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## 15 *Nephrops* in Division 7.a (Irish Sea East, FU14)

### 15.1 *Nephrops* Subarea 7 general section

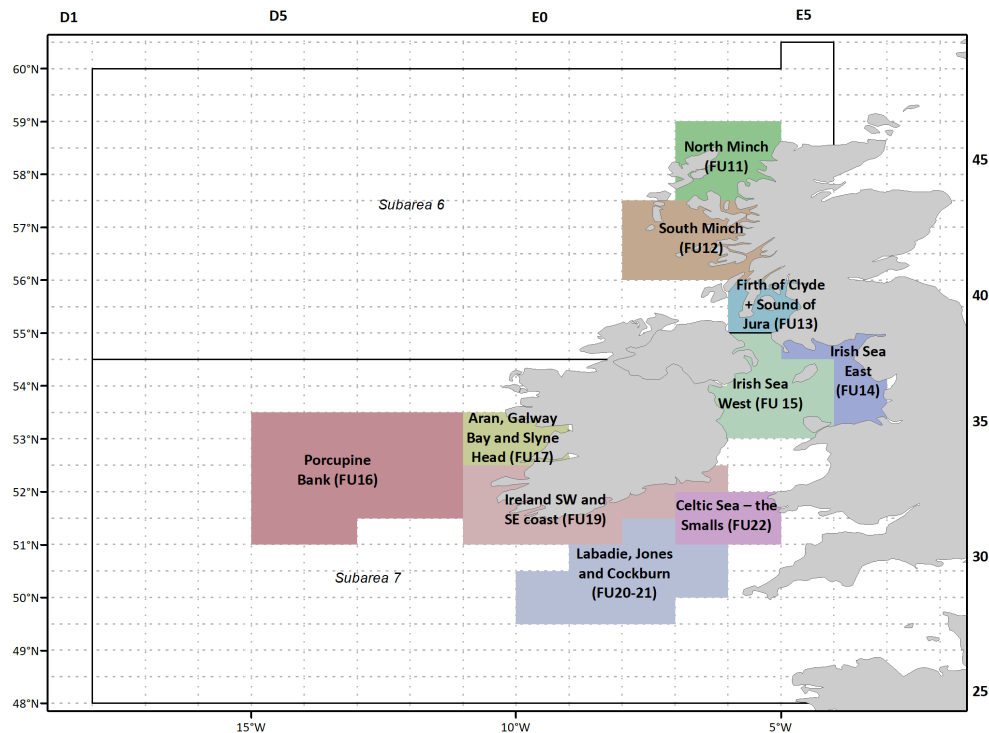
#### Stock description and management units

A TAC is in place for ICES Area 7 which does not correspond to the assessment units. As *Nephrops* are limited to muddy habitats the distribution of suitable sediment defines the species distribution and the stocks are therefore assessed as eight separate Functional Units. There are also some smaller catches from areas outside these Functional Units. The ICES statistical rectangles covered by the Functional Units in ICES Area 7 are listed in the table below.

FU no.	Name	ICES Divisions	ICES Statistical rectangles
14	Irish Sea East	7a	35–38E6; 38E5
15	Irish Sea West	7a	35E3, 36E3; 35–37 E4–E5; 38E4
16	Porcupine Bank	7b,c,j,k	31–35 D5–D6; 32–35 D7–D8
17	Aran Grounds	7b	34–35 D9–E0
18*	Northwest Irish Coast	7b	36–37 D9; 37E0–E1
19	Southeast and southwest Irish Coast	7a,g,j	31–33 D9–E0; 31E1; 32E1–E2; 33E2–E3
20-21	Labadie, Jones and Cockburn bank	7g,h	28 E0–E2; 29 E0–E3; 30E1–E3; 31E2
22	Smalls Ground	7g	31–32 E3–E4

\* Landings from FU18 are reported to other statistical rectangles outside FUs as these are minimal. WGCSE will monitor FU18 landings in case of any fishery developments.

*Nephrops* Functional Units in Subarea 7 (FU 14–22). The TAC covers all of Subarea 7. (Note: Functional Units in Subarea 6 (FU 11–13) also shown):



## Landings Obligation

From 2019, on the West Coast and around Ireland (FU 11–22), any vessels catching *Nephrops* had to land all *Nephrops*. High survival exemptions exist for creel caught *Nephrops*. *De minimis* exemptions apply to *Nephrops* vessels, for Subarea 7 allowing them to discard *Nephrops*, as long as they made up no more than 5% of the catch.

Minimum Conservation Reference Size (Minimum landing size)

Under the Landing Obligation, minimum landings sizes have been abolished. Instead a Minimum Conservation Reference Size (MCRS) for each species has been introduced. Unless exempt, *Nephrops* below the MCRS must be landed and may be sold but cannot go for human consumption. In most cases, the MCRS is the same as old MLS, being 25 mm carapace length (or over 85 mm total length) around Ireland (FUs 16–22); the MCRS is 20 mm CL (>70 mm TL) on the West coast (6.a, FUs 11–13) and the Irish Sea (7a, FUs 14–15).

The MCRS implemented for the Irish Sea at 20 mm CL is less than the rest of the ICES Area 7 (set at 25 mm CL) and applies to the Irish and UK fleets. A more restrictive regulation is adopted by the French Producers' Organisations (35 mm CL or 115 mm TL) to all French trawlers.

## Management applicable in 2021 and 2022

The TAC is currently set for the whole Area 7 with a special condition for Porcupine Bank (FU 16). The TAC for 2022 is set at 17,038 tonnes, which is a decrease of 5% compared to the 18,026 tonnes set for 2021. The TAC area includes a number of *Nephrops* stocks showing different levels of exploitation. A single TAC covering a number of distinct stocks allows the possibility of unrestricted catches being taken from a heavily exploited stock when advice suggests they should be limited.

Details of all regulations including effort controls in place are provided in the stock annex for all functional units under this subarea.

Fishing opportunities for Norway lobster (*Nephrops norvegicus*) in Division 27.7, with specific restrictions for FU 16.

	Allowances 2021 (tonnes)		Allowances 2022 (tonnes)		Change from 2021	
	Division 27.7	FU 16	Division 27.7	FU 16	Division 27.7	FU 16
Spain	993	992	924	846	-7%	-15%
France	4,023	621	3,746	530	-7%	-15%
Ireland	6,102	1,194	5,682	1,016	-7%	-15%
Union	11,118	2,807	10,352	2,392	-7%	-15%
UK	6,908	483	6,686	412	-3%	-15%
TAC	18,026		17,038		-5%	

**Sources:**

*Council Regulation (EU) 2021/92 of 28 January 2021 fixing for 2021 the fishing opportunities for certain fish stocks and groups of fish stocks, applicable in Union waters and, for Union fishing vessels, in certain non-Union waters*

*Council Regulation (EU) 2022/515 of 31 March 2022 amending Regulation (EU) 2022/109 fixing for 2022 the fishing opportunities for certain fish stocks and groups of fish stocks applicable in Union waters and for Union fishing vessels in certain non-Union waters*

## Landings area 7

Table below gives the summary of reported landings by Functional Unit for ICES Area 7.

Year	FU 14 - Irish Sea East	FU 15 - Irish Sea West	FU 16 - Porcupine Bank	FU 17 - Aran Grounds	*FU 18 - Ireland North-west Coast	FU 19 - Ireland Southwest and Southeast coast	FU 20–21 - Labadie, Jones, Cockburn	FU 22 - Smalls Grounds	FUs 20+21+22 - All Celtic Sea FUs combined	Other statistical rectangles Outside FUs	Total Landings ICES Subarea 7	TAC for 7
1978	961	7,296	1,744	481						249	10,731	
1979	900	8,948	2,269	452						237	12,806	
1980	730	4,578	2,925	442						205	8,880	
1981	829	7,249	3,381	414						382	12,255	
1982	869	9,315	4,289	210						234	14,917	
1983	763	9,448	3,426	131					3,667	174	17,609	
1984	602	7,760	3,571	324					3,653	187	16,097	
1985	498	6,901	3,919	207					3,599	194	15,318	
1986	671	9,978	2,591	147					2,638	113	16,138	
1987	449	9,753	2,499	62					3,409	107	16,279	24,700
1988	462	8,586	2,375	828					3,165	140	15,556	24,700

Year	FU 14 - Irish Sea East	FU 15 - Irish Sea West	FU 16 - Porcupine Bank	FU 17 - Aran Grounds	*FU 18 - Ireland North-west Coast	FU 19 - Ireland Southwest and Southeast coast	FU 20–21 - Labadie, Jones, Cockburn	FU 22 - Smalls Grounds	FUs 20+21+22 - All Celtic Sea FUs combined	Other statistical rectangles Outside FUs	Total Landings ICES Subarea 7	TAC for 7
1989	401	8,128	2,115	347		899			4,005	134	16,029	26,000
1990	563	8,300	1,895	519		754			4,290	102	16,423	26,000
1991	747	9,554	1,640	410		1077			3,295	169	16,892	26,000
1992	427	7,541	2,015	374		888			4,165	409	15,819	20,000
1993	515	8,102	1,857	372	10	905	3,466	1,182		455	16,864	20,000
1994	447	7,606	2,512	729	126	390	4,202	941		570	17,523	20,000
1995	584	7,796	2,936	867	26	695	3,536	1081		397	17,917	23,000
1996	475	7,247	2,230	528	46	888	2,822	937		623	15,796	23,000
1997	566	9,971	2,409	841	15	756	2,038	944		340	17,880	23,000
1998	388	9,128	2,155	1,410	78	827	1,713	835		514	17,048	23,000
1999	624	10,786	2,289	1,140	16	579	1,152	1,775		322	18,683	23,000
2000	567	8,370	910	880	9	696	1,778	2,890		243	16,343	21,000
2001	532	7,441	1,222	913	2	815	1,833	2,938		368	16,064	18,900

Year	FU 14 - Irish Sea East	FU 15 - Irish Sea West	FU 16 - Porcupine Bank	FU 17 - Aran Grounds	*FU 18 - Ireland North-west Coast	FU 19 - Ireland Southwest and Southeast coast	FU 20–21 - Labadie, Jones, Cockburn	FU 22 - Smalls Grounds	FUs 20+21+22 - All Celtic Sea FUs combined	Other statistical rectangles Outside FUs	Total Landings ICES Subarea 7	TAC for 7
2002	577	6,793	1,327	1,154	14	1,318	2,674	1,993		243	16,093	17,790
2003	376	7,052	1,064	933	16	1,239	2,953	2,065		186	15,884	17,790
2004	472	7,266	1,406	525	22	1,074	2,443	1,828		161	15,197	17,450
2005	570	6,529	2,197	778	15	712	2,469	2,533		180	15,983	19,544
2006	628	7,535	2,185	637	14	741	2,523	1,761		270	16,294	21,498
2007	959	8,424	2,074	913	3	957	2,419	2,950		206	18,905	25,153
2008	726	10,482	1,000	1,057	1	851	2,980	3,090		322	20,509	25,153
2009	693	9,166	879	626	10	868	3,145	2,185		316	17,888	24,650
2010	583	8,929	922	939	7	687	1,793	2,714		359	16,933	22,432
2011	561	10,159	1,278	659	13	643	1,237	1,636		110	16,296	21,759
2012	531	10,527	1,258	1,246	28	849	1,189	2,618		325	18,571	21,759
2013	495	8,672	1,141	1,295	0	794	1,387	2,257		194	16,235	23,605
2014	679	8,613	1,189	766	0	468	1,836	2,526		174	16,251	20,989

Year	FU 14 - Irish Sea East	FU 15 - Irish Sea West	FU 16 - Porcupine Bank	FU 17 - Aran Grounds	*FU 18 - Ireland North-west Coast	FU 19 - Ireland Southwest and Southeast coast	FU 20–21 - Labadie, Jones, Cockburn	FU 22 - Smalls Grounds	FUs 20+21+22 - All Celtic Sea FUs combined	Other statistical rectangles Outside FUs	Total Landings ICES Subarea 7	TAC for 7
2015	378	8,632	1,394	370	0	507	2 116	2,350		80	15,827	21,619
2016	237	7,327	2,154	641	0	590	2 453	3,329		118	16,849	23,348
2017	265	6,149	2,632	295	0	420	1,849	3,560		137	15,307	25,356
2018	263	5,756	2,751	536	0	238	1,803	1,974		200	13,521	29,091
2019	270	7,590	2,251	167	0	249	2,723	2,083		216	15,549	19,784
2020	232	6115	1899	222	0	249	413	1518		304	10887	16815
2021	519	6779	2476	498	0	415	736	1616		346	13385	18026
Average	559	8144	2105	620	16	728	2196	2073	3589	257	15869	22169

\*Landings from FU18 are reported to other statistical rectangles outside FUs as these are minimal since 2013. WGCSE will monitor FU18 landings in case of any fishery developments.



## ***Nephrops* FU14 section**

### **Type of assessment in 2022**

This stock was inter-benchmarked in September 2015 (ICES, 2015) and the assessment and provision of advice through the use of the UWTV survey data and commercial fishery data follows the process defined by the inter-benchmark process and described in the stock annex (updated at WGCSE 2020). The UWTV survey undertaken in the summer 2022 forms the basis of advice for this stock.

### **ICES advice published 29 October 2021**

*“ICES advises that when the MSY approach is applied, and assuming that discard rates and fishery selection patterns do not change from the average of the years 2017–2019, catches in 2022 should be no more than 835 tonnes.*

*To ensure that the stock in Functional Unit (FU) 14 is exploited sustainably, management should be implemented at the FU level.*

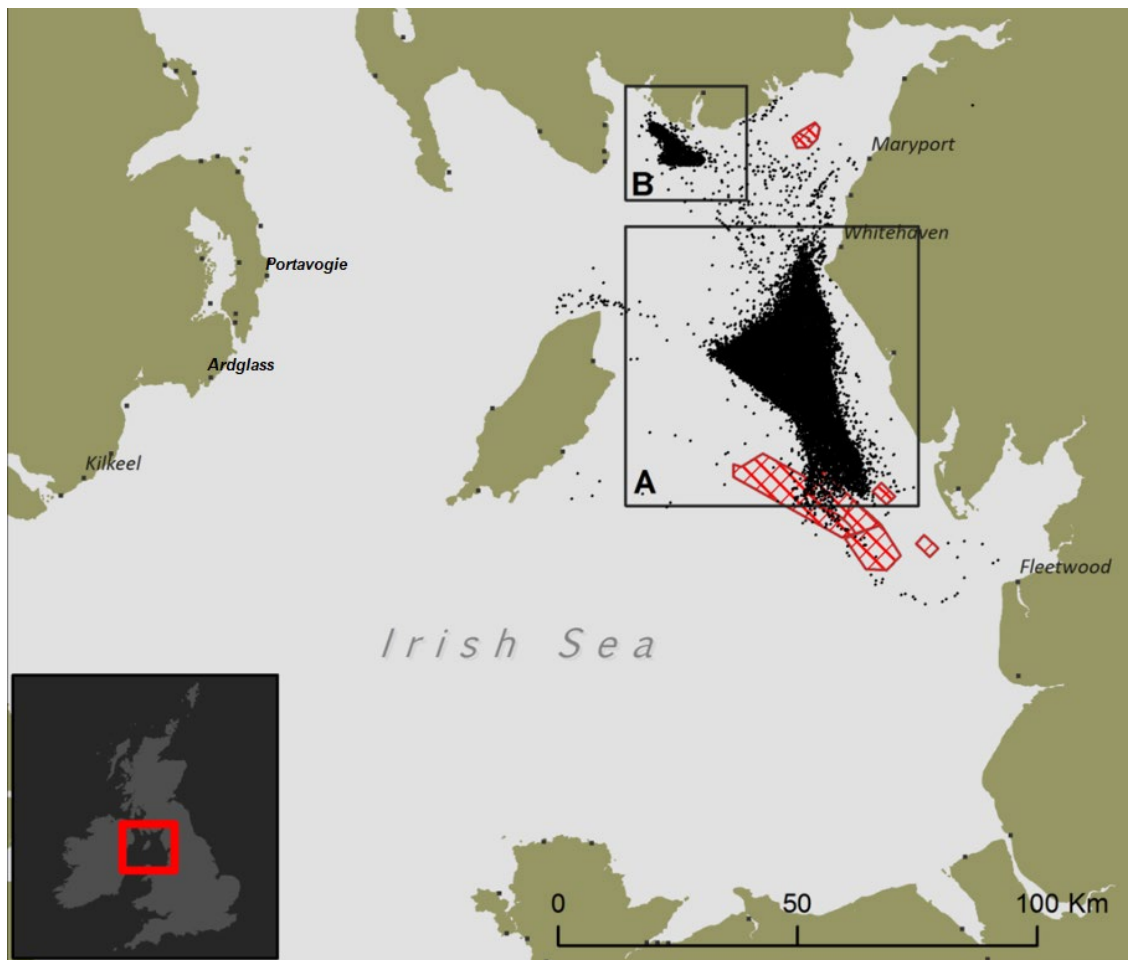
*ICES notes the existence of a management plan, developed and adopted by one of the relevant management authorities for Subarea 7. ICES considers this plan to be precautionary when implemented at the FU level.”*

## **15.2 General**

### **Stock description and management units**

The Irish Sea East *Nephrops* stock (FU14) is in ICES Subarea 7 and comprises ICES rectangles 38E5, 38E6, 37E6, 36E6, 35E6.

In FU 14 *Nephrops* are caught on two spatially discrete grounds. Most of the fishery takes place on the main ground located between the West coast of England and Isle of Man, additionally there is also fishing activity in a small inshore ground known as Wigtown Bay.



East Irish Sea fishing grounds: A= Main fishing ground; B= Wigtown bay area. Windfarms represented by red polygons. (Source: ICES, 2015).

Main landing ports: Kilkeel, Portavogie, Ardglass, Whitehaven, Maryport

## Fishery in 2021

The Eastern Irish Sea *Nephrops* fishery is relatively small compared to other FUs in the TAC area. Landings have been generally declining since 2009 (Table 3.8.2), with an isolated high of 679 tonnes in 2014 and another high of 519 tonnes in 2021. Lows were 237 and 232 tonnes in 2016 and 2020, respectively.

The fishery in FU 14 is dominated by UK vessel activity, on average accounting for 91% of the reported annual international landings since 2000. In 2021, only UK vessels reported landings from FU 14. Of these UK landings, 64.3% went into Northern Ireland (down from 80.3% in 2020), and 35.7% went into England (up from 19.2% in 2020). Unlike in 2020, no landings were reported in the Isle of Man.

The main fleets targeting *Nephrops* include single- and twin-rig otter trawlers operating out of ports in England, Wales, Northern Ireland, and the Republic of Ireland. In 2021, the fleet was split, according to landed weights, by 75.0% from Northern Irish vessels (78.7% in 2020), 22.3% from English vessels (10.9% in 2020), 2.7% from Scottish vessels (0% in 2020) and 0% from Irish vessels (10% in 2020). The TR2 gear class (otter trawls with 70 – 99 mm mesh sizes) accounted for 98.8% (99.3% in 2020) of the landings, with 1.0% (0.7% in 2020) of landings being reported from the TR1 gear class (otter trawls with  $\geq 100$  mm mesh sizes). The remaining 0.2% were caught in fixed pots.

A more detailed historical fishery description is provided in the stock annex.

## Information from stakeholders

No additional information was provided.

## 15.3 Data

### InterCatch

Data for 2021 were successfully uploaded to InterCatch prior to the 2022 WG meeting. According to the usual allocation procedure, English landings are allocated to English samples, Northern Irish landings are allocated to Northern Irish samples, and all remaining landings are allocated to pooled English and Northern Irish samples. Due to the impacts of the Covid-19 pandemic, no samples were available for 2020. Landings and discards length–frequency distributions for 2017–2019 were therefore used for the 2021 assessment. For the 2021 data year, Northern Irish samples were available and were allocated to all landings. Mean weights and discard rates for 2021 were calculated as the average of the values for 2019 and 2021.

### Landings

Official landings as reported to ICES from FU14 are presented in Tables 3.8.1 and 3.8.2. There are reported landings for this functional unit since 1973 with a minimum and maximum of 178.7 t (in 1974) and 960.5 t (in 1978) respectively. Between 1987 and 2006 landings from FU 14 appeared relatively stable fluctuating around a long-term average of about 550 t. The introduction of the UK Buyers and Sellers legislation in 2006 precludes direct comparison with previous years, as reported levels are considered to have significantly improved. Over the period 2007–2020, landings have declined considerably from the peak year of 2007 (959 t); landings in 2020 were the lowest in the period (232 t). There were no reported discards in 2020 and discarding (15 t) has been estimated based on 2017–2019 rates. In 2021, landings increased again to 519 tonnes, all into the UK, with 29 tonnes of reported discards.

### Effort

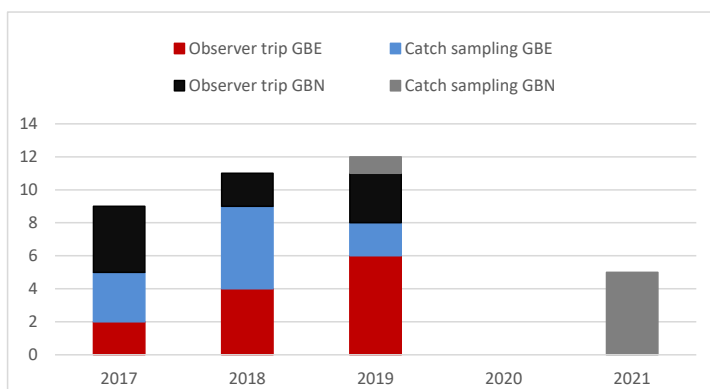
Following discussions at WGCSE, it was concluded that effort should be reported in the WGCSE report in kWdays, and LPUE should be reported in kg/kWdays in the knowledge that the trend is likely to be a biased underestimate because it is not adjusted for efficiency or behavioural changes. Effort calculations are likely to have been unreliable prior the introduction of the Buyers and Sellers legislation in 2006 by the UK and improvement in landings reporting.

Total UK and Irish targeted effort (70-99mm mesh with >30% *Nephrops* by weight) and LPUE is reported in Table 3.8.3 and shown in Figure 3.8.2. Until 2020, there was a general decline in targeted effort since 2007 (although 2014 did see a small rise in effort compared to 2013). In 2021, targeted effort increased again, almost tripling compared to 2020.

Within the UK targeted metier, there are significant differences between sub-fleets and changes in fleet composition may therefore unduly influence catch rate metrics. These issues need to be examined further.

## Sampling Levels

Sampling levels, data aggregating and raising procedures were reviewed by IBPNeph 2015, documented in the stock annex, and examined further at WGCSE 2018. Recent sampling levels have fluctuated; prior to 2016 sample data have only been available from landings into England, however since 2016 samples have also been available from landings into Northern Ireland. In 2020, there was no sampling activity from the fishery due to impact of the Covid-19 pandemic. For 2021, only Northern Irish samples are available.



Number of observer trips on English and Northern Irish vessels, as well as the number of shore-based catch samples.

## Commercial length–frequency distributions

The raised catch length distributions are shown in Figure 3.8.3. Mean individuals weights and carapace lengths are listed in Table 3.8.4. The mean sizes for both sexes from 2008 fluctuate considerably. For 2020, the mean individual weights and carapace lengths of *Nephrops* were estimated from the average of 2017–2019 values to be slightly lower than in 2019 and 2020 but higher than the record low of 2016. On the basis of Northern Irish samples, the mean weight and carapace length in landings decreased compared with the 2017–2019 average, as well as with the values in 2019, while mean weight and carapace length in discards increased compared with the previous years.

## Length composition

Between 2010 and 2012, sampling levels are considered insufficient to reliably characterise the length composition of extractions. Increased sampling levels from 2013 onwards have allowed for length compositions to be constructed. For 2013 and 2014, a full revision was done through an inter-benchmark process (ICES, 2015; described in the stock annex). Data aggregating and raising procedures from 2015 to 2017 were conducted according to benchmark procedures (ICES, 2005) and referred in the stock annex. These were revised during WGCSE 2018 to account for Northern Irish sampling data since 2016 and are described further in the stock annex. No sampling activity was possible during 2020 due to the effects of COVID-19 pandemic and length composition data from 2017 to 2019 were again used to generate mean sizes. In 2021, the only samples were from Northern Ireland, which were allocated to all landings.

## Sex ratio

Mature females are mainly caught in the non-berried state between moulting (which peaks in May), and spawning (which peaks in September). Females mature at about 23 mm carapace length. (Thomas and José Figueiredo, 1965).

The catch sex ratio by year is shown in Figure 3.8.5. The ratio is quite variable but average sex ratio is 56% male (1999–2019), the sex ratio for 2019 being slightly above this (62%). Sex ratio was not estimated in 2020. In 2021, the male sex ratio increased to 73%.

## Mean weight explorations

The annual mean weight estimate for landings and discards is provided in Table 3.8.4 and in Figure 3.8.6. There is a substantial difference between the mean weights prior to 2011 and after 2013 (the gap being where sampling was too low to be reliable). Since 2016, NI sampling has been included and the mean weight of NI samples is considerably lower than for English sampling (e.g. for 2017–2019, mean weight of landings from English sampling was 30.9 g compared to 15.2 g in Northern Irish sampling). As a result, comparison with years prior to 2016 is not practical. Mean weights over the years 2016–2019 have been variable without trend. Mean weights were not estimated for 2020 due to no sampling. Northern Irish sampling resumed in 2021, but due to the small sizes in the Northern Irish samples, compared with the English samples, the mean individual weights and sizes for that year need to be treated with scepticism.

## Discarding

Discard selection was revised at the IBP process in 2015 (ICES, 2015) and described in the stock annex. Figure 3.8.4 shows a single discard ogive fitted by pooling all years (2003–2014) and mesh sizes. Final discard selection for the East Irish Sea shows a  $L_{50}=23.54$  and a  $L_{25}=24.77$  mm CL (Figure 4.3.4), which shows a selectivity at higher sizes compared with FU15. Due to high inter-annual variation in mean sizes of both landings and discards, the discard ogive was not updated using later data.

Table 3.8.5 gives raised international landings and discard weight and numbers by year.

At IBPNeph (ICES, 2015), it was agreed that the discard survival rate should be updated from 0% to 10%. Although there are no direct survivability studies available for this area, it is expected that the survivability of discarded animals should be similar to the fishery in FU15 where fishing practices are similar and both are largely spring/summer fisheries and animals discarded are exposed to warmer temperatures before being returned to the sea.

## Abundance indices from UWTV surveys

Since August of 2007, the UK has carried out an underwater TV survey of the *Nephrops* grounds in the eastern Irish Sea. The survey is of a fixed grid design and is carried out using the same protocols used in UWTV surveys in the western Irish Sea (ICES, 2007; ICES, 2014, Dobby H., *et al*, 2021). The survey stations used in 2022 are presented in Figure 3.8.7.

Due to the construction of the windfarm in the southern part of the ground the survey area was reviewed at IBP 2015, but the protocols and standardised process to run the survey were not modified (see stock annex and IBP 2015 report ICES, 2015). The new survey area (based on a co-kriging model) is shown in Figure 3.8.8. The boundary used to define the ground limits for absolute abundance runs close to the outer survey stations.

Ground	Area Km <sup>2</sup>	Source
Main ground 2008–2010	1032.75	WGCSE 2008
Main ground 2011–2019	1019.79	IBP 2015 – ICES, 2015
Wigtown Bay	67.21	IBP 2015 – ICES, 2015

Wigtown Bay in relation to Main ground = 6.6% \* (increase from 1.9% prior to the windfarm construction).

Abundance indexes were revised back to 2011, the year where the effect of effort displacement is clearly visible due to the windfarm construction. Final updated burrow density estimates are presented in Table 3.8.6 and visualised in Figure 3.8.9 where the geo-spatial model was updated using the new area based on the co-kriging approach (1019.79 km<sup>2</sup>) and the extrapolation to Wigtown Bay using 6.6%.

The abundance estimate for 2022 (386 million) is a decrease of 1.7% compared to the 2021 figure of 393 million (Figure 3.8.10) and 18.9% lower than the 2008–2021 average of 476 million. The surveys show a clear spatial distribution pattern, with highest densities in the centre of the patch and more variable in the areas further north and south. The grounds are fairly well delineated by consistently low-density ground to the west (Figure 3.8.9). CVs over the entire time-series (Table 3.8.6) are within the accepted precision level of 20% (ICES, 2012).

The use of the UWTV surveys for the provision of *Nephrops* management advice was extensively reviewed by WKNEPH (2009). A number of potential factors were highlighted including those due to edge effects; species burrow misidentification and burrow occupancy. Using the same process adopted at WKNEPH, a cumulative absolute conversion factor for this FU was predicted to be 1.2 for FU 14 (see stock annex) which means the TV survey is likely to overestimate *Nephrops* abundance by 20%. The burrow abundances shown in Table 3.8.5 and Figure 3.8.9 have been adjusted using this conversion factor since 2008.

In 2021, a new survey camera system was implemented using high-resolution stills-based footage, generally resulting in improved picture and burrow definition. Comparison of the old and new systems in other survey areas (FU 16 and FU 20-21 combined) has shown no significant difference in density estimates and previous assumptions relating to correction factors are still applied.

## 15.4 Assessment

### Comparison with previous assessments

The methods normally used are in line with WKNEPH (ICES, 2009) and the approach taken by WGCSE for other *Nephrops* stocks in Subareas 27.6 and 27.7. This approach was inter-benchmarked at IBPNeph (ICES, 2015) and is described in the stock annex. Deviations from the standard procedure were required due to the lack of sampling data in 2020. As a result, WGCSE 2021 carried out the assessment for this stock using the same three-year average (2017–2019) for weights and discarding rates as for the 2020 assessment. For this current assessment, the average weights and discarding rates are based on 2019 and 2021 sampling data. Throughout the pandemic, the UWTV surveys were carried out as usual. Therefore, the current abundance values were used for the assessments in 2021 and 2022, according to the established procedure.

### State of the stock

UWTV abundance estimates suggest that the stock size has fluctuated between abundance values of 350 and 694 million *Nephrops*. The 2022 estimate (386 million) decreased by 1.7% in relation to 2021 but is still above the MSY B<sub>trigger</sub> (350 million).

Table 3.8.5 and Figure 3.8.11 summarise the abundance estimated including the confidence intervals and the harvest ratios (% total removed / UWTV abundance) which have been above the F<sub>MSY</sub> proxy.

## 15.5 Catch scenarios table

Catch scenarios table inputs and historical estimates of mean weight in landings and harvest ratios are presented in Table 3.8.5 and summarised below. The calculation of catch options for FU14 follows the procedure outlined in the stock annex. The basis for the catch options:

Variable	Value	Notes
Stock abundance (2023)	386	UWTV survey 2022; individuals in millions
Mean weight in projected landings	19.9	Average 2019—2021; in grammes
Mean weight in projected discards	9.13	Average 2019—2021; in grammes
Projected discard rate	13.9	Average 2019—2021; percentage by number of the total catch
Discards survival rate*	10	Percentage by number of the discards
Dead projected discard rate	12.7	Average 2019—2021; percentage by number of the total catch

\*Only applied in scenarios where discarding is allowed.

## 15.6 Reference points

Reference points were defined for this stock at the IBPNeph (ICES, 2015) and proposals for  $F_{MSY}$  ranges made by WKMSYRef4 (ICES, 2016a; 2016b).

Based on the fact that some biological parameters are poorly known; inconsistent biological sampling; uncertainties about the stability of the stock over the reference period and uncertainties about the variability of recruitment it is expected that a combined sex  $F_{0.1}$  is a suitable  $F_{MSY}$  proxy for this stock. This corresponds to a harvest rate of 11% and this value is expected to deliver high long-term yield with a low probability of recruitment over-fishing. These calculations assume that the UWTV survey has knife-edge selectivity at 17 mm and that the supplied length frequencies represented the population in equilibrium. Landings, and correspondingly harvest rates, were significantly higher in 2021 than in previous years. The harvest rate in 2021 was 6.14%, with an average of 2.92% over the previous three years. Historically the available data show a maximum harvest rate of 8.2% in 2008 which is below the  $F_{MSY}$  proxy.

At the IBPNeph, a  $MSY B_{trigger}$  was defined for this stock. According with this definition,  $B_{trigger}$  was set for FU14 as 350 million, corresponding to the lowest observed abundance estimate from the UWTV time-series, which occurred in 2009.

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY B <sub>trigger</sub>	350 million individuals	The lowest observed abundance estimate from the UWTV survey time-series.	ICES (2015)
	F <sub>MSY</sub>	11% harvest rate	F <sub>MSY</sub> proxy equivalent to F <sub>0.1</sub> for combined sexes.	ICES (2015)
	F <sub>MSY</sub> lower	9.1% harvest rate	Average of the F at 95 % of the YPR obtained at the F <sub>MSY</sub> proxy reference point	ICES (2016b)
	F <sub>MSY</sub> upper	11% harvest rate	Average of the F above F <sub>MAX</sub> that leads to YPR of 95 % of the maximum; capped at F <sub>MSY</sub>	ICES (2016b)

## 15.7 Management strategies

There are no explicit management strategies for this stock.

The European Parliament and the Council have published a multiannual management plan (MAP) for the Western Waters (EU, 2019). This plan applies to Norway lobster (*Nephrops norvegicus*) by functional unit in ICES Subarea 7 and also demersal stocks. The plan specifies conditions for setting fishing opportunities, depending on stock status and making use of the F<sub>MSY</sub> ranges.

## 15.8 Quality of assessment and forecast

The quality of landings data has improved since 2012, but concerns over the accuracy of earlier years limits the period we can be confident about regarding trends in LPUE and landings.

Underwater TV surveys have been conducted annually for this stock since 2007. The quality of the data from the first survey and the limited number of valid stations in the survey limits the number of useable surveys to 2008–2022.

In 2021, the survey camera system and reviewing method changed. Previous assumptions relating to correction factors are still applied. Comparison of the old and new systems in Functional Unit 16 has shown no significant difference in density estimates.

The revised algorithm used to derive distance covered by the sledge is considered significantly more robust than the previous algorithm.

The IBP 2015 managed to address key points:

- Revisions to the area of the *Nephrops* grounds based on new available data: VMS, UWTV data and sediment information.
- A review of fishery data and raising procedures.
- Review of Reference points: F<sub>MSY</sub> proxies and MSY B<sub>trigger</sub>.

After this revision the quality of the assessment improved. Although there are still specific uncertainties and assumptions that need to be examined further for the East Irish Sea before less conservative F<sub>MSY</sub> proxies could be considered.

There are several key uncertainties and bias sources in the method proposed (these are discussed further in ICES, 2009a). Various agreed procedures have been put in place to ensure the quality and consistency of the survey estimates following the recommendations of several ICES groups (ICES, 2007; ICES, 2008; ICES, 2009b). Taking explicit note of the likely biases in the surveys may at least provide an estimate of absolute abundance that is more accurate but no more precise (ICES, 2009a).



The cumulative absolute conversion factor estimates for FU14 are largely based on expert opinion. However, these were based on experience on other grounds and relatively limited experience on these grounds which would make this less reliable. The precision of these cannot yet be characterised. Ultimately there still remains a degree of subjectivity in the production of UWTV abundance estimates.

The effect of this assumption on realised harvest rates has not been investigated but remains a key uncertainty.

## 15.9 Recommendation for next benchmark

This stock was last benchmarked by IBPNeph (ICES, 2015). WGCSE will keep the stock under close review and recommend future benchmark as required.

At IBP 2015, it was mentioned that there are specific uncertainties and assumptions that need to be examined further for the East Irish Sea before less conservative  $F_{MSY}$  proxies could be considered.

- More accurate mapping of the spatial extent of the grounds and fisheries, this includes having positional data for <12 metre vessels and more survey data in Wigtown Bay area to better define this ground. Station grid was extended to Wigtown Bay in 2016.
- For now the total abundance estimate for FU14 is based on the abundance estimates of the geospatial model for the main ground plus adding the area of Wigtown Bay. As this area is becoming a more significant fishing patch it is worth to consider the use of a separate geospatial model in this ground. This should be explored in a future benchmark work.
- Improvement of spatial coverage and sampling of landings and discards, this includes increasing the sampling levels to cover Northern Irish vessels. Northern Irish sampling has been included in the assessment since 2018
- Area specific length–weight and maturity data to validate the parameters used for this FU.
- Better knowledge of the difference in growth and population structure across the area.
- If following the current advice, the recommended catches are taken, then the stock may decrease to well below  $MSY B_{trigger}$  in the short term. The basis for setting  $MSY B_{trigger}$  is currently from recent history may be too high, it could also be due to recent low recruitment (transitory issue) or that the  $F_{MSY}$  is too high. As such, the  $MSY_{trigger}$  reference point needs to be looked into. It was noted that the basis for  $MSY B_{trigger}$  was the recent history and that the value may be too high.
- Advice is compiled for ADGNEPH in October. Lagged (one year) TV survey gives good correlation with LPUE, could this be used to calculate harvest rate rather than the in-year ratio?

## 15.10 Management considerations

ICES and STECF have repeatedly advised that management should be at a smaller scale than the ICES division level. Management at the Functional Unit level could allow effort and catch to be controlled in line with the scale of the resource.

There are no explicit recruitment indices.

The UWTV survey data allow for the provision of catch options and also to adopt the MSY approach. The UWTV surveys are conducted annually and a benchmark process has been adopted

in 2015. In the past this stock has only been assessed biannually. These data provide the opportunity to reassess this stock more reliably on an annual basis.

## 15.11 References

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**Table 3.8.1. Irish Sea: Landings (tonnes) by FU. In 2012 and 2013 landings outside FU for Area 7a were not provided, so have been calculated from ICES official landings for 7a minus the FU areas.**

YEAR	FU14	FU15	OTHER	TOTAL	
2000		567	8370	1	8938
2001		532	7441	3	7976
2002		577	6793	1	7371
2003		376	7052	3	7431
2004		472	7267	25	7764
2005		570	6554	103	7227
2006		628	7561	52	8241
2007		959	8491	83	9533
2008		676	1050	122	11306
2009		708	9198	57	9963
2010		582	8963	23	9568
2011		561	10162	61	10784
2012		531	10527	208	11266
2013		495	8672	89	9256
2014		679	8613	NA	9292
2015		378	8632	NA	9010
2016		237	7327	9	7564
2017		265	6149	0	6414
2018		268	5756	0	6024
2019		270	7590	4	7864
2020		232	6115	7	6354
2021		519	6779	20	7318

**Table 3.8.2. Irish Sea East (FU14): Landings (tonnes) by country of landing and total discards, 2000–2019.**

Year	Rep. Of Ireland	UK	Other Countries	Total Landings	Discards
2000	114	451	2	567	80
2001	26	506	0	532	42
2002	203	373	1	577	42
2003	69	306	1	376	11
2004	62	409	1	472	28
2005	34	536	0	570	33
2006	34	594	0	628	22
2007	86	873	0	959	47
2008	29	652	0	681	37
2009	16	692	0	708	6
2010	45	538	0	583	9
2011	31	530	0	561	0
2012	53	478	0	531	0
2013	35	460	0	495	38
2014	31	648	0	679	35
2015	88	290	0	378	18
2016	21	216	0	237	20
2017	7	258	0	265	28
2018	5	263	0	263	9
2019	9	260	0	270	15
2020	23	209	0	232	15*
2021	0	519	0	519	58

\* Based on 2017-2019 discard rates

**Table 3.8.3. Irish Sea East (FU14): Effort data for the UK and Irish trawl *Nephrops* directed fleet.**

YEAR	UK direct fleet			Irish direct fleet		
	EFFORT (KW DAYS)	LANDINGS (TONNES)	LPUE	EFFORT (KW DAYS)	LANDINGS (TONNES)	LPUE
2006	343,249	577.2	1.7	6,932	18.3	2.8
2007	443,319	854.4	1.9	25,309	79.2	3.1
2008	366,696	628.9	1.7	8,136	14.9	1.9
2009	354,210	680.1	1.9	5,516	13.1	2.5
2010	296,097	527.3	1.8	13,496	44.6	3.3
2011	252,607	525.7	2.1	8,955	29.7	3.6
2012	215,851	452.4	2.1	21,224	52.8	2.6
2013	210,108	445.1	2.1	11,304	35.5	3.1
2014	279,606	636.8	2.3	10,259	28.5	2.8
2015	132,751	275.7	2.1	27,128	83.7	3.1
2016	109,449	214.9	2.0	9,496	21.2	2.2
2017	101,657	252.4	2.5	2,620	6.7	2.6
2018	113,740	245.8	2.2	3,042	5.2	1.7
2019	94,606	248.1	2.6	3,591	8.7	2.4
2020	61,747	203.1	3.3	7,660	22.9	3.0
2021	177,961	504.8	2.8	-	0	-

**Table 3.8.4. Irish Sea East (FU14): Mean size (CL) and weight combined by sex for total annual landings and discards and proportion discarded.**

Year	Mean CL (mm) Landings	Mean CL (mm) Discards	Mean Weight (g) Landings	Mean Weight (g) Dis- cards	Proportion dis- carded
2000	29.83	22.32	19.05	7.52	0.26
2001	30.59	22.74	20.87	7.97	0.17
2002	30.64	23.75	22.41	8.98	0.15
2003	33.69	22.43	29.12	7.62	0.10
2004	31.01	22.24	21.93	7.57	0.15
2005	30.74	23.16	21.48	8.44	0.13
2006	32.36	22.75	25.07	7.98	0.10
2007	31.81	21.92	23.94	7.33	0.14
2008	31.07	23.14	22.88	8.49	0.13
2009	35.57	23.21	36.49	8.58	0.04
2010*					
2011*					
2012*					
2013	30.14	22.43	19.94	7.87	0.16
2014	31.01	24.34	22.37	9.60	0.11
2015	32.05	22.57	25.19	7.82	0.13
2016 **	27.39	23.11	15.82	8.38	0.14
2017	29.05	24.07	18.97	9.50	0.18
2018	30.58	24.46	21.39	9.78	0.07
2019	29.49	22.90	20.93	8.40	0.12
2020 ***	29.71	23.81	20.43	9.23	0.12
2021 ****	29.35	24.09	19.56	9.07	0.17

\* Values for 2010, 2011 and 2012 are not reliable due to poor sampling.

\*\* Values for 2016 revised at WGCSE 2018 due to inclusion of Northern Irish sampling in 2016 and 2017.

\*\*\* No sampling in 2020; values for 2020 are based on 2017-2019 averages

\*\*\*\* Only Northern Irish samples; values for 2021 are based on 2019 and 2021 averages

**Table 3.8.5. Irish Sea East (FU14): Summary table for forecast inputs and historical estimates of raised landings and discards, mean weight in landings and harvest rate.**

Year	Landings in number millions	Total discards in number millions	Removals in number millions	Dead Discard Rate number %	Discard Rate number %	UWTV abundance estimate millions	95% Confidence Interval	Harvest rate %	Landings tonnes	Total discards* tonnes	Mean weight in landings gramme	Mean weight in discards gramme
2000	30	11	40	24.4	26.4				567	80	19.05	7.52
2001	26	5	31	15.5	17.0				532	42	20.87	7.97
2002	26	5	30	14.1	15.4				577	42	22.41	8.98
2003	13	1	14	9.0	9.9				376	11	29.39	7.64
2004	22	4	25	13.5	14.8				472	28	21.93	7.57
2005	275	4	30	11.8	13.0				570	33	21.48	8.44
2006	25	3	28	9.2	10.1				628	22	25.07	7.98
2007	40	6	46	12.5	13.8				959	47	23.94	7.33
2008	30	4	34	11.6	12.7	408	63	8.2	676	37	22.88	8.49
2009	19	1	20	3.3	3.7	350	76	5.7	707	6	36.49	8.58
2010						422	103		582			
2011						449	99		561			
2012						694	99		531			
2013	25	5	30	15.0	16.4	487	82	6.0	495	39	19.94	7.87
2014	30	4	34	9.8	10.8	449	92	7.5	679	32	22.37	9.60
2015	15	2	17	11.9	13.0	591	86	2.9	378	18	25.19	7.82
2016*	15	2	17	12.4	13.6	430	106	4.0	237	20	15.82	8.38
2017	14	3	17	16.2	17.6	580	89	2.9	265	29	18.97	9.50
2018	12	1	13	6.3	6.9	514	118	2.6	263	9	21.39	9.78
2019	13	2	14	11.1	12.2	399	69	3.6	270	15	20.93	8.40
2020 **	11	2	13	11.2	12.3	496	84	2.6	232	15	20.43	9.23
2021	21	4	24	13.5	15.0	393	78	6.1	519	58	19.56	9.07
2022						386	110					

**Note:** Abundance is adjusted by using a cumulative absolute conversion factor of 1.2. Abundance (millions) including Wigtown Bay (1.9% 2008–2010; 6.6% 2011–2019). Due to poor sampling no estimates for 2010–2012.

\* Values for 2016 revised at WGCSE 2018 due to inclusion of Northern Irish sampling in 2016 and 2017.

\*\* Removals for 2020 calculated using 2020 landings and unweighted average of mean weights from 2017–2019.



**Table 3.8.6. *Nephrops*, Irish Sea East (FU14): Results of the 2008–2020 TV surveys (values adjusted for bias).**

Year	No valid stations	Mean Kriged density (no./m <sup>2</sup> )	Abundance (millions) including Wigtown Bay (1.9% 2008–2010)	Abundance (millions) including Wigtown Bay (6.6% 2011–2018)	95% CI	CV
2007			Unreliable data			
2008	32	0.38	408		63	
2009	32	0.33	350		76	
2010	26	0.4	422		103	
2011	26	0.41		449	99	11.2%
2012	26	0.64		694	99	7.3%
2013	31	0.45		487	82	8.5%
2014	34	0.41		449	92	10.4%
2015	42	0.54		591	86	7.4%
2016	48	0.40		430	106	12.6%
2017	45	0.53		580	89	7.8%
2018	46	0.47		514	118	11.7%
2019	41	0.37		399	69	9.3%
2020	43	0.46		496	84	8.6%
2021	44	0.36		393	78	10.1%
2022	46	0.38		386	110	14.6%

**Note:** Abundance is adjusted by using a cumulative absolute conversion factor of 1.2. Abundance (millions) including Wigtown Bay (1.9% 2008–2010; 6.6% 2011–2020).

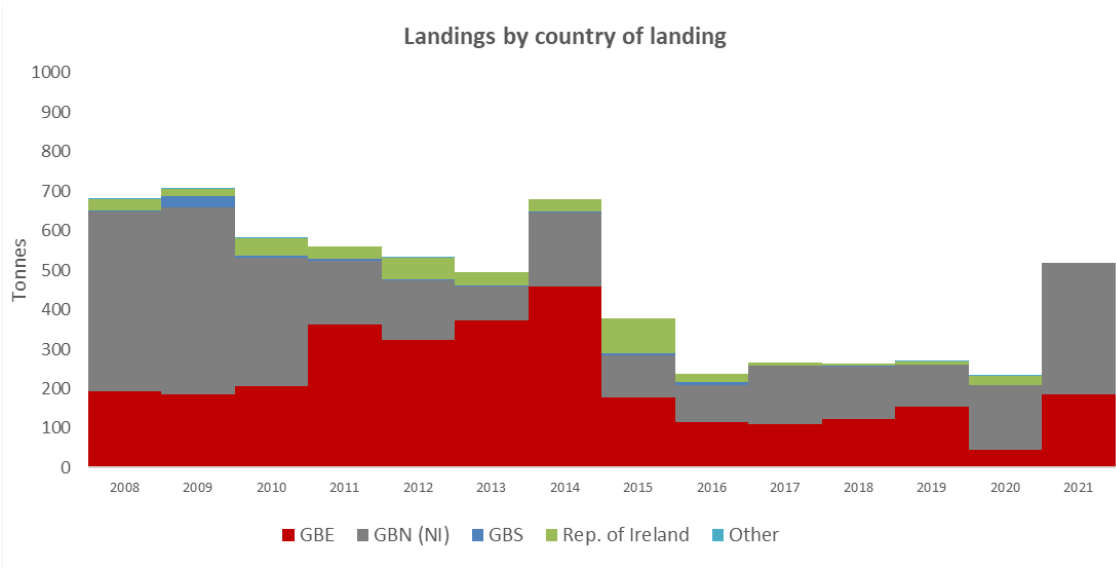


Figure 3.8.1. Irish Sea East (FU14): Landings in tonnes by country. GBE=England; GBN=Northern Ireland; GBS=Scotland; Rep. of Ireland=Republic of Ireland.

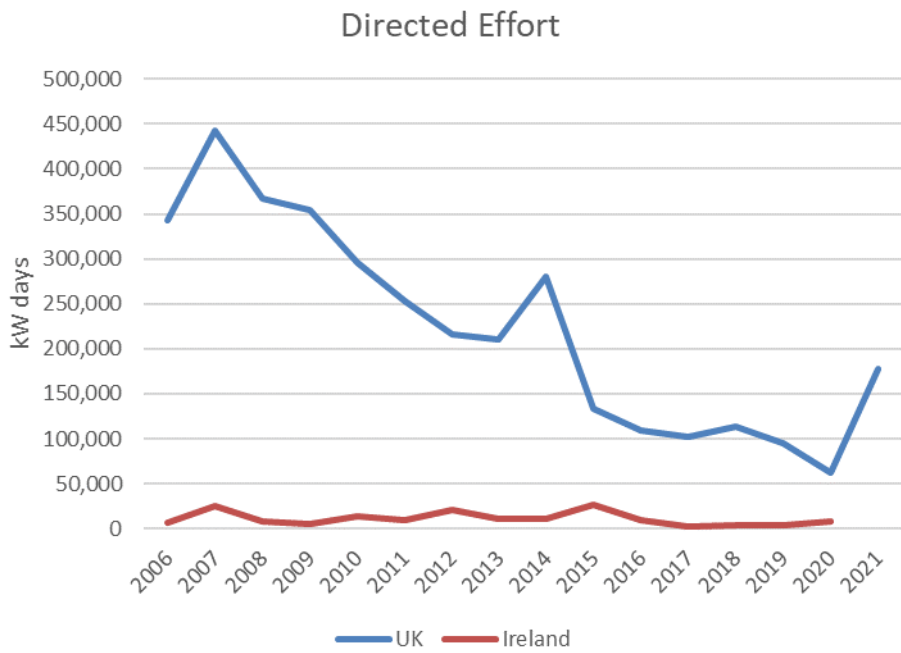


Figure 3.8.2. Irish Sea East (FU14): Effort data (KW days) for UK and Irish directed *Nephrops* fleet.

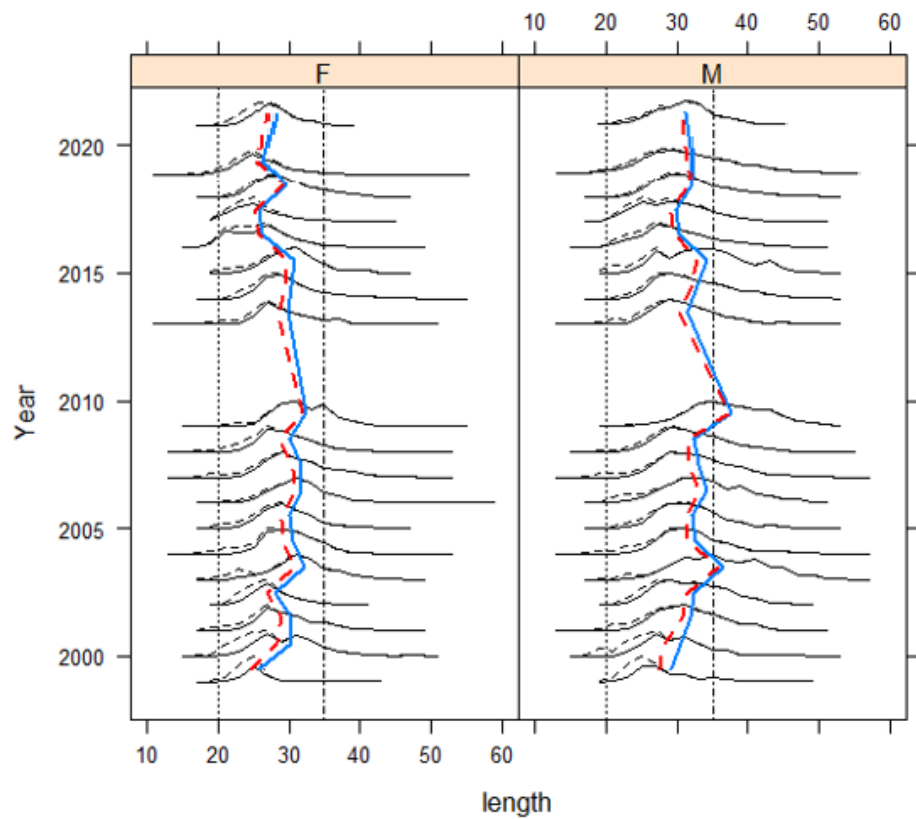


Figure 3.8.3. Irish Sea East (FU14): Length distribution of landings (solid lines) and catch (dotted lines), 2000–2021. Length frequencies for 2010–2012 are based in very poor sampling so not reliable. No sampling was carried out in 2020. Figure shows a vertical display of MLS (20 mm CL) and 35 mm CL levels.

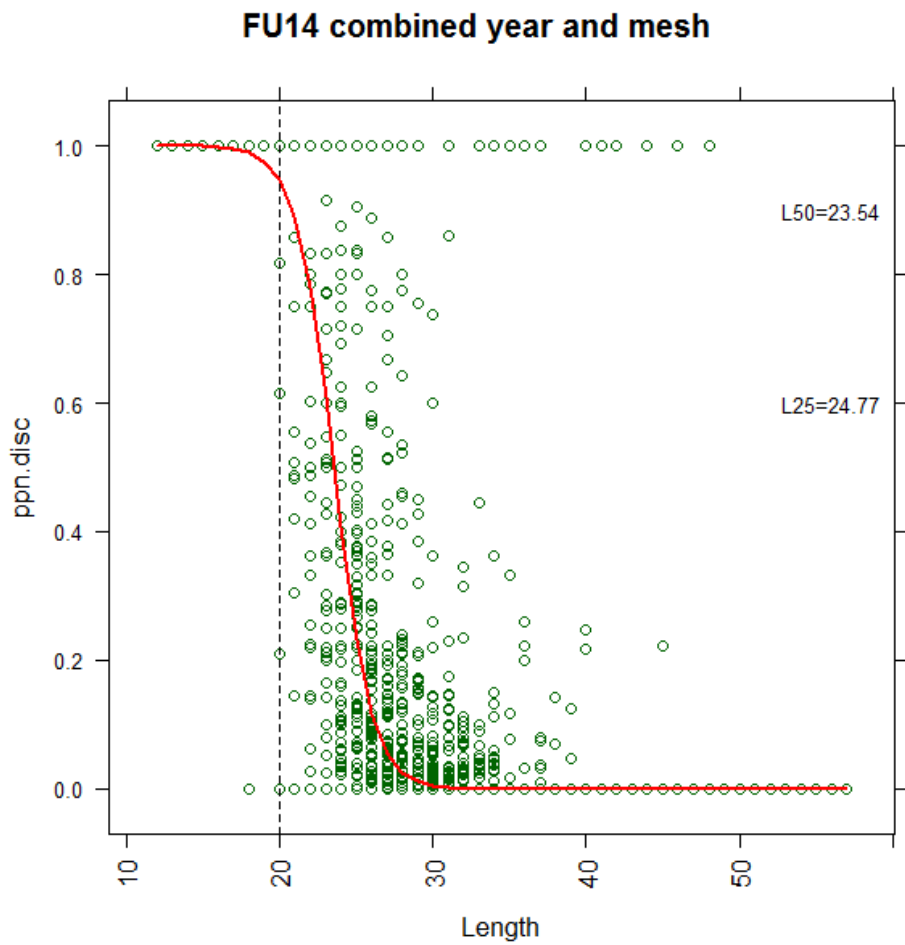


Figure 3.8.4. Irish Sea East (FU14): Final discard ogive pooled for all years (2003–2014) and mesh sizes. L50=23.54 and L25=24.77, (IBPNeph 2015).

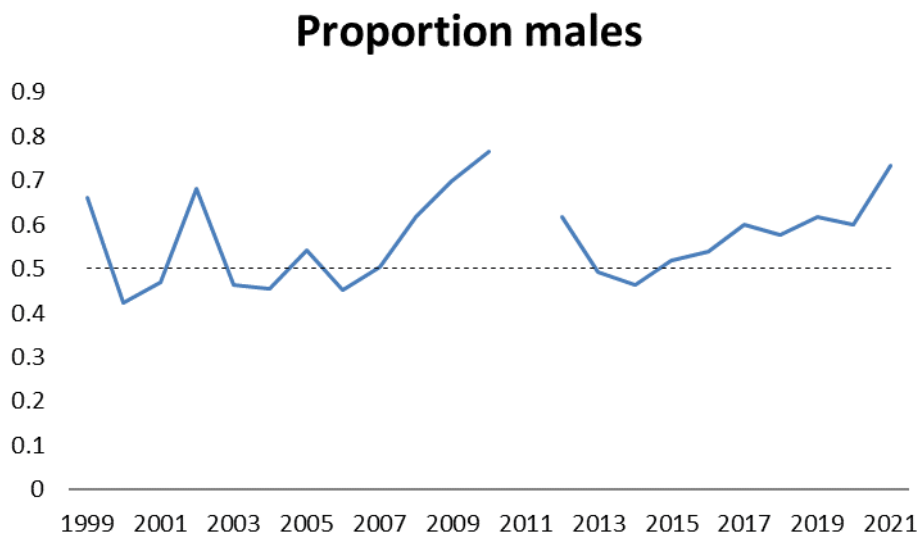


Figure 3.8.5. Irish Sea East (FU14): Proportion of males in catch since 1999. Between 2010 and 2012 due to poor sampling levels estimates of sex ratio are not reliable. No sampling was carried out in 2020

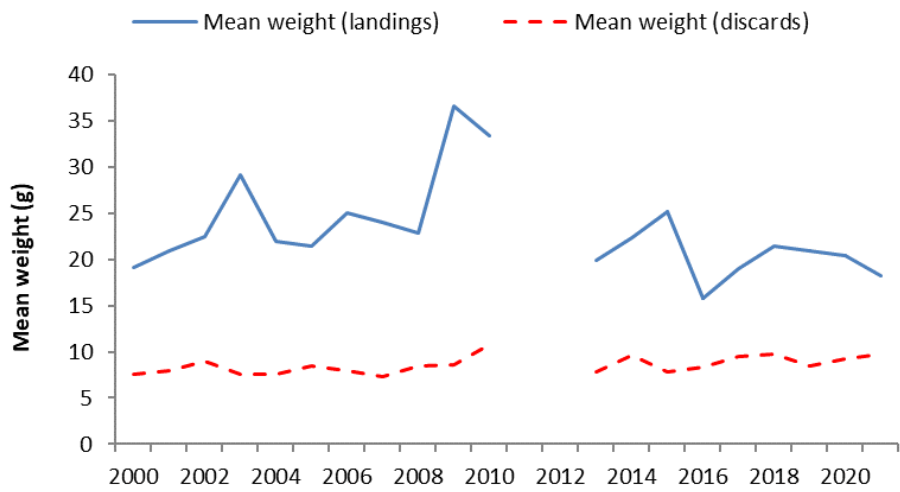


Figure 3.8.6. Irish Sea East (FU14): Mean weight (g) combined by sex for total annual landings and discards. Values for 2010, 2011 and 2012 are not reliable due to poor sampling. NI sampling included from 2016. Average of 2017-2019 sampling used for 2020

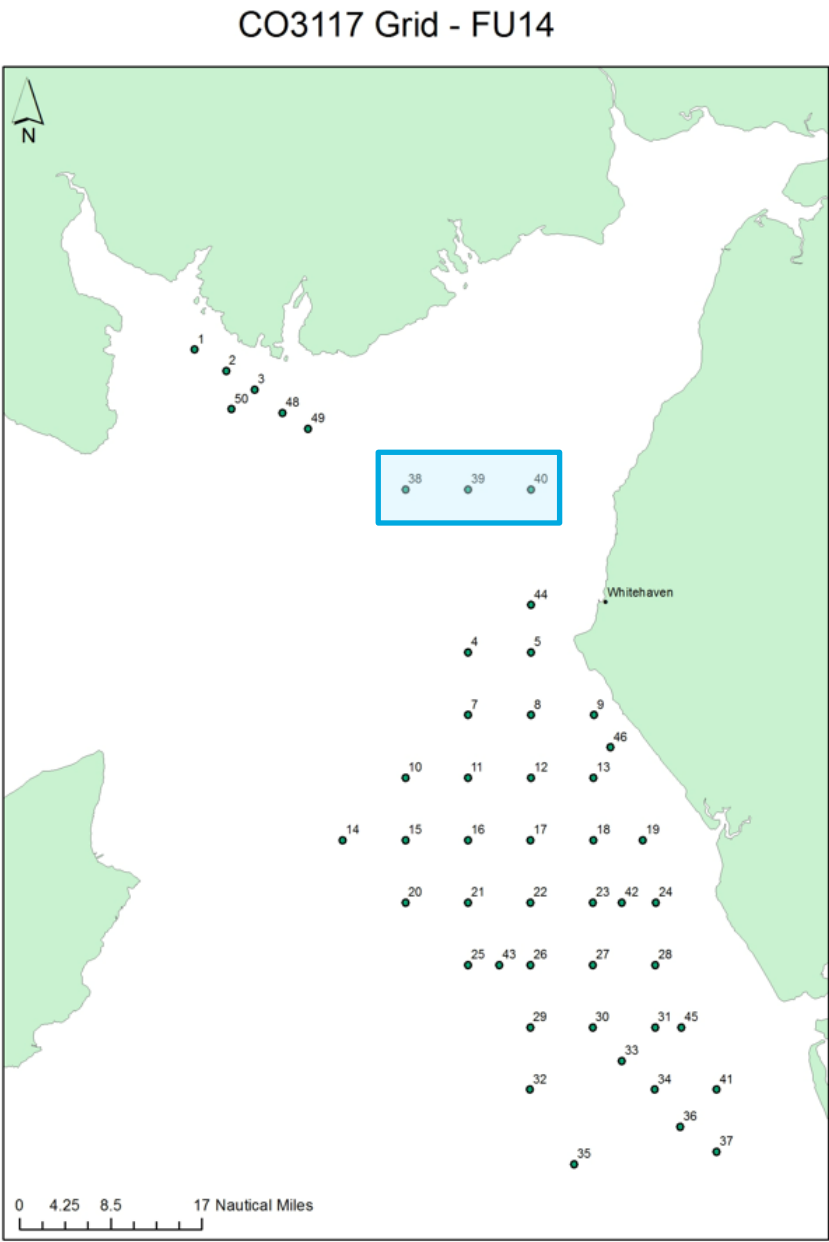


Figure 3.8.7. Irish Sea East (FU14): UWTV Survey stations for 2022. Highlighted stations 38—40 were not surveyed due to the presence of wind turbines.

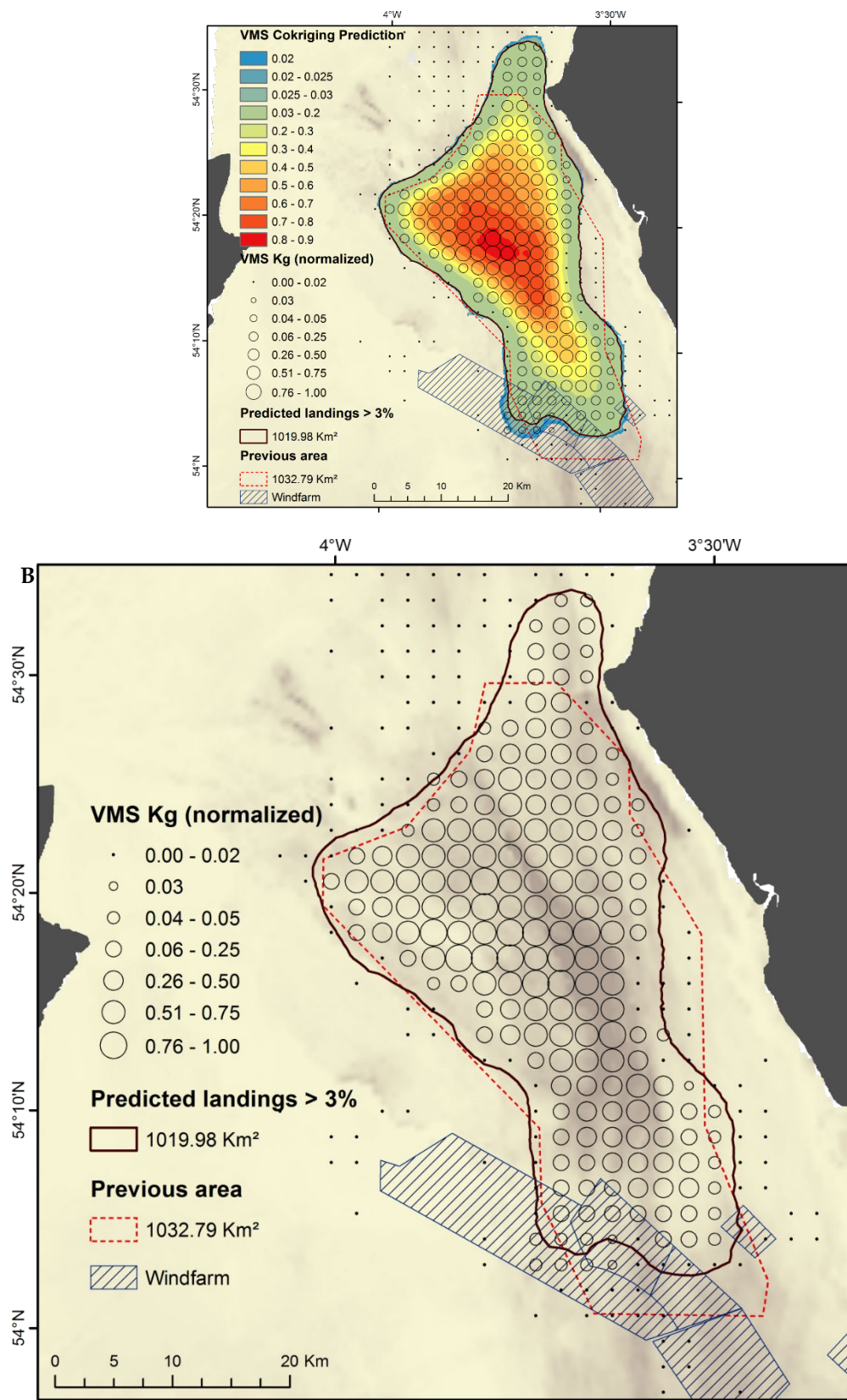
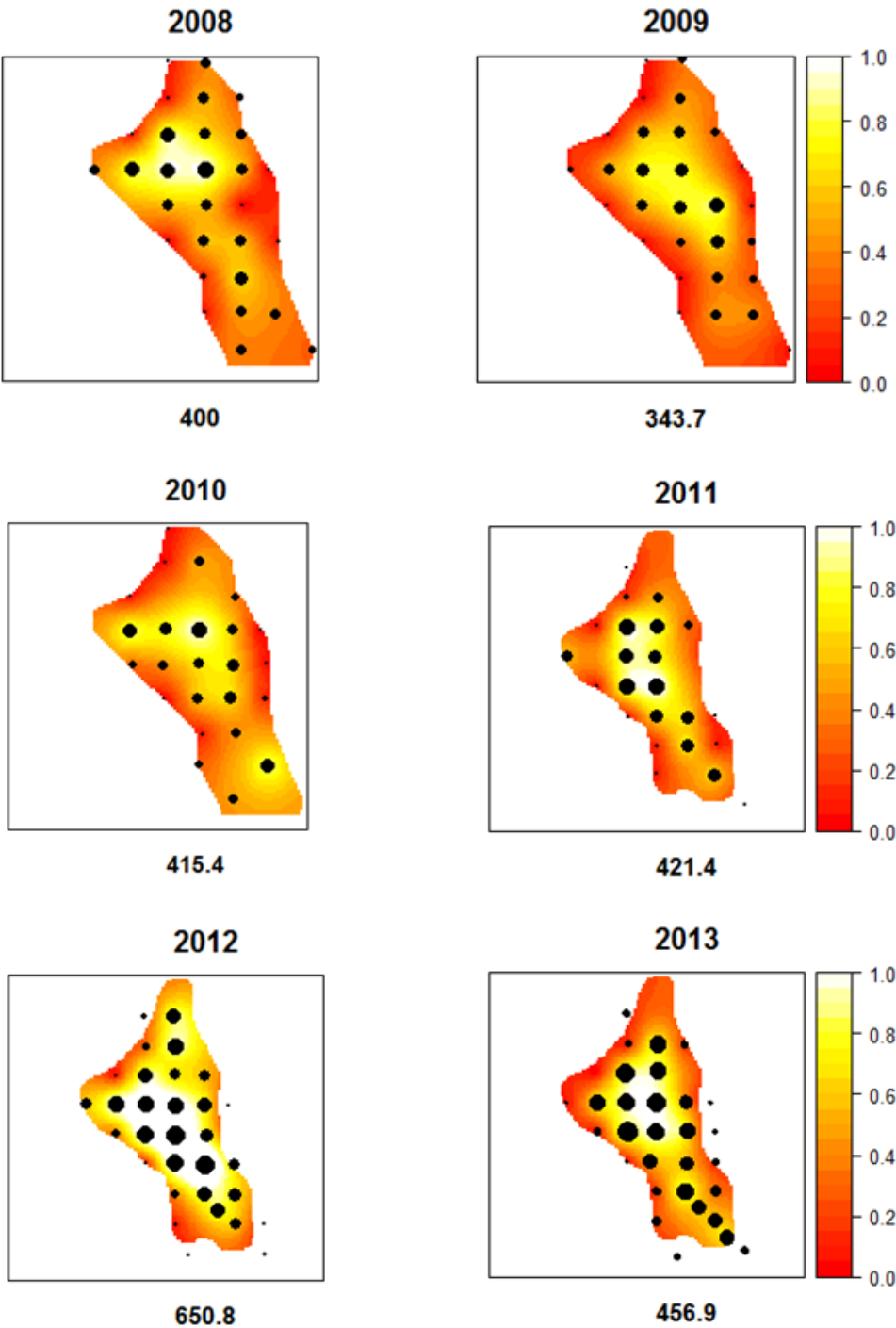
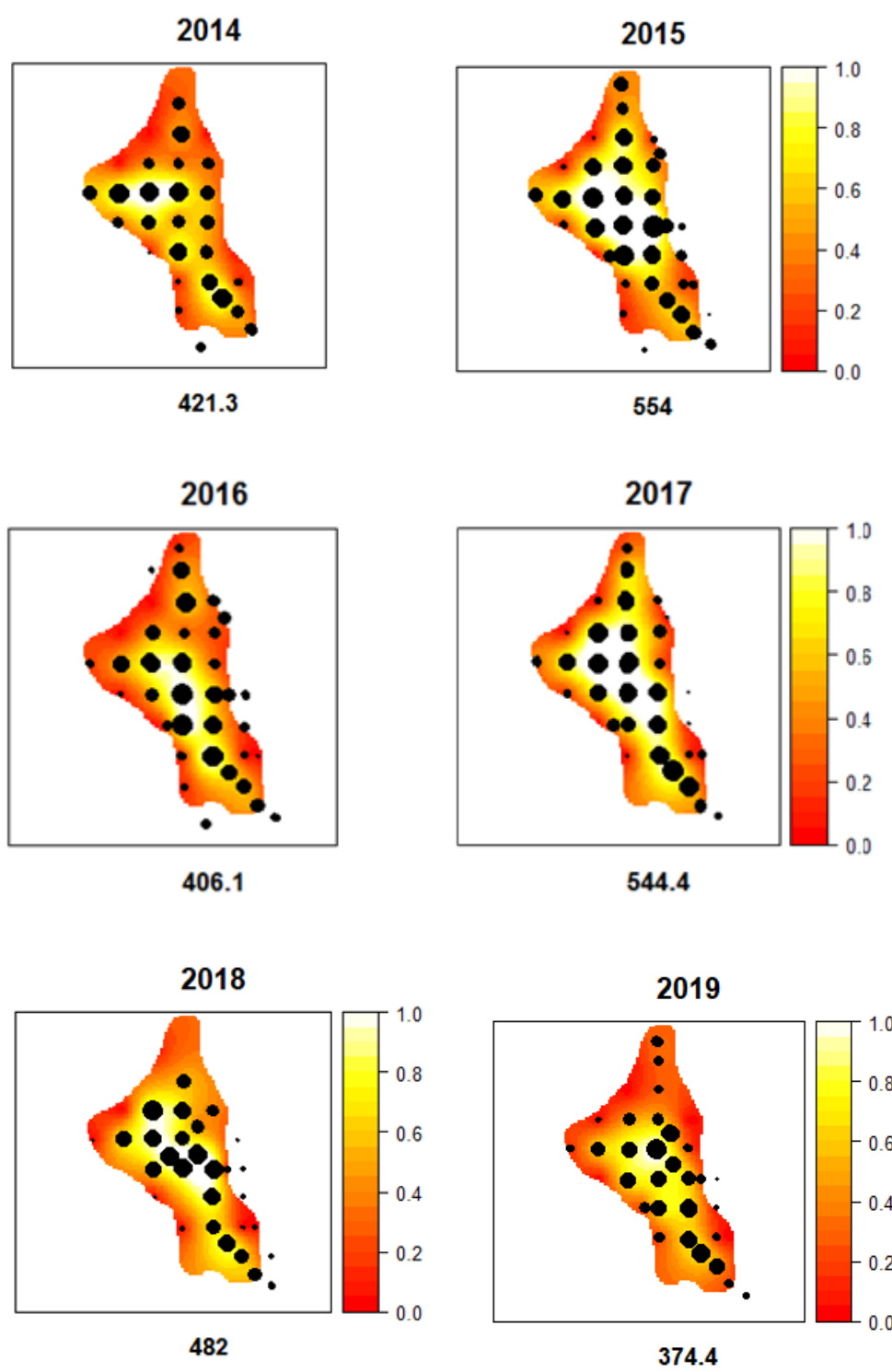


Figure 3.8.8. Irish Sea East (FU14): Co-kriging approach. Interpolation result of VMS (cut off 3%), survey density (2013–2015) data and mud distribution. A - model output; B - final polygon.







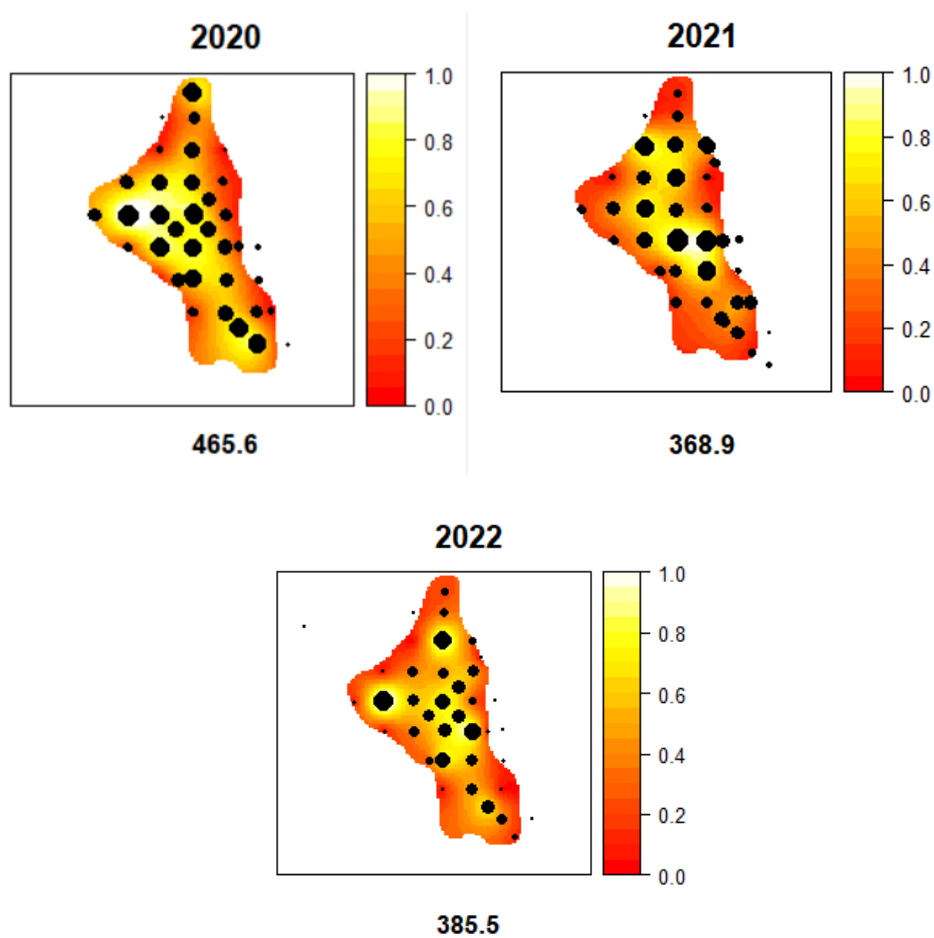


Figure 3.8.9. Irish Sea East (FU14): Burrow density estimates from the UWTV Survey (individuals / m<sup>2</sup>.) Abundance estimates (millions) given at the bottom of each plot are adjusted with the cumulative absolute conversion factor (but does not contain the additional area for Wigtown Bay). Area of ground = 1032.75 Km<sup>2</sup> for 2008–2010 and 1019.79 Km<sup>2</sup> for 2011–2022.

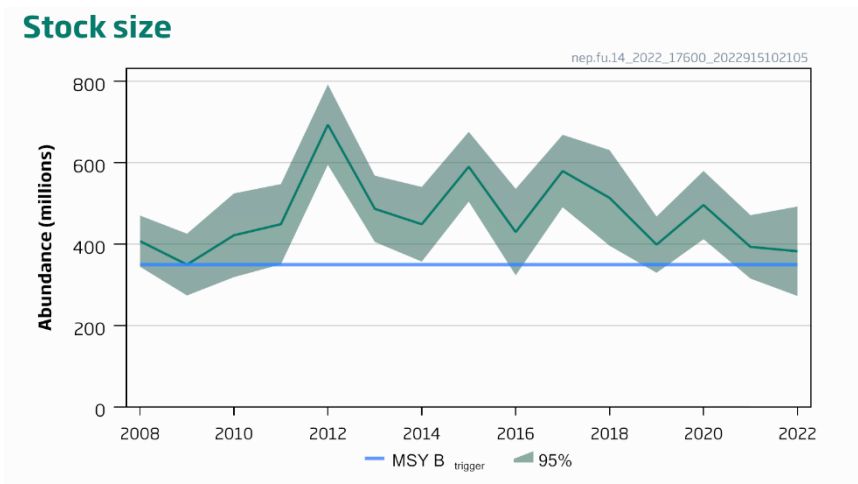
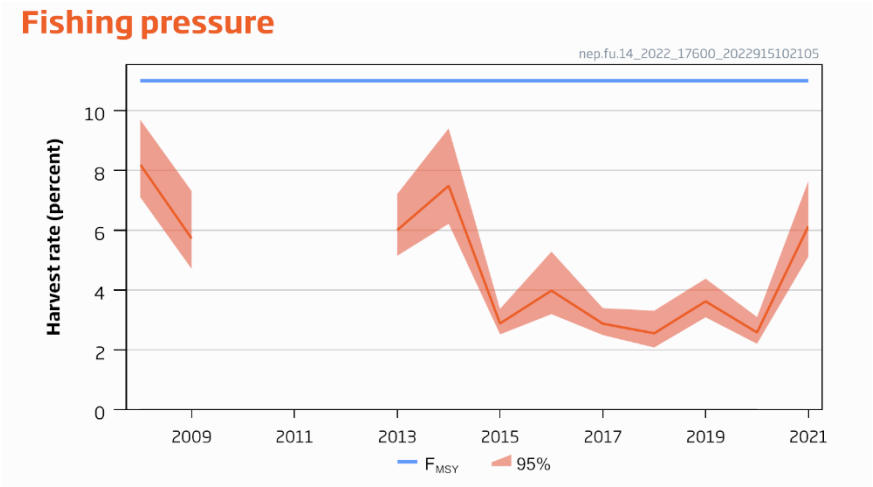


Figure 3.8.10. Irish Sea East (FU14): Abundance from the UWTV Survey. The shading indicates the 95% confidence interval.  $B_{\text{trigger}}$  is set at 350 million (blue line).



**Figure 3.8.11. Irish Sea East (FU14): Harvest Rate (% dead removed/UWTV abundance).** The blue line indicates  $F_{MSY}$  proxy (11%). Between 2010 and 2012, due to poor sampling levels, harvest rate estimates are not reliable.