Contents

12 Norway lobster (*Nephrops norvegicus*) in Division 6.a, Functional Unit 11 (West of Scotland, North Minch)

Nephrops stocks have previously been identified by WGNEPH on the basis of population distribution, and defined as separate Functional Units. The Functional Units (FU) in ICES Division 6.a (of which there are three) are defined by the groupings of ICES statistical rectangles given in Table 12.1 and illustrated in Figure 12.1. The functional unit is the level at which the WG collates fishery data (quantities landed and discarded, fishing effort and length distributions) and at which it performs assessments.

Type of assessment in 2022

The assessment of North Minch *Nephrops* in 2022 is based on a combination of examining trends in fishery indicators and abundance estimated by underwater TV survey, both of which comprise an extensive data series for this FU. The assessment follows the process defined by the benchmark WG (WKNEPH 2009 and WKNEPH 2013) and is conducted annually according to standards set out by the Manual for the Nephrops Underwater TV Surveys (Dobby H., et al, 2021). Further details on the assessment and catch options are provided 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 3075 tonnes and 3953 tonnes. The entire range is considered precautionary when applying the ICES advice rule.

To ensure that the stock in Functional Unit 11 is exploited sustainably, management should be implemented at the functional unit level.'

ICES advice applicable to 2022

'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 2018 – 2020, catches in 2022 should be no more than 3853 tonnes.

To ensure that the stock in Functional Unit 11 is exploited sustainably, management should be implemented at the functional unit level.

ICES notes the existence of a management plan, developed and adopted by one of the relevant management authorities for Subarea 6. ICES considers this plan to be precautionary when implemented at the FU level.'

12.1 General

Nominal landings as reported to ICES for divisions 6.a and 6.b are presented in Table 12.1.1. Total official landings from Division 6.a were 9764.4 tonnes in 2021, mostly reported by the UK

with only 42 tonnes reported from Ireland. Table 12.1.2 and Figure 12.1.1 shows WG estimates of landings in Division 6.a broken down by FU. *Nephrops* landings are also made from outside the functional units, from statistical rectangles where small pockets of suitable sediment exist, although these are generally small amounts. In 2021, 237 tonnes of landings were reported from outside the FUs which is lower than the long-term average (Table 12.1.2). The main areas of activity outside FUs are the Stanton Bank (to the west of the South Minch) and areas of suitable sediment along the shelf edge and slope to the west of the Hebrides. There are no functional units in Division 6.b and only very small quantities of *Nephrops* are landed (Table 12.1.1(b)).

Stock description and management units

The North Minch (FU 11) is located at the northern end of the west coast of Scotland (Figure 12.1). Owing to its burrowing behaviour, the distribution of *Nephrops* is restricted to areas of mud, sandy mud and muddy sand. Within the North Minch functional unit these substrates are distributed according to prevailing hydrographic and bathymetric conditions. The area is characterised by numerous islands of varying size and sea lochs, which occur along the mainland coast. These topographical features create a diverse habitat with complex hydrography and a patchy distribution of soft sediments. Results from work on mapping the spatial extent of *Nephrops* habitat in the North Minch sea lochs indicate that the muddy habitat in these areas is only a very small proportion of the total *Nephrops* grounds in the North Minch (WKNEPH 2013).

Management applicable to 2021 and 2022

The management unit is Subarea 6 and EU and international waters of 5.b. The TAC for this area is 12 065 tonnes in 2022, down from 15 294 tonnes in 2021.

Since 2016, fisheries catching *Nephrops* in Division 6.a have been covered by the EU landing obligation (EU, 2015a). Creel fisheries are exempt from the landing obligation due to high survivability of discards. Dermersal trawlers using a codend between 80mm–110mm and within 12 miles of shore are also exempt from the landings obligation.

Ecosystem aspects

Details of the ecosystem aspects for this functional unit are provided in the stock annex if available.

Fishery description

Information on developments in the fishery was provided by Marine Scotland compliance officers.

In 2021, the fishery was generally described as fairly good. It was reported that COVID-19 did not have much impact on the local fishery, with market remaining stable for most of the year.

In recent years the fishery starts steadily, with a good yield in the summer fishery from May to August. The fishery then tails off in the Autumn. This is said to be a seasonal occurrence rather than being caused by bad weather. The majority of the Western Isles trawl fleet has tended to relocate to the east coast and to the fishing grounds in the Firth of Forth/Eyemouth/Shields for the winter months in recent years. Trawl activity in the winter months is generally at a relatively low level.

Activity in the *Nephrops* trawl sector was up in 2021 owing to the relaxation of COVID-19 pandemic rules. However, the creel sector remained fairly stable.

The largest part of the North Minch fleet is still based at Stornoway, numbering approximately 75 vessels in 2021. The majority of the Stornoway vessels (52) are below 10 m in length.

The fleet were targeting the same areas in the North Minch as previous years. The notable changes were that the trawl fleet stayed in the West coast when in previous years they would go to the East coast from September onward. The trawl fleet also lost most of their summer fishing due to the COVID-19 pandemic.

Very few vessels came from outside to fish in the area and activity in the area overall has been reduced in 2021.

Since 2009, vessels have been required to fit 120 mm square meshed panels, in accordance with the west coast emergency measures (Council Reg. (EU) 43/2009). Large SMPs (200 mm) are also widely used in the North Minch and have been mandatory for all TR2 vessels with power >112 kW fishing under the Scottish Conservation Credits scheme.

Further general information on the fishery can be found in the stock annex.

12.2 Data available

InterCatch

Data for 2021 were successfully uploaded into InterCatch prior to the 2022 WG meeting. Uploaded data were worked up in InterCatch to generate 2021 raised international length–frequency distributions. Allocation schemes for any unsampled fleets are described in the stock annex. Data exploration in InterCatch has previously shown that outputs of raised data were very close to those generated by the previous method applied internally with differences being <0.1%. As such, InterCatch length–frequency outputs have been used in the stock assessment since 2012.

The COVID-19 pandemic resulted in a reduced sampling effort of commercial catches for FU11 in 2021, as was also the case in 2020. Discard sample data for FU11 were only available for Quarter three and four, and so, InterCatch estimates of discard rates for Quarters one and two in InterCatch were based on samples collected in Quarter three and four. Following download of data from InterCatch, alternate methods of 2021 discard estimation were thus considered. It was agreed at WGCSE that estimates of discard rates and associated size distributions for 2021 would be based on an averaging of discard samples across all quarters for which data are available between 2017 and 2021. Minimum and maximum discard rates over the same period were also examined to gain an appreciation of the plausible range of discarding that might have occur in 2021. Assessment estimates affected by changes in discard rates are annotated hereafter to reflect this; i.e. "x (y/z)", where x is the estimate based on the average discard rate between 2017 and 2021, y is based on minimum discard rate, and z on maximum discard rate over the same period.

Commercial catch

Official catch statistics (landings) reported to ICES are shown in Tables 12.1.1(a) and 12.1.1(b); these relate to the whole of 6.a of which the North Minch is a part. Landings by gear category for FU11 provided by country have been reported since 1981 and are presented in Table 12.2.1. Landings from this fishery are usually only reported from Scotland; between 2012 and 2014 two tonnes of *Nephrops* landings were reported by Ireland and values between one and three tonnes have been reported since 2017. Total reported Scottish landings in 2021 were 2073.1 tonnes, consisting of 1547 tonnes landed by trawlers targeting *Nephrops* (~75%), 472 tonnes landed by creel

vessels (~23%) and 53 tonnes by other trawlers. In 2021, a small amount of *Nephrops* below minimum size (BMS) was also reported (1.1 tonnes).

Effort data

In 2015, WGCSE agreed that effort should be reported in kW days as this is likely to be more informative about changes in the actual fleet effort. Reported effort by Scottish trawlers targeting *Nephrops* (Métiers: OTB_CRU – Bottom Otter Trawls Targeting Crustaceans and OTT_CRU – Multirig Otter Trawls Targeting Crustaceans) has shown a decreasing trend since 2000 (Figure 12.2.1) but in 2012 the effort increased by 20% due to the influx of vessels from the North Sea during the first quarter of the year. Since then, effort has declined although there was a small increase in 2016. The decline in effort observed in recent years continued until 2020. The observed increase in effort for 2021 may be attributed to the relaxation of the COVID-19 pandemic rules. Note that the year range in effort time-series (2000–2021) does not match the more extensive year range available for landings, due to a lack of confidence in the reliability of older effort data in the Marine Scotland Science database. The effort is also slightly inconsistent with the landings data because effort is provided for TR2 vessels only, while the '*Nephrops* trawl' landings also includes landings by large mesh trawlers targeting *Nephrops*.

Sampling levels

Length compositions of landings and discards are obtained during market and on-board observer sampling respectively. These sampling levels are shown in Table 12.2.2. Owing to the relaxation of COVID-19 pandemic rules, which disrupted both the fishing industry and government sampling programmes, sampling effort in 2021 was slightly higher compared to 2020, although still lower than recent years. Length compositions for the creel fishery are available for landings only as the small numbers of discards survive well and are not considered to be removed from the population.

Length compositions

Figure 12.2.2 shows a series of annual length–frequency distributions for the period 2000 to 2021. Catch (removals) length compositions are shown for each sex along with the mean length for both. In both sexes the mean sizes fluctuate over time and has generally remained stable since 2012. This parameter might be expected to reduce in size if overexploitation were taking place. In 2021, the mean size of males increased while that of the female slight decreased when compared to 2020. s.

Sex ratio

Males consistently make the largest contribution to the landings, although the proportion of males does vary between years (Figure 12.2.3(a)). This is likely due to the varying seasonal pattern in the fishery and associated relative catchability (due to different burrow emergence behaviour) of male and female *Nephrops.* Males are available throughout the year and the fishery is prosecuted in all quarters (although effort is usually reduced during the winter months when the weather is poor). Females are mainly taken in the summer when they emerge after egg hatching. The seasonal change in proportion of males to females is evident in Figure 12.2.3(b). In 2021 the normal temporal trend in sex ratios was observed where males dominate in quarters one and four but the ratio is more even (or often female dominated) in quarters two and three.

Mean weights

The mean weight in the landings (trawls and creels combined) shows substantial interannual variation (Figure 12.2.4 and Table 12.2.3) decreasing between 2010 and 2012, followed by an increase in 2013–2015 and a decrease again in 2016 and stable in 2017 followed by an increasing trend onward. Given the relatively larger size of creel caught *Nephrops* (compared to trawl) the proportion of creel landings has a substantial effect on overall size composition. The increases in mean weight to 2010 and 2020 (and also size, Figure 12.2.2) in particular were due to a higher proportion of creel landings. Figure 12.2.5 shows the mean weight by sample and gear type over the period 2011–2021. There is no obvious trend in North Minch trawl-caught mean weights for males and females, however, a decrease in the mean weight of creel caught males is still obvious. The mean weight in the landings has a significant impact on the catch forecast. Due to the high interannual variability in mean weights it was considered more appropriate to use a full time-series average, from 1999 (first year with creel and trawl length distributions combined) until 2021 for producing the catch options.

Discarding

Discarding of undersized and unwanted *Nephrops* occurs in this fishery, and quarterly discard sampling has been conducted on the Scottish *Nephrops* trawler fleet since 1990. Discard rates fluctuate in this FU and averaged ~5.8% by number in the last three years (Table 12.2.4). In 2021, the discard r**a**te increased to 6.2% by number (from 5.7% in 2020).

It is likely that some *Nephrops* survive the discarding process. An estimate of 25% (Charuau *et al*., 1982; Sangster *et al*., 1997; Wileman *et al*., 1999) survival is assumed for this FU in order to calculate removals (landings + dead discards) from the population. The discard survival rate for creel caught *Nephrops* has been shown to be high (ICES, 2013) and a value of 100% is used. The discard rate (adjusted for survival) which will be used in the provision of landings options for 2023 is 5.8% based on a three-year average of 2019 – 2021.

Abundance indices from UWTV surveys

The Underwater TV surveys are available for this stock since 1994 (missing surveys in 1995 and 1997). The stock area for this FU was updated in 2013 to 2908 km^2 (see stock annex for further details). In 2022, due to the COVID-19 pandemic, the UWTV survey was carried out with a reduced scientific staffing, necessitating a reduced sampling schedule in some areas. UWTV survey in 2022 sampled 72% of the planned stations in relative to 2021(100% of planned stations). While unquantified, the 28% reduction in the number of sampled stations is considered to have minimal impact on the quality of the abundance estimate.

A total of 36 valid TV stations were used in the final survey analysis (Table 12.2.5). Table 12.2.6 shows the basic analysis for the most recent TV survey conducted in FU11. At the 2012 SGNEPS meeting (ICES, 2012) it was decided that a CV (relative standard error) of <20% was an acceptable precision level for UWTV survey estimates of abundance. The CV for the most recent TV survey was 13.2%, lower than the precision level agreed (Table 12.2.6).

Figure 12.2.6 shows the distribution of stations in recent TV surveys (2016–2022), with the size of the symbols reflecting the *Nephrops* burrow density. Table 12.2.5 and Figure 12.2.7 show the time-series estimated abundance for the TV surveys, with 95% confidence intervals on annual estimates.

The use of the UWTV surveys for *Nephrops* in the provision of advice was extensively reviewed by WKNEPH (ICES, 2009; ICES, 2013). A number of potential biases were highlighted including

those due to edge effects, species burrow misidentification and burrow occupancy. The cumulative relative to absolute conversion factor estimated for FU11 was 1.33 meaning that the TV survey is likely to overestimate *Nephrops* abundance by 33%.

12.3 Assessment

Comparison with previous assessments

The assessment follows the same procedure as last year and is based on a combination of examining trends in fishery indicators and underwater TV abundance estimates. Landings predictions are derived by applying a harvest rate to the UWTV survey estimate of abundance and assuming a length composition derived from recent fishery data (including data from both trawl and creel fisheries).

State of the stock

The assessment summary is provided in Table 12.2.4. The underwater TV survey is presented as the best available information on the North Minch *Nephrops* stock. The surveys provide a fishery-independent estimate of *Nephrops* abundance. At present, it is not possible to extract any length or age-structure information from the survey and therefore it only provides information on abundance over the area of the survey.

TV survey estimated stock abundance in 2022 was 1346 million individuals, a 3.2% decrease from the 2021 estimate. The stock is still well above the MSY $B_{trigger}$ value of 541 million, or the rounded value of 540 million individuals used in the provision of advice (Figure 12.2.7).

The calculated harvest rate in 2021 (dead removals/TV abundance = 4.6%) is below the F_{MSY} proxy for this stock (the value associated with high long-term yield and low risk depletion) of 10.8%.

12.4 Catch option table

Landings predictions and catch options at various harvest rates (based on principles established at WKNEPH (ICES, 2009)), including a selection of those equivalent to the per-recruit reference points, are made on the basis of the 2022 UWTV survey conducted in August (although normally in June). These were presented in September 2022 for the provision of advice.

The table below shows the agreed inputs to the catch options table.

Input	Data	2022 assessment
Survey abundance (millions)	UWTV 2022	1346
Mean weight in projected landings (g)	1999–2021	26.54
Mean weight in projected discards (g)	1999–2021	11.3
Dead projected discards	average 2019–2021	5.8%*
Discards survival rate	Proportion by number (assumed)	25%**
Dead discard rate	average 2019 - 2021	4.4%

Due to the high interannual variability in mean weights it was considered more appropriate to use a full time-series average, from 1999 (first year with creel and trawl length distributions combined) until 2021 for producing the catch options.

*Based on mean discard rate (2017–2021) allocated to Quarters 1 – 2 of 2021; estimates of 8.4% and 4.0% were derived based on the maximum and minimum observed discard rates, respectively, for the same period

** Discard survival in the creel fishery is assumed to be 100%, as outlined in the stock annex.

12.5 Reference points

New reference point F_{MSY} were derived for this stock at WKMSYRef4 (ICES, 2016). This was updated 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. In cases where there is a clear trend in the values a five-year average was chosen. Similarly, the five-year average of the F at 95% of the YPR obtained at the F_{MSY} proxy reference point was proposed as the F_{MSY} lower bound and the five-year average of the F above F_{MAX} that leads to YPR of 95% of the maximum as the upper bound. Using an average value also has the advantage of reducing the effect of any unusually high or low estimates of the F_{MSY} proxy, which occasionally appear. For this stock, the F_{MSY} proxy has been revised from 10.9% to 10.8%.

WKFMSYRef4 did not update the MSY $B_{trigger}$ except for rounding to tens of millions. MSY $B_{trigger}$ has been defined as the lowest stock size from which the abundance has increased (ICES, 2013) and is calculated as 541 million individuals and rounded to 540 million for use as MSY $B_{trigger}$ in the advice. Full details are contained in the stock annex.

These reference points should remain under review by WGCSE and may be revised, should improve data become available.

Table 12.2.4 and Figure 12.5.1 show the harvest rates for FU11. From 2006–2009 there was a sustained period of high (above F_{MSY} proxy) harvest rates followed by two years of low harvest rates of around 6–7%. A sudden increase was observed in 2012, following this, the harvest rate declined and has remained below the F_{MSY} proxy. Harvest rate historical low of 3.1% was recorded in 2020, with a slight increase to 4.6% in 2021 (still well below F_{MSY} proxy). It is likely that prior to 2006, the estimated harvest rates may not be representative due to underreporting of landings.

12.6 Management strategies

Scotland has recently established a network of regional Inshore Fisheries Groups (rIFGs), non-statutory bodies that aim to improve the management of Scotland's inshore fisheries out to six nautical miles, and to give commercial inshore fishermen a strong voice in wider marine management developments. The rIFGs will contribute to regional policies and initiatives relating to management and conservation of inshore fisheries, including impacts on the marine environment and the maintenance of sustainable fishing communities and measures designed to better conserve and sustainably exploit stocks of shellfish and sea fish (including salmon) in their local waters. Although no IFG proposals specific to the management of *Nephrops* fisheries have yet been adopted, some of the IFG management plans for the Scottish West Coast include spatial management of *Nephrops* fisheries and the introduction of creel limits.

On the 8th of February 2016, phase 1 of the fisheries management measures for inshore MPAs in Scottish waters came into force (SG, 2016). These measures relate to both NCMPA (Marine (Scotland) Act and the UK Marine and Coastal Access Act) and SACs (EC Habitats Directives – Council Directive 92/43/EEC) both of which have the aim of conserving biological diversity in Scottish

waters and contribute to Scotland's MPA network (SG, 2017a). Although not specific to the management of the *Nephrops* fishery, they will influence spatial patterns of fishing for *Nephrops* where controls on the two main gear types, demersal trawls and creels are implemented on *Nephrops* habitat. Within the North Minch functional unit, two MPAs are covered by fisheries management measures. Specifically, the Wester Ross NCMPA where fishing activity is banned for demersal gears for vessels over 500 kW in power and banned in certain areas for vessels below 500 kW. North of the main *Nephrops* ground is the Loch Laxford SAC where demersal trawling is banned (SG, 2016). The areas of the SAC and NCMPA relative to the estimated *Nephrops* habitat within the North Minch functional unit are displayed in Figure 12.6.1.

12.7 Quality of assessment and forecast

The length and sex composition of the landings data is considered to be well-sampled. Discard sampling has been conducted on a quarterly basis for Scottish *Nephrops* trawlers in this fishery since 1990, and is considered to represent the fishery adequately. The reduced sampling effort in 2021 just like in 2020 meant that discard sample data were only available for Quarter 3 and 4, and it was agreed at WGCSE that estimates of discard rates and size distributions for Quarters 1 and 2 of 2021 would be adequately approximated for the purpose of forecasting by averaging of discard samples across all available Quarters between 2017 and 2021. The landings length compositions from 1999 onwards, are derived from both creel and trawl samples. The creel fishery which accounted for an increasing proportion of landings by 31% in 2020 has decrease in 2021 to 22.8%. This part of the fishery exhibits a length distribution composed of larger animals.

There were concerns over the accuracy of historical landings and effort data prior to 2006 when Buyers and Sellers legislation was introduced and the reliability began to improve. Because of this, the final assessment adopted is independent of historical landings data. Harvest rates since 2006 are also considered more reliable due to more accurate landings data reported under this legislation. Incorporation of creel length compositions (since the 2010 WG) has also improved estimates of harvest rates. Underwater TV surveys have been conducted for this stock since 1994, with a continual annual series available since 1998. The number of valid stations in the survey has remained relatively stable throughout the time period. Confidence intervals around the abundance estimates are relatively small for this functional unit. 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. A three-year average (i.e. 2019–2021 for the 2022 assessment) of discard rates (adjusted to account for some survival of discarded animals) has been used in the calculation of catch options.

The cumulative absolute conversion factor estimates for FU11 are largely based on expert opinion (see stock annex). The precision of these bias corrections cannot yet be characterised. The landings derived in the forecast (catch options table) are sensitive to the input dead discard rate and mean weights in landings, and this introduces uncertainties in the catch forecasts. Precision estimates are needed for these forecast inputs.

The stock area was revised in 2013 (ICES, 2013) using integrated VMS-logbook data to more accurately estimate the spatial extent of *Nephrops* catches. Two other factors however, have the potential to increase the fished area further. Firstly, the inclusion of vessels smaller than 15 m would likely increase the fished area in some of the inshore locations and secondly, it is known that most of the sea lochs have areas of mud substrate and are typically fished by creel boats. In recent years, a number of TV surveys have taken place in the major North Minch sea lochs in an attempt to improve estimates of the ground area and *Nephrops* abundance. Work presented at the WKNEPH 2013 (ICES, 2013) showed that the total area of the sea lochs is 105 km^2, which is considerably smaller than the offshore VMS area estimated to be 2908 km^2. Therefore, it is

unlikely that the exclusion of these inshore areas from the survey have an impact in the mean densities and overall abundance of *Nephrops* in the North Minch.

12.8 Recommendation for next benchmark

This stock was last benchmarked in 2013 (ICES, 2013). WGCSE will keep the stock under close review and recommend a future benchmark as required.

12.9 Management considerations

The WG, ACOM and STECF have repeatedly advised that management should be at a smaller scale than the ICES Division level and management at the functional unit level could provide the controls to ensure that catch opportunities and effort were compatible and in line with the scale of the resource.

Creel fishing takes place in this area but overall effort by this fleet in terms of creel numbers is not known, and measures to control numbers are not in place. There is a need to ensure that the combined effort from all forms of fishing is taken into account when managing this stock.

There is a bycatch of other species in the area of the North Minch and STECF estimates that discards of whiting and haddock are high in 6.a generally. It is important that efforts are made to ensure that unwanted bycatch is kept to a minimum in this fishery. Efforts to reduce discards and unwanted bycatches of cod include the implementation of large square meshed panels (SMPs) of 120 mm under the west coast emergency measures, and SMPs of 200 mm which were introduced under the Scottish Conservation Credits scheme.

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Table 12.1. *Nephrops* functional units and descriptions by statistical rectangle.

Functional Unit	Stock	Division	ICES Rectangles
11	North Minch	6.a	44–46 E3–E4
12	South Minch	6.a	41–43 E2–E4
13	Clyde	6.a	39–40 E4–E5

Table 12.1.1(a). Nominal landings (tonnes) of *Nephrops* in Division 6.a, 1980–2021, as officially reported to ICES.

	France	Ireland	Spain	UK-(Engl+Wales+N.Irl)	UK- Scotland	UK	TOTAL
1980	5	1	-	-	7422	-	7428
1981	5	26	-	-	9519	-	9550
1982	1	1	-	1	9000	-	9003
1983	1	1	-	11	10 706	-	10 719
1984	3	6	-	12	11 778	-	11 799
1985	1	1	28	9	12 449	-	12 488
1986	8	20	5	13	11 283	-	11 329
1987	6	128	11	15	11 203	-	11 363
1988	1	11	7	62	12 649	-	12 730
1989	-	9	2	25	10 949	-	10 985
1990	-	10	4	35	10 042	-	10 091
1991	-	1	-	37	10 458	-	10 496
1992	-	10	-	56	10 783	-	10 849
1993	-	7	-	191	11 178	-	11 376
1994	3	6	-	290	11 047	-	11 346
1995	4	9	3	346	12 527	-	12 889
1996	-	8	1	176	10 929	-	11 114
1997	-	5	15	133	11 104	-	11 257
1998	-	25	18	202	10 949	-	11 194
1999	-	136	40	256	11 078	-	11 510
2000	1	130	69	137	10 667	-	11 004
2001	9	115	30	139	10 568	-	10 861
2002	-	117	18	152	10 225	-	10 512
2003	-	145	12	81	10 450	-	10 688
2004	-	150	6	267	9941	-	10 364
2005	-	153	17	153	7616	-	7939
2006	-	133	1	255	13 419	-	13 808

	France	Ireland	Spain	UK-(Engl+Wales+N.Irl)	UK- Scotland	UK	TOTAL
2007	-	155	-	2088	14 120	-	16 363
2008	-	56	1	419	14 795	-	15 271
2009	-	53	-	1226	11 462	-	12 741
2010	-	45	1	1962	10 250	-	12 258
2011	-	38	-	2517	10 419	-	12 974
2012	-	28	-	2502	11 807	-	14 337
2013*	-	5	-	-	-	12866	12871
2014	-	51	-	-	-	12760	12811
2015	-	75	-	-	-	11653	11728
2016	-	107	0	-	-	14600	14707
2017	-	114	-	-	-	11442	11557
2018	-	65	0	-	-	8849	8914
2019	-	92	-	-	-	9 018*	9110
2020	-	71	-	538	6334	6872	6943
2021	-	42	-	984	8738.4	9722.4	9764.4

*** Includes 8.6 t landings reported by Isle of Man.**

Table 12.1.1(b). Nominal landings (tonnes) of *Nephrops* in Division 6.b, 1980–2021 as officially reported to ICES. There are no Functional Units in ICES Division 6.b but occasional small landings are made.

	France	Germany	Ireland	Spain	UK-(Engl+Wales+N.Irl)	UK- Scotland	TOTAL
1980	-	-	-	-	-	-	0
1981	-	-	-	-	-	-	0
1982	-	-	-	-	-	-	0
1983	-	-	-	-	-	-	0
1984	-	-	-	-	-	-	0
1985	-	-	-	-	-	-	0
1986	-	-	-	8	-	-	8
1987	-	-	-	18	11	-	29
1988	-	-	-	27	4	-	31
1989	-	-	-	14	-	-	14
1990	-	-	-	10	1	-	11
1991	-	-	-	30	-	-	30
1992	-	-	-	2	4	1	7
1993	-	-	-	2	6	9	17
1994	-	-	-	5	16	5	26
1995	1	-	-	2	26	1	30
1996	-	6	-	5	65	5	81
1997	-	-	1	3	88	23	115
1998	-	-	1	6	46	7	60
1999	-	-	-	5	2	5	12
2000	2	-	8	3	4	4	21
2001	1	-	1	14	2	7	25
2002	1	-	-	7	3	7	18
2003	-	-	1	5	6	18	30
2004	-	-	-	2	7	13	22
2005	3	-	1	1	5	7	17
2006	-	-	-	-	1	3	4

	France	Germany	Ireland	Spain	UK-(Engl+Wales+N.Irl)	UK- Scotland	TOTAL
2007	-	-	-	2	3	-	5
2008	-	-	-	-	-	-	0
2009	-	-	-	-	-	-	0
2010	-	-	-	-	-	-	0
2011	-	-	-	-	-	-	0
2012	-	-	-	-	-	-	0
2013	-	-	-	-	-	-	0
2014	-	-	-	-	-	-	0
2015	-	-	-	-	-	-	0
2016	-	-	-	-	-	0	0
2017	-	-	-	-	-	2	2
2018	-	-	-	-	-	0	0
2019	-	-	0	-	-	-	0
2020	-	-	0.5	-	-	-	-
2021	-	-	0.02	-	-	-	0

Table 12.1.2. ***Nephrops*****, Total** ***Nephrops*** **landings (tonnes) by Functional Unit plus Other rectangles, 1981–2021.**

Year	FU11	FU12	FU13	Other	Total
1981	2861	3652	2968	39	9520
1982	2799	3552	2620	27	8998
1983	3197	3413	4076	34	10720
1984	4143	4300	3310	36	11789
1985	4060	4008	4286	104	12458
1986	3381	3484	4341	89	11295
1987	4084	3892	3009	257	11242
1988	4035	4473	3664	529	12701
1989	3205	4745	2812	212	10974
1990	2546	4430	2909	182	10067
1991	2793	4442	3038	255	10528
1992	3559	4237	2803	248	10847
1993	3193	4458	3343	344	11338
1994	3614	4414	2630	441	11099
1995	3655	4682	3987	460	12784
1996	2872	3995	4057	239	11163
1997	3046	4344	3621	243	11254
1998	2441	3730	4841	157	11169
1999	3257	4052	3752	438	11499
2000	3247	3953	3417	421	11038
2001	3259	3991	3182	420	10852
2002	3440	3305	3384	397	10526
2003	3269	3879	3173	433	10754
2004	3082	3869	2973	403	10327
2005	2949	3848	3395	254	10446
2006	4166	4633	4780	241	13820
2007	3978	5471	6660	420	16529
2008	3799	5356	5923	128	15206
2009	3496	4285	4779	185	12745

Year	FU11	FU12	FU13	Other	Total
2010	2413	3846	5843	569	12671
2011	2697	3702	6432	219	13050
2012	3542	3989	6687	435	14653
2013	3413	3776	5435	234	12858
2014	3257	3179	6207	53	12696
2015	3002	3400	5147	309	11858
2016	3529.4*	4402	6447	236	14614.4
2017	2491	3757	5403	250	11901
2018	1956	2540	4143	160	8799
2019	1979	2220	4683	173	9055
2020	1331	1976	3636	151	7094
2021	2073.1	2696.3	4995	237	10001.31

***Includes below minimum size landed discards of 0.4 t.**

Table 12.2.1. ***Nephrops*, North Minch (FU11), Nominal Landings of *Nephrops*, 1981–2021.**

UK Scotland						Other United Kingdom and Ireland	Total
year	*Nephrops* trawl	other	creel	Below Minimum Size	Subtotal		
1981	2320	171	370	0	2861	0	2861
1982	2323	105	371	0	2799	0	2799
1983	2784	96	317	0	3197	0	3197
1984	3449	160	534	0	4143	0	4143
1985	3235	117	708	0	4060	0	4060
1986	2641	203	537	0	3381	0	3381
1987	3459	143	482	0	4084	0	4084
1988	3450	148	437	0	4035	0	4035
1989	2603	112	490	0	3205	0	3205
1990	1941	134	471	0	2546	0	2546
1991	2229	126	438	0	2793	0	2793
1992	2978	149	432	0	3559	0	3559
1993	2699	86	408	0	3193	0	3193
1994	2916	245	453	0	3614	0	3614
1995	2940	183	532	0	3655	0	3655
1996	2354	148	370	0	2872	0	2872
1997	2553	102	391	0	3046	0	3046
1998	2023	68	350	0	2441	0	2441
1999	2792	56	409	0	3257	0	3257
2000	2695	28	524	0	3247	0	3247
2001	2649	42	568	0	3259	0	3259
2002	2775	79	586	0	3440	0	3440
2003	2606	45	618	0	3269	0	3269
2004	2391	30	661	0	3082	0	3082
2005	2270	23	656	0	2949	0	2949
2006	3446	23	697	0	4166	0	4166

UK Scotland						Other United Kingdom and Ireland	Total
year	*Nephrops* trawl	other	creel	Below Minimum Size	Subtotal		
2007	3361	26	591	0	3978	0	3978
2008	3229	13	557	0	3799	0	3799
2009	2849	34	613	0	3496	0	3496
2010	1783	9	621	0	2413	0	2413
2011	2109	17	571	0	2697	0	2697
2012	2963	12	565	0	3540	2	3542
2013	2356	480	575	0	3411	2	3413
2014	2752	13	490	0	3255	2	3257
2015	2561	23	418	0	3002	0	3002
2016	3039	15	475	0.4	3529.4*	0	3529.4*
2017	2086	30	374	0	2489	1	2490
2018	1592	30	331	0	1950	3	1953
2019	1521	31	425	0	1975	2	1977
2020	900	17	414	0	1331	0	1331
2021	1547	53	472	1.1*	2073.1	0	2073.1

***Below minimum size landings not rounded to show it was reported.**

Table 12.2.2. ***Nephrops*** **Scottish sampling levels all FUs in 6.a (including N. Irish for Clyde).**

		2019		2020		2021	
FU		N trips*	N measured	N trips*	N measured	N trips*	N measured
North Minch	Landings	41	23 952	25	8 551	34	13368
	Discards	35	3 658	4	443	9	1439
South Minch	Landings	40	21 378	18	8 203	33	13770
	Discards	25	1 578	7	673	3	306
Clyde	Landings	22	19 227	24	10 037	31	14510
	N.Irish Landings						
	Discards	33	4 073	-	-		

*** Number of trips expressed as number of hauls for discards.**

Table 12.2.3. ***Nephrops*** **mean weight in the landings (FU11–13).**

Year	FU11	FU12	FU13
1990	21.39	19.99	24.27
1991	25.35	21.74	20.65
1992	21.66	24.10	25.16
1993	20.79	21.26	29.44
1994	23.45	24.96	25.28
1995	22.24	21.96	19.24
1996	26.68	23.10	21.68
1997	21.71	23.37	24.21
1998	23.65	22.18	17.98
1999*	22.70	25.14	17.39
2000	24.19	27.30	19.96
2001	25.33	23.79	19.46
2002	25.93	26.83	16.35
2003	26.03	27.86	19.13
2004	25.16	27.37	18.80
2005	27.65	28.11	17.96
2006	24.52	26.24	19.27
2007	23.61	23.95	19.05
2008	23.90	23.91	16.59
2009	25.42	23.87	18.31
2010	29.39	25.86	21.21
2011	27.56	31.10	19.34
2012	23.43	29.17	21.83
2013	27.52	27.48	20.72
2014	27.96	29.91	20.79
2015	28.74	28.15	22.21
2016	25.76	24.76	17.70
2017	25.89	27.76	17.02
2018	27.39	27.27	16.14
2019	26.59	28.54	17.2
2020	31.06	36.58	18.96
2021	34.78	29.96	15.27
Average**	26.54	27.43	16.91

*** From 1999 onwards, mean weights are shown for trawl and creels combined.**

**** Average for FU11 and FU12 (1999–2021); FU13 (2018–2021).**

Table 12.2.4. *Nephrops*, **North Minch (FU11): Adjusted TV survey abundance, landings, discard rate (proportion by number) and estimated harvest rate.**

YEAR	LANDINGS IN NUMBERS (MILLIONS)	DISCARDS IN NUMBERS (MILLIONS)	REMOVALS IN NUMBERS (MILLIONS)**	ADJUSTED SURVEY VMS (MILLIONS)*	HARVEST RATE VMS	LANDINGS (TONNES)	DISCARDS (TONNES)	DISCARD RATE	DEAD DISCARD RATE	MEAN WEIGHT IN LANDINGS (g)	MEAN WEIGHT IN DISCARDS (g)
1999	144	28	165	794	20.7	3257	273	16.4	12.8	22.7	9.69
2000	134	10	142	1166	12.1	3247	100	6.9	5.2	24.19	10.08
2001	129	17	141	1092	13	3259	160	11.7	9.1	25.33	9.32
2002	133	28	154	1337	11.5	3440	277	17.6	13.8	25.93	9.78
2003	126	30	148	1751	8.5	3269	299	19.2	15.2	26.03	10
2004	122	18	136	1751	7.8	3082	202	13	10.1	25.16	11.02
2005	107	50	144	1540	9.4	2949	507	32	26.1	27.65	10.09
2006	170	74	225	1762	12.8	4166	757	30.3	24.6	24.52	10.27
2007	168	12	177	1206	14.7	3978	214	6.5	5	23.61	18.1
2008	159	19	173	1047	16.5	3799	194	10.5	8.1	23.9	10.36
2009	138	35	164	1195	13.7	3496	327	20.3	16	25.42	9.34
2010	82	12	91	1293	7	2413	128	12.4	9.6	29.39	10.98
2011	96	16	108	1726	6.3	2697	154	14.2	11	27.56	9.66
2012	151	21	167	891	18.7	3542	213	12.6	9.3	23.43	10.33
2013	122	24	140	1403	10	3413	364	16.4	12.8	27.52	15.18
2014	115	8	121	1251	9.6	3257	77	6.3	4.8	27.96	9.99
2015	103	15	114	1445	7.9	3002	143	12.6	9.8	28.74	9.66
2016	136	22	152	1422	10.7	3529***	266	14	10.9	25.76	12.05
2017	95	5	99	1050	9.4	2491	65	5.3	4	25.89	12.51
2018	72	5	75	1188	6.4	1956	59	6.6	5.1	27.39	11.46
2019	74	4	78	1232	6.3	1979	51	5.5	4.2	26.59	11.92
2020	43	3	45	1439	3.1	1331	31	5.7	4.3	31.06	11.84
2021	61	4	64	1391	4.6	2073.1	65	6.2	4.7	34.78	16.02
2022				1346							
Average****									4.6	26.54	11.28

*** harvest rates previous to 2006 are unreliable.**

**** Removals numbers take the dead discard rate into account.**

***** Includes 0.4 tonnes of below minimum size landings.**

****** Dead discard average: 2018–2021; Mean weight in landings and discards average: 1999–2021.**

Table 12.2.5. *Nephrops*, **North Minch (FU11): Results of the 1994–2022 TV surveys (values adjusted for bias).**

YEARS	NUMBER OF VALID STATIONS	MEAN DENSITY (BURROWS/M²)	ABUNDANCE (SEDIMENT; MILLIONS)	95% CONFIDENCE INTERVAL (SEDIMENT; MILLIONS)	ABUNDANCE (VMS; MILLIONS)	95% CONFIDENCE INTERVAL (VMS; MILLIONS)
1994	41	0.29	500	74	820	122
1995				No Survey		
1996	38	0.19	330	47	541	76
1997				No Survey		
1998	38	0.31	547	77	898	127
1999	36	0.27	484	89	794	147
2000	39	0.40	711	82	1166	134
2001	56	0.38	666	81	1092	133
2002	37	0.46	815	91	1337	149
2003	41	0.60	1068	129	1751	211
2004	38	0.60	1068	107	1751	175
2005	41	0.53	939	100	1540	164
2006	30	0.61	1074	101	1762	165
2007	36	0.41	735	92	1206	150
2008	41	0.36	638	95	1047	157
2009	26	0.41	729	138	1195	227
2010	37	0.44	-	-	1293	231
2011	41	0.59	-	-	1726	226
2012	41	0.31	-	-	891	181
2013	41	0.48	-	-	1403	206
2014	44	0.43	-	-	1251	171
2015	41	0.50	-	-	1445	370
2016	39	0.49	-	-	1422	290
2017	42	0.36	-	-	1050	149
2018	44	0.40	-	-	1188	244
2019	47	0.42	-	-	1232	256
2020	33	0.49	-	-	1439	319
2021	50	0.48	-	-	1391	215
2022	36	0.46			1346	355

Table 14.2.6. *Nephrops*, **North Minch (FU11): Results of the 2022 TV survey.**

STRATUM	AREA (km^2)	NUMBER OF STATIONS	MEAN BURROW DENSITY ($no./m^2$)	OBSERVED VARIANCE	ABUNDANCE (MILLIONS)	STRATUM VARIANCE	PROPORTION OF TOTAL VARIANCE	SURVEY PRECISION LEVEL (CV)
2022 TV survey								
VMS	2908	36	0.463	0.134	1345.9	31531	1	
Total	2908	36			1345.9	31531	1	0.132

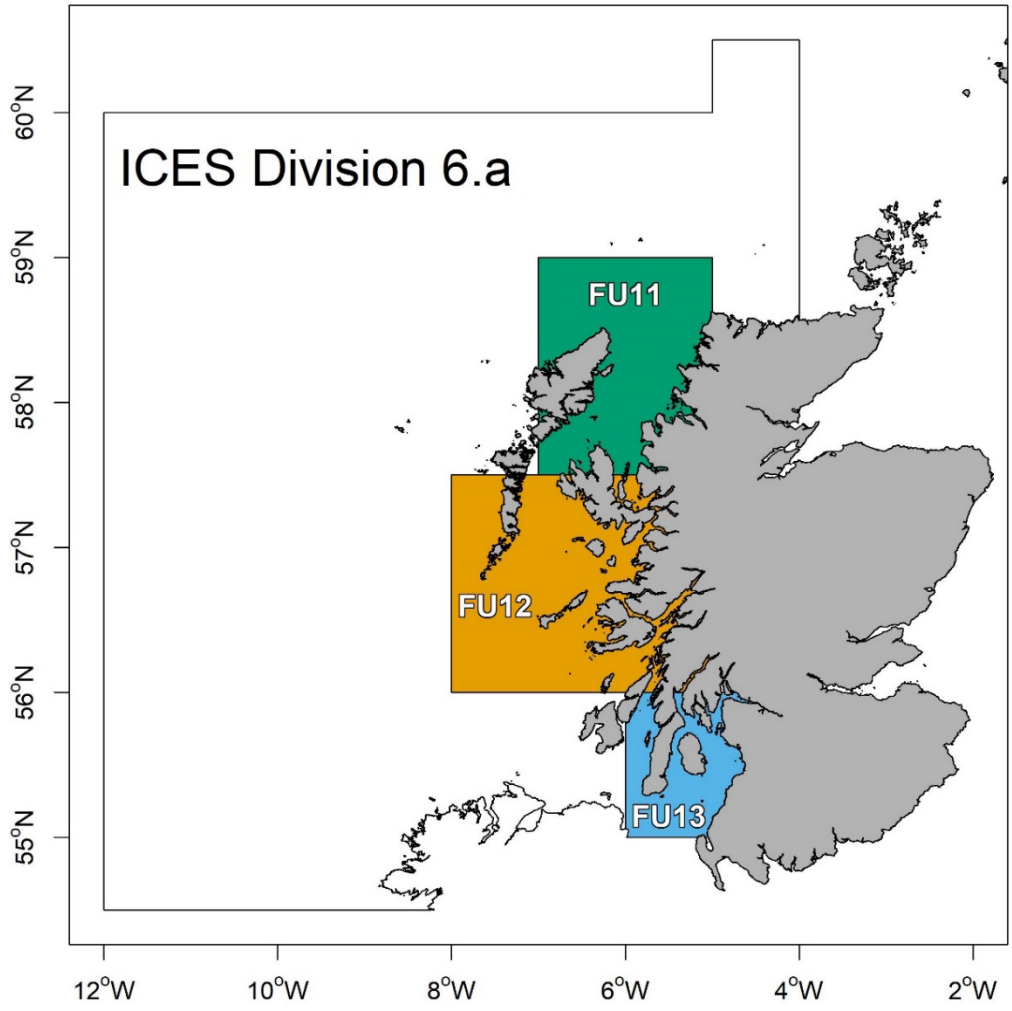


Figure 12.1. *Nephrops* Functional Units in 6.a. North Minch (FU11), South Minch (FU12), Clyde (FU13).

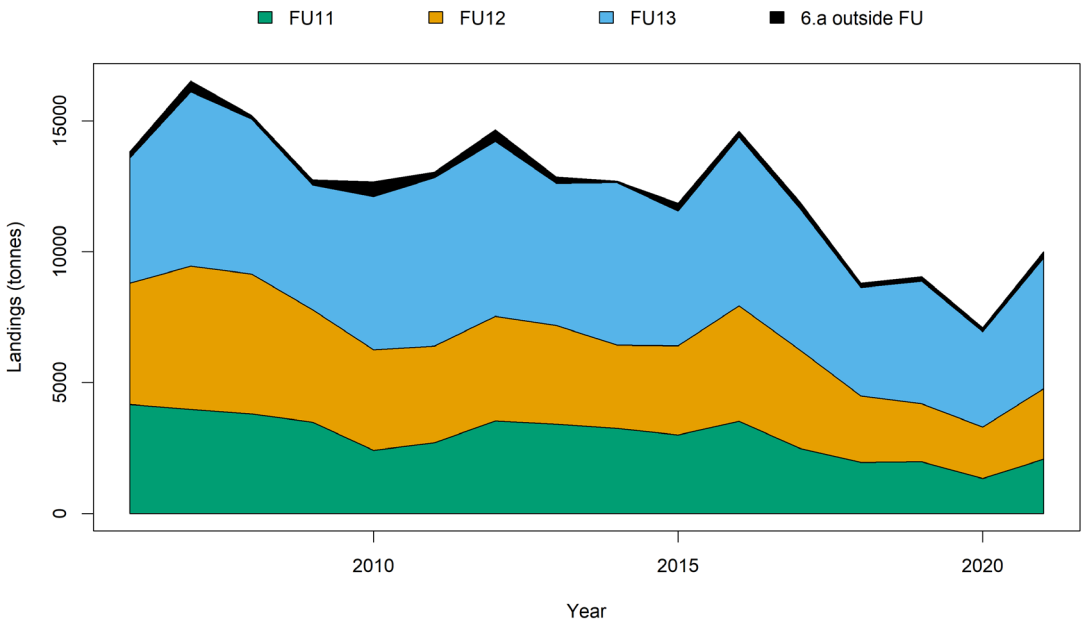
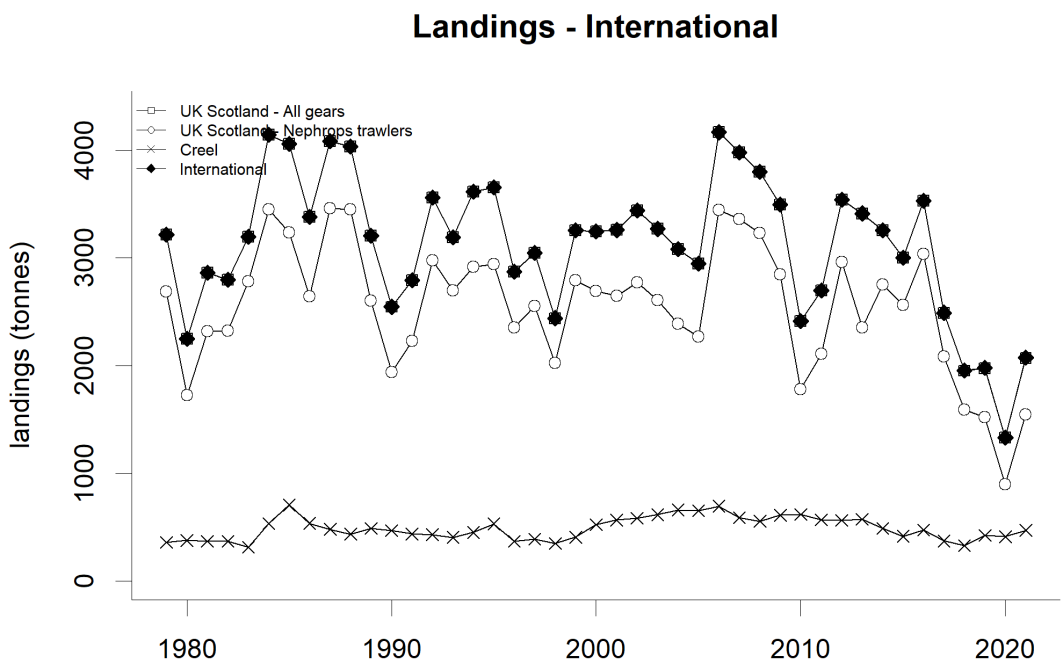


Figure 12.1.1. ***Nephrops*** **in Division 6.a. Landings (tonnes) by functional unit (FU11, 12 &13) and from rectangles outside the functional units (6.a outside FU).**



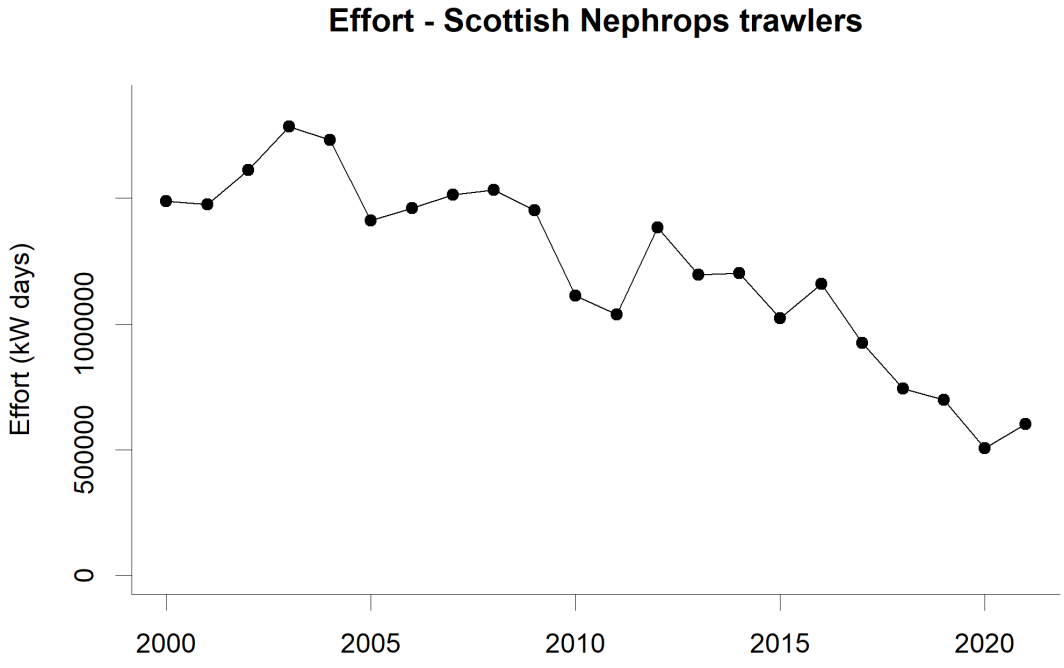


Figure 12.2.1. ***Nephrops*****, North Minch (FU11). Long-term landings and effort.**

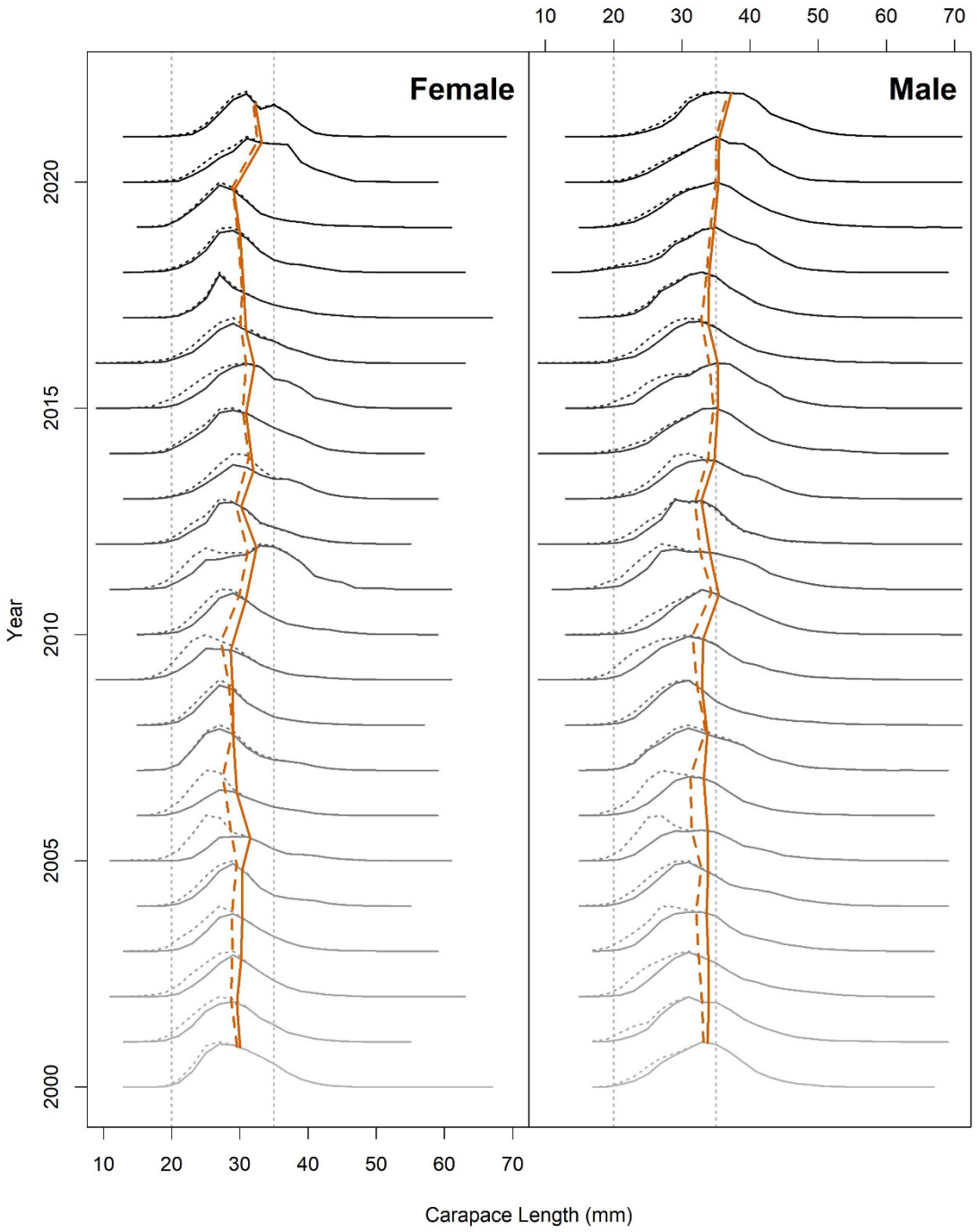


Figure 14.2.2. *Nephrops*, North Minch (FU11), Catch length–frequency distribution (dotted) and landings (solid) for Nephrops, 2000 – 2021. Mean size in catches and landings are represented by solid and dashed lines, respectively. Vertical dotted lines are minimum conservation reference size (20 mm) and 35 mm.

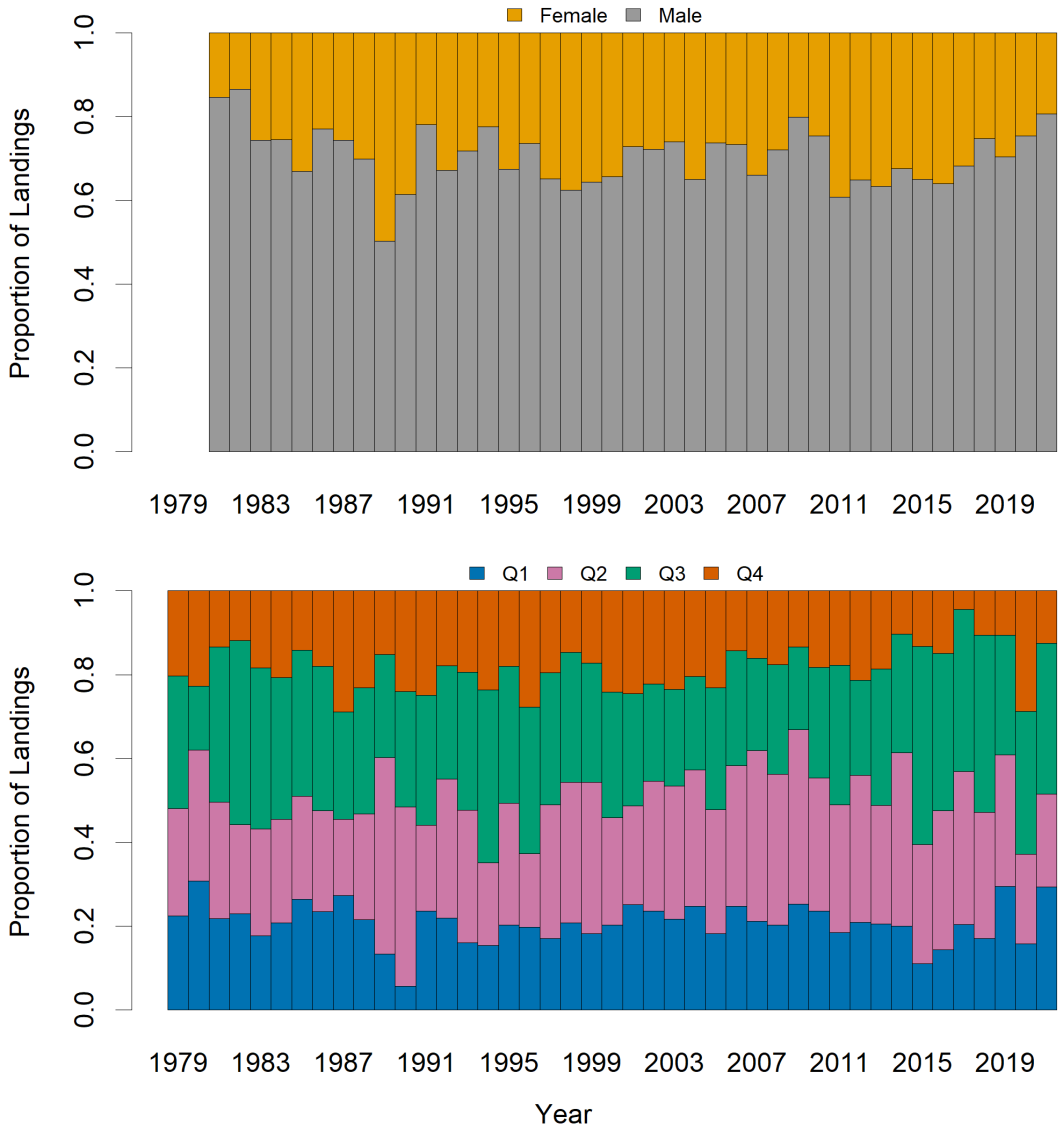


Figure12.2.3 (a). *Nephrops,* North Minch (FU11), Proportion of landed weight by sex (top), by quarter (bottom) from Scottish trawlers.

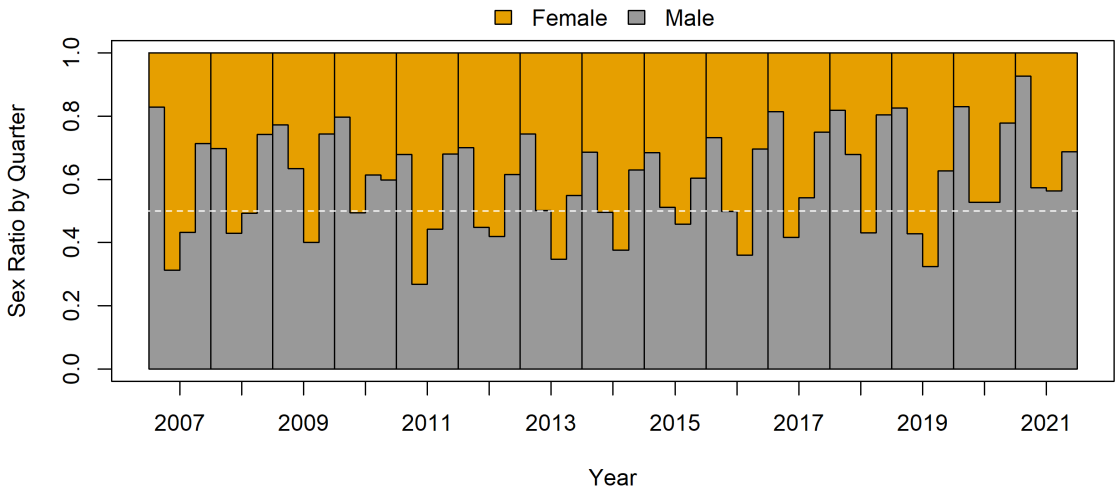


Figure 12.2.3 (b). *Nephrops,* North Minch (FU11), quarterly numeric proportions by sex (2007–2021).

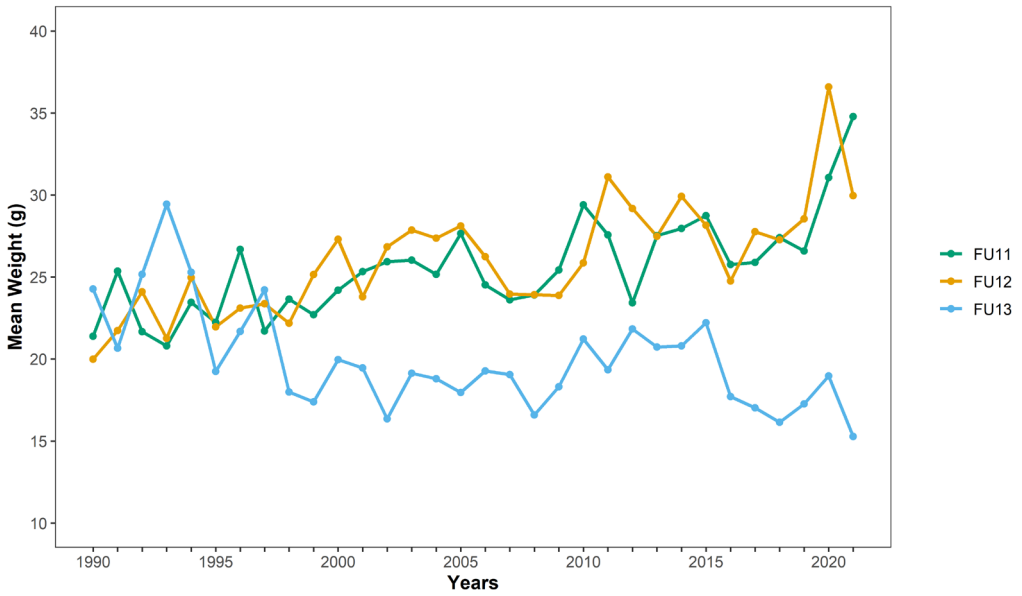


Figure 12.2.4. *Nephrops*, (FU11 North Minch, FU12 South Minch and FU13 Clyde), mean weight in the landings from 1990–2021 (from Scottish market sampling data).

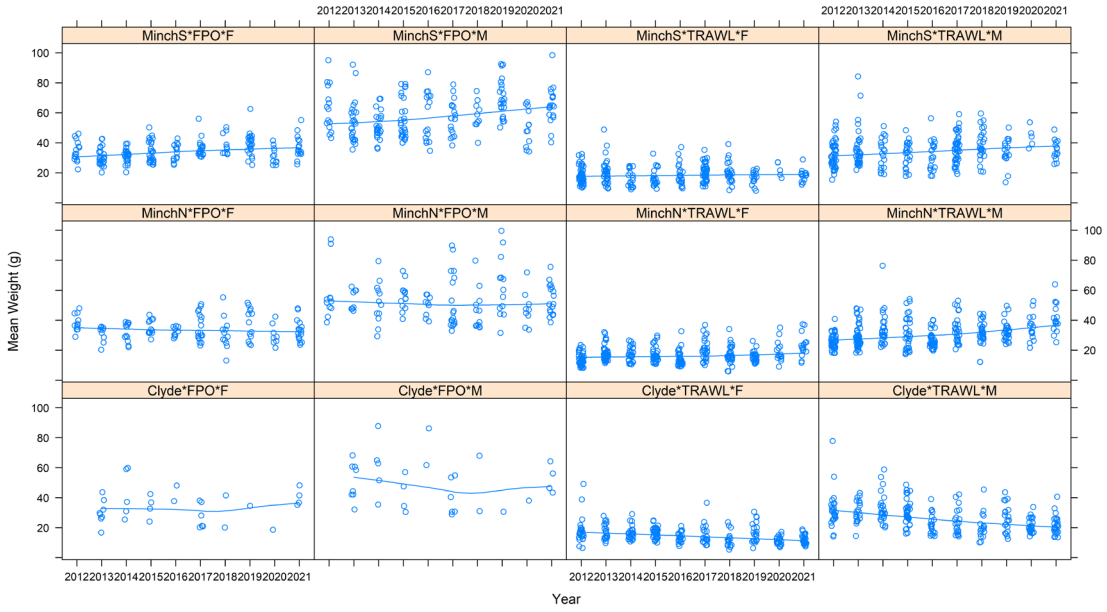


Figure 12.2.5. *Nephrops*, (FU11 North Minch, FU12 South Minch, FU13 Clyde), mean weight in 2011–2021 by sample date, sex, métier and functional unit.

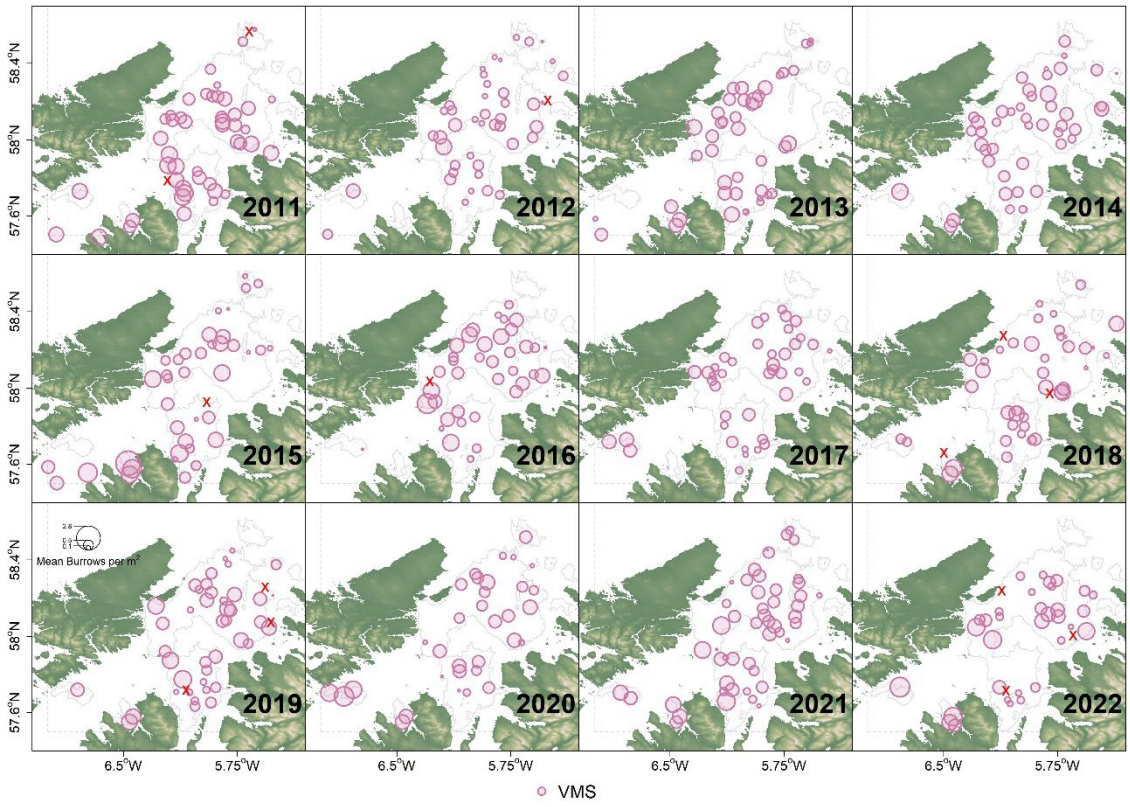


Figure 12.2.6. *Nephrops*, North Minch (FU11), TV survey station distribution and density (mean burrows/m^2), 2016–2021. Bubbles in these figures are all scaled the same. Red crosses represent zero observations.

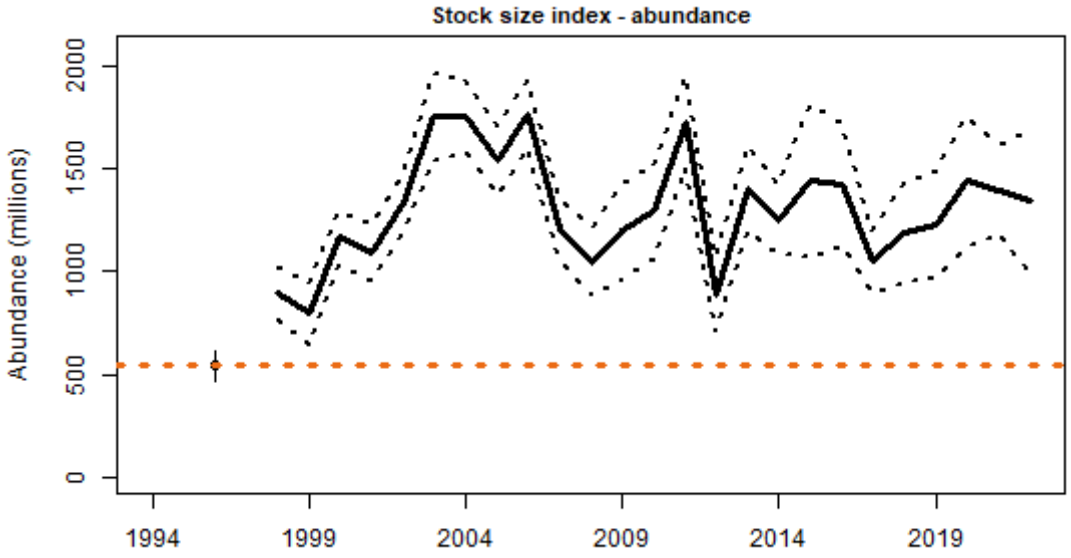


Figure 12.2.7. ***Nephrops*, North Minch (FU11), time-series of revised TV survey abundance estimates (adjusted for bias; solid black line), with 95% confidence intervals (dashed black lines), 1994–2022 (no survey in 1995 and 1997). The dashed red line is the rounded $B_{trigger}$ value of 540 million individuals.**

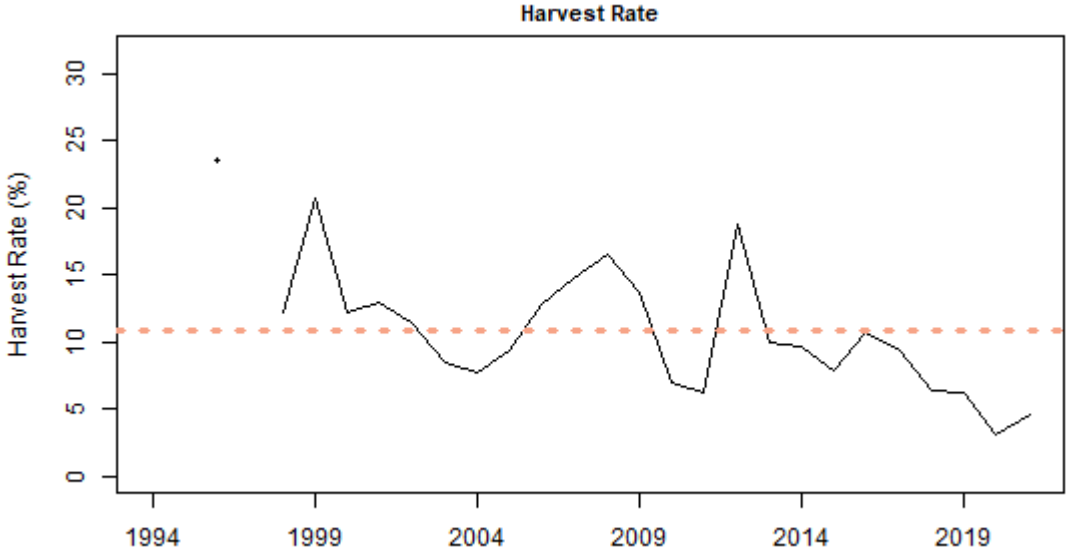


Figure 12.5.1. *Nephrops*, **North Minch (FU11), harvest rate, 1994–2021 (no survey data in 1995 and 1997). The harvest rate is calculated by dead removals/TV abundance. The dashed and solid lines are the F_{MSY} proxy harvest rate (10.8%) and the time-series of estimated harvest rates, respectively. Harvest rates prior to 2006 are considered unreliable.**

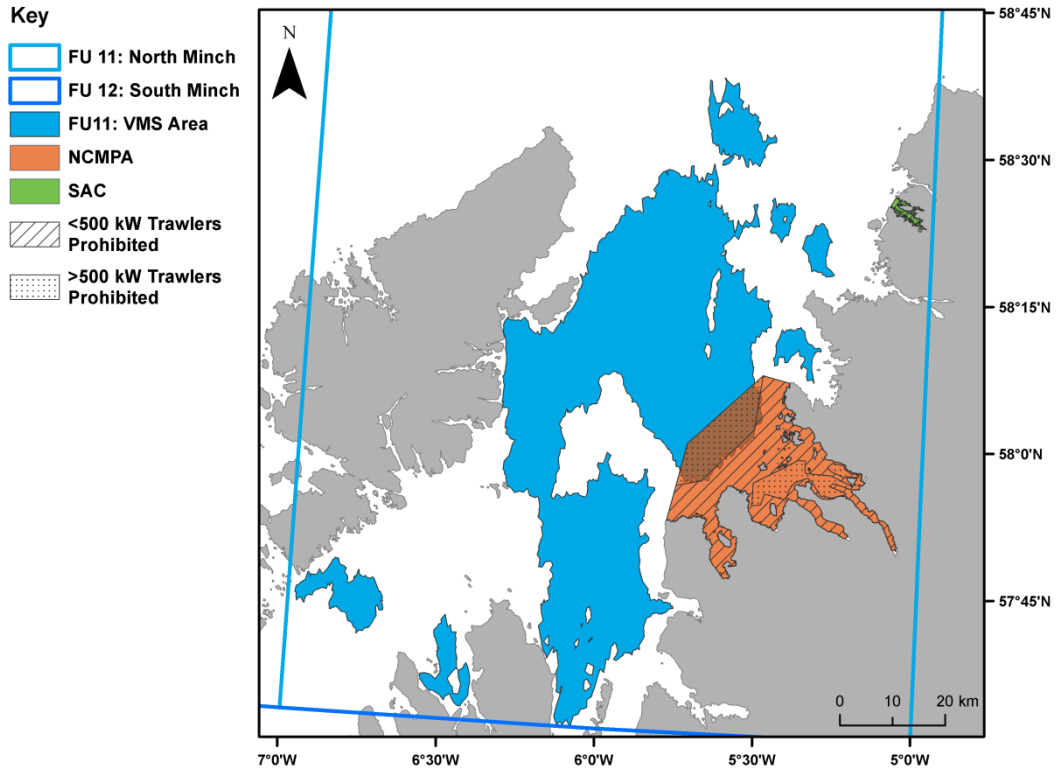


Figure 12.6.1. The area of *Nephrops* habitat (estimated from VMS data) within the North Minch (FU11) relative to the areas of the Nature Conservation MPA (NCMPA) and Special Area of Conservation (SAC) showing areas within these where demersal trawling is banned (hatched) and where it is permitted for vessels below 500 kW (clear; depending on gear type, see SG, 2016). Geographic Coordinate System: OSGB 1936, Datum: OSGB 1936, Projected Coordinate System: British National Grid. Coastline by Wessel and Smith (2016), MPA sites subsetted from NCMPA (SNH, 2015) and SAC (SNH, 2016) layers, management areas by SG (2017b) and functional units generated from merged ICES rectangles (ICES, 2017). Map and modified layers created using ArcGIS (ESRI, 2014).