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Nephrops and Blue Carbon consultation evidence document

Assessment of current Norway lobster (*Nephrops norvegicus*) fishing activity within the Isle of Man territorial sea.

Analysis to support the *Nephrops* and Blue Carbon consultation (2024)

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January 2024

To cite this report: Bloor, I.S.M., Coleman, M. & Jenkins, S.R. (2024). Assessment of current Norway lobster (*Nephrops norvegicus*) fishing activity within the Isle of Man territorial sea. Analysis to support the *Nephrops* and Blue Carbon consultation (2024). Sustainable Fisheries and Aquaculture Report, Bangor University. pp. 1 – 17

1.0 Introduction

The stakeholder directed consultation launched by the Department of Environment, Food and Agriculture ('the Department') is seeking views on the introduction of new spatial management measures in part of the territorial waters of the Isle of Man within an area known as the Western Irish Sea Mud-belt (WISMB) with the aim of delivering co-benefits in sustainable fisheries, marine conservation and blue carbon research.

A Blue Carbon research project is currently underway that is investigating the importance of this area of mud habitat for carbon uptake and storage and the impacts of any interactions with fisheries. The closed areas proposed within the consultation will facilitate this research. This area of mud habitat is of known importance for commercial shellfish species (i.e. *Nephrops norvegicus* and *Cancer pagurus*), Vulnerable Marine Ecosystems (VMEs) (e.g. Sea pens, *Virgularia mirabilis*), burrowing megafauna and is considered at risk from fishing activity (particularly from subsurface abrasion caused by bottom-towed gear). The minimum spatial management measures proposed here will enable Phase 1b research of the Manx Blue Carbon Project. The extended spatial management measures proposed would additionally enable the trial of a *Nephrops* creel fishery and support further research into the sustainable fisheries and marine conservation benefits of these spatial management measures. The closure of areas to bottom-towed gear that are productive *Nephrops* grounds provides an opportunity for Manx and UK fishermen to target *Nephrops* in these areas using alternative methods (i.e. creels) that are considered of lesser impact to the seabed. There is evidence that creel gear offer several advantages compared to bottom-towed gear in terms of environmental impact on the benthic environment, selectivity and socio-economics (e.g. Leocádio et al., 2012). The emergence of a creel fishery within the current extent of bottom-towed fishing activity in FU15 is unlikely because of potential gear conflict. The proposed temporary closures are consistent with the ecosystem approach to fisheries management and the Memorandum of Understanding between the four fisheries policy authorities of the United Kingdom and the Isle of Man (DEFA, 2023) where the transition towards more responsible fishing practices (i.e. the use of selective fishing gear and fishing techniques that have a reduced environmental impact) is encouraged.

For Norway lobster (*Nephrops norvegicus*), ICES sub-division VII (fishing grounds around Ireland) is split into seven Functional Units (FUs) which are used to assess the stocks within three broader grounds, the Irish Sea, West Ireland and the Celtic Sea (ICES 2014). In the Irish Sea, *Nephrops* are mainly exploited in the waters to the west of the Isle of Man in the west Irish Sea mud-belt (WISMB) which encompasses "Functional Unit 15" (FU15) which is officially delineated by ICES Statistical Rectangles 36E3, 35E4, 36E4, 37E4, 38E4 and 35E5, 36E5 and 37E5. The fishery occurs throughout the year with no major seasonality and most landings are made by vessels from Northern Ireland (5000 t per annum; 2017-2021) and the Republic of Ireland (ROI) (1500 t per annum ; 2017-2021) (ICES 2022). These landings gave a combined first-sale annual value of about £14.2 million for UK vessels in 2022 (IFISH; 5165 t). Although a single TAC is set for ICES Subarea VII, ICES advise that management should be implemented at the functional unit (FU) level to ensure that each FU is exploited sustainably. ICES advises that catches in 2023 for FU15 should be no more than 11069 t (ICES 2022). Historically landings of *Nephrops* within the Irish Sea have been dominated by vessels using otter trawl gear, including twin-rig and multi-rig arrangements (Ungfors et al., 2013).

The aims and objectives of the Department's proposal to introduce spatial management measures in the WISMB as set out in the consultation as follows:

Objective 1. To enable Phase 1b research of the Manx Blue Carbon Project, as part of the Island's Climate Change Plan, to inform future policy and Blue Carbon Management.

Objective 2. To enable further research into the sustainable fisheries and marine conservation benefits of spatial management measures, in particular for commercial fish stocks and conservation features that are assessed as being highly depleted or in a critical status, as well as other species that are known to rely upon the WISMB for nursery grounds.

Objective 3. Encourage the establishment and development of an environmentally sustainable prawn creel fishery, to allow for the Isle of Man's additional quota to be utilised in line with the Memorandum of Understanding between the Fisheries Administrations of the United Kingdom and the Isle of Man.

Minimum and extended spatial management measures are presented by the Department for consideration by interested stakeholders. This report provides an assessment of *Nephrops*-directed otter trawl fishing activity from 2012 – 2022 for these proposed spatial management measures relative to overall fishing in FU15 including the area of FU15 within IoM territorial waters specifically.

2.0 Methods and assumptions

The fishing effort exerted by the *Nephrops*-directed UK bottom-towed gear fleet inside and outside the proposed areas of interest was evaluated using data from Vessel Monitoring Systems (VMS) combined with Logbook data for the period 2012-2022 (Source: Citrix and MMO). VMS data for the *Nephrops*-directed otter trawl fishery are only available from vessels greater than 12m Length and are typically available at a 2-hour polling rate. The UK bottom-towed gear fleet (i.e. excluding ROI vessels and including vessels reporting with gear codes TBB, TBN, TB, OT, OTT, OTB and DRB) is made up of 295 vessels (81,787 fishing trips). Of this fleet, 222 vessels (approximately 75%) were identified in the available VMS dataset. A total of 73 vessels (12,255 trips) have logbook records with no matching VMS. Of these, 60 vessels (11,696 trips) are under 12m in length and therefore not required to operate VMS when fishing for *Nephrops* (3396.5 t for 2012-2022). Five vessels (29 trips) are registered to Belgium for which VMS data was unable to be accessed from Citrix (0.79 t for 2012-2022). There are also 8 vessels (530 trips) that are UK registered and over 12 m that have no matching VMS (318 t of *Nephrops* for 2012-2022).

Table 1: *Nephrops* live-weight landings (t), value (£) and unique vessels by year for FU15 in IoM, UK and EU waters (please note: this table excludes ROI vessel data and includes only bottom-towed gear codes included) – from Logbook data only (i.e. includes data from vessels without VMS).

Year	Live Weight (t)	Value (£)	Vessels
2012	6484.5	£15,134,414	150
2013	6151.4	£12,107,322	133
2014	5556.0	£12,119,914	141
2015	6436.5	£13,323,455	135
2016	5755.9	£12,730,690	136
2017	4880.9	£11,334,409	127
2018	4361.8	£10,147,736	111
2019	5673.9	£14,020,371	119
2020	4575.6	£8,565,989	103
2021	5246.4	£10,132,966	99
2022	5164.5	£14,224,404	94
Total	***60287.3***	***£133,841,670***	***295***

Given the lack of logbook and VMS data for Republic of Ireland (ROI) vessels and the lack of VMS data for under 12 m vessels it was not possible to spatially quantify the totality of fishing effort for FU15. However, for the purpose of the present study it was considered sufficient to obtain a relative estimate of the effort both inside and outside the area of interest. This is subject to the assumption that the 75 % vessel coverage of the UK fleet by the VMS data is representative of activity for both over 12m and under 12m fleet segments. Whilst ROI vessels will target the FU15 *Nephrops* fishery and are not captured within the data analysis in this report, it is also acknowledged that ROI vessels are unable to qualify for access to relevant parts of IoM territorial waters where management measures are being considered as a result of Article 502 of the EU-UK Trade and Cooperation Agreement. As such, no ROI vessels were licenced to fish for *Nephrops* in Isle of Man waters during the period assessed (i.e. 2012-2022). Therefore, any fishing activity that is not accounted for from these vessels will be limited to the FU15 fishery footprint outside of Isle of Man territorial waters. Overall, the spatial analysis presented in this report captures ≈ 65 % of live weight (t) landed (UK and ROI). It is also assumed that possible gaps in the identification of fishing tows, due to VMS data constraints (i.e. missing speed data or data points), take place with the same probability inside and outside the area of interest.

Duplicated VMS pings (i.e. exact or with time intervals of less than four minutes), pings on land, pings within 2 km of harbour and points missing latitude, longitude or fishing speed were also removed from the analysis. Assignment of logbook data to VMS pings then followed the methods described in Gerritsen and Lordan (2011). Although vessels fishing for *Nephrops* should have 120 minute ping rate for VMS there remains a degree of irregularity in the polling rate. Effort (fished hrs) was estimated for each VMS ping as the time interval since the previous ping for that vessel date. Any intervals of > 4 h were removed and substituted with the daily average time interval of the remaining records for that vessel date. This avoids assigning a disproportionate amount of effort (fished hrs) to pings that follow a period of missing data. A fishing speed criteria was then applied (2-4 knots) in order to remove all pings outside of this speed range where vessels are considered inactive or steaming. The register number (RSS No) allocated to a vessel, which is unique to a vessel, was combined with the date of fishing activity to link vessel data in the VMS and logbook datasets. There are usually a number of VMS pings that correspond to a vessel's fishing activity on any given date and the catches Live Weight (t) and Value (£) from the logbook data were assigned equally to all fishing locations (i.e. VMS pings at fishing speed) for each vessel on each day. For example, if a vessel with 10 VMS fishing records in a day catches 1000 kg of *Nephrops* then 100 kg of *Nephrops* will be assigned to each of the 10 VMS pings. This assumes that the catches made in a single day are distributed uniformly both temporally and spatially. Once the catch data (Live Weight (t), Value (£) and Effort (fished hrs)) have been assigned to VMS pings then the point data can be aggregated to a grid for mapping. Once merged, the data were also filtered to remove VMS pings not in FU15 (according to spatial location of VMS).

The spatial extent of the *Nephrops* grounds in FU15 has been defined using 2012-2022 integrated VMS logbook data (minus ROI, Belgium and < 12 m UK vessels) and incorporating data on suitable seabed sediments for *Nephrops* (MS 2017). Similar approaches have been used for other FUs (i.e. ICES 2019). In order to obtain a fishery footprint of FU15 the cleaned and merged logbook and VMS data from 2012-2022 were rasterised to a 1 km by 1km grid. MFRI (2021) used a minimum of 6 VMS pings per grid cell (800 * 800 m resolution and a nine year VMS and logbook dataset) as a threshold for including the cell within the fishery footprint for the N*ephrops* ground. As such, for this analysis, a similar approach was taken with raster cells outside of the area of suitable *Nephrops* sediment with less than 6 VMS pings reported in a 1km^2 cell between 2012-2022 excluded (Figure 1; 137 t removed). The filtered raster layer was then used to calculate the spatial extent of the grounds (km^2) with FU15 estimated as 4916 km^2 and the section of FU15 within Isle of Man territorial waters as 604 km^2 (i.e. 12.3% of the FU15 fishing area is within the Isle of Man territorial sea). In addition, the point data used in the analysis

below was also refined using this raster layer (i.e. only VMS fishing pings within green cells were retained).

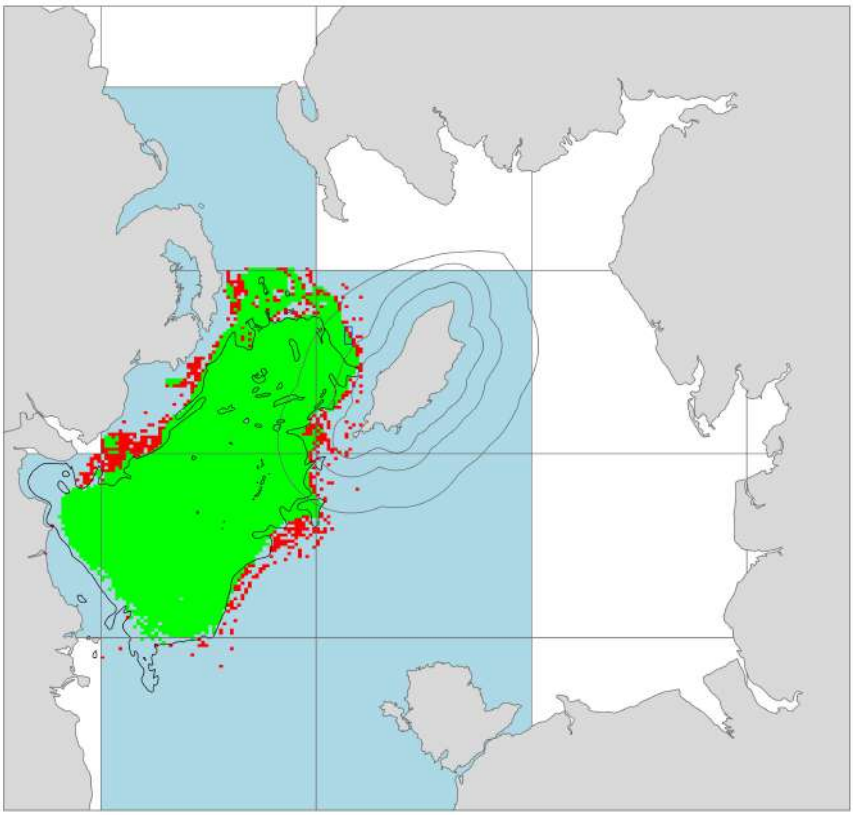

Figure 1: Raster layer with 1km^2 cells indicating the fishery footprint (green cells) for *Nephrops* within FU15. Red cells indicate cells outside of the known *Nephrops* habitat (polygon with black outline; source: Marine Scotland 2019) with less than 6 VMS fishing pings over the period 2012-2022. Green cells were used to determine the footprint of the fishery (each cell is 1km^2 giving a fishery footprint of 4916 km^2). The blue squares indicate the ICES Rectangles that comprise FU15. The grey are indicates land for UK, ROI, IRL and IOM. The 3,6 and 12 nm limits are also displayed for the Isle of Man.

Table 2: Merged Logbook and VMS data filtered to FU15 *Nephrops* fishery including IoM, UK and EU waters (please note: no ROI or Belgian vessel data, no under 12m vessels and only bottom-towed gear codes included) – excluding points which were in 1km^2 cells with ≤ 6 VMS fishing pings (2012-2022) within a 1km^2 grid cell.

Year	Live Weight (t)	Value (£)	Fishing (Hrs)	Vessels
2012	4659	£10,936,649	81460	94
2013	4145	£8,125,225	69283	87
2014	4199	£9,027,962	71197	99
2015	5673	£11,629,836	82795	103
2016	5065	£11,103,202	72531	108
2017	4110	£9,506,280	54568	97
2018	3872	£8,915,451	53149	80
2019	4900	£12,105,537	60406	88
2020	3990	£7,455,910	40791	73
2021	4423	£8,487,300	47874	69
2022	4168	£11,435,045	42173	64
Total	49205	£108,728,397	676225	203

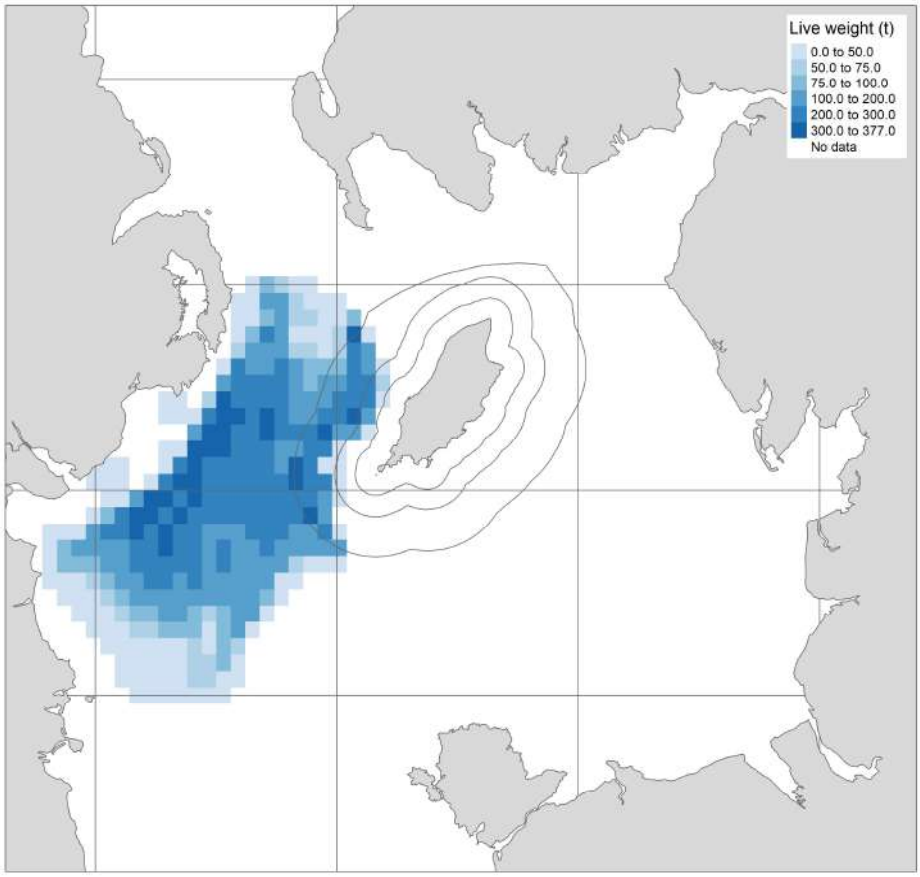

Figure 2: Raster layer showing Live Weight (t) of *Nephrops* over the period 2012-2022. The catch-and-effort data displayed here were aggregated to a grid of 0.06 longitude by 0.04 latitude (~2.2 x 2.4 nautical miles).

In order to calculate fishing effort (hrs) and landings (Live Weight t) from each of the proposed closed areas or options, VMS pings inside and outside of each closed area were identified and summed. One of the challenges in using static VMS pings to assess fishing activity is that as each ping should represent 120 minutes of fishing activity at an average speed of 2.7 knots (Irish and UK Reports) vessels could travel up to 5.4 nm during that ping interval. It is therefore not possible to accurately ascertain what proportion of fishing activity associated with each ping within a closed area occurred inside or outside of the polygon. As such, the entire proportion of fishing effort for these pings was considered to have occurred inside the closed area whilst the entire proportion of fishing activity for pings outside these closed areas were considered to have occurred outside. This provides a relative assessment of fishing activity inside and outside the proposed closed areas which is presented below.

Although the instantaneous speed and heading are recorded for each VMS ping meaning the trajectory and location between successive pings could be interpolated, for VMS data with 2 hr polling intervals there can be a large degree of error associated with these interpolations. For example, Lambert et al., (2012) concluded that 2 hr intervals are too long to accurately interpolate fishing tracks with their results broadly supporting the conclusion that point-density methods on cleaned VMS were suitable for providing information on patterns of fishing activity on large scales of space and time and that higher resolution data is required for accurate interpolation. Given the potential errors associated with track interpolation using 2hr ping intervals, only information on point-density estimates is considered within this report.

3.0 Minimum spatial management measures in the Western Irish Sea Mud-Belt to facilitate Blue Carbon Research

In order to enable the research requirements of the Manx Blue Carbon Project and facilitate Blue Carbon research the minimum spatial management requirements are the temporary closure of three sites in the Western Irish Sea Mud-Belt (Figure 3) known as Blue Carbon Experimental Research Zones (BCERZs). These three closures will be established on a temporary basis following the conclusion of the consultation and will be reviewed at the end of December 2026 when the research has been completed and analysed. These minimum spatial measures are considered to limit the impact upon existing UK *Nephrops*-directed bottom-towed gear fisheries whilst achieving Objective 1 set out by the Department.

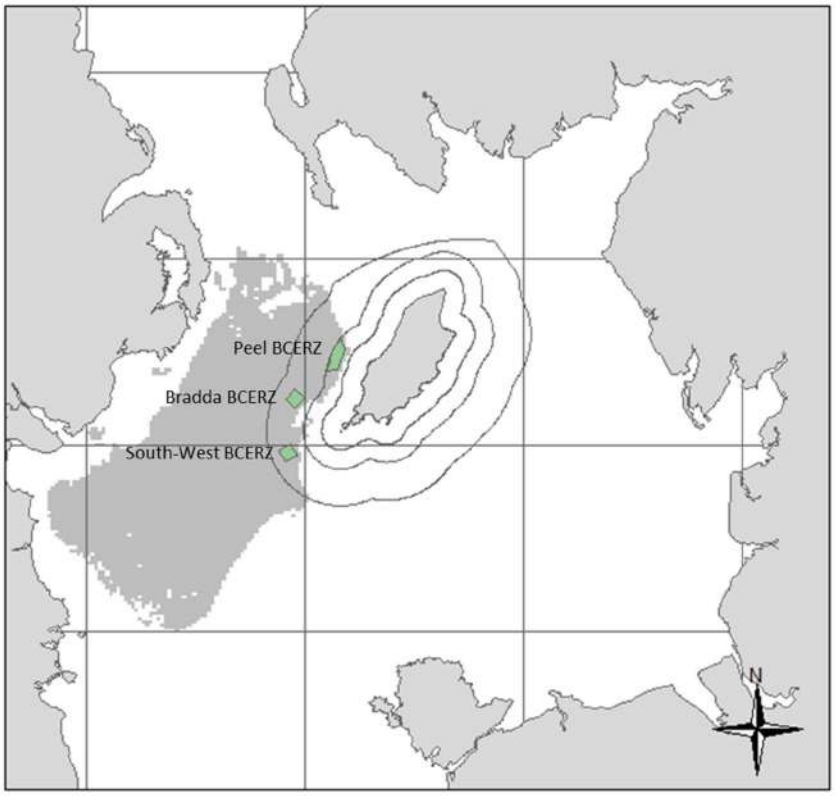

Figure 3: Minimum spatial management measures to facilitate Blue Carbon research – Three temporary Blue Carbon Experimental Research Zones indicated in green. The grey fishery footprint (2012-2022) for FU15 is displayed as are the lines indicating the 3, 6 and 12 nm limits of the Isle of Man. ICES Rectangles are indicated as grey lines.

The three areas are denoted from north to south are Peel BCERZ (28.47 km^2), Bradda BCERZ (15.43 km^2) and South-West BCERZ (15.82 km^2). The combined area of interest proposed (59.72 km^2) equates to 1.2 % and 9.9 % of the total fishing footprint for FU15 and the area of FU15 within IoM territorial waters respectively. Although these areas encompass < 10 % of the *Nephrops* fishing ground within Isle of Man waters the location of these proposed closures may have additional impacts on *Nephrops* trawl fishing activity within the remaining open area of the fishing area within the territorial sea if they interrupt traditional fishing tows. The impacts of these closures on existing *Nephrops* trawl vessels are considered short-term initially, with a review at the end of December 2026.

The number of fishing hours was estimated inside and outside this area for vessels for which VMS data was available (Table 3), indicating that relatively, the fleet spent 1.7 % (annual range 1.4 – 2.1 %) and

11.2 % (9.2 – 13.5 %) on average for 2012-2022 of their total fishing time per annum for FU15 and the area of FU15 within IoM territorial waters respectively within the areas proposed. The quantity (t) of *Nephrops* caught was estimated inside and outside this area for vessels for which VMS data was available (Table 3), indicating that relatively they caught 1.9 % (annual range 1.3 - 2.5 %) and 11.6 % (annual range 9.1 - 14.5 %) on average for 2012-2022 of their total Live weight (t) per annum for FU15 and the area of FU15 within IoM territorial waters respectively from within the areas proposed.

Annual figures for each metric are presented in Table 3.

4.0 Extended spatial management measures in the Western Irish Sea Mud-Belt to deliver co-benefits for Blue Carbon Research, Creel fishing and marine conservation objectives

In order to deliver co-benefits for Blue Carbon Research, Creel fishing and conservation objectives the Department has proposed an extension to the minimum spatial management measures. Under this proposal two of the previously described research sites (Peel and South-West BCERZs) would be extended closed areas (CA) described as the West of Targets CA and the Southwest CA whilst the remaining site (Bradda BCERZ) would remain unchanged (Figure 4). The two temporary CAs proposed are directly adjacent to UK Marine Conservation Zones ("South Rigg MCZ" is adjacent to the proposed West of Targets CA and "Queenie Corner MCZ" is adjacent to the proposed Southwest CA). All closures would be subject to review in 2026 following an assessment of the potential conservation, fishery and blue carbon benefits of the closures following evidence collected during the initial closure. These extended spatial management measures are considered by the Department to deliver on Objectives 1-3 initially on a short -term basis initially (with a review of closures in 2026).

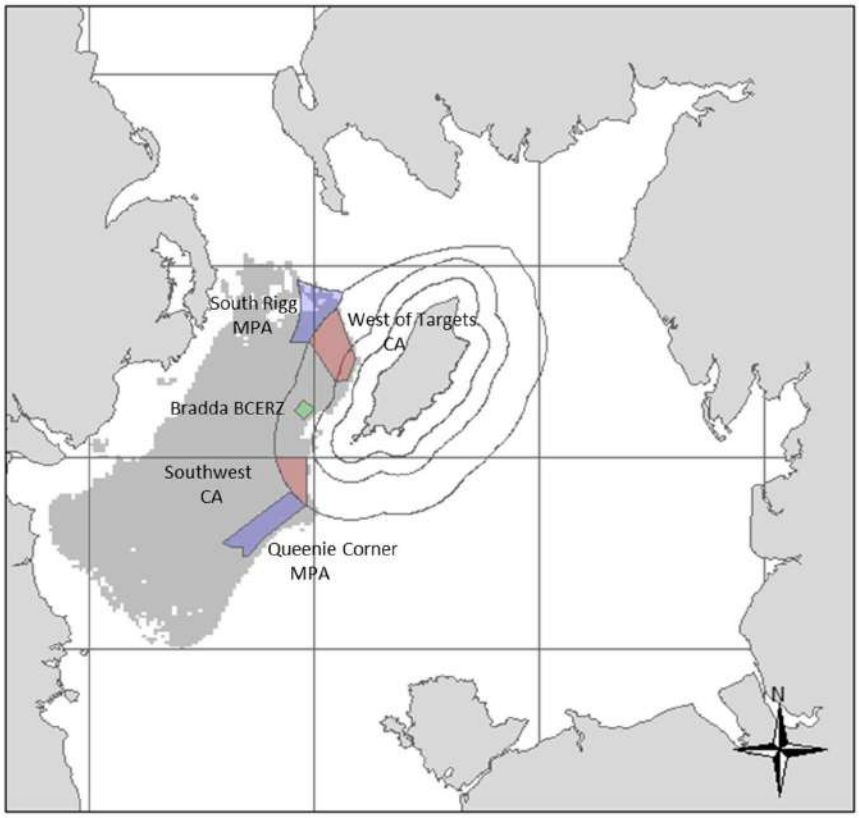

Figure 4: Extended spatial management measures for co-benefits of Blue carbon, Nephrops creel fishing and marine conservation. One temporary Blue Carbon Experimental Research Zone indicated in green (Bradda BCERZ). Two temporary CAs indicated in red (West of Targets and Southwest CAs). UK existing adjacent MCZs indicated in purple (South Rigg and Queenie Corner). The grey fishery footprint (2012-2022) for FU15 is displayed, as are the lines indicating the 3, 6 and 12 nm limits of the Isle of Man. ICES Rectangles are indicated as grey lines.

The three areas are denoted from north to south as West of Targets CA (161.49 km^2), Bradda BCERZ (15.37 km^2) and Southwest CA (80.69 km^2). The west of Targets CA has an abundant population of prawns and several species of conservation interest (i.e. sea pens) have also been recorded. Although *Nephrops* abundance in the Southwest CA is lower, it is considered in the consultation to be a good area for establishing a creel fishery whilst also providing protection for edible crab nursery grounds and some more fragile species of conservation interest. The combined area of interest proposed (257.55 km^2) equates to 5.2 % and 42.6 % of the total fishing footprint for FU15 and the area of FU15 within IoM territorial waters respectively. The location of the BCERZ between the CAs could have an additional impact on *Nephrops* trawl fishing activity within the remaining open area of the fishing area within the territorial sea if it interrupts traditional fishing tows. Initially these closures will be established on a temporary basis following the conclusion of the consultation and reviewed at the end of December 2026, when the research has been completed and analysed.

The number of fishing hours was estimated inside and outside this area for vessels for which VMS data was available (Table 4), indicating that relatively, the fleet spent 6.5 % (annual range 5.2 – 8.4 %) and 44.4 % (41.1 – 48.6 %) on average for 2012-2022 of their total fishing time per annum for FU15 and the area of FU15 within IoM territorial waters respectively within the extended areas proposed. The quantity (t) of *Nephrops* caught was estimated inside and outside this area for vessels for which VMS data was available (Table 4), indicating that relatively, they caught 7.1 % (annual range 5.0 – 9.1 %) and 44.4 % (annual range 39.6 – 49.7 %) on average for 2012-2022 of their total Live weight (t) per annum for FU15 and the area of FU15 within IoM territorial waters respectively from within the extended areas proposed.

Annual figures for each metric are presented in Table 4.

Table 3: Minimum spatial management measures to facilitate Blue Carbon research: values by year for the different metrics

Metric	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
LE (t)	115	78	82	100	75	73	66	80	84	107	53
Value (£)	£273,982	£152,225	£178,192	£203,141	£155,406	£164,468	£152,562	£194,583	£159,164	£193,848	£135,479
Vessels	63	62	61	68	72	52	41	53	44	46	42
Hours	1672	1101	1173	1273	981	841	814	886	836	1005	582

Table 4: Extended spatial management measures to deliver co-benefits of Blue Carbon, *Nephrops* creeling and marine conservation: values by year for the different metrics

Metric	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
LE (t)	396	294	342	402	355	265	238	292	361	353	209
Value (£)	£944,983	£583,819	£738,999	£826,477	£759,085	£595,239	£551,907	£730,961	£683,736	£656,312	£548,057
Vessels	75	72	74	77	82	64	52	70	50	54	45
Hours	6022	4383	4785	5133	4765	3294	3287	3377	3420	3537	2203

4.0 Conclusion

Limitations of report as a consequence of incomplete VMS data

As described above, logbook and VMS data for ROI vessels were not available for inclusion in this analysis. In recent years (2017-2021) this has accounted for an additional 1500 t of landings per year from FU15. In addition, under 12 m vessels are not required to operate VMS, and were therefore not captured within the spatial analysis. VMS data was also not available for vessels registered in Belgium but this only accounted for 5 vessels and 29 fishing trips in the ten year dataset. Logbook data is however available for under 12m and Belgian vessels and included in the landings detailed in Table 1. The lack of VMS coverage for these vessels has resulted in the majority of their fishing activity being excluded from the merged VMS and logbook data analysis presented here (i.e. Table 2 and all analysis within the Options sections of the report). The data presented within this report does not therefore reflect the totality of fishing activity. It should be noted that ROI landings equate on average to around 22 % annually (using data from 2012 – 2021; annual range is 18.7 – 25.6 %) of the total landings for FU15. It would be impossible for ROI vessels to qualify for access to demersal (including *Nephrops*) species in the areas of the Isle of Man territorial waters under consideration within the DEFA consultation as a result of Article 502 of the EU-UK Trade and Cooperation Agreement. Therefore, any fishing activity that is unaccounted for from these vessels will be limited to the FU15 fishery footprint outside of the Isle of Man territorial waters. Landings from under 12 m UK vessel and over 12m vessels (UK and Belgium) with missing VMS equate on average to around 5 % annually of the total landings for FU15 (using data from 2012 – 2021; including ROI landings; annual range is 2.8 – 8.1 %). For UK under 12m vessels and vessel trips of over 12 m vessels that cannot be merged, this report assumes that the fishing activity would be reflected by the patterns of the UK over 12m fleet for which we do have spatial data.

Overall it is acknowledged that owing to the limitations described above, the spatial analysis presented in this report lacks data that represents around 35% of live weight (t) landed from FU15 (UK and ROI; 2012 - 2021).

Uncertainties within point density estimates:

As acknowledged in the methods section due to the large ping rate intervals (2 hrs) and the unknown trajectory of the fishing path of a vessel within the interval between successive pings it is not possible, with absolute certainty, to determine what proportion of the fishing activity of each VMS fishing ping is within or outside of a proposed area. As such, this analysis has taken a relative approach that uses point density estimates to calculate relative effort inside and outside of the proposed closed areas. It is considered that given the ten-year time series of data and the relatively large area covered by FU15 that this method is suitable given the available data. It is however acknowledged that the data presented here are therefore relative and not absolute estimates and that a degree of uncertainty within these estimates exists.

Spatial displacement:

The minimum spatial management measures account for around 1.2 % of the fishery footprint for FU15 and 9.9 % of the fishery footprint calculated for the area of FU15 that is within Isle of Man territorial waters, as calculated from merged VMS and logbook data of *Nephrops* towed-bottom gear fishing trips from 2012-2022 combined. The extended spatial management measures proposed account for around 5.2 % of the fishery footprint for FU15 and 42.6 % of the fishery footprint calculated for the area of FU15 that is within Isle of Man territorial waters, as calculated from merged VMS and logbook data of *Nephrops* towed-bottom gear fishing trips from 2012-2022 combined. In the context of the Isle of Man

territorial waters both options are likely to have a negative impact on *Nephrops* towed-bottom gear vessels fishing in FU15. The placement and location of the CAs and BCERZs could cause impacts to current trawl vessels in addition to the direct loss of fishing grounds related to changes in spatial fishing patterns within the remaining open areas if the placement of the proposed temporary CAs or BCERZs impact on the traditional tow patterns of these vessels.

Current vessels targeting the fishery using trawls, and for which switching to creels is not an option, would be subject to a degree of spatial displacement of fishing activity. The degree to which individual vessels will be impacted will largely depend on their current fishing patterns and how consistently they fish within the area of FU15 which is inside Isle of Man territorial waters and/or within those areas where the proposed closures are located. Whilst ICES advise that the management of *Nephrops* fisheries should be implemented at the FU level a single TAC covers the entire ICES Subarea VII. Displacement of landings previously attributed within these proposed areas by trawl vessels can occur either within the remaining fishing area of FU15 or within any of the six other FUs located within ICES Subarea VII. Displacement to other FUs could lead to significantly longer steaming distances to these alternative fishing grounds causing potential increases in fuel use and reduction in revenue if these areas are further from vessels current home ports. Displacement of fishing activities to other areas of FU15 or other FUs within ICES Subarea VII could also cause greater effort to be exerted in those areas thereby also impacting vessels that fish within FU15 outside of the Isle of Man territorial waters.

Creel fishing:

Whilst the proposed closures are likely to have a negative impact on current *Nephrops* bottom-towed gear vessels, under the extended spatial management measure proposals within this consultation it would be possible to creel for *Nephrops* within either of the proposed CAs subject to having an Isle of Man sea fishing licence and any associated authorisations. It is likely due to vessel size or set-up that the vessels which would target *Nephrops* by creel would be a different part of the fishing sector than currently target *Nephrops* using towed-bottom gear. This will therefore create new opportunities for fishing diversification or additional fishing areas for existing *Nephrops* creel vessels for the IoM and UK static gear fleets.

According to previous studies (i.e. Ziegler & Valentinsson 2008, Leocadio et al., 2012, Eichert et al., 2018) there are potential positive benefits to the stock, ecosystem and socio-economics on switching from trawl to creel gear for targeting *Nephrops*. These include:

- Reduction in discards – creels are very selective for the target species, catching almost exclusively *Nephrops* while trawling produces large quantities of by-catch composed mainly of fish (i.e. Ziegler & Valentinsson 2008)
- Reduction in seabed disturbance – impact of creeling on benthic communities is minimal compared to trawling (i.e. Ziegler & Valentinsson 2008).
- Reduced fuel use – fuel consumption has been found to be 9 times lower in a creel fishery compared to trawlers with the majority of fuel use the journey to and from the fishing area, and fuel use during hauling of creels almost insignificant (i.e. Ziegler & Valentinsson 2008, Leocadio et al., 2012).
- Increased value in product – the unit value of landings for *Nephrops* caught by creels tends to be superior to that for trawls, due to the larger size and better condition of individuals (i.e. Eriksson 2006, Ridway et al., 2006, Leocadio et al., 2012); however, it should also be noted that the catch efficiency of creels is significantly lower than in bottom trawls.

For further information please see Appendix Reports 1 and 3.

5.0 References

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