

Crab & Lobster Symposium



BLUE MARINE
FOUNDATION

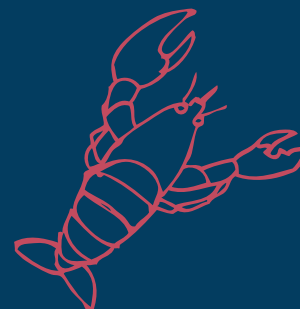
Proceedings
16 November 2022

EXECUTIVE SUMMARY

Overview

- **UK lobster and crab catches have increased significantly in the last 20 years**; for example, landings in Whitby have risen by 380 per cent since 2000.
- **Since 2018, while lobster catches have been relatively stable, crab catches have declined in several areas**, including the western and eastern Channel and the northern North Sea, with a significant mortality event in the Redcar-Hartlepool area in 2022, for which the cause is so far unexplained.
- **Proportions of crab catches are relatively equal among vessels of different lengths**, while under 10m vessels account for the majority of lobster catches.
- **There is a good level of understanding around the ecology of crab and lobster species in the UK.**

- **As Non-Quota Species, more research and data collection is needed to inform stock assessments** and post-Brexit fisheries management, especially at the regional level.
- **Regional approaches to management, such as Minimum Conservation Reference Size, are favoured by fishermen** over nationwide Total Allowable Catch (TAC) and quota restrictions.
- **The impact of environmental stressors on crab and lobster populations needs to be better understood**, including disease, sedimentation, pollution, and climate change, are largely unknown. More research is needed to understand these impacts and the ways in which they interact with fishing pressure.
- **Cross-sector collaboration is essential** for breaking down traditional barriers, supporting industry input, and reducing the communications gap between fishermen and regulators.



- **Targeted stakeholder engagement, tailored to the daily working practices of fishermen, is essential** for the successful development of England's Crab and Lobster Fisheries Management Plan (FMP).
- **The knowledge and expertise of all sectors of the fishing industry is vital** to jointly solve the issues facing crab and lobster stocks.
- The **Crab and Lobster Management Group**, which is developing the Crab and Lobster FMP for English waters, is presenting fishermen with the background to management decisions.
- The symposium's proceedings will contribute to and **support the development of the Fisheries Management Plan for brown crab and common lobster, which is due to take place in 2023.**

Background

In November 2022, **Blue Marine Foundation** (Blue Marine) held an online symposium dedicated to the sharing of knowledge on UK brown (edible) crab and European (common) lobster stocks, and their management. The event brought together over 250 academics, fisheries management bodies, fishermen and conservationists to promote collaborative action to support the development of England's Crab and Lobster Fisheries Management Plan.

Thirty speakers presented the available knowledge on crab and lobster stocks, fishery status, existing management measures, and perspectives on future management options to safeguard these species and secure sustainable fisheries.

A recording of the event can be viewed here: **[Blue Marine Foundation Crab and Lobster Symposium 2022 - YouTube](#)**

255 delegates

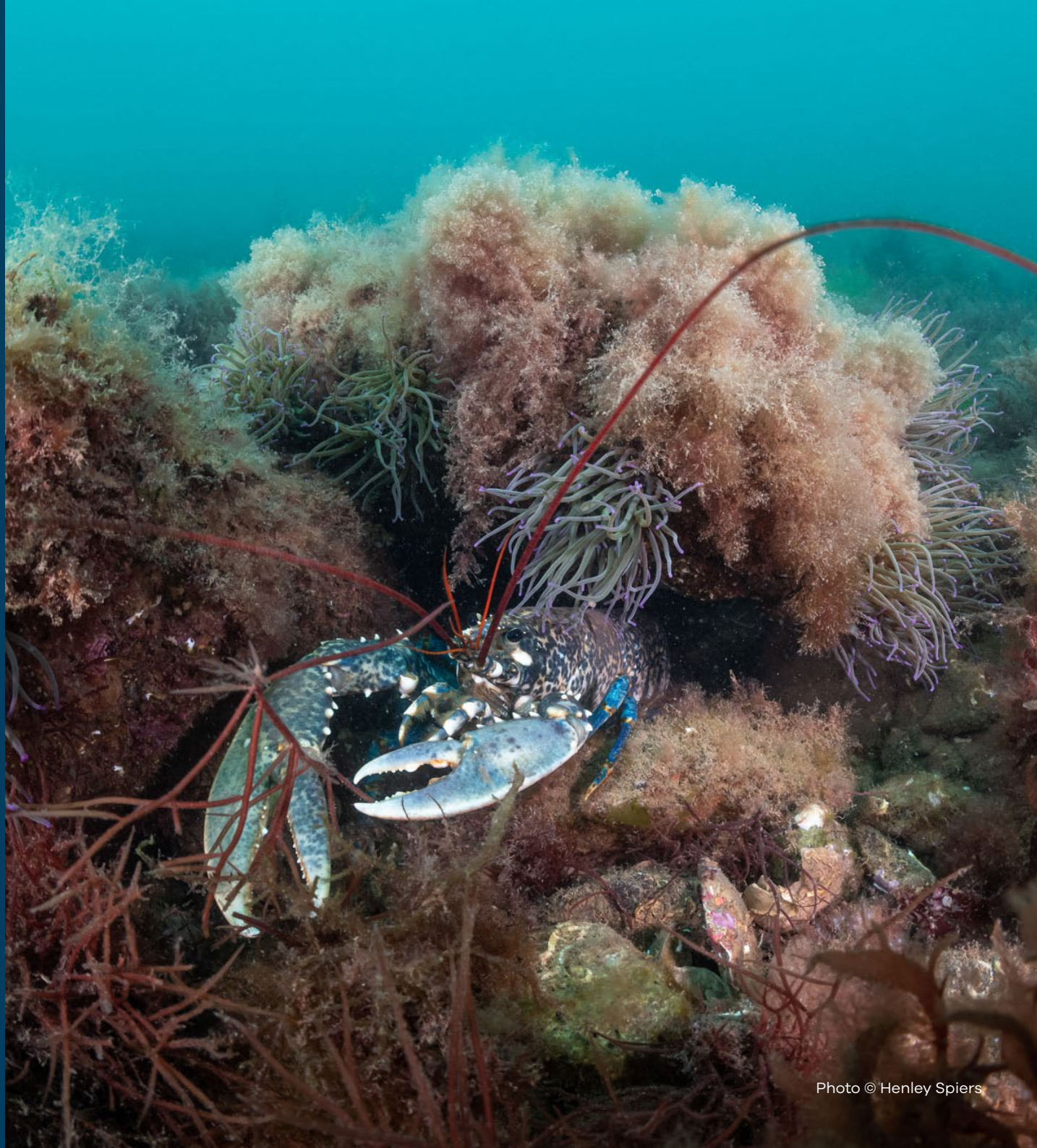


Photo © Henley Spiers

Biology

Crab

Brown crab (*Cancer pagurus*), also known as the edible crab, is found in the North Sea, Irish Sea and English Channel, off the coast of Portugal, and more infrequently in the Mediterranean. They are active predators and scavengers that inhabit the intertidal zone and deeper waters. Adult females are found down to 100 metres, juveniles occupy the intertidal zone, and adult males tend to remain within inshore waters. Mating takes place in spring and summer when females migrate inshore. As females restrict their movements once carrying eggs (called “**berried**”), they are unlikely to be caught in pots. Larger females produce more eggs.

Brown crabs reach sexual maturity when around 110mm in length, although this can vary to a degree between regions. The **Minimum Conservation Reference Size (MCRS)** – previously termed Minimum Landing Size (MLS) – for brown crabs, which varies regionally and between different UK authorities, intends to ensure that each adult has at least one opportunity to reproduce. However, further research is needed to clarify the effectiveness of this. The International Union for Conservation of Nature (IUCN) has not assessed the conservation status of the brown crab.

Velvet swimming crab (*Necora puber*) and spider crab (*Maja squinado*) are also fished in the UK but represent a much smaller share of UK crab landings, although in some areas such as the western Channel, spider crab abundance is showing significant increases in recent years.



Photo © Martin Stevens

Lobster

In the UK, two lobster species are caught commercially - the common lobster (*Homarus gammarus*), also known as the European lobster, and the European spiny lobster (*Palinurus elephas*).

The common lobster is found throughout the UK, Ireland, and the rest of Europe. Like brown crabs, they have a broad and carnivorous diet. Both juvenile and adult common lobsters prefer rocky seabed habitats, usually around depths of 10-60 metres. They can breed at any time of year, becoming sexually mature at around five years old, with larger females able to produce more eggs.

Management measures are in place with the aim of permitting individuals to breed at least once, although few reach full size before being caught for the first time and therefore discarded. The species is classified by the IUCN as of Least Concern due to its abundance, but both English and Scottish lobster assessments show that although the stocks are not collapsing the rate of exploitation has for many years been higher than that corresponding to **Maximum Sustainable Yield (MSY)**. There are significant genetic differences between populations in different areas, such that local overexploitation is a risk.

European spiny lobster (*Palinurus elephas*), also known as crawfish, crayfish, or rock lobster, can be larger than common lobster but lack the characteristic large claws of the common lobster. The UK represents their northerly limit, where they are found along the western coasts of England, Wales, and Scotland, preferring depths of 15 metres or more. They share similarities with common lobster in terms of behaviour, but there are important life history differences. Larvae of the common lobster occur mainly in inshore waters, while spiny lobster have a more dispersive and more prolonged larval phase.

As with the common lobster, management measures for spiny lobster aim to enable mature individuals to breed at least once. Atlantic and Mediterranean spiny lobster form two distinct stocks, though there is less genetic differentiation within these two main populations compared to the local variation seen in common lobster.

This implies that to ensure stock sustainability, management at the international level will have more impact than at the local level. The species is classified by the IUCN as Vulnerable, and it is a UK Biodiversity Action Plan priority marine species.



Photo © Mark Coombs

Common lobster (*Homarus gammarus*)



Photo © Charlie Ellis

European spiny lobster (*Palinurus elephas*)

Fishery

Crab and lobster, which for many years supported predominantly seasonal fisheries are now targeted all year round using baited pots, traps, or creels, which are lowered onto the seabed and usually collected between 24-48 hours later.

Crab and lobster landings in the UK have increased significantly in the last 20 years, with the majority of landings taken by UK-owned vessels. Although this may be partly due to improvements in data collection for shellfish landings, a considerable increase in fishing effort has also been observed. It is noted that fishers may return live crabs or lobsters to the sea if the market value is too low at the time, meaning that catch data should be used in conjunction with landings data.

Despite the increase in UK landings in the last two decades, and a concurrent rise in value since 2009 (up to £58.7 million in 2021), crab landings have recently fallen (31,100 tonnes in 2018 versus 24,000 in 2021). Under 10m and over 10m vessels caught fairly equal shares of crab between 2018 and 2022, although over 15m vessels overtook under 10m vessels in 2022 by a small margin. Between 2018 and 2022, the ports of Grimsby and Bridlington saw the greatest number of landings by a significant margin (13,449 tonnes and 11,038 tonnes, respectively).

Lobster landings have remained relatively stable, with 3,400 tonnes in 2018 and 3,200 in 2021 (representing values of £44.7 million and £51.7 million, respectively). Under 10m vessels land the majority, while over 15m vessels have the smallest share. Bridlington accounts for nearly half of all UK landings (1,846 tonnes).

In Scotland specifically, most landings are by vessels under 10m, and 90% of these target crab and lobster. In 2021, 8,275 tonnes of brown crab were landed (with a value of £18.4 million) and 1,168 tonnes of lobster were landed (with a value of £17.8 million).

	UK LANDINGS VALUE 2021	UK LANDINGS TONNES 2021
Crab	£58.7 million	24,000
Lobster	£51.7 million	3,200



Management

UK-wide

Crab and lobster species fished in the UK are classed as '**Non-Quota Species' (NQS)**, which means that their stocks are not subject to a Total Allowable Catch (TAC). A permit is not required for landing up to five lobsters and up to 25 crabs per day, using pots or nets. Shellfish permits for landing more than five lobsters or 25 crabs per day have been issued to 334 over 10m vessels (30% of the fleet) and 2,632 under 10m vessels (66% of the fleet).

In addition to permits, in some areas, licence variations are used to limit the number of fishing days. However, it is widely considered that there is a lack of coherence in the management of crab and lobster stocks, and the Marine Conservation Society has called for stock assessments to be conducted at least once every two years. It has been suggested that more regionalised and localised monitoring of stocks, as well as a range of different methods for estimating sexual maturity in crabs (due to variation in results depending on the method used), should be implemented.

National Administrations

Scotland

In Scotland, inshore fisheries management is delivered via its five non-statutory Regional Inshore Fisheries Groups (RIFGs). Crab and lobster stocks are mainly managed via input controls, for example, limiting the number of creels (pots). Results of the Outer Hebrides Pilot Pot Limitation Scheme, which recently concluded, indicate that current creel limits are too high and that other measures, such as limits on the number of creel days, may also be needed.

Across Scotland, recent and upcoming policy developments are expected to have a significant bearing on the future management of crab and lobster. The Bute House Agreement (2021) obligates the Scottish Government to rapidly improve fisheries management, and a consultation recently ended on its Future Catching Policy, which will cover static gear management, control, and policing. An additional consultation is due on new management measures, which may include capping the number of commercial vessels operating within three nautical miles of the coastline, where nearly all crab and lobster are caught. England's work on Fisheries Management Plans will also be used to inform Scotland's management as appropriate.

England

Regional Management

Inshore crab and lobster fisheries, which operate within 6 nautical miles of the coast, are subject to regional management measures set by England's ten Inshore Fisheries and Conservation Authorities (IFCAs). The measures in place for crab and lobster vary between each IFCA district, demonstrating important differences in regional management approaches, according to the characteristics of local shellfish populations, their habitats, and their fisheries. For example, only Northumberland IFCA and Sussex IFCA currently have pot limitations in place for crab and lobster, while six IFCAs have imposed a MCRS for crab. Devon and Severn IFCA, Cornwall IFCA, and the Isles of Scilly IFCA are the only organisations to set their own **Minimum Conservation Reference Size (MCRS)** for lobster, while the rest abide by the EU's MCRS.

The IFCAs also undertake their own monitoring and research to record the health of local shellfish populations and to better understand the impacts of fishing. This typically involves observer surveys, dive/camera surveys, quayside/wholesaler surveys, monitoring of landings, assessment of fishing effort, and partnership research projects. Furthermore, in Cornwall, a restocking program for lobster has been underway since 2000, operated by the National Lobster Hatchery.

Fisheries Management Plans (FMPs)

Fisheries Management Plans (FMPs) will be evidence-based action plans, to deliver the objectives of the Fisheries Act 2020 and developed with input from industry and other stakeholders. They aim to set out policies – based on scientific evidence – that detail how fishing is managed, by stock, fishery, or location.

The Crab and Lobster Management Group (CMG) is a collaborative, industry-led forum that brings together fishermen, regulators, and researchers. The CMG is leading the development of a FMP for crab and lobster in English waters.

Two further sub-groups fall under the remit of the CMG – the CMG FMP Working Group, which guides and will comment on the objectives of the FMP, and the CMG Science Sub-Group, which scopes out evidence gaps that need to be addressed to inform the FMP. Specific FMP objectives will be discussed with and take into account industry views prior to public consultation. Recent stakeholder engagement events run by Seafish have helped to raise awareness about the FMP for crab and lobster and have encouraged fishermen to become actively involved in its development.

Non-fishing related factors affecting stocks

In addition to fishing, crustaceans are susceptible to a range of environmental stressors including disease, sedimentation, pollution, and climate change. Disease is especially common in brown crabs, and novel pathogens are found in UK crab populations from time to time. In recent years, scientists have been monitoring an outbreak of Edible Crab Disease, which was first discovered off West Sussex in 2019. The disease affects crab behaviour, leading to slow and lethargic individuals, which can result in death following capture. Proper scientific investigation is essential to determine the significance of emerging diseases in shellfish.

Further research in West Sussex is examining the effects of sedimentation on crab and lobster populations. The research has, so far, identified changes in sediment distribution, coarseness, and particle size, as well as the accumulation of heavy metals in crab and lobster tissues, declines in water oxygen levels, and wider habitat change.

In Northeast England, research into the potential causes of a mass crab mortality event in the region in autumn 2021 is ongoing. Investigative research by Newcastle University indicated that pyridine released during seabed and river dredging could be a possible causal factor. Defra had postulated algal blooms and a rapid drop in sea temperature as the cause, although the results were inconclusive. Since the Symposium, Defra commissioned an independent panel to review the evidence and various hypotheses and concluded that it was unlikely that any of these factors were the primary cause and that it was as likely as not, a novel pathogen that caused the mass crab mortality. Debate is ongoing.

Growing attention is being paid to the potential positive and negative impacts of offshore wind farm development on crabs and lobsters, although evidence is currently lacking. The growth in offshore wind in the North Sea could affect crab and lobster fishing there. Research undertaken with fishermen and other stakeholders from this region reveals a variety of concerns, including the practical challenges of co-location, highlighting the need for co-development, and community management.

Fishery Perspectives

An open forum dedicated to fishery perspectives provided an opportunity for those working in the industry to voice their views.

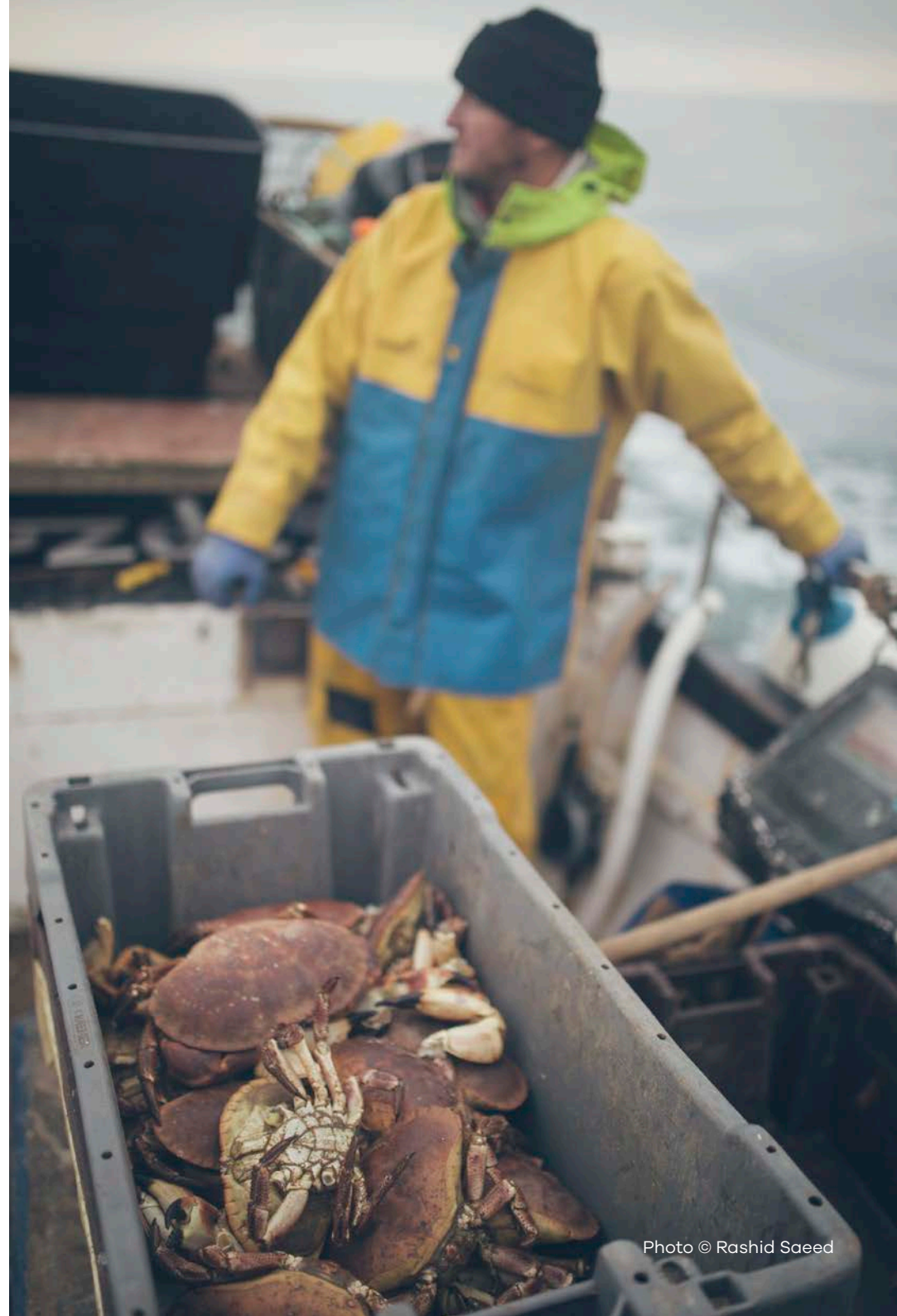
The challenges of online stakeholder engagement were emphasised, particularly the fact that fishermen are not paid to respond to consultations, which are often time consuming. Additionally, when fishermen do respond, their opinions are weighted equally to other non-fishing stakeholders. To overcome consultation fatigue among stakeholders, a suite of different engagement approaches are needed with a focus on in-person approaches.

TAC and quota restrictions are not popular among crab and lobster fishermen, who prefer regional measures that regulate the fishery on a local scale, such as increasing the MCRS and banning crab as whelk bait.

The simplification of regional legislation, notably around age at first maturity, was met with caution. While nomadic vessels would benefit from this, community-based fisheries may not, thus making it important to consider local variations in shellfish ecology when making management decisions.

The main concerns of the market pertain to the observed declines of crab stocks in recent years, access to UK/EU waters, and the recruitment of foreign crew.

Despite the concerns raised, it was agreed that the Symposium was a positive step towards reforming the management of crab and lobster – two stocks which until Brexit, were categorised as NQS and suffered from a lack of research. Looking ahead, the establishment of a collaborative approach between fishermen, researchers, and regulators will be critical for charting the future direction of crab and lobster fisheries management.



Conclusions

The Crab and Lobster Symposium aimed to share information on research, fishery trends, and current management to inform measures that support the long-term health of UK crab and lobster populations and sustainable fisheries. Presentations reflected a good current level of understanding around crab and lobster ecology. However, as Non-quota species, both crab and lobster could benefit from more research and data collection to inform stock assessments and post-Brexit fisheries management.

Regional approaches to management are favoured by active fishermen over nationwide TAC and quota restrictions. More targeted stakeholder engagement will be important to reduce consultation fatigue and ensure industry buy-in to the management measures developed as part of the Crab and Lobster FMP for English waters due to be published by the end of 2023.

Key points drawn from the Symposium:

- **There is an urgency among all stakeholders to address recent declines in UK crab landings.**
- **More work is required to understand the impact of environmental stressors on crab and lobster populations**, including disease, sedimentation, pollution, and climate change.
- **Existing national lobster and crab assessments have shown that in most UK potting areas the harvest rate has been above that required to deliver for MSY for some years.**
- **The preferred management approaches from an industry standpoint include increasing MCRS and improving the enforcement of existing legislation.** However, overarching nation-wide measures such as TAC and quota restrictions are unpopular.
- **Cross-sector collaboration will be essential** for breaking down traditional barriers, ensuring industry buy-in, and reducing the communications gap between fishermen and regulators.
- The Crab and Lobster Management Group, which is developing **the Crab and Lobster FMP for English waters**, is **actively engaging fishermen in developing management proposals** and this must continue.
- **There is a critical need to draw on the knowledge and expertise of all sectors of the fishing industry to jointly solve the issues facing crab and lobster stocks.**

SYMPOSIUM PROCEEDINGS

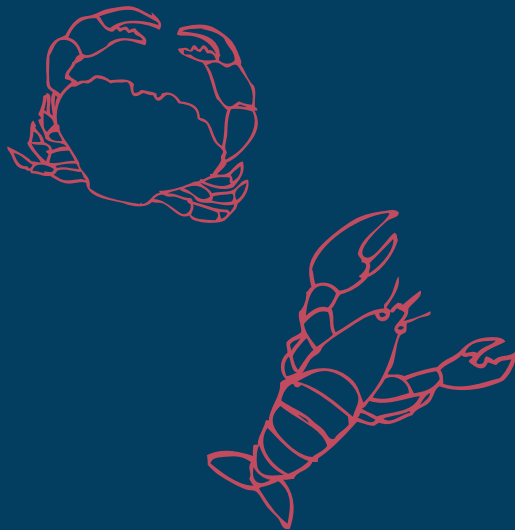
Sam Fanshawe, from **Blue Marine**, welcomed participants and introduced the symposium, highlighting its focus:

“To share current knowledge and support ongoing work to safeguard the long-term health of UK crab and lobster populations and sustainable fisheries.”



Brown (edible) crab (*Cancer pagurus*) and European (common) lobster (*Homarus gammarus*) are two of the UK's most commercially important fisheries.

The demand for UK crab in particular has risen in recent years, largely due to the growth of the export market, particularly to the EU and Asia. The value of landings has increased concurrently, leading to a rise in fishing effort for crab and lobster around the UK. There is common concern amongst fishermen, fisheries managers, and conservationists that some inshore regions are experiencing dramatic declines in availability of stock and increased mortality, particularly for brown crab.



The key issues affecting crab and lobster stocks include:

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Increasing effort and declines in landings

Challenges in assessing stock status

Disparity between regional management measures

Risk of over-exploitation without intervention

Susceptibility to the impacts of pollution, sedimentation, and climate change

The aims of the symposium were:

1
2

To share current information on crab and lobster research, factors affecting stocks, fishery status, current management measures, and the Fisheries Management Plan (FMP) in English waters.

To support the inclusive development of the Crab and Lobster FMP.

Dr Colin Bannister, Hon Life Member and Council Member of the **Shellfish Association of Great Britain**, gave an account of the history of UK crab and lobster fisheries, which have experienced prolonged expansion since 1965 and 1990 respectively. Today, stock assessments point to most regional fisheries being above sustainable limits, although there have been no signs of actual collapse.

Important considerations for shaping the future management of crab and lobster fisheries include:

- Differences in biology and reproduction between stocks inhabiting different regions
- The sensitivity of data sampling to fishing and stock abundance
- Management options including increases to Minimum Conservation Reference Size (MCRS) and a potential step-wide reduction in fishing effort
- Marine Stewardship Council certification criteria
- Increasing effects of water quality and climate change

“The Fisheries Act, and the scope it gives to shape the future by developing species-specific Fisheries Management Plans, is potentially game changing.”

Session 1

Biology & Research

Chaired by Dr Bryce-Stewart, Senior Lecturer, University of York

Carlos Mesquita, fisheries scientist at [Marine Scotland](#), gave an introduction to the [Working Group on the Biology and Life History of Crabs](#) (WGCRA). Formed in 2006, the membership comprises Canada and a number of European and Scandinavian countries. The group initially focused on snow crab (*Chionoecetes opilio*) in Canada and spider crab (*Maja squinado*) in the Northeast Atlantic. However, it has expanded its remit to other commercially important crab species and since 2014 has also considered common lobster.

The WGCRA seeks to build an international science program ensuring linkages between data and scientific advice, with its main aims being:

- Stock management and monitoring of crustacean fisheries
- Gathering and communicating new knowledge
- Collaborating on joint studies, data sharing, and combined stock assessments

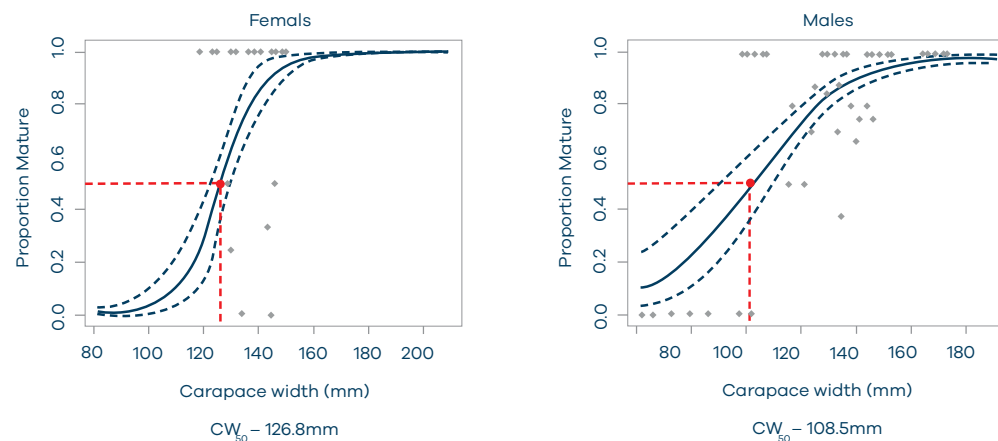
Highlights from the group's work include the tagging of brown crab around the UK, Ireland, France, and Sweden, which has yielded important new knowledge on stocks; and exploring the potential for integrated stock assessments across different countries. Research is published through three-yearly ICES working group reports and scientific journals. In addition to its ongoing focus on collaboration and data sharing, the WGCRA's current areas of research concern the falling abundance of brown crab stocks, and the impact of climate change on brown crab and snow crab. The group comprises a number of experts, and in the last few years, an influx of enthusiastic early-career scientists.

Blair Easton ([St Abbs Marine Station](#)), **Andrew Boon** ([Northumberland Inshore Fisheries and Conservation Authority \(NIFCA\)](#)), and **Joe Richards** ([Blue Marine](#)) shared **the results of a cross-border study on brown crab size at sexual maturity in Berwickshire and Northumberland**.

The MCRS for brown crab in both Berwickshire and Northumberland was 130mm until 2017, when following a consultation, the Scottish government increased this to 150mm. Local fishermen felt that this policy change was not warranted for the stock, especially given that neighbouring fishermen in Northumberland were not subject to it. In response, a cross-border study was carried out to determine whether the MCRS in both regions were adequate to ensure the sustainability of the stocks.

Sampling took place in 2020 and 2021, with a total of 769 crabs obtained from local fishing vessels and NIFCA potting surveys. Gonadal maturity, the presence of sperm plugs (in females), and energy stores were measured in order to determine sexual maturity. Females in both regions were found to reach sexual maturity at a larger size than males (**Figures 1 and 2**). There were also some variations between the two regions, for example, crabs in Berwickshire were found to recover less energy following reproduction than in Northumberland.

Berwickshire

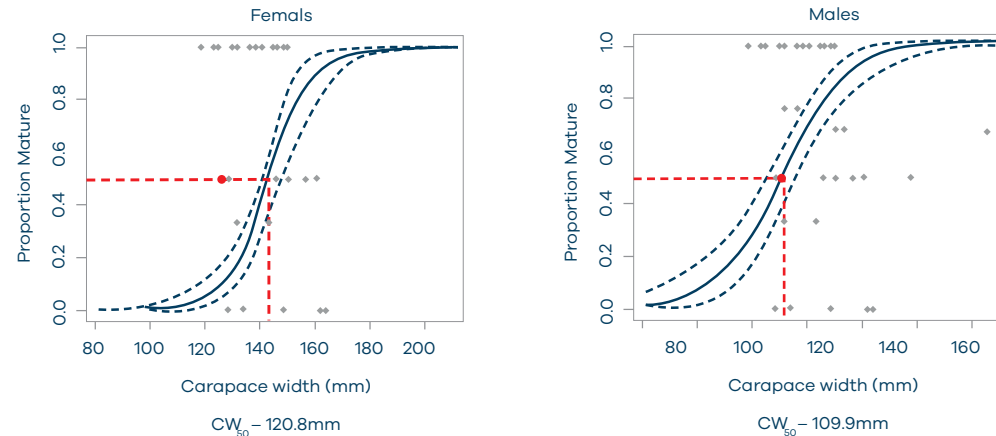


Gonad maturity of the *C.pagurus* cohort sampled from Berwickshire (females on left and males on the right). The point at which 50% of the population are said to be mature is highlighted in red (L50), with confidence intervals (95% CI) shown by the blue dashed lines. Logit regressions with non-parametric bootstrapping, based on general linear models, were used to conduct the analysis. The sizeMat package for studio was used (Rstudio Version 1.1.463 - © 2009-2018 RStudio, Inc.).

Figure 1 – Gonadal maturity of the female and male brown crabs sampled in Berwickshire

“The MCRS in Berwickshire and Northumberland are suitable for the current size at maturity, however, future work will monitor this.”

Northumberland



Gonad maturity of the *C.pagurus* cohort sampled from Berwickshire (females on left and males on the right). The point at which 50% of the population are said to be mature is highlighted in red (L50), with confidence intervals (95% CI) shown by the blue dashed lines. Logit regressions with non-parametric bootstrapping, based on general linear models, were used to conduct the analysis. The sizeMat package for studio was used (Rstudio Version 1.1.463 - © 2009-2018 RStudio, Inc.).

Figure 2 – Gonadal maturity of the female and male brown crabs sampled in Northumberland

The researchers concluded that current management measures are sufficient to enable individuals in both areas to reproduce at least once before being caught. The results highlight the need for both regional and local monitoring, as well as consistent monitoring every three years.

Alec Moore, Postdoctoral Fisheries Scientist on the [Sustainable Fisheries Wales](#) project at Bangor University, **presented on an investigation into size at sexual maturity (SOM) of brown crab in the Welsh waters of the Irish and Celtic Seas**. The MCRS across Wales is currently 140mm, having historically been lower. Given that a fall in SOM has been observed elsewhere in heavily-fished crustacean stocks, for example in North America, Moore sought to determine whether SOM for brown crab in the study areas had changed over time.

Sampling was undertaken in the winter of 2020-2021, by measuring the sexual morphology (including sperm plugs in females and claw size in males) of around 1,700 crabs. 50% of sampled crabs were mature, which was broadly in line with previous studies. A difference in gonadal maturity was found between populations in North and South Wales, which may reflect historic differences in landing size. However, there was no strong evidence of a decline in gonadal size over time since 2014-2015, and limited evidence for a fall in SOM since then.

The study has highlighted the need to employ a range of methods when estimating functional sexual maturity and indicates that the current Wales-wide MCRS is effective at protecting immature individuals.

Charlie Ellis, Postdoctoral Research Fellow within the [University of Exeter's Molecular Ecology & Evolution Group](#), presented on analyses of genetic variation among different populations of common lobster and spiny lobster in Europe. This was carried out by identifying instances of single nucleotide polymorphism (SNP), which can be used as markers for genetic variation.

For spiny lobster, clear differentiation was found *between* the Atlantic and Mediterranean stocks (**Figure 3**), although there was much less variation *within* the two populations. With such high connectivity apparent within the two stocks, localised management alone is unlikely to be sufficient to ensure sustainability, thus international approaches are also needed.



Photo © Charlie Ellis

Photo © Charlie Ellis

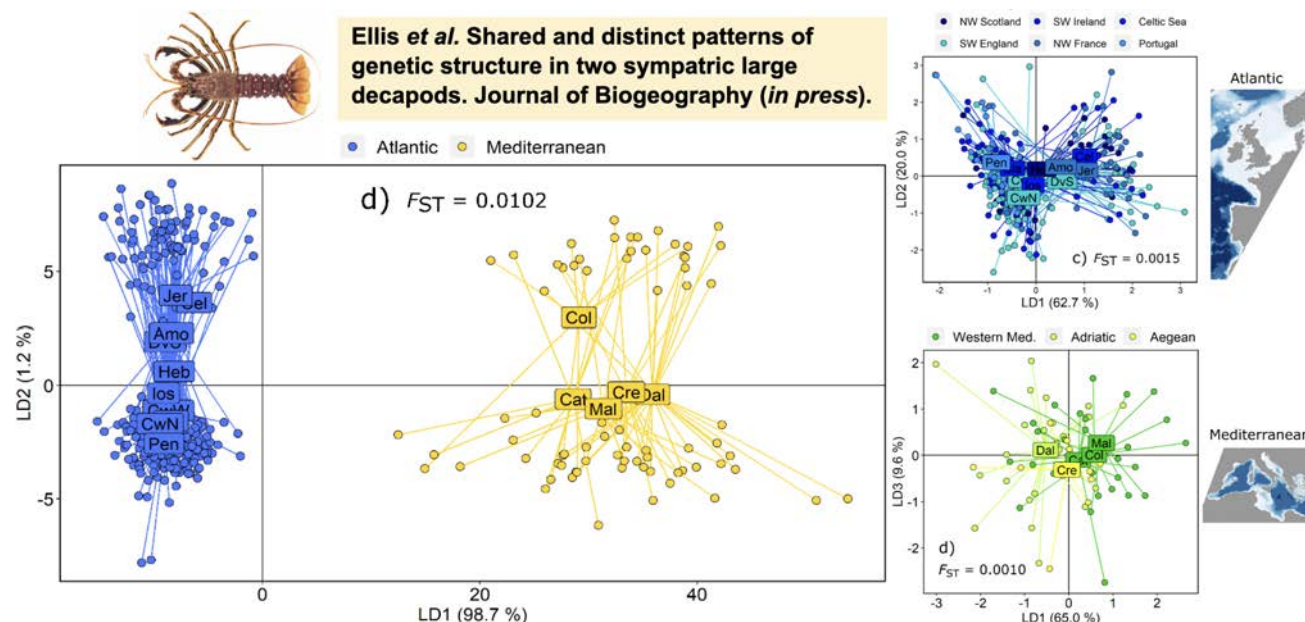


Figure 3 – Genetic differentiation of spiny lobster populations in Europe

For common lobster, although an Atlantic and Mediterranean divide was again observed, much more variation was found within the populations (**Figure 4**). Subtle variation, likely to reflect local retention of larvae and limited dispersal between regional stocks, was clear, even between stocks in East and West Britain. Full genome sequencing is currently being undertaken to investigate the reasons for this, including whether larvae are unable to travel far or are locally adapted. In the case of this species, localised management will likely have much more of an impact.

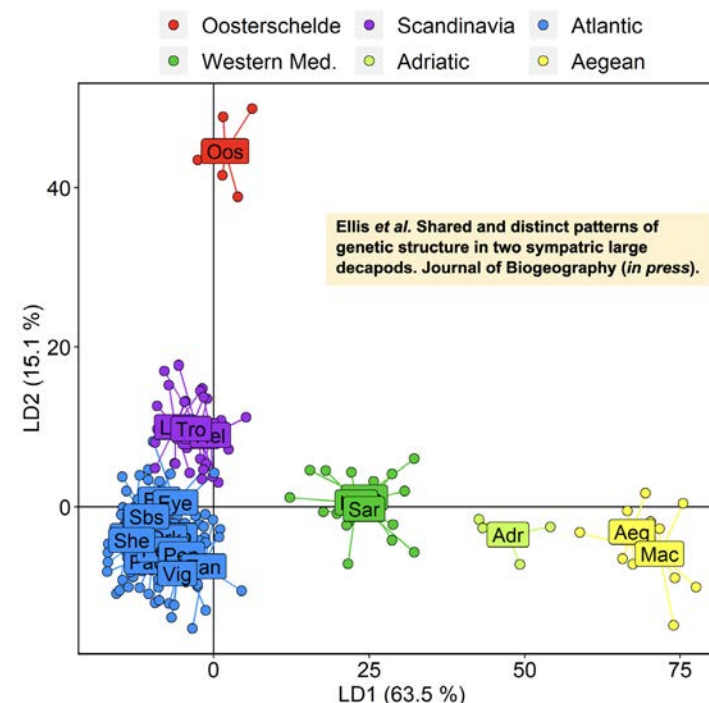


Figure 4 – Genetic differentiation of common lobster populations in Europe

The Molecular Ecology & Evolution Group is working to refine its genetic techniques to make this type of research cheaper and faster, and to realise other benefits, including the ability to determine the success of releases by identifying surviving individuals or their descendants. Understanding the genetic boundaries of different stocks will help managers to avoid inadvertently diluting genetic fitness through moving individuals across stocks.

Q&A on Biology & Research

Q: Is ICES looking at storm impacts e.g. the severe storms in 2014/2015 and the potential impact on juvenile crab/larvae in the South west which may have impacted recruitment into the fishery and potentially the decline in adult catches seen in recent years?

A: No. There is a lack of baseline data on larvae and juveniles.

Q: What is a sensible MCRS? Does it make sense to opt for a higher MCRS if the stock is subject to other pressures?

A: The cross-border study in Berwickshire and Northumberland was not able to differentiate impacts of fishing pressure versus other factors such as environmental stressors. The intent was to obtain baselines for the regions and the differences between these. Further work is needed.

Q: Is “size of 50% maturity” a good measure for a crab stock under pressure? MCRS for 100% maturity is now used in Scotland and Jersey.

A: 80% of females and 90% of males were mature in the cross-border study, regardless of the current MCRS. The MCRS in Wales has also been shown to protect immature individuals, however, other measures may be needed to increase confidence in the management of such stocks.

Q: Can you explain why another study conducted in 2008 found different results regarding the genetic differentiation of spiny lobsters between Brittany and Irish and Scottish stocks.

A: The 2008 study used mitochondrial DNA (mtDNA) from a single gene and had a small number of samples. The University of Exeter’s study had more samples and markers across the genome at a higher resolution and should be trusted over the earlier study. The author of the 2008 study subsequently repeated their work at slightly higher resolution and found no variation between those stocks, so the original result may have been due to low power.

Q: An intertidal survey over the last two years at Kimmeridge found that nearly all crabs found were male (only 4 females out of a total of 596). All crabs recorded were in the 2-10 cm size range. What is the explanation for this?

A: Some intertidal surveys of juvenile crabs were done in Berwickshire. At certain times of the year, the surveys recorded fewer females, which could be due to migration and/or a preference for deeper waters. Juvenile crabs can also be more difficult to sex, particularly before they reach two years of age.

Q: Given MCRS is partly focused on enabling each individual to produce at least one clutch of eggs before capture, can smaller or more inexperienced females have a smaller recruitment potential than larger ones?

A: Yes, this is true in decapod crustaceans. Smaller females produce fewer eggs, and some evidence that larvae from those eggs are less likely to survive compared to larger females. While MCRS is important, more and more fisheries around the world are considering a maximum landing size as well (MaxLS) to protect highly fertile large individuals, which can mitigate fishing-induced evolution by avoiding the promotion of smaller lobsters. A **MaxLS** has been introduced for lobsters in Scandinavia – 115mm. Scotland’s MaxLS (150mm) is arguably too large to make much of a difference, especially in the short term and should really be lowered to ensure it has the intended impact. Some fishermen carry out **v-notching**; this, in combination with MaxLS and potentially a slot limit (where individuals outside of a certain range of length cannot be kept), could be a way forward.

Session 2

Factors Affecting Stocks

Chaired by Sam Fanshawe, UK Projects Manager, Blue Marine Foundation

To illustrate some of the concerns being raised by fishermen about crab and lobster stocks and potential stressors, a short video was shown taken from a recent regional BBC News item – see the [Crab and Lobster Symposium recording](#) at 1hr 12mins.

Dr Rosslyn McIntyre, Shellfish Scientist at [Cefas](#), provided **an introduction to Edible Crab Disease**. Edible Crab Disease was first reported in brown crabs caught off Selsey in West Sussex in 2019. Fifty per cent of the live crabs sampled (n=98) from the fishery in autumn 2019 were found to be infected, and infections varied from mild to severe. Those heavily infected had organ and tissue damage, which was presumed would lead to mortality.

At least three species of amoebae (living, single-celled organisms capable of causing disease) were found in diseased crabs:

- *Neoparamoeba pemaquidensis*
- *Neoparamoeba aestuarina*
- *Janickina feisti* (which was identified as a novel amoeba)

Sampling of lobsters in the region demonstrated that the disease was not present in local lobsters, nor was it linked to recent unexplained crab and lobster mortalities in the Northeast of England, as the disease was not found in samples taken from this incident. Samples were taken in South Devon but no amoebae-like pathogens were found here (n=64).



Edible Crab Disease

What is it?

Edible Crab Disease is caused by an amoebic pathogen (a living single-celled parasite) that can infect adult brown crabs. It is also known as Amoebic Crab Disease.

Symptoms?

The disease affects crab behaviour, leading to slow and lethargic crabs, and can cause death following capture. No visible symptoms have been recorded on animals, but heavily infected crabs may suffer from internal organ and tissue damage.

Can it harm humans?

Edible crab disease poses no known risk to human health.

What to do?

Contact your local [**Inshore Fisheries and Conservation Authority \(IFCA\)**](#) if you see increased mortalities or unusual behaviour in crabs.

Current research on new and emerging pathogens, led by Cefas, is gathering information from crab fishermen via an online questionnaire. This will help to identify health issues in crabs seen from a fisherman's perspective, to target future sampling, and to gather general information about fishing methods and catches that may link perceptions of changes around the coast to reports of disease.

In addition, Cefas are carrying out a full health screen of the crabs to detect disease and identify different types of pathogens and investigate any spread of the novel pathogen *Janickina feisti*. Shore and vessel samples of juveniles, pre-recruits and adults are being undertaken to see if the whole population is affected or just juveniles or adults. Sampling is being undertaken in five locations across the UK (Central North Sea-Yorkshire; Southern North Sea-North Norfolk; Eastern Channel-Ramsgate; Western Channel-Weymouth; and Celtic Sea-North Cornwall). In the lab, pathogens are identified through dissection, by studying tissues and cells under a high-powered microscope, and genetic tests. It was noted that the presence of pathogens doesn't necessarily trigger an infection of mortality.

Diseases such as pink crab disease and shell disease (bacterial infection) are fairly common in brown crabs around the coast, and novel pathogens are found from time to time. Proper scientific investigation is required to determine their significance on the stocks.



Dr Charlie Thompson, Researcher at the [University of Southampton](#) and Director of the [Channel Coastal Observatory](#), gave an **overview of findings to date from the Crustaceans Habitat and Sediment Movement (CHASM) project**. CHASM is a multi-stakeholder project based in Selsey, West Sussex, which works with fishermen and other local marine users, as well as a range of local and national research partners to answer questions raised by stakeholders regarding “why are there so few crabs and lobsters” and “why is there so much more sediment in the area” than there used to be. Various techniques are used to measure the changes that may be impacting crab and lobster including assessments of coastal change monitoring data, sediment analysis, sondes to measure temperature, turbidity, conductivity, dissolved oxygen and chlorophyll, and interviews with local residents.

The main aims of the project so far have been to:

- Determine a local change narrative based on key user groups and recorded events that may relate to coastal change
- Establish the extent to which changes in sedimentation have been observed across the area of interest
- Assess regional trends of coastal change, from existing evidence-based datasets.

The research has so far identified changes in sediment distribution, coarseness, and particle size in the area of interest (**Figure 5**). Early findings have also identified the accumulation of heavy metals in crab and lobster tissues, declines in water oxygen levels, and wider habitat change, suggesting a larger impact beyond just crabs and lobsters.



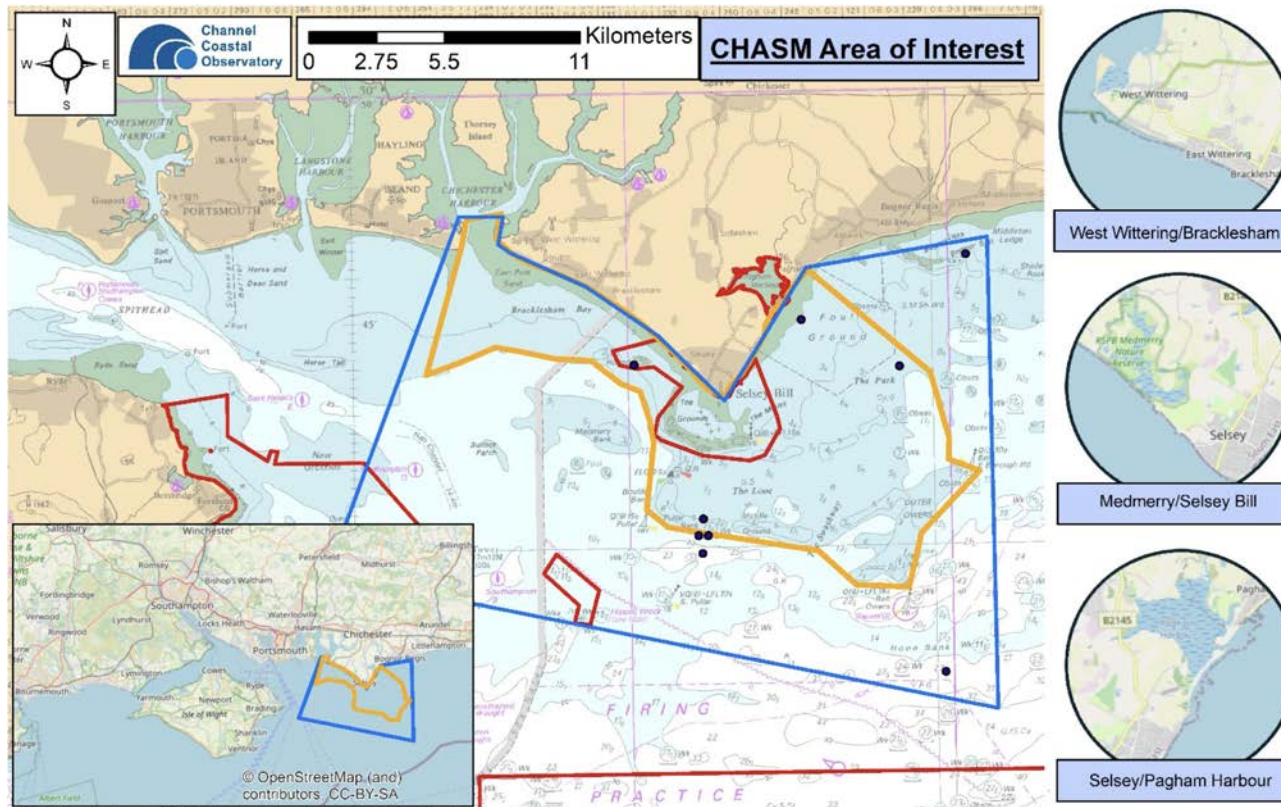


Figure 5 – CHASM project area of interest

Future work packages are set to investigate how the different factors affecting sediments interact (Figure 6) and impact shellfish. Central to the project is a strong dialogue between research partners and local people, with regular community meetings providing a platform to share information.



Figure 6 – Upcoming CHASM work packages and priorities

Dr Gary Caldwell, researcher at [Newcastle University](#), presented his research on the potential environmental transfer and toxicity of pyridine in brown crab following a mass crab mortality event in the Northeast of England in autumn 2021. This mass mortality coincided with intensive maintenance dredging in the River Tees over a period of 10 days which moved 150,000 tonnes of sediment to spoil grounds 4-5km offshore from Teesmouth.

Toxicological experiments showed that high levels of pyridine exposure (100 mg/l), which was well within the pyridine levels found in the dead crabs, caused convulsive (twitching) behaviours, paralysis, and death within six hours. The onset of paralysis took longer as the pyridine concentrations were lowered, but mortalities remained high even at lower concentrations, with paralysis occurring at levels as low as 0.066 mg/l. To evaluate the cumulative exposure of crabs to pyridine within the area, researchers combined the toxicity data with computer simulations of North Sea currents and tides during and after the autumn dredging activity. The modelling showed that pyridine would be quickly transported along the coastline, with areas around Hartlepool and Redcar worst affected, with the potential to kill approximately half of the crab population after only 24 hours of exposure (**Figure 7**). Levels of pyridine sufficient to kill approximately 10% of the population within three days were predicted to reach as far south as Whitby and Robin Hood's Bay.

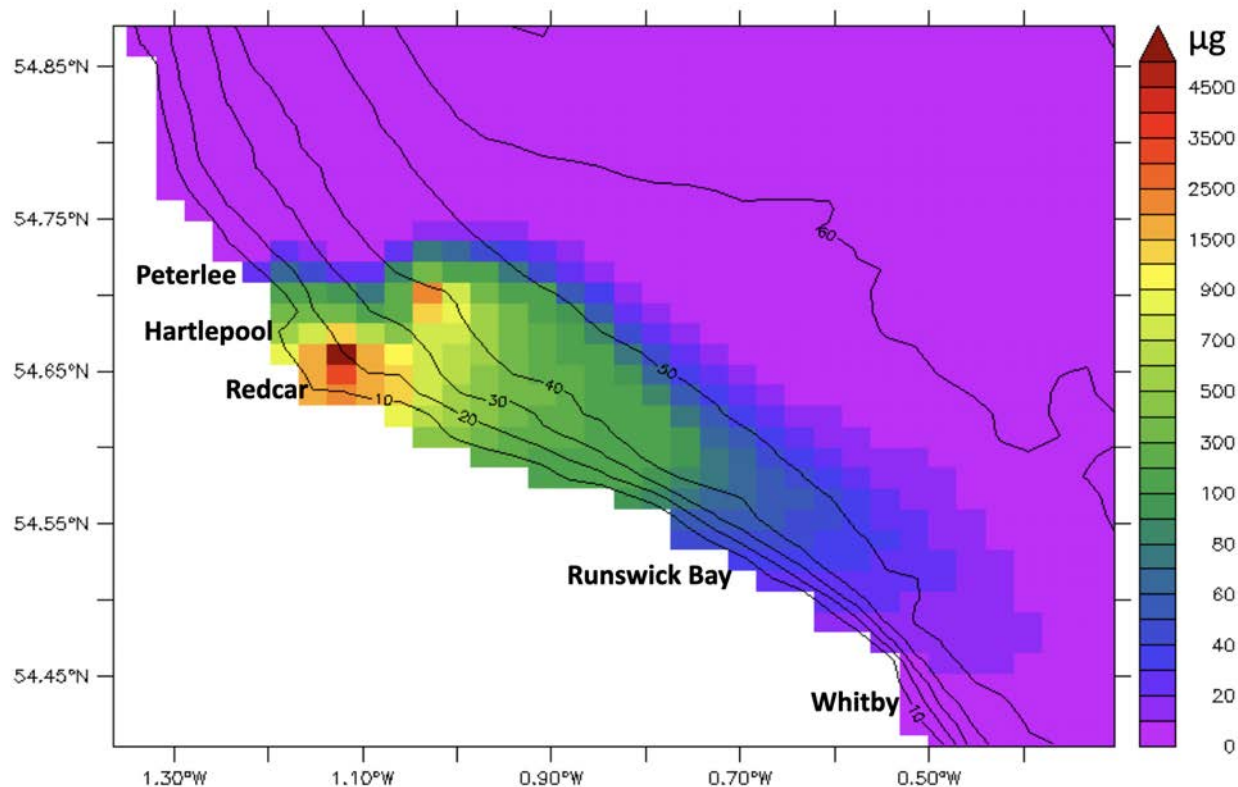


Figure 7 – Predicted total exposure of crabs to pyridine following the September and October 2021 dredging events

He concluded that pyridine is extremely toxic to brown crabs and that the River Tees dredging campaign had the potential to release significant quantities of pyridine that could have had the observed impacts on crab populations along the coast as far south as Whitby.

Tim Deere-Jones, Marine Pollution Consultant, shared an **overview of his report on the available empirical evidence for the potential cause of the mass mortality of crustaceans on the Northeast coast.**

His investigations found that pyridine was present in the tissues of local crabs at concentrations 70 times higher than that of control crabs from Padstow. He had assessed the potential sources of pyridine and identified industries located in the Teesmouth area that manufacture products containing pyridine, which is subsequently released in wastewater. Furthermore, pyridine is also a by-product of coal gasification and hydrocarbon refining processes, ship building and maintenance, providing strong evidence that the Tees estuary was likely to receive high inputs of pyridine in particulate form.

Pyridine like many contaminants is adsorbed onto sedimentary particles and can then be resuspended and dispersed into the environment following disturbance and dredging operations.

He concluded that dredging is a possible causal factor (in the absence of others) of pyridine redistribution in the marine environment. He commended Dr Gary Caldwell for his timely research and felt that Defra's conclusion of a harmful algal bloom (*Karenia sp.*) remains largely unevidenced.



Photo © Cefas



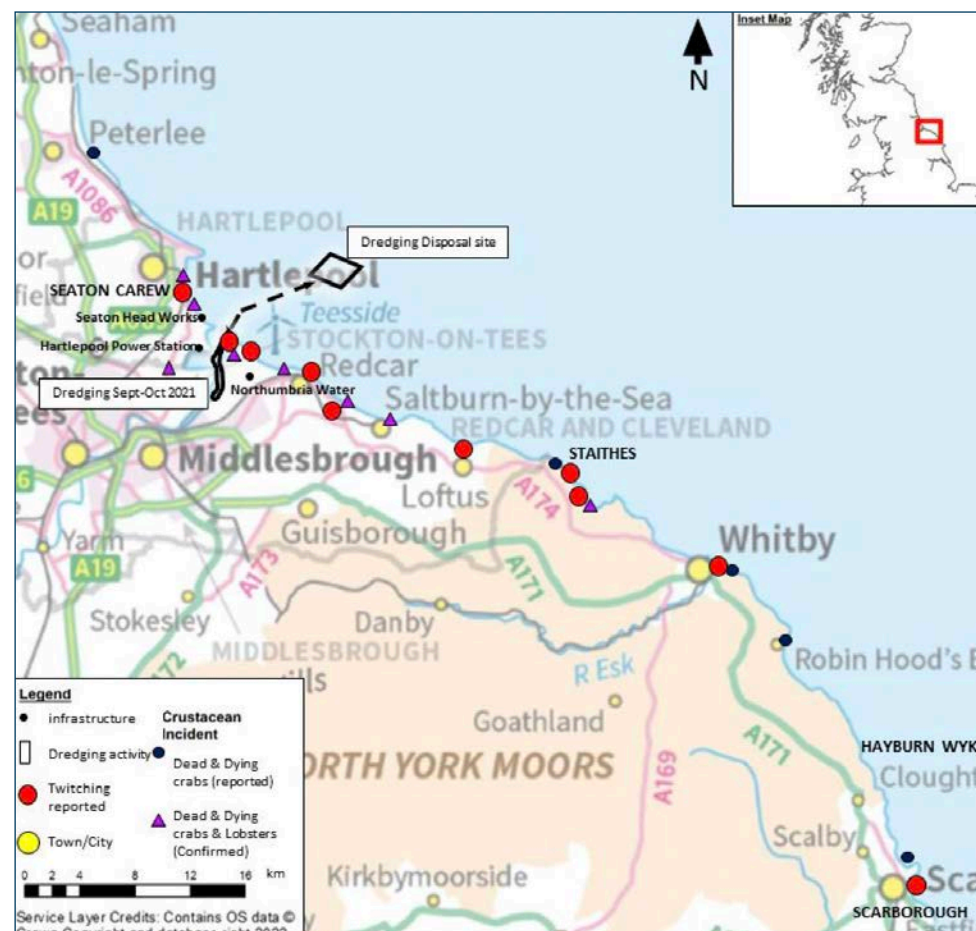
Photo © Cefas

Rachel Muckle, Deputy Director of Marine and Fisheries Programme at **Defra**, provided **an account of Defra's investigation into the crab deaths in the Northeast**, noting that the information shared would be limited due to the ongoing investigation. At the time of the mass mortality event, the Environment Agency screened water and sediment samples for more than 1,000 different pollutants, including pyridine, which found no levels of pollutant including pyridine that could have caused the mortalities. Working with a wide range of government agencies (Cefas, MMO, EA, NEIFCA, and food and health security agencies) a number of possibilities were explored, but a single cause could not be pinpointed, suggesting multiple stressors may have led to the die-offs. A significant presence of algal blooms coupled with a rapid drop in sea temperatures were proposed as an important part. Pyridine is naturally present in crabs and so the presence of this is to be expected and there was no conclusive pattern in the levels of pyridine in crabs inside and outside the affected area.

Validated tests are being developed to measure pyridine in shellfish samples and Defra is working to translate Dr Gary Caldwell's lab-based research into a field situation, whilst continuing to monitor stocks and economic impacts and dredging activity. The Environment, Food and Rural Affairs Select Committee recently held a one-off hearing about the incident, that made a number of interim conclusions including convening an expert panel to review all the science and give further advice to be set up by the government's Chief Scientist.

Post-Symposium note: Reports from the Government's investigation and the independent expert panel can be found here:

- **[Joint agency investigation into Teesside and Yorkshire Coast Crab and Lobster mortalities - GOV.UK \(www.gov.uk\)](https://www.gov.uk)**
- **[Independent Expert Assessment of unusual crustacean mortality in the north-east of England in 2021 and 2022 \(publishing.service.gov.uk\)](https://publishing.service.gov.uk)**



Source – Report of the Independent Expert Assessment of Unusual Crustacean Mortality in the North-east of England in 2021 and 2022 (January 2023).

[Assessment of unusual crustacean mortality in the north-east of England in 2021 and 2022 - GOV.UK \(www.gov.uk\)](https://www.gov.uk)

Q&A on Factors Affecting Stocks

Q: Are novel (and other) shellfish pathogens limited to particular crustaceans or can they affect more distantly related species?

A: The novel pathogen *Janickina feisti* has only been observed in edible brown crab so far. However, the majority of pathogens are found across species. For instance, as well as being identified in crabs, the pathogen *Neoparamoeba pemaquidensis* is found in several species of fish. Different strains of the same pathogen have been found to affect different species.

Q: The dredging of the River Tees was described as a routine activity. Has pyridine therefore been released historically? If so, have there been any previously recorded die-offs that correlated with dredging, or is this the first time this event has been reported/observed?

A: When dredging proposals are submitted, the release of a range of chemicals are stipulated, which are monitored and analysed on a three year basis. Pyridine is not one of the chemicals listed for analysis, and consequently, there is no long-term data set detailing pyridine levels in the River Tees or sediments. Furthermore, several other heavy industries based on the River Tees have recently been identified as potential pyridine polluters with untreated discharges onto marshland.

Q: Has the precautionary principle been applied in order to prevent the dredge spoil from the Tees being disposed of at sea, or to stop the dredging altogether whilst this investigation is ongoing?

A: Dredging in the River Tees has not been suspended based on the precautionary principle and has continued in parallel with the investigation. The maintenance dredging in the Tees has been happening for decades and is fully licensed by the MMO. It is a statutory requirement to dredge the Tees and maintain it for shipping and other access requirements and Defra's position on the dredging has not changed at this time.



Session 3

Fishery Status and Trends

Chaired by Richard Hoskin, Head of Fisheries and Marine Conservation Management, Marine Management Organisation

Tim Smith, Senior Policy Officer at the **Association of Inshore Fisheries and Conservation Authorities** (AIFCA), gave an **overview of stock status and recent trends in crab and lobster fisheries in the UK**, as published in a recent joint report by AIFCA and the New Economics Foundation (NEF): **Towards Regional Inshore Fisheries Management Plans - Opportunities for Change**. The report examined seven bivalve mollusc and shellfish fisheries in the context of the Fisheries Management Plans (FMPs), identifying problems in fisheries and wider management landscape. In many cases the stocks are exploited across multiple boundaries and fleet segments and so IFCA's are unable to manage the majority mortality in these stocks. The non-quota species have been neglected in terms of research, data collection and management, with minimal regulation and stock assessments. Detailed case studies assessed the range of fisheries management practices, stock health and fishing limits for seven regional fisheries.

The report highlighted several management challenges:

- Five shellfish fisheries recommended for inclusion in forthcoming FMPs.
- Lack of coherence of inshore and offshore management leading to risks of overfishing.
- Deficit of management and governance for the offshore component beyond 6nm where substantial mortality is taking place.
- Data deficits on stocks, fishing capacity.
- Two-tier approach of inshore and offshore management is cancelling out any benefits of good inshore management practices.
- Management should be undertaken at a regional or fisheries stock level rather than nationally.

The increase in crab landings has been mostly driven by an increase in effort by over 10m vessels. Value has correspondingly increased, rising from around £10 million in 2009 to £58.7 million in 2021.

Brown crab stock status for different regions is given in **Table 1**.

Similarly, lobster landings increased overall during the 2009 to 2019 period. Under 10m vessels continue to contribute a greater share than over 10m vessels (1000 and 600-700 tonnes, respectively). The value of these landings has roughly doubled for both classes of vessels. Common lobster stock status for different regions is given in **Table 2**.



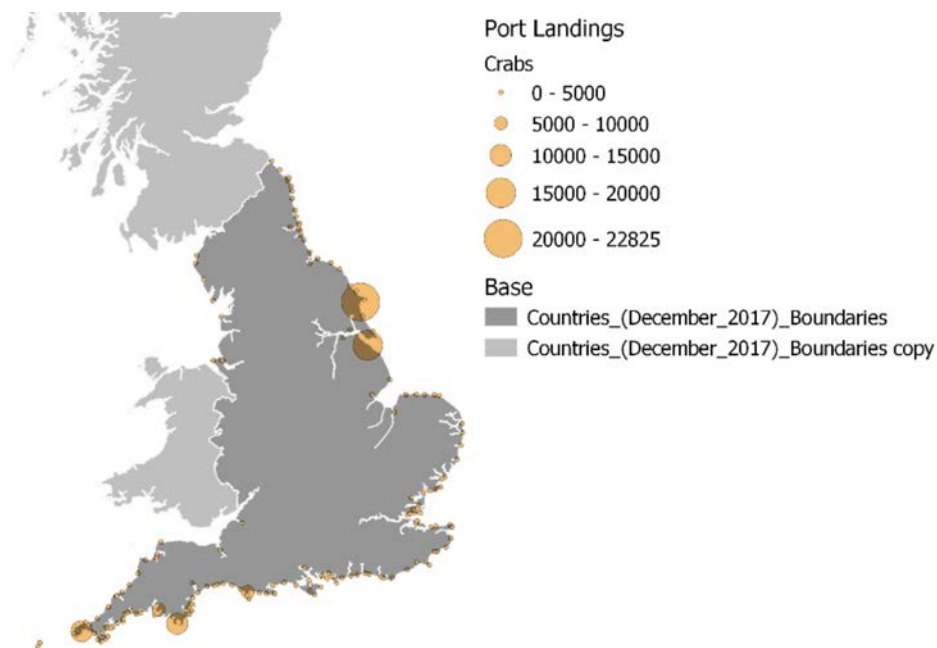
Photo © Geoff Lee

Table 1 – Brown crab stock status across UK and England

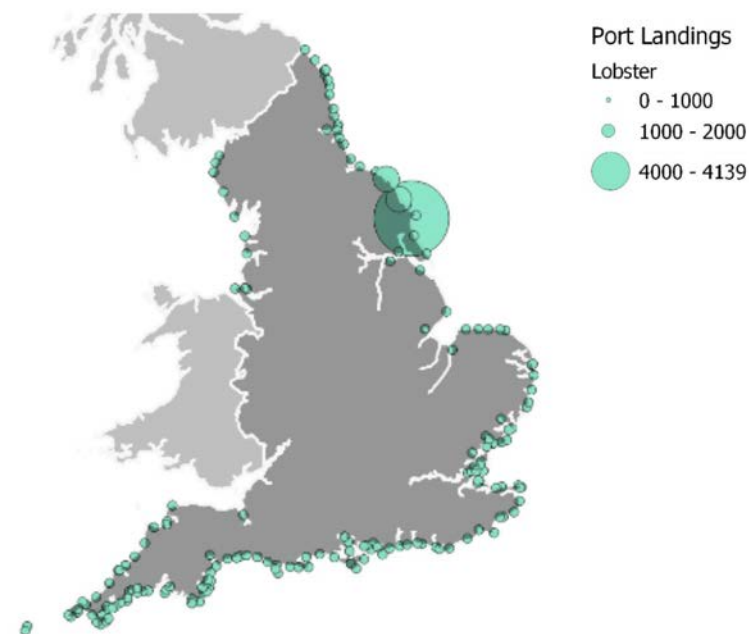
	STOCK SIZE	EXPLOITATION RATE
Eastern Channel	Unknown	Unknown
Western Channel	High, around the target level required to achieve MSY for females	Moderate, around target level required to achieve MSY for females
Celtic Sea	Below MSY level but above minimum reference point limit for females	Moderate, close to target level generating MSY
Central North Sea	Approaching target for males and above target for females	Moderate, below maximum reference point limit for females, males are at the limit
Southern North Sea	Between minimum reference point limit and target for males and females	High, above the maximum reference point limit for males and females

Table 2 – Common lobster stock status across England regions

	STOCK SIZE	EXPLOITATION RATE
Northumberland and Durham	Below minimum reference point for females, just above for males	High, around maximum reference point limit for males, above for females
Yorkshire and the Humber	Around minimum reference point for males and females	High, above the maximum reference point limit for both males and females
East Anglia	Low, below minimum reference point for males and females	High, above minimum reference point for males and females
Southeast South Coast	Around minimum reference point limit for males, between limit and target for females	Moderate, above rates consistent with MSY but below maximum reference point limit for males and females
Southwest	Above minimum reference point limit but below MSY target for males and females	Moderate, above rates consistent with MSY but below maximum reference point limit for males and females



Crab landings into English ports (cumulative landings 2009-2019).
Source: MMO/AIFCA and NEF 2022.



Lobster landings into English ports (cumulative landings 2009-2019).
Source: MMO/AIFCA and NEF 2022.

Jessica Duffill Telsnig, Principal Fisheries Manager for the [Marine Management Organisation](#) (MMO), **presented data on UK landings of crab and lobster**. She began by noting that without a shellfish permit any vessel may catch up to five lobsters and 25 crabs per day using pots or nets. A shellfish permit allows vessels to catch any number of lobsters and crabs per day using pots or nets and towed gear can be used to catch up to 10% by weight of the total catch. As of November 2022, the MMO had issued shellfish permits to 334 over 10m vessels (30% of fleet) and to 2,632 under 10m vessels (66% of fleet). Some areas are subject to additional restrictions including limits on number of days at sea for crabs in **ICES** Area 7.

The MMO records landings of crab and lobster based on fish log books (species, gear and area of catch) from over 10m vessels, catch records via the Catch app for under 10m vessels and sales notes. A UK electronic reporting systems (ERS) hub collects, processes and stores all data.

The key data for UK crab and lobster fisheries were presented:

- Crab are caught in much larger quantities than lobster, but there has been a downward trend for crab landings since 2018 whereas lobster catches remain relatively stable (**Figure 8**).
- It was noted that data for 2022 was presented up to the end of September, so landings may increase before the end of the year. Unless stated otherwise, data includes all vessels, both UK and non-UK sectors.
- The value for lobsters is higher than for crabs but the difference between crab and lobster in terms of value is smaller than that of weight of landings (**Figure 9**).
- Nearly all crab and lobster landed in the UK are from UK vessels with a very small proportion being caught by non-UK vessels and/or landed abroad.
- While the majority of crab has historically been caught by under 10m vessels, since 2021 the over 15m vessels have been catching more than under 10m vessels (**Figure 10a**).
- The significant majority of lobsters are consistently caught by under 10m vessels while over 15m vessels catch the least lobster (**Figure 10b**).

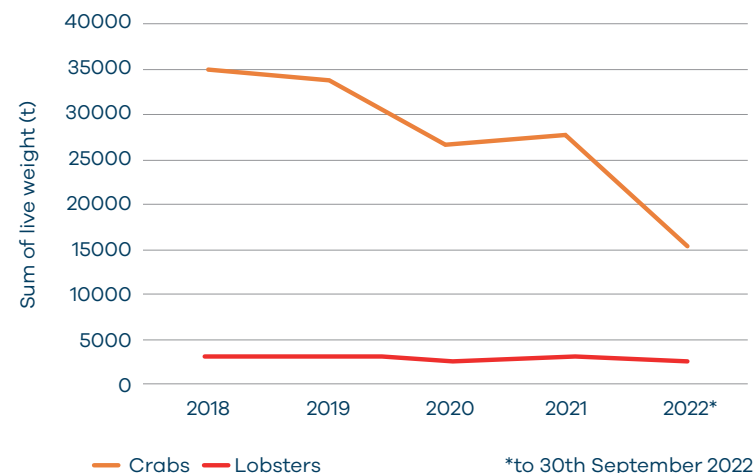


Figure 8 – Total live weight (tonnes) of crab and lobster landed by UK vessels into UK ports from UK waters (2018-2022)

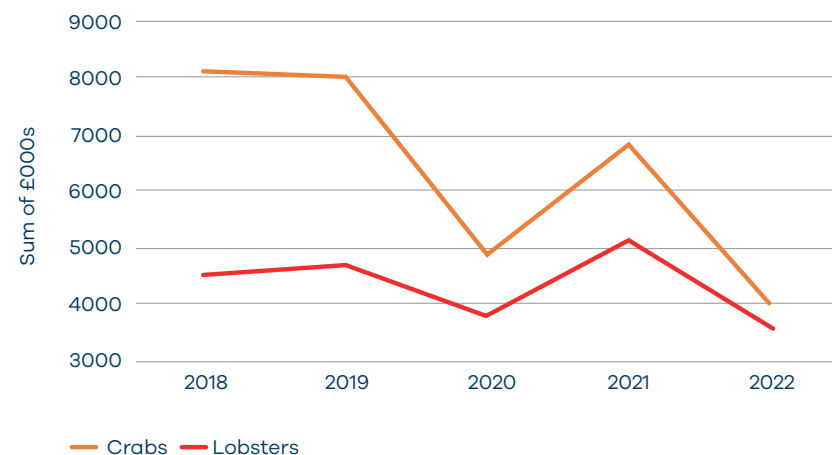


Figure 9 – Total value of crab and lobster landed in the UK from UK waters (2018-2022)

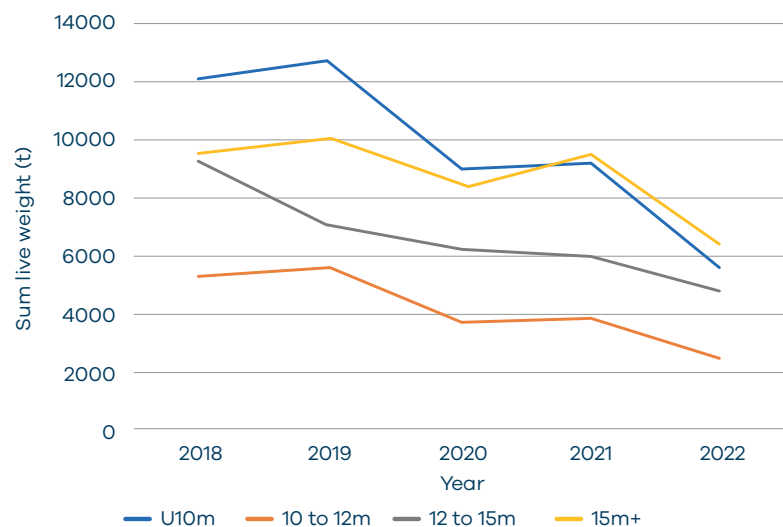


Figure 10a – Total live weight of landed crab by vessel length (2018-2022)

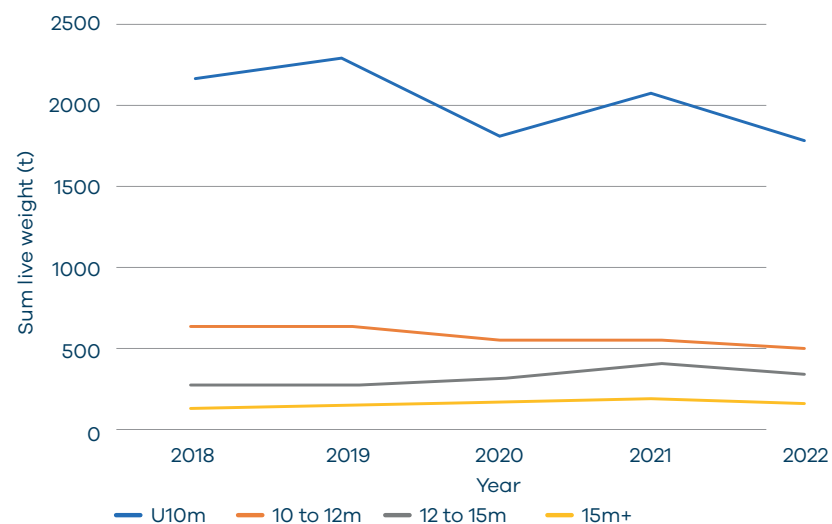


Figure 10b – Total live weight of landed lobster by vessel length (2018-2022)

Breakdowns for brown crab and common lobster landings by the top five port can be found in **Table 3** and **Table 4** below.

Table 3 – Top 5 UK landing ports for edible brown crab (2018-2022)

LANDING PORT	TOTAL LIVE WEIGHT (T) 2018-2022
Grimsby	13,449
Bridlington	11,038
Newlyn	5,677
Scrabster	5,019
Salcombe	4,721

Table 4 – Top 5 UK landing ports for European lobster (2018-2022)

LANDING PORT	TOTAL LIVE WEIGHT (T) 2018-2022
Bridlington	1,846
Scarborough	621
Whitby	548
Arbroath	483
Newlyn	411

Alice Moore, Good Fish Guide Ratings Officer at the **Marine Conservation Society (MCS)**, spoke on **the importance of data and management for informing sustainability advice targeted at consumers**. The **MCS Good Fish Guide** (GFG) provides around 620 ratings for 120 species of wild caught and farmed fish and shellfish sold in the UK, rating these from one (“Best Choice”) to five (“Fish to Avoid”).

Good Fish Guide ratings are intended to influence seafood buying decisions, thereby incentivising sustainable management. They are based on three criteria: stock status, management (appropriate, enforced, and effective), and capture method (seabed impact, bycatch, impacts on endangered species). The MCS relies on data and evidence that is publicly available and up to date and the ratings are reviewed annually and put out for public consultation. Fisheries lacking this information such as crab and lobster are treated as data-limited, and scoring is accordingly precautionary.

An example was given to show how the ratings are applied for common lobster in two different regions - Jersey (Granville Bay Treaty Area) and East Scotland. Jersey lobster is subject to regular stock assessments, has a biomass fluctuating around **BSY**, and fishing is below **FMSY**, resulting in a rating of two. Lobster in East Scotland has had no stock assessment since 2015, which will inevitably impact management and has led to the fishery being scored on a precautionary basis with a rating of five (fish to avoid).

The MCS believes that the following measures are required for sustainable management of crab and lobster in UK waters:

- Management measures with effort controls that are responsive to changes in stock status and can be shown to control fishing pressure accordingly
- Specific management measures including:
 - MCRS to be set relative to size at sexual maturity
 - Permits to control the number of boats in the fishery
 - Effort restriction measures such as pot limits
 - A ban on landing berried crabs and lobsters throughout Scotland
- Regular stock assessments (at least every two years)
- Capture methods that minimise habitat damage and impacts on vulnerable species

MCS welcomes input to the ratings and consultation process and any information to inform regional fishery ratings: ratings@mcsuk.org



Brown Crab



Mixed ratings!
26 rating



European Lobster



Mixed ratings!
26 rating

MCS Good Fish Guide ratings for Brown crab and European lobster range from 2 (Best choice) to 5 (Avoid) depending on region.

Joe Redfern, General Manager of **Whitby Lobster Hatchery** and representative of the **North East Fishing Collective**, gave a **short history of fishing and conservation in Whitby**. There is evidence that shellfish fishing has been taking place along the Northeast coast since 5000 BC. Whitby witnessed the rise and fall of the whaling industry, and more recently between 1970 and 2000 saw huge declines in catches of whitefish, such as cod and haddock. This has led to a corresponding increase in catches of lobster and crab, landings of which in Whitby have collectively shot up by 380% since 2000 (**Figure 11**). Most lobster in Europe is now caught off the East coast of England.

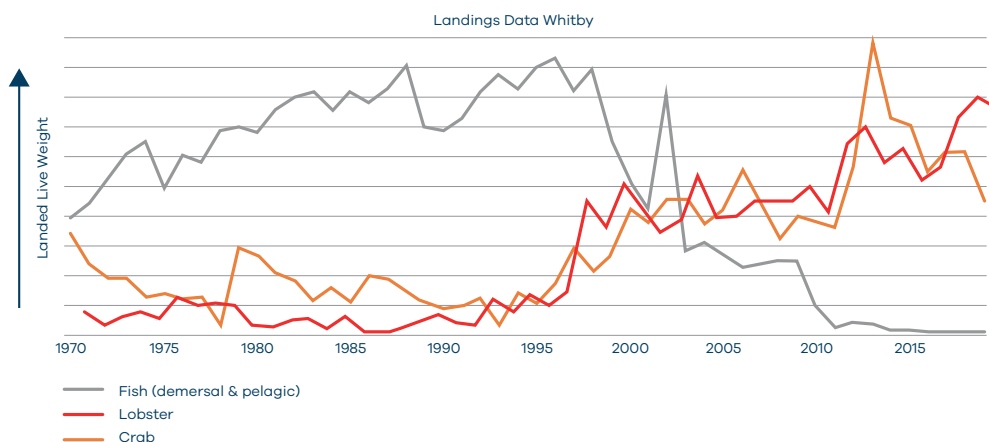


Figure 11 – Landed live weight of fish, crab and lobster into Whitby. Data taken from the Sea Fisheries Annual Statistic Reports 1970-2020

In 2017, stocks in Northumberland and County Durham were determined by Cefas to be overexploited due to poor management and overexploitation. In 2019, Cefas reported stocks in Yorkshire and the Humber as having an exploitation rate of “High, above the maximum reference point limit for both males and females”. Data from North Eastern Inshore Fisheries and

Conservation Authority (NEIFCA) shows an expansion of the fishery in Yorkshire and the Humber to offshore grounds since 2010, with a growing number of offshore Vivier vessels and a strong upward trend in catch and effort. Given this high exploitation rate, NEIFCA is currently trying to identify if the trend is nearing a peak or whether more active management is needed. A cautionary tale can be found in Norway, where the lobster stock crashed over a 50-year period to an all time low in the 1980s and is still struggling to recover (Agnalt et al. 2006).

“We’re looking to bridge the gap between fishers, scientists and members of the public and regenerating part of Whitby’s fish market.”

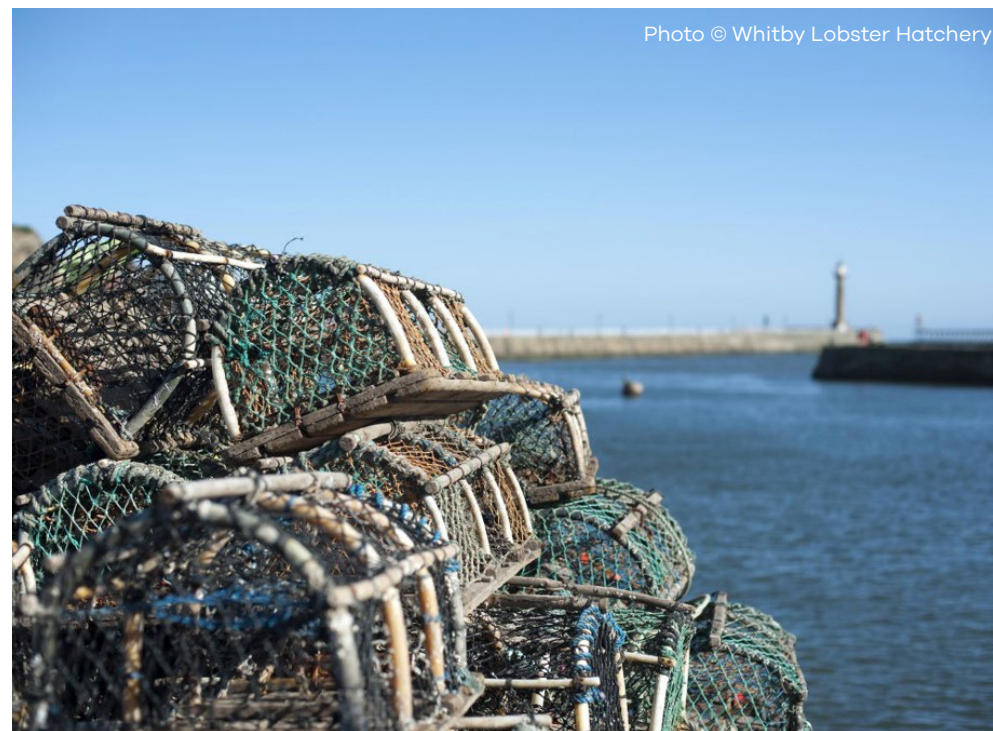


Photo © Whitby Lobster Hatchery

Current management techniques appear to be effective, but more proactive measures could support stock sustainability. Three such measures would be:

- Applying a maximum landing size - larger female lobsters produce more eggs, with higher fat content and therefore more viable young
- Bioengineering and artificial reefs – to provide habitat, boost biodiversity and more research is being carried out to understand the benefits for crustaceans, and designing the reefs to maximise particularly around wind farms
- Stock enrichment to offset exploitation by releasing juvenile lobsters (1% of lobster hatchlings survive in the wild, while 25% survive in a hatchery)

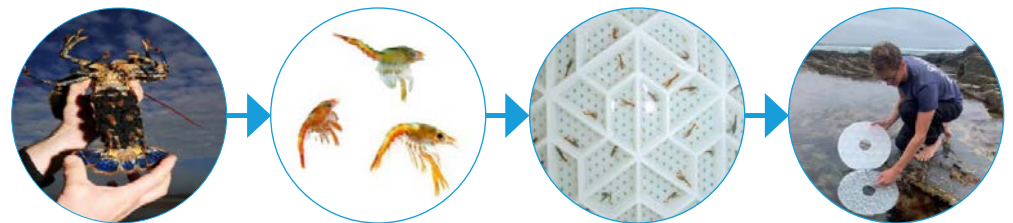
The Whitby Lobster Hatchery is newly established and expects to be fully operational in 2023, releasing juveniles and opening an education and visitors centre.



Carly Daniels, Head of Research and Production at the **National Lobster Hatchery** (NLH), spoke about her organisation's **efforts to help reverse the decline of lobster stocks in inshore waters around Cornwall and the Isles of Scilly**. The NLH has three charitable objectives covering conservation, education and research with a main facility in Padstow, a lobster module in Newlyn, and a trial area in St Austell Bay where lobsters are reared out at sea in conjunction with a mussel farmer.

"Lobsters are slow growing and take a relatively long time to reach maturity so they take a long time to recover from stock collapse."

The NLH bases its conservation and research work on better understanding "stock enhancement theory", which aims to increase survival during early planktonic stages when individuals have the lowest chance of survival, and then releasing them at a life stage when natural mortality is much lower. The NLH process involves acquiring berried females from local fishermen, allowing the young to hatch naturally in tanks, and then rearing them through their three planktonic life stages. Once they reach their first benthic stage, they are separated out and reared for a further month. At this time they become truly benthic and suitable for release, as they have the instinct to burrow and hide from predators.



Brood acquisition

Larvel culture

Post-larvel culture

Juvenile release

The NLH has released 290,000 juveniles since its establishment in 2000, although production varies depending on a number of factors, for example, the number of berried females caught by fishermen. Techniques are trialled to maximise survival rates at different stages including the impact of water quality on survivability, creating vessels to rear the juveniles within the hatchery in aqua-hives and in conjunction with aquaculture operations.

Quantifying success remains a perennial challenge for stocking programmes, although the NLH has received anecdotal evidence from local fishermen indicating that lobsters are more abundant in areas where releases have been carried out, in comparison to areas where they have not. Tissue samples are taken from all the females and larvae that come through the hatchery, to create a bank of genetic material to track how many of these survive in the wild.

"If you want to establish a lobster hatchery to support fisheries a more holistic approach has to be taken and should be used alongside traditional fisheries management measures."



Photo © Johnnt Fenn

290,000
juvenile lobsters released
since 2000

Tara Hooper presented some work undertaken with colleagues at the **Plymouth Marine Laboratory** on **constraints and opportunities for co-location of offshore wind farms (OWFs) and fisheries in the UK**. There are cases of OWFs being successfully utilised by both commercial and recreationally important species including brown crab, cod, pouting and whiting, but there is no benefit or a potentially negative impact on certain flatfish such as dab, and there was insufficient evidence for lobster.

However, given the lack of evidence on interactions between fishers and OWFs, the researchers conducted a qualitative study focusing on face-to-face surveys with 11 OWF developers and 67 commercial fishermen - mainly of crab and lobster - in Wales, North Norfolk, South Lincolnshire, and East and North Yorkshire.

Two-thirds of developers thought crab and lobster fishing should be permitted around OWFs, preferred co-location over No Take Zones, and were strongly in favour of licensing. Fishermen expressed concerns over negative environmental impacts such as construction disturbance and siltation, with some having observed crabs moving away from OWF sites. Few of them reported setting pots in an OWF.



On the whole, the fishermen were generally opposed to licensing, preferring a community-managed territorial rights model. There were also regional differences in opinion, with fishermen in South Wales expressing more optimism about OWFs in comparison to elsewhere, while Yorkshire fishermen held the greatest concern over OWFs potentially causing habitat damage. There were also reports of conflict, with fishermen experiencing displacement, loss of gear, and disruption to effort; while developers had experienced fishermen trying to tie onto structures and deliberately hindering activities. Both groups held practical concerns around co-location including insurance and liability if fishing gear became entangled with OWF structures.

The researchers concluded that issues and opportunities around OWFs are site-specific, with environmental conditions and both risk perception and acceptance playing important roles. Inshore fishermen are less likely to benefit from new OWFs which are too far offshore. As a result, co-development is essential, including early engagement, community management, and clear protocols with regards to insurance, liability, and gear retrieval. At the time of the study, less than 100 turbines were in operation and over 1,000 have been installed in the past decade, so co-location opportunities and benefits may increase as reefs mature around the base of turbines.

Q&A on Fishery Status & Trends

Q: With regards to data on UK landings of crab and lobster, are data available for different metiers between inshore and offshore boats, day boats and vivier boats?

A: The MMO is limited in what data it collects and how this can be used. However, we obtain data on engine power (kWh per vessel) and capacity (gross tonnage), which could be used to better understand metier differences (e.g. day boats versus vivier non-day boats). The FMP process will involve analysis of data from more sources, and so may yield more insights.

Q: Are there data on how many members of the public use the Good Fish Guide (GFG)? Does the GFG draw on raw data used by the MMO for stock assessments, or just publicly available reports?

A: The GFG has been around for about 20 years. The website had a refresh last year, with 100,000 citizens using/hits since then. The GFG does not use any data that is not publicly available, and the Marine Conservation Society encourages data sharing in the public domain.

Q: How is landings data from non-UK vessels obtained?

A: The MMO does monthly data exchanges with the EU and other countries where we have agreements, although data received may not necessarily be as detailed as the data we collect in the UK.

Q: Are crab and lobster landings data good enough to understand pressures on stocks and apply responsive management measures?

A: The Fisheries Management Plans will look into whether the current data is good enough and how can we improve that over time.

Q: How do you decide where to release lobsters?

A: European lobster is very cryptic at the early life stages. However, we know a lot from what the American lobster prefers in terms of habitat, and we work closely with fishermen and other stakeholders to identify good areas for release using criteria such as cobble cover and seaweed cover for shelter.

Q: Lab-hatched lobsters released off Aberystwyth were narrower in the carapace than the wild-born population (or the population where the mothers were caught). Can you explain why this might be?

A: Claw development may differ in “naive” habitats because the hatchery individuals are not subject to the same environmental pressures. Lobsters kept in offshore containers that were exposed to natural conditions and predator cues were noticeably darker in colour. Ecological conditioning may be occurring in wild lobsters and not in hatchery lobsters.

Q: Would the results of the co-location study be different if done today?

A: Yes, very likely that results will have changed as many more people are experiencing interactions. Offshore wind has different implications, for example wider exclusion zones due to cables. It would be good to update this research.

Q: Has the MMO done any assessment of total landings of crab as permitted bycatch?

A: The MMO collects data by gear type, so it should be possible to obtain this and the FMP may look into this.

Q: Does **CPUE** differ between International Council for the Exploration of the Sea (ICES) regions?

A: It is hard to quantify this. It might be possible to use days at sea as a proxy for effort, but otherwise we lack the level of detail needed; for example, to use “catching with pots”, we would need to know the number of pots used per vessel.

Session 4a

Fishery management

Chaired by Colin Bannister, Shellfish Association of Great Britain

The symposium heard from **Claire Pescod**, Head of Sustainability and Science at **Macduff Shellfish Ltd.**, who **presented an overview of the Crab and Lobster Management Group (CMG)**, of which she is the Chair.

The CMG works to tackle key issues facing crab and lobster fisheries, and provides a forum to build collaborative working relationships, create cross-sector solutions, and lead on the development of the Crab and Lobster FMP for English waters.

The CMG was formed in 2020 and is an industry-led collaborative management group made up of stakeholders from across the seafood supply chain (catching to processing/exporting/wholesale), regulators, and scientific researchers. The group is facilitated by Seafish but the work and priorities of the group and agendas are set by industry members. The aim of the group is to provide a space for these groups to work together to explore and discuss issues, and to collaborate to tackle challenges facing the UK crab industry. The CMG is UK-wide with members from across the country and across the supply chain and currently has over 100 members, of which around 70% are industry representatives.

The CMG sits within a wider network of shellfish management groups and under the umbrella of the Shellfish Industry Advisory Group (SIAG), which is an industry led co-management group focusing on issues related to national-level strategic management of the UK’s shellfish fisheries and issues relevant to all shellfish fisheries, e.g. climate change, marine spatial planning, and welfare issues. The SIAG acts as a central committee under which the species-specific shellfish groups operate (**Figure 12**).

These groups focus on issues specific to crab, lobster and whelk fisheries, and each have two sub groups. One is a CMG FMP Working Group developing species-specific FMP objectives, and the other is the CMG Science Sub-Group which scopes out evidence gaps and research requirements which will contribute towards the achievement of the FMP objectives.

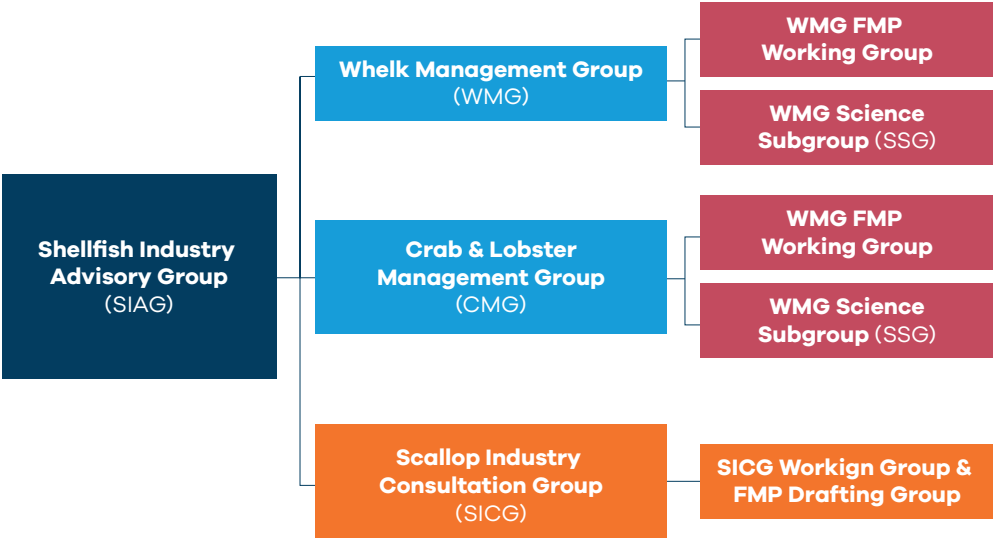


Figure 12 – Shellfish fishery management group structure

The CMG:

- Serves as a space to raise awareness about topics that are of interest to the shellfish industry and facilitate discussion, e.g. emerging crab disease issues or ongoing consultations and calls for evidence to encourage industry engagement
- Provides a forum for industry to raise issues they are seeing on the ground, e.g. issues around gear marking regulations which led to discussions with the MCA, RYA and Cruising Association
- Helps build collaborative relationships between sectors, e.g. in 2021 a group of CMG members and scientists were successful in securing Fisheries Industry Science Partnership (FISP) funding to undertake research on the use of autonomous sampling units fitted to vessels and artificial intelligence to gather data on crab and lobster catches
- The CMG is playing a central role in the collaborative development of the Crab and Lobster FMP for English waters

The CMG plays an important part in charting the future directions of crab and lobster fisheries. New industry representatives are always welcome on the CMG and anyone interested should contact rebecca.treacy@seafish.co.uk

Lewis Tattersall, Head of Fisheries Management at **Seafish**, expanded on the development of the **Fisheries Management Plan (FMP) for crab and lobster for English waters**. In March 2022, Seafish was commissioned by Defra as the delivery lead on the development of the FMP for brown crab and European lobster in English waters (as well as the whelk FMP).

FMPs aim to deliver collaborative development of objectives, aims and scientific research plans to deliver the objectives in the Fisheries Act. The Crab and Lobster FMP focuses on edible brown crab and European lobster, but the CMG is also looking at inclusion of secondary species including spiny lobster, spider crab, velvet swimmers and common prawns. FMPs are evidence-based action plans developed through collaboration between industry, regulators and researchers. The Crab and Lobster FMP includes three elements, covering shared shellfish objectives, species specific objectives and scientific research plans (**Figure 13**).

Shared Shellfish Objectives	<ul style="list-style-type: none"> • Developed by the SIAG FMP working group • Relevant to all shellfish fisheries
Shared Specific Objectives	<ul style="list-style-type: none"> • Developed by the CMG FMP working group • Apply to crab and lobster fisheries only
Scientific Research Plans	<ul style="list-style-type: none"> • Developed by the CMG Science Sub-group • Provide necessary detail on what research would be required to deliver FMP objectives

Figure 13 – Crab and Lobster FMP structure

A vision has been drafted for the shared shellfish and species-specific objectives along with a number of specific potential objectives to deliver the primary objective.

Joanna Messini, Policy Adviser in the Non-Quota Species Team at **Defra**, reported on the **Shellfish Legislation Mapping Tool**, a resource created to list all legislation and existing management measures for shellfish stocks in every region of the UK. It provides a snapshot of all legislative measures, as well as links to further information, categorised by jurisdiction (retained EU law, England, Scotland, Wales and the 10 IFCAs).

Following feedback from the Crab and Lobster Management Group, a 'crab matrix' has also been developed to provide a snapshot of the different measures (e.g. MLS, permits, pot limits) to identify how frequently each measure had been implemented in different jurisdictions (**Table 5**). The tool and crab matrix are updated every three months in order to ensure the information remains accurate, so anyone wishing to receive a copy of the latest version can email Joanna.Messini@defra.gov.uk.

Table 5 – Crab Matrix within the Shellfish Mapping Tool

CRAB MANAGEMENT MATRIX			
MEASURE	PORTION IMPLEMENTED		INTENDED OUTCOMES
MLS	16/16	Cornwall (female 150mm, male 160mm, spider crab 130mm), Devon & Severn (female 150mm, male 160mm, spider crab 130mm, velvet 65mm), Easter (edible crab 115mm, male spider 130mm, female 120mm, velvet 65mm), Isles of Scilly (male 160mm), Kent & Essex (male edible depends on (area), North Eastern (140mm, velvet 65mm), North Western (130mm), Northumberland (130mm, velvet 65mm), Souther (140mm), Sussex (140mm, male spider 130mm, female 120mm, velvet 65mm), Scotland (edible 150mm, spider 130mm, velvet and green 70mm), Wales (edible 140mm, male spider 130mm, female 120mm, velvet 65mm), Northern Ireland (150mm edible crab, 130mm male spider crabs, 65mm velvet), Isle of Man (140mm), England (edible 130mm, 160mm in specific are as, male spider 130mm, velvet 65mm), EU (140mm (4a), 130mm (4b and 4c), 115mm (specific area within 4b and 4c), 120mm spider crab).	Largely a result of transposed EU MLS that existed before the IFCAs created, allows crabs to reach maturity before being removed, giving smaller crabs time to breed.
Permits	10/16	Cornwall (if >5 per day), Devon & Severn (for all potting vessels; catch restriction on commercial permit holders without a shellfish entitlement of (25 per day, or 5 pots per permit recreational), Isles of Scilly, North Eastern, North Western (for recreational), Northumberland, Sussex, Scotland (if >25 per day), Wales, Northern Ireland.	Having a permit system reduced the unquantifiable effort/ catch of recreational fishing, making data more reliable. They also allow for a flexible management approach with different permits for different sectors.
Recreational catch limit	10/16	Cornwall (5), Devon & Severn (3), North Eastern (10), North Wester (5), Northumberland (5), Wales (5), Northern Ireland (5), Sussex (5), Scotland (25), IOM (5)	Again, to reduce fishing effort and catch that can't be easily measured, so pressure on the stock is managed and impacts of fishing can be fully understood.
Recreational pot limit	10/16	Devon & Severn (5), North Eastern (10), North Western (5), Northumberland (5), Sussex (5), Northern Ireland (5), Isles of Scilly (6), IOM (5)	Intended to aid the limitation of recreational catch for the same reason as above, reducing fishing effort and catch that can't be easily measured, so pressure on the stock is managed and impacts of fishing can be fully understood.

Ralf Bublitz, Environmental and Scientific Manager of the **North Eastern Inshore Fisheries and Conservation Authority (NEIFCA)**, outlined the different **management measures for crab and lobster fisheries implemented within 6 nautical miles of the coast across the ten Inshore Fisheries and Conservation Authorities (IFCAs) in England**. The measures in place for crab and lobster vary between each IFCA district, demonstrating important differences in regional management approaches reflecting different fleets and fisheries across the regions (**Figures 14 and 15**).

Currently, only Northumberland IFCA and Sussex IFCA have pot limitations in place for crab and lobster, while six IFCAs have implemented a MCRS for crab. Devon and Severn IFCA, Cornwall IFCA, and the Isles of Scilly IFCA are the only organisations to set their own MCRS for lobster, while the rest abide by the EU MCRS.

These differences will need to be considered in the FMPs and to help fishermen understand the different measures in place between IFCA districts, Kingfisher have established interactive maps visualising these differences: kingfisherrestrictions.org.

BYELAW	NORTHUMBERLAND	NORTH EASTERN	EASTERN	KENT & ESSEX	SOUTHERN	SUSSEX	DEVON & SEVERN	CORNWALL	ISLES OF SCILLY
Shellfish permits	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes
Minimum landing size	Yes – 130mm	Yes – 140mm	Yes – 115mm	No	No	Yes – 140mm	Yes – 150mm (females), 160mm (male)	Yes – 150mm (females), 160mm (male)	No
Maximum pot limit	Yes – 800	No	No	No	No	Yes-00<3nm, 600<6nm	No	No	No
Escape gaps	No	Yes	No	Yes	No	Yes	Yes	No	No
Maximum vessel length	Yes –12mm	Yes – 10m (0-3nm) & 16m (3-6nm)	No	Yes – 14m	Yes – 12m	Yes – 14m	Yes – 15.24m	Yes – 16.46m	Yes – 11m
Towed gear restrictions	Yes	No	Yes (some areas)	Yes	Yes	No	Inshore potting agreement area	No	Yes
Prohibits the use of crab for bait	Yes	Yes	Yes	Yes	No	No	Yes	No	No
Prohibits the removal of parts of crabs	Yes	Yes	Yes	Yes	No	No	Yes	Yes (30kg allowance for net catch)	No

Figure 14 – Edible brown crab management across IFCA districts

BYELAW	NORTHUMBERLAND	NORTH EASTERN	EASTERN	KENT & ESSEX	SOUTHERN	SUSSEX	DEVON & SEVERN	CORNWALL	ISLES OF SCILLY
Shellfish Permits	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes
Minimum Landing Size	As EU	As EU	As EU	As EU	As EU	As EU	Yes – 90mm	Yes – 90mm	Yes – 90mm
Maximum Pot Limit	Yes - 800	No	No	No	No	Yes-00<3nm, 600<6nm	No	No	No
Escape Gaps	No	Yes	No	Yes	No	Yes	Yes	No	No
Maximum Vessel Length	Yes - 12m	Yes – 10m (0-3NM) & 16m (3-6NM)	No	Yes - 14m	Yes- 12m	Yes -14m	Yes - 15.24m	Yes - 16.46m	Yes - 11m
Towed Gear Restrictions	Yes	No	Yes (some areas)	Yes	Yes	No	Inshore Potting Agreement Area	No	Yes
Prohibits the Removal of Parts of Lobsters	Yes	Yes	Yes	Yes (some areas)	No	No	No	No	No

Figure 15 – European lobster management across IFCA districts

Andrew Boon, Senior Environmental Inshore Fisheries and Conservation Officer at **Northumberland IFCA (NIFCA)**, gave an **overview of the management measures in place for crab and lobster static gear fisheries in the NIFCA district**, which are the region's most important fisheries.

There are currently nine byelaws in place to manage inshore fishing for these species:

- Commercial and recreational permits
- Vessel size limitations
- Effort limitation of 800 pots
- Catch limits for non-commercial collection
- Minimum conservation reference sizes
- Specific prohibitions relating to crab and lobster
- Permit returns (all commercial vessels must provide catch data)

Monitoring by NIFCA involves offshore observer surveys, quayside/wholesaler surveys, monitoring of landings, assessment of fishing effort and stock status, and ongoing partnership research projects such as the cross-border brown crab maturity study. NIFCA is also establishing fisher forums throughout its district to facilitate a two-way dialogue between industry and NIFCA (research and enforcement officers) to shape future work.



Ralf Bublit, Environmental and Scientific Manager of the **North Eastern Inshore Fisheries and Conservation Authority (NEIFCA)**, took to the floor once more to **report on the European Lobster Settlement Index (ELSI) project**. Larval settlement monitoring programmes have been in operation in the USA since the 1980s, as a means to forecast trends in stocks, but they have not been widely used in the UK or Europe. Gathering data on Early Benthic Phase (EBP) lobsters can help to predict harvest stocks six to eight years in advance, when EBP lobsters have been recruited into the fishery.

To implement a similar method, NEIFCA commenced a two-year project in 2022 in conjunction with the Holderness Fishing Industry group funded by a Fisheries Industry Science Partnership (FISP) grant. The first phase of the ELSI project assessed the abundance, density, and seasonality of EBP lobsters at 10 sites extending from the Holderness coast to Hartlepool, using custom-built settlement collectors to encourage settlement and plankton tows (**Figure 16**). Four settlement collectors were deployed in May/June 2022. EBP lobsters were not found on the settlement collectors but were present in plankton tows. The project will now work on refining its methodology over the winter including using different substrates in the collectors.



Figure 16 – European Lobster Settlement Index (ELSI) project sampling equipment. Left: settlement collector (wire mesh filled with cobbles of various sizes). Right: Neuston Plankton Tow (conducted at dusk).

Colin Trundle, Senior Scientific Officer at **Cornwall IFCA**, gave an **overview of current and proposed management measures for crab and lobster in Cornwall**. In 2021, 310 commercial fishing permits were issued, with boats ranging from 4m to over 17m in length. Over 2 million pot hauls and 6.7 million metres of net were hauled.

There has been increasing numbers of offshore Vivier vessels targeting the stocks since 2016, which has corresponded to a 40% decline in crab **Landings Per Unit Effort (LPUE)** since 2017.

Current management includes a permit scheme requiring fishermen to submit monthly activity data, and report daily on the numbers of pots and/or metres of net hauled in defined statistical areas, along with the weights of species retained. There are also minimum sizes for brown crab, lobster, and crawfish, and a ban on the removal of berried hens for lobster and crawfish. A recreational permit byelaw was also introduced with a bag limit.

The fishery is currently experiencing a fall in permit numbers, however, more pots are being deployed per vessel. Between 2015-2017, there was a 65% reduction in under 7m potting vessels and a 50% increase in 7-10m vessels within the Cornwall IFCA district.

“Cornwall IFCA has set a revised management aim: To develop an adaptive management structure that has the flexibility to be appropriate to changes in target species availability whilst ensuring the sustainability and economic value of the fishery into the future.”

Cornwall IFCA is now reviewing all aspects of the fishery by gaining input from the industry through surveys with permit holders, developing an industry steering group and implementing a catch sampling programme, while avoiding stakeholder fatigue and harmonising with national FMPs.



Sarah Clark, Deputy Chief Officer at **Devon and Severn IFCA** (D&SIFCA), provided an **update on management and research on crab and lobster fisheries in the district**.

D&SIFCA has the largest IFCA district of 4,522 km² with 22 Marine Protected Areas, most of which are closed or largely closed to demersal towed gear, but static gear fisheries are permitted. In addition, the Inshore Potting Agreement in South Devon restricts mobile gear spatially and temporally, but static gear is permitted.

Potting is a very important fishery in the area with 196 commercial potting permits and 540 recreational potting permits. For both commercial and recreational fisheries permit conditions set out measures such as gear, catch, spatial and time restrictions. These permit conditions are adaptive to allow flexibility in response to emerging fisheries or changes to legislation.

There are several ports on both the north and south Devon coasts, and Salcombe and Dartmouth have some of the largest landings of brown crab in England. However, there have been overall declines in landings of crab in recent years while lobster landings have been relatively static. The value of lobster has increased significantly despite stable landings (**Figure 17**).

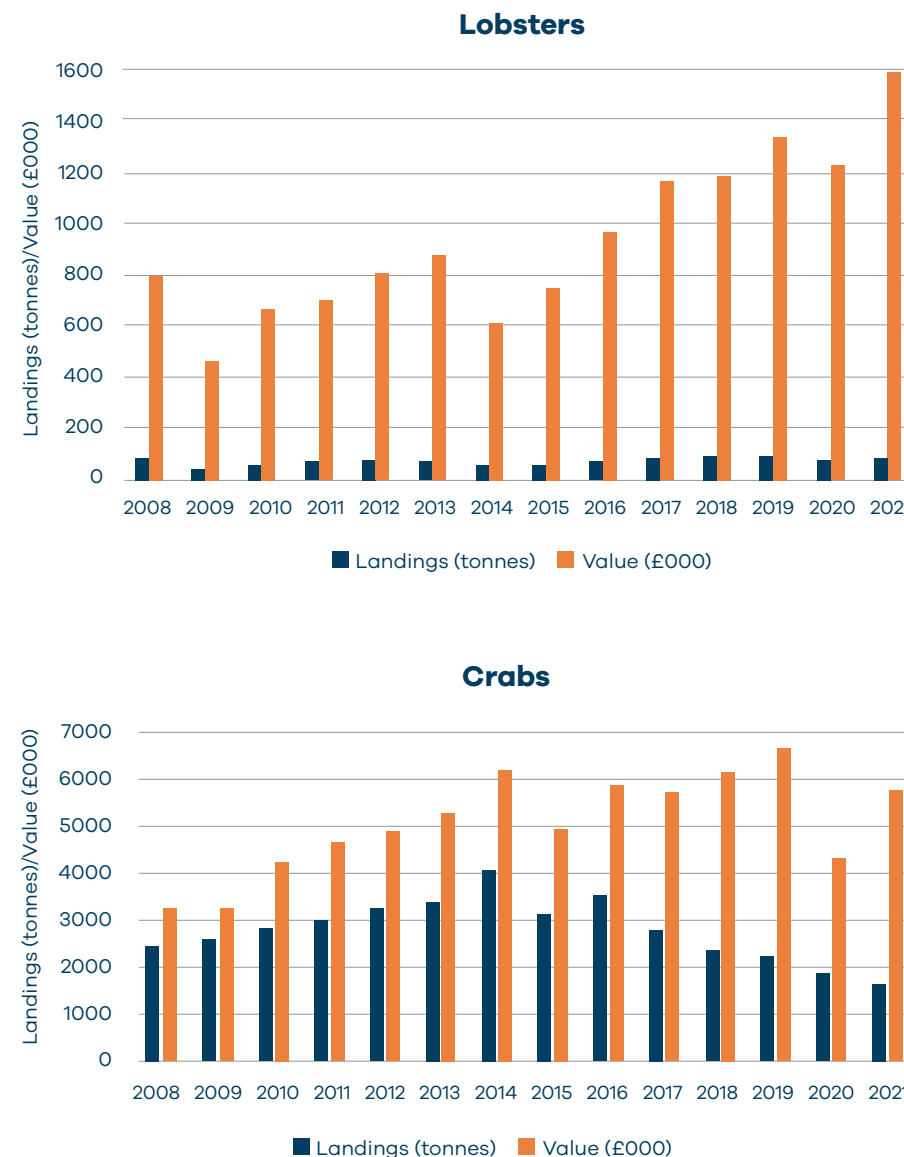


Figure 17 – Landings and value of common lobster and brown crab into Devon ports

A range of management measures apply to European lobster, brown crab, spiny lobster and spider crab (Table 6).

Table 6 – Devon & Severn IFCA management measures for crustacean fisheries

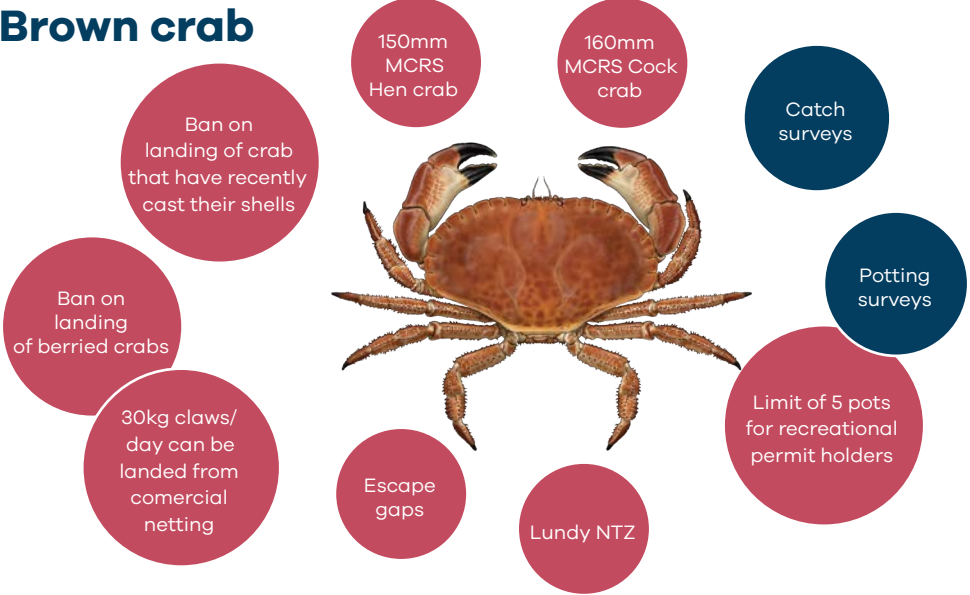
Species	MCRS	Ban/limits on landings	Escape gaps	Recreational limits
European lobster	90mm	Ban on landing berried hens, V-notched lobster, individuals that have recently cast their shell, parts detached from the carapace	Mandatory	5 pots and 2 lobsters
Edible brown crab	150 mm (hen) 160 mm (cock)	Ban on landing berried hens, individuals that have recently cast their shell; limit of 30 kg of crab claws per day by commercial netters	Mandatory	5 pots and 3 crabs
Spiny lobster/crawfish	110 mm	Ban on landing berried hens, individuals that have recently cast their shell, parts detached from the carapace Ban on removal from 3 MCZs	Mandatory	2 spiny lobsters
Spider crab	130 mm		Mandatory	5 spider crabs

A five-year lobster tagging study was carried out inside and outside the Lundy Island No-Take Zone (NTZ). Results from this showed: most lobsters moved less than 2.7km before recapture; only 2% of lobster tagged in NTZ were recaptured by fishers outside of the NTZ; growth increments per moult of 9-10mm.

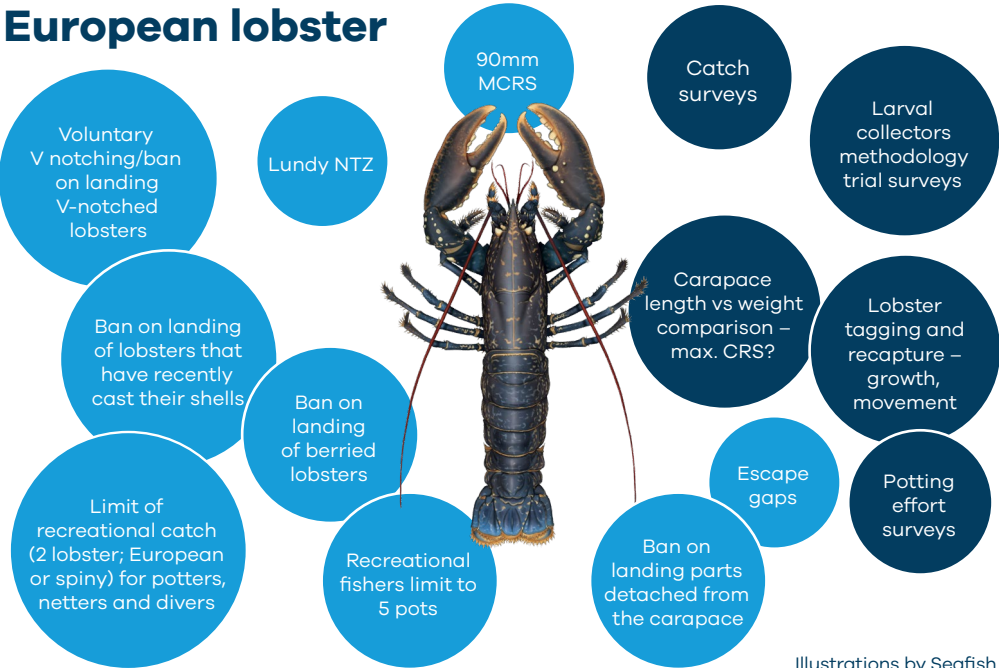
In response to concerns about the potential for a rush on the spiny lobster/crawfish fishery following recent increased numbers, surveys were undertaken with pot fishermen including a tagging study. Results showed some surprises including juvenile crawfish (under 80mm) being caught in 60-65m depths in contrast to the literature that suggests they are usually found in shallower water.

Research on crab stocks has been more limited due to resources, but recent funding will support further crustacean surveys to better understand the health of stocks and gather evidence to inform the Fisheries Management Plans.

Brown crab



European lobster



Q&A on Management: Session 1

Q: The introduction of measures within 0-6 nautical miles by the IFCA in England relies on consensus amongst the industry responses to byelaw consultations. Where this consensus is not reached, how will consensus be reached on the FMP actions - there will likely be a lot of conflicting opinions on management?

A: Seafish is currently assessing this via stakeholder engagement events around England. There are two aspects to the engagement; 1) reviewing aims and objectives as drafted by the FMP working group and 2) facilitated open discussion to both understand regional management aspirations and to review other tools as proposed via work such as Cefas management approaches review and SW FIP workshops. This will be compiled into an engagement report at the end of the process and used to refine the FMP content. Although there are sometimes conflicting opinions there are also overarching themes which seem to (so far) span different areas and fisheries. Our job will be to unpick this, with input from the FMP working groups, to develop a fit for purpose plan which will ultimately go to public consultation in 2023.

Q: To what extent are the IFCAs concerned about the impact of fishing effort that takes place beyond the 6 nautical mile limit, on the stocks and landings within the 0-6 nautical mile (inshore) region?

A: There are concerns within D&SIFCA about the potential displacement of vivier crab boats into inshore waters, particularly following the non-quota species tonnage of the Trade and Cooperation Agreement (TCA). There is limited knowledge regarding how shellfish populations move between offshore and inshore waters, and how differing levels of fishing pressure inside and outside 6nm affect stocks overall. In the English Channel in particular, the strong migratory behaviour of brown hen crabs to offshore waters in the centre of the Channel requires consideration. Therefore, the interactions between inshore and offshore areas are potentially very strong, making fisheries management a challenge.

Q: Spiny lobsters seem to be the 'elephant in the room' in all these discussions about shellfish. Is any attention being paid to better understand the status of crawfish stocks and how best to manage the fishery, so that it is sustainable and doesn't crash?

A: This question highlights why the industry management groups have pushed for inclusion of crawfish in the FMP. Although still in draft, the intention is that the FMP will provide the structure to both improve the evidence base for these fisheries and expedite appropriate management of these fisheries. There is a strong desire from many industry stakeholders in the Southwest of England for an increased/ harmonised MCRS for crawfish; this is the kind of information Seafish wants to gather and, as appropriate, include in the draft FMP. Cornwall IFCA noted a number of industry-led initiatives are underway in the Southwest to improve data collection for crawfish and CFPO are working to establish voluntary measures for fishers operating outside 6nm to ensure the longevity of the fishery.

Q: As the Shellfish Group is also covering Crawfish, Common Prawn etc, albeit to a lesser level, would it be helpful to include these species within the Defra Shellfish Legislation Mapping Tool?

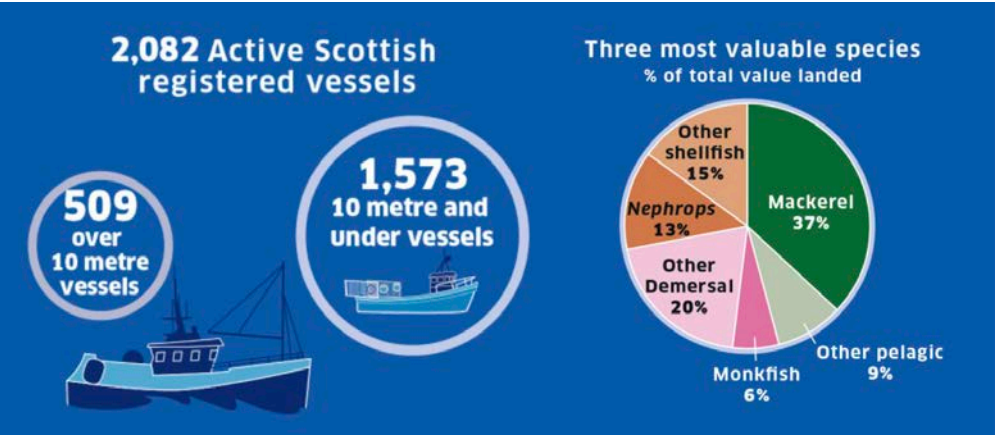
A: The shellfish legislation tool does include crawfish.

Session 4b

Fishery Management

Chaired by Morven Robertson, Head of UK Projects, Blue Marine Foundation

Stuart Bell, Senior Policy Manager at [Marine Scotland](#), explained the **work being undertaken towards a more strategic approach to inshore fisheries management**. Of Scotland’s 2,080 active licensed fishing vessels, about 90% are under 10m and focus on lobster and crab.



The tonnage and value of crab and lobster landed in Scotland in 2021 are provided in **Table 7**.

Table 7 – Tonnage and value of crab and lobster landings in Scotland in 2021

	Tonnes	Value
Brown crab	8,275	£18.5 million
Velvet crab	1,621	£4.8 million
Common lobster	1,168	£17.7 million

In Scotland, inshore fisheries management is delivered via six, non-statutory Regional Inshore Fisheries Groups (RIFGs). This network has been recently refreshed to ensure it is in-step with Scottish Government strategies and focused on evolving Operational Plans that will feed into national policy development.

Fishing for crab and lobster is principally managed through the vessel licencing scheme, though stock assessment data and anecdotal evidence from stakeholder suggest that additional controls are necessary to better manage these important fisheries. Recent studies such as the Outer Hebrides Pilot Pot Limitation Scheme, which recently concluded, agree this assessment.

Scotland’s 2020-2030 **Fisheries Management Strategy** established priorities for improving management of inshore commercial fisheries, with development of a new future catching policy, that will include management of static gear. The 2021 **Bute House Agreement** also prioritised inshore fisheries management, including capping fishing activity to current levels within 3 nautical miles of Scotland’s coast, as well as extending tracking solutions to all commercial fishing vessels under 12 metres in length.

The Scottish Government have also recently reconvened a Fisheries Management and Conservation (FMAC) group which has established subgroups to engage the wider stakeholder network in co-managing policy development on key matters, like inshore fisheries and fisheries management plans.

Note: At the time of the Symposium the latest stock assessment report was in draft and has since been published: **[Crab and Lobster Fisheries Stock Assessments 2016-2019](#)**.

Bryce Stewart, Senior Lecturer at the [University of York](#), spoke on the **long-term dynamics of crab and lobster populations under different regimes of protection around the Isle of Arran**.

Lamlash Bay, on the eastern side of Arran, remains Scotland's only No Take Zone (NTZ) since its designation in 2008 following years of campaigning by the founders of COAST with the aim to protect biodiversity as well as scallops. Monitoring of the NTZ provided evidence for designation of the much larger South Arran Marine Protected Area (MPA) in 2014, with limitations on some types of fishing in some areas.

Creel surveys for European lobster, brown crab, and velvet swimming crab have been undertaken in Lamlash Bay in most years between 2012 and 2022. Targeted sampling using 3 strings of 5 creels was carried out inside the NTZ and in two control sites (Near Control and Far Control) (**Figure 18**).

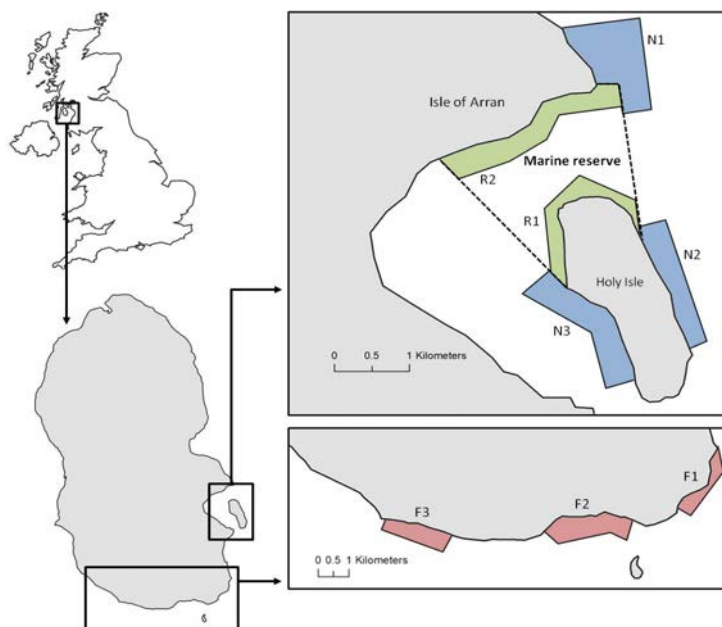


Figure 18 – Map indicating the creel sampling sites within the Lamlash Bay NTZ (shaded green), Near Control sites (shaded blue) and Far Control sites (shaded red).

A tagging study was also undertaken over four years (2012-2015) in which edible crab and lobster were captured, tagged and then recaptured. Through these studies a number of differences were recorded between the NTZ and control zones:

- Catch Per Unit Effort for legal sized lobsters was higher in the NTZ than the Near Control in 7 out of 9 years surveyed.
- A total of 832 lobsters and 68 brown crabs were tagged from 2012 to 2015
- 78 lobsters were recaptured (some more than once) – recapture rate 9.38%
- No brown crabs recaptured so tagging was stopped after the first year.
- 71 lobsters stayed within their original area of capture / 3 lobsters moved from inside reserve, 4 outside to inside.
- Average distance travelled by lobsters was 0.66 km BUT one lobster moved 15 km!
- Average growth 0.89 mm per moult
- Mean sizes of lobsters was higher in the NTZ than the Near Control in all years surveyed.
- One lobster in the NTZ measured 238 mm in carapace length! (Estimated weight 7.2 kg (male)/ 7.8 kg (female))
- Berried lobsters were twice as abundant in the NTZ as the Near Control
- Number of eggs per female lobster (reproductive potential) was 22.1% higher in the NTZ than Near Control
- High densities + high egg production = Potential for high larval export per unit area
- Disease was almost non-existent 0.73% compared to 24% at Lundy NTZ (Davies et al 2013)



The research undertaken in the waters of Arran highlights the importance of long-term, detailed monitoring programs, and reinforces previous findings that protected areas provide conservation and fisheries benefits for sedentary species such as crab and lobster. However, it is important to consider the effects of factors such as environmental conditions and species interactions – in the case of the protected areas off Arran, where lobster have increased in abundance, brown crab has declined, indicating inter-species competition.

“This work demonstrates marine reserves can provide both conservation and fisheries benefits for relatively sedentary species and protected areas should be used in conjunction with other measures to establish ecosystem-based management of fisheries.”

KEY REFERENCES

- Trade-offs in marine protection: multispecies interactions within a community-led temperate marine reserve: academic.oup.com/icesjms/article/74/1/263/2669577
- Marine Conservation Begins at Home: How a Local Community and Protection of a Small Bay Sent Waves of Change Around the UK and Beyond: www.frontiersin.org/articles/10.3389/fmars.2020.00076/full

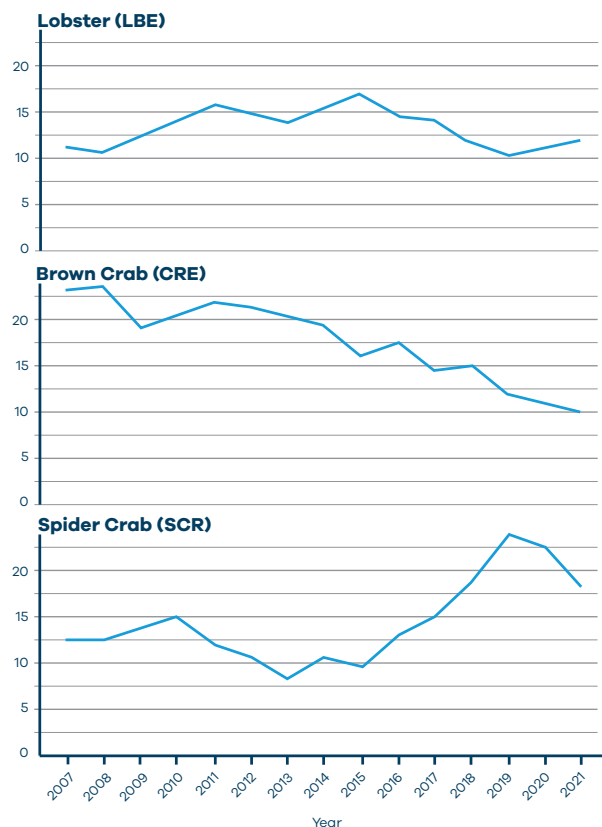
Alex Plaster, Fisheries Officer at **Jersey Marine Resources**, reported on statistics for landings of common lobster, brown crab, and spider crab in Jersey.

The Jersey fishing fleet consists of 130 vessels, predominantly static gear with 85% targeting shellfish and with a large fleet of French vessels (another 130 vessels) – but the figures presented do not include the French landings data. There has been a huge decrease (-58%) in brown crab landings since 2012, in contrast with a significant increase (+281%) in spider crab landings. Lobster landings have also declined significantly since 2015.

CMSY stock assessments are a means of estimating Maximum Sustainable Yield, particularly for data-limited stocks and are carried out for the three species in Jersey waters. These assessments are based on Jersey landings data and so do not account for all catches by French vessels from Jersey waters. On the other hand, some catches may be returned to the water alive if they have poor market value at the time, a factor which may partly explain the recent fall in lobster landings. Catch Per Unit Effort (CPUE) for the three species is summarised in **Table 8** and **Figure 19**.

Table 8: CPUE for common lobster, brown crab, and spider crab in Jersey

	PEAK YEAR	LOWEST YEAR	CHANGE	STATUS
Brown crab	2008, with 23.4 kg/100 pots	2021, with 9.8 kg/100 pots	-58%	Severe decline since 2012
Spider crab	2019, with 23.9 kg/100 pots	2013, with 8.5 kg/100 pots	+281%	Steep rise since 2013, with small decrease in 2020
Lobster	2015, with 16.7 kg/100 pots	2019, with 10.3 kg/100 pots	-38%	Steep decline between 2015 and 2019

**Figure 19 – Landings Per Unit Effort (LPUE) for Lobster, Crab and Spider Crab in Jersey waters 2007-2021**

Jersey Marine Resources has been carrying out annual potting trials since 2004, using modified parlour pots to retain juveniles. Over time, under-sized lobsters have increased in number, although they tend to be caught as soon as they have reached the MCRS. Brown crab was surveyed since 2008 and shows a wider range of sizes, but sampling catches have significantly dropped. Spider crab, conversely, has shown a huge increase, although this may be partly due to gear slipping onto sandy areas. It is noted that the brown crab stock in Jersey has always been low due to the habitat, which favours spider crab.

Jersey Marine Resources carries out landing checks to assess sizes for enforcement and research purposes. The largest lobster was 155mm carapace length. Two other research projects are currently underway: tagging and releasing a total of 2,000 “new shell” female brown crabs to better understand their migration, with recaptures already being reported off the Southwest coast of England; and potting trials inside the newly-established Portelet NTZ to compare with control sites outside.

Fisher groups are looking at future management including Maximum Landing Size, reducing pot limitations and hoping to bring management measures forward in 2023.



Jo Pollett, Fisheries Outreach Manager at the **Marine Stewardship Council (MSC)**, spoke on the **Western Channel and Celtic Sea Fisheries Improvement Project (FIP)**. The MSC is involved in efforts to improve the sustainability of this crab and lobster fishery, using the MSC Fisheries Standard as a benchmark.

In 2022, the Steering Group for the FIP focused on improving the harvest strategy and harvest control rule components. Early in 2022, online surveys were carried out with industry members to assess the challenges faced by the industry and their suggestions for management measures. Five workshops were subsequently held with industry members to discuss potential and preferred management measures.

Possible measures that were discussed in the workshops fell under the following categories with varying levels of agreement (**Figure 20**):

Fleet management

- Formal agreement on reciprocal access for UK/EU vessels
- Ensure all vessels fishing crab and lobster have a shellfish permit/license, including recreational fishermen, and cap permits at a level deemed appropriate to maintain the viability of the fishery
- Issue a pause on latent licenses while management is agreed and implemented.

Fishery management

- Cap the number of pots per vessel, based on current effort, with agreement to cut back by X% if the stocks decline
- Review vessel size classification and implement management of effort through DAS by fishing area and efficiency of the vessel rather than by vessel size. Over time introduce the use of days at sea for all vessels >10m, fishing inshore and offshore.

Technical measures

- Introduce consistent Minimum Landing Size for brown crab inshore and offshore.
- Use enforcement of quality to improve stock status:
 - No landing of damaged crab or berried crab
 - Agreement of what is considered soft shell, and legislation to prevent landing/sale
 - No landing or sale of undersized crab
 - Increase enforcement and fines for those found breaking the rules
- Closure of fishing ground during parts of the year.

Knowledge gaps

- Review accuracy of CPUE data
- Consider appropriate model to calculate pot or effort allocation
- Research approaches to defining fleet and fishing effort other than vessels size
- Seek clarification on international vessel access and their contribution for fishing pressure
- Review potential displacement impacts from management measures and undertaking risk assessments
- Review appropriate MLS and improve data on maturity and stock replenishment
- Review life history traits and lifecycle analysis to determine appropriate seasonal closure
- Research natural mortality and impacts on stocks from other non-fishing sources.

MANAGEMENT OPTION	ILLFRA-COMBE	STOKEN-HAM	BRIXHAM	NEWQUAY	NEWLYN	ONLINE	OTHER WRITTEN INPUT
Seasonal closure							
Alignment of Minimum Landing Size (MLS)							
Restrictions for larger vessels							
Gear modification e.g. escape gaps							
Ban on berried females							
Managing fishery by licence							
Capping all unused shellfish permits and entitlements/latent capacity							
Days at Sea							
Pot limit							
Managing fishery by TAC							
Zonal management							
Prohibition of crab as whelk bait							
SSS - size, sex, season							
Recreational limits*							
Management of quality							
Increased enforcement of regulations from IFCA/MMO							

	Agreement
	Unsure or only with other caveats
	Disagreement
	Not discussed or not considered an issue

*Dispite survey results,,this was not considered an issue

Figure 20 – Level of agreement to a range of potential crab and lobster management measures expressed by fishermen at workshops held during the Western Channel and Celtic Seas Fisheries Improvement Project

The discussions and conclusions from the workshops have been published in a report and presented to the national [Crab and Lobster Management Group](#) (CMG). The CMG will discuss next steps and consider how to sense check these management options.

Mark James, Operations Director of the [Marine Alliance for Science and Technology for Scotland](#) (MASTS) at the [University of St Andrews and leads the Coastal Resources Management Group](#) (CRMG), presented the **experiences and results from the Outer Hebrides Creel Limitation Pilot Trial**. Offering a case study in co-management, the trial has taken place since 2020 in an open access fishery. Concerned by increasing creel numbers, decreasing CPUE/LPUE, and conflict between fishers, the pilot was spurred by fishers who asked Marine Scotland to introduce creel limits as a way to potentially address these issues.

In 2020, Scottish Government, through Marine Scotland, introduced a legal derogation for an area to the east of the Outer Hebrides to enable the pilot, with 140 vessels signing up to participate. As part of an Early Adopters Pilot to test at scale, forty vessels participating in the Creel Limitation Pilot were fitted with a tracking system developed by the University of St Andrews. Thirty-three tracking devices yielded data between November 2020 and October 2022 and each fisher participating in the Early Adopters Pilot was able to see their own track data. When the Creel Limitation Pilot was first initiated, fishers and Marine Scotland agreed creel limits based on the maximum number of creels a vessel of given length could have deployed at any one time. These limits covered vessels that fish for both lobsters, crabs and nephrops. As nephrops creeling usually involves the deployment of larger numbers of creels than crab and lobster fishing, the limit was set with respect to agreed limits that reflected nephrops creel requirements.

However, the CRMG have developed algorithms based on vessel track data to infer target species (nephrops or crab and lobster) and estimate creel numbers being deployed by each vessel. In hindsight this information could have been used to establish lower creel limits for lobster and crab fishers. The results of the research suggest that the current pilot trial limits were conservative and there may be potential to refine and reduce creel limits. The tracking system performed well, providing highly spatially and temporally resolved location of fishing effort and estimates of creel numbers and soak times, while fishing depth and seabed type could be combined to infer the target species.

Analysis showed that fishers tend to focus on discrete grounds, suggesting co-operative agreements between individuals about who fishes what, where, and when, and with hotspots of activity changing seasonally. However, to gain a true picture of fishing effort and possible areas of conflict and competition for ground, it was recommended that all vessels operating within the creel limited area would need to be tracked.

In addition to providing new insights into the spatial and temporal distribution of fishing effort, the research also highlighted the potential scale and extent of creeling effort. A total of just over 2 million creel deployments were recorded by a sample of 25 tracked vessels over 21 months in the pilot area. The vast majority of vessels were clearly operating well within the creel limits suggesting that for those targeting crabs and lobster in particular, there is latitude to further reduce creel limits.

It is difficult to conclude whether the creel limitation has worked, as landings data is only available from 2017, and events in the last few years including COVID, Brexit and the cost-of-living crisis have directly affected catches and landings.

A qualitative survey including online and face to face interviews was undertaken with fishers from 49 vessels. 87% said they would reduce the number of creels they placed in the water if this was managed and policed properly. Further, 20% said that taking part in the creel limitation trial had improved their wellbeing, in terms of criteria such as business sustainability and mental health (**Figure 21**).

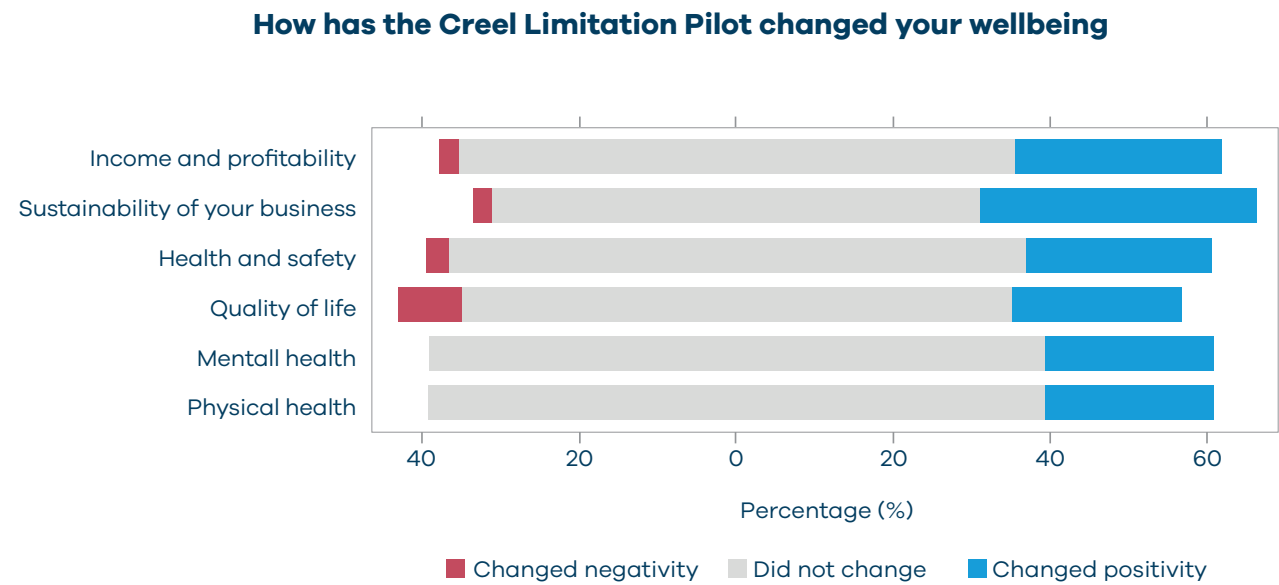


Figure 21 – Results from a questionnaire about wellbeing associated with participation in the creel limitation pilot (n=37)

Overall, the survey results provide a strong signal that for the Outer Hebrides, and potentially more widely, the industry is in favour of creel limitation. Creel effort reduction may be needed in addition to limitations, for example by limiting creel days, without pushing the trend towards fewer larger vessels or displacing fishing effort. Separate limits should also be introduced for nephrops versus crab and lobster vessels to cater for the different number of creels used by those fisheries as well as the type of creels being used and their efficiency.

Q&A on Fishery Management: Session 2

Q: Will new crab and lobster stock assessments for Scotland cover all years up to 2021?

A: Marine Scotland confirmed that the assessments would cover 2016 to 2019.

Q: Why have lobsters and velvet swimming crabs benefited from the Lamlash Bay NTZ, but not brown crabs? Might large lobsters have larger territories and display territorial behaviour?

A: Catch rates and landings data may not be a perfect way of measuring abundance, as they are affected by factors such as what you catch first, attraction of the bait, weather conditions, and interactions in the creel. If you catch a conger eel it will likely eat what is in the pot. Further, big lobsters may be too big to get into a creel. Large lobsters do have bigger territories, and may prevent brown crabs from entering these and chase crabs away. Velvet swimming crabs seem to “fly under the radar” so the lobsters may not see them as a threat. The NTZ is small, so competition could be heightened.

Q: What sort of concerns did fishermen have in terms of having the technology on board? How did you address them?

A: The fishers participating in the Early Adopters and Creel Limitation Pilot trial were all very positive and openly agreed to having the tracking devices on their vessel. As a matter of course, the research team at St Andrews must have ethical approval from the University to undertake research of this nature and we now have a good system in place to secure the consent of fishers to collect their track data. This agreement assures fishers that the data collected will only be visible to them or to named researchers and individuals (in this case within Marine Scotland) for the purposes of research. Any results are always presented in a way that anonymises the data unless we have the permission of the fisher(s) to share the data. We have now been tracking inshore vessels for several years and attitudes within the inshore sector to tracking (in Scotland) have changed. Many fishers now see tracking as positive if it can support sensible fisheries management and importantly, spatial management in our coastal waters. Threats from offshore wind developments, aquaculture and protected area designations demand that inshore fishers can evidence where they fish and its social and economic impacts.



Fishery Perspectives

Chaired by Andy Read, Editor of Fishing News.

An open forum dedicated to fishery perspectives provided an opportunity for those working in the industry to voice their views on the information shared during the symposium. **Andy Read** invited **Dr Mike Roach** of the **Holderness Fishing Industry Group (HFIG)**, and Chair of the Crustacean Committee for the **Shellfish Association of Great Britain** (SAGB) to provide an update on the SAGB focus and contribute his thoughts on stakeholder engagement and the symposium's discussions.

Dr Roach summarised that the SAGB is a membership organisation representing all aspects of crustaceans and shellfish supply-chains both for fishing and aquaculture. The SAGB's current priorities include:

- Active involvement in and development of the crab and lobster FMP as part of the Crab Management Group (CMG).
- Developing an industry-led proactive response to the addition of decapod crustaceans and cephalopods to the Sentients bill, to develop a code of practice for each sector of the supply chain.
- Dealing with the challenges of getting catch to market in a post-Brexit landscape to explore new markets.



He highlighted that market variables had not been mentioned during the day's discussions. In particular, the Chinese crab market was currently closed to UK exporters following the routine Chinese monitoring for heavy metals – however the same crab from FAO27 is successfully being exported to China via Holland and Portugal. The SAGB is working with the Chinese Embassy to introduce appropriate testing protocols. The situation may, therefore, change – hence the suggestion of market variability.

Mike reflected from a direct industry perspective that stakeholder engagement is challenging for fishermen when fishermen spend long days at sea 12-15 hours a day, whereas those wanting to engage with them work 9-5.

“One of the challenges of maintaining engagement is a perception within industry that a lot of stakeholder engagements are a box-ticking exercise and process rather than feeling that their opinions and expertise are valued and a complete swath of requests to comment.”

Fishermen and organisations give an enormous amount of time to input to Defra and regional consultations and the planning process, and while they are doing this they are not earning, whereas those who develop the consultations are paid to do so while fishermen are expected to give up their earnings to respond. The transition to working online during the Covid-19 pandemic was especially challenging for fishermen, who prefer in-person meetings and port visits. While there has been a slow move towards more in-person engagement, it's still not happening as much as it should. Furthermore, he felt the Northeast of England is often missed out during in-person engagement for consultations, with the majority of effort being focussed in the South and Southwest.

He added that *“fishermen's responses are weighted equally to those that are non-fishing stakeholders,”* which does not accurately reflect the voices of those who are most impacted. He added that the vilification of the fishing industry has not encouraged fishermen to engage as they are often perceived in the common media as being out to destroy the environment

and destroy the stocks, but the reality is that if they disappear, the fishermen will be the first ones who can't pay their mortgage. He stressed that high levels of survey fatigue have built up within the industry, who have been asked to input for the past 40 years, but with very little feedback and nothing seems to be taken onboard or acted upon. So *"there is a lack of faith that fishermen's opinions are considered relevant and important"*.

He concluded that online consultations do not work and many are biased and done online. Instead, stakeholder engagement should be a toolbox, with a suite of different approaches, with much more regular port visits and in person meetings.

"Maintaining engagement can only happen if fishermen's opinions and evidence is valued, given equal weight to larger more influential organisations and lobbyists, and we can't just rely on online consultations, there has to be a mix that can reach everyone that matters."



Photo © Geoff Lee



Photo © James Bowden

Andy Read considered that the recent steps taken by Defra towards co-management and different ways of collaborative working in the development of FMPs are a step in the right direction. He reflected on the results from the South West Crab FIP that reflected the views of the fishermen there. Total Allowable Catches (TACs) and quota limitations were highly unpopular with fishermen, whereas other more regionalised measures such as banning crab as whelk bait, MCRS, and bans on landing berried hens, received strong industry support. Does this reflect the general industry view on what is in favour and what is not in favour?

Dr Roach agreed that TAC and quota restrictions tend to be raised by the bigger fleets but are not popular across the board. Following a TAC or quota approach would fundamentally change the dynamic of the potting fishery, which is currently based on a skipper-owner system that employs local people. However, a TAC approach could result in the majority of the quota falling into the hands of the larger offshore Vivier vessels.

Conversely, he said changes to MCRS are favoured by fishermen as animals have more chance to reproduce prior to capture, and it is easily enforced. However, he noted that these measures would need to be implemented for the right reasons in order to benefit the stock, rather than being adopted simply for ease of enforcement.

Beshlie Pool, Executive Officer at **South Devon & Channel Shellfishermen**, shared the perspective of fishermen in the South of England from the smallest 6m beach boats to the super crabbers, voicing agreement with Dr Roach's comments. Southern fishermen have also been calling for additional management for stocks and their livelihoods. The most popular option being to standardise the Minimum Landing Size for crab and lobster. She added that there are concerns about the growing market for crab for whelk bait, and fishermen in the south are keen on pausing latent capacity (unused fishing licences and entitlements) while management measures are developed, and for more robust enforcement of existing legislation. Measures relating to tonnage and catch limits are less welcome as there is a perception that people may fish harder in order to reach the tonnage limits. She reflected: *"we are at opposite ends of the country and yet our members agree on the same things. Hopefully this is a real positive for the FMP and for stocks and livelihoods for the future."*



Photo © Alex Hyde

Andy Read commented on his experience of the bewilderment among fishermen about the levels of legislation at different levels, such as inside 6nm and outside 6nm, different MLS across IFCA Districts. He asked for feedback on the differences in age at first maturity, which varies across the UK, and whether there is a need to simplify, with one rule for everyone, or to allow variation to take account of local conditions.

Beshlie Pool noted that there is a perception that a lot of the fleet is nomadic, for whom a simplified approach would be beneficial, but for community-based fisheries with close links to its local area, there are important variations and nuances to consider. It's one species but not really one fishery.

Dr Roach agreed, stating that there is a need for simplification. However, within the current framework of IFCA's with jurisdiction out to 6 nm and the MMO beyond that there is a change in behaviour in response to the inconsistency in legislation. Small boats are having to move offshore in order to catch larger crabs above the MLS, which creates a safety issue. There is a need for simplification, but the regional biological traits need to be taken into account as well.

Colin Bannister highlighted the poignancy of the discussion, adding that *"this conversation could have taken place 20 years ago. Nothing has changed."* The accuracy and longevity of the science that underpinned the assessment process is questionable in light of some of the biological knowledge that we now have. He warned: *"The scale of the threat is completely different – in terms of the number of vessels, the pots used, their mobility and capacity is much greater than it was years ago"*. The tools being used to try and assess the populations haven't changed very much we don't understand the compensatory biology. The scale of threat is the concern, with declining crab landings particularly in the western Channel. **The solution needs to be found and a consultative approach is essential, but nevertheless, it's still not going to be easy to come to an agreed solution that works for all areas, all of the time.**

Andrew Brown, Director of Sustainability & Public Affairs at **Macduff Shellfish Ltd.**, one of the biggest processors of crab in the country provided a processor's perspective on the discussions. He noted their primary concern about the decline of crab stocks in recent years after a steady historic level, across the whole of the UK at the same time, which may indicate a climate change factor as well as fishing pressure. Other concerns relate to the lack of agreement to limits on how much crab UK vessels can take from EU waters, or the amount of crab that the EU can take from UK waters so there are no figures to assess how much crab is being caught. He noted a recent EU consultation about closures in Dutch and German waters which will lead to more displacement back into UK waters. Market access is also an issue, as well as the restrictions on transit visas and recruitment of foreign crew, which is a particular problem in the West coast of Scotland.

Regardless of the challenges, he was optimistic about the momentum. Brexit has created a situation whereby we now have to pay attention to crab and lobster, which were previously ignored in the Common Fisheries Policy as they were categorised as Non-Quota Species, and so suffered from a lack of research. Crab and other shellfish that were ignored in the past are in the first tranche of FMPS which can be used to drive momentum. *"It's more than just a consultative approach, it's a collaborative approach to work with all the players."*

In concluding the open forum, **Andy Read** voiced his support for Andrew Brown's use of the term 'collaborative' as being different from 'consultative'.

"In the face of falling catch rates and the threat of a lot of effort being displaced back into British waters could lead to pessimism, so I'm glad to hear that optimism remains. This is the start of a process, not the end of process and I look forward to seeing how the FMPS develop."



Closing remarks



Sam Fanshawe (Blue Marine) closed the Symposium by highlighting some key points:

- **There is an urgency expressed by all stakeholders to address recent declines in UK crab landings.**
- **Management shortfalls need to be addressed now before these declines result in total collapse as was evidenced in the Scandinavian lobster fishery, which has yet to recover.**
- **There is some consensus among fishermen across different regions about preferred management approaches.**
- **This is a discussion that has been ongoing for some time and potential solutions have been there, but these need to be put in place.**
- **The day provided an overview, but only scratched the surface of the information and we need to drill down into the knowledge of the fishing industry.**
- **The FMP process is giving fishermen a platform to share their concerns as part of a formalised process that will be recorded and taken into account and channelled into the final position taken.**
- **More work is required to understand the impact of non-fishing stressors on crab and lobster populations, including, sedimentation, pollution, and climate change and addressing these where we have control.**

"The programme today provided an overview of several of the key issues relating to crab and lobster fisheries presented by speakers with a great wealth of experience and knowledge, and the Fisheries Management Plan development provides an opportunity to harness all of this knowledge and engage with the fishing industry on the ground to develop a management approach and measures that make a real difference to the stocks and the fishing communities that depend on them."

"There are a lot of opportunities to engage in the FMP process and other national initiatives. This is an opportunity that has been a long time coming and it is up to all of us to input and inform the best decisions for effective management and safeguard these vital fisheries."



Glossary

Berried - A female lobster or crab, which is carrying eggs externally.

BMSY - The biomass that enables a fish stock to deliver the Maximum Sustainable Yield.

Catch Per Unit Effort (CPUE) - An indirect measure of the abundance of a target species, which assumes that the number of fish caught per unit of effort expended is proportional to stock size.

FMSY - The maximum rate of fishing that will eventually result in a population size of BMSY. FMSY is a constant and can be applied to any stock whose reproductive capacity is not impaired.

International Council for the Exploration of the Sea (ICES) - A regional fishery advisory body for the North Atlantic, the Baltic Sea, and the North Sea, which also supports fisheries management research worldwide.

Landing Per Unit Effort (LPUE) - Used in the same way as CPUE, but using data on landings rather than catches. These two measures may differ as not all catches may be landed.

Minimum Conservation Reference Size (MCRS) - The minimum size at which an individual fish or shellfish is permitted to be taken by the fishery. Previously termed Minimum Landing Size.

Maximum Landing Size (MaxLS) - The maximum size at which an individual fish or shellfish is permitted to be taken by the fishery.

Maximum Sustainable Yield (MSY) - The largest theoretical catch that can be taken from a fish stock over an indefinite period under constant environmental conditions.

Non-Quota Species (NQS) - A species or group of species of which stocks are not subject to a Total Allowable Catch. In other words, in the absence of other regulations, there is no limit on how many can be taken.

Size of Maturity (SOM) - The size at which the probability of an individual being mature is 0.5, i.e. the size at which 50% of the population is mature.

V-notching - The practice whereby a fisherman cuts a triangle out of the tail of a berried (egg-bearing) female lobster, then releases it back into the sea. If another fisherman lands the same lobster, he knows she is a breeding female due to this 'V' marking in the tail and has to return her to the sea. This ensures that fewer sexually-mature female lobsters are caught, which helps protect the lobster population.



Q&A Report: Crab & Lobster Online Symposium

Additional questions answered via the webinar chat

QUESTION	ANSWER
Crab and Lobster Biology and Fisheries management	
What are the panel's views on a potential inward migration of large berried lobsters from deep water to warmer inshore waters for larval release?	The results of tagging studies for both clawed and spiny lobsters shows that the majority of adults show relatively high site fidelity, though there seems to be some regular seasonal migration offshore during winter (possibly to see out storms in deeper water, etc), and back inshore again when the water warms and booming primary productivity creates feeding opportunities nearer coasts. Given the relatively short pelagic larval duration (PLD) of clawed lobster (estimated to be ~4 weeks in the wild), it's possible that lobsters spawn inshore to try and ensure favourable habitat for settling juveniles, though the much longer PLD of crawfish (~1yr!) probably means that larval drift spreads surviving juveniles far and wide, both inshore and offshore.
Spiny lobsters are a stock that has seen, between the early 1970s and about 2014, a collapse in many areas. Is the management of this fishery going to be addressed?	Spiny lobsters are included in the Crab and Lobsters FMPs being developed.
Spiny lobsters seem to be the 'elephant in the room' in all these discussions about 'shellfish'. Where is there attention being paid to understanding what is 'happening' with crawfish and how best to manage any fishery so that it is sustainable and doesn't crash (again)? Apologies if I have missed something.	This highlights why the industry management groups have pushed for including crawfish in the FMP. Although still in draft the intention is that the FMP will provide the structure to both improve the evidence base for these fisheries but also to expedite appropriate management of these fisheries. There is a strong desire from many industry stakeholders in SW England for increased/harmonised MLS for crawfish; this is the kind of information we want to gather and, as appropriate, include in the draft FMP that is delivered to Defra for public consultation.
As the Shellfish Group is also covering Crawfish, Common Prawn etc, albeit to a lesser level, would it not be helpful to include these species within the DEFRA Shellfish Legislation Mapping Tool?	The shellfish legislation tool does include crawfish
Are crab and lobster landings data good enough to really understand pressures on stocks and apply responsive management measures?	Unanswered
What were the reasons for the collapse in shellfish catches in Scandinavian countries?	Largely overfishing. Most Scandinavian countries have a rather different relationship with lobster fisheries, in that the recreational sector is huge and relatively unmanaged. Many Scandinavian families have coastal homes in which they spend the summer, and I think the rule in Norway is (or was) that you could fish 10 pots per member of your family! So you can imagine that recreational fishers were effectively operating at semi-commercial scales for generations... Alf Kleiven produced a good paper showing the huge extent of unregulated fishing for lobsters that still continues and hampers recovery efforts... https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0031216
In Jersey, aside from the NTZ mentioned, does Jersey have any other spatial management measures?	Jersey has two no parlour pot zones which are based around our two main offshore reefs to the NE and S of Jersey. We also have no mobile gear zones around these reefs and it spreads around Jersey following the 20m contour. We have found the two no parlour pot zones to be successful with increasing lobster and crab numbers and size inside the protected zones.
Why emphasise pot limits in the Good Fish Guide criteria over other potential measures?	Pot limits are just one method of managing effort but it is one that is more easily implemented. Harvest control rules and catch limits would be ideal but they will take a lot more time and resource to implement, whereas pot limits are a step that IFCA's and other management bodies can more easily take.

Q&A Report: Crab & Lobster Online Symposium

Additional questions answered via the webinar chat

QUESTION	ANSWER
Crab and Lobster Fisheries Management Plan	
How will consensus be reached on the FMP actions – there will likely be a lot of conflicting opinions on management	This is what we are currently assessing via stakeholder engagement events around England. There are two aspects to the engagement; 1) reviewing aims and objectives as drafted by the FMP working group and 2) facilitated open discussion to both understand regional management aspirations and to review other tools as proposed via work such as Cefas management approaches review and SW FIP workshops. This will be compiled into an engagement report at the end of the process and used to refine the FMP content. Early days yet as we only started meetings last week but although there are sometimes conflicting opinions there are also overarching themes which seem to (so far) span different areas and fisheries. Our job will be to unpick this, with input from the FMP working groups, to develop a fit for purpose plan which will ultimately go to public consultation in 2023.
Introduction of measures within 0-6nm by IFCAs in England relies on consensus amongst the industry responses to Byelaw consultations. Where this consensus is not reached, how will the FMP aim to introduce any regional measures identified as being necessary to protect stocks/fisheries?	The FMP stakeholder engagement work aims to identify where consensus ‘may’ be reached on management both at national and regional scales to deliver on the objectives of the Fisheries Act. We have only just started this work so it is too early to say what those key themes may be but also worth noting that the draft FMP will be handed to Defra in Q1 2023 and will then go to public consultation later in 2023.
Offshore Wind Farms	
Has there been any work into examining the effects of OWFs acting as unofficial no take zones due to the fishers reluctance to fish within them? Has their presence had any positive or negative effects on nearby catch/landing figures for nearby fishermen and stock?	“Check out our fisheries led research looking into this https://academic.oup.com/icesjms/article/75/4/1416/4841920 https://academic.oup.com/icesjms/article-abstract/79/4/1175/6547885?login=false ”
What are your thoughts on electromagnetic fields (EMF) from Offshore Wind Farms? Did this come up when discussing with fishers?	Not in terms of crab/lobster, but it did with recreational fishers. I’ve not directly engaged with the EMF literature for a while, but there was some emerging around changes to crab/lobster behaviour.
Do you think the results of the co-location study will be different today as perceptions of the time have become reality and the scales of developments have massively changed. We are now looking at perceptions to floating wind that will soon become a reality. I think this work redone could present very different results now.	I would be very surprised if the results hadn’t changed, and would very much like to see the evidence updated.
Offshore Wind Farms were not considered ‘suitable’ as Highly Protected Marine Areas by the recent Defra consultation. Many are de facto No Take Zones and may benefit as ‘fish [incl. shelfish] recovery areas’. (Disappointing that not identified as potential HPMAs.)	Statement

Q&A Report: Crab & Lobster Online Symposium

Additional questions answered via the webinar chat

QUESTION	ANSWER
Teeside mass crustacean mortality event	
Was the mortality event in the north east limited to crustaceans, or were other impacts on other species or habitats observed?	There were mortalities in limpets, razor clams, mussels and octopus - but nothing approaching the scale that was seen with the crustaceans. Perhaps the closest impact was on the barnacles - there was a virtual extinction of the barnacle population at Staithes - this is a long term monitoring site that we maintain and have 20 years of data. We are still exploring the data for other species monitored at Staithes.
After waste disposal, what was the second contemporary source of pyridine mentioned?	There are three main sources of pyridine input into the Tees - two legacy sources: from coking for steel-making (pyridine is a well known by-product of coking). Also, pyridine is produced from thermal cracking of the C5 (naptha) fraction of crude oil distillation and was routinely discharged into the river. More latterly, there was a production plant on the north bank that was specifically manufacturing pyridine and pyridine derivatives for chemical synthesis, e.g. for herbicides.
Can you tell us how closely the ecotox tests followed good lab practice, OECD guidelines and quality control protocols.	GLP and OECD guidelines were met. We will very shortly (later this week) be depositing our draft manuscript in a preprint server - we are still awaiting some additional data from York but these will be added ahead of submission for peer review.
What is the alternative to disposal at sea (if the contaminant tests indicate that the spoil is not fit for disposal at sea)? Is there a disposal on land option which could be pursued?	Unanswered
What is being done to help or support the fishermen who have potentially lost their livelihoods due to this mass mortality event? and are there plans in place to improve the stocks?	Unanswered
General statements re Teeside event	
What about the Freeport dredge being put on hold in the Tees, since they started removing phase 1, supposedly contained dredge, the most toxic results in the silt, it is falling into the River on removal, opening the seams to the tides.	
Die offs have started becoming increasingly regular since this Freeport dredge started.	
The Tees Freeport dredge should be put on hold, it is capital dredge not maintenance. We have had mass wash ups of whelks, mussels, sprats, more dead lobsters in pots again,	
The merchants are losing up to 20% stocks overnight, the local boats up to 30% catch dead before landing, now, even dead scallops being caught, to go with the ecosystem extinction episode, of all shellfish, and now no prawns being caught locally.	
The Orca dredge, of 148,000 tonnes over 10 days, wiped out many thousands of tonnes of shellfish, over @200 sq miles, it was dumped 3 mile off.	
The Freeport dredge will dump 1.7 million tonnes, 6 miles off, it hasnt been tested for pyridine, it needs halting until this had been thoroughly investigated as the source of the die offs	
General comments	
Thanks everyone for the presentations and comments. The sadness for me is that many of the issues are exactly the same as those I was hearing and trying to address with the local fleet in the 1990's. However, despite some limited improvements brought about by the hard work of hundreds of best intentioned persons over the last few decades, that type of work needs to go on!	

Citation

Blue Marine Foundation (2023). Crab and Lobster Symposium November 2022 Proceedings Report.

The Symposium is available to view on Blue Marine's YouTube channel [here](#).

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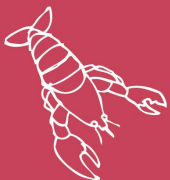
Contacts

- **Blue Marine:** Sam Fanshawe: sam@bluemarinefoundation.com
- **Seafish:** Crab and lobster Fisheries Management Plan: fisheriesmanagementplans@seafish.co.uk



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Symposium Agenda



AGENDA



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Crab & Lobster Symposium – 16 November 2022

1000-1015 Introduction

- Sam Fanshawe Blue Marine Foundation
- **Shaping the future** - Colin Bannister, SAGB

1015-1055 Session 1: Biology and Research

Chair: Bryce Stewart, Senior Lecturer, University of York

- **10:15 ICES Working Group on Biology and Life History of Crabs** - Carlos Mesquita, Chair ICES Working Group/ Marine Scotland Science
- **10:25 Comparing the size at onset of sexual maturity of *Cancer pagurus* in Berwickshire and Northumberland** - Joe Richards, Blue Marine Foundation, Blair Easton, St Abbs Marine Station, and Andrew Boon, NIFCA
- **10:35 Crab maturity study: Irish Sea** - Alec Moore, Bangor University
- **10:45 Genetic assignment for improved ecological understanding of lobster stocks** - Charlie Ellis, Postdoctoral Researcher (Molecular Ecology & Evolution Group), University of Exeter

1055-1110 Session 1: Q&A

1110-1120 BREAK

1120-1200 Session 2: Factors affecting stocks

Chair: Sam Fanshawe, UK Projects Manager, Blue Marine Foundation

- **11:20 Crab health survey and novel disease** - Rosslyn McIntyre, Cefas
- **11:30 CHASM – potential impacts of sediment on crab and lobster health and habitat on the south coast** - Dr Charlie Thompson, Lecturer, University of Southampton and Director, Channel Coastal Observatory
- **11:40 Recent research findings of the mass mortality event** - Gary Caldwell, University of Newcastle
- **11:50 Alternative report on the mass mortality of crustaceans along N.E coast** - Tim Deere-Jones, Marine Pollution Research and Consultancy
- **12:00 Initial investigation into the deaths of crustaceans in the North East** - Rachel Muckle, Deputy Director of Marine and Fisheries Programme, Defra

1210-1225 Session 2: Q&A



1225-1325 Session 3: Fishery

Chair: Richard Hoskin, Head of Fisheries & Marine Conservation Management, MMO

- **12:25 Recent trends in crab and lobster fisheries: NEF/AIFCA report** - Tim Smith, Senior Policy Officer, Association of IFCAs
- **12:35 Fishery status: UK landings data** - Jessica Duffill-Telsnig, Marine Management Organisation
- **12:45 The importance of data and management for sustainability advice** - Alice Moore, Good Fish Guide Ratings Officer, Marine Conservation Society
- **12:55 Yorkshire gold: Lobster fishing and conservation; past, present and future** - Joe Redfern, General Manager of Whitby Lobster Hatchery and representative of the North East Fishing Collective
- **13:05 National Lobster Hatchery** - Carly Daniels, Head of Research & Production
- **13:15 Co-location of offshore windfarms and decapod fisheries** - Tara Hooper, Natural England

1325-1345 Session 3: Q&A

1345-1435 LUNCH

1435-1525 Session 4a: Management

Chair: Colin Bannister, SAGB

- **14:35 History of Management** - Colin Bannister, SAGB
- **14:40 Crab and Lobster Management Group** - Claire Pescod, CMG Chair and Head of Sustainability and Science, Macduff Shellfish Ltd.
- **14:50 Fisheries Management Plans development process** - Lewis Tattersall, Head of Fisheries Management, Seafish
- **15:00 Shellfish legislation mapping tool** - Joanna Messini, Policy adviser in Non-Quota Species Team Defra
- **15:10 IFCA management measures** - Tim Smith, Senior Policy Officer, Association of IFCAs
- **15:15 Andrew Boon, Senior Environmental IFCO, Northumberland IFCA**
- **15:20 European Lobster Settlement Index** - Ralf Bublitz, Environmental and Scientific Manager, North Eastern IFCA
- **15:25 Colin Trundle, Senior Scientific Officer, Cornwall IFCA**
- **15:30 Sarah Clark, Deputy Chief Officer, Devon & Severn IFCA**

1535-1555 Session 4a: Q&A

1555-1605 BREAK

1605-1655 Session 4b: Management

Chair: Morven Robertson, Head of UK Projects, Blue Marine Foundation

- **16:05 Taking a strategic approach to inshore fisheries in Scotland** - Stuart Bell, Senior Policy Manager, Marine Scotland
- **16:15 Crab and lobster management in Lamlash Bay** - Bryce Stewart, Senior Lecturer, University of York
- **16:25 Overview of the Outer Hebrides creel limitation pilot** - Dr Mark James, MASTS Operations Director, St Andrews University Coastal Resources Management Group
- **16:35 Jersey crab and lobster fisheries** - Alexander Plaster, Jersey Marine Resources
- **16:45 Western Channel and Celtic Sea Fisheries Improvement Project** - Jo Pollett, Fisheries Outreach Manager, MSC, Marine Stewardship Council

1655-1715 Session 4b: Q&A

1715-1800 Session 5: Fishery perspectives and Open Floor Forum

Chair: Andy Read, Editor, Fishing News

- **17:15 Updates from the Shellfish Association of Great Britain**

1800 Closing Remarks





**BLUE MARINE
FOUNDATION**

3rd Floor South Building,
Somerset House, Strand, London,
WC2R 1LA

+44 0207 845 5850

info@bluemarinefoundation.com
www.bluemarinefoundation.com

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