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Annual Fisheries Science Report

2025

Sustainable Fisheries and Aquaculture Group

School of Ocean Sciences

Annual Report for 2025
(Report No. 11)

Isle of Man Fisheries Science

Sustainable Fisheries and Aquaculture Group
Bangor University

PRIFYSGOL BANGOR UNIVERSITY

Isle of Man Government
Reiltys Ellan Vannin

Review of 2025 by Professor Stuart Jenkins

Stuart Jenkins is a Professor of Marine Ecology, Head of the School of Ocean Sciences , Bangor University and is the academic and scientific lead for Bangor's Isle of Man fisheries work.

As always it's a pleasure to introduce this Annual Report showcasing Bangor University's work with DEFA and the Manx fishing industry throughout 2025. A particular highlight was the successful re-tendering of our contract with DEFA, to secure a further five year continuation of our provision of independent scientific research and advice for commercial fisheries, running from 1st September 2025 to 31st August 2030. A fundamental part of our contract with DEFA is the running of a small team of Bangor University staff within the St Johns offices. 2025 saw a change in Bangor University personnel. Dr Matt Coleman left the team in February 2025 after a working with us for three and a half years. During that time Matt made a huge contribution to our work on the sustainable management of crab, lobster and whelk fisheries, as well as important investigative work into pollack and *Nephrops*. At about the same time Matthew Garratt had just received his doctorate from Bangor based on his work on Manx and Welsh whelk fisheries (Thesis entitled: *Investigating methods to assess stock status in common whelk (Buccinum undatum*) fisheries). We were fortunate that Matt Garratt was able to join our team and fill the gap left by Matthew Coleman

Our annual scallop surveys in 2025, both that conducted by our science staff on Bangor University's Prince Madog and the Industry Survey coordinated by David Beard, Chief Executive of the MFPO, showed that both queen scallop and king scallop stocks around the Isle of Man remain in a healthy condition, providing confidence in the continued sustainable management of these valuable fisheries. For queen scallops, increasing stock biomass and strong catch rates supported advice for a precautionary increase in fishing opportunities. King scallop surveys also produced encouraging results, with adult stock levels remaining among the highest recorded in more than 30 years of monitoring. Also, strong recruitment of juvenile scallops is expected to support the fishery in the coming years. Critically these scientific surveys allow us to identify areas where protection from fishing in the short term may provide both ecosystem and fishery benefits. These protection measures are welcomed and supported by Isle of Man fishers. In this Annual Report we also outline our work with collaborators at Bangor in understanding the dispersal and settlement of scallop larvae; by integrating findings we expect to enhance decision making on how protection of some areas of the seabed may benefit the fishery.

2025 saw the first real benefits of the introduction of iVMS (inshore vessel monitoring systems) to the static gear fleet. The introduction of high-resolution vessel tracking data has greatly enhanced reporting on potting activities, allowing detailed mapping of crab, lobster and whelk fishing effort throughout the Isle of Man territorial sea. We now have the ability to automate the production of detailed reports showing the spatial distribution of effort and catch. This brings us much closer to our long-term ambition of understanding these fisheries in the same detail as the Isle of Man scallop fisheries. The next challenge is to work with the fishing industry to translate this improved evidence into management that supports productive and sustainable fisheries.

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Annual scallop surveys (2025)

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Within Isle of Man territorial waters King and Queen scallops stocks are assessed via two annual surveys:

- A long-term, coarse-scale fixed station survey (1992 onwards) undertaken by Bangor University's research vessel.
- A short-term, fine-scale stratified-random survey (2019 onwards) undertaken by commercial fishing vessel(s).

The long-term data enables quantitative stock assessment models to be used, whilst the fine-scale nature of the shorter-term survey data means inter and intra seasonal spatial patterns can be visualised and managed at the resolution of individual fishing grounds, which is of importance when managing high density areas of recruitment ('hotspots') which can vary annually.

The R.V. Prince Madog surveyed 60 stations (fixed locations) between 22nd and 31st May 2025 (Figure 1). The survey was undertaken later than usual due to technical issues which required the vessel to remain in dry dock during April and early May. The standard survey gear comprises of a set of four Newhaven dredges: two with 80 mm ring diameter and 9 teeth of 110 mm [king dredges] and two with 55 mm ring diameter and 10 teeth of 60 mm [queen dredges]. At each station the dredges are towed at 2.6 knots for 20 minutes with the direction of the tow dependent on tidal state and current condition. For each tow the total biomass of king and queen scallops is recorded by dredge and a subsample of 90 queen scallops and 90 king scallops from each dredge are then weighed and measured (king scallops are also aged).

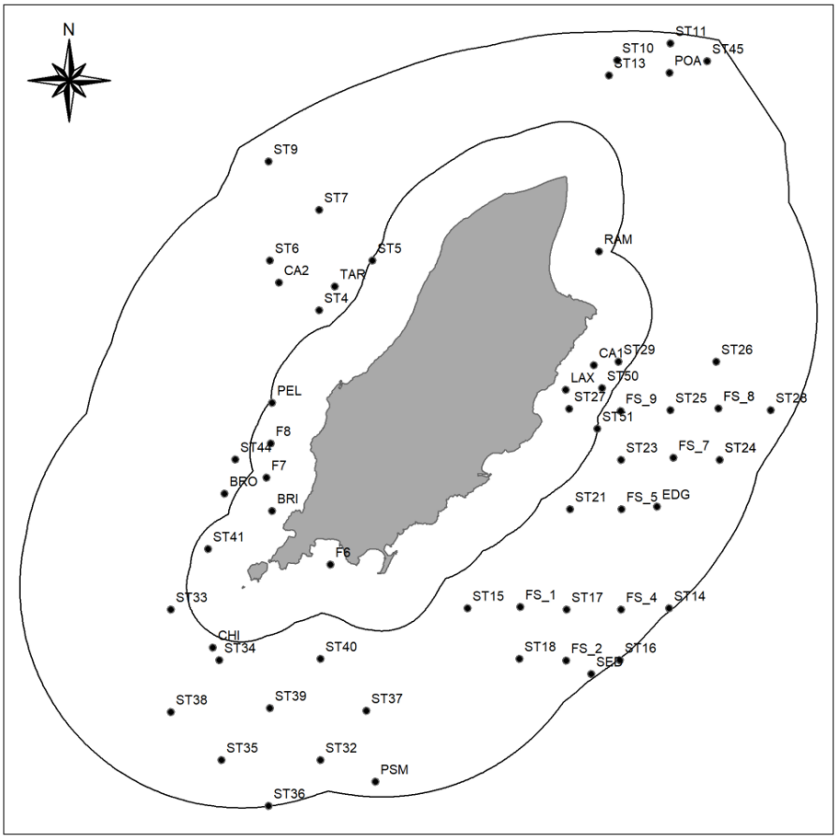


Figure 1: A map showing the location of fixed stations surveyed by the R.V. Prince Madog in 2025.

The F.V. Benolas surveyed 278 stratified random survey cells between 11th May and 10th June 2025 with sampling coordinated by the MFPO with scientific support from Bangor University. Survey areas were split into a fixed grid with a resolution of 1 min (longitude) x 0.5 min (latitude). Survey cells were sampled randomly within each ground strata (strata were defined predominately by depth) with approximately equal effort to ensure relatively even distribution of survey effort across the entire fished ground (Figure 2). Within each survey cell a 10-minute tow was undertaken at ~ 2.5 knots. Each vessel towed two dredge bars, a 'standard survey dredge bar' (two King and two Queen dredges interspersed along the bar) and a 'juvenile survey dredge bar'. This is of the same design but uses Queen dredges with 17 teeth with a mesh (60 mm) attached internally that when stretched into a fixed position results in a maximum mesh size of 38 mm. These 'juvenile' dredges are designed to enable smaller queen scallops to be sampled. The catch from each dredge was counted and a subsample of up to ~ 90 kings and 90 queens were measured.

Further details of the standardised methodology used by each survey are provided within the annual survey reports.

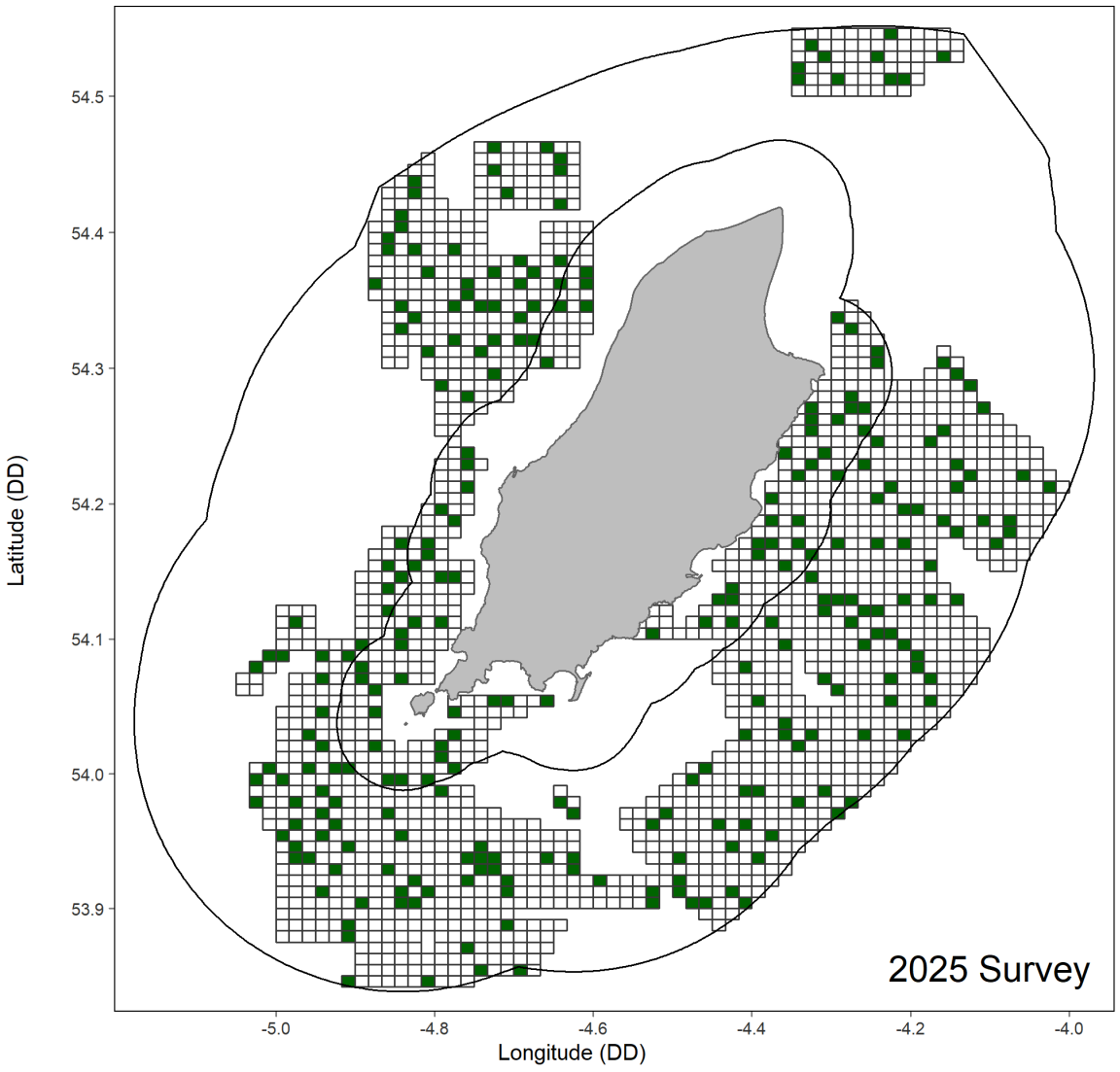


Figure 2: *A map showing the survey grid for the fine-scale random stratified scallop survey undertaken by industry vessels. Green cells show the locations of randomly selected cells for surveying in 2025.*

Long-term, Coarse-Scale Survey 2025: Queen scallops

The long-term nature of this dataset enables quantitative stock assessment to be undertaken whilst the coarse-scale of the survey is suited to the assessment of trends at the scale of the whole territorial sea (TS). The key results and analysis from this survey are presented below.

The mean density (scallops per 100 m^2) of queen scallops from queen scallop dredges for all stations where queen scallops were present (i.e. over 0.45 scallops per 100m^2) is displayed in Figure 3. The survey site with the highest density is ST9 (west coast; 265 queen scallops per 100m^2).

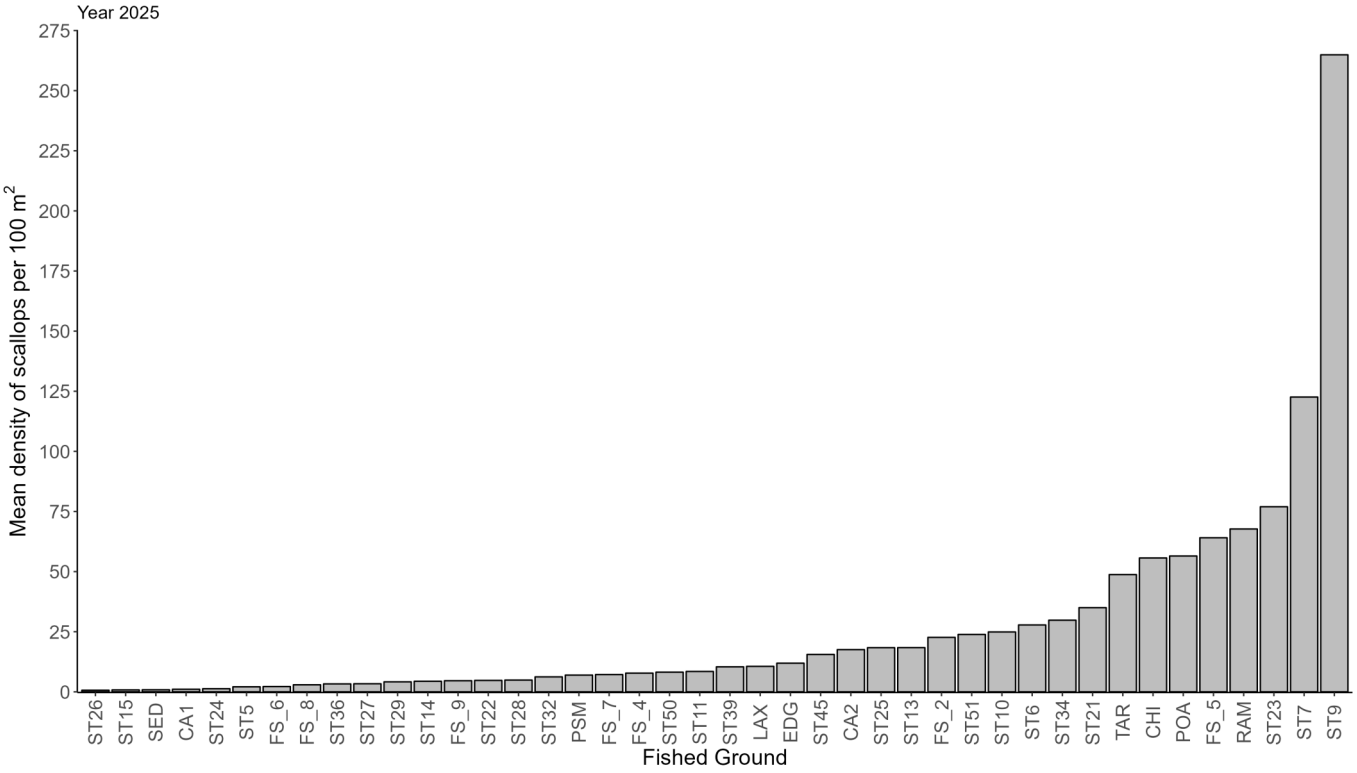


Figure 3 : *Average survey density (scallops per 100m^2) of queen Scallops from queen scallop dredges from all sites surveyed during the 2025 Prince Madog survey. For plotting purposes sites where QSC density was > 0.45 scallops per 100 m2 are not*

Stations that have been sampled over at least two years and at which queen scallops are present (3, 4, 5, 9, 10, 14, 17, 20, 21, 22, 23, 24, 25, 32, 35, 36, 38, 39 and 45), in addition to the standard historical queen scallop survey stations (CHI, EDG, LAX, POA, PSM, RAM, SED and TAR), were included in the 2025 stock assessment for Isle of Man territorial waters (Figure 4 and Figure 5).

The abundance index (derived from the survey data using the geometric mean of queen scallop densities) for recruits (scallops < 55 mm) is typically very variable but has been consistently low since 2011. The value for 2025 (160) was the highest recorded for recruits since 2005 and is above the long-term mean of 82 (Figure 4).

The abundance index for post-recruits (scallops ≥ 55 mm) had an increasing trend from 2007 to 2010, reaching the highest levels on record in 2010. From 2012 to 2019 there has been a declining trend in post-recruit abundance (slight increase observed in 2016). The value for 2025 (292), although still below the long-term mean (~377), is the highest recorded for post-recruits since 2013 (Figure 5).

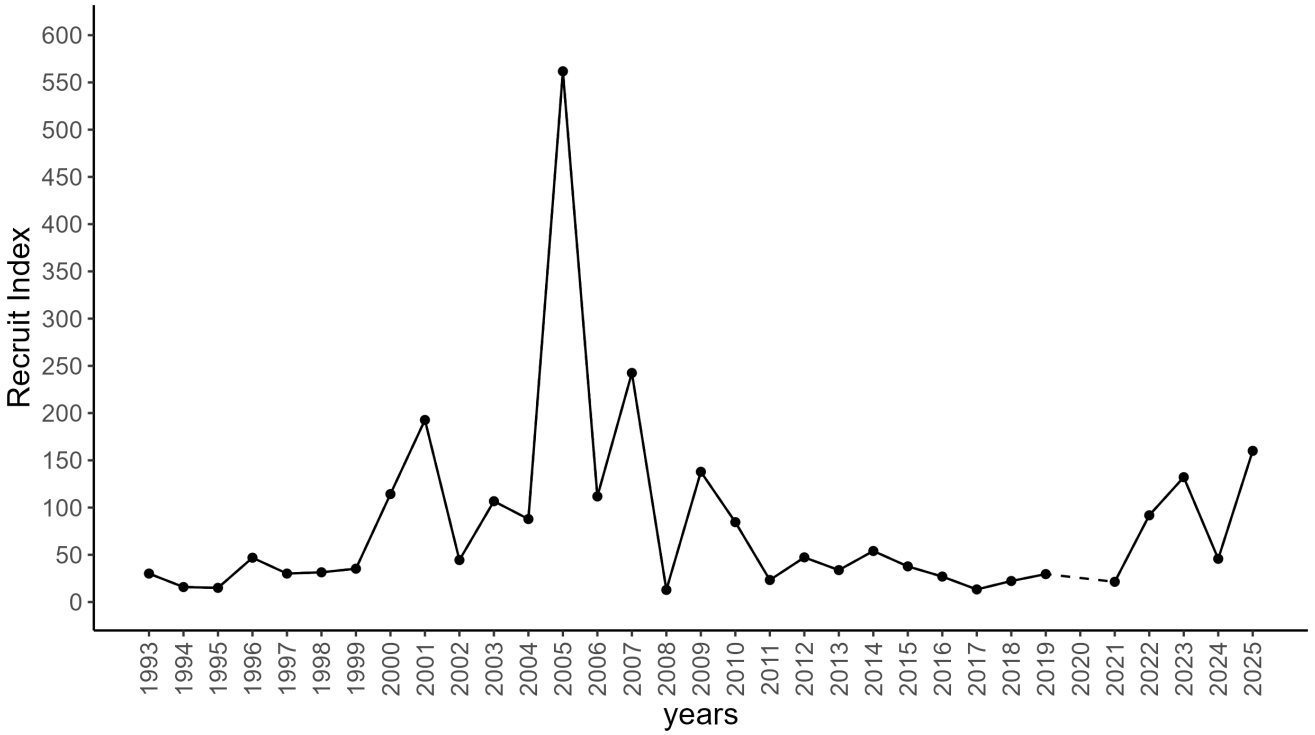


Figure 4: *Abundance index (based on geometric mean) for recruits (under 55 mm) used in the catch survey analysis model. This is calculated using data from only the stations used in the stock assessment model. In order to calculate the geometric mean 0.01 was added to each site in order to account for zero data values. Dashed line represents missing values. Note that in 2005 there were only three historic sites surveyed of which one (LAX) had a very high density of recruits recorded which is driving the spike in that year.*

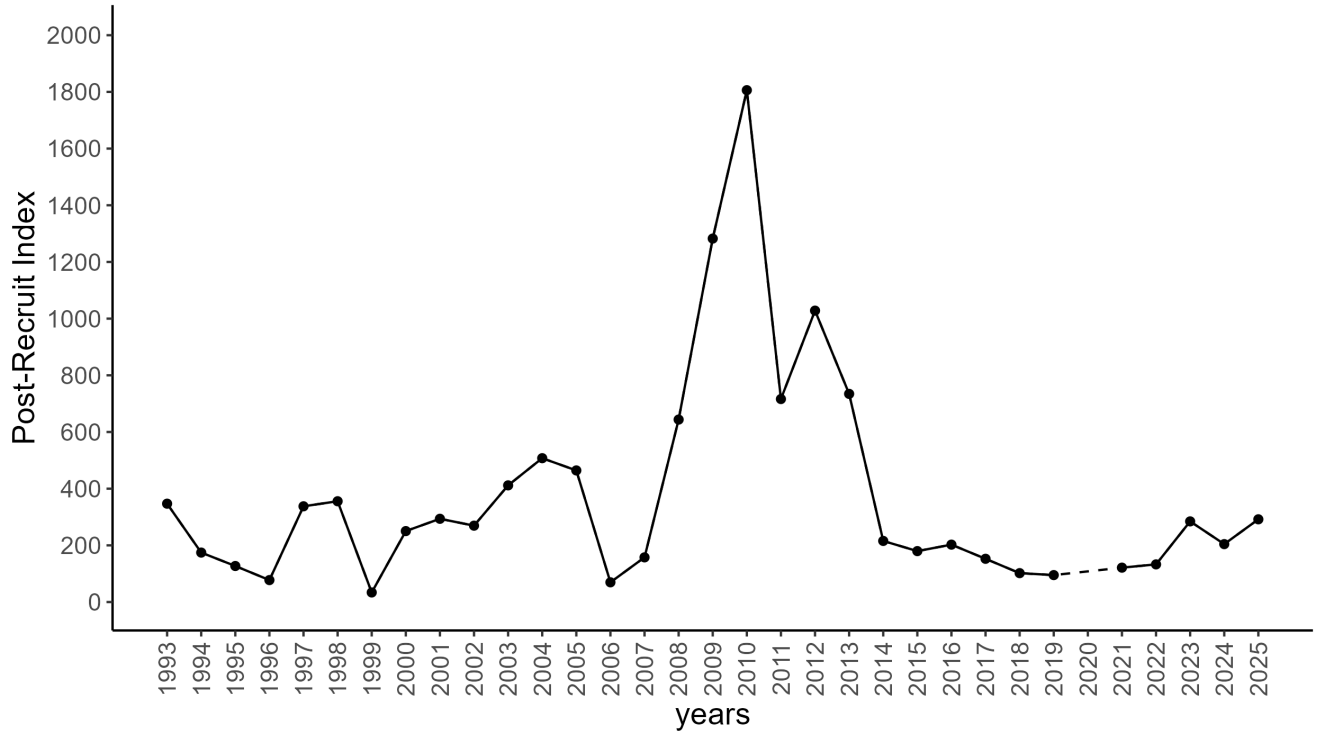


Figure 5: *Abundance index (based on geometric mean) for post-recruits (over 55 mm) used in the catch survey analysis model. This is calculated using data from only the stations used in the stock assessment model. In order to calculate the geometric mean 0.01 was added to each site in order to account for zero data values. Dashed line represents missing values.*

Long-term, coarse-scale Survey 2025: QSC - Continued

An annual assessment of the Isle of Man queen scallop stock has been undertaken since 2012 using the Catch-Survey Analysis (CSA) method, first developed by Collie and Sissenwine (1983). Further information on this method and the results from previous stock assessment are presented by Murray and Kaiser (2012a, 2012b), Murray (2013) and Bloor et al., (2014). Within the stock assessment unit (Isle of Man's territorial waters), the trend from the model output (Figure 6) indicates that following five years of increasing biomass (2006-2010), total biomass has decreased during each of the subsequent eight years (2011–2018) before slight annual increases in each of the last 7 years (2019 – 2025) (2025: median estimated biomass of 7853 t) Note, that there is a missing year of survey data for 2020 in the input data.

The management currently in place for queen scallops within the Isle of Man's territorial waters has included closing areas of high density juvenile scallops for on-growing which has created spatially discrete high density areas within several fishing grounds. The methods used for the stock assessment down-weights high density isolated patches of queen scallops when calculating the overall stock biomass. As such, assessing the stock at the territorial sea level may be less applicable for the current fine scale spatial management that is in place for queen scallops. Whilst the densities among general fishing grounds remains low and the model indicates only a slight increase in biomass, there are spatially discrete areas within grounds with exceptionally high densities of post-recruits. In this scenario data assessment and management at a fishing ground level may provide a better basis for on-going spatial management than assessment of the overall stock biomass.

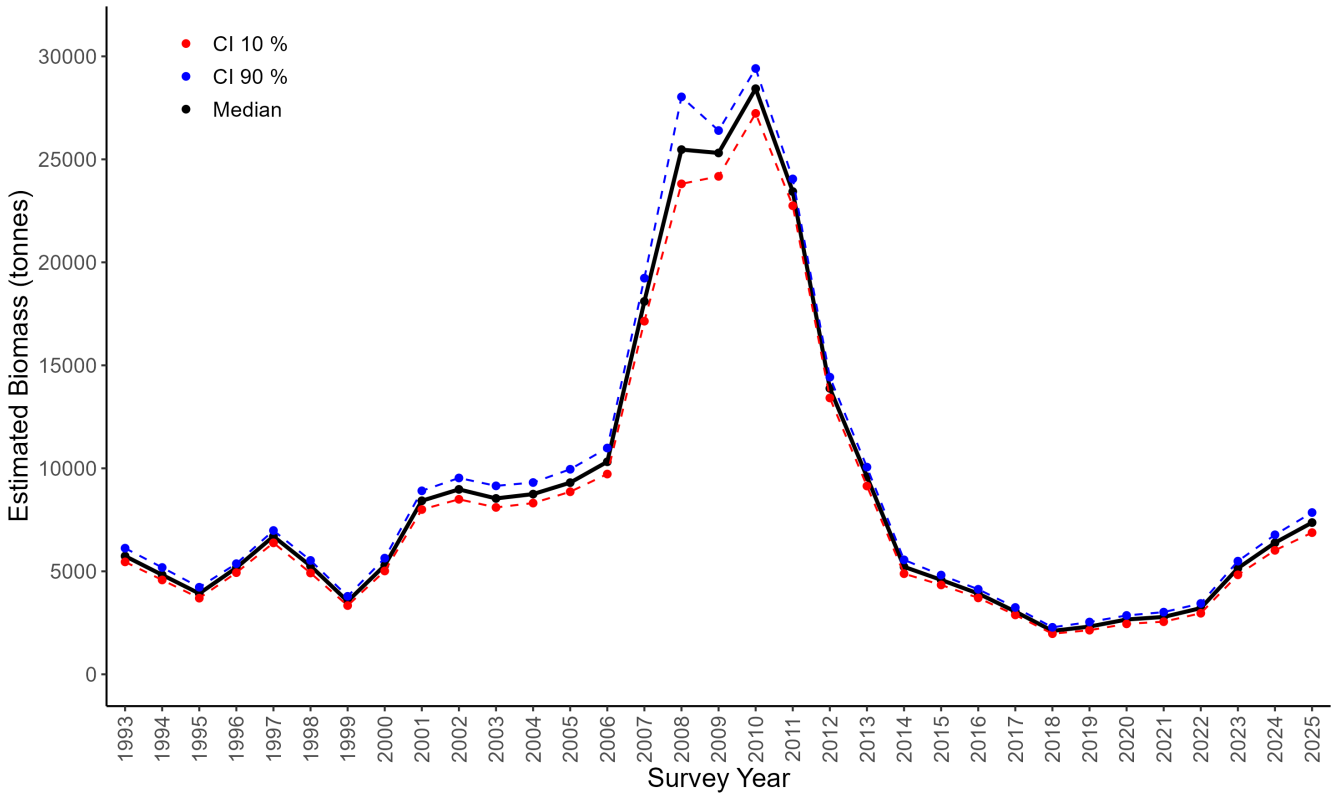


Figure 6: *Estimated biomass for the stock assessment unit (Isle of Man territorial waters) MCMC results*

The full report is also available on request from **i.bloor@bangor.ac.uk**

Bloor, I.S.M., Garratt, M. and Jenkins, S.R. (2025). Isle of Man Queen Scallop: 2025 Stock Survey Report . Bangor University Sustainable Fisheries and Aquaculture Group, Fisheries Report. pp. 41.

Short-term, fine-scale survey 2025: Queen scallops

The short-term nature of this dataset limits its use in quantitative stock assessment models at present. However, the fine-scale nature of the survey is suited to the assessment of trends at the scale of individual fishing grounds which is important given the sedentary and aggregating nature of queen scallops, which also have variable spatial and temporal recruitment patterns (i.e. high densities occurring in spatially discrete areas which vary in location and size temporally). The key results and analysis from this survey are presented below.

For recruits, the overall data for the TS (Figure 7) indicates that the majority of high densities are focused on the west coast in the Targets fishing ground, with smaller localised hotspots around the rest of the main fishing grounds.

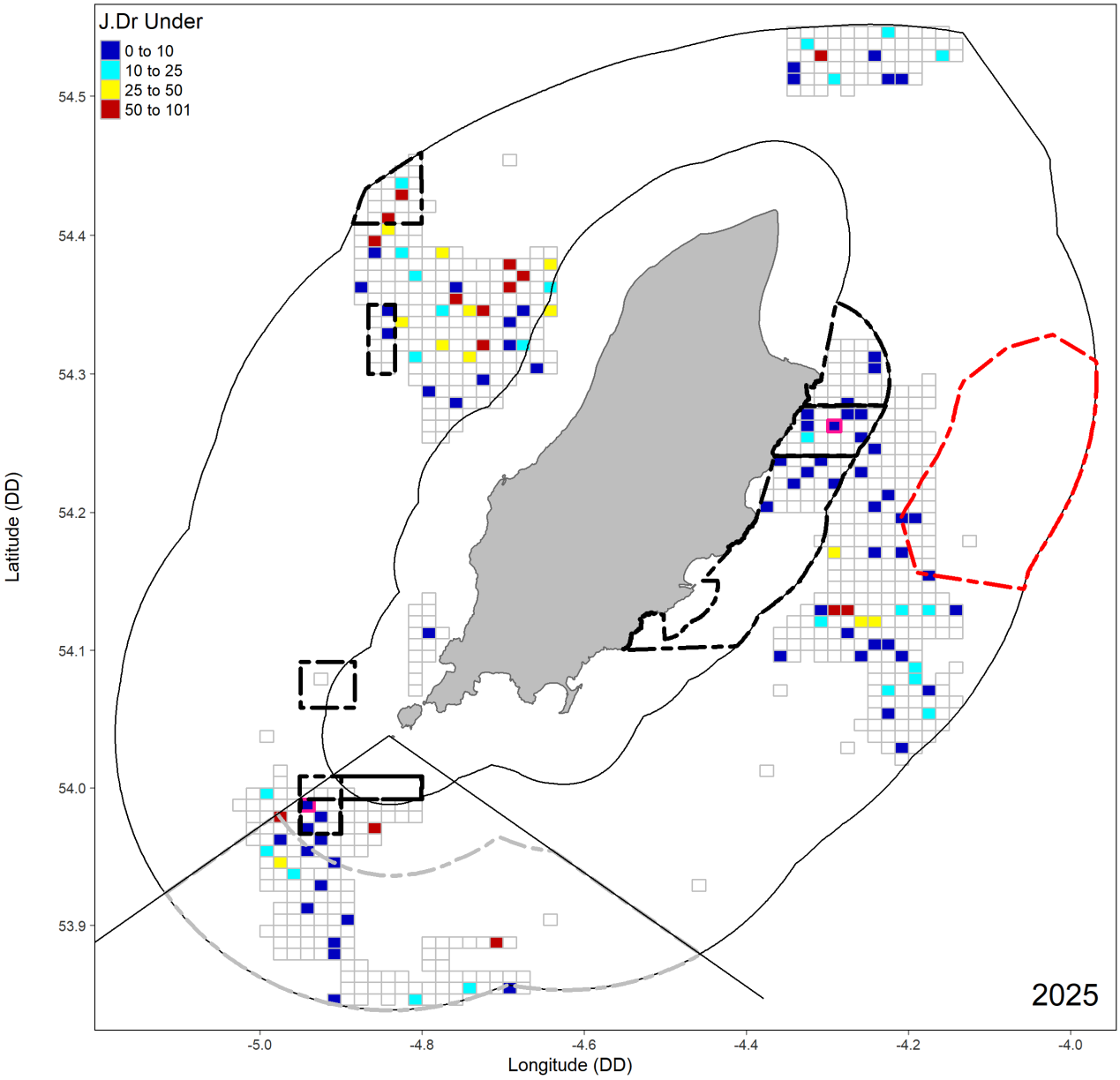


Figure 7: *Map illustrating the survey densities for queen scallops under MLS from juvenile dredges for 2025. The pink cell borders indicate cells that were part of an additional targeted survey and are not included in the main analysis. The black dashed boxes indicate closed or managed areas for the 2024 queen scallop fishery and the 2024/2025 king scallop fishery. The grey dashed line and solid black lines indicate the queen scallop dredge zone. The red dashed line indicates the area for lease for a proposed wind farm.*

Short-term, fine-scale survey 2025: Queen scallops - Cont.

For post-recruit scallops, the overall data for the TS (Figure 8) also indicates that the majority of higher densities are focused on the west coast in the Targets fishing ground, with smaller localised hotspots around the rest of the main fishing grounds.

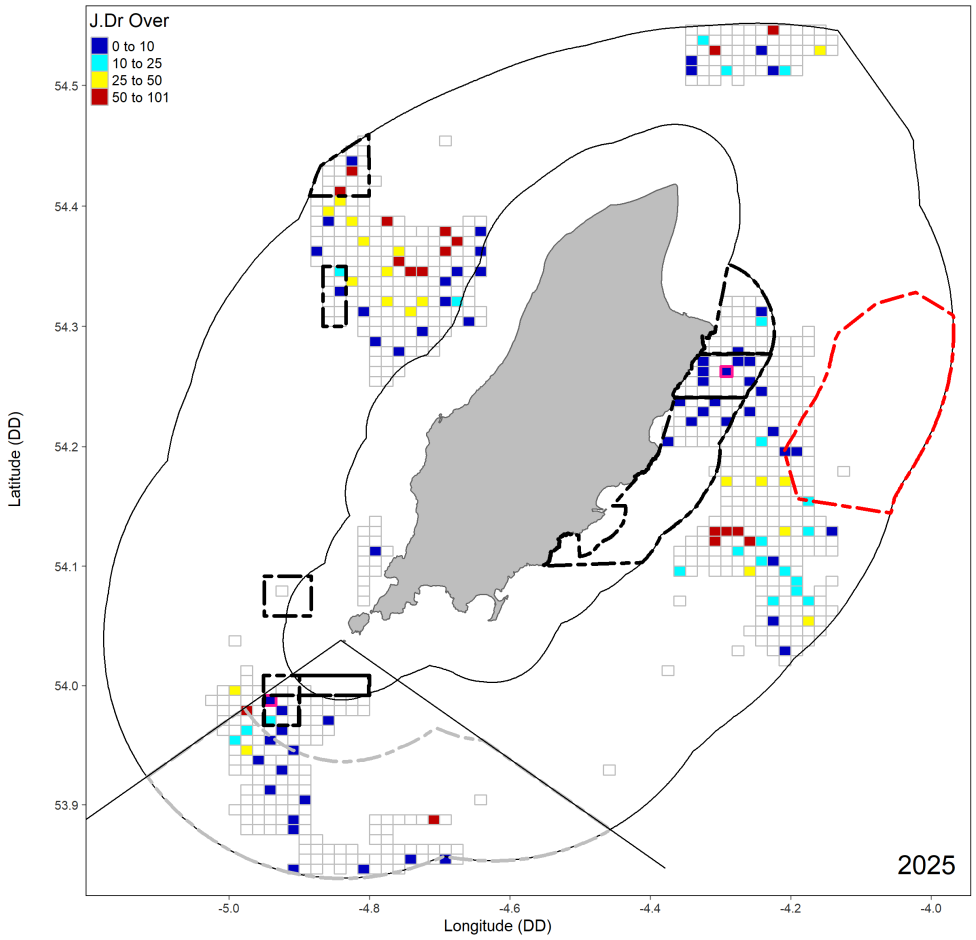


Figure 8: *Maps illustrating the survey densities for queen scallops over MLS from juvenile dredges 2025. The pink cell borders indicate cells that were part of an additional targeted survey and are not included in the main analysis. The black dashed boxes indicate closed or managed areas for the 2024 queen scallop fishery and the 2024/2025 king scallop fishery. The grey dashed line and solid black lines indicate the queen scallop dredge zone. The red dashed line indicates the area for lease for a proposed wind farm.*

The survey index (based on the geometric mean) indicates a significant increase for 2025 across all three categories (all sizes, over 55 mm and under 55 mm) and is the highest value for all three categories in the current time series (Table 1).

Table 1: Industry queen scallop survey index (based on the geometric mean) for all sizes of queen scallops and then split between over 55 mm and under 55 mm queen scallops.

Year	All Scallops	Over 55 mm	Under 55 mm
2019	4.74	2.45	0.62
2020	5.37	4.24	0.45
2021	1.66	1.51	0.11
2022	1.55	1.36	0.16
2023	1.51	1.18	0.36
2024	1.17	0.65	0.35
2025	15.9	6.55	5.59

Queen Scallop Surveys Summary 2025

The latest survey results indicated a continued increase in stock biomass such that following the ICES Category 3 approach for setting TACs for data limited stocks a 20% increase in fishing opportunities relative to last years landings is recommended (i.e. 1350 t).

Using the harvest rule proposed for sustainable fishing mortality as part of the MSC certification in 2011 (20% of the estimated post-recruit biomass) would give a biomass linked TAC for the 2025 fishing season of 1570 t, slightly higher than the ICES Category 3 approach.

As such, a TAC range of 1350 t (based on 20% increase on 2024 season landings) – 1570 t (which reflects a 20% Harvest Rate of estimated post-recruit biomass) has been calculated for the 2025 fishing season. It should be noted when setting a TAC at the territorial sea level this does not consider the spatial variability of fishing opportunities. The upper value of the TAC range should include any catches from the dredge fishery as it is based on estimated biomass for the entire territorial sea.

Recommendations for the management approach for the 2025 queen scallop fishing season were as follows:

- TAC of between 1350 – 1570 t
- Separate management for high-density hotspots should be considered (i.e. closure of high-density area of pre-recruits at Targets and Chickens for the 2025 fishing season; Figure 9).
- Regular monitoring and triggered reviews of all fishing areas throughout the fishing season in terms of LPUE thresholds and total catch.
- Development of a long-term management plan for queen scallops within the Isle of Man and wider Irish Sea (including development of future Harvest Control Rules and TAC calculations and the future of the dredge fishery).

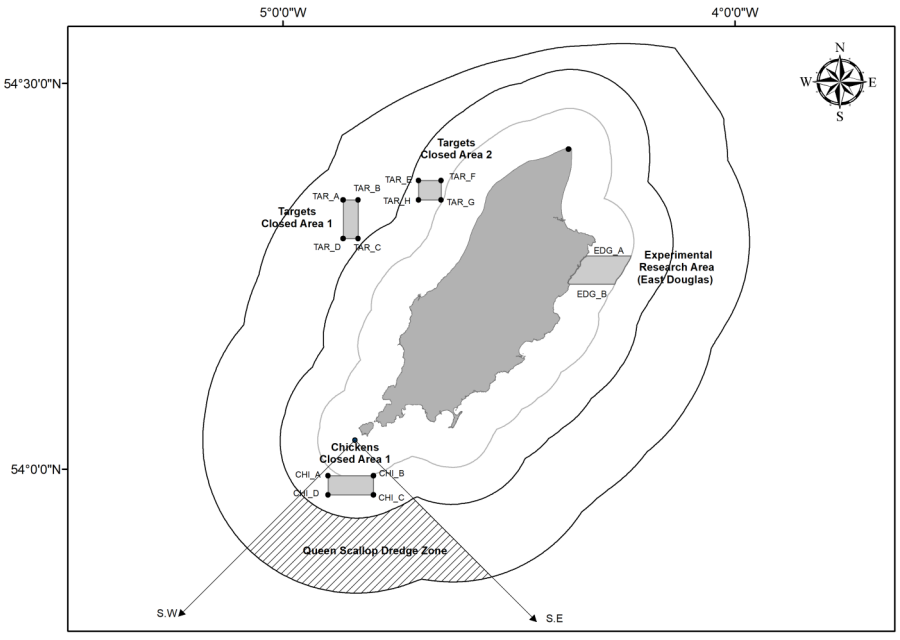


Figure 9: *Map showing closed areas for the 2025 queen scallop season.*

Queen Scallop Stock Advice Summary 2025

The 2025 Queen Scallop stock assessment for the Isle of Man territorial sea indicates a broadly positive outlook for the fishery, with both scientific and industry surveys showing increases in recruit (under 55 mm) and post-recruit (over 55 mm) indices compared to 2024. These findings suggest a potential improvement in stock status, particularly in key fishing grounds.

The **Targets ground** on the west coast continues to be the most productive area, contributing approximately 71% of total landings in 2024. Both surveys identified this ground as a hotspot for queen scallops, with high densities of both recruits and post-recruits, particularly around stations ST7 and ST9 (scientific survey) and survey cells 1638, 1710, 1782, 1851, 1926 1335 and 1190 in the industry survey. The industry survey also highlighted a relatively widespread recruitment event in this area, reinforcing its importance for future management considerations.

At **Chickens**, on the south coast, survey results were more mixed. While overall densities were low, one high-density cell was identified in the industry survey (survey cell 5942; the highest recorded density in the 2025 survey), and signs of recruitment were evident particularly in the 3nm area around survey cell 5203 and survey stations CHI and ST34. This suggests potential for recovery, though spatially targeted management may be required.

The **East of Douglas** ground showed relatively strong performance in 2025, with good levels of both recruits and post-recruits. Station 23 recorded the third highest density in the scientific survey, and the industry survey indicated relatively good recruitment in the southern part of the ground.

At **Point of Ayre**, although landings from 2024 were low, both surveys recorded good densities of recruits and post-recruits across the area. Given the small size of the ground, no specific closures were recommended.

The **stock assessment model** (CSA) estimated a total biomass of 7,853 tonnes in 2025, with 5,247 tonnes of post-recruits and 2,107 tonnes of recruits. This represents the highest recruit biomass since 2010 and suggests potential for further increases in fishable biomass in 2026 if managed appropriately.

Overall, the 2025 data continue to reinforce the importance of spatially explicit management. Spatial analysis from both the scientific and industry surveys highlights significant heterogeneity in stock distribution. While total biomass is increasing, the spatial variability in recruit and post-recruit indices suggest that a single TAC applied across the territorial sea may not adequately reflect localised stock dynamics. Continued use of fine-scale closures, particularly at Targets, and adaptive management based on real-time LPUE and survey data are recommended to ensure the long-term sustainability of the fishery.

Queen Scallop Trawl Fishery Update (2025)

A requirement of the queen scallop fishing licence in the Isle of Man is that Daily Catch Return forms (DCRs) are submitted through an electronic app by midnight on the day of fishing. This provides almost real-time fisheries dependent data for monitoring total allowable catches (TACs) and catch rates (i.e. landings per unit effort [LPUE]) and the ability to modify management at a fine spatial resolution within the fishing season.

The 2025 Isle of Man queen scallop trawl fishery, for which 30 vessels were licenced, had a TAC range of 1350 t (20% increase from 2024 harvest value) to 1570 t (20% of estimated post-recruit stock biomass). The trawl fishery opened on Monday 1st July 2025 and closed on 31st October 2025. An initial weekly catch limit (WCL) of 8520 kg per vessel per week was implemented for the general territorial sea with an additional initial exploratory catch at Point of Ayre (POA) of 2850 kg per week per vessel. In Week 4, for the general territorial sea, the WCL was increased to 11070 kg and additional 'exploratory' WCL for Point of Ayre was increased to 3720 kg (per vessel per week). Total reported landings for the trawl fishery during the 2025 fishing season were ~ 1049 t with 15 unique vessels reporting landings. Most landings for the 2025 season came from Targets (Table 2).

In 2025 0 t was landed from the Ramsey Bay permit only fishery which has its own total allowable catch.

For 2025/2026, only one of the two licenced dredge vessels indicated an intention to participate in the fishery. However, due to circumstances outside of the control of the fisheries department and fisheries legislation, it was not possible for this dredge vessel to prosecute the fishery during the 2025/2026 season.

Weekly mean landings per unit effort (LPUE), standardised to 35 kg bags per hour fished per 10 fathoms of net, are displayed for each of the main fishing grounds in Figure 10. Chickens (IS21: CHI) and Point of Ayre (IS6: POA) both recorded LPUE for the 2025 fishing season at the top range of historical values (Figure 10).

LPUE, standardised to 35 kg bags per hour fished per 10 fathoms of net, is displayed for each fishing season from 2014 to 2025 in Figure 11. The boxplot indicates that the median LPUE for the 2025 fishery was the 3rd highest in current time series (Figure 11).

Table 2: *Landings by ground for the 2025/2026 queen scallop fishery (trawl and dredge; 0 t landed from dredge fishery)*

Area	**Landings (t)**
IS9: Targets	862
IS21: Chickens	88
IS6: Point of Ayre	66
IS15: East Douglas	33

Queen Scallop Trawl Fishery Update (2025) - Continued

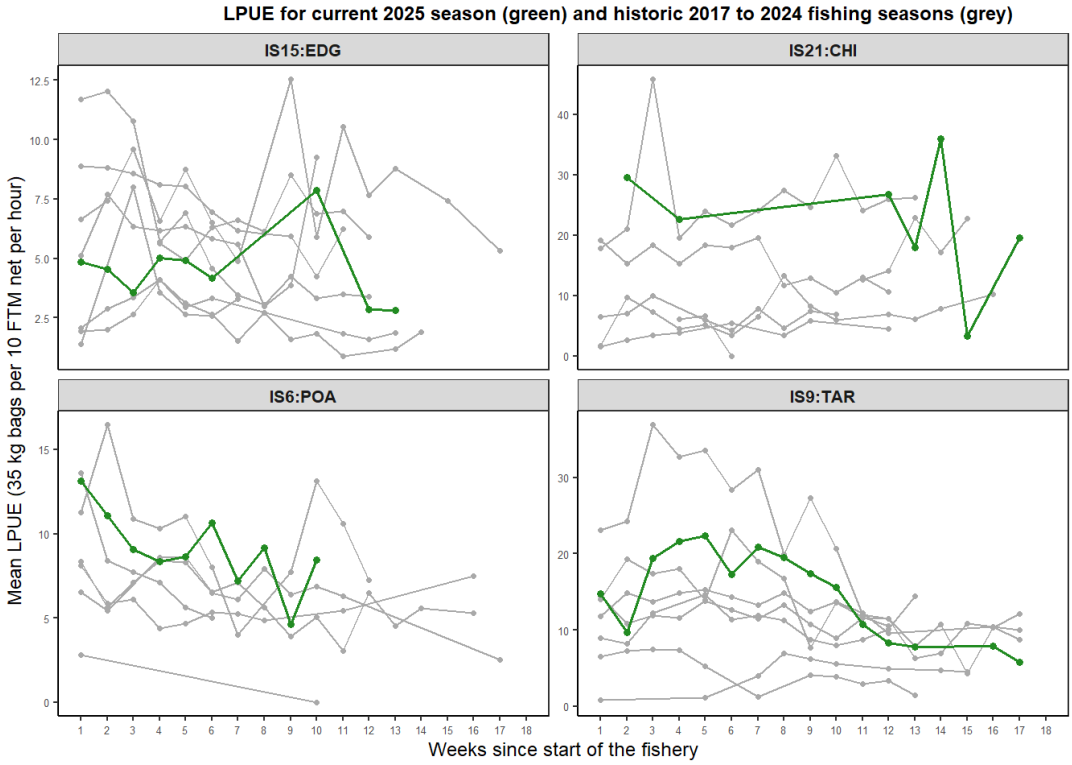


Figure 10: *Mean queen scallop trawl LPUE (35 kg bags per hour fished per 10 fathom of net) for the 2025 queen scallop trawl fishing season (green) compared with previous seasons (2017 to 2024; grey lines) displayed by week and main fished ground.*

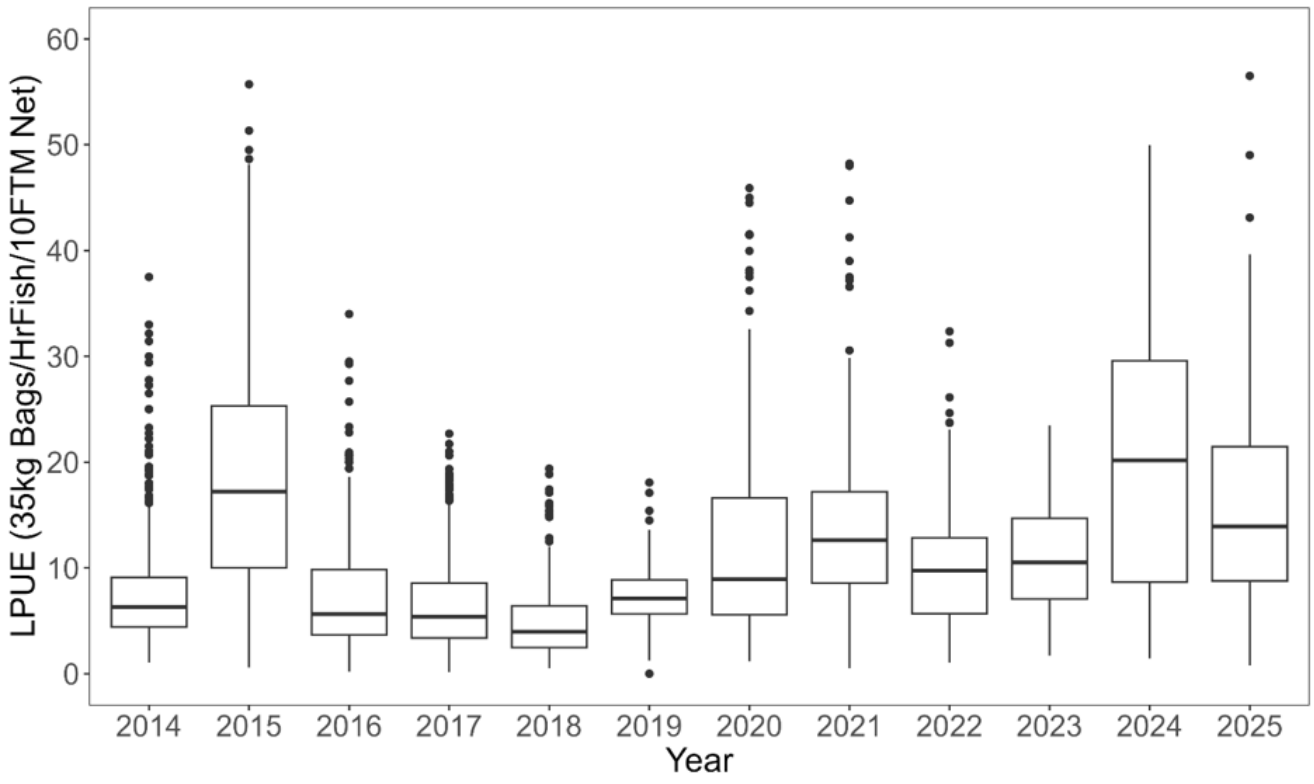


Figure 11: *A boxplot of queen scallop trawl LPUE (35 kg bags per hour fished per 10 fathom of net) for all vessel trips by fishing season from 2014 to 2025.*

Queen Scallop Dredge Fishery Update (2025)

The 2025/2026 dredge fishery, for which only one of the two licenced vessels indicated an intention to fish, was allocated a sub-TAC of 70 t. However, the vessel was unable to prosecute the fishery due to circumstances outside of the control of the Fisheries Department and Fisheries legislation.

Prior to 2021, LPUE for the dredge fishery had seen annual declines with the lowest value (based on a single trip) recorded in 2020. However, the LPUE for 2024 was significantly higher than the values at the start of the time series in 2017 (Figure 12). Due to lack of fishing in 2025 the LPUE data set for the dredge fishery cannot be updated at present.

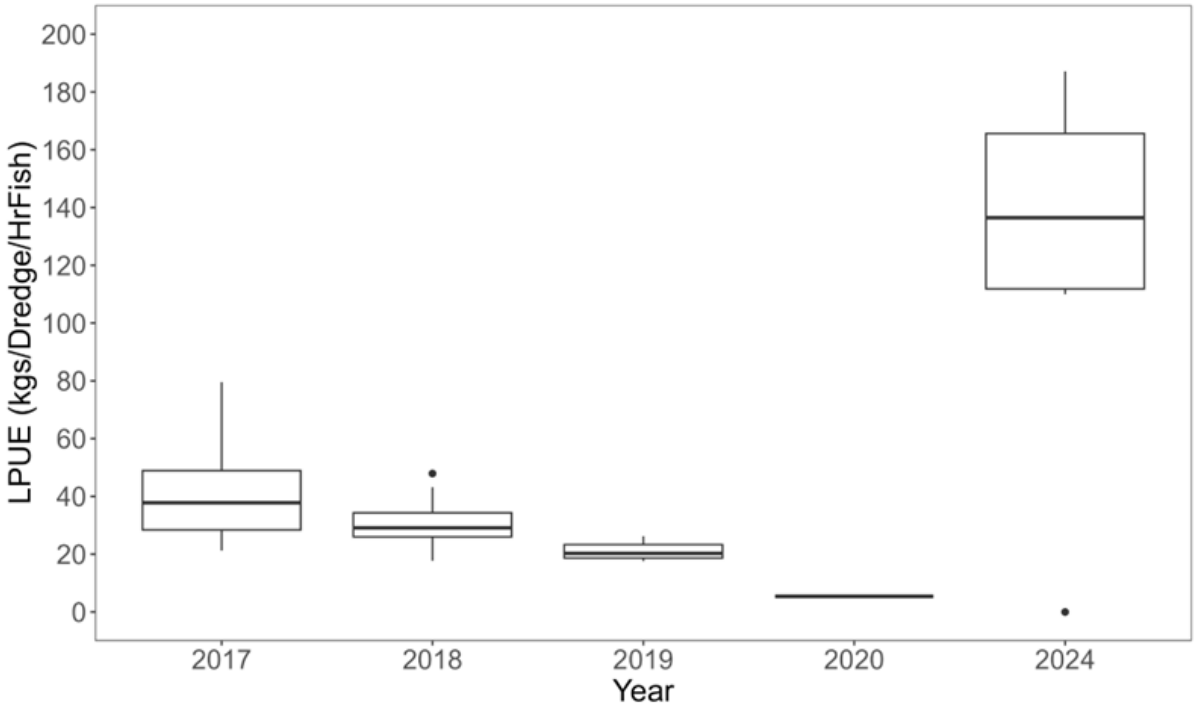


Figure 12: *LPUE standardised to kg per dredge per hour for dredge vessels participating in the Isle of Man queen scallop dredge fishery which occurs within the dredge box located within the CHI fishing ground from 2017 to 2025. Note no landings reported in 2021, 2022, 2023 or 2025) and the October 2024 fishery was delayed until March 2025 and prosecuted by a single vessel.*

Queen Scallop Research Priorities for 2026:

- Draft manuscript on ageing and growth analysis of queen scallops within ICES areas and the development of a standardised ageing protocol for queen scallops.
- Investigate the use of updated data limited approaches by ICES for the queen scallop stock and associated fisheries management.
- Draft manuscript assessing historic fisheries dependent and independent data on in-field depletion.
- Contribute data and analysis to the ICES Queen Scallop subgroup to collate regional information on stocks (ToR G – ICES WGScallop)

Review: King Scallop Fishery (2024/2025)

Electronic monitoring via the Nestforms App continues to be used in the king scallop fishery providing high resolution data. This allows near real-time monitoring and analysis of commercial data for this fishery. These analyses, which are provided on a weekly basis, enable the SMB and DEFA to respond rapidly to conditions in the fishery as they occur.

The fishery opened on Friday 1st November 2024 and closed on Saturday 31st May 2025. The total allowable catch (TAC) for the 2024/2025 Isle of Man king scallop fishery was 2352 t. This was a 20% increase on landings for the 2023/2024 fishing season. Total reported landings for the Isle of Man king scallop fishery during the 2024/2025 season were 2289 t (~ 17% increase from 2023/2024) with 44 unique vessels (no change from 2023/2024 season) reporting landings from 3117 fishing trips (~ 12% increase from 2023/2024). The total reported numbers of hours fished for the 2024/2025 fishing season was 20,298 hours (~ 3% decrease from 2023/2024).

Landings are reported below by IS Box, which represents the main fishing grounds (Figure 13). The principal fishing grounds are Targets (IS9), East Douglas (IS15), Bradda/Port St Mary (IS14), Chickens (IS21), Maughold (IS10) and Point of Ayre (IS6). The largest proportion of landings during the 2024/2025 fishing season came from IS9 (Targets; TAR), with IS15 (East Douglas; EDG) contributing the second-largest proportion. The fill colour of each bar represents landings by month, allowing temporal changes in the spatial distribution of landings throughout the season to be visualised.

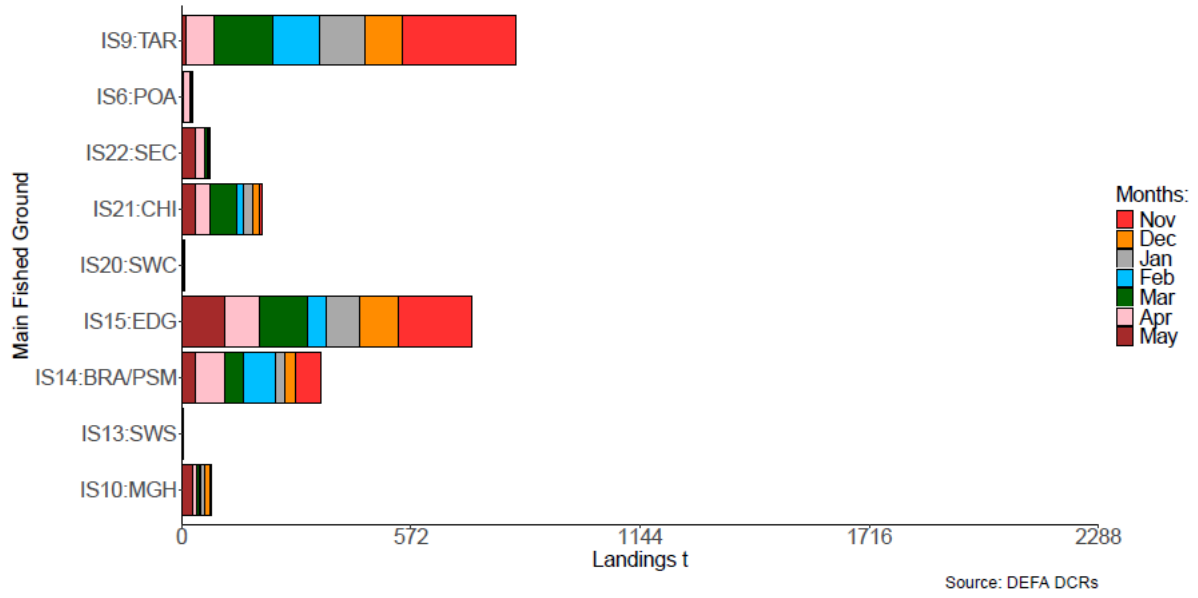


Figure 13: *King scallop landings (t) from Isle of Man territorial waters displayed by main fished ground and month for the 2024/2025*

The Daily Catch Limit (DCL) for the 2024/2025 Isle of Man king scallop dredge fishery within the 0 to 12 nm zone was set at 800 kg per vessel. This was increased to 900 kg from Thursday 5 December 2024 until the start of the Christmas break. When the fishery reopened on Saturday 4 January 2025, the DCL reverted to 800 kg per vessel. At the start of the fishing season (November 2024), approximately 90% of vessel trips met the DCL, landing around 700 kg or more per trip. By the end of the season (May 2025), this proportion had declined to approximately 70% of trips, a level that was typical for much of the season, reflecting the consistently high catch rates (LPUE) observed across the fishery.

The 2024/2025 average LPUE (kg per dredge-hour fished) for each of the main fishing grounds is shown in Figure 14 (green line), together with corresponding data from 2017/2018, 2018/2019, 2019/2020, 2020/2021, 2021/2022, 2022/2023 and 2023/2024 (grey lines), plotted by fishing week. Average LPUE during 2024/2025 was highest in the limited-permit fishery operating within the Ramsey Bay Fisheries Management Zone during December, where values ranged from approximately 20 to 35 kg/Dr/HrF. (N.B. A commercial survey was also conducted in Ramsey Bay towards the end of the season.) Across all other fishing grounds, LPUE generally ranged between approximately 5 and 20 kg/Dr/HrF during the 2024/2025 season

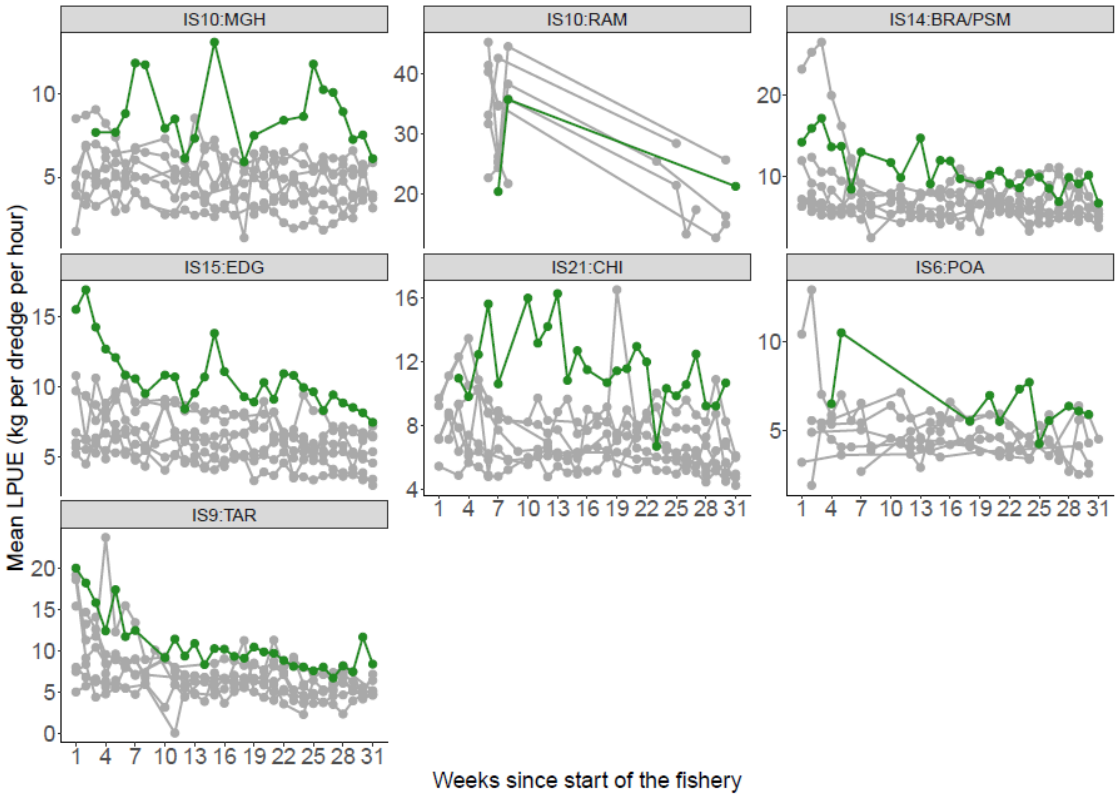


Figure 14: King scallop LPUE (kg per dredge per hour) for the 2024/2025 (green) and historic (grey) fishing seasons.

Research set aside scheme:

In 2022, the Department introduced a pilot scheme that allowed the industry to establish a Research Fund using "excess scallops". The fund is generated through the sale of excess scallops that vessels were previously required to discard in order to remain below the Daily Catch Limit (DCL). Processors receiving excess scallops from participating vessels pay the landed value of these scallops into the industry research fund. Landings of excess scallops count towards the fishery Total Allowable Catch (TAC) and are capped at 30 t.

For the 2024/2025 season, the scheme was open to all licensed vessels, although both vessels and processors were required to sign up jointly and obtain a permit issued by the Department. The scheme is currently being used to support the MFPO's high-resolution scallop surveys.

During the 2024/2025 fishing season, approximately 22 t of king scallops were landed through the scheme, contributing to the research fund. This represented an increase of approximately 5 t compared with the 2023/2024 fishing season.

Long-term, Coarse-Scale Survey 2025: King scallops

As for queen scallops, the results for king scallops from the long-term, coarse-scale survey enable territorial sea trends to be assessed and the long-term nature of the data means that they are sufficient for undertaking stock assessments. The average survey density of king scallops (of all sizes caught) per 100 m^2 around the Isle of Man for the 2025 survey is displayed in Figure 15 for all survey stations where the density is greater than 0.25 scallops per 100 m^2. In 2025 the highest density station ST33 (~ 18 king scallops per 100 m^2) is on the southwest coast (Figure 15).

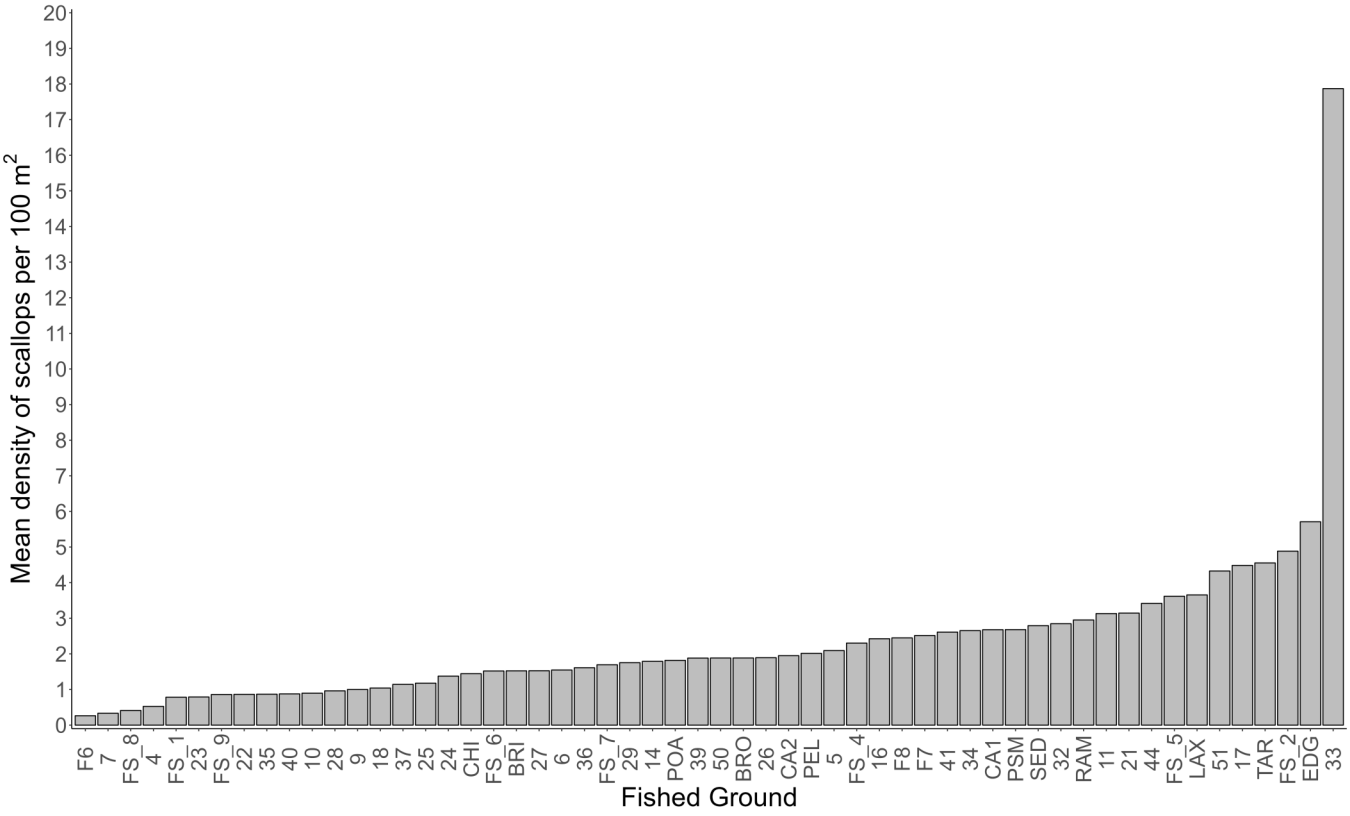


Figure 15: *Survey densities (king scallops per 100 m2) displayed by survey station for spring 2025 survey (average of queen scallop dredge data). Only sites with densities ≥ 0.25 king scallops per 100 m^2 are displayed.*

Overall stock trends for recruits can be observed using the recruit abundance index calculated using the geometric mean (solid line; Figure 16). The recruit index (geometric mean) had previously peaked in 2014 (66) with subsequent year on year reductions until it reached a time-series low in 2018 (6). From 2019 to 2022 there were annual increases in the abundance of recruits for the first time since 2014 followed by a slight decline in 2023 (solid line; Figure 16). The recruit abundance in 2024 was the highest value recorded in the 33-year time series (91) although it has declined again in 2025 (52), it remains high relative to the overall time-series. This is a positive sign for the fishery over the next 1 or 2 years as these small scallops will hopefully grow and recruit into the fishery increasing the harvestable quantity of stock.

The recruit abundance index calculated using the arithmetic mean (dashed line; Figure 16), which does not down -weight isolated high-density patches of scallops, can be useful to identify cyclical spatially specific recruitment events. Whilst the use of this index for stock assessment would cause an over-estimation of stock abundance it is useful for observing spatially specific recruitment events which may need to be managed independent of the remaining stock. This index shows peaks in 2007/2008 and in 2015 which tally with large recruitment events at both Chickens (south coast) and Targets (west coast). Both recruitment events supported high density fisheries of post-recruits on the west coast of the Island in the subsequent year (i.e. November 2009 and November 2016).

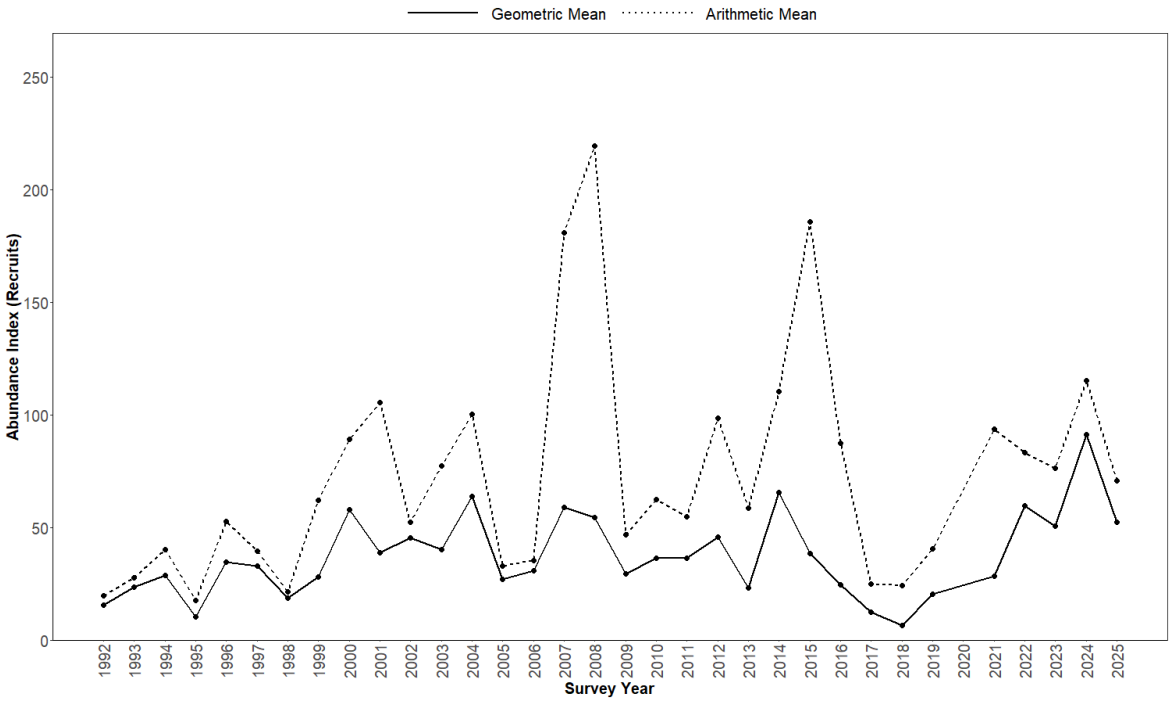


Figure 16: *Recruit abundance index (scallops < 95 mm). Calculated based on length-based data where recruits were categorised as scallops under 95 mm at the time of the spring survey (generally April) which would typically be considered too small to grow into the fishery by 31st May (i.e. final day of the following season). The index is displayed using calculation of both the Geometric mean (solid line) for general stock trends and the Arithmetic mean (dashed line) for spatially specific cyclical recruitment events.*

Overall stock trends for post recruits can be observed using the abundance index calculated using the geometric mean (solid line; Figure 17) which shows a general increasing trend in the mean abundance of post recruits (scallops ≥ 95 mm) from 1992 to 2015 (2015 is the 2nd highest value (186) in the time series). This was followed by four years of decreasing values before increasing again in 2021, 2023 and 2024 (slight decrease in 2022). Post-recruit abundance in 2024 was the highest value recorded in the 33-year time series (206), whilst the index has decreased again in 2025 it is still the third highest value in the time series (178).

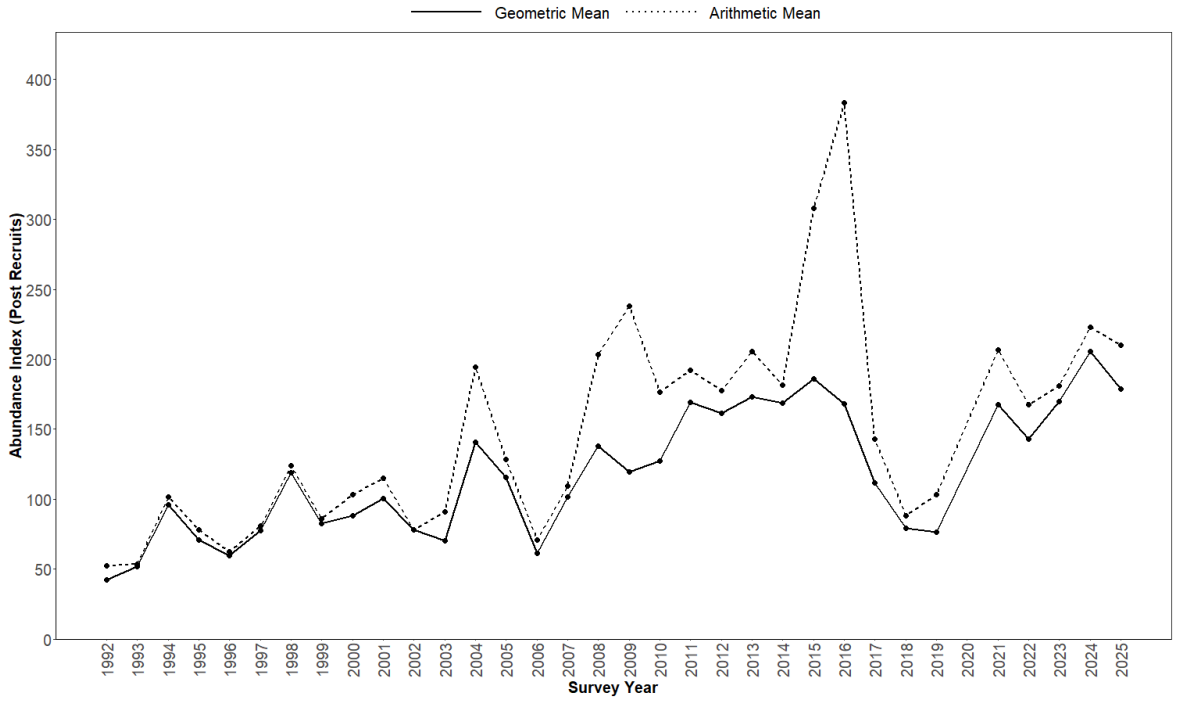


Figure 17: *Post recruit abundance index (scallops ≥ 95 mm). Calculated based on length-based data where post recruits were categorised as scallops 95 mm or above at the time of the spring survey (generally April) which would typically be considered too small to grow into the fishery by 31st May (i.e. final day of the current season). The index is displayed using calculation of both the Geometric mean (solid line) for general stock trends and the Arithmetic mean (dashed line) for spatially specific cyclical recruitment events.*

Short-term, fine-scale survey 2025: King scallops

The standardised index produced for the whole TS using the sdmTMB model indicates relative stability in biomass over the period 2020-2022 followed by a year-on-year increase to 2025 which shows the highest value in the seven-year time series (Figure 18).

High densities identified in the surveys were not confined to a small subset of grounds, but occurred across a range of fishing grounds (Figure 19). The survey showed strong results, with record-high post-recruit densities at all grounds except Maughold (MGH), and increased recruit densities at most grounds, notably Chickens (CHI), East of Douglas (EDG), Bradda (BRA) and East Coast (ECO) High density areas identified in the surveys were not isolated to a few grounds but spread across most fishing grounds within the Isle of Man territorial waters. The industry survey recorded peak densities for post-recruits (> 15.0 scallops per 100 m^2) at six survey cells within EDG, BRA and CHI and for recruits (> 10.0 scallops per 100 m^2) at six survey cells at CHI.

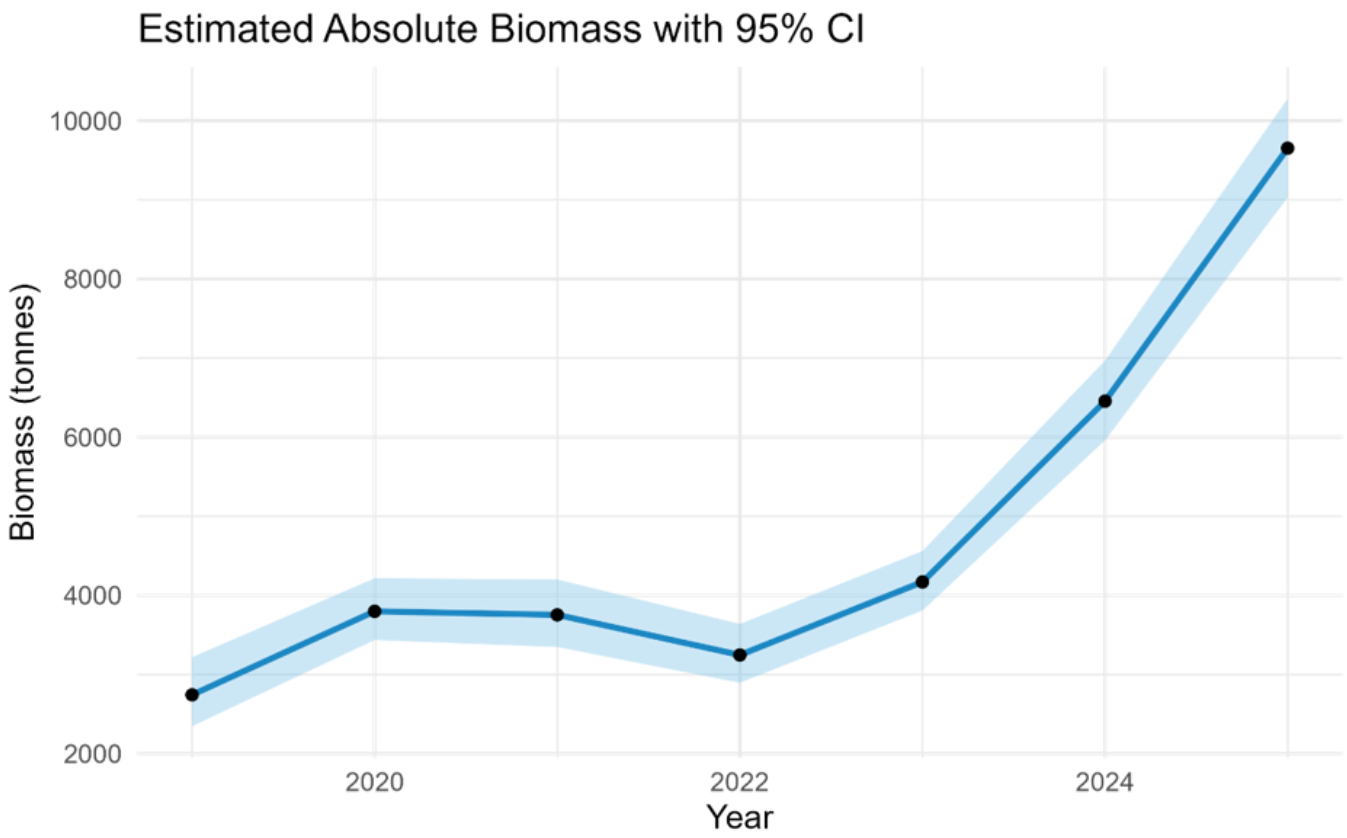


Figure 18: *Standardised survey index for king scallops within Isle of Man Territorial Waters (2019 – 2025). Black line indicates the mean values, and the grey shaded areas indicate the upper and lower boundaries. Using data from standard queen scallop dredges only (scallops of all sizes).*

The full report is available on request from **i.bloor@bangor.ac.uk**

Bloor, I.S.M., Coleman, M. and Jenkins, S.R. (2025). Isle of Man King Scallop 2025 Stock Survey Report. Bangor University Sustainable Fisheries and Aquaculture Group, Fisheries Report pp. 56.

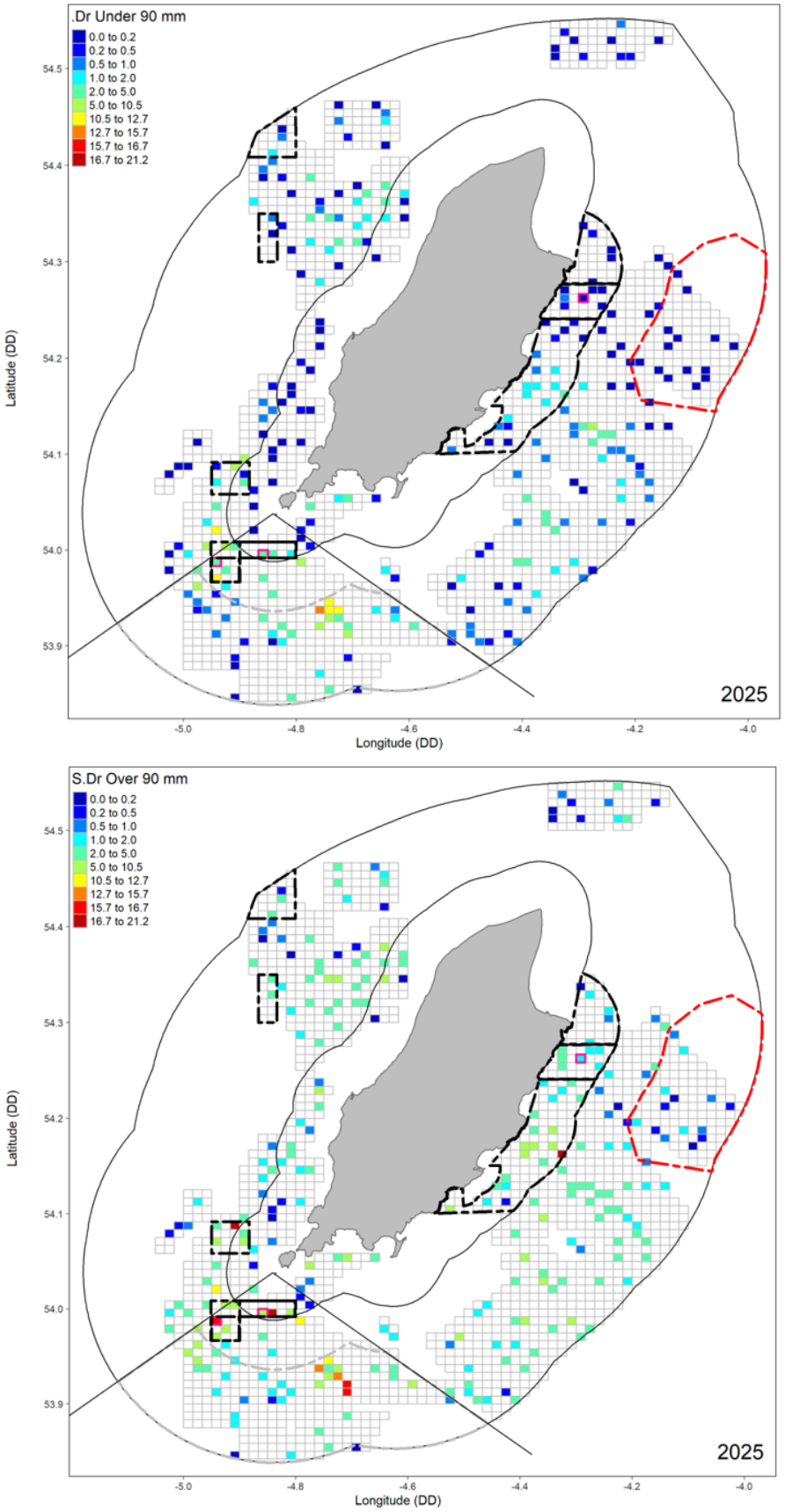


Figure 19: *Maps illustrating the survey densities (scallops per 100 m^2) for king scallops under 95 mm (top) and over 95 mm (bottom) from standard king and standard scallop dredges for 2025. Black dashed boxes indicate closed or restricted access areas during the 2024/2025 king scallop fishing season, grey dashed line indicates the queen scallop dredge zone, and the red dashed line indicates the area for lease for the proposed Mooir Vannin offshore windfarm. Black solid line box indicates the East of Douglas Experimental Research Area. Pink cell borders indicate cells that were targeted during the survey.*

King Scallop Stock Advice (2025/2026)

The advice below was provided by Bangor University to the Scallop Management Board (SMB) for consideration for management of the 2025/2026 king scallop fishing season.

Summary of survey findings

Survey data from both the Prince Madog and Industry surveys indicate a continued positive trend in king scallop abundance within Isle of Man territorial waters. In summary, across both surveys, densities of both king scallop post-recruits and recruits are indicating good densities spread around the main fishing grounds. This indicates a positive outlook for the current and future fishery seasons if the current stock continues to be well managed. In addition, LPUE remained high across all the main scallop fishing grounds at the end of the 2024/2025 fishing season

Recommendations

It was recommended that the management approach for 2025/2026 king scallop fishery continued to be precautionary and that it should incorporate all of the following three elements:

- **In-season reviews:** Monthly reviews of the fishery by the SMB or a subgroup for the entire TS fishery should be scheduled as standard.

- **Spatial monitoring and management:** Spatial monitoring for each individual ground should be undertaken as part of the in-season review to allow flexible spatial management (i.e. individual grounds to be opened or closed) based on the real-time data collected by the fishery. High-density areas within a ground may require additional fine scale management to avoid high fishing intensities leading to excessive fishing mortality and habitat damage.

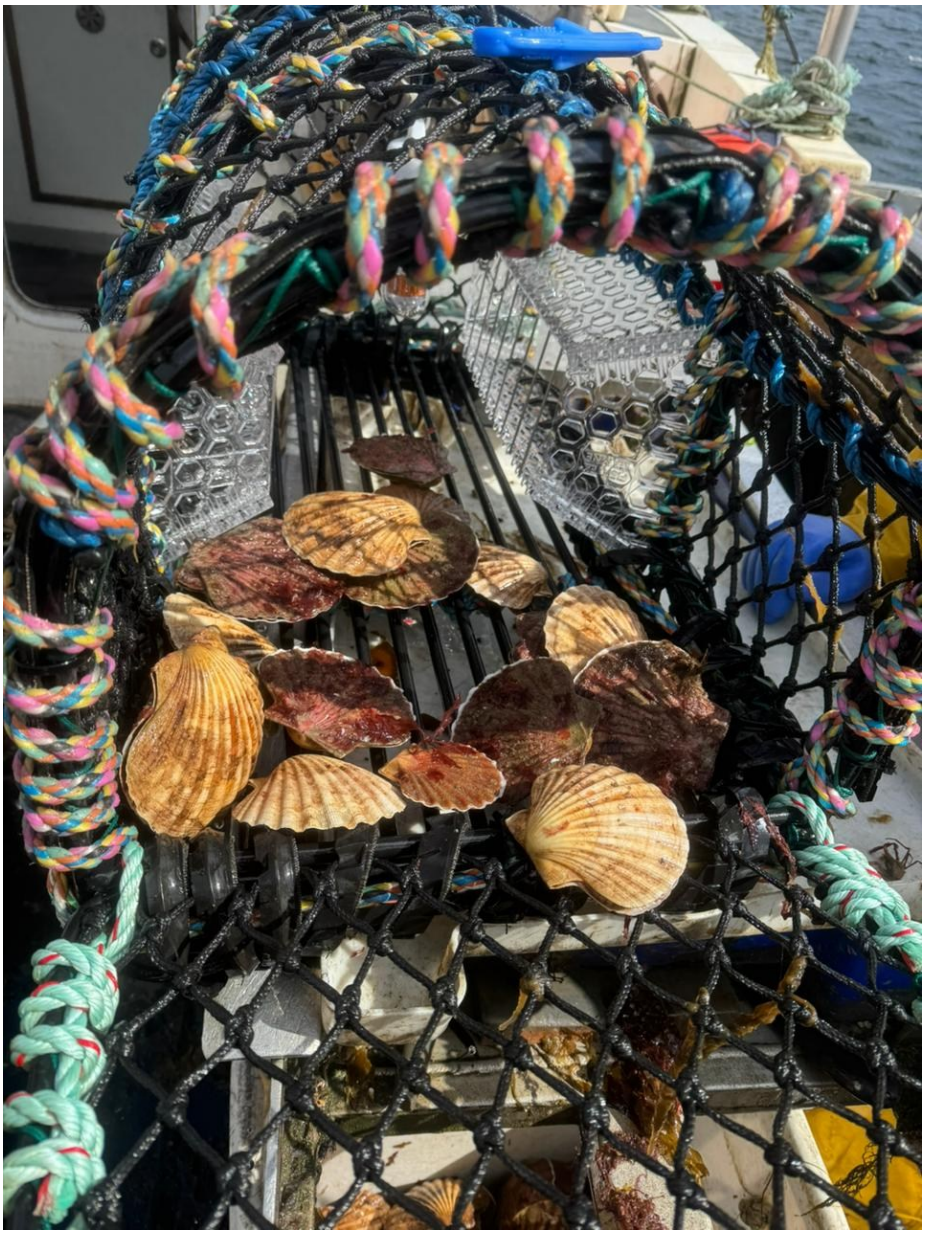
- **Closed area management:** The continued management of restricted areas and current/new closed areas is required to protect high density areas of post-recruits and recruits (king and queen scallops).

General recommendations for the 2025/2026 king scallop fishery based on the survey data analysis produced here therefore include:

- Maintain a precautionary management strategy, aligned with the long-term management plan (LTMP), promoting continued stock resilience and sustainable exploitation.
- Set an initial starting TAC of 2785 t, reflecting a 20% increase from 2024/2025 landings, in line with the ICES Category 3 approach for data limited stocks.
- Protect high-density areas of recruits and/or post-recruits, particularly within CHI, through temporary closures or restricted access areas (the exact locations of these closures will be discussed at the SMB meeting).
- Weekly in-season review of the TAC and fishery dependent data by the SMB subgroup, including monitoring of LPUE and swept area to prevent overexploitation of spatially discrete aggregations.

King Scallop Research Priorities for 2026:

- Development of a stock synthesis (SS3) stock assessment for Isle of Man king scallops.
- Review of Short-Term objectives for king scallop Long term management plan
- Progress stock assessment model development for the Isle of Man and the wider Irish Sea with collaboration with ICES colleagues as part of WGScallop.
- Progress towards Marine Stewardship Council pre-assessment
- Research into catch efficiency and commercial viability of scallop potting



ICES Working Group on Scallop Stock Assessment

7TH – 9TH OCTOBER 2025, HYBRID, EDINBURGH, SCOTLAND

The ICES Scallop Assessment Working Group (WGScallop) was attended in person by Dr Isobel Bloor. The Working Group discusses scallop surveys, stock assessment methodologies, advances in technology, scallop aging procedures, and recent studies on scallop species to develop and improve stock assessment methods. A summary of the work from the 2025 meeting is below:

This year, WGScallop made significant progress in improving the quality and consistency of scallop fisheries data, while continuing work to strengthen stock assessments for both king and queen scallops. Efforts focused on addressing differences between data sources and refining analytical approaches used to support management advice.

Collaboration remained a key strength of the group, with survey exchanges, methodological comparisons, and intersessional meetings helping to advance the development and testing of assessment models. These activities have improved knowledge sharing and strengthened links between participating countries.

The group also expanded its focus on emerging environmental challenges, including the potential effects of offshore wind farm development on scallop fisheries. Work began on mapping renewable energy developments in relation to fishing activity, alongside plans for a dedicated multidisciplinary survey in the Irish Sea.

New research on larval dispersal and population genetics provided valuable insights into scallop stock connectivity and highlighted the potential for these tools to inform future stock boundary definitions. Collaboration with SIMWG will continue to support this work.

Chairs: Dr Isobel Bloor and Dr Adam Delargy

The 2025 WGScallop Report is available as below:

ICES. 2025. Scallop Assessment Working Group (WGSCALLOP; outputs from 2025 meeting).

ICES Scientific Reports. 8:5. 113 pp. https://doi.org/10.17895/ices.pub.31149055

Trace Element Analysis of the calcareous hinge plate in *Aequipecten opercularis*

Our work on methods to age queen scallops continued throughout 2025. Unlike king scallops, queens lack the very obvious yearly growth lines used for aging. Previous work by Maya Harries in 2024 had explored use of the internal calcareous hinge plate structure located beneath the hinge ligament. Visual examination of the hinge plate following careful removal revealed numerous dark bands and associated notches that appeared to represent periodic growth interruptions. However, because the annual nature of these features could not be confirmed by visual observations alone, trace element analysis was incorporated in 2025 as an independent means of validation.

Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICP-MS) was applied to cross-sections of the hinge plate from 33 scallops covering a broad size range (22.8–75.1 mm shell height). Concentrations of six elements (Ca, Mg, Sr, Li, Ba and Na) were mapped across the hinge structure. Of these, strontium (Sr) exhibited the clearest and most consistent banding patterns. Distinct zones of elevated Sr concentration were identified throughout the hinge plate, particularly in the juvenile and mid-growth regions.

To investigate whether these chemical signatures corresponded with putative annual growth marks, Sr concentration profiles were extracted along the hinge growth axis and compared directly with visual growth features (Figure 20). While complete agreement between all visually observed bands and Sr peaks was not observed, a notable relationship emerged between Sr peaks and the notch-associated bands. Across all samples, approximately 61% of growth notches coincided with a corresponding Sr peak, compared with only 37% of visually identified dark bands. Furthermore, 36% of individual scallops showed complete agreement between all predicted notch ages and Sr peaks.

These findings suggest that strontium incorporation reflects periodic changes in shell formation and provides partial independent support for the interpretation of notch-associated hinge marks as annual growth features. Although Sr peaks alone did not provide a reliable ageing method, the trace element analysis strengthened confidence in the notch-based visual ageing approach. Consequently, the combined evidence indicates that hinge plate notches represent the most promising ageing feature identified in this study and warrant further validation through future work involving known-age individuals or mark–recapture experiments.

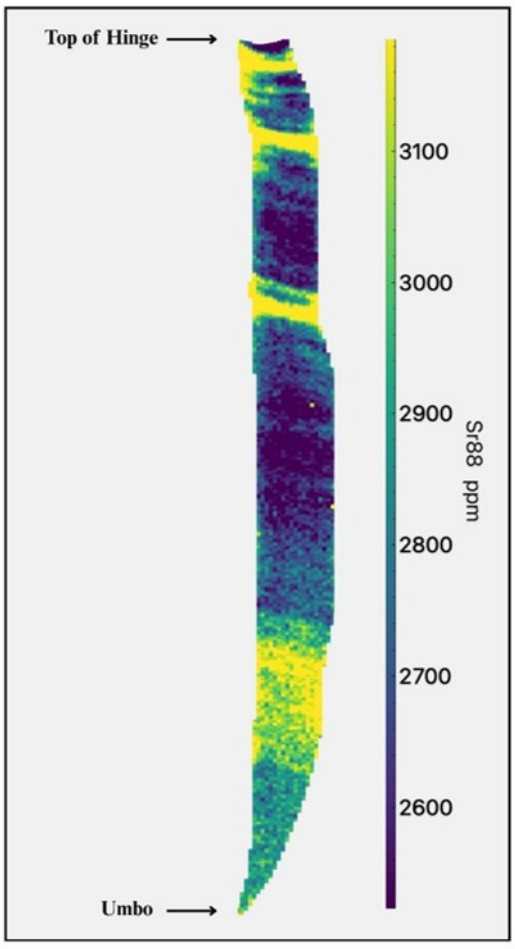


Figure 20: *Strontium heat map of A. opercularis hinge plate through a medial dissection of the structure. Valve height 69.1 mm. Strontium estimated age 4 years which corresponds to the four bands of highest concentration.*

MSc: Investigating the potential of illuminated scallop pots

Student: Nathan Poll

Supervisors: Isobel Bloor, Matthew Garratt and Stuart Jenkins

Scallop potting has emerged as a promising innovation in scallop fisheries. Previous proof-of-concept studies have shown that king scallops can be attracted to modified crab/lobster pots using LED lights. Since this work, 'scallop pots', essentially crustacean pots modified to include an entrance door and an LED light, have been marketed and a number of fishers around the UK adopted the approach. Despite moderate uptake, little targeted research has addressed key questions : what determines catch rates, when does the method work best, and under what conditions might it become commercially viable?

To address these questions, we undertook the first large-scale field study of illuminated scallop pots in the Port Erin Marine Nature Reserve. The reserve which was closed to mobile gear in 1989 and now supports naturally high scallop densities, providing an ideal natural laboratory for testing how catch rates respond to differences in stock abundance and environmental conditions.

Before fishing trials, we conducted detailed seabed surveys using a video sledge to capture underwater video and still imagery (Figure 21) so we could map habitats and quantify scallop density across the reserve. This revealed high scallop densities which critically varied significantly, allowing patches of different densities to be identified. We deployed 400 illuminated pots at 20 sites spanning a broad scallop density gradient during both summer and winter.

In total, the trials caught 1,784 king scallops. Our results demonstrated that catch rates were directly related to seabed density; higher densities led to higher catch rates. Overall, across both seasons catch rates increased by around 3% for every additional scallop per 100 m^2 on the seabed. However, catch rates differed significantly between seasons, with winter catch rates on average 5.5 times higher than those recorded during summer (Figure 22). We also found that catch rates were highest during periods of low lunar illumination. The size distribution of captured scallops appeared to match the size distribution of scallops on the seabed. In the case of the surveyed location, the vast majority of scallops are over the minimum landing size, reflected in almost 90% of captured scallops being > MLS.

These findings provide valuable insight into the behaviour underpinning scallop potting. Winter water temperatures might be expected to lessen the potential of scallops to swim toward lit pots, however the opposite was true. This, combined with the finding that catch rates were higher when lunar illumination was low, suggest that the contrast of LED lights against the ambient light environment is critical for catch success.

Our results give an indication of the natural scallop densities required to achieve commercially viable catch rates and show clearly that this fishing approach will depend on targeting areas of relatively high scallop densities. Our work has provided the first steps in scientific evidence needed to guide future development of this novel fishery.

Figure 21: Towed video sledge system, a screen shot from the GoPro video used to determine scallop seabed density and still image used to determine habitat type.

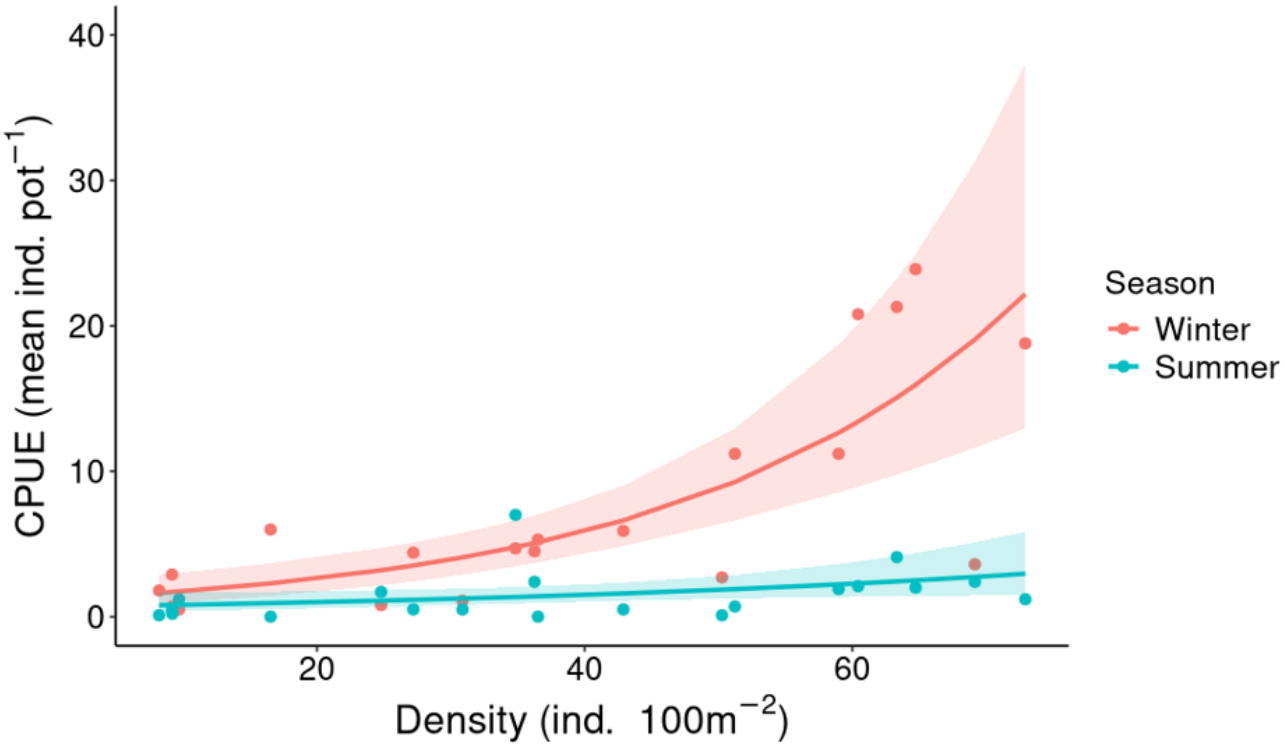


Figure 22: The relationship between scallop density on the sea bed and catch rates in summer and winter

The full report can be accessed here: http://sustainable-fisheries-iom.bangor.ac.uk/theses.php.en

King Scallop Larval Dispersal Modelling in the Irish Sea (with an Isle of Man focus)

During 2025, work continued on a project investigating how king scallop larvae move around the Irish Sea and how different scallop fishing grounds are connected, with a particular focus on the Isle of Man. Understanding where scallop larvae travel is important because it helps identify which spawning areas contribute to future scallop populations, both locally and in neighbouring waters. The study examined the extent to which Isle of Man scallop stocks rely on locally produced larvae compared with larvae arriving from elsewhere in the Irish Sea, and whether patterns differ between the inshore (0-3 nautical mile) and offshore (3-12 nautical mile) zones. The modelling also explored how management measures, such as Marine Nature Reserves and other closed areas, as well as existing and potential future offshore renewable energy developments, may influence scallop population connectivity, stock dynamics and long-term stock health.

To understand how scallop larvae move between fishing grounds, researchers combined detailed computer models of ocean conditions with models of scallop larval development. A high-resolution model of currents and sea temperatures across the Irish Sea (NEATL ROMS, 2 km resolution) was used alongside the OceanParcels particle-tracking system to simulate the movement of scallop larvae. Virtual larvae were released monthly during the spawning season (May to September) over a 4 year period (2019-2022) from 20 known scallop beds across the northern Irish Sea (Figure 23) and from specific locations within the Isle of Man's 12 nautical mile territorial sea. The model accounted for the influence of sea temperature on larval growth and development, with larvae considered unlikely to survive if they did not reach key growth stages within the required time. This allowed researchers to investigate how ocean conditions influence larval survival, dispersal and settlement.

The modelling showed that scallop larvae can travel considerable distances, linking scallop grounds across the northern Irish Sea. At the same time, some areas retained enough of their own larvae to help sustain local populations. On average, around half of all larvae successfully settled each year, although settlement rates varied considerably between seasons and years. Scallop grounds in the south and east of the Isle of Man generally showed the highest levels of recruitment, while sites in the north experienced lower settlement due to prevailing currents that transport larvae northwards. The southern Isle of Man grounds were identified as particularly important sources of larvae, supplying both nearby and more distant beds. While most scallop grounds relied heavily on larvae arriving from elsewhere, some areas showed much stronger self-recruitment, with one northeastern bed retaining around 70% of its own larvae. Results also highlighted the wider connectivity of the Irish Sea, demonstrating that larvae from the Irish coast can contribute to Isle of Man scallop populations through large-scale circulation patterns within the Irish Sea.

The study also examined how the depth at which larvae drift in the water column influences their survival and settlement. While larval depth had relatively little effect on overall recruitment success, larvae closer to the surface tended to settle slightly earlier than those deeper in the water. The modelling showed that around 16% of larvae released within the Isle of Man's 0-3 nautical mile zone were retained locally, increasing to 46% when the entire 12 nautical mile territorial sea was considered. Most successful recruits originated from scallop grounds in the south of the Isle of Man, although larvae from Irish Sea populations, particularly along the Irish coast, also contributed to recruitment within Manx waters.

Overall, the findings reinforce that Isle of Man scallop populations form part of a wider, interconnected Irish Sea network, with the movement of larvae linking fishing grounds across national boundaries. This highlights the importance of protecting productive spawning areas both inside and outside the IoM territorial sea, as their benefits can extend well beyond individual fishing grounds and support scallop populations elsewhere in the region. The results provide valuable evidence to inform future fisheries management decisions, marine protected area planning and the long-term sustainable management of the king scallop fishery. Further analysis and discussion of the modelling outputs are planned for 2026, and the collaborative project team from the Isle of Man Fisheries and Bangor University (including Dr Soizic Garnier, Prof Peter Robins and Dr Laura Richardson) will also begin preparing a peer-reviewed scientific manuscript to publish the findings.

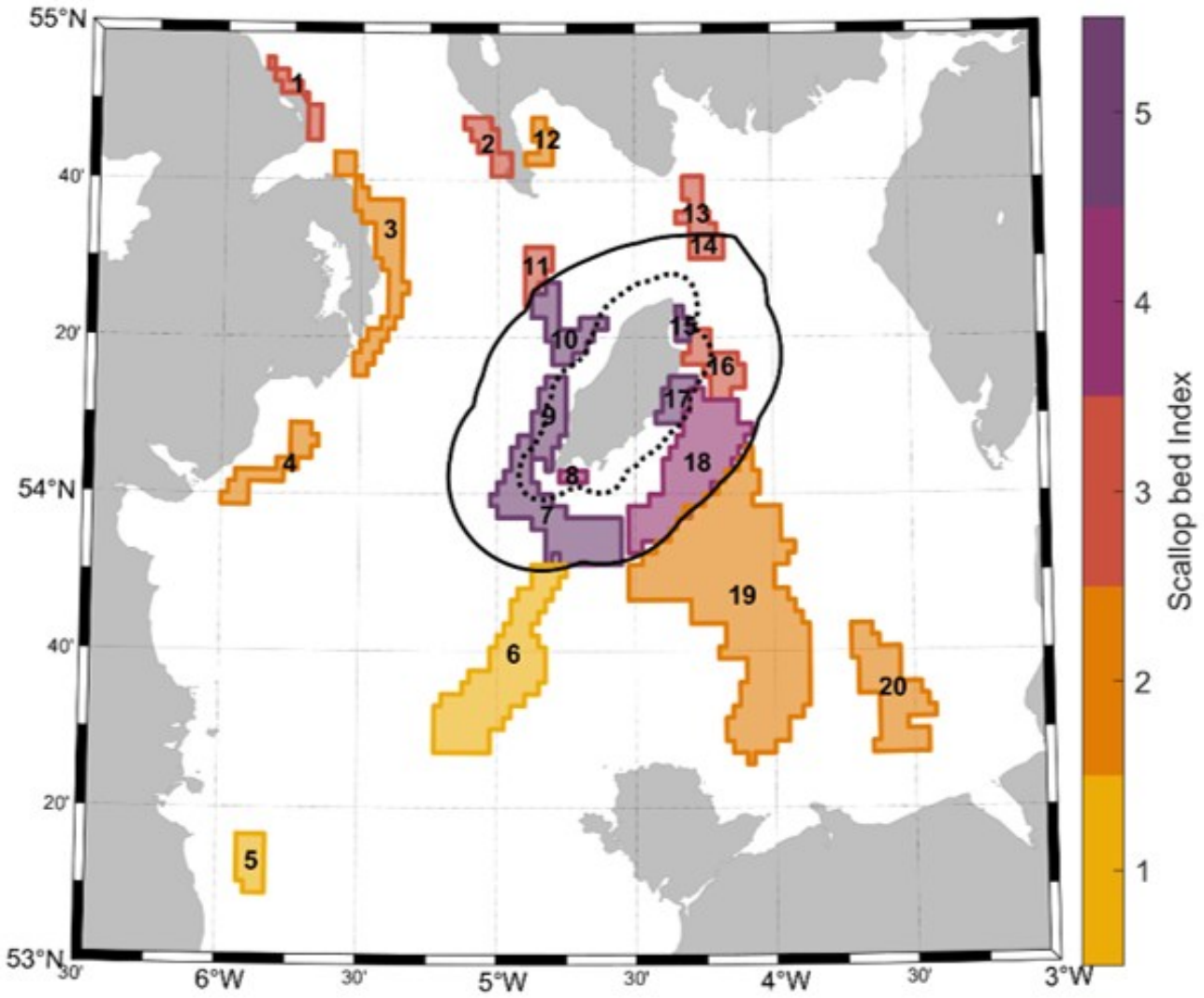


Figure 23: Scallop stocks identified within the northern Irish Sea using VMS data. The colours refer to categorical scallop densities from low to high based on survey data (where available) and intensity of VMS activity

Brown Crab (*Cancer pagurus)* Fishery Update

Landings of brown crab from the Isle of Man territorial sea have fluctuated between 400 and 600 tonnes annually since 2010, with 565 tonnes fished in 2025 (Figure 24A). Fishing effort, however, has steadily increased over this period, from around 200,000 to 350,000 pots hauled per year during targeted crab fishing trips (defined as those where crab comprised >50% of landings) (Figure 24B). Mean monthly landings per unit effort (LPUE) in the targeted crab fishery displays a distinct seasonal cycle, peaking during summer and autumn (July–November) (Figure 24C). From 2010 to 2025, standardised annual LPUE (accounting for vessel-specific effects and seasonal variation) has fluctuated but shows a long-term declining trend, decreasing by approximately ~30%, from 0.9 to 0.6 kg pot^{-1} (Figure 24D).

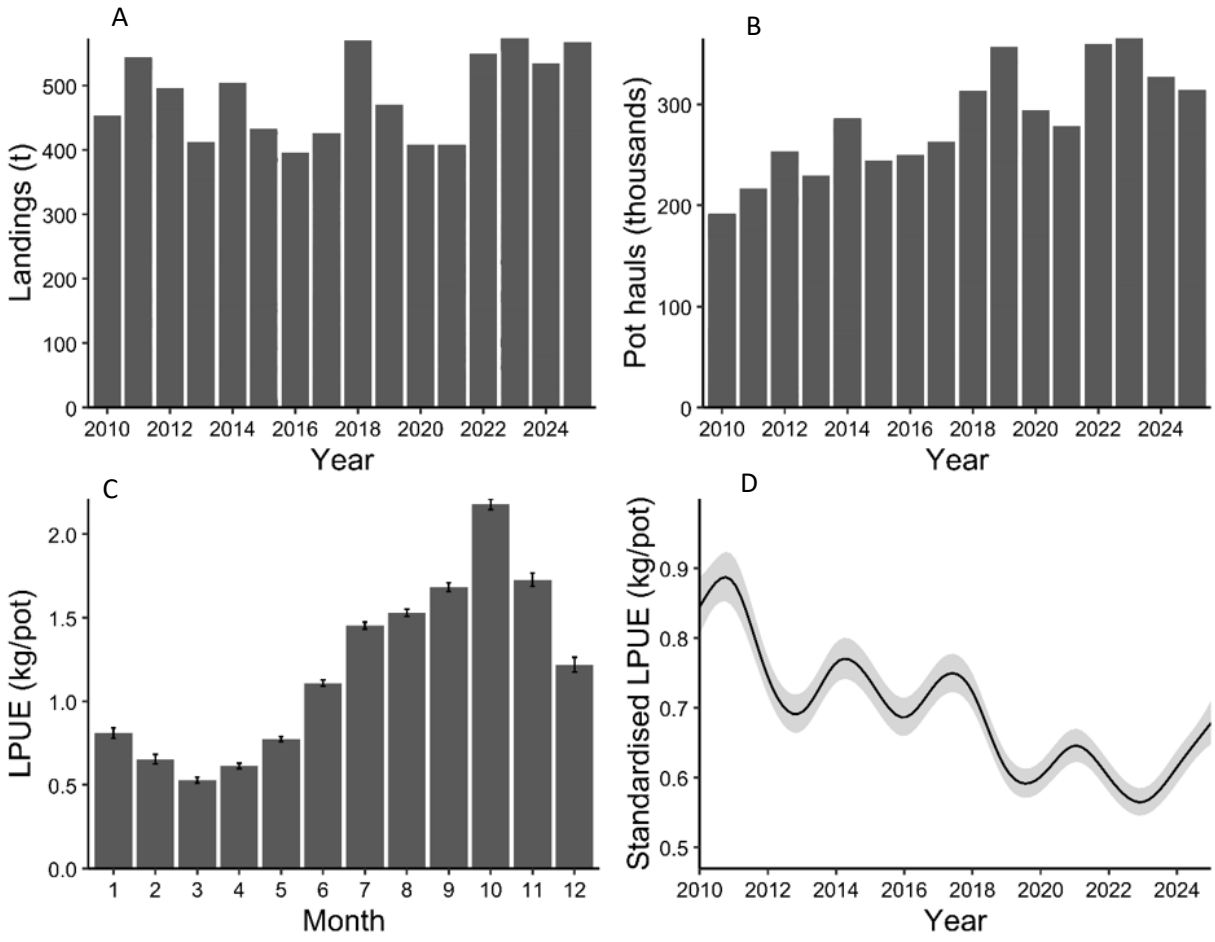


Figure 24: *Total annual landings (A), total annual pot hauls (B), mean monthly LPUE (C), and standardised annual LPUE trend (D) in the Isle of Man crab fishery from 2010 to 2025. This data includes all vessels up to 12 m in length.*

European Lobster (*Homarus gammarus*) Fishery Update

Landings of European lobster from the Isle of Man territorial sea have fluctuated between 40 and 60 tonnes annually since 2010, with 43 tonnes fished in 2025 (Figure 25A). Fishing effort during this period has varied between 60,000 and 160,000 pots hauled per year during targeted lobster fishing trips (defined as those where lobster comprised >50% of landings) (Figure 25B). Mean monthly landings per unit effort (LPUE) in the targeted lobster fishery displays a concurrent but less pronounced seasonal cycle to the crab fishery, peaking during summer and autumn (July–November) (Figure 25C). Between 2010 and 2025, standardised annual LPUE (accounting for vessel-specific effects and seasonal variation) has fluctuated within a narrow range of approximately 0.20 and 0.24 kg pot^{-1} (Figure 25D).

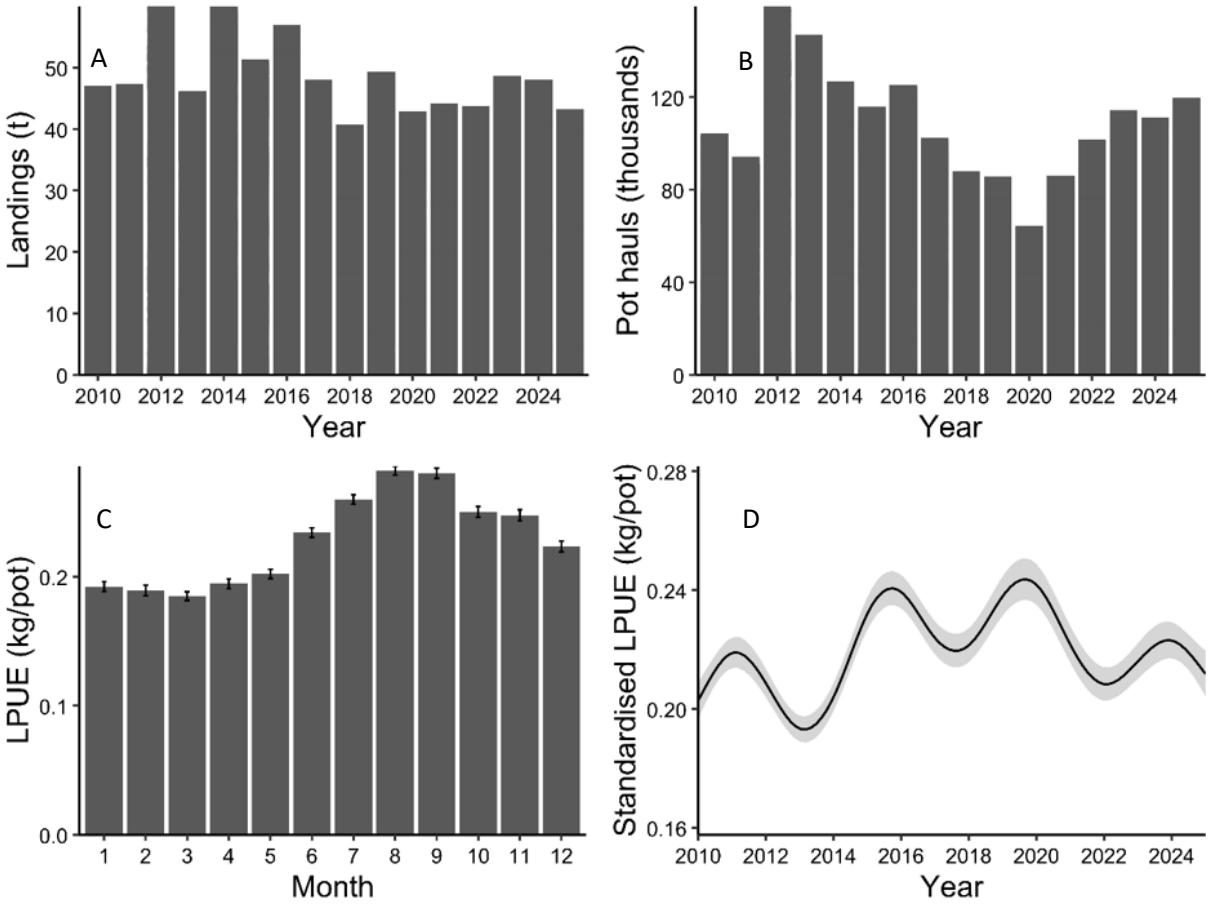


Figure 25: Total annual landings (A), total annual pot hauls (B), mean monthly LPUE (C), and standardised annual LPUE trend (D) in the Isle of Man lobster fishery from 2010 to 2025. This data includes all vessels up to 12 m in length

Common Whelk (*Buccinum undatum*) Fishery Update

Landings of whelk from the Isle of Man territorial sea have fluctuated dramatically since 2010, increasing from around 100 to 850 tonnes per year (peaking in 2019), before declining to around 300 tonnes per year since 2022, with 255 tonnes recorded in 2025 (Figure 26A). Fishing effort shows a similar pattern over this period, varying between 40,000 and 400,000 pots hauled annually (Figure 26B). Mean monthly landings per unit effort (LPUE) in the whelk fishery is relatively stable from January to August and declines during the reproductive period (September–December) (Figure 26C). From 2010 to 2025, standardised annual LPUE (accounting for vessel-specific effects and seasonal variation) shows a long-term declining trend, decreasing by approximately 50% from 2.3 to 1.2 kg pot^{-1} (Figure 26+D).

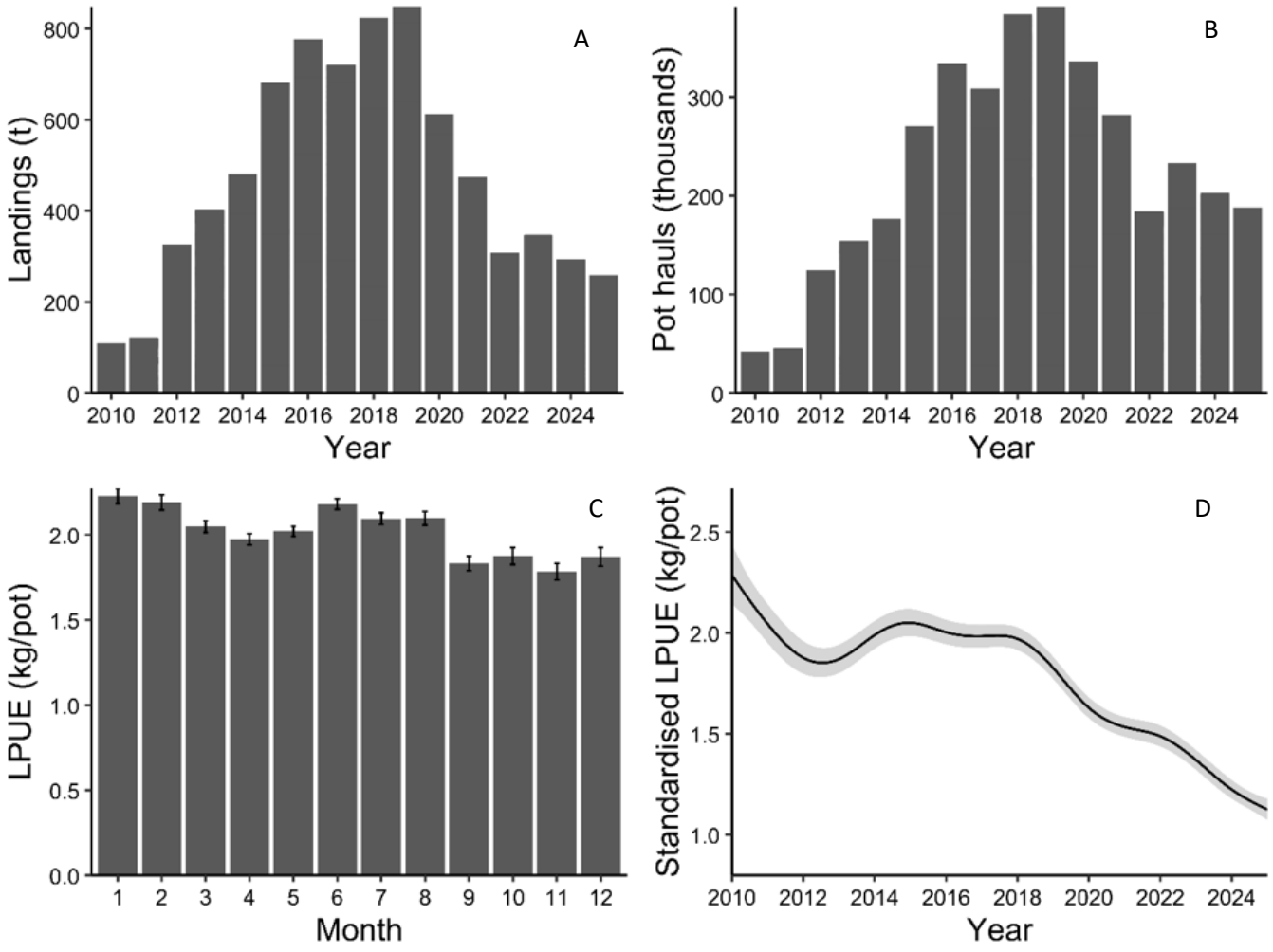


Figure 26: *Total annual landings (A), total annual pot hauls (B), mean monthly LPUE (C), and standardised annual LPUE trend (D) in the Isle of Man whelk fishery from 2010 to 2025. This data includes all vessels up to 12 m in length.*

Update on static gear reporting: Crab, lobster and whelk

Following the introduction of iVMS (inshore vessel monitoring systems) to the under-12 m fleet in 2023, work has been ongoing to determine how best to utilise these data for fishery-dependent monitoring. The availability of high-resolution vessel tracking data has substantially improved the level of reporting possible within the static gear potting fleet, enabling fine-scale spatial mapping of fishing activity for crab, lobster, and whelk across the Isle of Man territorial sea.

In 2025, this work progressed further with the development of an R Markdown script to produce standardised, automated annual reports for the crab and lobster and whelk fisheries. This framework integrates commercial landings and effort (pot hauls) data reported via the 'Record Your Catch' application (<10 m) and paper logbooks (10–12 m), together with iVMS data, within a reproducible pipeline enabling efficient generation of key outputs. These include species-specific monthly landings, effort, and LPUE metrics, as well as spatial maps of fishing activity at a 1 km grid cell resolution. It is anticipated that a combined crab and lobster report and a separate whelk report will be delivered annually to DEFA from 2026, although the script also supports the generation of part-year reports where required.

Landings and effort data are first cleaned to remove duplicate entries and extreme outliers (e.g. implausible landings or pot numbers). LPUE (kg per pot) is calculated on a trip-by-trip basis by dividing the landed weight by the number of pot hauls. For crab and lobster, species-specific LPUE is derived from 'targeted' fishing trips only, defined as those where a single species comprises at least 80% of the landed weight, to account for the mixed nature of the fishery. Historic landings and effort data during a reference period (2010–2015) are also incorporated in the reports to provide a baseline for comparison with current trends (Figure 27; Figure 28).

Prior to mapping, iVMS data are cleaned by removing duplicate pings, positions on land or within harbours, and invalid ping intervals (<1 minute or >7 minutes). Fishing activity is then classified using a vessel speed threshold of <3 knots. Logbook trips are linked to iVMS records using a two-stage matching approach: initially by vessel identifier and exact date, and subsequently (where possible) by matching records within ±1 day. Trip-level landings and pot hauls are then divided evenly across associated iVMS pings, allowing catch and effort to be mapped at fine spatial scales (maps not included due to commercial sensitivity). Looking ahead, fishery-dependent metrics can also be easily extracted and reported across any specified spatial zones, providing flexibility to support regional monitoring and management.

In addition to these annual reports, the aim is to formalise a second R Markdown script for reporting long-term trends in the Isle of Man static gear fishery, combining current data with historic logbook records dating back to 2010. This will build on the static gear updates currently provided in the Bangor annual reports for crab, lobster, and whelk, including standardised, species-specific LPUE trends for monitoring purposes. Together, these developments represent a significant step forward in improving the efficiency, consistency, and spatial resolution of reporting for the Isle of Man pot fishery.

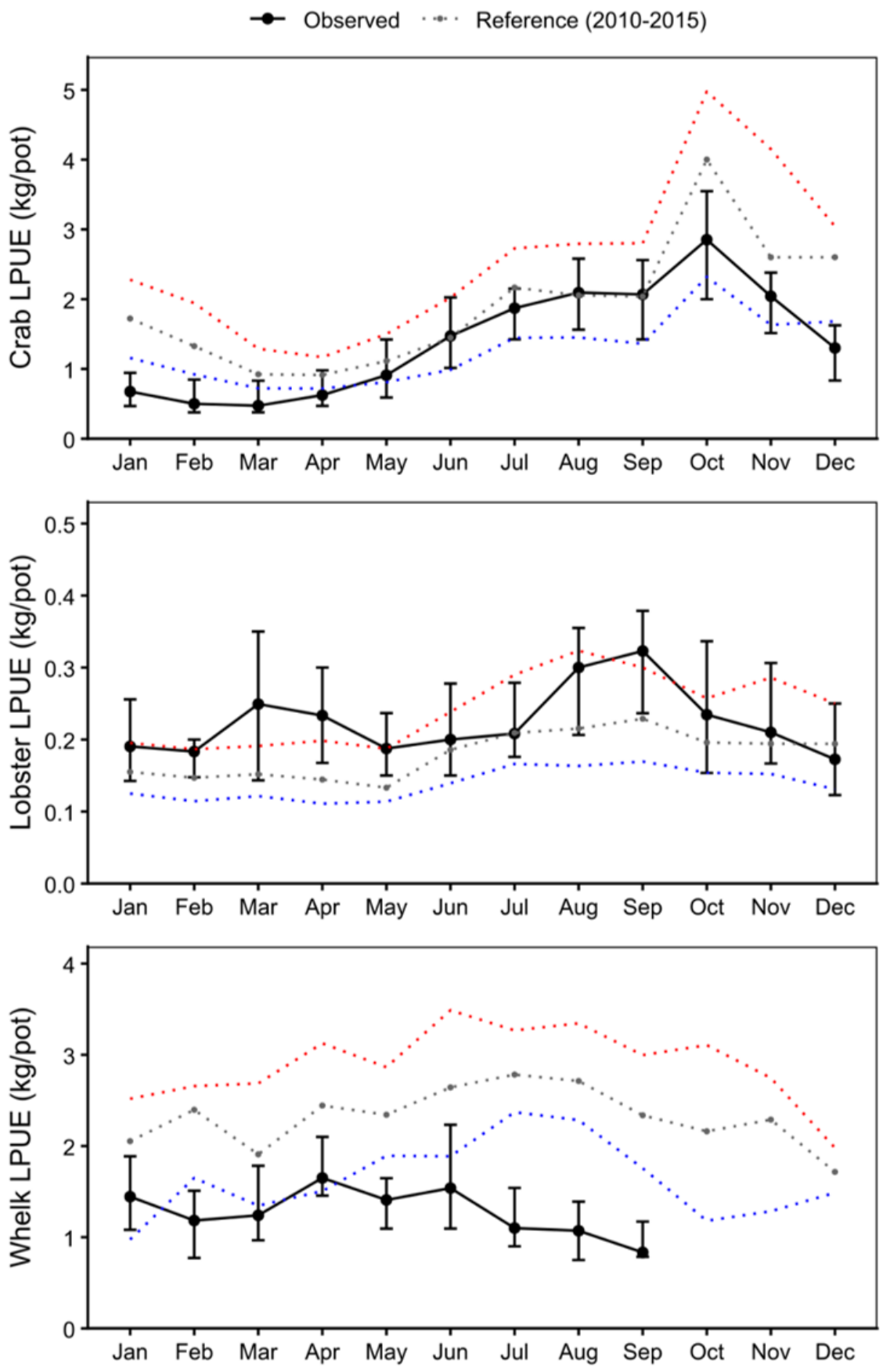


***Figure 27**: Monthly median LPUE (with 25%–75% quantile error bars) of crab, lobster, and whelk in the Isle of Man from January–December 2024. Dotted lines show typical seasonal trends during the reference period (2010–2015), calculated as the median monthly LPUE and median monthly 25%–75% quantiles across those years.*

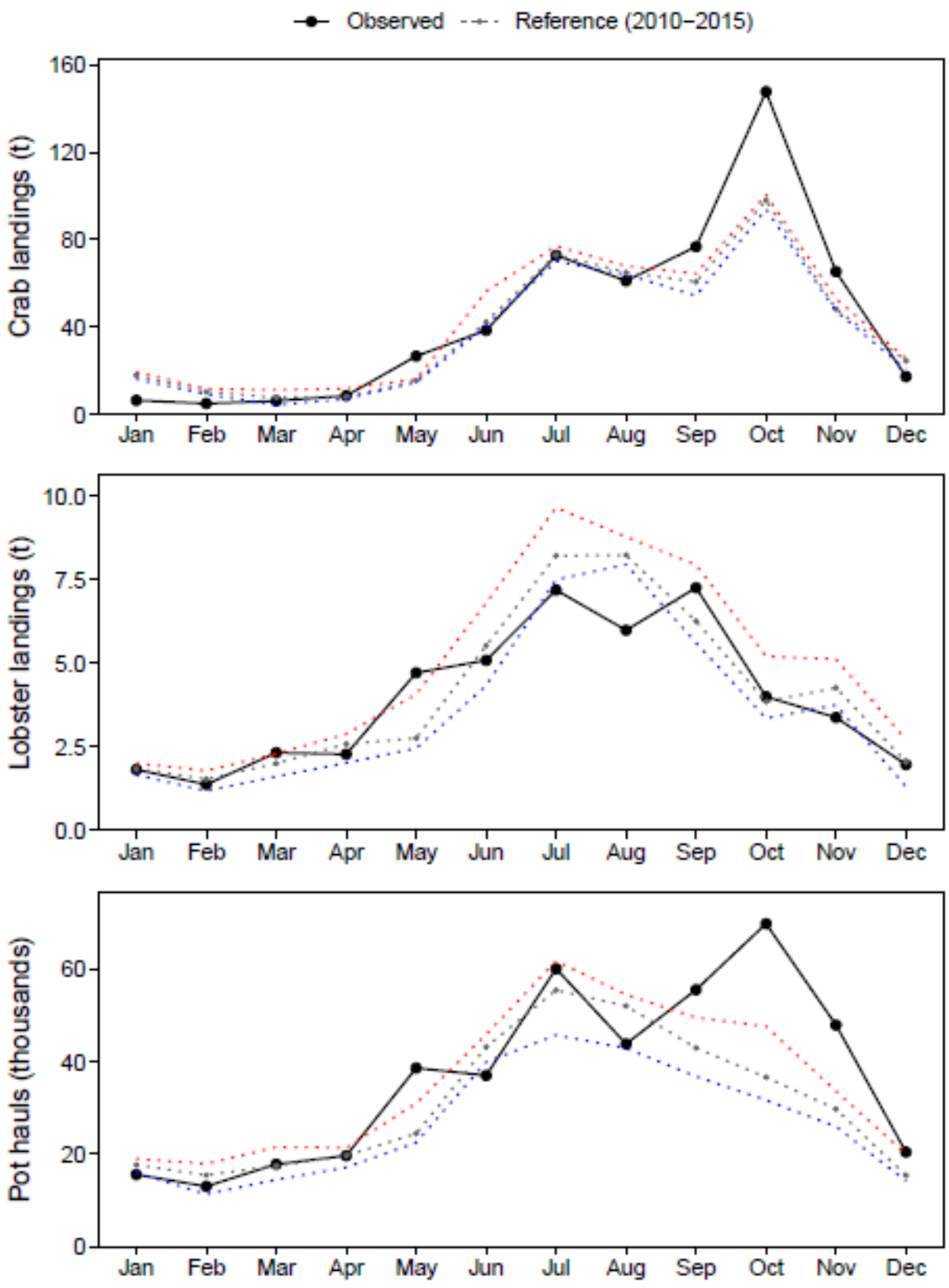


Figure 28: Monthly landings of crab and lobster (top panels) and associated monthly pot-haul effort across both species (bottom panel) in the Isle of Man between 1st January 2024 and 31st December 2024. Dotted lines show typical seasonal trends during the reference period (2010-2015), calculated as the median and 25%-75% quantiles of monthly landings and pot hauls across those years.

Using Vessel Monitoring Systems to investigate static gear effort in Marine Nature Reserves.

Currently, the Isle of Man's marine nature reserve (MNR) network reserves fishing rights exclusively for the static gear fleet (comprised predominantly of potting vessels) due to their recognised low relative impact on the benthos when compared to other fishing practices. However, recent studies have shown that although the overall impacts of pot fishing are relatively low, negative effects can still occur, particularly among upright and reef-forming taxa. Moreover, concern over the effect of high fishing effort on the stock of target species (crab, lobster and whelk) is increasing. Until recently, it has been very challenging to understand the spatial distribution of fishing effort. This changed with the rollout of statutory iVMS to vessels between 6 and 12 m vessels on 1st April 2023, enabling an understanding of where and when potting effort is being applied.

We used iVMS data from the Isle of Man's fishing fleets over the period of April 2023 to December 2025 to address this knowledge gap by investigating static gear fishing effort with a particular focus on the Isle of Man's MNR network. To do this, we applied an unsupervised learning algorithm (expectation maximisation) to iVMS data to delineate where and when pot fishing vessels were hauling pots; we then used these "hauling" points to estimate the shape and size of strings deployed on the sea floor.

There are many ways in which the effort, and hence impact of static gear, can be estimated. We used a novel approach by applying a buffer around the estimated position of the strings (Figure 29). Two buffer types were used; one based on an estimate of the amount of lateral movement of pots and strings (termed the benthic impact buffer) and one on the estimated area over which traps attract prey (termed the fishing impact buffer). These distances were based on unpublished estimates for lateral movement on the seabed (1.09m) and our own estimates of trapping area (7m for whelk: Garratt et al 2025; 90m for crab: Hiddink et al 2024).

Buffered strings (representing benthic impact and fishing impact) were mapped onto a 250 m x 250 m grid spanning the Territorial Sea and a swept area ratio (SAR) value calculated by grid cell, equivalent to the grid cell area divided by the summed intersection area of any buffered strings within it. Swept area values approaching or exceeding values of 1 likely indicated repeated fishing activity within the corresponding grid cell.

By analysing the swept area ratios of benthic impact and fishing influence across the MNR network, we have quantified the benthic and fishing impact and shown that, although variable, there are some areas with surprisingly high impact. These patterns are not displayed here to protect the fishing patterns of individual fishers. However, Figure 30 demonstrates the SAR for an area of seabed within one of the MNRs based on 'benthic impact' and 'fishing impact' for both whelk and crab.

One way in which these data can be used is to assess how potting effort (and hence impact) varies, both spatially and seasonally. An important potential factor driving seasonal variation in the distribution of effort is the interaction between static and mobile gear fleets. 'Gear conflict' is a well-known phenomenon which can drive spatial and temporal patterns in inshore fisheries. We assessed to what extent the opening of grounds for the king scallop fishery may influence spatial distribution of pot fishing effort. Outside the king scallop season, the distribution of pot fishing effort was roughly balanced between the MNR network and the rest of the territorial sea (48.6% vs 51.4%), but during the king scallop season this became disproportionately concentrated inside MNRs (66.6% vs 33.4%). Generalised additive models (GAMs) accounting for spatial autocorrelation supported this further, indicating a 47.1% cellwise increase in MNR fishing influence (and a 38.2% decrease elsewhere), an 83.2% increase in MNR benthic impact, and a 19.6% increase in MNR pot hauls during the king scallop season, all coinciding with likewise decreases across the rest of the territorial sea.

These findings demonstrated that pot fishing effort distributions around the Isle of Man can vary significantly across seasons and provide a reference point for establishing dynamic and responsive management of the island's MNR network.

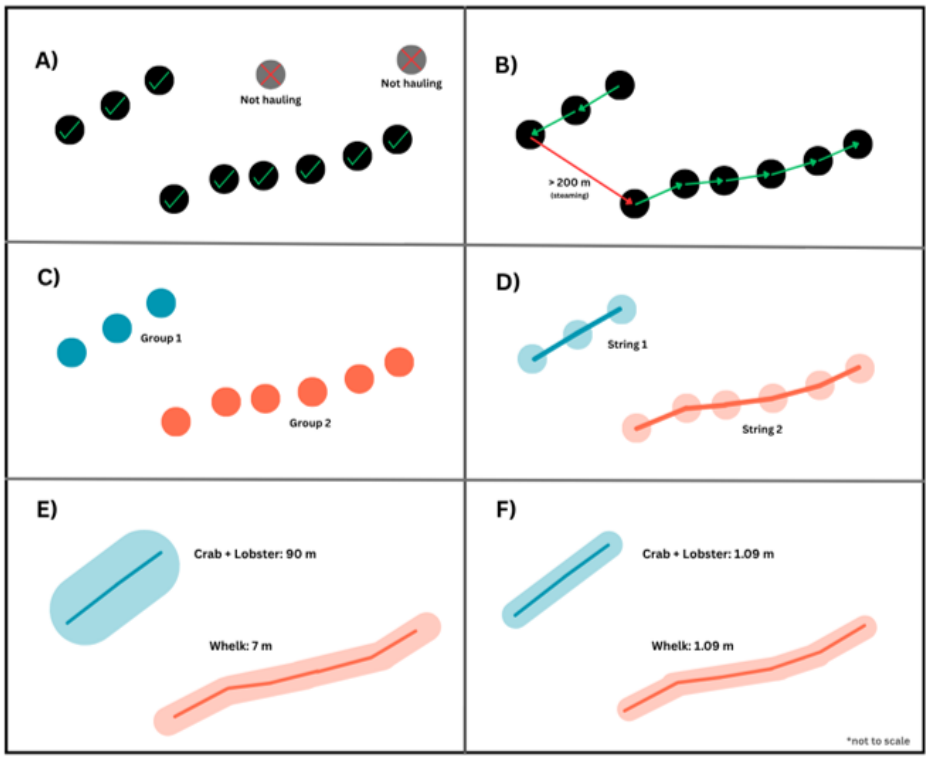


***Figure 29**: Graphical representation of the process of estimating potting impacts from iVMS polls. A) iVMS polls are passed into an unsupervised machine learning algorithm to classify where hauling is occurring based on speed; B/C) hauling points are grouped into strings based on a distance threshold (200 m); D) string shapes are estimated by connecting all points belonging to the same group with line segments; E) strings are buffered by the trapping radius of the targeted species to provide a proxy of fishing influence; F) in a separate instance, strings are buffered by pot movement estimates to provide a proxy of benthic impact.*

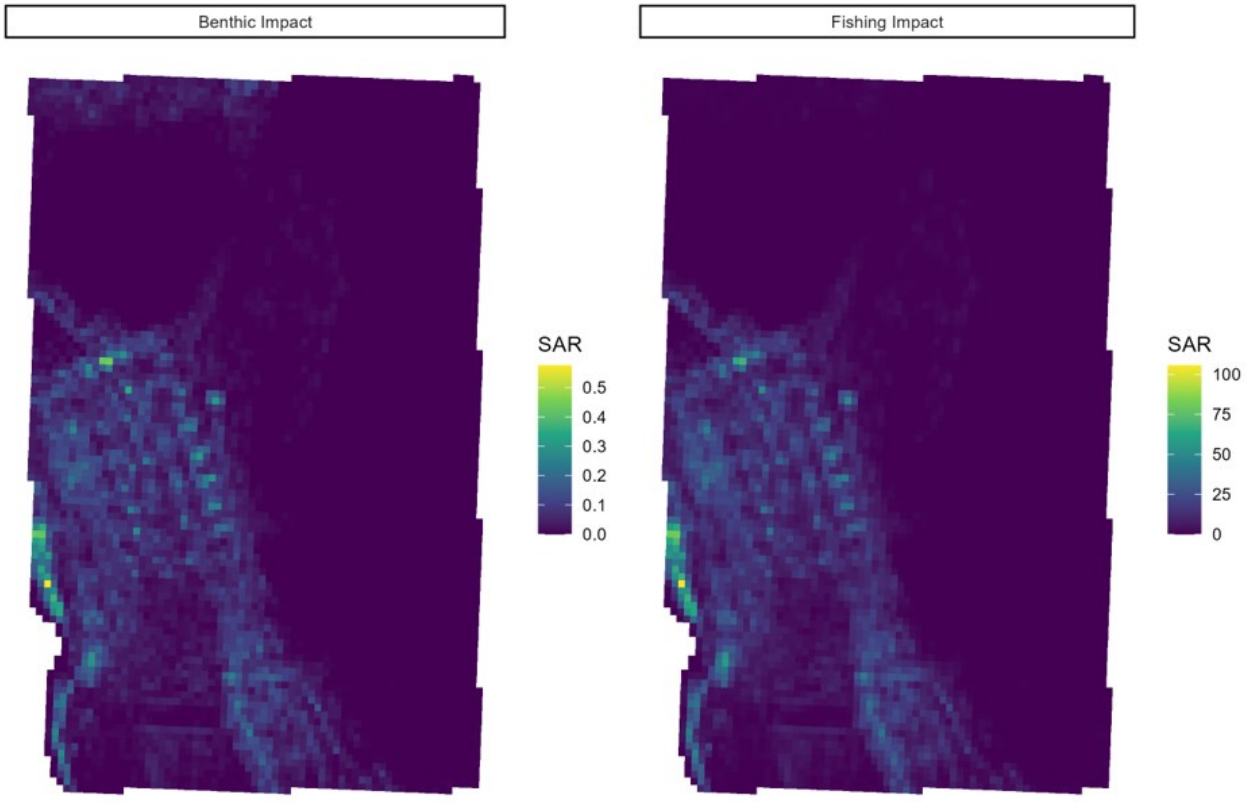


***Figure 30**: Visualisation of the pot fishing swept area ratio analysis on an anonymised section of the territorial sea between April 2023 and December 2025. Benthic impact buffer radius: 1.09 m (crab, lobster and whelk); Fishing impact buffer radius: 90 m (crab and lobster), 7 m (whelk). SAR values of 1 indicate total coverage of a grid cell from the corresponding buffer; SAR values above 1 indicate cumulative impacts across the study period.*

MSci: Investigating the diet of data limited *Pollachius pollachius* to inform future fisheries management

Student: Felix Wagner

Supervisors: Matthew Coleman, Matthew Garratt , Craig Robertson and Stuart Jenkins

Pollack (*Pollachius pollachius*) is an ecologically important species in Isle of Man waters and also supports a long-established inshore line fishery. Recent assessments by the International Council for the Exploration of the Sea (ICES) indicate that the Celtic Seas pollack stock has declined below precautionary biological limits, resulting in the introduction of a zero Total Allowable Catch (TAC) for 2024–2025. However, pollack remains a data-limited species, with significant uncertainties surrounding its ecology, particularly its feeding behaviour. Improving understanding is therefore essential for supporting evidence-based fisheries management and future stock recovery.

A Bangor University 4th year project undertaken by Felix Wagner addressed one of these key knowledge gaps by investigating the diet of pollack caught by commercial inshore fishers around the Isle of Man. A total of 260 fish were collected from the south-east coast, with 126 stomachs suitable for detailed dietary analysis. Samples were collected during both summer and winter to investigate seasonal variation, while fish spanning a range of sizes allowed examination of changes in diet throughout the life of the species.

The results demonstrate that pollack is an opportunistic generalist predator capable of exploiting a wide range of prey. Rather than specialising on a single food source, pollack alters its diet in response to seasonal changes in prey availability while continuing to utilise both benthic (seabed-associated) and pelagic (water column) food resources (Figure 31).

A clear seasonal difference in diet was identified. During summer, pollack fed predominantly on decapod crustaceans, particularly juvenile squat lobsters (*Galathea* spp.), swimming crabs (*Liocarcinus* spp.) and megalopa larvae. Fish prey were also important, especially sand eels, which formed a substantial component of the diet of larger individuals. These findings indicate that pollack exploit seasonal peaks in juvenile crustaceans and small fish that occur in coastal habitats during the summer months.

In contrast, winter diets differed markedly. Polychaete worms, particularly nereidid worms, became the dominant prey, while teleost fish and cephalopods remained important food sources. The shift towards benthic prey suggests that pollack alter their foraging behaviour during winter, possibly moving into shallower inshore habitats or feeding closer to the seabed. This change may reflect seasonal reductions in pelagic prey availability, changes in habitat use before spawning, or increased nutritional requirements associated with reproduction.

The study also identified changes in feeding behaviour as pollack grow. Smaller fish relied mainly on small crustaceans and other invertebrates, whereas larger pollack increasingly consumed fish, particularly sand eels. This ontogenetic shift towards piscivory was evident during summer, reflecting the greater ability of larger fish to capture larger, more energy-rich prey. Interestingly, this size-related pattern was absent during winter when pollack of all sizes consumed broadly similar prey, dominated by nereidid polychaetes. These findings suggest that seasonal prey availability can override differences in feeding behaviour normally associated with body size.

The research confirms that pollack functions as an important link between benthic and pelagic food webs within the Isle of Man's coastal ecosystem. Its ability to exploit multiple prey types highlights the importance of maintaining healthy and diverse coastal habitats that support crustaceans, sand eels, polychaetes and other key prey species. The work also demonstrates that understanding predator-prey relationships is essential if fisheries management is to move beyond single-species assessments towards a more ecosystem-based approach. The work strengthens the Island's capacity to contribute robust scientific evidence to regional fisheries discussions and supports the long-term objective of achieving sustainable, ecosystem-based management of valuable commercial fish stocks

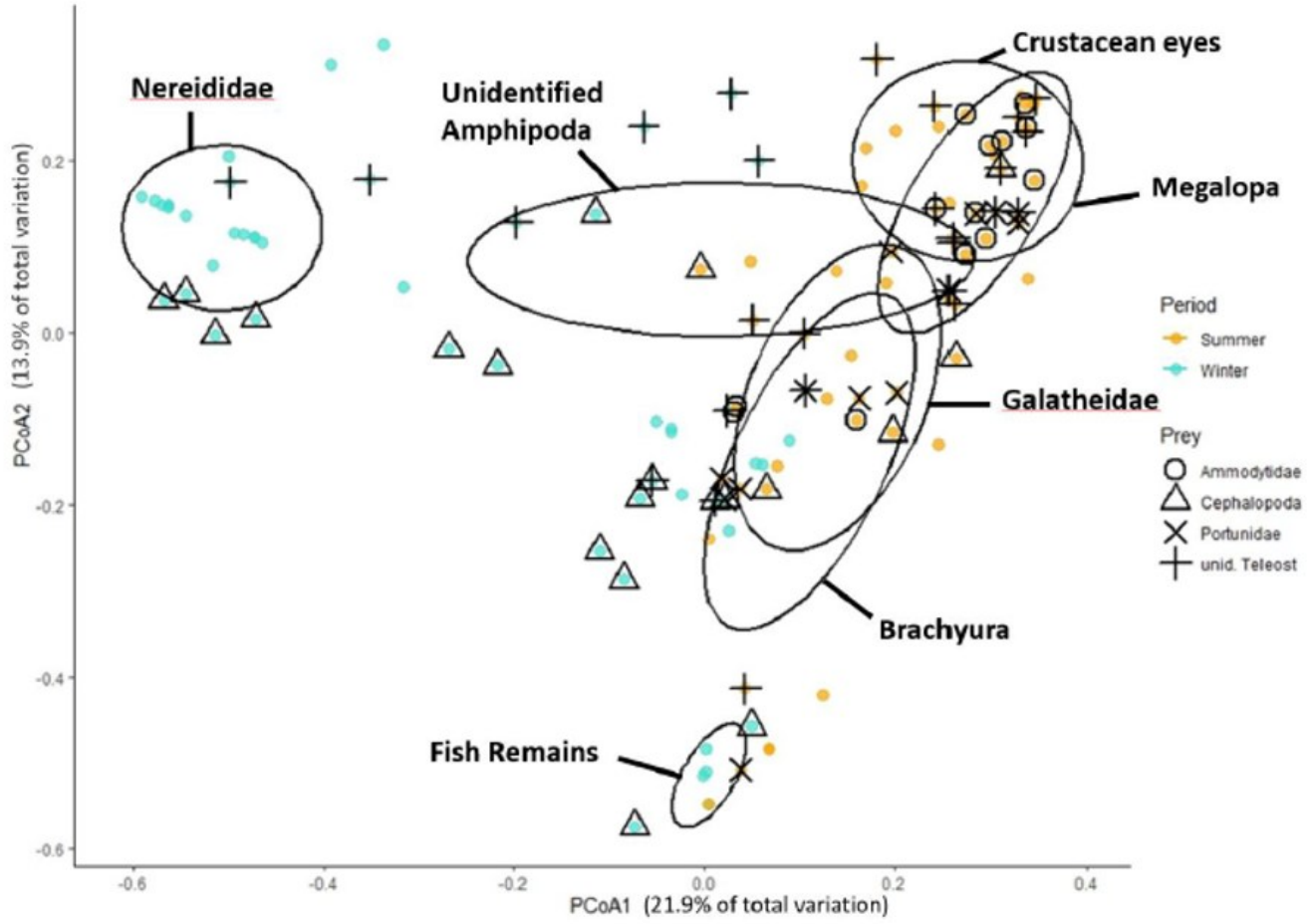


Figure 31: Principal Coordinates Analysis (PCoA) of individual pollack (*Pollachius pollachius*) stomach contents. Each point represents a single stomach content sample (SC), coloured by season (summer = orange, winter = turquoise). Distances between points reflect differences in prey composition among individuals.

The full report can be accessed here: http://sustainable-fisheries-iom.bangor.ac.uk/theses.php.en

During 2025, the Isle of Man research team (staff and students) have communicated the findings of the scientific work undertaken to interested stakeholders. These communications include advisory reports to the Isle of Man Government and during attendance at national and international committees, working groups and meetings.

Peer reviewed publications:

- Garratt, M. J., Bloor, I. S. M., Coleman, M. T., Colvin, C. N., Hiddink, J. G., Hold, N. & Jenkins, S. J. (2025). Estimating the trapping area and density of common whelk (*Buccinum undatum*) using experimental fishing. Fisheries Research, 284(9), 107320, https://doi.org/10.1016/j.fishres.2025.107320

Government Reports:

- Bloor, I. S. M., Coleman, M. and Jenkins, S. R. (2025). Isle of Man Queen Scallop: 2025 Stock Survey Report. Bangor University Sustainable Fisheries and Aquaculture Group, Fisheries Report.
- Bloor, I. S. M., Coleman, M. and Jenkins, S. R. (2025). Isle of Man King Scallop 2025 Stock Survey Report. Bangor University Sustainable Fisheries and Aquaculture Group, Fisheries Report.
- Coleman, M. T., Garratt, M. J., Bloor, I. S. M., Harries, M., Hollyman, P. R., Wagner, F., & Jenkins, S. R. (2025). Addressing knowledge gaps in the Isle of Man pollack (*Pollachius pollachius*) fishery: Collection of baseline fishery-dependent and biological data. Bangor University Sustainable Fisheries and Aquaculture Group, Fisheries Report, 32 pp.
- Garratt, M. J., Bloor, I. S. M, Coleman, M. T., Hold, N., and Jenkins, S. R. (2025). Assessing size-based indicators and life history parameters for common whelk (*Buccinum undatum*) in the Isle of Man territorial sea. Bangor University Sustainable Fisheries and Aquaculture Group, Fisheries Report, 39 pp.

Thesis:

- Wagner, F. (2025). Investigating the diet of data limited *Pollachius pollachius* to inform future fisheries management. MSci, Bangor University, School of Ocean Sciences.
- Poll, N. (2025). Investigating the potential of illuminated scallop pots. MSc, Bangor University, School of Ocean Sciences.

Meetings and Committees:

- International Council for the Exploration of the Sea (ICES) Working Group on Scallop Stock Assessment. Hybrid Meeting, 7th—10th October 2025, Hybrid, Edinburgh.
- International Council for the Exploration of the Sea (ICES) Working Group Chairs, online meeting, 27-30th January 2025.
- Workshop on “Biology, Ecology And Management of Irish Sea Herring (7aN) (WKBEAMISH)”, 20th February 2025, Hybrid, AFBI, Northern Ireland.
- Scallop Management Board meeting, Queen Scallop Management for 2025, Friday 13th June 2025; King Scallop Management for 2025/2026, Tuesday 30th September 2025.

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Bangor University has undertaken research for the Isle of Man's Department of Environment, Food and Agriculture since 2007. The research focuses on achieving sustainable and economically viable fisheries within an ecosystem context. We are assessing scallop, crustacean and mollusc stocks and quantifying bycatch, as well as focusing on the ecosystem through habitat surveys and studies examining the impacts of different fishing gears. We also use state of the art techniques utilising fishery-dependent data to understand how the Island's scallop fisheries are exploited and how their management can be improved.

The work is funded by the Isle of Man's Department of Environment, Food and Agriculture

Professor Stuart Jenkins:

I graduated in Zoology from Cambridge University in 1990 and undertook my PhD at Port Erin Marine Laboratory between 1991 and 1995. I remained at Port Erin for a further 6 years, working first on intertidal rocky shores and then with Dr Andy Brand and colleagues at Seafish, examining the effect of scallop dredging on the wider marine ecosystem. In 2001 I moved to Plymouth to the Marine Biological Association where I developed a research group in coastal ecology and in 2007 moved to the School of Ocean Sciences, Bangor University. My research interests are varied, addressing questions in both fundamental and applied ecology. I have particular interests in recruitment dynamics, non-native species, the role of key species over large geographic scales and effective management of marine resources.

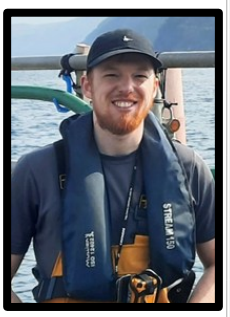
Dr Isobel Bloor:

After graduating from Queen Mary's University of London with an MSc in Marine Ecology and Environmental management, I worked as a marine ecologist at a small independent marine consultancy managing the impacts of marine related projects. I then worked on a cross-Channel EU project on cephalopod ecology and completed my PhD in conjunction with the Marine Biological Association and the Marine Institute, University of Plymouth on Cephalopod ecology, movement and behaviour. My research has been predominately fisheries and field-work based working directly with inshore potting fishermen, undertaking acoustic and data storage tagging studies and completing *in situ* scuba surveys of spawning grounds. I also have experience in developing presence-only and presence-absence species distribution models. My current role as a postdoctoral fisheries scientist on the Isle of Man involves developing and undertaking stock assessments and providing the science necessary to assist the government in managing all their commercial fisheries.

Dr Matthew Coleman:

I am fisheries scientist focusing on the management and the interaction of biological characteristics of crustacean stocks in static gear fisheries. I gained a BSc in Zoology from the University of Exeter and a MSc Marine Biology from Bangor University. Following graduation from Bangor University I have worked as a fisheries scientist for Orkney Sustainable Fisheries in Orkney, Scotland for the past 7 years. During my time in Orkney, I undertook a part-time industry funded PhD with Heriot-Watt University focusing on addressing key knowledge gaps on reproductive biology of the European lobster and their incorporation in sustainable regional management, working collaboratively with other researchers from France to Norway. My current role on the Isle of Man focuses on the static gear fisheries providing scientific advice for sustainable management of crab, lobster, and whelk fisheries.

Dr Matthew Garratt:



I graduated from Bangor University in 2017 with a BSc in Ocean Science, followed by an MSc in Marine Environmental Protection in 2018. After completing my master's, I moved to the Isle of Man and joined the Bangor University fisheries team at DEFA for a period of two years as a research assistant, during which time I was involved in a wide range of shellfish-related projects. Following this, I remained on the Isle of Man and undertook my PhD from 2021 to 2024, which was joint-funded by DEFA and Welsh Government, and looked at potential methods for assessing stock status in common whelk (*Buccinum undatum*) fisheries. This included investigating fishery-independent survey methods, abundance indicators, and size-based indicators. My current role as a postdoctoral scientist is focused on delivering static gear research over the remainder of this contract period with DEFA (ending August 2025).