Contents

19 Norway lobster (*Nephrops norvegicus*) in divisions 7.a, 7.g and 7.j, Functional Unit 19 (Irish Sea, Celtic Sea, eastern part of southwest of Ireland)

Type of assessment in 2022

This stock was benchmarked in February 2014 and the assessment and provision of catch advice through the use of the UWTV survey data and other commercial fishery data follows the process defined by the benchmark WG (ICES, 2014) and set out in the stock annex. This stock assessment is available in the ICES Transparent Assessment Framework (TAF) here.

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 531 tonnes and 595 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) 19 is exploited sustainably, management should be implemented at the functional unit level."

ICES advice applicable to 2022

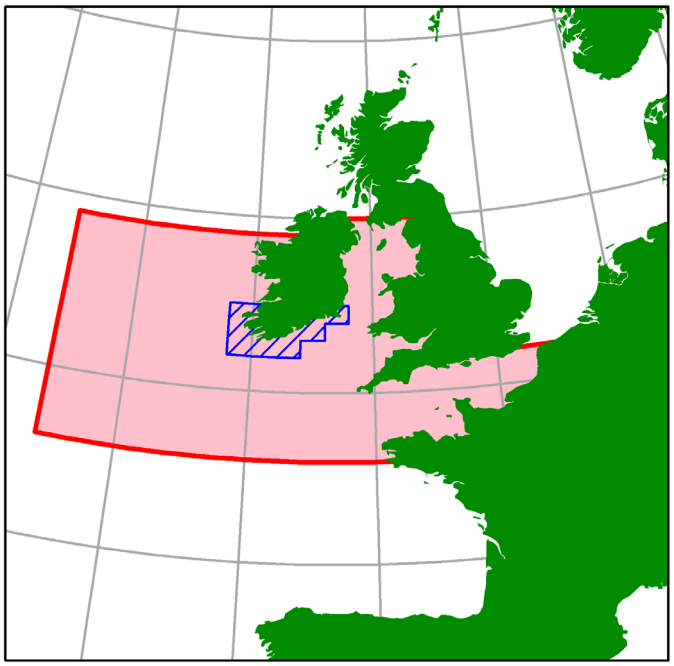
"ICES advises that when the EU multiannual plan (MAP) for Western Waters and adjacent waters is applied, and assuming that discard rates and fishery selection patterns do not change from the average of the years 2018–2020, catches in 2022 that correspond to the F ranges in the MAP are between 337 and 378 tonnes.
To ensure that the stock in Functional Unit (FU) 19 is exploited sustainably, management should be implemented at the FU level."

19.1 General

Stock description and management units

In FU19 *Nephrops* are caught on a large number of spatially discrete small inshore grounds and on some larger grounds further offshore and of these the 'Galley ground 4' and around Cork channels appear to be the most important (see Figure 19.1.1). The *Nephrops* stock (FU19) covers ICES rectangles ; 31–33 D9–E0; 31E1; 32E1–E2; 33E2–E3 within 7.a, 7.g, and 7.j. 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) and the Celtic Sea (FU20–22).

The map below shows FU19 assessment area (blue) and TAC area (red). There is no evidence that the individual functional units belong to the same stock. See Section 18 for details on *Nephrops* in Subarea 7 general section.



Ecosystem aspects

This section is detailed in stock annex. There are no updates.

Fishery description

A description of the fleet is given in the stock annex.

The time-series of numbers of vessels reporting landings greater than 10 t is updated in Figure 19.1.2. The numbers of vessels has been relatively stable from 1995 except since 2018, where there was a sharp decrease that has levelled. The time-series of vessel power is shown as a box and kite plot in Figure 19.1.3.

Fishery in 2021

There has been a trend for Irish vessels (>18 m) to switch to multi (quad) rig trawls. Provisional data suggest a ~30% increase in *Nephrops* catch rates and a reduction in fish bycatch of ~30% due to the lower headline height. The number of French vessels reporting landings in FU19, has decreased from 35 vessels in 2005 to five vessels in 2021.

Information from stakeholders

None available.

19.2 Data

InterCatch

All data were available in InterCatch and used for catch data only. French catch data provided directly by the national expert and not extracted from InterCatch.

Landings

Landings data for FU19 are summarized in Table 19.2.1. Ireland, France and the UK report landings for FU19. Landings data for Ireland were revised back to 2008 which resulted in minor revisions in the order of 1 to 5 % (stock annex). These revised data has been used in the assessment this year. The Republic of Ireland landings have fluctuated considerably throughout the time-series, with a marked dip in 1994 (Table 19.2.1; Figure 19.2.1). The highest landings in the time-series were observed in 2002–2004 (>1000 t). Landings in 2005 and 2006 have been below average for the series. In 2017 landings decreased by approximately 30% for the Irish fleet and were below the series average. This can be explained due to the poor weather conditions in quarter 1 which hampered fishing activities of smaller vessels and the larger vessels maximising effort in other FUs. There was a minor revision to 2018 landings for Ireland. Landing in 2021 were at a similar level to that reported in 2016. Landings by the French fleet have fluctuated with a declining trend throughout the time-series from the highest value in 1989 of 245 t to 1.1 t in 2020. There was a minor revision to the 2019 UK(E&W) landings due to a code error (from 1.4 t to 1.1 t). Landings from the UK are minor < 0.5 t in 2020. This had a minimal effect on combined international data workup for that fishery year (Table 19.3.1.).

Total landings for years 2019 (value 249.1477 t) and 2020 (value 248.9602 t) are the same (249 t) due to rounding.

WGCSE 2022 discovered a code error in year 2019 assessment where the international scaling was not carried out fully. This revision was presented to WGCSE 2022 and resulted in changes to numbers in landings, discards, removals, harvest rate and mean weights for year 2019. Table 19.3.1 is updated to reflect this change.

This data revision affects advice issued by WGCSE 2021 where the input year range is recent three year average (2018, 2019, 2020).

Effort

In line with WGCSE 2015 recommendation effort is reported in KWdays and lpue 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 effort series is based on the same criteria for FU15, 16, 17, 22 and 20–21 (30% landings threshold) and will be contingent on the accuracy of landings data reported in logbooks.

Disaggregated effort and landings data are available for the Irish *Nephrops* directed fleet in FU19 from 1995–2021 for all vessels and vessels >18 metres total length. (Table 19.2.2; Figure 19.2.2). For vessels >18 effort (since early 2000s) has fluctuated with an overall decreasing trend in recent three years. This can be explained by fleet mobility where vessels target *Nephrops* in this area in periods of good emergence. For vessels <18 effort has decreased in 2017 to 2019 due to weather conditions.

Sampling levels

Sampling levels, data aggregating and raising procedures were reviewed by WKCELT 2014, and are documented in the stock annex. The time-series of samples is shown in Figure 21.2.3 and Table 21.2.3. Sampling levels in 2021 were good and are comparable to recent levels.

Commercial length–frequency distributions

Length–frequency data of the landings were collected on a regular basis from 2002 to 2020. Spatial and temporal coverage is problematic with landings from FU19 coming from several discrete grounds (see stock annex.) The sampling intensity and coverage has varied over the time-series (see stock annex). Since 2008 sampling has been good although the majority of the samples come from Bantry Bay recently. Also sampling of the discards is quite sparse over the time-series and are difficult to obtain due to the spatial coverage of the grounds. The catch samples from 2008 to 2021 were split using the discard selection ogive agreed at the benchmark. The length–weight regression parameters given in the stock annex are used to calculate sampled weights and appropriate quarterly raising factors. The length distributions are shown in Figure 19.2.4. The mean size has remained relatively stable and the trend in mean size is stable in recent years.

Sex ratio

The sex ratio in the landings is male biased in most years but there is a trend towards increased percentage of females in the landings (Figure 19.2.5). The proportion of females was higher in 2013 and this was confirmed by the industry.

Mean weight explorations

Explorations of the mean weight in the catch samples by sex shows a strong cyclical pattern in the females for all grounds combined (Figure 19.2.6). This corresponds with the emergence of mature females from the burrows to mate in summer. These data also show an increase in mean weights for males in 2016. The annual mean weight estimate for landings and discards is shown in Figure 19.2.7. The landings mean weight estimates increased in 2019 and then show a decrease in 2020.

Discarding

Sampling of the discards has quite sparse over the time-series and are difficult to obtain due to the spatial coverage of the grounds (see stock annex). Since 2002 discard rates have been estimated using unsorted catch and discards sampling (as described in the stock annex). WKCELT 2014 examined the available discard data observations for FU19. An average discard selection ogive using data from Bantry Bay in years 2008 and 2013 was generated and deemed appropriate given the variable sampling intensity and coverage. The catch data from 2008 were then revised and split into landings and discards. Catch data sampling for years previous to 2008 was not revised as was considered to be not of good enough quality. The catch data were split using this selection ogive for the time series to date.

Discard rates range between 25–86% of total catch by weight and 40–80% of total catch by number (Table 19.2.4). These high discard rates are very high compared with other FUs. This is because the fleet is mainly smaller inshore vessels with limited space for extra crew. On-board "tailing" of the smaller *Nephrops* is not usually practised and the bigger *Nephrops* are picked from catches. There is no information on discard survival rate in this fishery but a 25% discard survival rate is assumed in line with other *Nephrops* stocks in the Celtic Sea.

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.

Table 19.3.1 gives weights, numbers and mean weights of the landings and discard raised internationally according to the stock annex.

Abundance indices from UWTV surveys

The methods used during the survey were similar to those employed for UWTV surveys [U5917] of *Nephrops* stocks around Ireland and elsewhere are documented by WKNEPHTV (ICES, 2007), WKNEPHBID (ICES, 2008), SGNEPS (ICES, 2009; 2010; 2012), WGNEPS (ICES, 2013; 2014; 2015; 2016a; 2017; 2018a, 2020, 2021, 2022), WKNEPS (ICES, 2016b; 2018b), Leocádio, A., *et al*, 2018 and Dobby H., *et al*, 2021. SGNEPS 2012 (ICES, 2012) recommended that a CV (or relative standard error) of <20% as an acceptable precision level for UWTV survey estimates of abundance. Given the scale of the area and the number of distinct patches it is unrealistic to expect sufficient stations (~10) in each individual patch to estimate densities separately. The random stratified approach may cause problems in years where the planned survey coverage is not achieved. WKCELT 2014 concluded that WGCSE or WGNEPS should make recommendations on the most appropriate fill in procedure to be adopted in these cases.

The spatial extent of the *Nephrops* grounds in FU19 has been re-defined by WKCELT 2014 and the abundance estimates are calculated using these areas. The redefinition of the polygons in FU19 resulted in ~16% increase in overall area from 1653 km² to 1973 km² (see stock annex). The discrete grounds have been named as: Bantry Bay, Galley Ground 1–4, Cork Channels and Helvick 1–2 and are shown in Figure 19.1.1. In terms of area the Galley Grounds (1–4) account for 61% of the total grounds in FU19 and Galley Ground 4 is the largest of these representing 47% of the total area (Table 19.2.5). Helvick patches 2 and 3 were also amalgamated and renamed Helvick 2 based on the information from the VMS data.

From 2011 to 2022 an average of 42 stations have been completed annually. The survey design is based on randomly picked stations from the ground polygons and the sampling effort on each ground was determined by relative area.

All grounds except Galley Ground 4 in 2011 and Galley Ground 1 in 2012 were covered by the TV survey. Since 2015 a new patch Kenmare Bay was surveyed.

Detailed summary statistics for the various *Nephrops* patches in FU19 over the time-series are presented in Table 21.2.6. The mean density varies across the different patches, but there is some consistency to the estimates over time. In 2022 all discrete grounds were covered by the TV survey (Doyle *et al.,* 2022).

The 2022 mean density estimates vary between patches from the lowest value 0.04 (no./m²) observed at Kenmare Bay to the highest observed at 0.39 (no./m²) at Galley ground 2 (Table 19.2.6, Figure 19.2.8). The overall mean density for FU19 in 2022 is 0.13 (no./m²) which is the lowest observed in the time-series (Table 19.2.7).

Figure 19.2.9 and Table 19.2.7 shows the total abundance estimate for FU19 with the WKMSYRef4 proposed MSY $B_{trigger}$ (ICES, 2016XX, ICESYY). The 2022 abundance estimate was 4% lower than in 2021 and at 259 million is below the MSY $B_{trigger}$ (430 million) with a RSE of 14% which is below the 20% limit recommended by SGNEPs (2012).

Information from Irish Groundfish survey

Length–frequency data of the *Nephrops* catches on the Irish groundfish survey-Q4: IGFS-WIBTS-Q4 [G7212] from 2003–2021 are available (Stokes *et al.,* 2014; ICES, 2015). These data were investigated for trends in indicators such as possible recruitment signals (Figure 19.2.10). The mean size of males and females in from the survey was fairly stable over time at 33 mm for males and 25 mm for females.

19.3 Assessment

Comparison with previous assessments

The WGCSE 2019 carried out an UWTV based assessment for this stock. The methods used were very much in line with WK*NEPH* (ICES, 2009) and the approach taken for other *Nephrops* stocks in 6 and 7 by WGCSE. This approach was benchmarked at WKCELT 2014 (ICES, 2014).

State of the stock

UWTV abundance estimates suggest that the stock size has fluctuated with a declining trend in the recent five years. The 2022 estimate is the lowest observed and is below the MSY $B_{trigger}$. The 2022 abundance remains below the average of the series (geomean: [2011–2022]: 401 million).

Table 19.3.1 summarizes recent abundance estimates, harvest rates for the stock along with other stock parameters. Harvest rate is calculated as (landings + dead discards)/(abundance estimate).

Table 19.3.1.and Figure 19.3.1 summarize recent harvest ratios which have been below the F_{MSY} proxy for the last three years.

19.4 Catch scenario table

Catch scenario table inputs and historical estimates of mean weight in landings and harvest ratios are presented in Table 19.3.1 and summarised below.

The basis for the catch options:

Variable	Value	Notes
Stock abundance (2023)	259	Numbers of individuals (millions); UWTV survey 2022
Mean weight in projected landings	27.2	Average 2019–2021in grammes
Mean weight in projected discards	13.5	Average 2019–2021 in grammes
Projected discards	48.6	Proportion by number; average 2019–2021
Discards survival	25	Proportion by number
Projected dead discards	41.5	Proportion by number; average 2019–2021

The average in the recent three years is used to calculate the mean weight for landings and discards. 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).

A prediction of landings for the FU19 using the approach agreed procedure proposed at WK*NEPH* 2009 and outlined in the stock annex will be made on the basis of the 2022 UWTV survey. This will be presented in October 2022 for the provision of advice.

19.5 Reference points

WKMSYRef4 updated the F_{MSY} reference points for FU19 (ICES, 2016XX; 2016YY) on the basis of an average of estimated F_{MSY} proxy harvest rates over a period of years, this corresponds more

closely to the methodology for finfish. The updated harvest rate calculated at 9.3% is expected to deliver high long-term yield with a low probability of recruitment overfishing. This is close to the harvest rate of 8.1% calculated by WKCELT (ICES, 2014)

This stock previously did not have MSY $B_{trigger}$ specified, the time-series and range of indicator biomass is also limited such that direct use of B_{loss} is considered too close to equilibrium biomass. The workshop proposed to use the 5% interval on the probability distribution of indicator biomass assuming a normal distribution, which is analogous to the 5% on B_{MSY} proposed for finfish stocks assuming these *Nephrops* FU have been exploited at a rate close to near $HR_{MSY.}$ The MSY $B_{trigger}$ for FU 19 is 434 million individuals rounded to 430 million.

These reference points shown in text table below should remain under review by WGCSE should improved data become available.

Stock code	MSY Flower*	FMSY*	MSY Fupper* with AR	MSY Btrigger	MSY Fupper* with no AR
nep-19	8.3%	9.3%	9.3%	430***	9.3%

*** Harvest rate (HR).**

***** Abundance in millions.**

19.6 Management strategies

No specific management plan exists 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.

19.7 Quality of assessment and forecast

Biological sampling for this stock is improving given the spatial distribution of the *Nephrops* mud patches. A number of other biological parameters such as mean weights and length distributions have also been revised. The revisions were made as part of the 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. For FU19 deterministic estimates of the mean weight in the landings and discard rates for 2019–2021 are used although there is some variability of these over time.

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).

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. The average discard rate by weight for FU19 over the last three years is 32%. Catch advice and scenarios are provided this year on the assumption that discarding is assumed to continue at the recent average.

There are several key uncertainties and bias sources in the method used here (these are discussed further in WK*NEPH* 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 (WKNEPTV 2007; WKNEPHBID 2008; SGNEPS 2009; WGNEPS 2014). 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 WK*NEPH* (ICES, 2009). Different densities are apparent on the various different grounds within this FU. For the 2022 survey the number of observations on each individual patch is relatively low making the relative standard error (RSE) estimates not that relevant. Aggregating all areas together gives a mean burrow density of 0.13 with a RSE of around 14% which is below the 20% threshold recommended by SGNEPS (ICES, 2012). The cumulative bias estimates for FU19 are largely based on expert opinion. The precision of these bias corrections cannot yet be characterized, but is likely to be lower than that observed in the survey.

Landings data are adjusted to take into account landings that have been misreported from FU16 since 2011. This adjustment is thought to be reasonably accurate (See Section 19).

19.8 Recommendations for next benchmark

This stock was benchmarked by ICES in February 2014 (ICES, 2014). WGCSE will keep the stock under close review and recommend future benchmark as required.

19.9 Management considerations

The trends from the fishery (landings, effort, mean size, etc.) appear to show a decline. The UWTV abundance and mean density estimates vary between the discrete patches and population dynamics between these are not fully understood. The 2022 survey result is the lowest observed in the time-series.

In recent years several newer vessels specializing in *Nephrops* fishing have participated in this fishery. These vessels target *Nephrops* on several other grounds within the TAC area and move around to optimize catch rates. Since the introduction of effort management associated with the cod long-term plan (EC 1342/2008) there have been concerns that effort will be displaced towards FU19 and other *Nephrops* grounds where effort control has not been put in place.

Nephrops fisheries in this area are fairly mixed also catching megrim, anglerfish and other demersal species. There are also some catches of hake, and in the offshore parts of the area. The *Nephrops* grounds in FU19 coincide with an important nursery area for juvenile hake and anglerfish among other species (ICES, 2009).

19.10 References

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Table 19.2.1. *Nephrops* in FU19 (SW and SE Ireland). Landings in tonnes by country. The figures in the table are rounded. Calculations were done with unrounded inputs and computed values may not match exactly when calculated using the rounded figures in the table.

Year	FU 19			
	France	Rep. of Ireland	UK	Total
1989	245	652	2	899
1990	181	569	4	754
1991	212	860	5	1077
1992	233	640	15	888
1993	229	672	4	905
1994	216	153	21	390
1995	175	507	12	694
1996	145	736	7	888
1997	93	656	7	756
1998	92	733	2	827
1999	77	499	3	579
2000	144	541	11	696
2001	111	702	2	815
2002	188	1130	0	1318
2003	165	1075	0	1240
2004	76	997	1	1074
2005	62	648	2	712
2006	65	675	1	741
2007	63	894	0	957
2008	46	790	15	851
2009	55	798	15	868
2010	14	660	13	687
2011	23	619	1	643

Year	FU 19 France	Rep. of Ireland	UK	Total
2012	11	837	1	849
2013	4	783	6	794
2014	6	459	3	468
2015	5	502	0	507
2016	4	583	3	590
2017	4	412	4	420
2018	4	229	5	238
2019	2	247	1	249
2020	1	247	1	249
2021	1	413	1	415

Table 19.2.2. *Nephrops* in FU19 (SW and SE Ireland). Irish *Nephrops* directed effort (Kw Days) and landings. Irish Fleet - *Nephrops* trawlers (>30% landings weight)

Year	All Vessels		Vessels >18 m	
	kW days ('000)	Landings Tonnes	kW days ('000)	Landings Tonnes
1995	222.0	380	80.7	121
1996	178.6	355	55.6	86
1997	161.0	306	53.9	101
1998	329.6	498	144.6	189
1999	182.9	236	42.3	47
2000	142.0	217	56.2	86
2001	193.3	397	89.1	139
2002	506.7	883	323.7	446
2003	555.9	693	318.8	364
2004	488.1	558	303.0	311
2005	405.0	471	220.6	219
2006	424.2	478	208.8	186
2007	558.8	713	287.4	262
2008	534.1	643	288.1	319
2009	472.0	613	224.5	243
2010	382.2	494	103.7	114
2011	337.3	449	142.9	167
2012	355.5	541	91.9	126
2013	336.1	571	88.6	133
2014	213.6	332	52.1	74
2015	244.6	393	85.5	118
2016	287.3	558	111.2	233
2017	118.2	425	111.4	179
2018	71.6	107.1	24.1	29.9
2019	91.4	145.9	31.6	37.5

Year	All Vessels		Vessels >18 m	
	kW days ('000)	Landings Tonnes	kW days ('000)	Landings Tonnes
2020	72.3	133.4	12.7	19.1
2021	125	261	29	47

Table 19.2.3. *Nephrops* in FU19 (SW and SE Ireland). Irish Sampling levels.

Year	Quarter	Number of samples			Numbers Measured		
		Catch	Discards	Landings	Catch	Discards	Landings
2008	1	3	0	0	1502	0	0
2008	2	6	0	0	3521	0	0
2008	3	6	0	0	6412	0	0
2008	4	3	0	0	876	0	0
2009	1	3	0	0	1347	0	0
2009	2	6	0	0	3369	0	0
2009	3	2	0	0	1003	0	0
2009	4	5	0	0	1882	0	0
2010	1	2	0	0	840	0	0
2010	2	7	0	0	2989	0	0
2010	3	4	0	0	1457	0	0
2010	4	6	0	0	2376	0	0
2011	1	3	0	0	1493	0	0
2011	2	5	0	0	2747	0	0
2011	3	2	0	0	938	0	0
2011	4	5	0	0	2686	0	0
2012	1	6	0	0	2053	0	0
2012	2	7	0	0	3956	0	0
2012	3	4	0	0	1980	0	0
2012	4	4	0	0	1969	0	0

Year	Quarter	Number of samples			Numbers Measured		
		Catch	Discards	Landings	Catch	Discards	Landings
2013	1	3	0	0	1857	0	0
2013	2	8	5	0	4117	2059	0
2013	2	3	3	0	1177	1250	0
2013	4	3	3	0	1472	1276	0
2014	1	3	2	0	1137	941	0
2014	2	7	7	0	3331	2319	0
2014	3	3	2	0	1344	682	0
2014	4	10	8	0	3455	2200	0
2015	1	1	1	0	417	310	0
2015	2	3	3	0	1417	1267	0
2015	3	2	2	1	856	648	321
2015	4	3	2	0	1250	774	0
2016	1	3	3	0	1500	1631	0
2016	2	6	5	0	2310	1760	0
2016	3	9	7	0	3328	2448	0
2016	4	5	5	0	1,923	1521	0

Table 19.2.3. Continued.

Year	Quarter	Number of samples			Numbers Measured		
		Catch	Discards	Landings	Catch	Discards	Landings
2017	1	4	4	0	1860	1283	0
2017	2	3	3	0	1572	1281	0
2017	3	2	2	0	998	943	0
2017	4	4	2	0	1200	785	0
2018	1	1	1	0	304	380	0
2018	2	7	7	0	3579	3230	0
2018	3	1	1	0	255	275	0
2018	4	1	1	0	370	404	0
2019	1	4	5	0	1630	2222	0

Year	Quarter	Number of samples			Numbers Measured		
		Catch	Discards	Landings	Catch	Discards	Landings
2019	2	3	3	0	1275	1398	0
2019	3	0	0	0	0	0	0
2019	4	4	4	0	1810	1798	0
2020	1	2	2	0	728	702	0
2020	2	7	7	0	3095	2855	0
2020	3	1	1	0	489	404	0
2020	4	3	4	0	1671	1900	0
2021	1	2	2	0	842	782	0
2021	2	5	5	0	2530	2484	0
2021	3	3	3	0	1497	1326	0
2021	4	4	4	0	2363	2415	0

Table 19.2.4. *Nephrops* in FU19 (SW and SE Ireland). Landings and estimated discards by weight.

	Female		Male		Both sexes
Year	**Landings (t)**	**Discards (t)**	**Landings (t)**	**Discards (t)**	**% Discard**
2008	99	29	691	69	11.0
2009	117	106	681	141	23.7
2010	138	98	522	148	27.2
2011	169	155	450	250	38.9
2012	190	202	647	265	35.8
2013	259	210	525	220	35.4
2014	106	71	353	87	25.6
2015	79	64	423	101	24.8
2016	154	91	429	100	24.7
2017	133	58	280	79	24.9
2018	71	27	157	40	22.9
2019	66	48	181	63	31.1
2020	40	46	207	89	35.3
2021	83	63	331	109	29.4

Table 19.2.5. *Nephrops* in FU19 (SW and SE Ireland). Landings and estimated discards by number.

	FEMALE NUMBERS '000S		MALE NUMBERS '000S		BOTH SEXES
Year	Landings	Discards	Landings	Discards	% Discard
2008	3,893	1,781	19,516	3,255	17.7
2009	5,819	8,250	20,324	8,793	39.5
2010	6,276	8,147	16,001	10,117	45.1
2011	7,295	12,895	16,900	18,192	55.7
2012	9,266	17,635	22,540	19,108	53.6
2013	11,680	18,945	17,399	17,034	55.3
2014	4,862	5,647	11,183	5,572	41.1
2015	3,706	5,255	13,111	6,462	41.1
2016	6,877	6,761	12,610	6,668	40.8
2017	5,295	4,400	9,022	5,044	39.7
2018	2,908	1,866	5,197	2,454	34.8
2019	2,970	3,909	6,023	4,474	48.2
2020	2,006	3,971	7,595	6,026	51.0
2021	3,701	5,133	10,817	7,481	46.5

Table 19.2.6. *Nephrops* in FU19 (SW and SE Ireland). Area (Km²) of discrete patches and percentage contribution to overall area.

Ground	Area (Km²)	% Contribution
Bantry	121.5	6%
Cork Channels	562.0	28%
Galley Grounds 1	60.9	3%
Galley Grounds 2	76.7	4%
Galley Grounds 3	133.9	7%
Galley Grounds 4	925.1	47%
Helvick 1	33.1	2%
Helvick 2	59.5	3%
Total	1972.8	

Table 19.2.7. *Nephrops* in FU19 (SW and SE Ireland). Detailed summary statistics for the various *Nephrops* patches in FU19 over the time-series. (N = number of stations, Mean Density (burrow/m^2) is adjusted for the bias correction factor in Table 3, sd, se and ci are the standard deviation, standard error and 95% confidence intervals on the mean density).

Year	Ground	N	Mean Density	sd	se	ci
2006	Galley Grounds 4	6	0.21	0.18	0.08	0.19
2011	Bantry	5	0.33	0.23	0.1	0.28
2011	Cork Channels	12	0.35	0.32	0.09	0.2
2011	Galley Grounds 1	3	0.52	0.41	0.24	1.02
2011	Galley Grounds 2	3	0.59	0.43	0.25	1.07
2011	Galley Grounds 3	4	0.58	0.22	0.11	0.35
2011	Helvick 1	3	0.6	0.01	0.01	0.04
2011	Helvick 2	5	0.12	0.21	0.09	0.26
2012	Bantry	1	0.2	NA	NA	NA
2012	Cork Channels	9	0.27	0.17	0.06	0.13
2012	Galley Grounds 2	4	0.59	0.12	0.06	0.19
2012	Galley Grounds 3	1	0.51	NA	NA	NA
2012	Galley Grounds 4	16	0.39	0.16	0.04	0.09
2012	Helvick 1	3	0.33	0.13	0.08	0.33
2012	Helvick 2	6	0.33	0.41	0.17	0.43
2013	Bantry	4	0.38	0.2	0.1	0.31
2013	Cork Channels	11	0.12	0.1	0.03	0.07
2013	Galley Grounds 1	2	0.23	0.18	0.13	1.59
2013	Galley Grounds 2	3	0.48	0.44	0.25	1.09
2013	Galley Grounds 3	4	0.59	0.24	0.12	0.38
2013	Galley Grounds 4	13	0.19	0.27	0.07	0.16
2013	Helvick 1	1	0.09	NA	NA	NA
2013	Helvick 2	2	0.06	0.05	0.04	0.48
2014	Bantry	4	0.25	0.05	0.03	0.09
2014	Cork Channels	10	0.1	0.06	0.02	0.04
2014	Galley Grounds 1	2	0.61	0.41	0.29	3.69
2014	Galley Grounds 2	2	0.82	0.14	0.1	1.23
2014	Galley Grounds 3	4	0.66	0.23	0.12	0.37

Year	Ground	N	Mean Density	sd	se	ci
2014	Galley Grounds 4	14	0.29	0.29	0.08	0.17
2014	Helvick 1	2	0.67	0.28	0.2	2.53
2014	Helvick 2	2	0.03	0.04	0.03	0.39
2015	Bantry	2	0.32	0.11	0.08	1.02
2015	Cork Channels	10	0.08	0.11	0.03	0.08
2015	Galley Grounds 1	2	0.32	0.46	0.32	4.12
2015	Galley Grounds 2	2	0.53	0.08	0.06	0.74
2015	Galley Grounds 3	4	0.40	0.14	0.07	0.23
2015	Galley Grounds 4	14	0.27	0.19	0.05	0.11
2015	Helvick 1	2	0.30	0.23	0.16	2.08
2015	Helvick 2	2	0.09	0.09	0.06	0.79
2015	Kenmare Bay	1	0.30	NA	NA	NA
2016	Bantry	4	0.20	0.07	0.04	0.12
2016	Cork Channels	10	0.21	0.11	0.03	0.08
2016	Galley Grounds 1	2	0.03	0.01	0.01	0.08
2016	Galley Grounds 2	2	0.53	0.12	0.09	1.11
2016	Galley Grounds 3	4	0.16	0.12	0.06	0.19
2016	Galley Grounds 4	14	0.17	0.20	0.05	0.12
2016	Helvick 1	2	0.38	0.08	0.06	0.70
2016	Helvick 2	2	0.07	0.09	0.06	0.81
2016	Kenmare Bay	2	0.24	0.15	0.11	1.33
2017	Bantry	3	0.29	0.15	0.09	0.37
2017	Cork Channels	10	0.25	0.20	0.06	0.14
2017	Galley Grounds 1	2	0.24	0.11	0.08	1.00
2017	Galley Grounds 2	2	0.63	0.06	0.04	0.55
2017	Galley Grounds 3	3	0.45	0.12	0.07	0.30
2017	Galley Grounds 4	15	0.16	0.16	0.04	0.09
2017	Helvick 1	2	0.46	0.07	0.05	0.66
2017	Helvick 2	2	0.16	0.23	0.16	2.03

Year	Ground	N	Mean Density	sd	se	ci
2017	Kenmare Bay	2	0.16	0.22	0.16	1.97
2018	Bantry	4	0.06	0.02	0.01	0.04
2018	Cork Channels	10	0.11	0.11	0.04	0.08
2018	Galley Grounds 1	2	0.06	0.01	0.01	0.10
2018	Galley Grounds 2	2	0.19	0.19	0.14	1.75
2018	Galley Grounds 3	4	0.11	0.09	0.05	0.14
2018	Galley Grounds 4	14	0.07	0.08	0.02	0.05
2018	Helvick 1	2	0.11	0.10	0.07	0.92
2018	Helvick 2	2	0.06	0.03	0.02	0.28
2018	Kenmare Bay	2	0.07	0.03	0.02	0.25
2019	Bantry	4	0.13	0.04	0.02	0.06
2019	Cork Channels	10	0.16	0.17	0.06	0.13
2019	Galley Grounds 1	2	0.12	0.17	0.12	1.57
2019	Galley Grounds 2	2	0.66	0.38	0.27	3.40
2019	Galley Grounds 3	4	0.21	0.14	0.07	0.23
2019	Galley Grounds 4	14	0.18	0.23	0.06	0.13
2019	Helvick 1	2	0.34	0.27	0.19	2.46
2019	Helvick 2	2	0.00	0.00	0.00	0.00
2019	Kenmare Bay	2	0.27	0.10	0.07	0.88
2020	Bantry	0.31	0.11	0.05	0.17	0.31
2020	Cork Channels	0.13	0.20	0.06	0.14	0.13
2020	Galley Grounds 1	0.13	0.10	0.07	0.87	0.13
2020	Galley Grounds 2	0.43	0.24	0.17	2.14	0.43
2020	Galley Grounds 3	0.20	0.15	0.08	0.24	0.20
2020	Galley Grounds 4	0.10	0.10	0.03	0.06	0.10
2020	Helvick 1	0.24	0.05	0.04	0.48	0.24
2020	Helvick 2	0.06	0.08	0.06	0.73	0.06
2020	Kenmare Bay	0.18	0.12	0.09	1.11	0.18
2021	Bantry	4	0.09	0.03	0.01	0.04

Table 19.2.7. Continued.

Year	Ground	N	Mean Density	sd	se	ci
2021	Cork Channels	10	0.20	0.19	0.06	0.14
2021	Galley Grounds 1	2	0.08	0.06	0.04	0.54
2021	Galley Grounds 2	2	0.31	0.10	0.07	0.87
2021	Galley Grounds 3	4	0.22	0.13	0.06	0.20
2021	Galley Grounds 4	14	0.09	0.07	0.02	0.04
2021	Helvick 1	2	0.09	0.08	0.05	0.69
2021	Helvick 2	2	0.08	0.05	0.04	0.48
2021	Kenmare Bay	2	0.05	0.03	0.02	0.30
2022	Bantry	4	0.08	0.06	0.03	0.10
2022	Cork Channels	10	0.10	0.13	0.04	0.09
2022	Galley Grounds 1	2	0.06	0.01	0.01	0.13
2022	Galley Grounds 2	2	0.39	0.26	0.19	2.35
2022	Galley Grounds 3	4	0.17	0.05	0.03	0.08
2022	Galley Grounds 4	14	0.15	0.11	0.03	0.07
2022	Helvick 1	2	0.14	0.00	0.00	0.02
2022	Helvick 2	2	0.08	0.08	0.06	0.74
2022	Kenmare Bay	2	0.04	0.05	0.04	0.46

Table 19.2.7. *Nephrops* in FU19 (SW and SE Ireland). Summary statistics for FU19 combined over the time-series.

Year	Number of stations	Mean Density adjusted (burrow /m²)	Standard Deviation	Raised abundance estimate adjusted (million burrows)	Upper 95%CI on Abundance	Lower 95%CI on Abundance	CVs (%)
2006	6	0.21	0.18	408	789	26	36
2007*							
2008*							
2009*							
2010*							
2011	35	0.34	0.26	665	836	494	13
2012	40	0.3	0.18	594	705	484	9
2013	40	0.25	0.26	487	648	326	17
2014	40	0.32	0.31	636	823	448	15
2015	39	0.24	0.2	482	608	356	13
2016	42	0.2	0.17	399	498	299	13
2017	41	0.25	0.20	499	619	379	12
2018	42	0.09	0.09	176	229	124	15
2019	42	0.20	0.21	386	514	259	17
2020	42	0.16	0.16	320	412	227	15
2021	42	0.14	0.13	270	347	193	15
2022	42	0.13	0.12	259	332	185	14

***No TV survey from 2007 to 2010.**

Table 19.3.1. *Nephrops* in FU19 (SW and SE Ireland). Forecast inputs (bold) and historical estimates of mean weight in landings and harvest rate (landings + dead discards)/(abundance estimate), discard rate (discards divided by landings + discards) and dead discard rate as dead discards divided by removals (landings + dead discards). * 2019 revision due to code error.

Year	Landings in number	Total discards* in number	Removals in number	Discard Rate number	Dead discard rate number	UWTV abundance estimate	95% Conf. intervals	Harvest rate	Landings	Total discards*	Mean weight in landings	Mean weight in discards
	millions	**millions**	**millions**	**%**	**%**	**millions**	**millions**	**%**	**tonnes**	**tonnes**	**grammes**	**grammes**
2006	26.2	2.6	28.1	8.9	6.8	na	na	na	741	37	28.3	14.4
2007	30.8	1.5	31.9	4.8	3.6	na	na	na	957	26	31.1	17
2008	25.2	5.4	29.3	17.7	13.9	na	na	na	851	105	33.7	19.4
2009	28.4	18.5	42.3	39.5	32.8	na	na	na	868	269	30.5	14.5
2010	23.2	19.0	37.4	45.1	38.1	na	na	na	687	257	29.6	13.5
2011	25.8	32.4	50.1	55.7	48.5	665	171	7.5	643	409	24.9	12.6
2012	32.3	37.3	60.2	53.6	46.4	594	111	10.1	849	473	26.3	12.7
2013	29.5	36.5	56.8	55.3	48.1	487	161	11.7	794	436	26.9	11.9
2014	16.3	11.4	24.9	41.1	34.4	636	188	3.9	468	161	28.6	14.1
2015	17.0	11.8	25.9	41.1	34.3	482	126	5.5	507	167	29.8	13.8
2016	19.7	13.6	29.9	40.8	34.1	399	99	7.5	590	193	29.9	14.2
2017	14.6	9.6	21.8	39.7	33.1	499	120	4.4	420	139	28.8	14.5
2018	8.4	4.5	11.8	34.8	28.6	176	53	6.7	238	71	28.2	15.7
2019*	9.1	8.5	15.4	**48.2**	**41.1**	386	127	4.0	249	112	**27.4**	**13.3**
2020	9.7	10.1	17.2	**51**	**43.9**	320	93	5.4	249	136	**25.8**	**13.5**
2021	14.6	12.7	24.1	**46.5**	**39.4**	270	77	8.9	415	173	**28.5**	**13.6**
2022						**259**	**73**					
Average 2019–2021				**48.6**	**41.5**						**27.2**	**13.5**

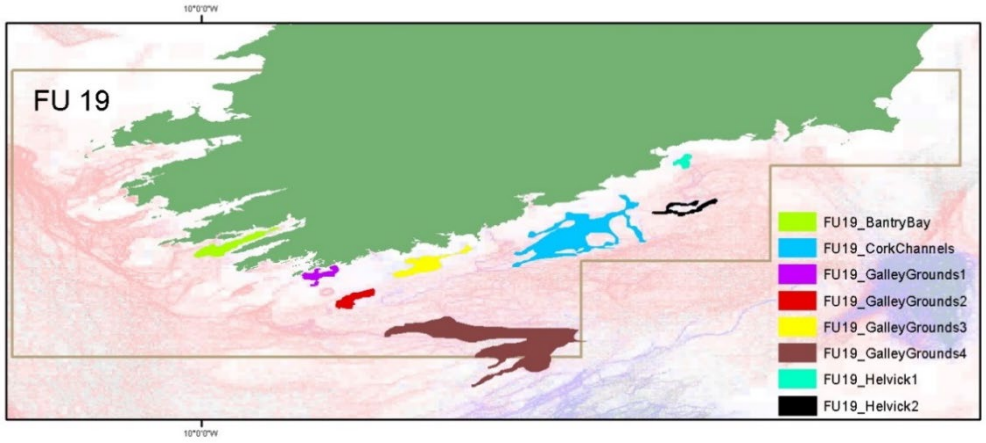

Figure 19.1.1. *Nephrops* in FU19 (Ireland SW and SE Coast). Revised discrete patches overlaid on overlaid on proportion of *Nephrops* in the Irish landings overlaid on international OTB effort (red=0% *Nephrops*; blue=50–60% *Nephrops*; grey=unknown (no Irish landings).

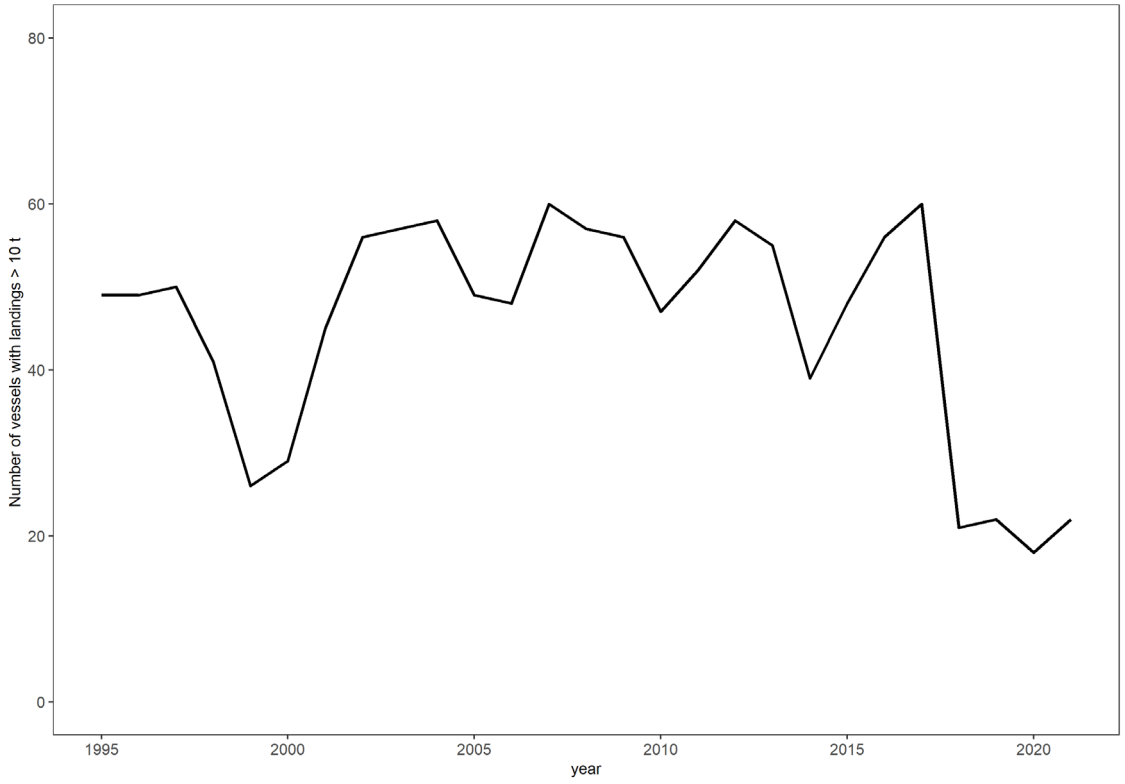

Figure 19.1.2. *Nephrops* in FU19 (Ireland SW and SE Coast). Time-series of the number of Irish vessels reporting landings of *Nephrops* from FU19 with a >10 t threshold.

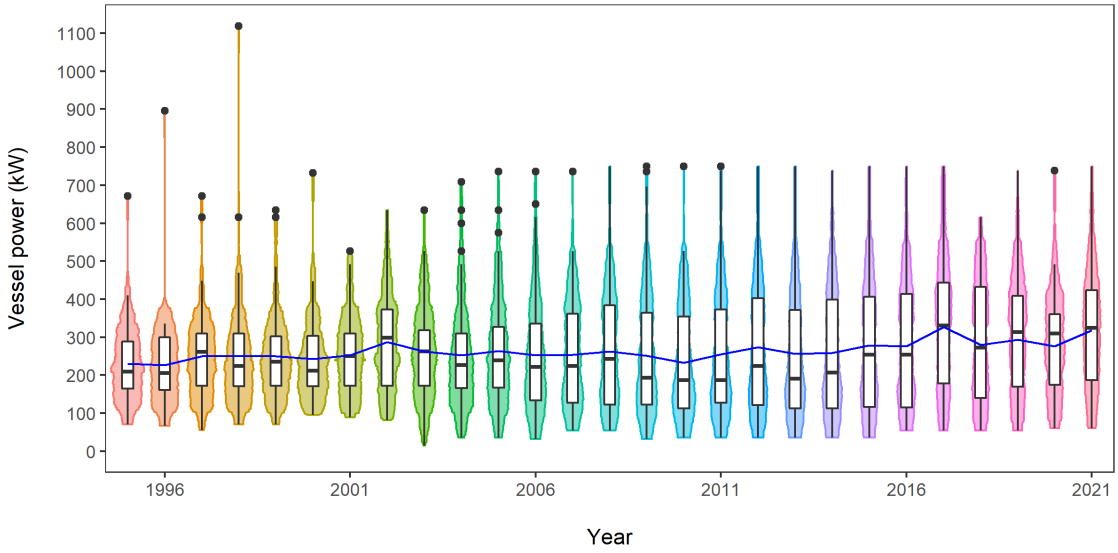

Figure 19.1.3. *Nephrops* in FU19 (Ireland SW and SE Coast). Combined box and kite plot of vessel power by year. The blue line indicates the mean.

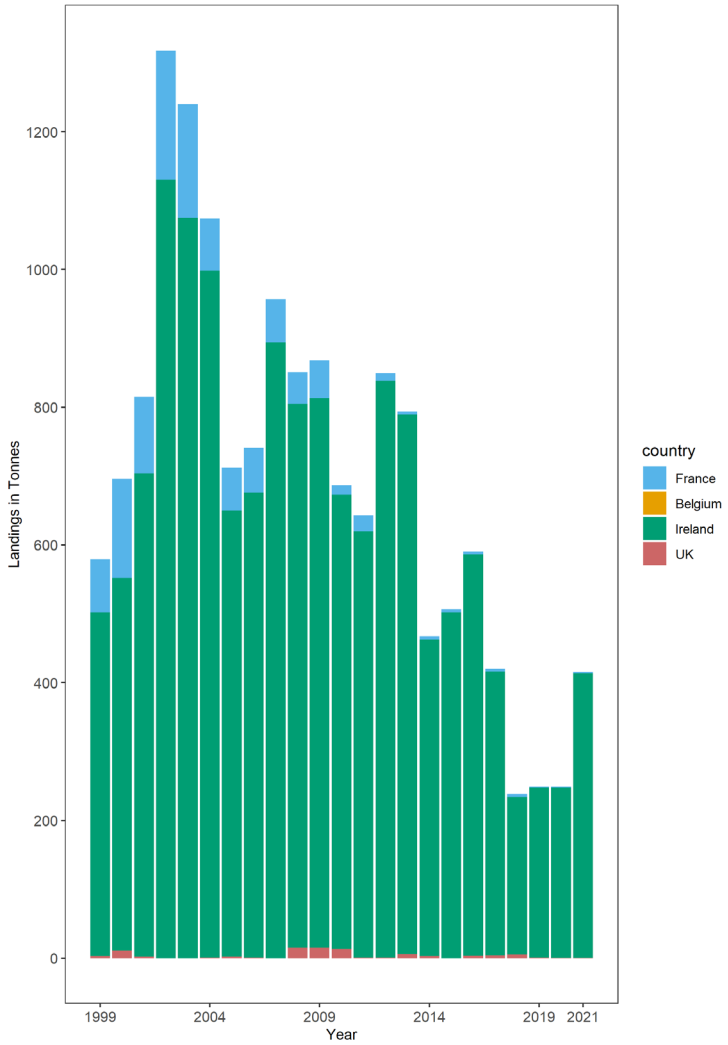

Figure 19.2.1. *Nephrops* in FU19 (Ireland SW and SE Coast). Landings in tonnes by country.

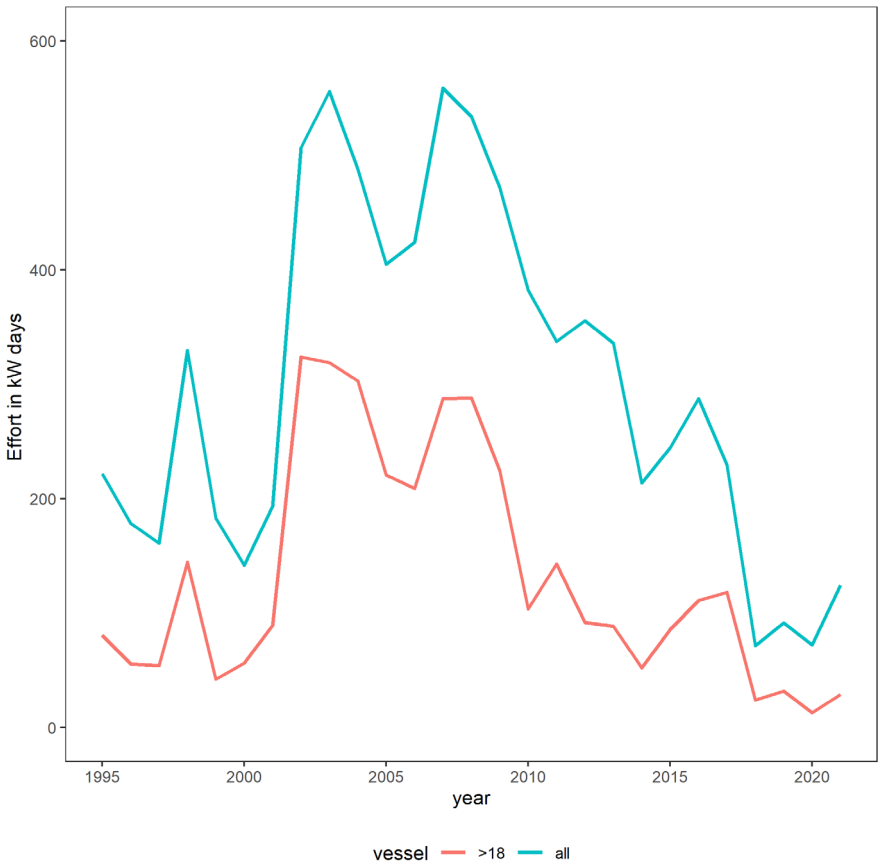

Figure 19.2.2. *Nephrops* in FU19 (Ireland SW and SE Coast). Trawl effort for Irish OTB vessels where >30% of landed weight was *Nephrops.*

Figure 19.2.3. *Nephrops* in FU19 (Ireland SW and SE Coast). Sampling levels for FU19.

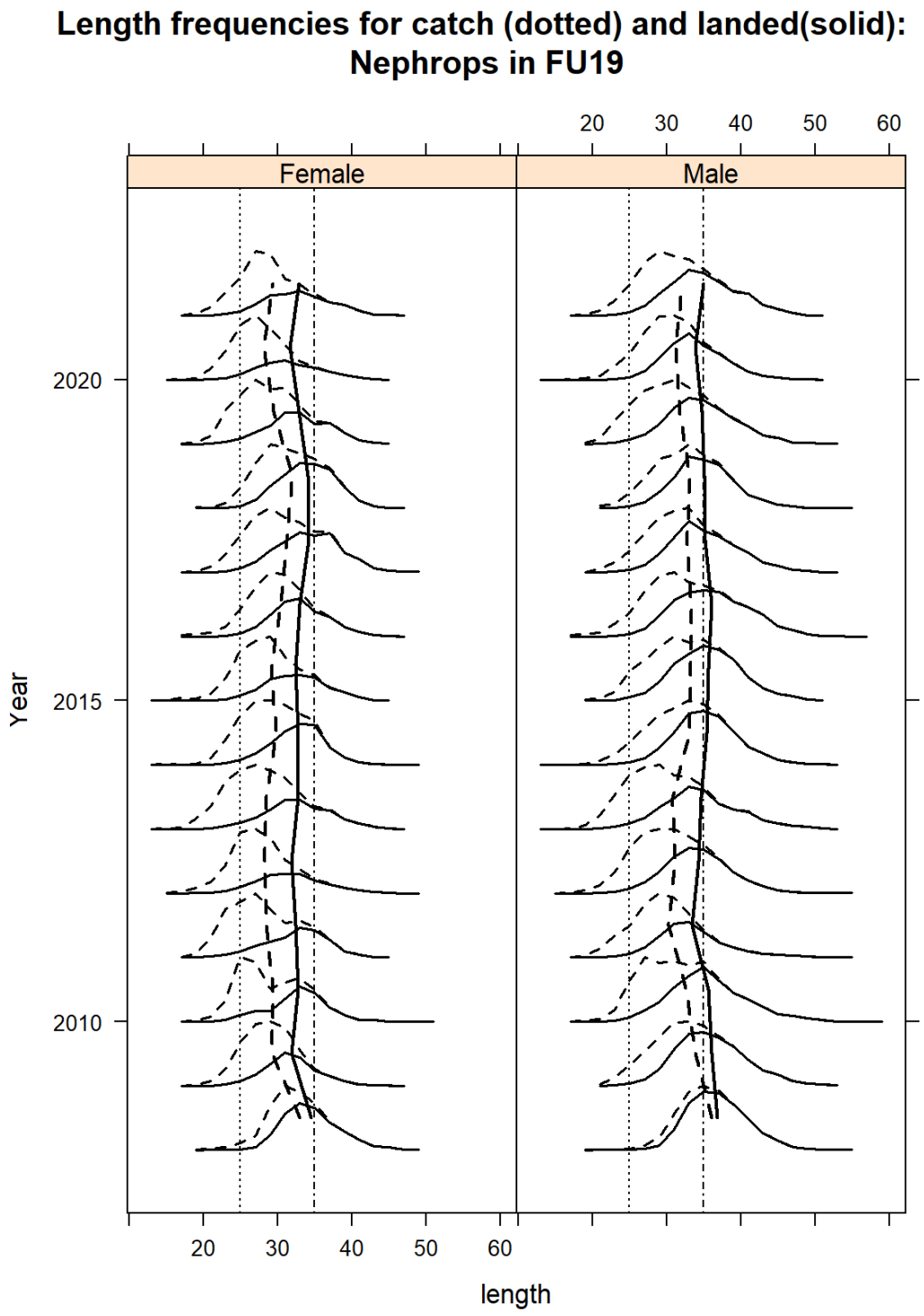

Figure 19.2.4. *Nephrops* in FU19 (Ireland SW and SE Coast). Mean size trends for catches (dotted) and whole landings (solid) by sex 2002–2021. Vertical lines displayed are Minimum Conservation Reference Size 25 mm Carapace Length (CL) and 35 mm CL.

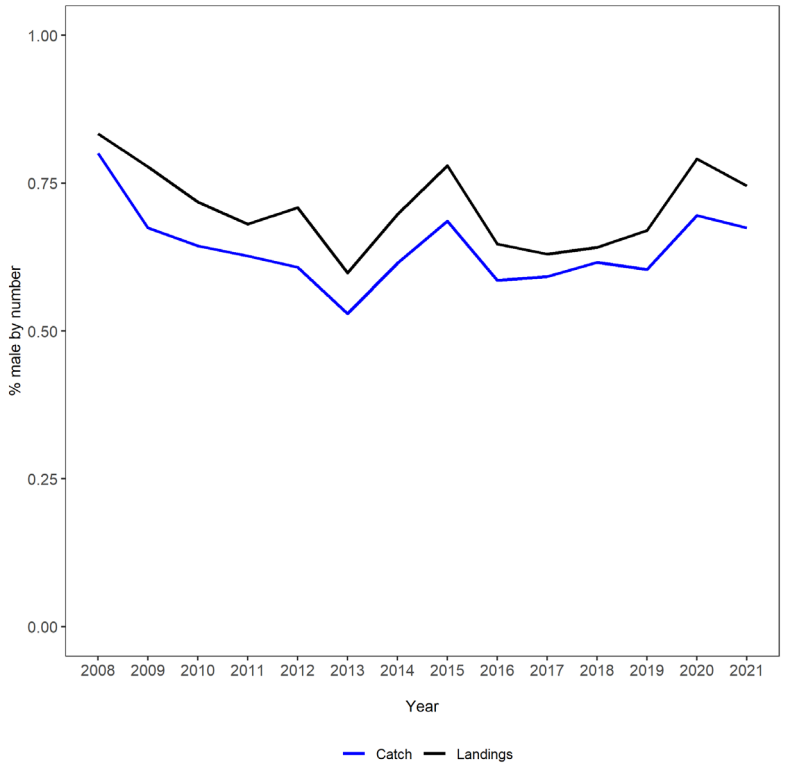

Figure 19.2.5. *Nephrops* in FU19 (Ireland SW and SE Coast). Annual sex ratio of landings (2008–2020) and catch (2008–2021).

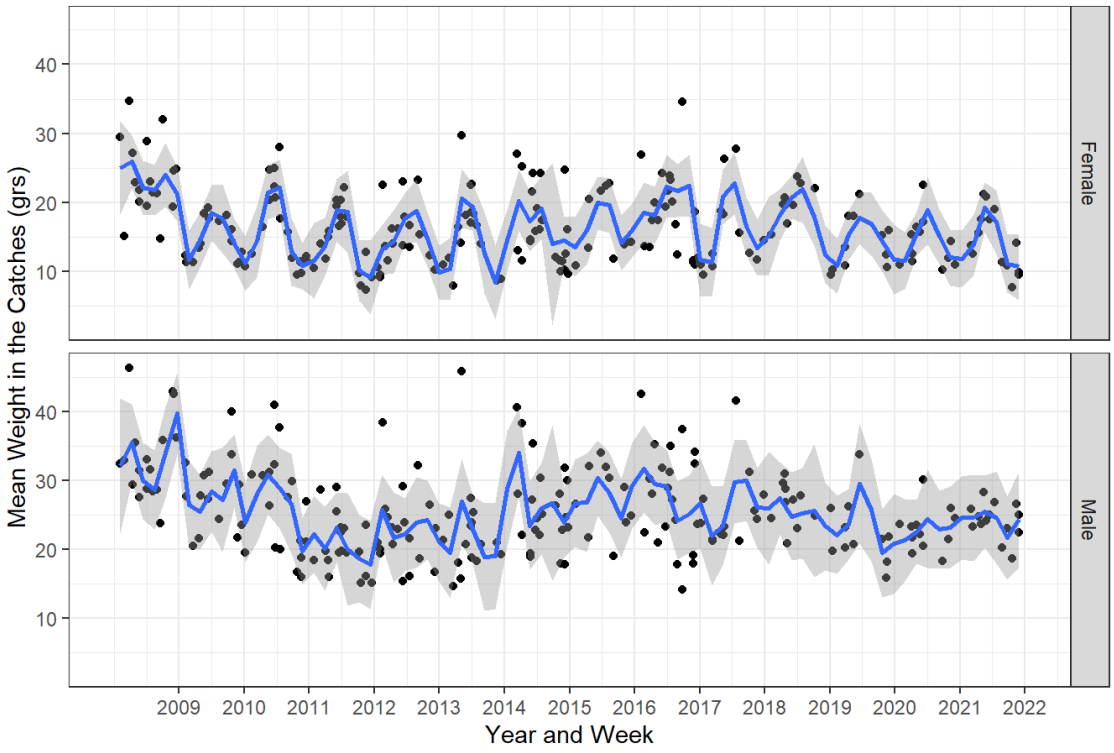

Figure 19.2.6. *Nephrops* in FU19 (Ireland SW and SE Coast). Mean weight in catch data for all grounds in FU19 by sex with loess smoother and showing cyclical trends.

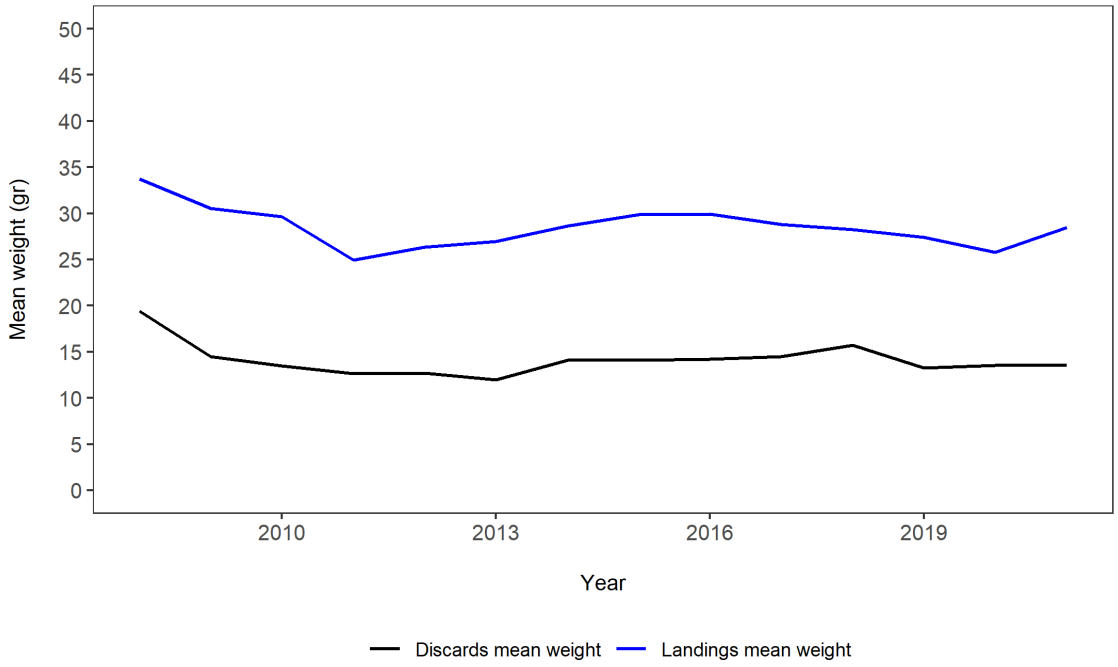

Figure 19.2.7. *Nephrops* in FU19 (Ireland SW and SE Coast). Annual estimated mean weights (gr) in the landings and discards.

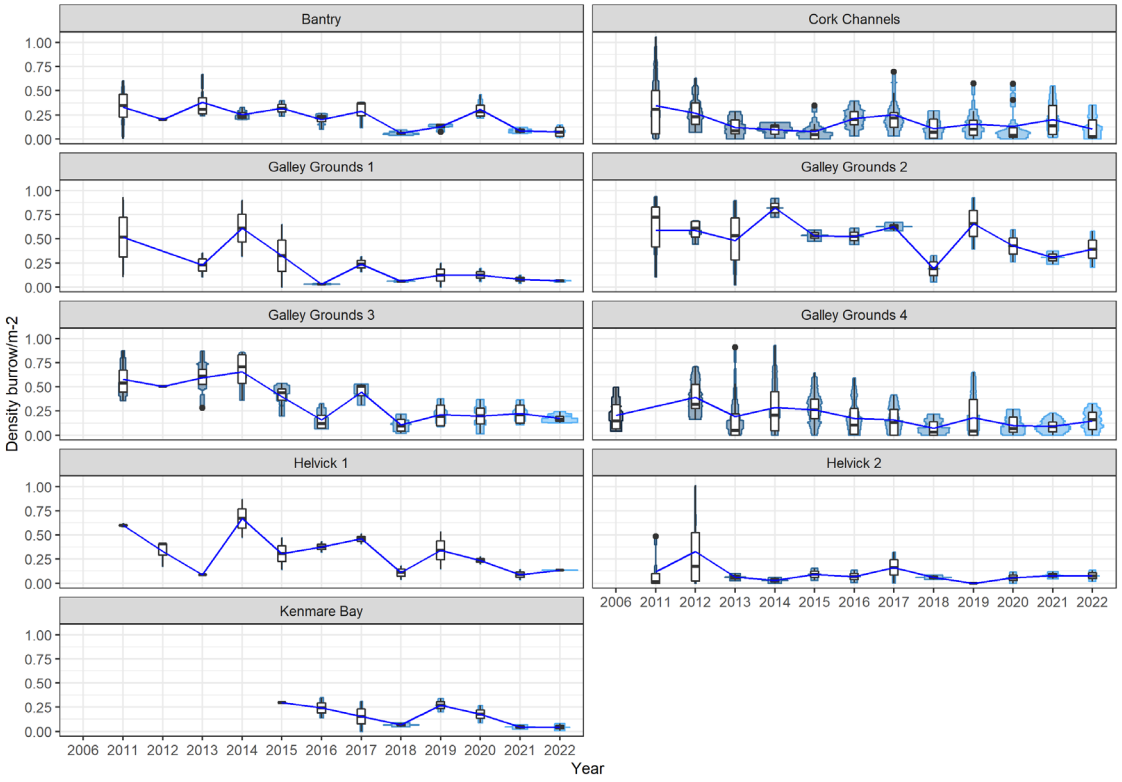

Figure 19.2.8. *Nephrops* in FU19 (Ireland SW and SE Coast). Violin and box plot a of adjusted burrow density (burrow/m²) distributions by year from 2006–2022. The blue line indicates the mean density over time. The horizontal black line represents the median, white box is the interquartile range, the black vertical line is the range and the black dots are outliers. No estimate available for Galley Ground 4 in 2011, Galley Ground 1 in 2012. No TV survey from 2007 to 2010.

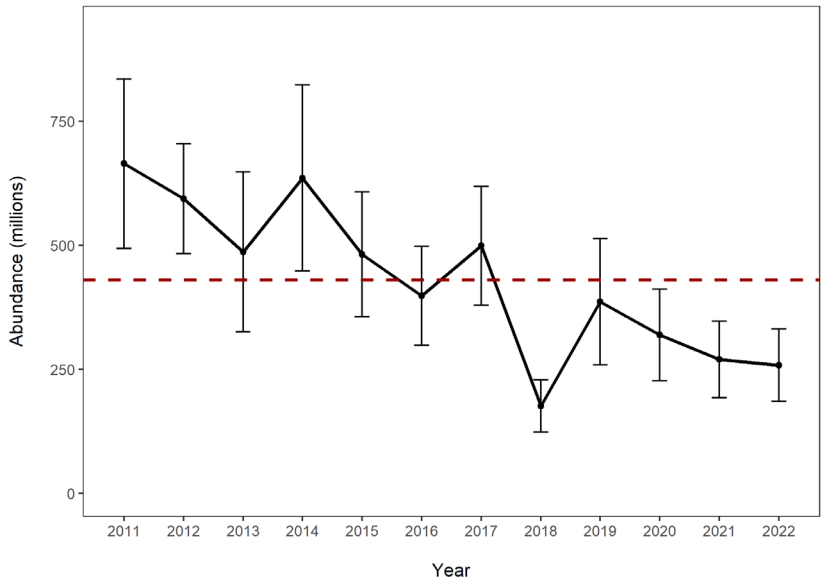

Figure 19.2.9. *Nephrops* in FU19 (Ireland SW and SE Coast). Time-series of total abundance estimates for FU19 (error bars indicate 95% confidence intervals) and $B_{trigger}$ is dashed line.

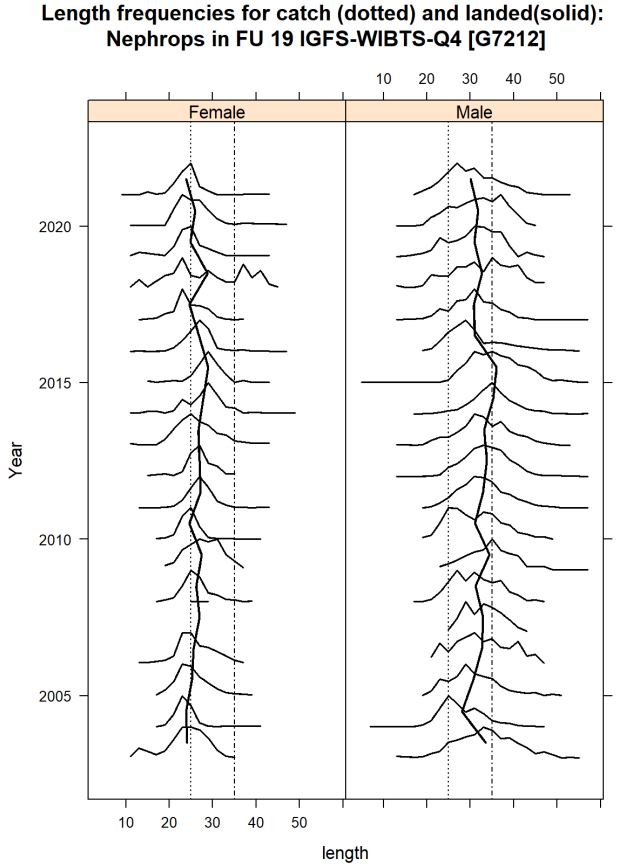

Figure 19.2.10. *Nephrops* in FU19 (Ireland SW and SE Coast). Mean size trends for catches by sex from IGFS- WIBTS-Q4 [G7212] Irish survey 2003–2021. Vertical lines displayed are Minimum Conservation Reference Size 25 mm Carapace Length (CL) and 35 mm CL.

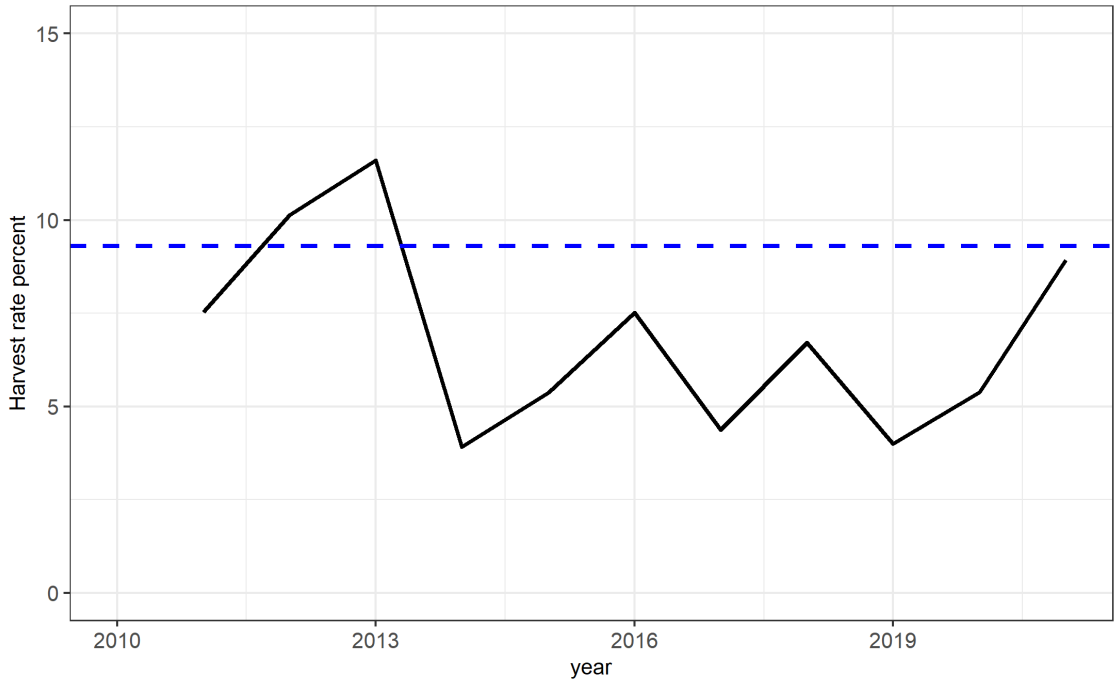

Figure 19.3.1. *Nephrops* in FU19 (Ireland SW and SE Coast). Harvest Rate (% dead removed/UWTV abundance). The dashed and solid lines are the MSY proxy and the harvest rate respectively.