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## 18 Norway lobster (*Nephrops norvegicus*) in Division 7.b, Functional Unit 17 (west of Ireland, Aran grounds)

### Type of assessment in 2022

This stock was inter-benchmarked in September 2015 by correspondence (ICES, 2016a). The assessment and catch options follow the agreed procedures set out in the stock annex.

### ICES advice applicable to 2021

*“ICES advises that when the EU multiannual plan (MAP) for Western Waters and adjacent waters is applied, catches in 2021 that correspond to the F ranges in the MAP are between 443 tonnes and 508 tonnes, assuming recent discard rates. The entire range is considered precautionary when applying the ICES advice rule.*

*To ensure that the stock in Functional Unit (FU) 17 is exploited sustainably, management should be implemented at the functional unit level.”*

### ICES advice applicable to 2022

*“ICES advises that when the EU multiannual plan (MAP) for Western Waters and adjacent waters is applied, and assuming that discard rates and fishery selection patterns do not change from the average of the years 2018–2020, catches in 2022 that correspond to the F ranges in the MAP are between 313 and 360 tonnes.*

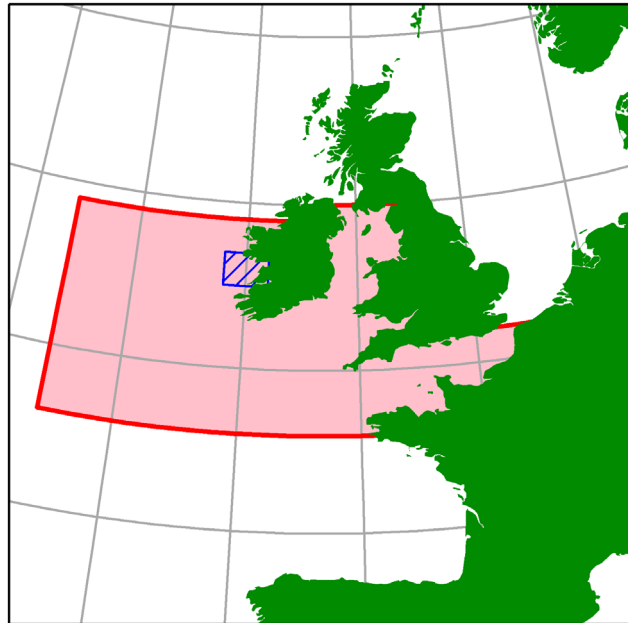
*To ensure that the stock in Functional Unit (FU) 17 is exploited sustainably, management should be implemented at the FU level.”*

## 18.1 General

### Stock description and management units

The Aran Grounds *Nephrops* stock (FU17) covers ICES rectangles 34–35 D9–E0 within 7.b. This stock is included as part of the TAC Area 7 *Nephrops* which includes the following stocks: Irish Sea East and West (FU14, FU15), Porcupine Bank (FU16), northwestern Irish Coast (FU18), south-eastern and south-western Irish Coast (FU19) and the Celtic Sea (FU20–22).

Map below shows FU17 assessment area (blue) and TAC area (red). See Section 18 for details on *Nephrops* Subarea 7 general section.



## Ecosystem aspects

Details of the ecosystem on the Aran grounds are provided in the stock annex updated by IBPNeph (ICES, 2016a).

## Fishery description

A description of the fleet is given in the stock annex. The time-series of numbers of vessels is updated in Figure 21.1.1. The numbers of vessels had been relatively stable from 1995 to 2018, but it decreased in 2019 and 2020 to half, and increased again to previous numbers in 2021. The time-series of vessel power is shown as a box and kite plot in Figure 21.1.2.

The majority of the landings are made with 80 mm mesh.

The majority of the landings come from the grounds to the west and southwest of the Aran Islands known as the 'back of the Aran ground' (See stock annex). The fishery on the Aran Grounds operates throughout the year, weather permitting with a seasonal trend (See stock annex).

## Fishery in 2021

In recent years several newer vessels specializing in *Nephrops* fishing have participated periodically in this fishery. These vessels target *Nephrops* on several other grounds within the TAC area and move around to optimize catch rates. There has been a trend for Irish vessels to switch to multi (quad) rig trawls since 2012. These vessels are more efficient at catching *Nephrops* ([BIM, 2014](#)).

## Information from stakeholders

Voluntary effort restriction were put in place by the Irish fishing industry in April and May 2015. These measures reduced catches and effort significantly on the stock in advance of the 2015 UWTV survey.

## 18.2 Data

### InterCatch

Data were available in InterCatch and used for catch data only.

### Landings

The reported landings time-series is shown in Figure 21.2.1 and Table 21.2.1. The 2021 landings increased by about 124% from those made in 2020 and amounted to 498 t.

### Effort

The IBPNeph 2015 reviewed Irish commercial landings and effort data in detail. They 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. The time-series of effort and lpue is updated in Figure 21.2.2 and Table 21.2.2. There was a significant decline in lpue and effort in 2015 due to the local management efforts put in place in April and May. In 2016 effort level increased to values similar to those observed previously prior to 2011. However, since 2017 effort levels have declined, reaching in 2020 the lowest values in the data series, and increasing slightly in 2021.

### Sampling levels

Sampling levels, data aggregating and raising procedures were reviewed by IBPNeph 2015 and are documented in the stock annex. The time-series of samples is shown in Figure 21.2.3 and Table 21.2.3. Given the low level of landings in recent years, it has been challenging to obtain sufficient samples to provide robust estimates of mean weights.

### Commercial length–frequency distributions

The raised catch length distributions are shown in Figure 21.2.4. The mean length of females decreased in 2018, increasing the discard rate for females. Female lengths increased in 2019 and 2020 to similar values of 2017, and they decreased again in 2021, but not to the levels of 2018.

### Sex ratio

In 2021 the difference on the proportion of males between the catches and the landings is similar to values from 2017 to 2019 (Figure 21.2.5). Sex ratio has a distinct seasonal pattern with lowest male proportions in the samples in May and June. Males dominate the catches in the autumn and winter.

### Mean weight explorations

Explorations of the mean weight in the catch samples by sex shows a strong cyclical pattern in females, which corresponds with the emergence of mature females from the burrows to mate in summer (Figure 21.2.6). The annual mean weight estimate for landings and discards is shown in Figure 21.2.7. The mean weight estimates have been relatively stable from 2011, where main

change occurred in 2008–2011. In 2020 the discards mean weight increased significantly, but in 2021 it decreased to similar values of previous years.

## Discarding

Table 21.2.4 gives weights, numbers and proportions of the landings and discard raised internationally according to the stock annex. A 25% discard survival rate is assumed in line with other *Nephrops* stocks in the Celtic sea (see stock annex) as the basis for the catch scenarios. Gear selectivity trials by Bord Iascaigh Mhara (BIM, 2017) reported a 64% survivor rate for *Nephrops* caught in a trawl with a SELTRA selectivity device in the outer Galway Bay area.

## Abundance indices from UWTV surveys

The spatial extent of the *Nephrops* grounds in FU17 was re-defined by IBPNeph 2015 and the total abundance estimates were revised using a new procedure (ICES, 2016a). The redefinition of the polygons in FU17 resulted in ~30% increase in overall area from 1007 km<sup>2</sup> to 1320 km<sup>2</sup> (stock annex). The 2022 UWTV survey was not deemed robust enough for the assessment because of the reduced number of stations completed due to disruption to the survey schedule (Aristegui et al., 2022). As such, the stock size is unknown for 2022. The assessment and advice is therefore based on the 2021 UWTV survey.

The spatial distributions of burrow densities are shown in Figure 21.2.8. The densities have fluctuated considerably over the time-series and throughout the Aran grounds. In general, the densities are higher towards the middle-western side of the ground and there is a notable trend towards lower densities towards the east. On the south-western boundary, there are often high densities close to the boundary. In this area, there is a sharp transition from mud to rocky substrate.

The summary statistics from this geostatistical analysis are given in Table 21.2.5 and plotted in Figure 21.2.10. The geostatistical abundance estimate adjusted is derived using the mean of the krigged grid where the mean of the observations is reported in Table 21.2.5. In recent years the Aran Grounds accounted for ~92% of the total estimated burrow abundance from FU17 (Table 21.2.5). Galway Bay accounted for ~5% and Slyne Head for ~3% (Table 21.2.6). The Galway Bay estimates fluctuate widely but are highly correlated with the Aran ground (Figure 21.2.9). Estimates for the Slyne Head ground also fluctuate considerably but show no significant correlation with the other areas except for the peaks of 2010, 2015 and 2018 (Figure 21.2.9).

Aran ground abundance estimate's CV (Table 21.2.5) has been always well below the recommendation of 20% by SGNEPS (ICES, 2012). The CV on the abundance estimates for Galway Bay and Slyne Head have also stayed low (Table 21.2.6) and within the recommendation, showing the surveys are precise. Figure 21.2.10 and Table 21.2.7 show the total abundance estimate for FU17 with the IBPNeph proposed MSY  $B_{trigger}$ . The 2022 abundance estimate is based on the 2021 UWTV survey, and thus has not changed from last year's 331 million, which is below the MSY  $B_{trigger}$  (540 million).

## 18.3 Assessment

### Comparison with previous assessments

The WGCSE 2022 carried out an UWTV based assessment for this stock. The methods used were very much in line with WKNEPH (ICES, 2009a) and the approach taken for other *Nephrops* stocks in 6 and 7 by WGCSE. This approach was inter-benchmarked at IBPNeph (ICES, 2016a).

## State of the stock

The stock size is unknown for 2022. The assessment and advice is therefore based on the 2021 UWTV survey. UWTV abundance estimates suggest that the stock size has fluctuated widely with an overall declining trend and is below  $MSY B_{trigger}$  since 2012 (except 2015 and 2018). The 2021 estimate was lowest observed in the time-series and was below the  $MSY B_{trigger}$ . The 2021 abundance remained below the average of the series (geomean [2002–2019]: 617 million). Harvest rate [calculated as (landings + dead discards)/abundance estimate] was below the  $F_{MSYproxy}$  from 2017 to 2020, and increased up to  $F_{MSYproxy}$  in 2021 (Table 21.3.1 and Figure 21.3.1).

## 18.4 Catch scenario table

Catch scenario table inputs and historical estimates of mean weight in landings and harvest ratios are presented in Table 21.3.1 and summarised below. The calculation of catch options for the Aran Grounds follows the procedure outlined in the stock annex.

The basis for the catch scenarios.

Variable	Value	Notes
Stock abundance (2023)	331	UWTV survey 2021; numbers of individuals in millions
Mean weight in projected landings	22.4	Average 2008–2021; in grammes
Mean weight in projected discards	11.4	Average 2008–2021; in grammes
Projected discards	24.1	Average 2019–2021; percentage by number
Discards survival	25	Percentage by number

Given the fluctuations observed in mean weights for landings and discards (Figure 21.2.7) an average from 2008 to the most recent year is used in the calculation of catch options as set out in the stock annex. The discard rates and proportions for the last three years are used to account for recent on-board retention practices (this is also according to the stock annex).

## 18.5 Reference points

New reference points were defined for this stock at the IBPNeph (ICES, 2016a) and no new proposals were made by WKMSYRef4 (ICES, 2016b). For *Nephrops* stocks  $MSY B_{trigger}$  has been defined as the lowest stock size from which the abundance has increased. This corresponds to the abundance observed in 2008 rounded to the nearest 10 = 540 million individuals (Figure 21.2.10 and Table 21.2.7).

The  $F_{MSY}$  proxy was revised during the benchmark in 2015. The observed burrow density has declined, from high ( $>0.8$  individuals  $m^{-2}$ ) at the start of the series to medium density ( $\sim 0.3$  individuals  $m^{-2}$ ) towards the end of the time-series. The nature of the fishery has also changed, from a continuous fishery throughout the year to a fishery which is more concentrated on sporadic periods of high catch rates. For these reasons a harvest rate consistent with a combined sex  $F_{0.1} = 8.5\%$  is considered an appropriate proxy for  $F_{MSY}$ .

These should remain under review by WGCSE and may be revised while data become available.

## 18.6 Management strategies

As yet there are no explicit management strategies for this stock but there have been some discussions among the fishing industry and scientists about developing a long-term plan for the management of the Aran fishery. Sustainable utilization of the *Nephrops* stock will form the cornerstone of any management strategy for this fishery.

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.

## 18.7 Quality of assessment and forecast

Biological sampling for this stock is adequate. From 2002 to 2021 a dedicated annual UWTV survey has provided abundance estimates for the Aran Grounds with high precision. However, in 2022 the UWTV survey was not deemed robust enough for the assessment because of the reduced number of stations completed due to disruption to the survey schedule. The area of the Aran Grounds was revised in 2015, resulting in a recalculation of the abundance time-series which now also includes Galway Bay and Slyne Head. A number of other biological parameters such as mean weights and length distributions have also been revised. The revisions were made as part of an inter-benchmark process and have improved the quality of the assessment.

In the provision of catch options based on the absolute survey estimates additional uncertainties related to mean weight in the landings and the discard rates also arise. From 2016, fisheries catching *Nephrops* in Subarea 7 are covered by the EU landings obligation (EU, 2015). Creel fisheries are exempted from the landings obligation, with a *de minimis* exemption consisting of a 5% discard rate by weight for the trawl fishery in 2019 (reduced from 6% in 2018 and 7% in both 2016 and 2017). The average discard rate by weight for FU17 over the last three years is 12.4%. Catch advice and scenarios are provided this year on the assumption that discarding is assumed to continue at recent average.

Irish discard survival experiments indicate that the trawl discard survival may be around 64% (BIM, 2017). As a result, an exemption from the landings obligation based on high survivability has been granted by the European Commission. ICES continues to use the survival rate of 25% (ICES, 2016c) as the survival rates estimated by BIM (2017) have not been evaluated by ICES.

There are several key uncertainties and bias sources in the method used here (these are discussed further in WKNeph 2009). 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 (WKNPTV 2007; WKNPHBID 2008; SGNeps 2009b; WGNeps 2014; WKNeps 2016d; Dobby *et al.*, 2021). Ultimately there still remains a degree of subjectivity in the production of UWTV abundance estimates (Marrs *et al.*, 1996). Taking explicit note of the likely biases in the surveys may at least provide an estimate of absolute abundance that is more accurate, although no more precise (ICES, 2009a).

Landings data were adjusted to take into account landings that had been misreported from FU16 from 2011 to 2017. This adjustment is thought to be reasonably accurate (See Section 18).

## 18.8 Recommendation for next benchmark

This stock was last benchmarked by IBPNeph (ICES, 2016a). WGCSE will keep the stock under close review and recommend future benchmark as required.

## 18.9 Management considerations

A meeting was held with stakeholders in March 2015 to discuss the state of the Aran *Nephrops* stock. In response to this meeting voluntary effort limits were put in place for April, May and June 2015. These voluntary measures have significantly reduced effort and catches on the Aran grounds in 2015 before the UWTV survey.

Small whole *Nephrops* are the main species comprising the discards. The main fish species discarded are haddock, hake, whiting, megrim and dogfish (Anon, 2011).

The 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 provide controls to ensure effort and catch were in line with resources available.

## 18.10 References

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**Table 21.2.1. *Nephrops* in FU17 (Aran Grounds). Landings in tonnes by country.**

Year	France	Rep. of Ireland	UK	Total
1974	477			477
1975	822			822
1976	131			131
1977	272			272
1978	481			481
1979	452			452
1980	442			442
1981	414			414
1982	210			210
1983	131			131
1984	324			324
1985	207			207
1986	147		1	148
1987	62		0	62
1988	14	814		828
1989	27	317	3	347
1990	30	489		519
1991	11	399		410
1992	11	361	2	374
1993	11	361	0	372
1994	18	707	4	729
1995	91	774	2	867
1996	2	519	7	528
1997	2	839	0	841
1998	9	1401	0	1410
1999	0	1140	0	1140
2000	1	879	0	880
2001	1	912	0	913
2002	2	1152	0	1154

Year	France	Rep. of Ireland	UK	Total
2003	0	933	0	933
2004	0	525	0	525
2005	0	778	0	778
2006	0	637	0	637
2007	0	913	0	913
2008	0	1050	7	1057
2009	0	625	0	625
2010	0	930	9	939
2011	0	659	0	659
2012	0	1246	0	1246
2013	0	1295	0	1295
2014	0	766	0	766
2015	0	370	0	370
2016	0	641	0	641
2017	0	295	0.4	295
2018	0	494	42	536
2019	0	162	4	167
2020	0	188	34	222
2021	0	490	8	498

**Table 21.2.2. *Nephrops* in FU17 (Aran Grounds). Effort data for the Irish otter trawl *Nephrops* directed fleet.**

Year	Effort (Kw Days)	Landings (Kgs)
1995	286,939	522,007
1996	174,030	312,421
1997	260,676	442,218
1998	445,308	940,902
1999	366,839	782,407
2000	293,684	561,244
2001	362,754	586,462
2002	350,346	798,744
2003	492,284	801,813
2004	355,673	420,652
2005	396,202	708,540
2006	337,503	618,515
2007	460,396	905,282
2008	512,245	1,052,077
2009	319,873	613,220
2010	441,080	910,346
2011	332,300	667,564
2012	488,721	1,139,413
2013	571,916	1,239,469
2014	460,818	774,097
2015	232,190	461,409
2016	396,502	578,420
2017	277,117	258,052
2018	233,793	483,723
2019	136,278	148,795
2020	91,263	177,895
2021	184,881	444,551

**Table 21.2.3. *Nephrops* in FU17 (Aran Grounds). Sampling levels.**

Year	Quarter	Number of samples		Numbers Measured	
		Catch	Discards	Catch	Discards
2008	1	2	3	565	1376
2008	2	9	8	2224	3758
2008	3	5	4	1266	1834
2008	4	3	3	889	1733
2009	1	3	3	800	1184
2009	2	6	6	1685	1978
2009	3	6	6	2260	2726
2009	4	2	2	1491	1149
2010	1	4	4	3322	2322
2010	2	8	7	3577	2957
2010	3	2	2	951	742
2010	4	6	4	3209	1802
2011	1	7	7	3755	3537
2011	2	7	7	7399	6617
2011	3	4	2	3531	2386
2011	4	5	5	2440	2271
2012	1	3	3	1538	1250
2012	2	17	15	6481	5113
2012	3	0	0	-	-
2012	4	5	5	2333	1945
2013	1	10	9	3108	2983
2013	2	11	11	3733	3733
2013	2	3	3	1163	1263
2013	4	7	7	2956	1779
2014	1	3	3	1208	1223
2014	2	12	12	5365	3563
2014	3	2	2	786	499
2014	4	8	8	3542	2760

Year	Quarter	Number of samples		Numbers Measured	
		Catch	Discards	Catch	Discards
2015	1	2	2	827	611
2015	2	2	2	961	664
2015	3	0	0	-	-
2015	4	2	2	1047	1388
2016	1	5	4	2292	876
2016	2	11	11	4756	3383
2016	3	6	5	3020	2048
2016	4	6	6	1389	1311
2017	1	3	3	1214	845
2017	2	6	4	2911	1569
2017	3	2	1	1018	223
2017	4	3	3	1176	839
2018	1	3	3	1224	1241
2018	2	8	8	3179	2971
2018	3	1	1	467	388
2018	4	6	6	1894	2487
2019	1	3	3	1151	1368
2019	2	5	5	1552	1441
2019	3	2	2	628	480
2019	4	2	2	519	558
2020	1	4	4	1037	984
2020	2	5	5	1706	1666
2020	4	1	0	302	0
2021	1	3	3	740	778
2021	2	5	4	1558	1059

**Table 21.2.4. *Nephrops* in FU17 (Aran Grounds). Raised landings and discard weight and numbers by year.**

Year	Landings (t)	Discards (t)	Landings in number ('000s)	Discards in number ('000s)	Discards by weight (%)	Discards by number (%)
2008	1057	248	48,162	22,074	19.0	31.4
2009	626	129	24,935	9,487	17.1	27.6
2010	939	224	37,341	15,246	19.3	29.0
2011	659	92	31,950	8,542	12.2	21.1
2012	1246	86	61,076	8,292	6.5	12.0
2013	1295	129	60,016	12,034	9.1	16.7
2014	766	48	33,882	5,038	5.9	12.9
2015	370	15	17,693	1,622	3.8	8.4
2016	641	69	30,231	6,375	9.7	17.4
2017	295	38	13,269	3,605	11.3	21.4
2018	536	106	22,049	10,490	16.5	32.2
2019	167	21	7,568	2,098	11.1	21.7
2020	222	54	9,516	3,525	19.5	27.0
2021	498	88	22,750	7,049	15.0	23.6

**Table 21.2.5. *Nephrops* in FU17 (Aran Grounds). Results summary table for geostatistical analysis of UWTV survey.**

Ground	Year	Number of stations	Mean Density adjusted** (burrow/m <sup>2</sup> )	Domain Area (km <sup>2</sup> )	Geostatistical Abundance Estimate adjusted (millions burrows)	CV on Burrow estimate %
Aran Grounds	2002	49	0.79	1196	947	3
	2003	41	0.94	1196	1118	6
	2004	64	1.08	1196	1297	3
	2005	70	0.81	1196	972	2
	2006	67	0.46	1196	556	3
	2007	71	0.69	1196	828	2
	2008	63	0.41	1196	494	3
	2009	82	0.52	1196	627	2
	2010	87	0.63	1196	752	2
	2011	76	0.51	1196	609	2
	2012	31*	0.33	1196	397	3
	2013	31*	0.33	1196	390	4
	2014	33*	0.28	1196	332	4
	2015	34*	0.40	1197	480	4
	2016	34*	0.29	1197	343	3
	2017	31*	0.31	1196	377	3
	2018	33*	0.40	1196	488	3
	2019	31*	0.39	1196	458	4
	2020	34	0.29	1196	359	4
	2021	34*	0.26	1196	311	4

\* reduced isometric grid.

\*\* mean density of the observations.



**Table 21.2.6. *Nephrops* in FU17 (Galway Bay and Slyne Head). Results summary table for analysis of UWTV survey. Random stratified estimates given for these grounds only.**

Ground	Year	Number of stations	Mean Density adjusted (burrow/m <sup>2</sup> )	Domain Area (km <sup>2</sup> )	Raised Abundance Estimate adjusted (millions burrows)*	CV on Burrow estimate %
Galway Bay	2002	7	1.18	79.0	93.1	7
	2003	3	1.30	79.0	102.6	16
	2004	8	1.17	79.0	92.2	14
	2005	4	1.30	79.0	103.0	11
	2006	3	0.74	79.0	58.8	9
	2007	5	0.91	79.0	71.8	8
	2008	5	0.40	79.0	31.6	4
	2009	8	0.71	79.0	56.3	4
	2010	10	1.24	79.0	97.6	11
	2011	6	0.55	79.0	43.2	12
	2012	4	0.64	79.0	50.9	10
	2013	5	0.37	79.0	29.6	10
	2014	3	0.50	79.0	39.8	6
	2015	5	0.71	79.0	55.8	15
	2016	7	0.32	79.0	25.1	7
	2017	5	0.20	79.0	15.8	4
	2018	5	0.41	79.0	32.5	17
	2019	5	0.29	79.0	22.8	11
	2020	5	0.34	79.0	27.2	13
	2021	5	0.15	79.0	11.5	2
	2022*	5	0.19	79.0	14.8	3

\* 2022 abundance estimate for Galway Bay was not used in the assessment, as the rest of the stations in the Aran Grounds and Slyne Head were not completed due to disruption to the survey schedule.

Ground	Year	Number of stations	Mean Density adjusted (burrow/m <sup>2</sup> )	Domain Area (km <sup>2</sup> )	Raised Abundance Estimate adjusted (millions burrows)*	CV on Burrow estimate %
Slyne Head	2002	5	0.76	39.1	29.8	8
	2003*	0	0.65	39.1	25.3	0
	2004	3	0.53	39.1	20.8	10
	2005	3	0.44	39.1	17.4	1
	2006	3	0.30	39.1	11.8	9
	2007	4	0.51	39.1	19.8	12
	2008*	0	0.41	39.1	16.0	0
	2009	6	0.31	39.1	12.2	7
	2010	7	0.73	39.1	28.7	4
	2011	7	0.51	39.1	20.0	5
	2012	3	0.52	39.1	20.5	2
	2013	4	0.54	39.1	21.1	10
	2014	4	0.28	39.1	11.0	6
	2015	5	0.50	39.1	19.6	4
	2016	4	0.27	39.1	10.8	3
	2017	4	0.27	39.1	10.7	4
	2018	5	0.84	39.1	33.0	12
	2019	5	0.29	39.1	11.5	8
	2020	5	0.19	39.1	7.4	4
	2021	5	0.23	39.1	9.1	2

\*estimated as no survey data available for these years.

**Table 21.2.7. *Nephrops* in FU17. Results summary table for analysis of UWTV survey for the combined grounds.**

Year	Abundance (Millions)	Upper bound	Lower bound
2002	1070	1154	985
2003	1246	1434	1059
2004	1410	1517	1302
2005	1092	1154	1030
2006	627	703	551
2007	920	982	858
2008	541	588	494
2009	696	739	653
2010	879	926	831
2011	672	720	624
2012	468	520	417
2013	441	506	376
2014	383	440	327
2015	556	627	484
2016	379	420	339
2017	404	445	362
2018	554	637	471
2019	493	558	427
2020	394	453	335
2021	331	362	301
2022	331*		

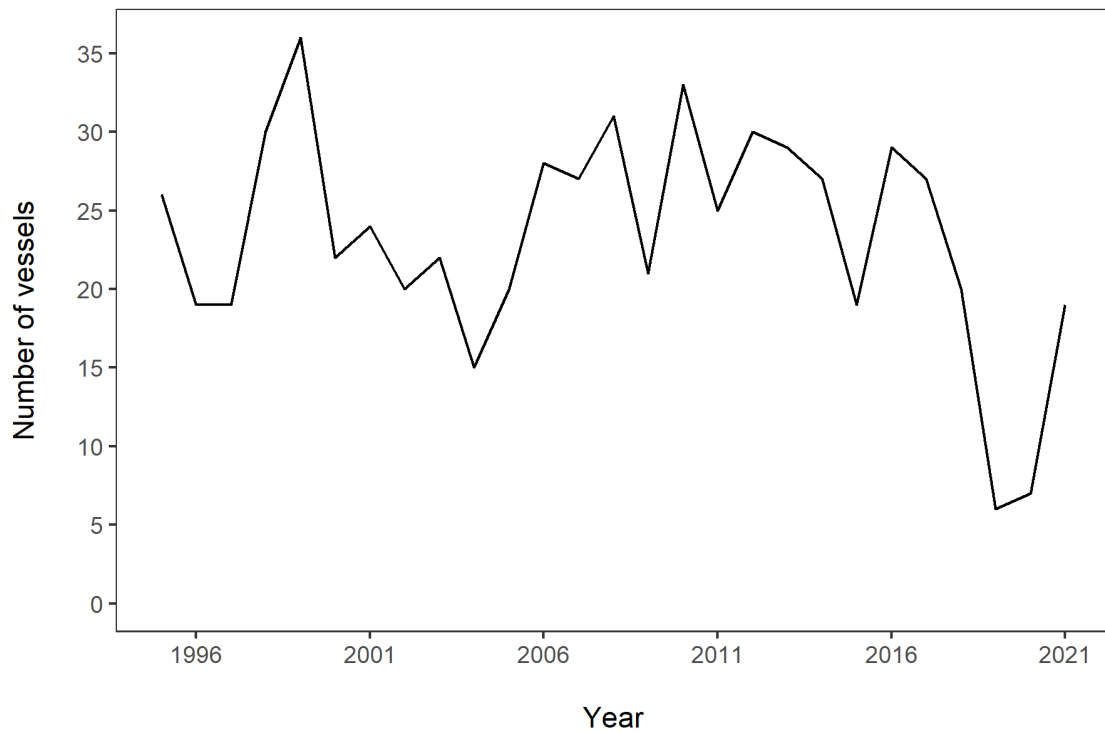
\* 2022 abundance estimate used in the assessment was based on 2021 UWTV survey abundance estimate.

**Table 21.3.1. *Nephrops* in FU17 (Aran Grounds). Forecast inputs (bold) and historical estimates of mean weight in landings and harvest rate. Removals estimated in years with no sampling (\*) using ratio of removals to landings in adjacent years. n/a = not available due to non-cooperation with sampling programmes.**

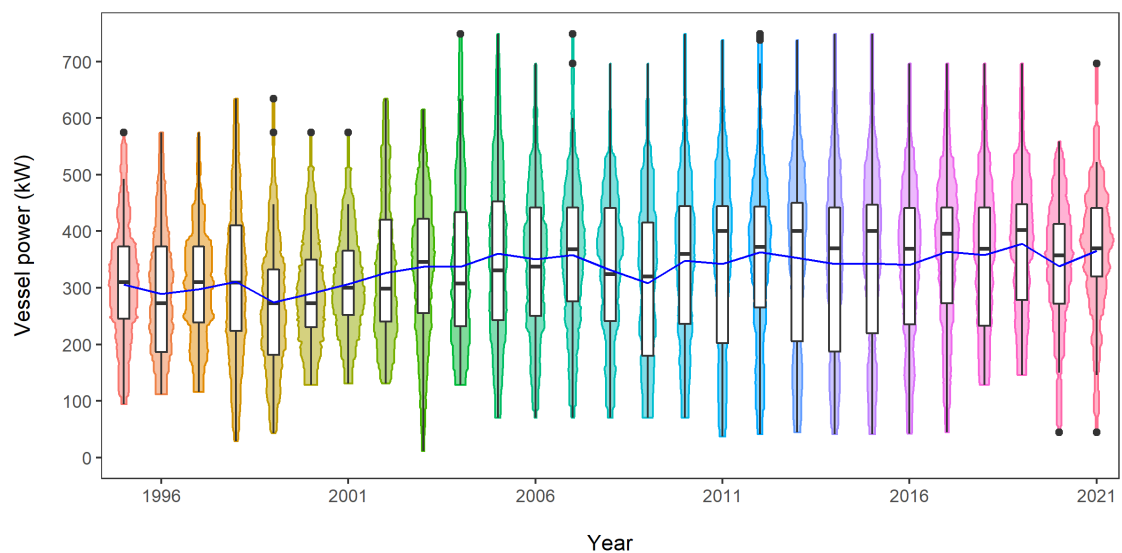
Year	UWTV abundance estimate	95% Confi- dence Interval	Landings in number	Total discards in number*	Removals in number	Harvest rate (by number)***	Landings	Total discards*	Discard rate (by number)	Dead discard rate (by number)	Mean weight in landings	Mean weight in discards
	millions					%	tonnes		%		grammes	
2002	1070	84	55	18	68	6.3	1154	192	24.5	19.6	21.2	10.8
2003	1246	187	44	18	58	4.6	933	183	29.3	23.7	21.2	10.0
2004	1410	108	29	11	38	2.7	525	112	28.2	22.9	18.1	9.9
2005	1092	62	42	20	57	5.2	778	182	31.7	25.9	18.4	9.2
2006	627	76	n/a	n/a	50	7.9	637	n/a	n/a	n/a	n/a	n/a
2007	920	62	n/a	n/a	57	6.2	913	n/a	n/a	n/a	n/a	n/a
2008	541	47	48	22	65	12.0	1057	248	31.4	25.6	21.94	11.23
2009	696	43	25	9	32	4.6	625	129	27.6	22.2	25.12	13.63
2010	879	47	37	15	49	5.6	939	224	29.0	23.4	25.16	14.70
2011	672	48	32	9	38	5.7	659	92	21.1	16.7	20.62	10.75
2012	468	52	61	8	67	14.4	1246	86	12.0	9.2	20.40	10.39
2013	441	65	60	12	69	15.7	1295	129	16.7	13.1	21.59	10.73
2014	383	57	34	5	38	9.8	766	48	12.9	10.0	22.62	9.56

Year	UWTV abundance estimate	95% Confi- dence Interval	Landings in number	Total discards in number*	Removals in number	Harvest rate (by number)***	Landings	Total discards*	Discard rate (by number)	Dead discard rate (by number)	Mean weight in landings	Mean weight in discards
	millions					%	tonnes		%		grammes	
2015	556	71	18	2	19	3.4	370	15	8.4	6.4	20.91	9.13
2016	379	41	30	6	35	9.2	641	69	17.4	13.7	21.21	10.85
2017	404	41	13	4	16	4.0	295	38	21.4	16.9	22.23	10.46
2018	554	83	22	10	30	5.4	536	106	32.2	26.3	24.33	10.11
2019	493	66	8	2	9	1.9	167	21	21.7	17.2	22.00	9.94
2020	394	59	10	4	12	3.1	222	54	27.0	21.7	23.31	15.29
2021	331	31	23	7	28	8.5	498	88	23.6	18.9	21.88	12.48
2022	331*											

\* 2022 abundance estimate used in the assessment was based on 2021 UWTV survey abundance estimate.



**Figure 21.1.1. *Nephrops* in FU17 (Aran Grounds).** Time-series of the number of Irish vessels reporting landings of *Nephrops* from FU17 with a >10 t threshold.



**Figure 21.1.2. *Nephrops* in FU17 (Aran Grounds).** Combined box and kite plot of Irish vessel's power on the Aran Grounds by year. The blue line indicates the mean.

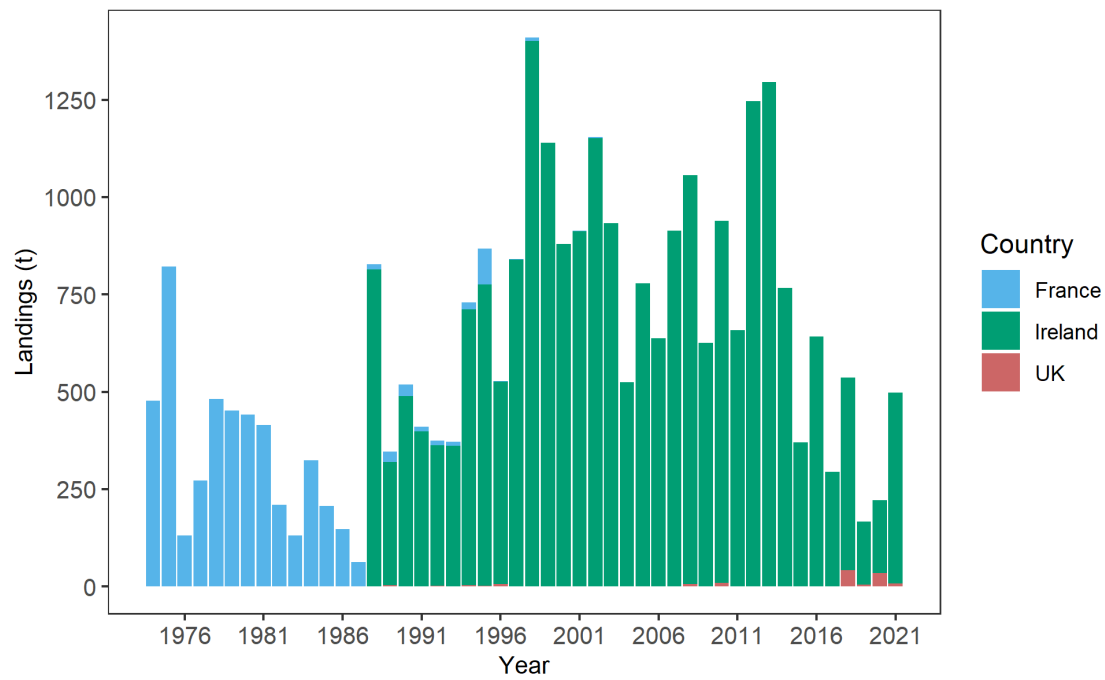


Figure 21.2.1. *Nephrops* in FU17 (Aran Grounds). Landings in tonnes by country.

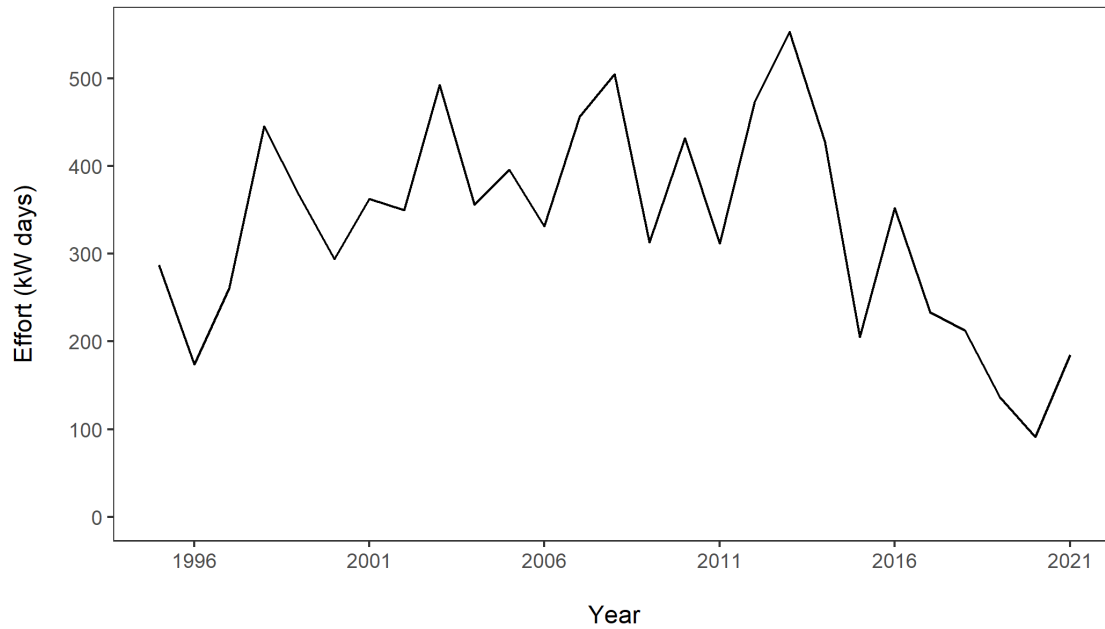


Figure 21.2.2. *Nephrops* in FU17 (Aran Grounds). Effort data (kW days) for Irish directed *Nephrops* fleet.

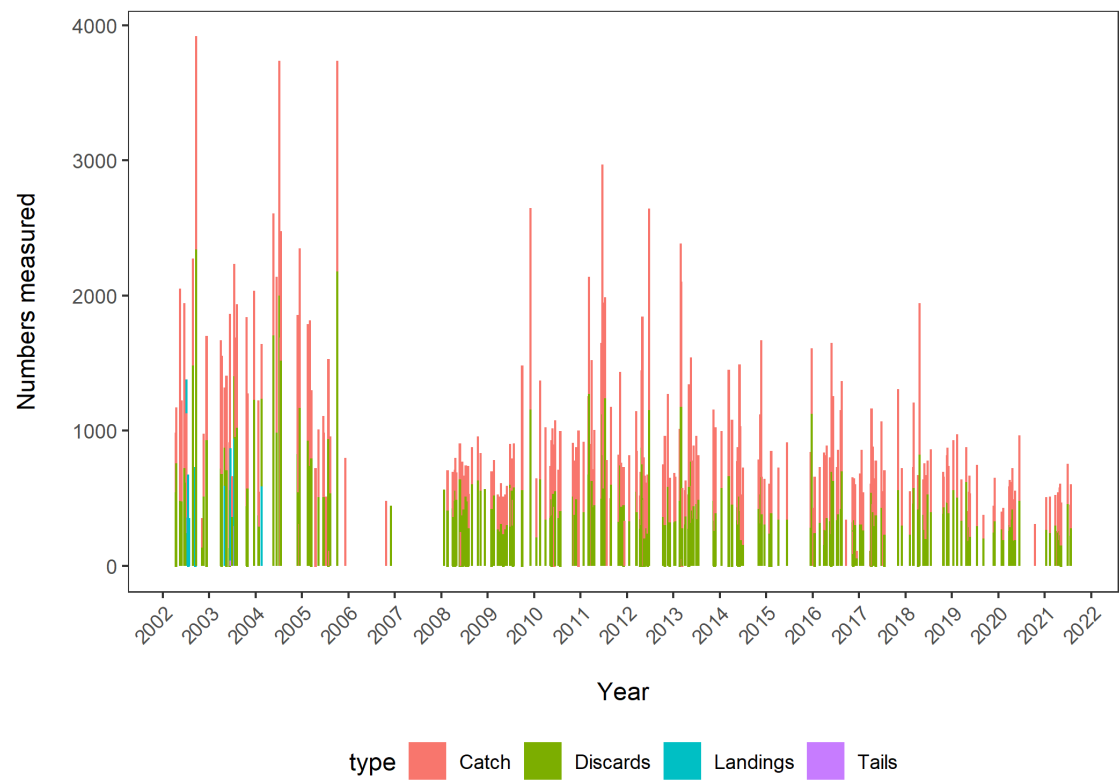
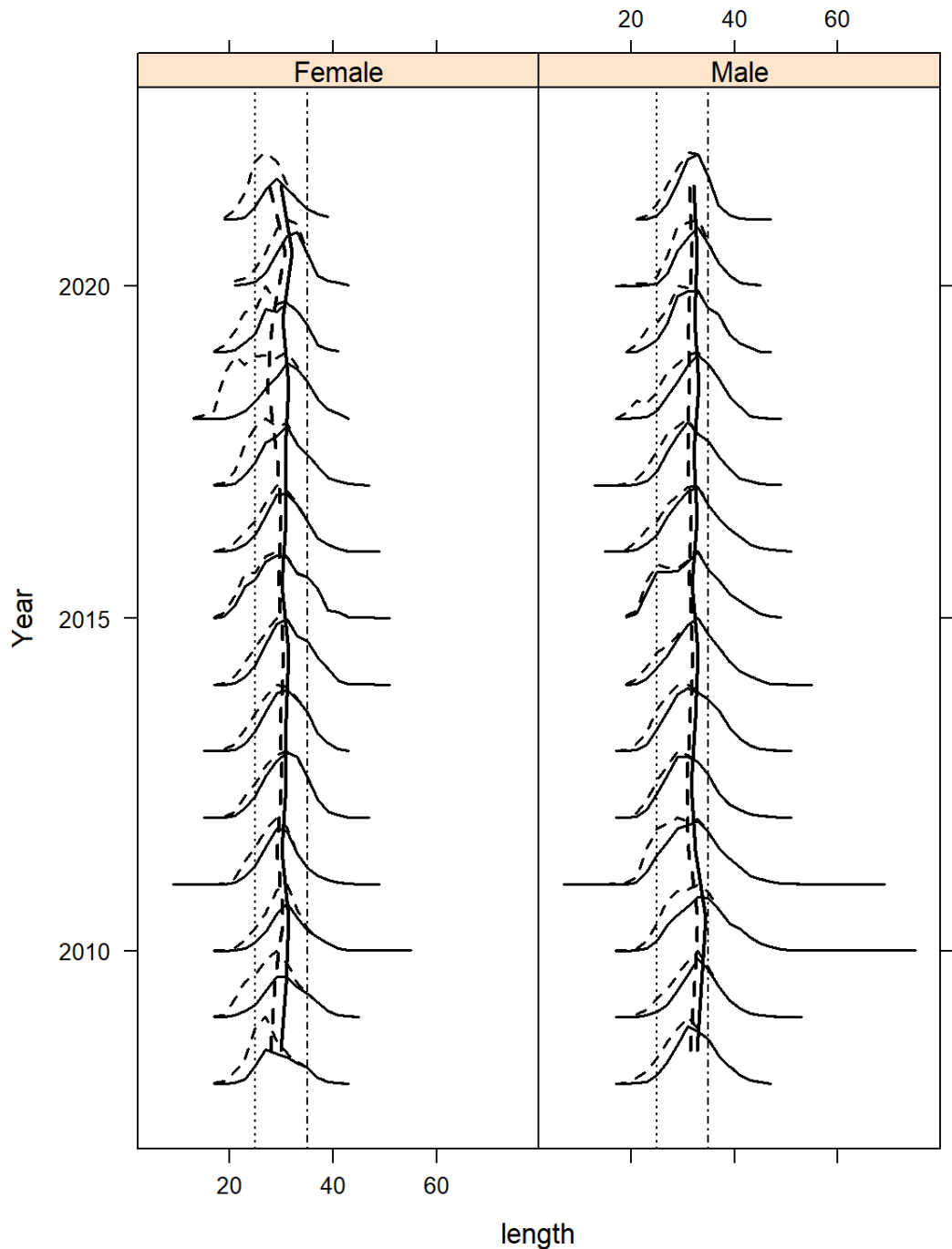


Figure 21.2.3. *Nephrops* FU17 (Aran Grounds). Sampling levels for the Aran grounds.



Length frequencies for catch (dotted) and landed(solid):  
Nephrops in FU17



Mean length of landings and catch vertically  
MLS (25mm) and 35mm levels displayed

Figure 21.2.4. *Nephrops* FU17 Aran Grounds. Annual length composition of catches (dotted line) and landings (solid line) for females (left) and males (right) from 2008 (bottom) to 2020 (top). Annual mean length of catches (dotted vertical line) and landings (solid vertical line) are also shown. Minimum Landing Size (25 mm) and 35 mm levels are also displayed with vertical lines.

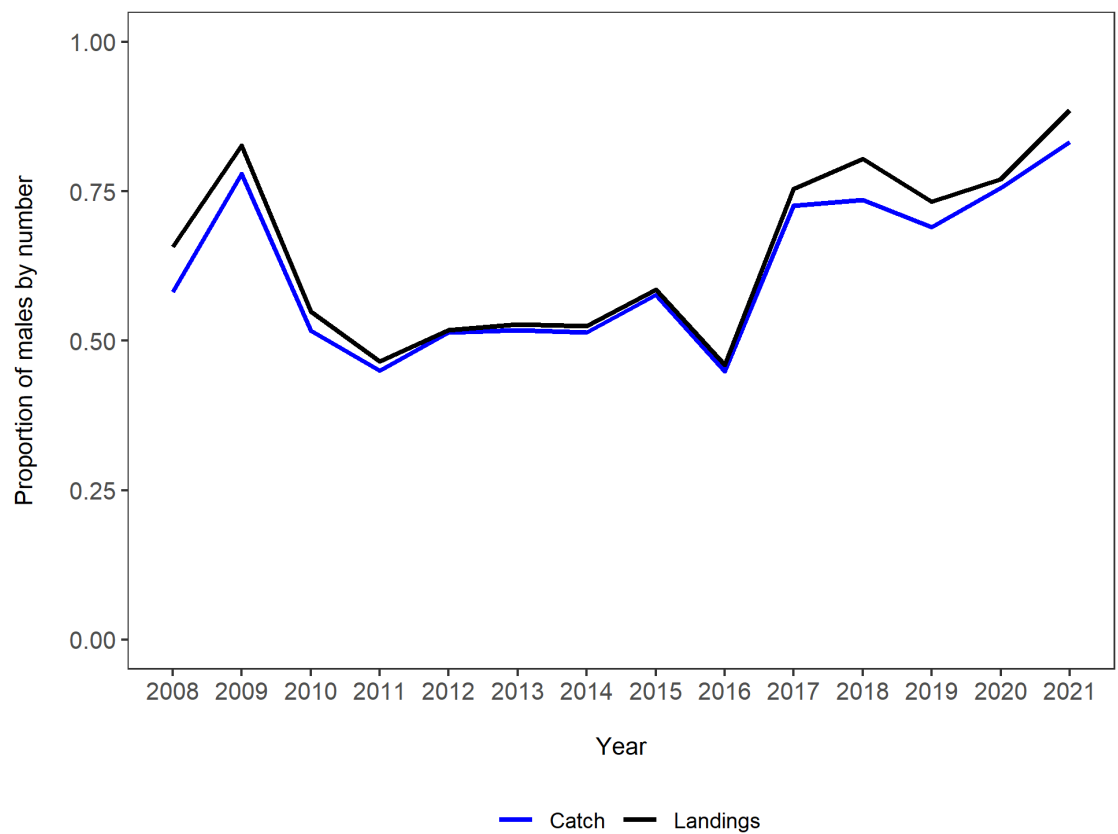


Figure 21.2.5. *Nephrops* FU17 (Aran Grounds). Proportion of males by number in the catch (blue) and landings (black).

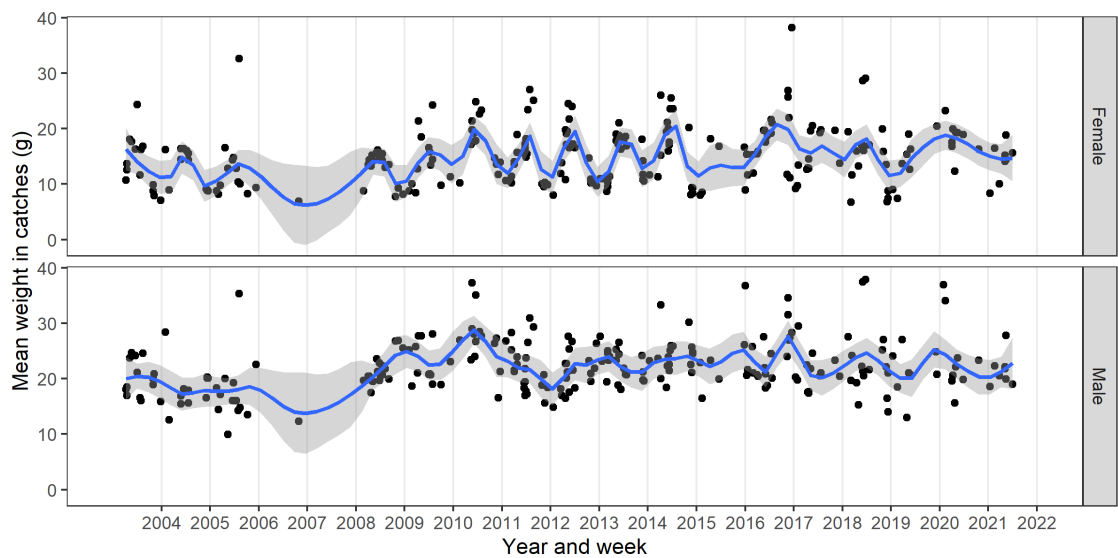


Figure 21.2.6. *Nephrops* FU17 (Aran Grounds). Mean weight in catch samples by sex showing cyclical trends.

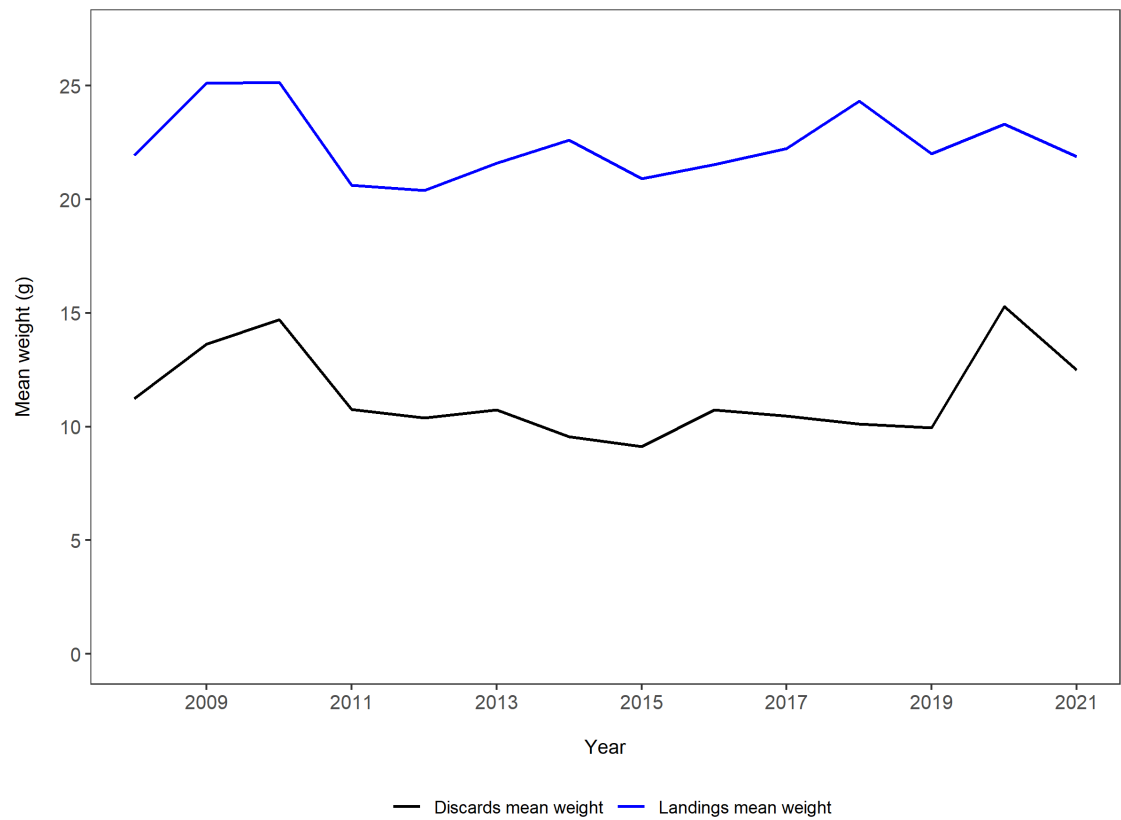


Figure 21.2.7. *Nephrops* FU17 (Aran Grounds). Annual mean weight (g) estimates of landings (blue) and discards (black).

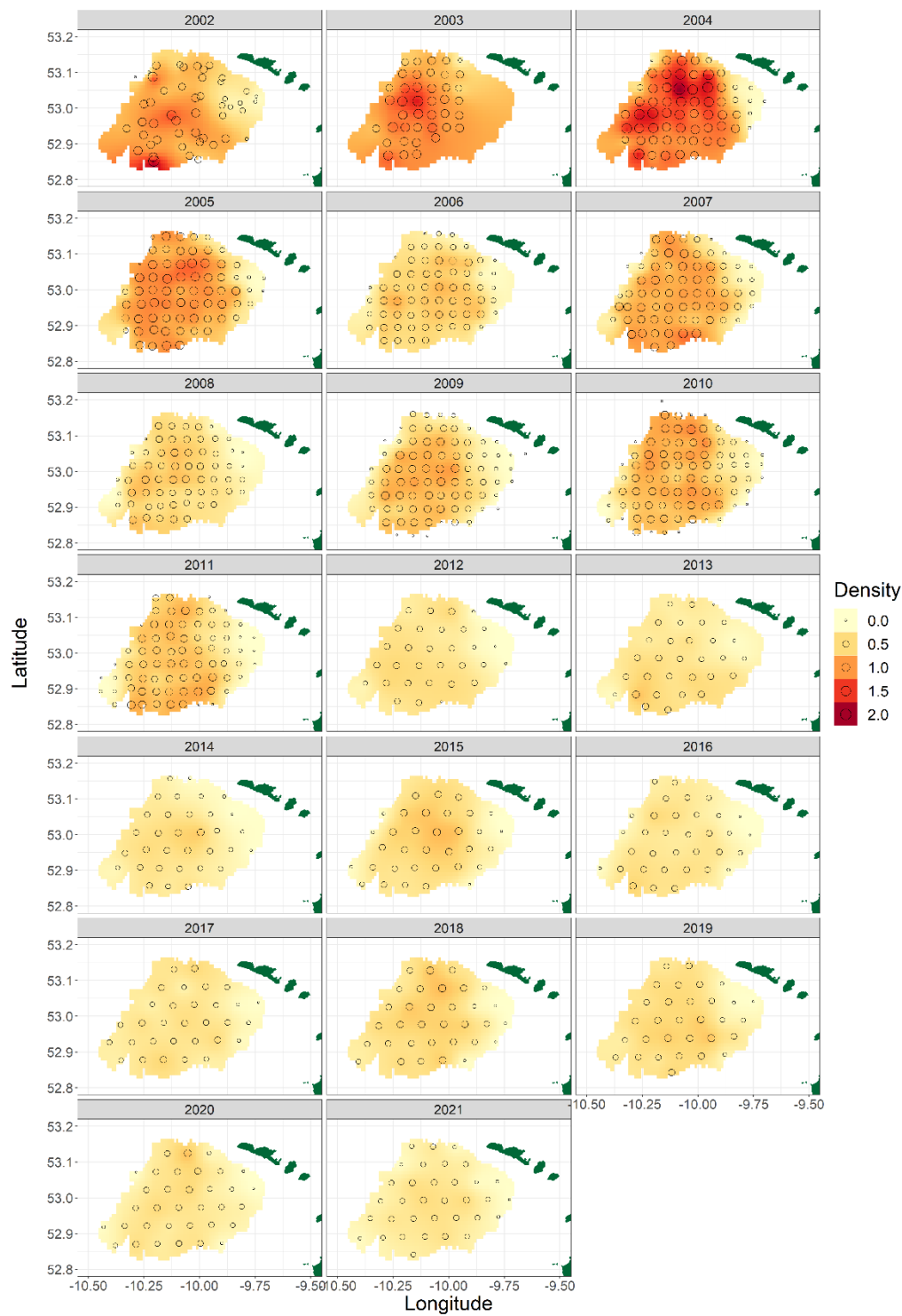
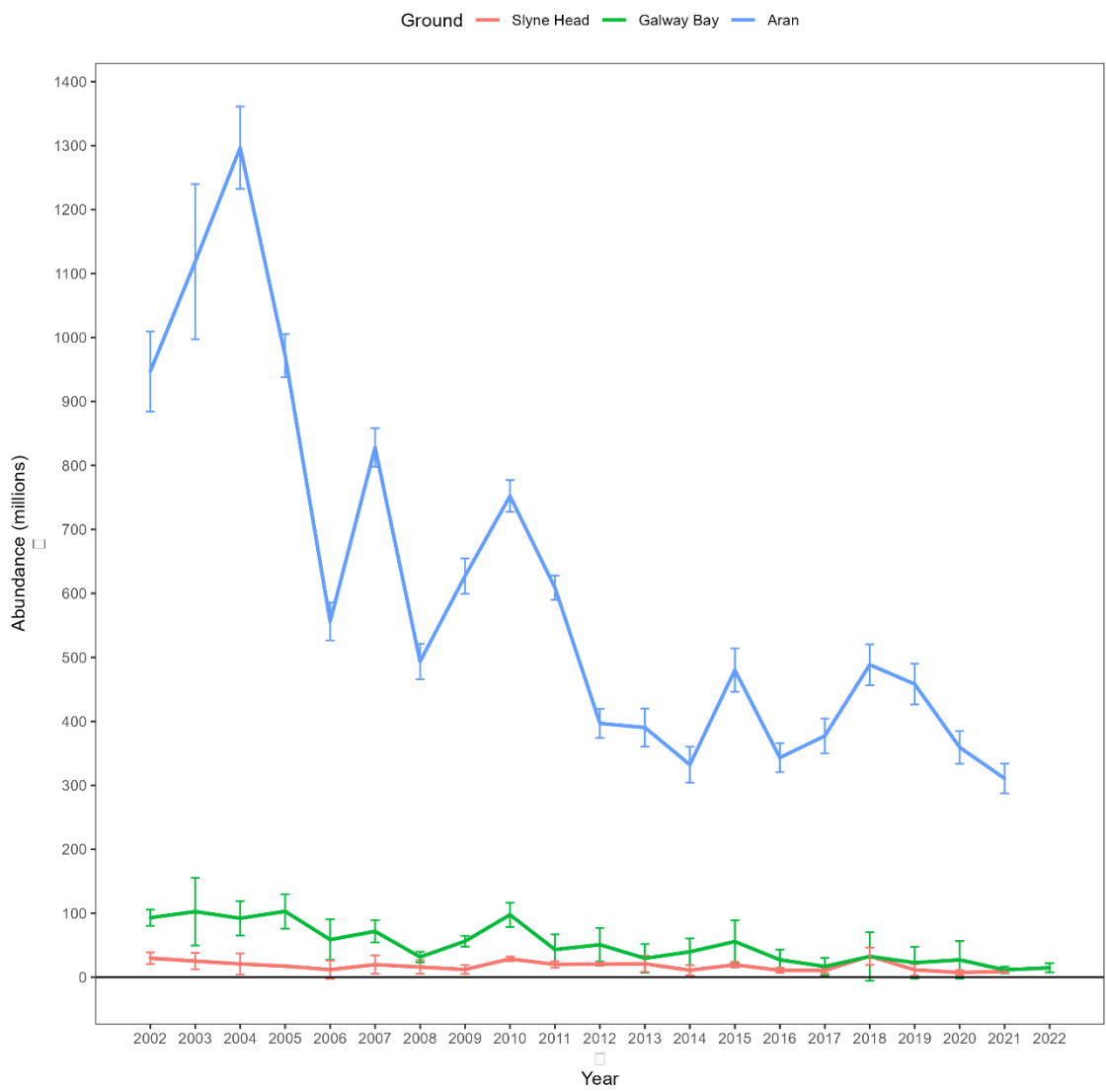


Figure 21.2.8. *Nephrops* in FU17 (Aran Grounds). Contour plots of the kriggered density estimates for the Aran Ground UWTV surveys from 2002 (top left) to 2021 (bottom). No UWTV survey in 2022.



**Figure 21.2.9. *Nephrops* FU17 Aran Grounds. *Nephrops* burrow estimates in FU17 Aran (blue), Galway Bay (green) and Slyne Head (red) grounds 2002–2021. 2022 UWTV was only carried out in Galway Bay.**

Stock size

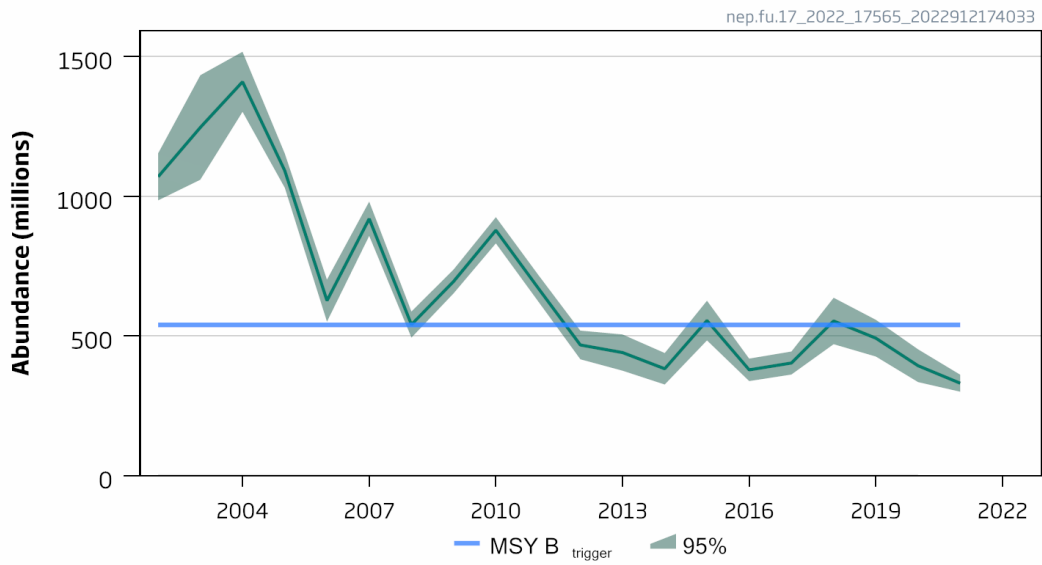


Figure 21.2.10. Time-series of total abundance estimates for FU17.

Fishing pressure

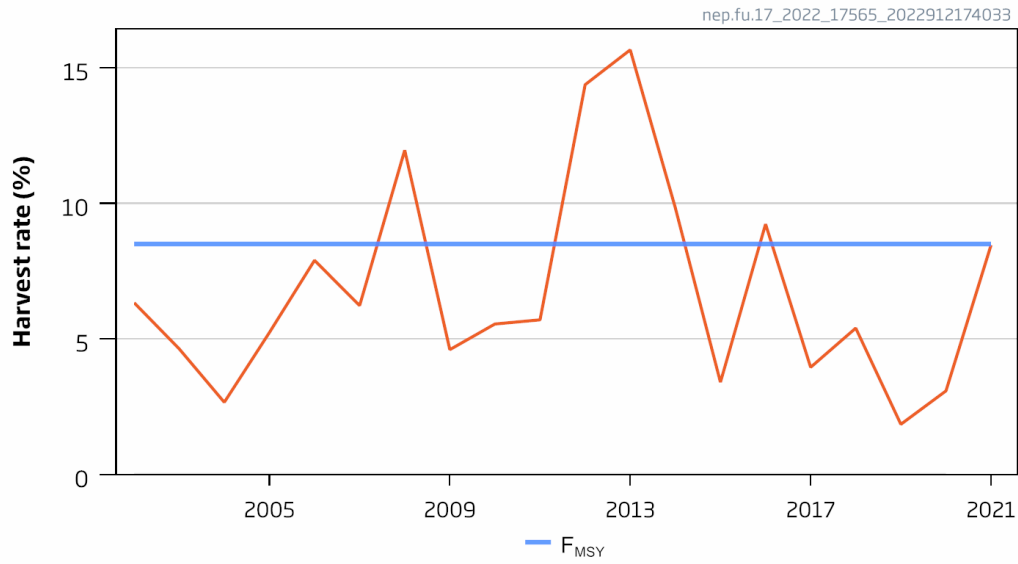


Figure 21.3.1. *Nephrops* FU17 Aran Grounds. Harvest Rate represented by red line (% dead removed/UWTV abundance).