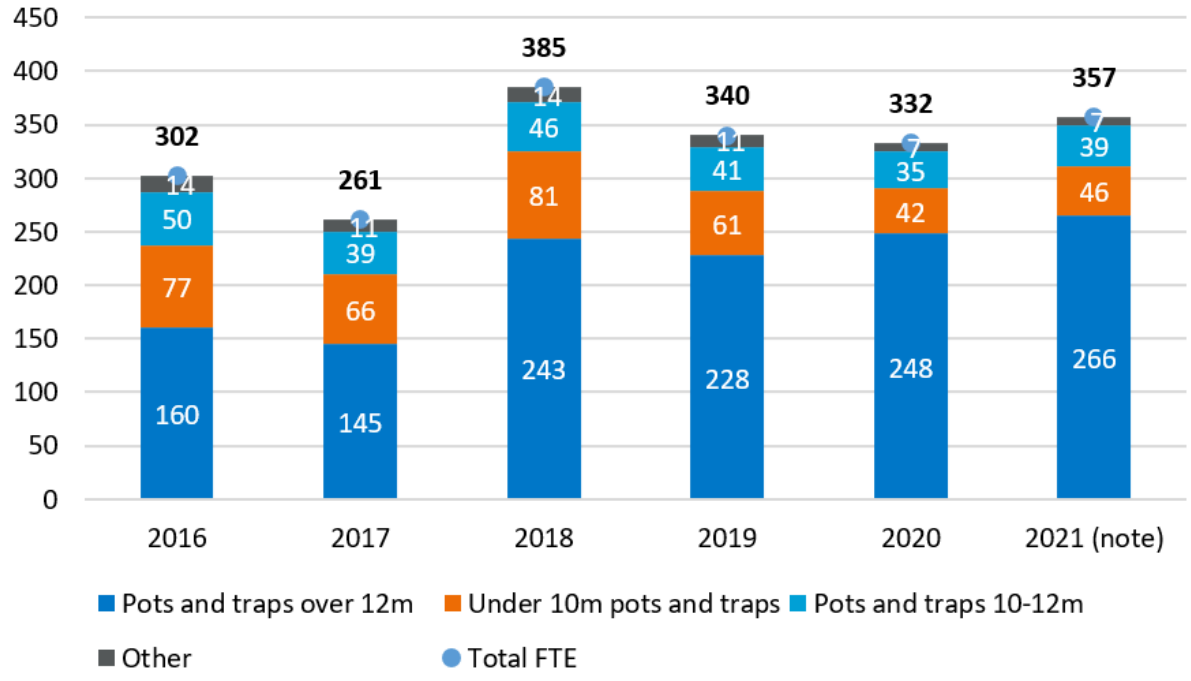

Figure 43: Employment (Full Time Equivalent, or FTE) associated with the brown crab FMP by Seafish fleet segments in 2018-2021 (Seafish FMP evidence, 2022)

There was a notable increase in the number of FTEs supported by over 12m vessels from 2016-2021, with over 100 more supported in 2021 (266) than 2016 (160). At the same time, the number of jobs supported by vessels under 12m fell between 2016 and 2021, for both the under 10m, and 10-12m vessel categories. FTEs supported by under 10m vessels fell from 77 in 2016 to 46 in 2021. In each year from 2017 to 2021, more than half of jobs FTEs were on over 12m vessels (and in 2019-2021 this was more than two thirds of FTEs). In 2016 less than half of jobs were on these vessels.

Lobster

Figure 44 shows employment calculated in terms of full-time job equivalents (FTEs) for the pots and traps lobster fishery in English waters. FTEs are a standardised measure of employment calculated based on average vessel crew and effort, assuming one FTE is representing 2,000 hours of work per year. The data is differentiated following the same methodology used for the economic performance indicators (see section above). Information about social and demographic

characteristics of employees is also published as part of Seafish's 2021 Employment in the UK Fishing Fleet report[88].

The total number of FTEs supported by the lobster fleet fishing in English waters was, between 2016 and 2021, highest in 2016 with 322 FTEs and lowest in 2019

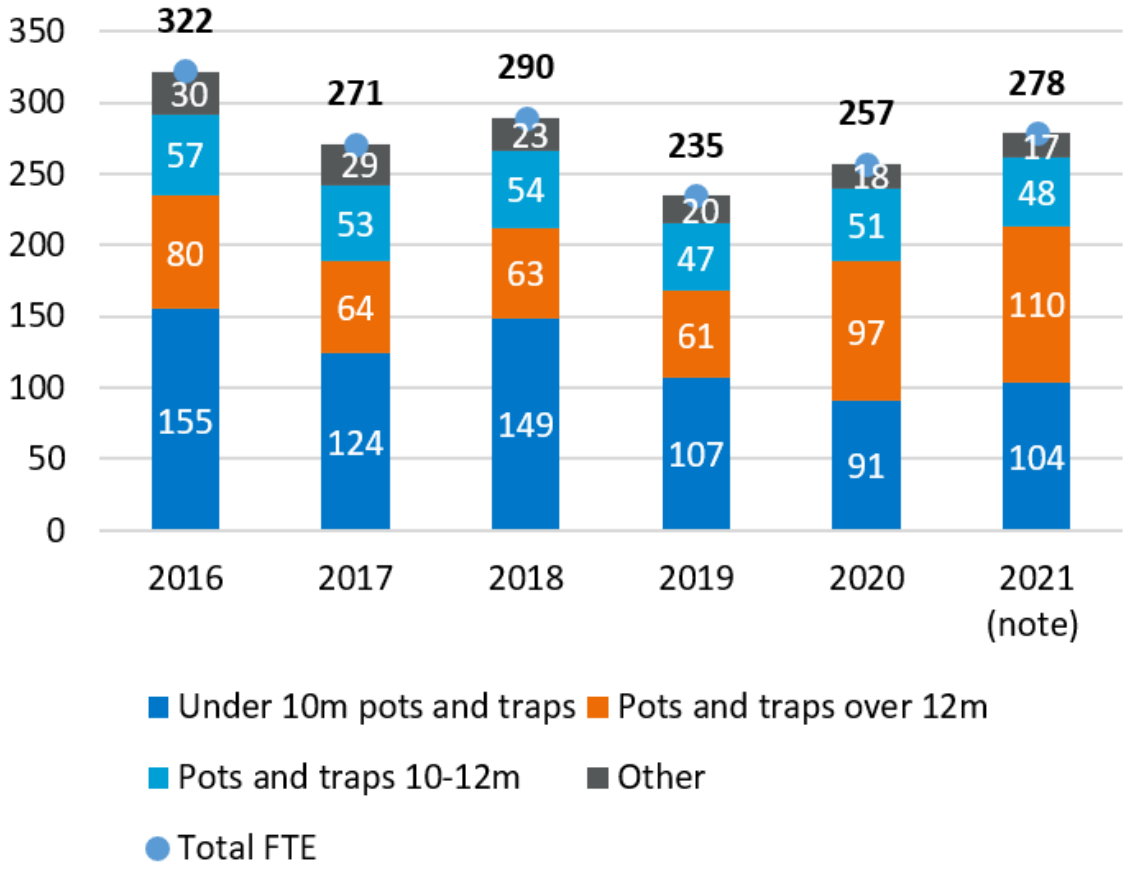

Figure 44: Employment (Full Time Equivalent, or FTE) associated with the lobster FMP by Seafish fleet segments in 2018-2021 (Seafish FMP evidence, 2022)

with 235 FTEs. In 2021, 278 FTEs were supported.

There was a notable decrease in the number of FTEs supported by under 10m vessels from 2016-2021. The number of FTEs supported by vessels over 12m in length fell between 2016 and 2019, before nearly doubling from 2019 (61 FTEs) to 2021 (110 FTEs). In 2020 and 2021, more FTE jobs were supported by the over 12m fleet than by the under 10m fleet. This is in contrast to 2018 when the number of FTEs supported by the under 10m fleet was more than twice as high as the number supported by the over 12m fleet.

Overall, English vessels primarily catching the species concerned in this FMP supported 563 FTEs in 2020. This was the lowest number since 2008 (when Seafish

88 https://www.seafish.org/document/?id=7D65694D-7F4F-4BFC-ACD0-EB4D6C66A549

data collection began). FTEs in England supported by vessels targeting these shellfish species peaked in 2018, with 795.

In 2020, over 23% of all FTE positions supported by the English fishing fleet were on vessels targeting the species relevant to this FMP. This was a higher proportion than any year from 2008 to 2018.

Despite the fact that 460 vessels fished predominantly for lobster in 2020, the English lobster fleet supported 219 FTE jobs, the lowest level since pre-2008. The most jobs supported by vessels targeting lobster was 338 in 2016.

While less than a quarter of the number of vessels that fished for lobster, caught predominantly crab in England in 2020 (112), these vessels supported significantly more jobs (339). This is a higher number of jobs than the fleet supported in any year from 2008-2015. The number of FTEs supported by the crab fleet peaked at 502 in 2018.

Vessels targeting spider crab in England have supported at least one FTE job every year since 2008, however the number of FTE positions has fallen from a high of 10 in 2011 to 1 in 2020. Vessels landing predominantly spider crab supported 4 FTE positions in 2019.

Since 2015, no vessels fishing predominantly for velvet crab in England have supported the equivalent of one FTE job.

Vessels for which the main target species was crawfish, supported 4 FTE jobs in England in every year from 2017 to 2020.

Onshore employment

In 2021, overall, there were 18,021 full time equivalent (FTE) jobs in the UK seafood processing industry, across 344 majority seafood processing sites (some of which belong to multi-site companies).

Employment in the English shellfish processing sector is predominantly in Yorkshire and the Humber, which had 4,407 FTE jobs across all sites in 2021. These sites include shellfish only processing sites and mixed sites (which also process shellfish).

FTE figures from other regions (combining both shellfish only and mixed processors) in England for 2021 are as follows:

- Midlands (East and West): 510
- East of England: 267
- Northeast (England): 185
- Northwest (England): 208
- Southeast (England) and London: 200

- Southwest (England): 1,326

In total, the English shellfish processing sector had 7,101 jobs as of 2021. Employment data does not differentiate down to species level (e.g., crab and lobster only processors).

The latest financial data (from 2018) calculated the total income from the seafood processing sector to be £4.1 billion, with a £427 million turnover. These figures will be updated following the results of the 2022 industry census conducted by Seafish.

Fishery management

Biological reference points currently in use

Current assessments for crab use 35% of virgin Spawner per Recruit (SpR) as a proxy for MSY, which 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[89,90,91,92].

Current management approaches

Fisheries management jurisdiction is organised on two different scales around England. Beyond 6 nautical miles, Defra and the MMO are responsible for managing crab and lobster fisheries, whereas from the coast out to 6 nautical miles responsibility lies with the Inshore Fisheries and Conservation Authorities (IFCAs) (see relevant IFCA byelaws listed in Table 24).

89 Clark, W. G. (1991) 'Groundfish exploitation rates based on life history parameters', Canadian Journal of Fisheries and Aquatic Sciences, 48, pp. 734-750. https://doi.org/10.1139/f91-088

90 Mace, P. M. and Sissenwine, M. P. (1993) 'How much spawning per recruit is enough?', in S. J. Smith, J. J. Hunt and D. Rivard (ed.) Risk evaluation and biological reference points for fisheries management. Canadian Special Publications of Fisheries and Aquatic Sciences, pp. 101-118.

91 Tully, O., Robinson, M., Cosgrove, R., O'Keeffe, E., Doyle, O. and Lehane, B. (2006) 'The Brown Crab (Cancer pagurus L.) Fishery: Analysis of the resource in 2004 – 2005'. Fisheries Resource Series, Bord Iascaigh Mhara (Irish Sea Fisheries Board), Dun Laoghaire, Ireland, 4, 48 pp.

92 ICES (2018) 'Technical Guidelines - ICES reference points for stocks in categories 3 and 4', ICES Technical Guidelines. Available at: https://doi.org/10.17895/ices.pub.4128

Management of crab and lobster fisheries within English waters relies on technical measures only, except for the Western Waters management regime for >15m vessels, which are limited by days at sea restrictions.

National legislation restricts the number of shellfish licences available (in England and Wales) and prohibits landing of berried lobster, soft-shelled crabs (unless for bait), and lobsters with a v-notch in their tail fin. Minimum Conservation Reference Sizes (MCRS) are applicable to both brown crab and lobster. Landing of crab claws is also prohibited if the weight exceeds 1% of the total landings (pots) or 75kg (nets). Regional measures are enforced by the 10 IFCAs within England, whose jurisdictions extend from the coast out to 6nm.

Marine Plans

There are 11 marine plans in place around England, the purpose of marine plans is to guide those who use and regulate the marine area to encourage sustainable development while considering the environment, economy and society. Marine plans set out priorities and direction for future development, inform sustainable use of resources, and help marine resource users understand where new developments may be appropriate. The MMO is responsible for preparing marine plans in England, plans are based on the policy framework of the UK Marine Policy Statement (under the Marine and Coastal Access Act 2009) and serve as a link between national and local policy application[93].

Marine plans are particularly relevant to fisheries in the context of minimising spatial conflict and spatial squeeze. Prospective users applying for licences to develop activities in the marine space are required to show how they have considered local marine plans and the Marine Policy Statement and evidence how their proposal aligns with the objectives laid out in local plans, this includes collecting and mapping information about fishing activities in the proposed development area in order to mitigate environmental, social, and economic impacts.

93 Marine planning in England, gov.uk

Table 24: Summary of IFCA byelaws for regional management of English crab and lobster fisheries. Full byelaws available from relevant authority.

Byelaw	IFCA	Crab	**Lobster**
Permit required for commercial landings:	Northumberland	Yes	Yes
	North-Eastern	Yes	Yes
	Eastern	Yes	Yes
	Kent & Essex	Yes	Yes
	Southern	No	No
	Sussex	Yes	Yes
	Devon & Severn	Yes	Yes
	Cornwall	Yes	Yes
	Isles of Scilly	Yes	Yes
	North-Western	Yes	Yes
Minimum landing size:	Northumberland	Yes - 130mm	Yes - UK MCRS
	North-Eastern	Yes - 140mm	Yes - UK MCRS
	Eastern	Yes - 115mm	Yes - UK MCRS
	Kent & Essex	Yes - UK MCRS	Yes - UK MCRS
	Southern	Yes - UK MCRS	Yes - UK MCRS
	Sussex	Yes - 140mm	Yes - UK MCRS

Byelaw	IFCA	Crab	**Lobster**
	Devon & Severn	Yes - 150mm (f), 160mm (m)	Yes - 90mm
	Cornwall	Yes - 150mm (f), 160mm (m)	Yes - 90mm
	Isles of Scilly	Yes - 150mm (f), 160mm (m)	Yes - 90mm
	North-Western	Yes - UK MCRS	Yes - UK MCRS
Maximum pot limit:	Northumberland	Yes - 800	Yes - 800
	North-Eastern	No	No
	Eastern	No	No
	Kent & Essex	No	No
	Southern	No	No
	Sussex	Yes - 300 (<3m), 600 (<6m)	Yes - 300 (<300m), 600 (<6m)
	Devon & Severn	No	No
	Cornwall	No	No
	Isles of Scilly	No	No
	North-Western	Yes	No for full commercials with shellfish entitlement, yes for other categories.
Escape gaps:	Northumberland	No	No
	North-Eastern	Yes	Yes
	Eastern	Yes	No

Byelaw	IFCA	Crab	**Lobster**
	Kent & Essex	Yes	Yes
	Southern	No	No
	Sussex	Yes	Yes
	Devon & Severn	Yes	Yes
	Cornwall	Yes	No
	Isles of Scilly	No	No
	North-Western	Yes	Yes
Maximum vessel length:	Northumberland	Yes - 12m	Yes - 12m
	North-Eastern	Yes – 10m inside 3nm/16m inside 6nm	Yes – 10m inside 3nm/16m inside 6nm
	Eastern	No	No
	Kent & Essex	Yes - 14m	Yes - 14m
	Southern	Yes - 12m	Yes - 12m
	Sussex	Yes - 14m	Yes - 14m
	Devon & Severn	Yes - 15.24m	Yes - 15.24m
	Cornwall	Yes - 16.46m	Yes - 16.46m
	Isles of Scilly	Yes - 11m	Yes - 11m
	North-Western	Yes - 12m	Yes - 12m

Byelaw	IFCA	Crab	**Lobster**
Towed gear restrictions:	Northumberland	No	No
	North-Eastern	No	No
	Eastern	Yes	Yes (some areas)
	Kent & Essex	Yes	Yes
	Southern	Yes	Yes
	Sussex	No	No
	Devon & Severn	Yes	Yes
	Cornwall	No	No
	Isles of Scilly	Yes	Yes
	North-Western	No	No
Prohibits removal of parts of species (crab or lobster):	Northumberland	Yes	Yes
	North-Eastern	Yes	Yes
	Eastern	Yes	Yes
	Kent & Essex	Yes	Yes (some areas)
	Southern	No	No
	Sussex	No	No
	Devon & Severn	Yes (30kg allowance when using nets)	Yes

Annex 1: Evidence Statement for Crab & Lobster FMP

Byelaw	IFCA	Crab	**Lobster**
	Cornwall	Yes	No
	Isles of Scilly	No	No
	North-Western	No	No

Department
for Environment
Food & Rural Affairs

Proposed Fisheries Management Plan for Crab and Lobster in English Waters

Annex 2: Evidence and Research Plan

Date: July 2023

Version: public consultation

Context

In this document, “crab” refers to brown crab (Cancer pagurus) and “lobster” refers to European lobster (Hommarus gammarus) unless specified otherwise.

The FMP has identified evidence gaps which may need to be filled to achieve the stated FMP goals. In the short term, Defra will collate and prioritise these evidence gaps across the entire FMP programme, to look to deliver evidence to support in addressing some of the most pressing and key questions identified within the FMPs. However, all evidence gaps identified across the FMP programme cannot be funded by Defra alone. In the longer term, to support the phased approach of FMPs and progress towards meeting the Fisheries Act objectives, Defra are developing an evidence pathway that promotes collaboration between industry, academia and fisheries managers to address these identified evidence gaps for FMPs.

For the following table, **Reference number** relates to FMP objective for example research need 1.1 relates to FMP objective 1, research need 2.1 relates to FMP objective 2 etc.

Crab and Lobster FMP objectives

Reference	Research need	Description of activities and overall aim(s)	Progress
FMP objective 1. Develop and pilot a comprehensive data collection programme for crab and lobster fisheries which supports a data-rich future and results in the establishment of a reliable time series that facilitates sustainable management.			
1.1	Develop and implement an efficient **fishery-dependent**[1] data collection programme capable of establishing a long-term time series of data suitable for evidence-based	(a) Define fishery-dependent data requirements to support assessment/ monitoring of stock status; development/ monitoring/ evaluation of harvest strategies, and MCS[2]. For example: 1. **Spatial distribution of fishing activity** (for example per ICES (sub)rectangle; VMS; iVMS) 2. **Amount of fishing effort** (for example pot numbers at sea; pot numbers hauled per trip) 3. **Landings** (tonnages; value)	Strategic approach to evidence provisioning for UK fisheries under development[4] CMG SSG[5] have met quarterly since spring 2021 to discuss data requirements for crab and

1 Fishery-dependent data is collected from the fishery itself, using both commercial and recreational sources. There are a variety of methods for obtaining fishery-dependent data. The most common approach is to use recorded landings.

2 MCS = Monitoring, Compliance, and Surveillance.

4 Strategic Evidence Framework for Fisheries (SEFF). This brings together key stakeholders, including Defra, MMO, Cefas, AIFCA, FAs, and Seafish.

5 CMG SSG = Crab and lobster Management Group Science Sub-Group, which consists of Cefas scientists, independent scientists, and a subset of scientifically minded regulators and industry representatives who meet on a quarterly basis to discuss current best available evidence on crab and lobster fisheries in support of the FMP.

Reference	Research need	Description of activities and overall aim(s)	Progress
	management (improving on existing mechanisms).	4. **Fleet characteristics** (for example vessel length; nationality) 5. **Fishing method(s)** (for example gear type(s); bait used; soak time) 6. **Bycatch** (for example species; frequency of capture) (b) Review what fishery-dependent data[1] are currently collected from crab and lobster fisheries (how, when, and by whom) to identify where data gaps exist. (c) Evaluate efficiency and appropriateness of current data gathering protocols, considering: 1. Whether data collected are fit for purpose[3] 2. Whether data is collected as the appropriate resolution (for example ICES rectangle/ sub-rectangle) (link to principles three to seven) 3. Where there is duplication of effort 4. Agility to address emerging evidence gaps 5. Opportunities for improvement (d) Develop and implement an improved national crab and lobster fishery-dependent data collection strategy (building on existing mechanisms where appropriate), which delivers evidence which is fit for purpose[3].	lobster fishery management. Shellfish Industry Advisory Group (SIAG) data inventory (2021) contains a collation of all fishery-dependent data collected from UK shellfish fisheries Fishery-dependent data currently gathered through eLogs and Catch app, however key data gaps still exist General consensus that improved **effort data** will be critical for evidence-based management. Mandatory data collection mechanisms must therefore collect data on:

3 With respect to supporting responsive, evidence-based fishery management decisions in line with Fisheries Act 2020 objectives.

Reference	Research need	Description of activities and overall aim(s)	Progress
			• Pot numbers at sea • Pot numbers hauled • Soak time • Bait type
1.2	Improve (as required) **fishery-independent[6]** data collection programmes for crab and lobster fisheries, ensuring they can establish a long-term time series of data suitable for evidence-based management.	(a) Define fishery-independent data[6] requirements to support assessment/ monitoring of stock status; and development/ monitoring/ evaluation of harvest strategies[7]. Consider data requirements of length-based assessment method(s). (b) Review what fishery-independent data[6] are currently collected from crab and lobster fisheries (how, when, where, and by whom) to identify where data gaps exist. (c) Review options around the gathering of catch composition data, for example 1. New technologies (REM; AI) 2. Opportunities for data collection at multiple stages of the supply chain (for example processors)	Time-series of core biological data collected and available under current stock assessment protocols Strategic approach to evidence provisioning for UK fisheries under development[8]

6 Fishery-independent data is typically collected through scientific surveys at sea, and often forms the cornerstones of stock assessments.

7 MCS = Monitoring, Compliance, and Surveillance.

8 Strategic Evidence Framework for Fisheries (SEFF).

Reference	Research need	Description of activities and overall aim(s)	Progress
		(d) Develop and implement an improved national crab and lobster fishery-independent data collection strategy (building on existing mechanisms where appropriate), which delivers evidence which is fit for purpose[3], and available at the appropriate spatial and temporal resolution (link to principles two, five, and six).	CMG SSG[9] have met quarterly since spring 2021 to discuss data requirements for crab and lobster fishery management
1.3	Develop and implement an efficient **social and economic** data collection programme capable of establishing a long-term time series of data suitable for evidence-based management.	(a) Define social and economic data requirements to support development/ monitoring/ evaluation of harvest strategies. (b) Review what social and economic data are currently collected from crab and lobster fisheries (how, when, where, and by whom) to identify where/ whether data gaps exist. (c) (If required) Improve upon the existing national, social and economic data collection strategy to ensure evidence is fit for purpose[3].	An ongoing data collection programme covering social and economic data across the UK fishing fleet is coordinated by Seafish

9 CMG SSG = Crab and lobster Management Group Science Sub-Group, which consists of Cefas scientists, independent scientists, and a subset of scientifically minded regulators and industry representatives who meet on a quarterly basis to discuss current best available evidence on crab and lobster fisheries in support of the FMP.

Reference	Research need	Description of activities and overall aim(s)	Progress
1.4	Improve availability of data required to assess **wider environmental interactions** of crab and lobster fisheries.	(a) Define wider environmental data requirements to support development/ monitoring/ evaluation of management measures addressing the "ecosystem objective"[10]. (b) Review what data on wider environmental interactions are currently collected from crab and lobster fisheries (how, when, where, and by whom) to identify where data gaps exist. (c) Design and deliver research addressing key data gaps around the wider environmental impacts of crab and lobster fisheries, delivering evidence which is fit for purpose[3].	Some evidence exists (and is currently being collected through a 2022-24 FISP project led by Bangor University) on the wider environmental interactions of crustacean pot fisheries, however no strategic approach
FMP objective 2. Establish methods to better assess stock status that reflect the life history of the target species and fishery exploitation patterns.			
2.1	Critique and improve upon current stock assessment	(a) Explore current state of understanding/ uncertainties around parameters such as:	ICES WGCRAB[18] generates advice on crab and lobster biology

10 Fisheries Act 2020 "ecosystem objective" is that: (a) Fish and aquaculture activities are managed using an ecosystem-based approach so as to ensure that their negative impacts on marine ecosystems are minimised and, where possible, reversed, and (b) incidental catches of sensitive species are minimised and, where possible, eliminated.

Reference	Research need	Description of activities and overall aim(s)	Progress
	approaches[11] by evaluating sources of uncertainty, their impact on stock assessment outputs, and recommended improvements.	a. Stock definition (CFUs and LFUs)[12] i. Migration patterns[13] ii. Settlement & recruitment dynamics iii. Larval dispersal dynamics b. Population abundance[14] c. Catchability[15] (and selectivity) i. Behavioural influences ii. Implications of bait-type[16] d. Growth rates	(reproduction, recruitment, growth, and distribution), assessment methods and impacts Female crabs in the Channel migrate from east to west with no evidence of return[19]Assessments must consider that

11 Cefas currently produced bi-annual stock summaries which estimate sustainability based on the results of Length-Based Cohort Analyses (LCA) and Yield Per Recruit assessments. Fishing mortality and spawning stock biomass estimates are calculated and presented in relation to reference points: Target reference is a maximum sustainable yield proxy of 35% virgin spawner per recruit (SPR) and the limit is 15% SPR.

12 Crab Fishery Units (CFU) and Lobster Fishery Units (LFU) are stock defined based on understandings of larval distribution, hydrographic conditions, and distributions. CFU and LFU are assessed by Cefas as part of the Cefas stock assessment programme.

13 The current model used to carry out the national stock assessments does not incorporate migration within its calculations and assumes the system is closed. Migration is a key life history trait of crabs that needs to be taken into consideration when conducting stock assessments, as it impacts biomass availability within the fishery. This is less of a consideration for lobster fisheries as this is a more sedentary decapod species.

14 Population abundance indices are a key component in most stock assessments. The use of CPUE (or LPUE) often use days fished as the effort metric, which is not a very accurate representation for crab and lobster pots. Instead, the number of pot hauls per day is considered to be more representative of true fishing power.

15 Currently estimated through modelling.

16 Skerritt et al (2020).

19 Hunter, E., Eaton, D., Stewart, C., Lawler, A. and Smith, M.T., 2013. Edible crabs “Go West”: migrations and incubation cycle of Cancer pagurus revealed by electronic tags. PLoS One, 8(5), p.e63991.

Reference	Research need	Description of activities and overall aim(s)	Progress
		e. Natural mortality[17] (b) Explore uncertainties associated with stock assessment input data such as: 1. Landings data 2. Effort data (currently based on days at sea) (c) Evaluate the impact of uncertainties upon final sustainability estimates and conclusions, and how such uncertainties can be accounted for in management measures.	exploitable biomass in the west will be influenced by biomass in the east[20] Larval dispersal rate in the Channel estimated using hydrodynamic & particle tracking models[21] NIFCA study[22] compared number of individuals caught to number observed around pot[23]

17 Natural mortality is assumed to be 20% for crab, and 15% for lobster (ICES WGCRAB).

20 ICES Working Group on the biology and life history of crabs.

20 Pearson, E., 2017. A collaborative study to develop and facilitate a fisher-directed stock assessment of Cancer pagurus in the Inshore Potting Area, south Devon (Doctoral dissertation, University of Leicester).

21 Cefas - Nawri et al. (2021).

22 NIFCA - Wright, J., Lobsters on the ground: improving understanding of shellfish populations on the Northumberland coast.

23 Such studies will allow catch data to be put in context of the estimated population size, and to assess the feasibility of using catch rates as indices of stock assessments.

Reference	Research need	Description of activities and overall aim(s)	Progress
2.2	Address uncertainties in current modelling approach.	(a) Undertake research to address uncertainties in input parameters, for example: 1. Develop pre-recruit indices of abundance (for lobster) 2. Explore animal behaviour to obtain more insight into pot selectivity 3. Provide more accurate estimates of growth parameters and natural mortality. (b) Explore models less sensitive to regional minimum landing size[24]. (c) Explore methods of gathering useful fishing effort data from static gear fisheries. (d) Determine the granularity at which long-term data collection should be carried out to provide a greater understanding of stock dynamics for example migration.	Cefas developing Length-based Virtual Population Analysis model (LVPA)[25] Testing new technologies to improve data on population structure/dynamics[26] HFIG FISP camera project (2022) will contribute towards assessing uncertainties associated with the catchability/ selectivity of pot fisheries Exploratory work on natural mortality rates/ growth parameters and

[24] ICES WGCRAB recommendation.

[25] LVPA includes coupling of different populations, which enables migration to be included within the assessment.

[26] for example 'Bluetooth callipers' (Masefield et al., 2017) and AI monitoring in England (Gouldby et al, 2021) and Wales (Hold et al., 2015; 2022 FISP project).

Reference	Research need	Description of activities and overall aim(s)	Progress
			their influences on sustainability estimates completed in support of Orkney brown crab FIP (unpublished or grey literature)[27]
2.3	Test amended modelling approaches.	(a) Benchmark LCA assessments[11] to review: 1. Sensitivity of model parameters 2. Model assumptions (using simulated datasets) (b) Consider means of developing more dynamic stock assessment methodologies, for example accounting for variability between years.	(see point above on development of LVPA models)
FMP objective 3. Assess the impact of crab and lobster fishing activity on the wider marine environment.			
3.1	Evaluate direct impacts of crab and lobster fisheries on the wider marine environment.	(a) Review of current literature on the direct environmental impacts of crab and lobster pot fisheries (excluding impacts arising from pot losses, see research need 3.2), for example 1. Nature of the risk posed to benthic habitats (seafloor interactions)	Joint Nature Conservation Committee (JNCC) and Natural England (NE) advice to Defra received December 2022

27 M. Bell, pers. comms. (2023).

Reference	Research need	Description of activities and overall aim(s)	Progress
		2. Nature of the risk posed to ETP[28] species 3. Hotspots where risk is highest (b) Identify key evidence gaps/ requirements for supporting appropriate management. (c) Design and deliver research to fill key evidence gaps. (d) Evaluate anticipated need for management interventions.	Impacts on ETP species investigated through the PUK SW Crab and Lobster FIP[29] Study using underwater video to quantify the footprint and impact of potting in South Devon[30] Evidence gaps identified around short-to-long term impacts and habitat recovery rates[31]

28 Endangered, Threatened and Protected.

29 Project UK (PUK) Fishery Improvement Project (FIP) for the UK Western Channel and Celtic Sea is a five-year project that supports Brown crab and European lobster fisheries management by developing action plans to enhance the sustainability of stocks and minimise the environmental impacts from the fisheries.

30 Sarah C. Gall, Lynda D. Rodwell, Sarah Clark, Tim Robbins, Martin J. Attrill, Luke A. Holmes, Emma V. Sheehan. The impact of potting for crustaceans on temperate rocky reef habitats: Implications for management. Marine Environmental Research, 2020; 162: 105134.

31 Defra NQS Evidence Strategy.

Reference	Research need	Description of activities and overall aim(s)	Progress
3.2	Explore the frequency, scale, and impact of pot losses.	(a) In collaboration with industry, review drivers of pot losses (for example inclement weather). (b) In collaboration with industry, review frequency and scale of pot losses. (c) Assess impact(s) of pot losses (on the wider marine environment) in terms of risk and severity. (d) Evaluate anticipated need/ options for management interventions.	Some wider literature exists, but there is a need for improved evidence relevant to the FMP area
3.3	Review existing mitigation and avoidance measures used in shellfish pot fisheries to minimise benthic impact, and the need for additional measures.	(a) Map the prevalence and efficacy of avoidance and mitigation measures applied in English crab and lobster fisheries to minimise negative benthic impacts, accounting for regional variation in 1. Fishing methods/ activity 2. Gear types/ design 3. Species/ habitats present 4. Legislative context, for example MPA designations. (b) Review measures employed in other jurisdictions/ fisheries to reduce negative interactions between static gear fisheries and benthic habitats.	JNCC and NE advice to Defra received December 2022
3.3	Review existing mitigation and avoidance measures used in shellfish pot	(a) Map the prevalence and efficacy of avoidance and mitigation measures applied in English whelk fisheries	JNCC and NE advice to Defra received December 2022

Reference	Research need	Description of activities and overall aim(s)	Progress
	fisheries to minimise impacts on endangered, threatened, and protected (ETP) species, and the need for additional measures.	to minimise negative impacts on ETP species, accounting for regional variation in 1. Fishing methods/ activity 2. Gear types/ design 3. Species/ habitats present 4. Legislative context, for example MPA designations. (b) Review measures employed in other jurisdictions/ fisheries to reduce negative interactions between static gear fisheries and ETP species.	Alternative management measures to minimise mortality to non-target species reviewed through the PUK SW Crab and Lobster FIP[29] Hauling Up Solutions (2019) and Hauling Up Solutions 2 (2022) recommendations for gear modifications to address wildlife bycatch in UK fisheries
FMP objective 4. Improve understanding of interactions between the UK crab and lobster fisheries, and other fisheries.			
4.1	Review interactions between crab and lobster fisheries and other fisheries (including bycatch species).	(a) Review of available information on nature of interactions between crab and lobster fisheries and other fisheries, for example 1. Direct interactions (incidental capture of non-target species) 2. Indirect interactions (through sourcing or provisioning of bait) 3. Regional differences/ localisation of issues (b) Assess impacts of interactions (as per 4.1a) on :	SIAG and CMG meetings may be used as a forum to invite discussions on this topic PUK SW Crab and Lobster FIP[29] review of

Reference	Research need	Description of activities and overall aim(s)	Progress
		i. Economic impacts ii. Sustainability implications (c) Identify key evidence gaps/ requirements for supporting appropriate management. (d) Design and deliver research to fill key evidence gaps. (e) Evaluate anticipated need for management interventions.	management for non-target species
4.2	Review issues and potential solutions surrounding gear conflict where fisheries interact on shared fishing grounds.	(a) Review available evidence on gear conflict (for example between the potters and scallopers) between crab and lobster fisheries and other fisheries to: 1. Identify hotspots (defined both spatially and temporally) where conflict occurs 2. Inform future management measures across relevant fisheries (for example zonal management)	SIAG and CMG meetings may be used as a forum to invite discussions on this topic Discussions around potential hotspots in the SW of England, and off the coast of Hartlepool
4.3	Assess the impact of other fisheries on crab and lobster stocks, in terms of bycatch and additional mortality.	(a) Review available evidence the impact of other fisheries on crab and lobster stocks to: 1. Identify hotspots (defined both spatially and temporally) where bycatch and/or mortality occurs 2. Inform future management measures across relevant fisheries	SIAG and CMG meetings may be used as a forum to invite discussions on this topic

Reference	Research need	Description of activities and overall aim(s)	Progress
FMP objective 5. Devise and implement a short- to medium -term management approach proposal that considers the external regulatory environment.			
5.1	Evaluate the appropriateness of existing management measures (for example MLS, WWER[32]).	(a) Review existing technical conservation measures by mapping their: 1. Application and enforcement 2. Effectiveness (if possible) 3. Unintended consequences (if relevant) (b) Produce guidelines for optimising the effectiveness of technical conservation measures.	SIAG and CMG meetings may be used as a forum to invite discussions on this topic Cefas review of WWER[32] alternatives evaluates current effort management approach, and potential Size, Sex, and Season (3S) approach PUK SW Crab and Lobster FIP[29] Harvest Control Rules (HCR) workshops indicated industry views on options for fleet and effort

32 WWER = Western Waters effort regime, applicable to UK crab and scallop fisheries.

Reference	Research need	Description of activities and overall aim(s)	Progress
			management, and technical measures
5.2	Evaluate means of managing fishing effort by improved **technical measures**.	(a) Evaluate options around improving technical measures (for example gear handling and use; gear design; and catch composition/ MLS), considering: 1. Appropriate design of management measure (for example MLS, gear design) 2. Anticipated effectiveness (and whether supporting measures would be required) 3. Practicalities of implementation/ enforcement 4. Appropriate scale for implementation given local variations in biological and fishery characteristics 5. Impact and likelihood of unintended consequences, for example displacement to other NQS fisheries 6. Likely economic and social impacts (b) Identify data requirements and evidence gaps inhibiting optimisation of technical measures. (c) Design and deliver research to fill key evidence gaps (as required).	Cefas review of WWER alternatives evaluates Size, Sex, and Season (3S) approach PUK SW Crab and Lobster FIP[29] HCR workshops gathered industry views on options for fleet and effort management, and technical measures Discussions held in CMG meetings Discussions invited on this topic during early crab and lobster FMP stakeholder engagement events

Reference	Research need	Description of activities and overall aim(s)	Progress
		(d) Estimate a timeframe for implementation, accounting for time to deliver on key data requirements/ evidence gaps.	(October - December 2022)
5.3	Evaluate options for managing fishing effort by controlling **fleet capacity** in the absence of full time series data on effort.	(a) Evaluate options around controlling fleet capacity, considering: 1. Appropriate design of management measure 2. Anticipated effectiveness (and whether supporting measures would be required) 3. Practicalities of implementation/ enforcement 4. Impact and likelihood of unintended consequences, for example displacement to other NQS fisheries 5. Likely economic and social impacts	PUK SW Crab and Lobster FIP[29] HCR workshops indicated industry views on options for fleet and effort management, and technical measures Discussions held in CMG meetings

Reference	Research need	Description of activities and overall aim(s)	Progress
		(b) Identify and address data requirements/ evidence gaps. (c) Estimate a timeframe for implementation, accounting for time to deliver on key data requirements/ evidence gaps.	Discussions invited on this topic during early crab and lobster FMP stakeholder engagement events (October - December 2022)
5.4	Evaluate options for managing fishing effort by **input controls** in the absence of full time series data on effort.	(a) Evaluate options around input controls (for example spatial or seasonal closures), considering: 1. Appropriate design of management measure (for example details of closed areas/ timings) 2. Anticipated effectiveness (and whether supporting measures would be required) 3. Practicalities of implementation/ enforcement 4. Appropriate spatial and temporal scale given local variations in biological and fishery characteristics 5. Impact and likelihood of unintended consequences, for example displacement to other NQS fisheries 6. Likely economic and social impacts (b) Identify data requirements and evidence gaps for determination of appropriate spatial and/or seasonal closures (for example spawning period). (c) Design and deliver research to fill key evidence gaps.	Cefas review of WWER alternatives evaluates Size, Sex, and Season (3S) approach PUK SW Crab and Lobster FIP[29] HCR workshops gathered industry views on options for fleet and effort management, and technical measures Discussions held in CMG meetings Discussions invited on this topic during early crab and lobster FMP stakeholder

Reference	Research need	Description of activities and overall aim(s)	Progress
		(d) Estimate a timeframe for implementation, accounting for time to deliver on key data requirements/ evidence gaps.	engagement events (October - December 2022)
5.5	Evaluate options for managing fishing effort by **output controls** in the absence of full time series data on effort.	(a) Evaluate options around output controls (for example TACs[33]), considering: 1. Appropriate design of management measure (for example details setting catch limits) 2. Alignment with requirements of the UK-EU Trade and Cooperation Agreement 3. Anticipated effectiveness (and whether supporting measures would be required) 4. Practicalities of implementation and enforcement 5. Appropriate scale given local variations in biological and fishery characteristics 6. Impact and likelihood of unintended consequences, for example displacement to other NQS fisheries 7. Likely economic and social impacts	Cefas review of WWER alternatives evaluates catch limits[34] approach PUK SW Crab and Lobster FIP[29] HCR workshops gathered industry views on options for fleet and effort management, and technical measures Discussions held in CMG meetings Discussions invited on this topic during early crab and lobster FMP stakeholder

33 TAC = Total Allowable Catch.

34 Whilst it could be possible to set limits based on recent landings (analogous to ICES Category 3 assessments), it is not possible to provide annual TAC advice using current stock assessments and uncertain stock boundaries makes setting catch limits for discrete populations complex.

Reference	Research need	Description of activities and overall aim(s)	Progress
		(b) Identify data requirements and evidence gaps for setting of TACs (for example analytical basis for catch forecasts to provide annual TAC advice). (c) Design and deliver research to fill key evidence gaps (as required). (d) Estimate a timeframe for implementation, accounting for time to deliver on key data requirements/ evidence gaps.	engagement events (October – December 2022)
5.6	Evaluate alternate interim management scenarios to identify an appropriate approach.	(a) Collaboratively determine appropriate interim management approach under current data availability (relating to outputs of 5.2 to 5.5). (b) Develop methods to ensure that management measures may be adjusted in response to changes in the assessed state of the stock (according to best available evidence).	To be commenced.
FMP objective 6. Establish a long-term management approach for crab and lobster fisheries in line with improvements in data collection and stock assessment.			
6.1	Identify appropriate management options under improved evidence availability.	(a) Revise research needs 5.2 to 5.5 to identify appropriate long-term management options available under improved evidence provisioning.	To be commenced.

Reference	Research need	Description of activities and overall aim(s)	Progress
6.2	Evaluate and identify options around setting Harvest Control Rules (HCRs)[35].	(a) Collaboratively evaluate whether HCRs would be an appropriate management tool for crab and lobster fisheries. (b) Determine what information would be required to set HCRs, for example 1. Indicators of stock status 2. Reference points (c) Develop and agree methods to ensure that HCRs may be adjusted in response to changes in the assessed state of the stock (according to best available evidence).	Cefas review of WWER alternatives evaluates catch limits approach PUK SW Crab and Lobster FIP[29] HCR workshops gathered industry views on options for fleet and effort management, and technical measures Discussions held in CMG meetings Discussions invited on this topic during early crab and lobster FMP stakeholder engagement events (October - December 2022)

35 Harvest control rules (HCRs) = the operational component of a harvest strategy and set a pre-agreed response to changes in the fishery; for example, a pre-determined reduction in fishing effort triggered by changes to an indicator of stock status.

Reference	Research need	Description of activities and overall aim(s)	Progress
			In Cefas stock assessments, fishing mortality estimates are calculated in relation to reference points (% SPR)[11]
6.3	Evaluate alternate long-term management scenarios, to identify an appropriate approach.	(a) Undertake scenario modelling to explore alternate management regimes (i.e. different combinations of management measures and/or scales of implementation etc.), considering costs and benefits in terms of: 1. Long-term stock sustainability 2. Long-term economic sustainability 3. Long-term social sustainability 4. Wider environmental impacts 5. Climate change mitigation and adaptation (b) Collaboratively determine most appropriate long-term management approach.	To be commenced.

Evidence and research plan: shared shellfish principles

Shared shellfish principles developed alongside frontrunner FMPs for crab and lobster (English waters only), crab and lobster (English waters only), and king scallop fisheries (English and Welsh waters).

Reference	Research need	Description of activities and overall aim(s)
Shared principle 4. Support the shellfish industry in matters regarding marine spatial planning and spatial squeeze.		
4.1	Develop and pilot an approach for identifying important fishing areas.	Evaluate potential methodologies and data requirements for identifying important shellfish fishing areas, for example by considering: • Hotspots where high densities of individuals above MCRS[36] are consistently recorded • Spatial patterns of fishing activity and catches across different seasons (present/ historic) Spatial distribution of areas where fishing is possible (for example substrate suitability, absence of other marine activities/ environmental protection which would inhibit fishing). Ensure data is available to support the shellfish sector in marine spatial planning issues. Agree on an appropriate methodology and trial under a pilot scheme.
Shared principle 10. Support the shellfish industry to (a) Mitigate emissions from the shellfish supply chain, and (b) Adapt to the environmental impacts of climate change.		

[36] MCRS = Minimum Conservation Reference Size.

Reference	Research need	Description of activities and overall aim(s)
10.1	Assess the carbon footprint of English shellfish supply chain using a scientifically informed metric.	Develop a scientifically informed metric for assessing the carbon footprint (for example emissions/per kg of catch) of the shellfish catching sector, which considers: • Blue carbon • Emission generations of fishing activity • Different fleet metiers • Carbon sequestration in shell material Develop a scientifically informed metric for assessing the carbon footprint of the shellfish supply chain, for example • Processing • Refrigeration • Transport Identify carbon 'hotspots' across the supply chain where efforts to reduce carbon emissions should be focused. Evaluate impacts of seasonal closures in terms of carbon footprint (i.e. rotational closures to fish only during the most productive season(s) may improve catch efficiency and reduce carbon footprint).
10.2	Identify opportunities for reducing carbon emissions in the shellfish sector.	Review strategies (operational changes and/or new technologies) employed in other comparable fisheries/ jurisdictions/ supply chains for reducing carbon emissions.

Reference	Research need	Description of activities and overall aim(s)
		Review potential strategies (operational changes and/or new technologies) for reducing carbon emissions across the English shellfish supply chain (catching, processing, transport), in terms of: • Targeting carbon hotspots in the supply chain • Quantifying potential reductions in overall carbon footprint • Economic viability (and whether additional funding streams would be required) • Practicalities of implementation (for example whether additional infrastructure is required at ports) • Time frames for implementation/ observed reductions in carbon emissions • Unintended consequences
10.3	Explore innovative uses for shellfish co- / by-products, for example shell waste, to minimise scope three emissions in the supply chain.	Facilitate collaboration between the shellfish sector, researchers, and other industries to identify viable uses for shellfish co- / by-products (for example shell waste).
10.4	Evaluate likely impacts of changing climatic conditions on English shellfish fisheries.	Review current literature on direct climate change impacts (including ocean acidification) on shellfish fisheries, for example • Population dynamics of target species • Fishing opportunity

Reference	Research need	Description of activities and overall aim(s)
		Review current literature on indirect climate change impacts on shellfish fisheries, for example • Toxic algal blooms • Incidence of disease Assess likely impacts of climate change on economic viability of commercial fisheries, with reference to knock-on societal impacts (for example loss of employment in coastal communities).
10.5	Assess options for English shellfish fisheries to adapt to operate under changing climatic conditions, with the aim of safeguarding long-term environmental and socio-economic sustainability.	Facilitate collaboration between the shellfish sector and researchers (and other relevant industries) to identify opportunities for the shellfish sector adapt to operate under changing climatic conditions.

Department for Environment Food & Rural Affairs

Proposed Fisheries Management Plan for Crab and Lobster in English Waters

Annex 3: Stakeholder Engagement Report

Date: July 2023

Version: public consultation

Contents

Summary

This report presents a summary of stakeholder feedback gathered by Seafish from informal stakeholder engagement activities delivered to develop the Crab and Lobster FMP for England. The report summarises feedback gathered from stakeholders at in-person events in England; from online events with participation from around the UK; and from emails and letters sent directly to the dedicated Seafish FMP inbox. The purpose of the report is to provide a summary of feedback which Seafish has used to refine FMP content.

The Crab and Lobster FMP has been prioritised for delivery in 2023 based on the economic value of these fisheries and the perceived need for improved management.

Between November and December 2022 inclusive, on behalf of Defra, Seafish hosted a series of in-person and online events as part of informal engagement to:

- Raise awareness about development of the Crab and Lobster FMP for English waters amongst stakeholders; and
- Present draft FMP objectives to stakeholders in order to gather feedback to determine whether they are fit for purpose and set the right direction of travel for crab and lobster fisheries in English waters.

This report was compiled by Seafish based on information gathered through the stakeholder engagement events and was used to refine draft FMP content, including fisheries management aims and objectives. Amendments to draft FMP content were presented to the Crab & Lobster Management Group's FMP Working Group to review and action as appropriate.

Overview

Historical engagement via the Crab & Lobster Management Group

The Crab and Lobster Management Group (CMG) was formed in July 2020 to focus on the sustainable management of the UK crab and lobster fishery. The CMG is an industry-led group which brings together industry stakeholders from across the UK crab and lobster supply chain, including scientific researchers, government, and fishery regulators to facilitate collaborative working between members to help inform management and regulation of crab and lobster fisheries at a national level.

A key driver to form the CMG was discussions at the Future of Our Inshore Fisheries conference in October 2019. Following the event there was an increased interest in considering how best to co-manage inshore fisheries. This initiative led to the formation of the Shellfish Industry Advisory Group (SIAG) and shellfish species-specific groups including the CMG. The CMG first met in February 2020 and meets quarterly to discuss issues facing crab and lobster fisheries, share knowledge and scientific research, and raise awareness about fisheries management developments.

Membership of the CMG is open to all industry stakeholders with an interest in UK crab and lobster fisheries, the group has members from across the UK and membership has grown organically through word-of-mouth communication between peers, publications in trade media, and awareness raising efforts publicised through social media. At the time of writing the CMG has 105 members, 55% of whom are industry representatives from the catching, processing, and export / wholesale sectors.

In mid-2020 Seafish canvassed CMG members to better understand stakeholder priorities regarding management of crab and lobster fisheries to help steer the focus of the group. Feedback from members was collated and grouped into three key priorities as follows:

- Establishing a baseline - improving understanding of crab and lobster fisheries as they currently are, including:
    - Current patterns of fleet activity and performance
    - Available biological information on stock status, life history, and stock boundaries
    - Appropriateness and effectiveness of management tools currently used in UK crab and lobster fisheries, including unintended consequences
- Data and research
    - Support development of stock assessment models better suited to the life history of the target species and fishery exploitation patterns
    - Improve understanding of how crab and lobster fisheries interact with other fisheries (including bait sourcing and provisioning, displacement of activity between sectors, and gear conflict and spatial considerations)
- Managing fishing effort
    - Explore opportunities to limit fishing effort in the short-term, either at a local or national level, to safeguard the fishery
    - Develop a management toolbox for crab and lobster fisheries of ‘fit for purpose’ measures to deliver sustainable fisheries

In early 2022 the CMG formed an FMP working group to bring together industry stakeholders and regulators to develop draft FMP objectives. The CMG’s efforts to identify key priorities for the UK crab and lobster fisheries helped inform early

discussions on potential FMP objectives by aligning stakeholder priorities with the objectives of the Fisheries Act 2020.

Through the CMG and associated sub-groups industry stakeholders have played an integral role in developing draft content which was presented at FMP engagement events in 2022.

Attendance and representation

In total 223 stakeholders attended the events hosted by Seafish as summarised in table 1. This included representation from the catching sector (individual fishers, producer organisations, and associations), processors, Inshore Fisheries and Conservation Authorities (IFCAs), non-governmental organisations (NGOs), and scientific researchers. The 'other' column in table 1 includes private individuals. Some stakeholders opted to attend more than one meeting meaning there is some duplication in total numbers of individual attendees presented in table 1.

The number of attendees at each meeting was recorded using either a sign-in sheet (in-person meetings) or by recording names of attendees in Microsoft Teams. It should also be noted that some attendees did not sign the attendance register or fill in all requested information (for example business sector) as such, the figures in table 1 may be slightly lower than actual attendance at individual meetings.

Table 1: Summary of attendance, by sector, at Crab and Lobster FMP engagement events, November - December 2022

Event location and date	Format	Seafish	Industry	Government / public body / research	NGO	Other*	Total
Salcombe (8 November 2022)	In-person	3	9	1	0	0	13
Ilfracombe (9 November 2022)	In-person	3	5	1	2	1	12
Padstow (9 November 2022)	In-person	3	14	1	0	1	19
Newlyn (10 November 2022)	In-person	4	8	4	0	0	16

Event location and date	Format	Seafish	Industry	Government / public body / research	NGO	Other*	Total
Bridlington (15 November 2022)	In-person	2	21	7	0	2	32
Amble (17 November 2022)	In-person	2	0	6	0	1	9
Drop-in session (18 November 2022)	Online	6	13	7	2	7	35
Shoreham-by-Sea (22 November 2022)	In-person	2	1	5	2	0	10
Drop-in session (24 November 2022)	Online	3	2	9	3	0	17
Drop-in session (1 December 2022)	Online	5	1	3	0	7	16
Cromer (14 December 2022)	In-person	2	14	5	0	2	23
Whitby (19 December 2022)	In-person	3	11	4	0	3	21
	Total	38	99	53	9	24	223

Event format

Seafish delivered a mix of in-person and online stakeholder engagement events to ensure as many stakeholders as possible had the opportunity to discuss and provide feedback on the draft FMP vison and objectives.

Locations of in-person events were initially proposed based on MMO landings figures for crab and lobster as an indication of fleet activity and local importance. Industry insight and advice was provided by CMG members to finalise the list of

venues so that events were held in areas where industry attendance and interest in the FMP was likely to be highest. Venues were selected at central locations to ensure that stakeholders were able to travel from neighbouring ports to attend in-person events.

Three online events were held using Microsoft Teams to broaden the reach of engagement activities beyond the ports selected for in-person events. Online events were not based on targeting specific areas and were open to all stakeholders with an interest in the FMP, regardless of their location or sector. On 24 November 2022 a dedicated online meeting was held for representatives of environmental NGOs; however, attendance was low, with some NGO representatives stating that static gear fisheries were not considered a priority in terms of environmental concerns or that they did not have sufficient expertise on the topic of crab and lobster fisheries to warrant engaging in the FMP development process. In addition to dedicated online sessions, a Seafish representative attended a quarterly meeting of Defra's NGO group to discuss the crab and lobster FMP, draft objectives, and proposed initial management interventions.

The engagement events were attended by a broad range of stakeholders including representatives of the catching sector (large and small (inshore / offshore) vessels, processors / wholesalers, regulators, scientific researchers, and some NGOs.

In-person and online events comprised of:

- An overview of the legislation background to the FMP project and development process
- An overview of the Crab and Lobster FMP development timeline and milestones
- An overview of the draft vison and objectives of the FMP as agreed by the CMG FMP Working Group and actions that need to be taken to achieve the objectives of the FMP

Events were focused on facilitated discussion and review of FMP objectives and open discussion of management options and aspirations for the future.

A dedicated FMP email inbox, hosted by Seafish, was made available for attendees to share further thoughts and feedback on the FMP. This report summarises information gathered via email between the Salcombe event on Tuesday 8 November 2022 and the completion of the draft report on 27 January 2023. Information was received from individual businesses / vessel owners, industry associations, and associations of seafood businesses and producer organisations. The email inbox will remain live and further feedback received through this channel will be reviewed by Seafish and Defra.

Promotion of events

Promotion of stakeholder engagement events was achieved through:

Direct communication with stakeholders, including:

- Email correspondence via the CMG, Shellfish Industry Advisory Group (SIAG), with members asked to help pass on information to colleagues, peers, association / organisation members
- Social media content shared through Seafish channels
- Email correspondence via the Defra FMP Comms & Engagement Group
- Email correspondence via IFCAs, Regional Fisheries Groups, and the Future of Inshore Fisheries (FOIF) mailing list
- Circulation through Seafish alerts and newsletters
- Email correspondence to all stakeholders who registered an interest in the Crab and Lobster FMP via a dedicated email address which was included in all promotional materials
- Circulation of online event joining details to individuals who had attended in-person events and provided contact details
- Direct communication with the eNGO community via Defra's eNGO group and through targeted email invitations sent directly to individuals engaged in other forums

Posters produced for each event using a template created by Mindfully Wired Communications of which was adapted for each individual event and shared widely via the means mentioned above

- Requested regular agenda segments to promote CMG FMP engagement events at Regional Fisheries Group (RFG) meetings and Inshore Fisheries and Conservation Authority Technical Advisory Group (IFCA TAG) meetings
- Publication of articles in the trade newspaper Fishing News by Seafish, Defra comms and Mindfully Wired Communications which including background information to the FMP process and dates for all FMP engagement events

Summary of discussion from Crab & Lobster FMP engagement events

Overview of the FMP development process

Seafish presented an overview of the FMP development process, how the Crab and Lobster FMP has been developed, discussed issues facing crab and lobster fisheries in English waters, and an overview of the timeline to get the FMP finalised.

Feedback on the FMP development process

General feedback on the development process for the Crab and Lobster FMP is presented below:

- Attendees welcomed the development of an FMP for crab and lobster fisheries but stressed the need for a joined-up approach to fisheries management both at a regional and national level. Crab and lobster fisheries and stocks span different regional boundaries (for example IFCA jurisdictions), national boundaries (both UK and EU), and crab migration and larval dispersal means that connectivity should be acknowledged
- The 'legislative hierarchy' of how the FMP will interact with other regulations – including IFCA byelaws and the UK / EU Trade and Cooperation Agreement – was not immediately apparent and requires further consideration. An action was taken by Defra to delineate these relationships
- Future management of crab and lobster fisheries via the FMP requires better understanding of segmentation within the shellfish fleet. There are significant differences between different vessels
- The spatial scale of any future management of crab and lobster fisheries should be determined with input from the fishing industry. Crab and lobster stocks and fisheries are highly variable around the coast and fishers are well placed to input to management discussions based on their experience
- Some small-scale fishers felt they were generally underrepresented in all management discussions and meetings (not limited to FMP engagement events or meetings). More work is required by regulators to ensure appropriate representation from all sectors, particularly those stakeholders who are not part of an association or producers' organisation

Overview of shared shellfish FMP principles, aims and objectives

Seafish presented the first draft of shared shellfish principles, as developed by the FMP working group of the SIAG. The proposal sets out an overarching vision to "Contribute to the long-term sustainability and economic viability of the UKs shellfish fisheries" and principles as follows:

- Formalise the structure of the SIAG and associated sub-groups and ensure effective representation so that it becomes a focal point of engagement on shellfish fisheries management in England.
- Assess fishing effort (including latent capacity) and, if necessary, recommend appropriate measures to manage effort
- Establish a mechanism that enables regulators to effectively engage with and draw on shellfish industry knowledge in relation to discussions relating to NQS management through the Trade and Cooperation Agreement.
- Enable better involvement of the shellfish industry in matters regarding marine spatial planning and spatial squeeze by facilitating better collaboration between regulators, planners, and industry stakeholders.
- Improve understanding of the impacts of non-fishing marine activities (for example capital dredging, undersea cables) on English shellfish stocks.
- Progress initiatives to increase and promote consumption of sustainable UK shellfish.
- Facilitate and promote trade opportunities for shellfish in overseas markets (EU and non-EU).
- Develop advice and guidance on shellfish welfare issues to help the industry to further develop and implement best practice handling measures.
- Industry to take collective responsibility to comply with welfare and good working conditions legislation and guidance to ensure the highest possible levels of standards across the shellfish sector supply chain.

Open discussion was invited on the draft content with a focus on determining the appropriateness of the principles and management options.

Feedback on draft shared shellfish FMP principles, aims and objectives

Draft FMP principles, aims and objectives were widely agreed to be sensible and appropriate in the English crab and lobster context. Feedback from attendees at events was largely positive, with minor points of clarification or amendment sought on the more detailed sub-objectives.

Annex 3: Stakeholder Engagement Report for Crab & Lobster FMP

A summary of key themes in feedback received is presented below:

- There was general support for the vison of contributing to the long-term sustainability and economic viability of shellfish fisheries at engagement events. Attendees discussed the definition of ‘sustainability’ and the need to ensure that social, economic, and environmental sustainability are considered collectively
- Attendees supported the formalisation of industry involvement in fisheries management and a move to a more collaborative management approach for shellfish fisheries in English waters
- Mixed views were gathered on the perceived importance of the objective to assess and address latent capacity in the shellfish fleet. This ranged from attendees’ perception that latent capacity was a major issue facing the fleet, to others stating that latent fishing effort has no (current) impact on stocks so other aspects of fisheries management should take precedence.
- There was broad support for the progression of initiatives to increase and promote consumption of UK shellfish, but attendees agreed that improving data collection and evidence-based management is a higher priority for crab and lobster fisheries
- The FMP does not consider issues in recruiting and retaining crew etc., attendees acknowledged that the FMP is (not a?) means of addressing this type of issue but that it is a significant challenge facing many vessel owners
- Attendees at one meeting discussed the need for regulators to be aware of the impact on fisher mental health and wellbeing of an ever-changing management and legislative landscape. Such changes often incur costs and / or administrative work on the fishers’ behalf and such changes are not necessarily aligned
- Attendees requested the inclusion of an additional objective focused on the impact of non-fishing, commercial marine activities (for example aggregate dredging, capital dredging dumping at sea, or pollution incidents) on shellfish stocks. Inclusion in the FMP was seen as a means of ensuring these issues were addressed
- Attendees at some meetings felt that the industry’s ability to affect change in the climate change space, due to the small scale of the shellfish sector, is very limited and as such the objective should be considered a lower priority. It was noted that the climate change objective is directly aligned with an objective of the Fisheries Act 2020 and must be included in all FMPs. Other attendees felt that improved understanding of the carbon footprint of shellfish fisheries could help support positive environmental messaging about low impact fisheries

Key themes in feedback on crab- and lobster-specific objectives

To reflect the FMP engagement events, feedback will be combined for the crab and lobster objectives, reflecting where the feedback is most relevant to one species over the other.

Objective 1: Develop and pilot an improved data collection programme for crab fisheries, which supports a data rich future:

- Widely supported as a pre-requisite to improved management. Attendees stressed that in addition to ensuring the right fishery-dependent data are gathered (from the appropriate stage in the supply chain), opportunities to streamline data gathering processes should be explored
- Desire to standardise information gathered via different methods, for example Catch App, e-logs, and paper logbooks, to ensure that all fishers are collecting the same data in the same way for consistency and compatibility
- Efforts to improve data gathering should be accompanied by improvements / support for better stock assessments and communication of outputs
- Attendees noted that many fishers will hold their own historical data, and this could potentially be used to supplement existing data assets (for example records of pot numbers fished). Anecdotal information from fishers could be used to add additional detail and give information on general trends in fleet activity

Objective 2: Establish methods to better assess stock status that reflect the life history of the target species and fishery exploitation patterns.

- Attendees acknowledged the importance of having well informed stock assessments but noted the need to ensure that any outputs inform management decisions at an appropriate spatial scale; a one-size-fits-all approach will not work, and regional / local differences must be taken into account.
- Attendees discussed external events such as changing weather patterns, temperature trends, and pollution incidents, which have changed fisheries. Modelling approaches should consider the impact of non-fishing activities on shellfish stocks

Objective 3: Assess the impact of crab and lobster fishing activity on the wider marine environment.

- Some IFCAs already hold regional information on benthic impacts, it is possible that lessons could be learned in terms of methods and outputs

Objective 4: Improve understanding of interactions between the crab fishery and other fisheries.

- Acknowledged as a significant knowledge gap in crab and lobster fisheries, both in terms of direct impacts of other fisheries as a source of crab and lobster mortality (for example dredging and trawling) and indirect impacts (for example using crab as bait in the whelk fishery)
- Examples of industry-led spatial management approaches exist elsewhere (for example mid-Channel boxes) and should be considered as part of the approach to reducing conflict and inter-fishery impacts

Objective 5: Devise and implement a short- to medium-term management approach proposal that takes into account the external regulatory environment.

- There were concerns that smaller vessels operating inshore were considered ‘easier to manage’ and so could bear the brunt of management changes. Attendees stressed that management should be equitable
- Some attendees cited examples of IFCA byelaws (for example MLS increases) that have proved successful and may be suitable for application elsewhere. Harmonisation of management measures was seen as a positive proposal in terms of creating a level playing field for different fishers, making enforcement easier, and simplifying the management landscape for fishers
- Any future management of crab and lobster fisheries should also consider displacement and unintended consequences of management interventions. Small vessels in particular may prosecute a number of different fisheries at different times in the season; restricting crab and lobster fishing will likely lead to fishers seeking other fishing opportunities
- Management of crab and fisheries must be both regional, but also specific to different sectors of the fleet (for example small inshore boats and larger vivier vessels); different sectors of the fleet may fish the same stocks, but their patterns of activity and economic needs are very different

Objective 6: Establish a long-term management approach for crab fisheries in line with improvements in data collection and stock assessment.

- Concerns were raised about the provision of data to inform appropriate long-term management decisions, if the wrong information and data are gathered (objective 1) then assessment outputs will be inaccurate and management decisions will have a negative impact on fisheries. Some scientific studies have suggested that as much as 10 years of data are required to underpin sound management decisions so the FMP must focus on setting the right ‘direction of travel’ for crab and lobster fisheries to address knowledge gaps as soon as possible.

Objective 7: Secure appropriate access arrangements

- Attendees at some meetings wished to see more emphasis on the positive aspects of small-scale fisheries and greater consideration of these fisheries in management decisions. Small-scale fisheries were felt to have positive environmental messaging around carbon footprint and as providing valuable contributions to coastal communities
- Regarding latent capacity, attendees noted that the inshore sector relies on flexibility and exploiting different fisheries as opportunities are available. As such a 'latent' licence one year may be important the following year. This flexibility for fishers needs to be retained.

Objective 8: Explore trade-offs between arrangements for providing access to crab and lobster fisheries:

- This objective had general support.

Objective 9: Maintain a watching brief on other key commercial crustacean species (crawfish, spider cab, velvet swimmer crab, and common prawns):

- There was very strong support for harmonisation of the crawfish of MLS nationally to 110mm (up from 95mm outside of Cornwall and Devon & Severn IFCA districts). This was seen as a key precautionary measure to protect a valuable and growing fishery of regional importance

Management options and discussion:

Open discussion was facilitated on future management approaches for crab and lobster fisheries in English waters. The aim of this session was to understand:

- What management changes stakeholders would like to see in the short-, medium- and long-term
- What management tools were appropriate for crab and lobster fisheries and what were considered inappropriate (i.e. what management tools were most likely to deliver sustainable fisheries)
- What are the strengths and weaknesses of different management approaches in the crab and lobster fishery context

Key themes emerging from these discussions are summarised below, comments are grouped by the range of management tools that received significant discussion at stakeholder engagement events. The order of management measures is not indicative of support or favourability amongst attendees.

Pot limitation

- In some areas, pot limits were supported as long as they could be effectively enforced. Attendees noted that pot limitations required gear marking and sufficient at-sea monitoring. It was suggested that effective gear marking would only require the first, middle, and last pots to be marked
- Those in support of pot limits felt that the ‘race to fish’ or to occupy fishing grounds had driven increases in pot numbers, meaning that some vessels were now using more pots than they required
- In other areas pot limits were seen as un-enforceable, and it was noted that the lack of available data on pot numbers currently in use would make it incredibly difficult to set fair pot limits that would allow fishers to remain economically viable
- There were concerns that any pot limit would become a target and so could inadvertently incentivise fishers to increase the number of pots fished
- Gear conflict and gear losses was cited as another driver of increase pot numbers, as fishers would use more pots to compensate for those likely to be lost
- Concerns were raised about the practice of ‘storing’ pots at sea, this was seen as an artefact of fishers having too many pots. Storing pots at sea was thought to contribute to spatial squeeze, gear conflict, and potentially ghost fishing if the gear is lost during bad weather

Effort limits (days at sea)

- There were mixed views on the appropriateness of days at sea (DAS) based effort regimes as a means of managing static gear fisheries. Some attendees felt DAS restrictions would be an effective way of managing crab and lobster fisheries and would effectively limit pot numbers as only so many pots can be hauled in a given time; others felt that DAS was not an effective proxy for fishing effort as fishers can buy and fish with more pots. Attendees cited the example of the low uptake of effort through the Western Waters Effort Regime as an example of regulations which was not effectively restriction effort or fishing mortality
- Operators of smaller fishing vessels felt that their level of fishing activity was already restricted by weather
- Any limitation of effort would require better understanding of current effort
- Concerns that those vessels responsible for the recent increase in effort on crab and lobster stocks might reap the highest benefits if they can show a higher track record of catches
- Suggestion that effort should be managed at a stock level, raising questions around how cross boundary management will be considered and facilitated

Minimum landing size (MLS)

- There were mixed views on MLS increases for crabs. The crab MLS landscape is very fragmented, harmonisation would bring consistency however current MLS are regionally appropriate and a national approach would not cater for these variations (for example Cromer crab MLS of 115mm compared to Cornwall IFCA MLS of 150mm for females and 160mm for males)
- Attendees acknowledged that an increased MLS – if specific to the biology of each stock – could allow crabs an additional spawning cycle, however any consideration of MLS changes should be based on scientific understanding of stock-specific spawning sizes otherwise increasing the MLS would not deliver any benefit
- There was general support for increasing the lobster MLS outside of IFCA jurisdictions to 90mm (from 87mm). Attendees felt that MLS increases should be phased, it was suggested that an increase of one mm per year would minimise the economic impact on fishers (of having to return more undersize lobster)
- Lobsters are slow growing so overexploitation could have long-term impacts on stock size, because of this some attendees felt that management of lobster should be more precautionary until better data is available to inform more responsive management
- There was very strong support for harmonisation of the crawfish of MLS nationally to 110mm (up from 95mm outside of Cornwall and Devon & Severn IFCA districts).
- There were concerns that MLS increases could incentivise fishers to increase pot numbers to compensate for losses (see: pot limitations discussion)
- Mixed views on the concept of a maximum landing size for lobster. Whilst it was acknowledged that it is beneficial to retain larger females in the population as they are more fecund and have a higher reproductive potential, the practicality of this management measure was questioned given high economic value of larger lobsters

Catch limits (quotas / TACs)

- The majority of attendees at engagement events felt that catch limits (quotas / TACs) were not appropriate for crab or lobster fisheries
- There were concerns that the use of a quota / TAC system in the future to manage crab or lobster fisheries would lead to the consolidation of fishing opportunities by larger, better resourced businesses and would negatively impact smaller businesses
- It was acknowledged that the lack of catch limits can drive markets for poor quality crab, however attendees felt that this could be managed more

effectively using other tools (for example prohibiting the landing of soft brown crab for bait)

- Some attendees felt that the accuracy of existing stock assessments (due to uncertainties and assumptions in the modelling approach) means that the data on which catch limits could be based is not currently well informed enough

Prohibiting the landing of soft crab for bait

- There was widespread support for banning the landing of soft crab for whelk bait. Bans already exist in some IFCA districts and in other administrations. Allowing soft crab to be landed as bait means some fishers involved in the trade will take every crab caught, regardless of quality. This means there is more pressure on stocks (as crabs that would previously have been returned to the sea are now landed) and has an economic impact on all fishers as crab that would previously have been returned and possibly caught again when their shells have hardened are now landed for a fraction of the price of crab for human consumption
- Attendees made clear the distinction between poor quality crab landed intentionally for use as whelk bait and crab which die in transit or are otherwise not fit for human consumption being used as bait. The former was considered an issue; the latter was considered an appropriate use of what would otherwise be an animal by-product waste which has to be disposed of by landfill or incarnation at the cost of the processor / merchant

Spatial measures

- Concerns about gear losses outside of six nautical miles means that some inshore fishers feel that they are already limited in terms of where they can fish
- Some longstanding voluntary agreements already exist (for example the Inshore Potting Agreement) between sectors to minimise gear conflict, such examples could provide a template and ‘proof of concept’ for fishers elsewhere

Other measures

Suggestions that measures differentiating between male and female crabs or lobsters could provide benefits. For example, some attendees suggested that expansion of V-notching schemes, bans on ‘scrubbing’ female lobsters, or bans on landing female lobsters from December to April (peak breeding season in the area) could help boost recruitment to the fishery. However, some fishers operating in IFCA districts with sex-specific management measures felt that they had led to an

imbalance in the number of males and females in the stock which would hinder spawning.

Department
for Environment
Food & Rural Affairs

Proposed Fisheries Management Plan for Crab and Lobster in English Waters

Annex 4: Shellfish Shared Principles

Date: July 2023

Version: public consultation

Shared Shellfish Principles

Set out below are nine overarching shared shellfish principles designed to address key management, social, and economic issues that face all shellfish fisheries in English waters.

These principles have been developed by the Shellfish Industry Advisory Group (SIAG). This group brings together regulators, researchers, and industry stakeholders to discuss national-level strategic management of shellfish fisheries. Many issues facing the sector are not specific to individual shellfish species. These principles recognise common challenges and issues and have been reflected in each of the shellfish FMPs.

While these principles, and the associated actions, go beyond the legal obligations for FMPs in section 6 of the Fisheries Act 2020, Defra welcomes these industry commitments to complement and support the delivery of the FMPs and objectives in the Act.

The SIAG will maintain responsibility for the principles and the actions set out to deliver them.

Annex 4: Shellfish Shared Principles for Crab & Lobster FMP

#	Principle	Rationale	Activities
1	Formalise the structure and operation of the SIAG, and associated sub-groups and ensure effective representation, so that it becomes a focal point of engagement on shellfish fisheries management in England.	The SIAG will act as a forum through which industry, regulators, and the research community can engage and work collaboratively on shellfish fisheries management. The SIAG will collaborate with Defra and other partners on setting annual work plans and monitoring the delivery of overarching strategic objectives included in all shellfish FMPs.	Establish the SIAG (and species sub-groups) as a key point of engagement on shellfish matters in England. The SIAG to consider options to formalise this arrangement. Undertake regular reviews of group membership structures and take a targeted approach to ensure adequate and effective representation from all areas of the seafood supply chain; all business sizes; and relevant researchers and regulators. Develop and implement a comprehensive communication plan to raise awareness of the SIAG amongst shellfish fishermen and encourage engagement.
2	Assess fishing effort (including latent capacity) and, if necessary, recommend appropriate measures to manage effort.	Improve understanding of the scale and likelihood of impacts on fishing effort. Whether or not action is needed to remove or manage effort (including latent capacity) from different shellfish fleets will depend on management measures introduced.	Work collectively to: Undertake a desk-based review of: • The scale of the effort issue in different sectors of the shellfish fleet • The extent of the risk increased effort (including latent capacity) poses to long-term sustainable management of English shellfish fisheries • The potential impact of changes on individual shellfish businesses, considering business needs for flexibility and the availability of alternative fisheries on a regional basis

#	Principle	Rationale	Activities
			• Species-specific considerations on the topic of effort (including latent capacity) that will require input from specific sub-groups (Crab and Lobster Management Group / Scallop Industry Consultation Group / Whelk Management Group) and the wider shellfish industry • The likelihood of effort being displaced into other fisheries if action is taken to remove effort (including latent capacity) from the fleet • Case study examples from other fisheries around the world where efforts have been made to address effort (including latent capacity) • Conclusions drawn from Defra's 2021 calls for evidence on latent capacity in shellfish fleets Identify opportunities to monitor latent capacity as part of the wider assessment of fishing effort, and outline options.
3	Establish a mechanism that enables regulators to effectively engage with and draw on shellfish industry knowledge in relation to discussions relating to NQS management through the Trade	The TCA sets tonnage limits on access for UK vessels to fish NQS in EU waters and vice versa as well as allowing for multi-year strategies for the management of NQS. Discussions and negotiations between the UK and the EU are conducted via annual consultations and the Specialised Committee	Work collectively to facilitate engagement with industry stakeholders on matters relating to management of shared NQS as required, including the assessment of the likely implications of the management measures implemented through the TCA on NQS over the short-, medium- and long-term.

#	Principle	Rationale	Activities
	and Cooperation Agreement.	for Fisheries (made up of the Parties to the TCA). A mechanism will help enable meaningful communication, information sharing, and engagement between government, regulators, and industry to ensure transparency and collaborative working.	
4	Enable better involvement of the shellfish industry in matters regarding marine spatial planning and spatial squeeze by facilitating better collaboration between regulators, planners, and industry stakeholders.	Competition for marine space means there is a need to ensure the shellfish sector has the appropriate data, evidence, and means of engaging with regulators on marine spatial planning and access issues. This will help avoid the assumption that fishing is an infinitely relocatable activity and articulate the needs of the shellfish sector.	Work collectively to: Continue to explore the relationship and interaction between FMPs and MSP, by progressing actions such as: • marine spatial planning processes and opportunities for better engagement between planners and the shellfish sector • available information on current patterns of fishing activity; means of identifying important fishing areas or 'food production areas'; and social and economic importance of key fishing areas • current marine space use and competing interests including the needs of the shellfish fishing industry, and how this may change in the future • legislative drivers of competition for marine space • what evidence is required to influence marine spatial planning decisions

#	Principle	Rationale	Activities
	Develop and pilot an approach for identifying important fishing areas to better address issues of marine spatial conflict aligned with the requirement for increased marine protection.		• opportunities for minimising spatial conflict Ensure data, analyses, and narrative on shellfish sector is available to support marine spatial planning issues Ensure the shellfish sector are engaged in marine spatial planning discussions alongside other marine users.
5	Improve understanding of the impacts of non-fishing marine activities (for example capital dredging, undersea cables) on English shellfish stocks.	Identification of non-fishing marine issues impacting shellfish will help drive changes to potentially damaging practices to minimise the impact non-fishing marine activities have on shellfish stocks.	SIAG to: • Act as a central forum for fishing stakeholders to raise issues relating to non-fishing marine matters • Engage with non-fishing marine sectors on activities identified by the fishing industry as possibly impacting shellfish grounds and stocks

Annex 4: Shellfish Shared Principles for Crab & Lobster FMP

#	Principle	Rationale	Activities
6	Progress initiatives to increase and promote consumption of sustainable UK shellfish.	Increased consumption of sustainable shellfish (overseas and domestic markets) would build business resilience, create opportunities for cost reduction, build industry reputation and provide economic and employment benefits to coastal communities.	Work collectively to: • Maintain a watching brief on trade issues and legislation that could impact shellfish consumption in domestic and overseas markets • Consider ways to improve the economic benefit brought to the UK by shellfish production and consumption • Build industry reputation, aligned with the implementation of credible fisheries management measures, and provide businesses with information to promote shellfish consumption • Use the SIAG as a forum to horizon scan, identify and discuss issues relating to shellfish consumption, and engage with stakeholders more widely on means of promoting consumption of shellfish
7	Facilitate and promote trade opportunities for shellfish in overseas markets (EU and non-EU).	Strengthening markets for shellfish provides greater business resilience and improved ability to adapt to social, economic, or environmental influences on trade.	Publish straightforward technical guidance for shellfish exporters to enable businesses to navigate export requirements Promote and facilitate shellfish suppliers' presence at international trade shows to promote shellfish and expand markets
8	Develop advice and guidance on shellfish welfare issues to help the	Adopting best practices regarding shellfish welfare improves industry reputation	Work collectively to: • Maintain a watching brief on the impact of legislative changes around animal welfare and sentience that could impact the shellfish sector

#	Principle	Rationale	Activities
	industry to further develop and implement best practice handling measures.	and provides economic benefits.	• Work with government and fisheries authorities to understand and implement relevant shellfish welfare guidance and legislation.
9	Industry to take collective responsibility to comply with welfare and good working conditions legislation and guidance to ensure the highest possible levels of standards across the shellfish sector supply chain.	Furthering best practice regarding human welfare in the shellfish supply chain will: Help stamp out poor practice Build a positive reputation for the shellfish sector Provide businesses with resources to support responsible sourcing credentials Support new recruitment and employee retention in the sector Ensure the sector is prepared to champion and	Work collectively to: • Maintain a watching brief on legislative and non-legislative developments and work with government and fisheries authorities to ensure the UK shellfish sector can meet any social and human welfare requirements. • SIAG to act as a forum to raise issues relating to human welfare in the shellfish supply chain, work collaboratively to maintain or improve good practice, and build the shellfish sector's positive reputation.

Annex 4: Shellfish Shared Principles for Crab & Lobster FMP

#	Principle	Rationale	Activities
		transparently implement social or human welfare requirements that may be introduced.	

Department
for Environment
Food & Rural Affairs

Proposed Fisheries Management Plan for Crab and Lobster in English Waters

Annex 5: Legislative Context and Governance

Date: July 2023

Version: public consultation

Contents

Legislative requirements for Fisheries Management Plans (FMPs) under the Fisheries Act 2020 and Governance

The Crab and Lobster Fisheries Management Plan has been prepared for the purpose of meeting the requirements set out in the Fisheries Act 2020 (the Act). This statement confirms the obligation set out in section 6(5) of the Act.

The UK Government set out in the 2018 Fisheries white paper: sustainable fisheries for future generations a clear ambition for sustainable stewardship and management of UK fisheries that committed to deliver - “a more competitive, profitable and sustainable fishing industry across the whole of the UK, setting a gold standard for sustainable fishing around the world”.

The Fisheries Act 2020 sets out the legal framework governing fisheries in the UK and provides for UK Fisheries Policy Authorities to prepare and publish Fisheries Management Plans (FMPs) setting out policies designed to restore stocks and maintain them at sustainable levels.

The Joint Fisheries Statement (JFS), published in November 2022 sets out further details of the policies the UK fisheries authorities will follow to achieve or contribute to achieving the eight fisheries objectives in the Act. It includes a list of FMPs, setting out the lead authority for each FMP, the stocks covered and timescales for publication.

The legislative context that applies to the development and implementation of the Crab and Lobster FMP is set out below:

Requirement of the Fisheries Act 2020	Approach in Crab and Lobster FMP
Section 1 of the Act details the eight overarching Fishery Objectives that guide its application and subsequent decisions made under that Act.	The Crab and Lobster FMP establishes how the management of crab and lobster fisheries in English waters will contribute to the delivery of these legislative objectives. Where relevant, the Species-Specific Objectives are also mapped to the relevant Fisheries Act objective.

Annex 5: Legislative Context and Governance for Crab & Lobster FMP

Requirement of the Fisheries Act 2020	Approach in Crab and Lobster FMP
Section 1(3) & (10) of the Act sets out how the precautionary approach must apply, defining it as "an approach in which the absence of sufficient scientific information is not used to justify postponing or failing to take management measures to conserve target species, associated or dependent species, non-target species or their environment".	The current management of crab and lobster fisheries is characterised by 'inconsistent' information and fragmented management which makes it challenging to deliver effective and long-term sustainable management of these iconic species. Recognising the requirements of the precautionary objective, the Crab & Lobster FMP proposes an adaptive and agile management approach focused on improved data collection, targeted research, and proactive effort management. The implementation of the plan will be underpinned by best available evidence. Even where information is uncertain or inadequate, it will still be necessary to act to deliver on management outcomes, but caution will be required, as will the need to monitor and review the effectiveness of any management intervention so that it can be refined.
Section 2(3) of the Act states that the JFS should detail the plans that are either in force or will be prepared, the scope of each plan, the responsible body for delivering the plan and the timeframes for preparation and publication.	The JFS published in November 2022 details these requirements for the Crab and Lobster FMP.
Section 2(6) of the Act explains that a "fisheries management plan" means a document, prepared and published under this Act, that sets out policies designed to restore one or more stocks of sea fish to, or maintain them at, sustainable levels."	This Crab & Lobster FMP sets out a structured approach to improve the evidence base and to manage effort levels to ensure that the species included in this plan can be managed at sustainable levels.

Requirement of the Fisheries Act 2020	Approach in Crab and Lobster FMP
Section 6(2) references that the plan should detail the indicator or indicators that will be used to monitor its effectiveness.	The section on 'Implementation, monitoring and review" details the performance indicators that will be used to monitor and assess the performance on this plan against the desired outcomes for these fisheries. In addition, the proposed implementation approach will enable effective monitoring of the delivery of the FMP's priorities.
Section 6(3) of the Act sets out that FMPs "must specify whether the available scientific evidence is sufficient to enable the relevant authority or authorities to make an assessment of the stock's maximum sustainable yield and if it is not, (I) must specify policies of the relevant authority or authorities for maintaining or increasing levels of the stock, (ii) specify the steps (if any) that the relevant authority or authorities propose to take to obtain the scientific evidence necessary to enable an assessment of the stock's maximum sustainable yield to be made, and (iii) where no such steps are proposed, state the reasons for that."	The Crab & Lobster FMP presents the current available evidence on crab and lobster fisheries in English waters. Both species have fishery independent timeseries of core biological data, and there has been some success in establishing biological reference points. However, the lack of reliable, high quality effort data which can be fed into stock assessments mean that that it is difficult to accurately assess the impact that current fishing effort is having on long-term stock viability or how to effectively limit effort. The Crab and Lobster FMP seeks to address this to ensure that Maximum Sustainable Yield (MSY) can be more accurately assessed, and action taken to maintain stock status at or above this level. While this plan also has data-limited shellfish species which are not subject to formal stock assessments in scope, the primary focus over the first six-year period is to target improved management of brown crab and lobster fisheries. Care will be taken to ensure management interventions do not create unintended consequences for these other species. Section 6 details the future fishery

Requirement of the Fisheries Act 2020	Approach in Crab and Lobster FMP
	management strategy and Annex 2 details the Research Strategy which collectively detail how S.6(3) will be addressed.
Section 6(5) of the Fisheries Act requires that the plan must contain a statement to the effect it has been prepared and published for the purposes of the Act.	This FMP sets out the policies and measures to manage fishing activity within the crab and lobster fisheries in English waters. The policies and measures contained within this plan have been prepared to meet the requirement of section 6(5) of the Fisheries Act 2020

The implementation of the Crab & Lobster FMP should also have regard to:

- Retained EU Regulation, commonly referred to as the Western Waters (WW) effort regime, places an annual upper limit on the amount of kilowatt (kW) days at sea effort UK 15m and over vessels can utilise to fish for crabs and spider crabs in the English Channel, Irish sea, and some areas of Scottish waters (ICES areas V, VI and VII). For 2023, a days-at-sea limit has been set at 160 days per vessel.
- Various IFCA management measures and byelaws in English inshore waters. Noting that the Crab & Lobster FMP will apply to all English waters – both inside 6nm and beyond.

Roles and responsibilities in relation to the Crab and Lobster FMP

The Department for the Environment. Food and Rural Affairs (Defra) is responsible for UK fisheries policy and governance. Fisheries management is carried out by devolved fisheries administrations: Welsh Government; Scottish Government; and Department of Agriculture, Environment and Rural Affairs in Northern Ireland. Collectively, including Defra, these organisations are known as the UK Fisheries

Policy Authorities[1]. As the Crab and Lobster FMP only applies to the management of Crab and Lobster fisheries in English waters, the devolved fisheries administrations have no formal responsibility for the delivery of this plan. However, Defra will continue to engage with devolved departments and governments on future crab and lobster management measures.

The Marine Management Organisation (MMO) in England has designated authority to manage fisheries and carry out enforcement activities in English waters. The MMO has the power to make byelaws within 0–200 nautical miles (nm) and leads on management of fishing activities between 6–200nm.

Ten Inshore Fisheries and Conservation Authorities (IFCAs) have the power, in English waters, to deliver additional fisheries conservation and management within the inshore 0–6nm zone. The MMO has the power to make byelaws to manage fishing activity within an IFCA district and quality assures all IFCA byelaws prior to submission to the Secretary of State.

Seafish is the non-departmental public body that works to support the UK seafood sector across the supply chain. It is sponsored by Defra but works to all four fisheries administrations. While it holds no statutory functions relevant to fisheries management it does convene the Shellfish Industry Advisory Group (SIAG), Crab Management Group (CMG), and the various sub-groups. It has also led on the development of the Crab & Lobster FMP in collaboration with the CMG.

The development of this FMP has been delivered through the shellfish management groups primarily through the CMG but also with input from the SIAG on the development of the shared shellfish high level principles. These management groups provide a forum for industry, regulators, policy makers and researchers to come together to work collaboratively on strategic and operational issues relevant to the management of these fisheries.

Development of the FMP

The Crab and Lobster FMP was developed by Seafish, on behalf of Defra, in collaboration with the Crab & Lobster Management Group (CMG). The CMG was formed in early 2020 to bring together industry stakeholders, from across the shellfish supply chain, scientific researchers, and fishery regulators to work collaboratively to address issues facing UK crab and lobster fisheries. The CMG is facilitated by Seafish, and membership is open to all industry stakeholders with an interest in UK crab and lobster fisheries. The CMG oversaw the development of the

[1] Fisheries Policy Authorities are defined in Section 52 Interpretation of the Fisheries Act 2020: the Secretary of State, Scottish Ministers, Welsh Ministers, and the Northern Ireland Department.

FMP with the support of the following stakeholder groups. A schematic diagram of the sub-group structure is shown in figure 1 but the key engagement points are as follows:

- **Shellfish Industry Advisory Group (SIAG) and FMP working group**: The SIAG is focused on the strategic management of UK shellfish fisheries. It provides a forum for discussion and collaboration between members on overarching issues that are relevant to all shellfish fisheries. Membership includes representatives from across the seafood supply chain, scientific researchers, and regulators. An SIAG FMP working group was formed in 2022 and tasked with developing the shared shellfish high level principles (see Section 6). These principles apply to all shellfish related FMPs. The SIAG meets quarterly, and all meetings have a standing agenda item for updates from the respective chairs of the Whelk Management Group (WMG), CMG, and Scallop Industry Consultation Group (SICG).
- **CMG FMP working group:** The CMG established a working group as a task and finish group of industry stakeholders and regulators to develop draft FMP content. The group focused on the development of the crab and lobster specific objectives. Members were selected from across the supply chain based on their interest in crab and lobster fisheries in English waters and their ability to represent views indicative of the wider sector considering different patterns of activity and fleet metiers (e.g., inshore / offshore, day boat / multi-day trip boat). In addition to industry representatives, Defra, Cefas, MMO, and IFCAs participated in the FMP working group.
- **The CMG FMP working group** met to discuss and refine draft objectives for the FMP, ensuring alignment with objectives of the Fisheries Act. Between meetings Seafish updated drafts and collated content for all sections of the FMP and at subsequent working group meetings members would review and approve the changes made. Each quarter Seafish provided updates to the wider CMG on progress in drafting the FMP, and members were invited to discuss details of the draft and ask questions of Seafish and the FMP working group. The working group also advised Seafish on the delivery of stakeholder engagement events, including providing expert advice on locations of meetings, testing presentation materials, and reviewing stakeholder feedback on draft content as required.
- **CMG Science Sub-group:** the CMG science sub-group brings together industry stakeholders and scientific researchers from government agencies, research institutes, and academia. The group provides a forum for discussion and collaborative working (e.g. joint development of funding bids) on research needs facing crab and lobster fisheries in the UK. The science sub-group contributed to the FMP development by identifying evidence gaps and drafting the evidence and research plan presented in Annex 2. The evidence and research plan underpins the objectives of the FMP and provides additional

detail on the research activities that should be undertaken to deliver the objectives of the FMP.

Future role of the CMG

The CMG has worked collaboratively with Seafish on developing the Crab and Lobster FMP and in engaging the wider stakeholder community on this work. It is expected that the CMG will continue to work collaboratively to provide input as the measures are developed to help inform implementation of the FMP and to ensure the ambition for long-term sustainable and profitable crab and lobster fisheries is realised.

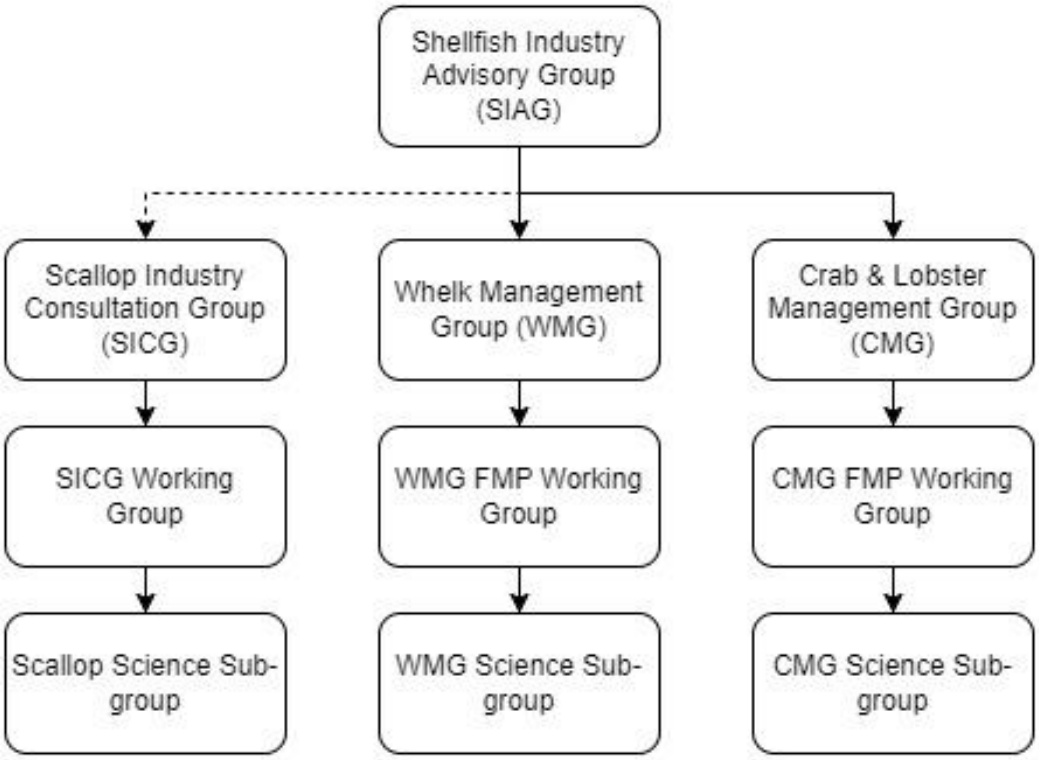

Figure 1: Diagram of the Shellfish Industry Advisory Group (SIAG) sub-group structure, including working groups and science.

Processes followed to develop the FMP

In mid-2020 Seafish canvassed CMG members to better understand stakeholder priorities regarding management of crab and lobster fisheries to help steer the focus of the group. Feedback from members was collated and grouped into three key priorities as follows:

- Establishing a baseline - providing reliable and regular information on:
    - Current patterns of fleet activity and performance
    - Available biological information on stock status, life history, and stock boundaries, and
    - Appropriateness and effectiveness of management tools currently used in UK crab and lobster fisheries, including any unintended consequences created for target or other fisheries
- Data and research:
    - Support development of stock assessment models better suited to the life history of the target species and fishery exploitation patterns, and
    - Improve understanding of how crab and lobster fisheries interact with other fisheries (including bait sourcing and provisioning, displacement of activity between sectors, and gear conflict and spatial considerations).
- Managing fishing effort:
    - Explore opportunities to limit fishing effort in the short-term, either at a local or national level, to safeguard the fishery
    - Develop a management toolbox for crab and lobster fisheries of 'fit for purpose' measures to deliver sustainable fisheries

The CMG's efforts to identify key priorities for the UK crab and lobster fisheries helped inform early discussions on FMP objectives by aligning stakeholder priorities with the objectives of the Fisheries Act 2020. The CMG's FMP working group used this information to develop the draft FMP objectives and actions which were subsequently presented at stakeholder engagement events to gather feedback and stimulate discussion amongst stakeholders about prioritisation and management.

Through the CMG and associated sub-groups industry stakeholders have played an integral role in developing draft content which was presented at FMP engagement events in 2022.

Informal stakeholder engagement activities

As part of the FMP development process, Seafish delivered a series of informal stakeholder engagement events during late 2022. A full summary of these events – including format of sessions and key themes emerging in stakeholder feedback – is presented in the Stakeholder Engagement Report in Annex 3. The events were promoted via social media, industry media including Fishing News, and posters in ports and harbours. Members of the CMG were encouraged to promote the events within their local communities. The purpose of these events was to:

Annex 5: Legislative Context and Governance for Crab & Lobster FMP

Raise awareness about the development of the Crab and Lobster FMP for English waters and what this means for seafood businesses;

Present draft FMP aims and objectives (as developed by the CMG FMP working group) to stakeholders and gather feedback on the proposed direction of travel for crab and lobster fisheries; and

Discuss future management of crab and lobster fisheries in England and to help establish priority management areas.

Five in-person and three online stakeholder engagement events were held to ensure that as many stakeholders as possible had the opportunity to discuss and provide feedback on the draft FMP content. In-person events were held in Weymouth, Ilfracombe, Shoreham-by-Sea, Wells, and Fleetwood; locations were selected based on the regional significance of crab and lobster fisheries. Events were open to all stakeholders with an interest in English crab and lobster fisheries. Attendance included representation from the catching sector; processing and export sectors; scientists and academics; local fishery managers; and non-government organisations (NGOs). A dedicated online meeting was held for representatives of environmental NGOs providing an opportunity for those organisations to engage with the process.

Following engagement events, feedback on draft FMP content and proposed initial management interventions was collated by Seafish and a stakeholder engagement report (Annex 3) drafted. Feedback from the events was used by Seafish to refine draft FMP content, which was then presented to the CMG FMP working group, alongside comments on why changes had or had not been made. Key themes emerging from stakeholder engagement events were presented to the wider CMG and SIAG in November / December 2022, affording stakeholders further opportunity to comment on priority issues or concerns about FMP content. Drafts of the FMP objectives and proposed initial management interventions were tabled at a CMG working group in January 2023 for sign off before submission to Defra.

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Proposed Fisheries Management Plan for Crab and Lobster in English Waters

Annex 6: Environmental Considerations

Date: July 2023

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Environmental Considerations

In addition to the Ecosystem Objective and Climate Change Objective in the Fisheries Act 2020, all FMPs are subject to legal obligations for environmental protection arising from the Habitats Regulations, Marine and Coastal Access Act 2009, UK Marine Strategy Regulations 2010, and the Environmental Principles policy statement for the Environment Act 2021. These obligations are summarised in table 1 below.

In developing the Crab & Lobster FMP advice was sought from the UK's Statutory Nature Conservation Bodies (SNCBs), including Joint Nature Conservation Committee (JNCC) and Natural England, to assess the wider environmental matters that need to be considered when implementing the Crab & Lobster FMP and driving future management of these fisheries.

While the shared shellfish principles and Species-Specific Objectives explicitly address environmental considerations, the delivery of all objectives detailed in the 'Description of fishery management objectives' section will need to adhere to the legal obligations detailed below.

This section provides a more detailed overview of how known environmental risks will be assessed and managed, how climate change mitigation and adaptation measures will be progressed, and how the impact that crab and lobster fishing effort can have on Marine Protected Area MPA outcomes will be monitored.

Table 11: Summary of relevant environmental legislation and FMP obligations

Environmental UK legislation and frameworks	FMP obligations
The Conservation of Habitats and Species Regulation 2017 **The Conservation of Offshore Marine Habitats and Species Regulations 2017**	FMPs and their measures must not result in adverse impact to site integrity for European Marine Sites. FMPs and their measures must not result in an adverse impact to site integrity for Offshore Special Areas of Conservation and Special Protection Areas (SPAs). to the competent authority must undertake a Habitats Regulation Assessment (HRA) to determine whether the FMPs (including proposed management measures) may have an impact on Marine Protected Areas (MPAs) features or site integrity.

Environmental UK legislation and frameworks	FMP obligations
Marine and Coastal Access Act 2009	FMPs and their measures must not hinder the conservation objectives of Marine Conservation Zones (MCZs). FMPs may need to undertake an MCZ impact assessment to determine whether they (including proposed management measures) may have an impact on MPA conservation objectives.
UK Marine Strategy (UKMS) Regulations 2010	The UKMS requires the UK to take the necessary measures to achieve or maintain Good Environmental Status (GES), set out through the UK Marine Strategy. The UKMS identifies FMPs as a tool to support the delivery of GES.
Environment Act 2021	When developing fisheries management measures or policies, FMPs must have due regard to the Environmental Principles Policy Statement in the Environment.

Part A: Risks and impacts arising from crab and lobster fisheries to the wider seas

The UK Marine Strategy Regulations (2010) place a responsibility on the UK to take the necessary measures to achieve or maintain Good Environmental Status (GES) through the development of a UK Marine Strategy (UKMS). The UKMS provides the policy framework for delivering marine policy at the UK level and sets out how the vision of clean, healthy, safe, productive, and biologically diverse oceans and seas will be achieved. The target for GES is measured through the 11 qualitative descriptors, which describe what the environment will look like once GES has been achieved.

Pot fishing for crab and lobster potentially poses two environmental risks, acknowledging that based on current evidence both are considered low risk

- Risk 1: Bycatch of Endangered, Threatened and Protected (ETP) species and unwanted marine species.
- Risk 2: Marine litter from abandoned, lost and otherwise discarded fishing gear.

Risk 1: Bycatch of Endangered, Threatened and Protected Species

Bycatch is the incidental catch of unused or unmanaged species and is globally recognised as a major threat to the sustainability of marine fisheries and ecosystem functioning[1]. The bycatch rate within crab and lobster pot fisheries is highly dependent on gear type, environmental factors (for example, season, fishing areas), fishery-specific factors (for example, pot design, 'soaking' time) and data collection method (for example, fishery dependent or fishery independent surveys)[2].

Potting is generally considered a low-risk fishing method, but large mobile species such as cetaceans (whales, dolphins, porpoises) can become entangled in pot ropes. Best data on entanglement comes from Scotland - the likelihood of any individual fisher encountering an entanglement is rare (<1 per decade) but events become common when aggregated to the level of the industry. This has implications for the feasibility of certain monitoring strategies, for example placing observers on vessels[3]. Consultation with Scottish creel fishers found whale entanglement was more than twice as likely than strandings surveys had previously indicated, with bottom ropes particularly likely to entangle.

While such captures are usually released alive, the degree of risk can vary geographically. Since such entanglements are unlikely to have population-level effects the risk profile is considered low. However, incidental catches of mobile sensitive species should still be minimised and, where possible eliminated.

1 Komoroske LM and Lewison RL (2015) Addressing fisheries bycatch in a changing world. Front. Mar. Sci.

2 Öndes, F., Kaiser, M. J., & Murray, L. G. (2018). Fish and invertebrate by-catch in the crab pot fishery in the isle of man, irish sea. Marine Biological Association of the United Kingdom. Journal of the Marine Biological Association of the United Kingdom, 98(8), 2099-2111.

3 MacLennan, E., Hartny-Mills, L., Read, F.L., Dolman, S.J., Philp, A., Dearing, K.E., Jarvis, D. and Brownlow,A.C. Scottish Entanglement Alliance (SEA) - understanding the scale and impacts of marine animal entanglement inthe Scottish creel fishery. NatureScot Research Report 1268

Mitigation

The Bycatch Mitigation Initiative published in August 2022 sets out in more detail policy objectives and actions that should be taken to achieve the ecosystem objective in the Fisheries Act. The Bycatch Monitoring Programme is dedicated to better monitoring, reducing - and where possible - eliminating bycatch through developing and trialling technology to enhance on the ground bycatch reporting capabilities, as well as testing bycatch avoidance devices in the field. However much of its focus is currently on gillnetters, trawls and longliners, so further consideration will be needed on how best to incorporate potting issues.

However, reducing bycatch is complex and requires solutions that are tailored to the different fisheries. There is limited evidence on the impact of bycatch on mobile species in crab and lobster fisheries, and while the risk is considered to be low, more accurate reporting on the nature and the extent of interactions would provide greater confidence that this is a reliable assessment. As such a priority focus under Species Specific Objectives #3 and #4 will be to improve reporting via a bycatch monitoring plan which will encourage fishers to report accidental bycatches along with their geographical location – noting that it is already a requirement to notify of any marine mammal bycatch within 48 hours of returning to port. This information will be used to better assess risk, establish if there are any potential hotspot areas, and determine if management measures are required (such as reducing pot limits and soak times – reducing the time ropes, which are the key cause of entanglement, spend in the water is likely to be a key mitigation).

Risk 2: Litter from fishing gear

Marine litter is described as any persistent, manufactured or processed solid material discarded, disposed, or abandoned in the marine and coastal environment. At a global scale, it is estimated that 8.6% of all pots and traps are lost each year[4].

Crab and lobster fisheries contribute to fishing related litter through the loss of pots, ropes, and buoys. Rates of fishing gear loss for potting is low in comparison to other fishing practices. The greatest harm is likely to be associated with entanglement and ghost fishing from lost fishing gear. While the risk from potting is considered low further consideration of how best to avoid or minimise gear loss and how to achieve sustainable end of life disposal remains important.

[4] Richardson, K., Hardesty, BD., Wilcox C. (2019). Estimates of fishing gear loss rates at a global scale: A literature review and meta-analysis. Fish and Fisheries. 20: 1218-1231. https://doi.org/10.1111/faf.12407

Mitigation

The UK is committed to protecting the marine environment from all human-induced stressors, including marine litter such as abandoned, lost, and discarded fishing gear (ALDFG). Existing monitoring programmes assess seafloor litter, surface litter and beach litter. We are also working internationally, calling for an ambitious legally binding treaty to end plastic pollution, and pushing for action to reduce marine litter through the G7, our regional seas convention (OSPAR) and the International Maritime Organisation. The UK is a member of the Global Ghost Gear Initiative (GGGI), the first initiative dedicated to tackling this problem on a global scale. Through the UK's £500m Blue Planet Fund that was launched in 2021, we are also working in partnership with developing countries to tackle marine pollution, including ALDFG. In addition to tackling marine litter, we are exploring methods to recycle and reuse end of life gear at ports and aquaculture farms with the intention of moving the sector towards a circular economy model which will reduce the impacts generated from fishing gear waste.

The UK Gear Forum will lead on exploring these issues for all pot and trap fisheries and will work with the CMG, WMG and the SIAG to ensure alignment with relevant FMP Objectives. This will include (1) improving understanding of the scale of ecosystem impacts from abandoned lost and discarded potting gear (2) identifying opportunities to collect and reuse end of life potting gear, (3) assessing how to better record and assess the scale of abandoned and lost fishing gear, and (4) reviewing the effectiveness of existing technical measures to minimise ghost fishing from pots and rope entanglement.

Part B: Climate change adaptation/mitigation

Crab and lobster stocks and fisheries are sensitive to the environmental changes brought about by climate change – such as ocean warming and ocean acidification which can have an impact on stock range and health. Whilst these stocks and fisheries are affected by this change, they are also one of the contributors. All fishing activity has a carbon footprint, which can further exacerbate the environmental impacts of climate change. The contribution of carbon emissions from crab and lobster fisheries can come from vessel emissions, as well as disruption and release of carbon stored in marine sediments through the impact of fishing gear on the seafloor. Further emissions occur throughout the supply chain as these products are processed and transported to the final consumer.

This is not an issue that is limited to crab and lobster fisheries. The challenge to mitigate impact by reducing emissions and to ensure resilience to adaptation is being

addressed across English crab and lobster fisheries through brown crab objective #10 and European lobster objective #9.

Two elements are considered in the context of climate change – supporting the seafood industry to adapt to the impacts of climate change, and the mitigation of emissions (reducing the direct and indirect emissions profile of the crab and lobster fishing sector).

Climate change mitigation – reaching Net Zero

The Climate Change Act 2008 (Amended in 2019) sets a legally binding target of achieving net-zero greenhouse gas (GHG) emissions by 2050 across the UK economy, with an ambition of a 78% reduction by 2035. The SIAG have committed through the high-level principles for all shellfish management to support the shellfish industry to a) mitigate emissions from the shellfish supply chain, and b) adapt to the environmental impacts of climate change.

Between 2016 to 2021, more than 97% of crab and lobster fisheries across England used static pots and traps to catch crabs and lobsters. While specific vessel emissions for these fisheries are not yet known for England, recent analysis has shown that the total UK pot and trap fishing fleet segment (which comprises of 1542 vessels) produced 12.5% (101kt CO2e) of the total carbon emissions at sea each year across the UK's fishing fleets[5]. Whilst passive gears are generally less emission-intensive than mobile gears, quantification of carbon emissions across the fishing fleet supply chain (for example, preharvest through to postharvest) is required to truly understand the fisheries carbon footprint. Before any action can be taken to reduce emissions the extent of the emissions and their origin must first be understood.

The UK shellfish sector collectively will need to consider how it will reduce emissions to contribute to meeting the Net Zero target. Mitigating actions could include technological, regulatory, managerial, and behavioural changes to increase efficiency or transition to alternative fuels and energy sources, and reducing the direct impact that fisheries' have on marine carbon stores. Work is occurring at a national level to understand the current evidence gaps and latest innovations to support the development of pathways towards Net Zero for the UK fishing fleet.

From a shellfish-specific perspective the FMP aspirations will be progressed through the Seafood Emissions Profiling Tool in the first instance, to help establish a more detailed emissions profile (and emissions' hotspots) for crab and lobster products.

5 Engelhard, GH., Harrod, OL., Pinnegar, JK. (2022). Carbon emissions in UK fisheries: recent trends, current levels, and pathways to Net Zero. Defra project – in review.

This information will then help establish what mitigation actions could be taken to further reduce the emissions profile.

Seafish has recently established the Vessels of the Future forum which brings together the fishing industry, researchers, boat builders and regulators to explore opportunities to assist the UK fishing sector to make the transition to a low emissions fleet. This forum will work with the SIAG to explore the opportunity for change in the potting sector.

Blue carbon habitats:

Healthy coastal and marine environments can provide nature-based solutions to help tackle climate change. For example, certain marine habitats (including some that are home to crabs and lobster), such as seagrass, kelp, and muddy sediments, are able to capture and store carbon and therefore these are known as blue carbon habitats. If left undisturbed, these habitats can contribute to GHG emissions reductions. Habitat disturbance through fishing practices may affect seabed carbon dynamics. The evidence around the risks and impacts of potting gear on blue carbon habitats within English waters is limited but work continues to build the evidence base to understand the trade-offs and wider consequences of decisions.

Given the lack of information available on potting specific impacts the priority for this iteration of the Crab & Lobster FMP will be to collate research findings to build an improved understanding of the potential impacts that pot fishing can have on blue-carbon habitats.

Climate Change Adaptation

Climate change and warming oceans are changing the distribution of commercially important shellfish species[6].Crustaceans (such as crabs and lobsters) are considered to be more tolerant to the changes in ocean acidification than molluscs (such as scallops) and gastropods (such as whelks)[7]. However, there is variation in the tolerance between crab species, with recent studies highlighting the vulnerability

6 Mieszkowska, N., Burrows, M. and Sugden, H. (2020) Impacts of climate change on intertidal habitats relevant to the coastal and marine environment around the UK. MCCIP Science Review 2020, 256–271. doi: 10.14465/2020.arc12.ith

7 Kroeker, KL., Kordas, RL., Crim, RN., Singh, GG. (2010). Meta-analysis reveals negative yet variable effects of ocean acidification on marine organisms. Ecology letters 13:1419-1434

of the brown crab to conditions expected by 2100[8], which could have significant economic implications to the UK crab fisheries.

Adaptation is an important consideration for any future crab and lobster fishery management strategy. Climate influenced changes to a species range, and its physical and biological characteristics can influence how sensitive a stock is to fishing pressure. These changes can also impact where and how fishing vessels operate.

Work on adaptation is occurring at a national level via the Marine Climate Change Impact Partnership (MCCIP) which provides a coordinating framework for the UK, delivering high quality evidence on the latest marine climate change impacts, and guidance on adaptation advice to policy advisors. Defra's Marine Natural Capital and Ecosystem Assessment (mNCEA) includes sampling, collation, and data analysis to baseline the location, extent, and condition of marine natural capital assets in English seabed environments. Marrying this intel up with known climate change impacts to crab and lobster can support in identifying which stocks might be most vulnerable to the changes in ocean acidification and ocean warming.

Over the duration of this plan the focus will be on contributing to the evidence base and monitoring trends to assess likely impacts to shellfish species generally, and crab and lobster specifically.

Part C: Risks and impacts arising from crab and lobster fisheries to the designated interest features of Marine Protected areas (MPAs)

Between 2016 to 2021, more than 97% of crab and lobster fisheries across England used pots and traps to catch crabs and lobsters. The main environmental pressure of pots and traps on MPA features includes the removal of target and not-target species, as well as abrasion and disturbance of the substrate on the surface of the seabed. Figure 1 shows the distribution of MPA’s around England.

Whilst management within an MPA site considers fishing activity that occurs within MPA boundaries, there remains the potential for fishing activity occurring outside of an MPA to have impacts on the features protected within an MPA. This may happen

8 Whiteley, N. M., Suckling, C. C., Ciotti, B. J., Brown, J., McCarthy, I. D., Gimenez, L., & Hauton, C. (2018). Sensitivity to near-future CO2 conditions in marine crabs depends on their compensatory capacities for salinity change. Scientific Reports, 8(1), 1-13.

when either the pressure exerted by the fishery impacts protected features beyond its spatial footprint or when the feature of an MPA is mobile and travels outside the site. Bycatch from crab and lobster fisheries on protected mobile shellfish (such as spiny lobster) and marine mammal species (including otters) within the MPA network has been identified as low risk. There are examples of how pot fisheries can be managed and operate sustainably within an MPA (for example, Lyme Bay and Torbay SAC). The Marine Management Organisation and the Inshore Fisheries and Conservation Authorities assess on a site-by-site basis which fishing activities could prevent MPAs from achieving their conservation objectives. The government is aiming to have all MPAs in English waters protected from damaging fishing activity by 2024.

Specific issues which will need to be considered include crawfish and otter.

Crawfish (*Palinurus elephas)* are listed by the International Union for Conservation of Nature (IUCN) as a globally vulnerable Red List species. A status that has been reflected in the national-level protection in the UK and the species is a Feature of Conservation Importance for the network of Marine Conservation Zones (MCZs) including in 14 MCZs off the coasts of Devon, Cornwall, and Isles of Scilly, which can be seen in figure 2. For these MCZs to meet their conservation objectives, the population size within these sites would need to recover to historic population levels.

However due to the restricted movement of adult crawfish, it is probable that crawfish caught as bycatch outside the MCZs sites are not the same individuals as those residing within the MCZs. However, it is reasonable to assume that recruitment into populations within MCZs are at least, in part, linked to the wider population outside of the site. Therefore, if bycatch levels outside of the MCZ increase with fishing pressures, there is the potential for the knock-on reduction in recruitment to impact the MCZ conservation objectives being met.

Otters are features of 83 Special Areas of Conservation (SACs), 15 of which cross over into English waters, and this can be seen in figure 3 The SAC conservation objectives require that levels of otter mortality from human activity is reduced to mitigate adversely affecting the overall abundance and viability of the population. Bycatch of otters in crab and lobster pots and traps remains a concern, but the scale of the impact is largely unknown. Areas where bycatch is a risk will likely be very localised and restricted to shallow inshore waters. Previous evidence suggests that pots set at depths greater than 10-15m are unlikely to catch otters, whereas pots set

at shallower depths of 2-5m at low spring tide levels have the potential to result in bycatch[9],[10].

There is limited data available on how often otter bycatch occurs and no established reporting process. Because of this, it is difficult to determine if the level of mortality is such that it is adversely affecting the overall abundance of the populations within SACs. The bycatch monitoring plan will be key to trying to improve the evidence

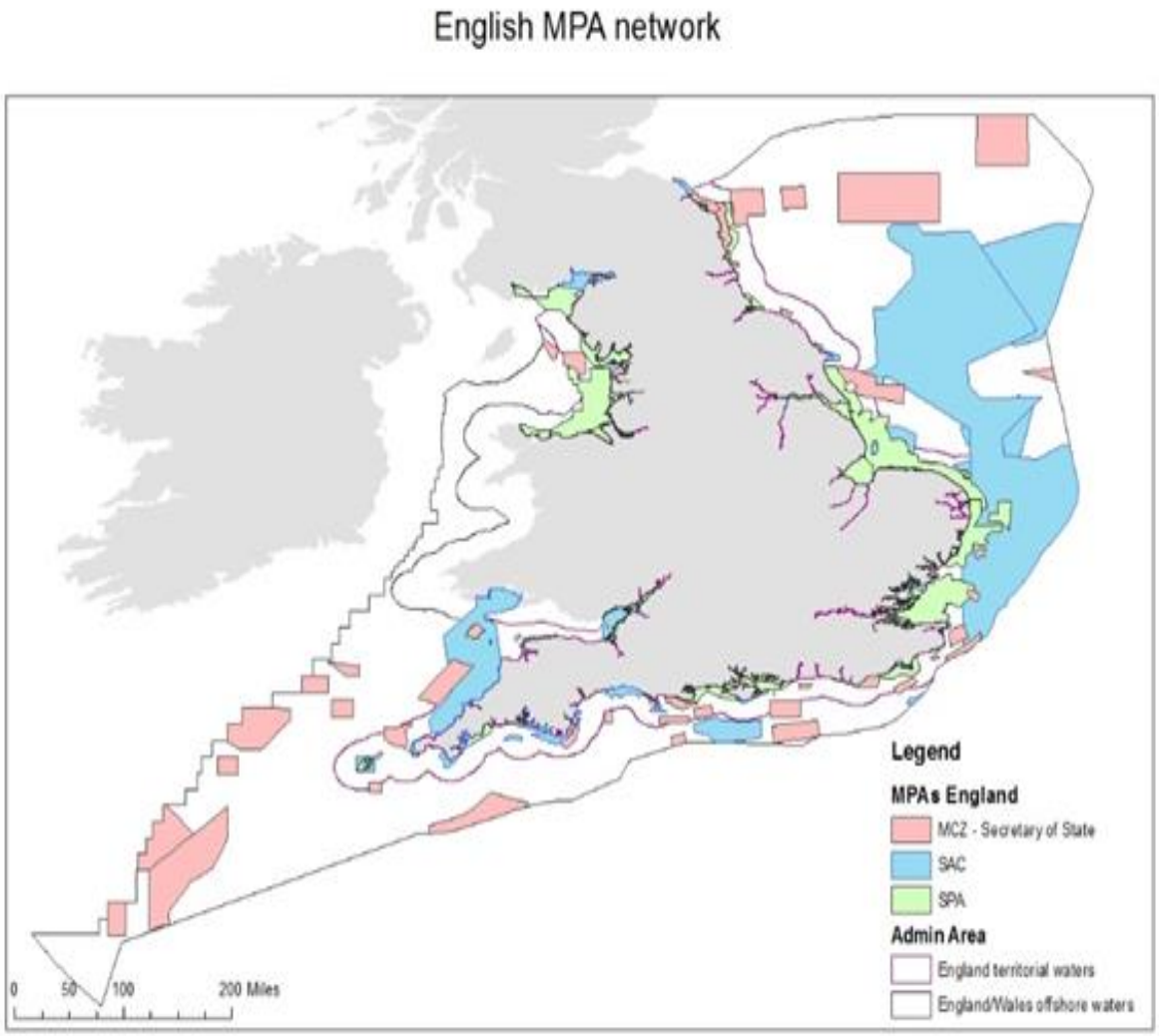

Figure 1: Map of the English Marine Protected Areas Network categorised by Marine Conservation Zones (MCZ), Special Areas Conservation (SACs), and Special Protection Areas (SPAs)

9 Twelves, J, 1983, Otter (lutra lutra) mortalities in lobster creels, Journal of Zoology, vol 201, Issue 4, pp585-588

10 Jefferies et al, 1984, referenced in https://ptes.org/wp-content/uploads/2015/06/National-Otter-Survey.pdf

base to confirm the perception that interactions are infrequent and a low risk to otters.

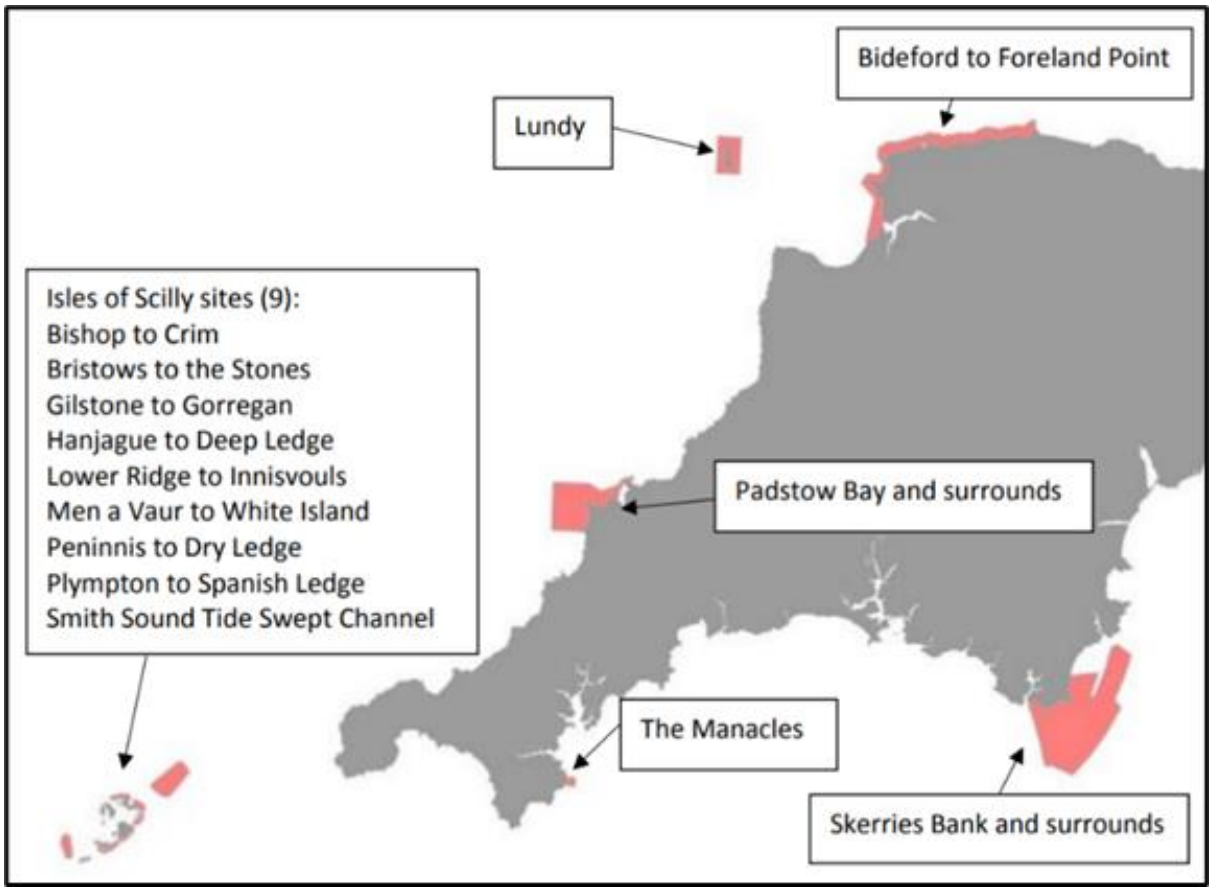

Figure 2: The 14 Marine Conservation Zones in England that have crawfish as a feature.

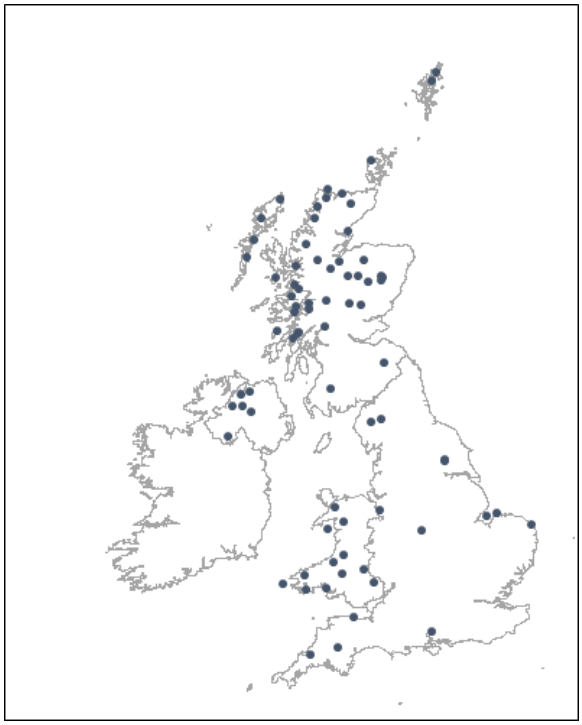

Figure 3: Special Areas of Conservation across the UK where Otters are considered as specialised feature. Dots on the map represent the centre point for the SAC. There are 15 SACs that are fully or partially in England (JNCC).