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13 Norway lobster in Division 9.a

Nephrops norvegicus – nep.fu.2627, nep.fu.2829, nep.fu.30

Functional Units 26–27 (Atlantic Iberian waters East, western Galicia, and northern Portugal)
Functional Units 28–29 (Atlantic Iberian waters East and southwestern and southern Portugal)
Functional Unit 30 (Atlantic Iberian waters East and Gulf of Cádiz)

The ICES Division 9.a has five *Nephrops* Functional Units (FUs): FU 26, West Galicia; FU 27 North Portugal; FU 28, Alentejo, Southwest Portugal; FU 29, Algarve, South Portugal and FU 30, Gulf of Cádiz.

13.1 *Nephrops* in FUs 26–27, West Galicia and North Portugal (Division 9.a)

Nephrops in FUs 26–27 was recently benchmarked by WKMSYSPiCT 2021 (ICES, 2021a). The Surplus Production in Continuous Time (SPiCT) model (Pedersen and Berg, 2017) was accepted to produce MSY advice and the stock was upgraded to category 2.

The last advice given in 2019 was valid for 2020, 2021, and 2022. However, as it is now considered a category 2 stock, new advice according to this category will be given in 2021 for 2022.

13.1.1 General

13.1.1.1 Ecosystem aspects

See Stock Annex.

13.1.1.2 Fishery description

See Stock Annex.

13.1.2 ICES advice for 2021 and management applicable to 2020 and 2021

13.1.2.1 ICES advice for 2021

The advice for these *Nephrops* stocks was triennial and valid for 2020, 2021 and 2022. However, new advice for 2022 according to category 2 stock will be given this year.

For *Nephrops* in FUs 26–27, ICES advises that when the precautionary approach is applied, there should be zero catch in each of the years 2020 and 2021.

To ensure that the stocks in FUs 26 and 27 are exploited sustainably, ICES advises that management should be implemented at the functional unit level.

13.1.2.2 Management applicable to 2020 and 2021

A recovery plan for southern hake and Iberian *Nephrops* stocks has been in force since the end of January 2006. The aim of the recovery plan was to rebuild the stocks within 10 years, with a reduction of 10% in F relative to the previous year and the TAC set accordingly (EU, 2005). This plan was based on the precautionary reference points for the southern hake stock. In March 2019, the European Parliament and the Council have published a multiannual management plan (MAP) for the Western Waters (EU, 2019a) and repealed the previous recovery plan. This plan applies to demersal stocks including *Nephrops* in FUs 26–27 in ICES Division 9.a.

In order to further reduce F on *Nephrops* stocks in this division, seasonal fishing restrictions were introduced in the trawl and creel fishery in two boxes, located in FU 26 and 28, in the peak of the *Nephrops* fishing season. These boxes are closed for *Nephrops* direct fishing in June–August and in May–August, respectively (EU, 1998 amended by EU, 2005). A new regulation on technical measures implemented in 2019 (EU, 2019b), repealed the CR(EC) No 850/98 but kept the two boxes allowing the fishing of *Nephrops* only as bycatch.

The TAC set for the whole Division 9.a was 386 t for 2020 and 374 t for 2021, respectively, of which no more than 6% may be taken in FUs 26 and 27 and no more than 77 t in 2020 and 62 t in 2021 may be taken in FU 30. In the current Management Plan for Western Waters, applied from 2020 onwards, no effort limitations were established.

A Fishing Plan for the Northwest Cantabrian ground was established in 2013 (BOE, 2013) and modified in 2014 (BOE, 2014). These regulations establish a quota assignment system for several stocks (including *Nephrops*) by vessel.

13.1.3 Data

The sampling programs coordinated by the IEO (onshore, onboard observers and biological sampling) were partially suspended in 2020 due to administrative problems and to the COVID-19 disruption, affecting the data collection for all stocks. Details of the impact on each individual stock are provided in the templates provided to ICES and in each stock-specific section.

13.1.3.1 Commercial catches and discards

Spanish landings are based on sales notes which are compiled and standardized by IEO. Since 2013, trips from sales notes are also combined with their respective logbooks which allowed the georeferencing of catches. During the same year, the Spanish concurrent sampling is used to raise the FUs 26–27 observed landings to total effort by *métier*. When the estimated landings exceed the official landings, the difference is provided to InterCatch as non-reported landings.

Landings in these FUs are reported by Spain and, in minor quantities, by Portugal. The catches are taken by the Spanish fleets fishing along the coast of western Galicia (FU 26) and northern Portugal (FU 27) fishing grounds, and by the artisanal Portuguese fleet fishing on FU 27. *Nephrops* represents a minor percentage in the composition of total trawl landings and can be considered as bycatch despite being considered a very valuable species.

Considering the whole 1975–2019 landings time-series for both FUs and countries combined, two periods can be distinguished (Figure 13.1.1). During 1975–1989, the mean landing was 680 t fluctuating between 575 and 800 t, approximately. From 1990 onwards, there has been a marked downward trend in landings, being below 50 t from 2005 to 2011 and below 10 t since 2012. Landings remained minimal and not even reaching 10 t since that year, with recently recorded landings of 2, 7, and 5 t in 2018, 2019, and 2020, respectively.

Table 13.1.1 shows the total landings in FUs 26–27 by FU and country for the time-series. Information on discards was sent to the WG through InterCatch although no discards are recorded in these FUs. Differences between landings in both FUs diminished with FU 27 recording higher landings despite remaining stable at low levels. Landings in FU 27 represent 64% of the total landings (5 t) in 2019 and 74% (4 t) in 2020.

Along the time-series, landings by the Spanish fleets are mostly from FU 26, together with smaller quantities taken from FU 27. Yet, before 1996, no distinction was made between these two FUs and therefore they were considered together. Overall, Spanish landings recorded in both FUs decreased in the time-series, from a maximum of 359 t in 1997 in FU 26 and 68 t in

FU 27 to a minimum of near 0 t in both FUs in recent years. From 2005 onwards, Spanish landings from both FUs were of the same order of magnitude.

Total Portuguese landings from FU 27 have decreased from almost 100 t in 1988 to 17 t in 1996. During the 1997–2004 period, landings decreased to a mean value of 7 t but a slight increase was observed from 2005 to 2009 (mean value of 11 t). From 2010 onwards, landings decreased to the lowest values in the time-series (ranging from 0 to 4 t). In 2019 and 2020, Portuguese landings were 4 t and 2 t, respectively.

13.1.3.2 Biological sampling

The sampling levels for 2020 are shown in section 1 of this report. The number of samples decreased due to some administrative problems coupled with the COVID-19 disruptions.

Mean size (carapace length, CL) for both sexes showed an increasing trend from 2001 to 2010 with the highest value recorded in 2010 for both males (52.0 mm CL) and females (43.7 mm CL) (Figure 13.1.1). In contrast, mean carapace length declined in both sexes in the period 2011–2013. The mean size trend increased for males from 2014 onwards but it declined for females in 2016. In 2016, males achieved a mean carapace length of 45.1 mm and females 37.5 mm. No length frequencies distributions for both sexes were available in 2017 and 2018. In 2019, the mean length in both sexes was higher than in the previous data available: 46.9 mm for males and 40.6 mm for females. Sampling was only partially conducted in 2020 because of the COVID-19 disruption and administrative issues. Only two samples of *Nephrops* were carried out in the third quarter of 2020. Information obtained from these samples were deemed not representative of the stock size composition and, therefore, not considered. Annual length compositions for males and females combined, mean size and mean weight in landings for the period 1988–2019 are given in Tables 13.1.2a and 13.1.2b and Figures 13.1.2a and 13.1.2b.

13.1.3.3 Commercial catch-effort data

Fishing effort and LPUE estimates are available for the Marin trawl fleet (SP-MATR) for the period 1990–2019 (Table 13.1.3; Figure 13.1.1). LPUE estimate is not available in 2020 because of the COVID-19 pandemic disruption and administrative problems which affected the sampling programs. However, it should be noted that the overall trends for the SP-MATR effort and LPUE time-series are decreasing. Fishing effort have remained at very low levels since 2010 (mean value of 447 trips). LPUE series shows are also very low since 2012, with values lower than 1 kg/trip since 2014, indicating that the abundance of the stock in these FUs is very poor. In 2019, the fishing effort was 383 trips and the LPUE 0.3 kg/trip.

Time-series of fishing effort and LPUE of the bottom-trawl fleets with the Spanish home ports of Muros (1984–2003), Riveira, (1984–2004) and Vigo (1995–2008 and 2010) are also available. These data are plotted in Figure 13.1.1 for complementary information.

13.1.4 Biomass index from surveys

13.1.4.1 International bottom-trawl surveys

The Spanish International Bottom Trawl Survey-Q4 (SPGFS-WIBTS-Q4, G2784) covers the northern Spanish shelf in ICES Division 8.c and the northern part of 9.a, including the Cantabrian Sea and off Galicia waters from 70 m to 500 m of depth (Figure 13.1.3). This survey usually starts at the end of the third quarter (September) and finishes in the 4th quarter. Time-series is available for the 1984–2020 period. No survey was carried out in 1987. This survey is designed to estimate demersal species abundance but it could be used for the analysis of the *Nephrops* abundance trends. In the past, the abundance index survey was estimated for the whole surveyed area and not by FU. Data from the G2784 survey was used to estimate a *Nephrops* index for all ICES statistical rectangles (14E0, 13E0, 13E1) in FU 26 (West Galicia). This survey index time-series was

presented for the first time in WGBIE 2020 (ICES, 2020) and it was expressed as the mean biomass or abundance per haul (mean kg/haul and mean number of individuals per haul). WKMSYSPiCT 2021 did not consider appropriated this estimation because depth was not taken into account and the quality of the index was questioned. Based on the depth stratification and the total area in FU 26, a new G2784 survey index was estimated and standardized to one hour during WKMSYSPiCT 2021 (ICES, 2021a).

The survey index shows an increasing trend from 1985 to 1991 (Figure 13.1.4) when the highest value was recorded (3.5 kg/h). The *Nephrops* index decreased in 1994 (0.1 kg/h) and fluctuated up to 2001 (0.6 kg/h). In 2002, the biomass index decreased and remained at very low levels onwards. The mean value in the 2001–2020 period was 0.05 kg/haul (Table 13.1.4 and Figure 13.1.4).

The Portuguese International Bottom Trawl Survey Q4 (PTGFS-WIBTS-Q4, G8899) is carried out in Division 9.a covering the Portuguese continental waters from 20 to 500 m of depth (Figure 13.1.3). The abundance index is available from 1989 to 2018. The survey was not carried out in 2019 due to external administrative issues and then again in 2020 due to the COVID-19 disruption. The main objective of the survey is to estimate the abundance of the most important commercial fish species in the Portuguese trawl fishery and it is conducted in autumn (October). *Nephrops* biomass index in FU 27, from the depth, stratified G8899 survey, was estimated using hauls included in ICES statistical rectangles corresponding to FU 27 (6E0–12E0) during the WKMSYSPiCT benchmark (ICES, 2021a).

The biomass index was almost zero g/h at the beginning of the time-series (1985–1988 period). After that, the *Nephrops* biomass index increased but has greatly fluctuated up to 2000. In 2001, the G8899 survey index decreased and it has remained at about zero g/h since then, only a peak was observed in 2015 although not very high (Table 13.1.4 and Figure 13.1.4).

Figure 13.1.5 shows the sector areas from Spanish (G2784) and Portuguese (G8899) IBTS surveys-Q4 covering FUs 26 and 27, respectively. *Nephrops* is mainly distributed in the Miño-Fisnisterre sector (GAL) in FU 26 from about 100 to 700 m depth and the Caminha sector (CAM) in the northern part of FU 27 from 100 to 500 m depth (Table 13.1.4). In the rest of the FU 27, *Nephrops* patches occur particularly in the Figueira da Foz sector (FIG) in the deepest stratum and Berlengas sector (BER) in a higher bathymetric range. In the Lisbon sector (LIS), *Nephrops* is present in a small patch in front of Cascais about 350 m depth.

The annual spatial distribution of *Nephrops* biomass index in FUs 26–27 for the time-series is shown in Figure 13.1.6a and Figure 13.1.6b, indicating a declining trend of the biomass index since 1983 as well as of the *Nephrops* patches in FUs 26–27.

A new depth stratified biomass index (G2784_G8899) based on the area and depth strata for the total area covering FUs 26–27 was estimated during WKMSYSPiCT (ICES, 2021a) considering the following area/sectors: Miño-Finisterre (GAL), Caminha (CAM), Matosinhos (MAT), Aveiro (AVE), Figueira da Foz (FIG), Berlengas (BER) and Lisbon (LIS) from Spanish and Portuguese IBTS surveys (Figure 13.1.4; Table 13.1.4), as parts of a unique survey and taking into account the area corresponding to each stratum of depth. *Nephrops* weight by haul was standardized to one hour. Both surveys use different vessels and gears so catchability could be also different for some species. The Portuguese survey is not suitable for flatfish, anglerfish and probably *Nephrops*. However, no weight has been applied to these surveys in order to standardize the *Nephrops* biomass index. The knowledge of the fishery in FUs 26–27 suggests that the main *Nephrops* fishing ground is in FU 26 and a small part in the north of Portugal near the border with Spain which is exploited by the Spanish trawl fleet. Therefore, the combined biomass index trend should not be very different.

The new combined (G2784_G8899) index increased from 1983 to 1991, recording the highest value of the time-series (0.17 g/h) but it showed a decreasing trend from that year to 1994

(0.01 g/h). In 1995, *Nephrops* biomass index increased again and after that, it has fluctuated at low levels up to 2001 (0.03 g/h). The G2784_G8899 biomass index value has been minimal since 2002.

13.1.4.2 Trawl surveys with the fishing industry

Marine Fishing Industry (OPROMAR, Productores de Pesca Fresca del Puerto y la Ría de Marín) promoted a survey with a commercial vessel in order to estimate *Nephrops* abundance index in FU 26 with an observer onboard under the IEO supervision. The survey hereinafter referred to as GALNEP-26 started in 2019 and was also carried out in 2020. These surveys were conducted in summer (July–August) during the main *Nephrop*s fishing season when both males and females are accessible to the gear due to their reproductive behaviour. The survey design followed a systematic sampling over a 5 x 5 nm grid over the *Nephrops* distribution area estimated by VMS and sediment information (Vila *et al*., 2020). The survey index from GALNEP-26 with a 95% confidence interval was estimated at 0.74 ± 0.58 kg/h in 2019. The index increased in 2020 (1.82 ± 1.86 kg/h). Figure 13.1.7 shows the *Nephrops* biomass index distribution in FU 26. *Nephrops* represented about 1% of the total retained catch while the discard rate was zero in both years. The spatial analysis of the survey index indicates that *Nephrops* is concentrated in a small area on the Northwest half within the original distribution area of FU 26 (Figure 13.1.7). In 2019, the mean lengths were 39.9 mm CL for females and 43.9 mm CL for males. Similar mean length sizes were observed in 2020 (Table 12.1.5). Figure 13.1.8 shows the LFDs by sex in 2019 and 2020.

13.1.5 Assessment

This stock was considered as category 3.1.4 according to the ICES data-limited approach since 2012 (ICES, 2012) and it was assessed by analysing the LPUE series trend.

The Surplus Production in Continuous Time (SPiCT) model (Pedersen and Berg, 2017) was proposed during WKMSYSPiCT (ICES, 2021a) to produce MSY advice. Data available for the stock were reviewed and several tests were conducted. Results and discussions about the exploratory runs and the final accepted model are available in the WKMSYSPiCT report (ICES, 2021a). Assessment has been carried out this year according to category 2 using the SPiCT model and the Stock Annex was modified accordingly.

13.1.5.1 SPiCT model

Input data (Table 13.1.6 and Figure 13.1.9.)*:*

- Total landings from 1975–2020 (discards are considered negligible).
- Spanish and Portuguese International Bottom Trawl surveys-Q4 combined index (G2784+ G8899) from 1983–2020 (no data in 1987).

Settings:

- Euler time-step (years): 1/16 (default).
- The biomass index time-series was scaled to mean 1 in order to obtain better numerical stability.
- An extra uncertainty was applied to landings from 1975 to 1980 as during this period is possible that a wrong gear identification in some trips could have occurred and as consequence *Nephrops* landings were more uncertain.
- Moreover, the uncertainty of the survey index for the period 1983–1990 was also increased.

- The following priors were applied:
    i. Initial biomass depletion level, *B*/*K* prior: 0.5 with a low CV (medium level), i.e. inp$priors$logbkfrac <-c(log(0.5),0.2,1)
    ii. Intrinsic growth rate, *r* prior: 0.2 with a low CV in order to increase model stability, i.e inp$priors$logr <-c(log(0.2),0.2,1)
    iii. Schaefer production curve type using a tighter prior for *n*, i.e. inp$priors$logn <-c(log(2),0.5,1)
    iv. Default priors on alpha and beta are disabled: inp$priors$logalpha <- c(0,0,0); inp$priors$logbeta <- c(0,0,0)
    v. In order to decrease the confidence intervals of the results, priors for the F process noise and for catch observation noise are set as: inp$priors$logsdf <- c(log(3), 0.5, 1); inp$priors$logsdc <- c(log(0.1), 0.2, 1)

13.1.5.2 Assessment diagnostics

Diagnosis is conducted using the OSA (one step ahead) approach to assess the goodness-of-fit. The plots in Figure 13.1.10 confirm normality in the residuals, using the QQ-plot and Shapiro test. Confidence intervals for F/F_{MSY} and B/B_{MSY} do not span more than 1 order of magnitude, as proposed by Mildenberger *et al*. (2020).

The retrospective patterns for the relative biomass and relative fishing mortality, using the peels of the last five years assessments, are shown in Figure 13.1.11. The Mohn's rho values (Mohn, 1999) estimated for B/B_{MSY} and F/F_{MSY} were 0.365 and -0.259, respectively. However, all five peels are within the 95% confidence intervals of the assessment and the plots do not show a strong retrospective pattern.

13.1.5.3 Assessment results

SPiCT results are shown in Tables 13.1.7 and 13.1.8 and in Figure 13.1.12

Nephrops landings in FU26–27 decreased more than 95% along time-series and the biomass survey indices indicate extremely low biomass. Spatial analysis of the biomass surveys indices shows a reduction of the historical *Nephrops* distribution in these stocks.

The biomass decreased from the beginning of the time-series to the 2000s, remaining at a very low level since then. Biomass dropped below MSY $B_{trigger}$ since the end of the 1980s and the fishing mortality is below F_{MSY} since 2013. In the last year of the time-series, F was 43% below F_{MSY} with very low biomass. Results indicate a depleted stock.

13.1.6 Short-term projections

Short-term projections consider the fishing mortality in the intermediate year as the estimated F in 2020. Results for the scenarios discussed in WKMSYPiCT (ICES, 2021a) are presented in Table 13.1.9 and Figure 13.1.13. All scenarios recommend zero catch for 2022 except for F_{sq} with projected catches of 5.2 t.

13.1.7 Comment on the assessment

Portuguese IBTS survey-Q4 (G8899) was not carried out in 2019 due to external issues and again in 2020 due to the COVID-19 disruption. However, this survey has very little weight in the estimation of the new combined (G2784_G8899) survey index. Therefore, this survey had very little or no impact on the current assessment.

13.1.8 Quality considerations

A combined biomass index from Spanish and Portuguese IBTS surveys-Q4 taking into account the spatial-temporal analysis using a Bayesian hierarchical model was estimated. This work was presented in WKMSYSPiCT 2021 (ICES, 2021a). However, the model-based index used an auto-regressive process to estimate the time-trend. This implies that the resulting indices by year are not independent of each other, and the time-series will appear smoother as opposed to when year effects are treated independently. This is undesirable when the index is used as data in an assessment model that assumes that each data point is independent of the others. It was therefore recommended to use independent year effects in model-based approaches. A simpler approach to estimating a combined index survey based on area and depth was used in the assessment.

13.1.9 Biological reference points

In the SPiCT model, the stock status evaluation and stock catch forecast options are based on relative reference points. This is because the absolute reference points are re-estimated every time the model is applied as opposed to many other assessments where the reference points remain fixed until the next benchmark.

WKMSYSPiCT (ICES, 2021a) reiterated the use of MSY reference points as previously defined for biomass dynamics models (now updated in ICES, 2021b). Reference points are shown in the table below.

Framework	Reference point	Relative value	Technical basis	Source
MSY approach	MSY $B_{trigger}$	0.5	Relative value. B_{MSY} is estimated directly from the assessment model and changes when the assessment is updated.	ICES (2021a)
	F_{MSY}	1	Relative value. F_{MSY} is estimated directly from the assessment model and changes when the assessment is updated.	ICES (2021a)
Precautionary approach	B_{lim} proxy	$0.3 \times B_{MSY}$	Relative value (equilibrium yield at this biomass is 50% of the MSY proxy).	ICES (2021a)
	B_{pa}	Not defined		
	F_{lim} proxy	$1.7 \times F_{MSY}$	Relative value (the F that drives the stock to the proxy of B_{lim}).	ICES (2021a)
	F_{pa}	Not defined		
Management plan	SSB_{mgt}	Not defined		
	F_{mgt}	Not defined		

13.1.10 Management Considerations

Nephrops is taken as bycatch in a mixed bottom-trawl fishery. Landings of *Nephrops* have substantially declined since 1995. Recent landings represent less than 1% of the average landings in the early period of the time-series (1975–1992). Fishing effort in FUs 26–27 has decreased throughout the time-series.

There is a seasonal closure (June–August) for *Nephrops* in a *box* within West Galicia (FU 26) fishing grounds, which was amended in the Council Regulation (EC) No 850/98 (EU, 1998). A new regulation on technical measures, the Regulation (EU) No 2019/1241 (EU, 2019b) replaced and repealed the CR (EC) No 850/98 but kept the *box* previously defined, allowing fishing *Nephrops* only as bycatch.

A multiannual management plan (MAP) for the Western Waters has been published by the European Parliament and the Council (EU, 2019a). This plan applies to demersal stocks including *Nephrops* in FUs 26–27 in ICES Division 9.a.

A Fishing Plan for the Cantabrian and Northwest fishing grounds was established in 2013 (BOE, 2013) and modified in 2014 (BOE, 2014). These regulations establish a quota assignment system for several stocks (including *Nephrops*) by vessel.

Unwanted catches from *Nephrops* are regulated by the discard plan for demersal fisheries in Southwestern waters for the period 2019–2021 (EU, 2018 replaced by EU, 2019c), under which an exemption from the landing obligation is applied based on this species high survival rates. This exemption applies to all catches of Norway lobster from ICES subareas 8 and 9 with bottom-trawls, with the immediate release of all discards in the area where they were caught.

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13.1.12 Tables and Figures

Table 13.1.1. *Nephrops* in FUs 26–27, West Galicia and North Portugal. Landings in tonnes by FU and country.

	Spain		Portugal	Total
Year	FU 26*	FU 27	FU 27	FU 26–27
1975				622
1976				603
1977				620
1978				575
1979				580
1980				599
1981				823
1982				736
1983				786
1984	603		14	617
1985	731		15	746
1986	655		37	692
1987	670		71	741
1988	631		96	727
1989	577		88	665
1990	402		48	450
1991	515		54	569
1992	584		52	636
1993	472		50	522
1994	428		22	450
1995	501		10	511
1996	264	50	17	331
1997	359	68	6	433
1998	294	42	8	344
1999	192	48	6	246
2000	102	21	9	132

Year	Spain FU 26*	Spain FU 27	Portugal FU 27	Total FU 26–27
2001	105	21	6	132
2002	59	24	4	87
2003	39	26	8	73
2004	38	24	9	71
2005	16	16	11	43
2006	15	17	12	44
2007	20	17	10	47
2008	17	12	13	42
2009	10	17	10	37
2010	9	13	4	26
2011	7	8	4	19
2012	2	4	1	7
2013	1	< 1	1	3
2014	1	1	1	3
2015	1	< 1	1	2
2016	1	< 1	3	5
2017	< 1	< 1	2	3
2018	1	1	0	2
2019	3	1	4	7
2020	1	2	2	5

*** Prior to 1996, landings of Spain recorded in FU 26 included catches in FU 27.**

Table 13.1.2a. *Nephrops* in FUs 26–27, West Galicia and North Portugal. Length compositions, mean weight (kg) and mean size (CL, mm) in landings for the 1988–2019 period. Data were not available in 2017, 2018 and 2020.

Lenght (mm)	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
12	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	71	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	69	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	451	110	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	191	289	13	0	0	0	0	0	0	0	0	3	17	0	0	0	0	0	0	0	0	0	0	0
17	0	128	518	17	0	0	7	0	0	0	0	0	3	11	0	0	0	0	0	0	0	0	0	0	0
18	0	683	898	25	0	0	2	1	0	0	0	0	16	19	0	4	0	0	0	0	0	0	0	0	0
19	0	679	1502	38	0	0	0	0	0	0	0	0	38	52	0	4	0	0	0	0	0	0	0	0	0
20	27	1057	2044	97	6	5	10	7	25	3	0	0	86	151	3	29	0	0	0	0	0	0	0	0	0
21	27	1260	2489	199	12	24	19	8	78	0	0	0	119	236	3	27	0	0	1	0	0	0	0	0	0
22	39	1657	2642	398	48	99	84	47	202	12	1	0	129	348	11	11	1	0	1	0	0	0	0	0	0
23	109	1901	3063	568	103	99	77	151	373	26	6	0	127	518	16	31	0	0	0	0	1	0	0	0	0
24	198	1626	2736	1216	284	222	169	338	550	46	7	3	93	466	22	17	1	2	1	0	2	0	0	0	0
25	290	2212	1802	1477	541	381	199	672	906	113	45	15	134	441	35	28	1	2	1	0	3	1	0	0	0
26	574	1675	1451	1516	829	542	289	709	960	184	40	43	145	365	56	22	7	2	2	1	2	1	0	0	0
27	854	1878	1333	1351	926	904	409	933	746	306	80	68	129	419	106	40	18	8	5	2	3	1	0	0	0
28	1272	1560	1319	1940	1079	1017	524	1298	842	402	138	109	123	274	74	46	23	12	8	6	9	4	0	0	0
29	1487	1716	913	1797	1023	987	613	1223	706	489	191	134	143	266	86	60	20	15	13	7	7	9	0	0	0
30	1615	1510	845	1501	1069	1140	767	1371	792	681	295	195	172	252	118	90	31	25	20	12	13	11	0	2	1
31	1960	1106	632	1450	1180	890	802	1378	609	719	359	239	182	209	105	102	27	21	21	13	16	9	1	2	0
32	1951	1472	772	1484	1197	912	847	1491	601	888	411	292	285	220	160	95	49	29	35	23	27	11	2	5	2
33	2288	1313	601	1126	1378	878	898	1444	517	780	525	377	176	201	167	84	56	26	40	47	23	11	2	3	2
34	1581	1299	572	1160	1001	849	853	1255	542	745	551	376	192	156	131	83	56	31	51	43	37	22	5	3	2
35	1487	952	518	1044	915	855	745	963	506	637	569	432	200	148	96	91	53	26	48	46	25	18	4	5	2
36	1161	634	407	879	776	901	611	744	433	527	484	360	176	120	110	85	56	21	42	36	22	15	4	4	1
37	838	545	284	651	627	736	546	580	348	484	417	321	175	143	106	111	70	31	51	49	31	17	7	2	2
38	1196	608	294	616	545	682	621	542	346	534	425	308	128	110	76	72	86	35	61	38	28	20	6	2	2
39	837	451	226	600	505	510	475	425	285	406	292	240	128	85	95	79	65	27	43	36	21	14	6	8	3
40	501	325	199	450	666	573	412	455	284	466	393	218	115	65	76	60	90	24	55	39	32	21	7	7	4
41	428	288	165	375	431	385	321	321	213	399	312	182	112	58	88	48	60	21	40	32	23	16	8	6	4
42	367	287	144	220	362	375	314	214	182	360	249	210	66	57	81	54	101	22	47	43	26	14	6	7	6
43	433	296	156	203	425	307	293	188	165	325	292	219	64	36	76	47	73	25	38	49	25	13	9	7	4
44	164	277	87	136	301	251	200	152	127	290	207	193	61	44	52	33	62	20	32	38	36	13	10	7	4
45	165	286	58	110	303	219	178	125	118	218	196	162	58	42	44	34	56	17	18	29	17	12	8	10	5
46	96	135	23	90	350	153	129	116	94	191	178	152	40	28	49	26	29	20	18	24	18	8	10	11	3
47	94	117	45	82	228	104	92	84	56	123	120	84	38	47	42	31	38	26	18	28	17	8	8	9	4
48	71	100	25	49	222	58	96	55	70	117	147	96	23	18	22	13	28	18	12	15	16	7	7	7	3
49	73	76	29	42	148	84	71	46	23	60	105	64	21	16	15	16	18	13	11	14	9	5	7	7	3
50	83	127	14	46	63	81	69	29	31	81	95	54	17	12	12	15	16	15	13	14	9	9	10	14	3
51	15	48	9	14	71	27	59	13	21	43	59	21	17	6	7	15	7	15	7	7	9	6	4	5	3
52	20	75	14	33	71	21	59	18	22	43	55	30	18	6	7	10	12	10	8	10	9	6	5	5	3
53	23	34	13	26	34	20	28	6	13	30	37	33	5	5	6	10	5	7	6	8	4	6	5	6	2
54	14	10	11	23	23	14	12	6	15	42	28	27	8	3	2	8	4	11	10	6	7	4	5	4	3
55	6	27	1	6	13	17	12	1	9	25	26	12	6	7	3	4	5	8	3	6	6	5	7	5	1
56	6	9	1	5	5	10	5	1	9	14	14	14	7	4	3	5	3	4	2	3	6	6	4	5	1
57	10	5	1	2	6	5	10	0	4	8	12	6	5	3	3	2	2	3	2	4	5	5	3	2	0
58	11	5	1	4	6	5	14	0	3	6	11	5	4	5	4	3	3	4	4	4	5	5	4	2	0
59	7	0	4	0	7	2	7	0	0	2	1	5	3	3	0	1	4	3	1	3	2	2	1	3	1
60	2	0	2	0	4	3	3	0	0	1	2	3	2	2	2	2	7	4	2	1	3	3	4	3	1
61	4	0	1	0	3	2	12	0	0	0	2	0	3	2	0	2	1	14	1	2	1	1	3	2	1
62	2	0	1	0	1	0	7	0	0	0	0	0	1	5	0	2	2	4	2	1	3	2	1	1	1
63	1	0	1	0	3	0	5	0	0	1	0	0	3	3	0	2	1	2	1	1	1	1	2	2	0
64	2	0	1	0	3	1	4	0	0	0	1	0	2	2	0	2	1	1	1	1	2	3	2	2	0
65	2	0	1	0	1	0	2	0	0	0	0	0	1	1	1	1	2	2	1	1	1	2	2	2	0
66	3	0	1	0	1	0	2	0	0	0	1	0	2	2	0	1	0	1	1	1	1	1	1	1	1
67	2	4	1	0	1	1	1	0	0	0	1	0	3	1	0	2	1	2	1	1	1	1	1	1	0
68	2	11	1	0	2	2	6	0	0	0	0	0	2	1	0	2	1	1	2	2	2	1	2	2	0
69	1	4	1	0	1	1	0	0	0	0	0	0	2	1	0	1	1	1	2	1	1	1	1	1	1
70	12	25	1	2	12	6	8	0	1	0	3	0	11	1	1	5	4	8	1	1	4	1	1	1	0
71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	1	2	0
72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
77	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
78	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
81	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
84	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total number (thousand)	22409	31275	29319	23087	17811	15360	12003	17411	11828	10827	7383	5302	3822	5712	2169	1666	1257	638	800	752	569	355	191	191	81
Total weight (t)	727	708	450	603	636	522	448	511	331	432	344	246	132	132	87	72	70	42	44	46	36	25	19	20	8
Mean weight (kg)	0.032	0.023	0.015	0.026	0.036	0.034	0.037	0.029	0.028	0.040	0.047	0.046	0.035	0.023	0.040	0.043	0.056	0.066	0.057	0.061	0.063	0.071	0.099	0.105	0.098
CL Mean length (mm)	34.0	29.1	25.9	31.4	34.5	34.3	35.2	32.9	31.9	36.2	38.1	38.1	33.5	29.5	36.0	36.2	40.2	42.0	40.0	41.3	41.5	42.6	48.4	46.5	46.1

(Continued in the next page)

Table 13.1.2b. *Nephrops* in FUs 26–27, West Galicia and North Portugal. Length compositions, mean weight (kg) and mean size (CL, mm) in landings for the 1988–2019 period. Data were not available in 2017, 2018 and 2020. (continued from the previous page).

Lenght (mm)	2013	2014	2015	2016	2017	2018	2019
12	0						
13	0						
14	0						
15	0						
16	0						
17	0						
18	0						
19	0						
20	0						
21	0						
22	1						
23	0						
24	0	1					
25	0	2	0	1			0
26	0	1	0	0			0
27	0	1	0	0			0
28	0	2	0	1			0
29	0	2	0	2			0
30	1	4	0	4			2
31	1	1	0	0			1
32	1	1	0	2			1
33	1	0	1	2			1
34	1	5	1	3			3
35	1	5	2	5			2
36	1	2	1	2			3
37	1	3	1	2			3
38	1	1	1	3			2
39	1	2	1	2			3
40	1	4	3	5			4
41	1	1	1	1			3
42	1	1	1	2			2
43	1	1	2	1			6
44	0	3	1	3			3
45	0	3	1	6			5
46	0	1	0	1			2
47	0	1	0	3			3
48	1	1	0	2			3
49	0	1	0	2			3
50	0	2	0	3			3
51	0	0	0	1			1
52	0	0	0	1			1
53	0	0	0	1			2
54	0	1	0	1			1
55	0	1	0	2			1
56	0	0	0	0			1
57	0	0	0	0			0
58	0	1	0	0			1
59	0	0	0	0			1
60	0	1	0	1			1
61	0	0	0	1			0
62	0	0	0	0			1
63	0	0	0	0			1
64	0	0	0	0			0
65	0	0	0	0			0
66	0	0	0	0			0
67	0	0	0	0			0
68	0	0	0	0			0
69	0	0	0	0			0
70	0	0	0	1			0
71	0	0	0	0			0
72	0	0	0	0			0
73	0	0	0	0			0
74	0	0	0	0			0
75	0	0	0	0			0
76	0	0	0				0
77	0	0	0				0
78	0	0	0				0
79	0	0					
80	0						
81	0						
82	0						
83	0						
84	0						
Total number (thousand)	20	60	23	69			72
Total weight (t)	3	4	2	5			5
Mean weight (kg)	0.081	0.059	0.087	0.077			0.065
CL Mean length (mm)	35.8	39.4	42.0	42.2			45.0

Table 13.1.3. *Nephrops* in FUs 26–27, West Galicia and North Portugal. Fishing effort and LPUE for the SP-MATR fleet.

Year	Landings (t)	trips	LPUE (kg/trip)
1994	234	2692	87.0
1995	267	2859	93.2
1996	158	3191	49.5
1997	246	3702	66.3
1998	189	2857	66.0
1999	134	2714	49.5
2000	72	2479	28.9
2001	80	2374	33.6
2002	52	1671	31.2
2003	38	1597	24.0
2004	38	1986	19.2
2005	17	1629	10.3
2006	18	1547	11.9
2007	22	1196	18.1
2008	17	980	17.2
2009	7	517	14.1
2010	5	676	7.7
2011	3	513	6.0
2012	1	483	2.1
2013	< 1	418	1.0
2014	< 1	491	0.8
2015	< 1	384	0.8
2016	< 1	396	0.8
2017	< 1	386	0.3
2018	< 1	369	1.1
2019	< 1	383	0.3
2020*	na	na	na

***No estimate can be made in 2020 as sampling was only partially conducted due to COVID-19 disruption and administrative issues.**

Table 13.1.4. *Nephrops* FU 26–27, West Galicia and North Portugal: Biomass index from Spanish International Bottom Trawl Survey in FU26 (SPGFS-WIBTS-Q4, code G2784), Portuguese International Bottom Trawl Survey in FU27 (PTGFS-WIBTS-Q4, code G8899) and combined index estimated from both surveys (G2784_ G8899) in g/h.

Years	Spanish International Bottom Trawl Survey (G2784)	Portuguese International Bottom Trawl Survey (G8999)							Combined index (G2784-G8999)
	FU26	FU27							FU26-27
	GAL	CAM	MAT	AVE	FIG	BER	LIS	All sectors	
1983	711.11								0.0304
1984	382.53								0.0164
1985	261.67	12.03	3.81	0.00	0.00	10.77	0.00	0.0014	0.0123
1986	866.49	0.00	0.00	0.00	0.00	0.00	0.00	0.0000	0.0371
1987	na	8.56	0.00	0.00	0.00	0.00	0.00	0.0004	na
1988	1488.09	0.00	0.00	0.00	0.00	0.00	0.00	0.0000	0.0636
1989	643.79	49.66	0.00	19.09	0.00	202.68	0.00	0.0142	0.0391
1990	1495.42	293.99	50.12	164.78	5.45	18.31	69.77	0.0316	0.0897
1991	3460.29	377.36	0.00	8.47	0.15	22.69	6.77	0.0218	0.1658
1992	971.21	300.42	0.00	58.89	2.92	23.15	0.00	0.0202	0.0580
1993	239.85	160.92	4.89	10.89	11.36	41.64	0.00	0.0121	0.0201
1994	146.91	4.77	0.00	0.00	0.00	77.87	0.00	0.0043	0.0098
1995	748.55	16.14	0.00	26.54	112.50	592.77	0.00	0.0393	0.0640
1996	117.28	87.55	0.00	0.00	0.00	59.63	0.00	0.0077	0.0113
1997	163.11	174.52	0.00	158.77	1.54	164.28	43.66	0.0285	0.0302
1998	315.49	0.00	0.00	138.11	0.00	56.96	0.00	0.0102	0.0218
1999	359.80	26.06	0.00	0.00	0.00	0.00	0.00	0.0014	0.0165
2000	188.58	33.16	0.00	105.84	2.34	115.32	0.00	0.0135	0.0190
2001	610.60	4.44	0.00	0.00	0.00	63.91	0.00	0.0036	0.0290
2002	59.95	18.62	0.00	0.00	0.00	0.00	0.00	0.0010	0.0034
2003	88.02	33.50	0.00	0.00	8.28	0.00	0.00	0.0022	0.0056
2004	44.56	0.00	0.00	0.00	0.00	0.00	0.00	0.0000	0.0019
2005	15.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0000	0.0007
2006	78.31	0.00	0.00	0.00	0.00	0.00	0.00	0.0000	0.0033
2007	28.34	0.00	0.00	0.00	4.36	0.00	0.00	0.0002	0.0014
2008	46.64	18.87	0.00	0.00	0.00	0.00	0.00	0.0010	0.0028
2009	30.41	0.00	0.00	0.00	0.00	0.00	0.00	0.0000	0.0013
2010	135.44	0.00	0.00	0.00	0.00	0.00	0.00	0.0000	0.0058
2011	20.04	0.00	0.00	0.00	0.00	0.00	0.00	0.0000	0.0009
2012	9.47	0.00	0.00	0.00	0.00	0.00	0.00	0.0000	0.0004
2013	81.30	0.00	0.00	0.00	0.00	0.00	0.00	0.0000	0.0035
2014	21.39	0.00	0.00	0.00	0.00	0.00	0.00	0.0000	0.0009
2015	28.70	0.00	0.00	0.00	0.00	24.40	315.14	0.0178	0.0157
2016	62.34	0.00	0.00	0.00	0.00	79.26	0.00	0.0042	0.0061
2017	61.16	0.00	0.00	0.00	0.00	0.00	0.00	0.0000	0.0026
2018	54.76	0.00	0.00	0.00	0.00	0.00	0.00	0.0000	0.0023
2019	56.06	na	na	na	na	na	na	na	0.0024
2020	19.89	na	na	na	na	na	na	na	0.0009

Table 13.1.5. *Nephrops* in FUs 26–27, West Galicia and North Portugal. Biomass index from the GALNEP-26 in FU 26 and mean sizes by sex.

	Biomass survey index		Mean size		
Year	K/h	nº indiv./h	Males	Females	Combined
2019	0.74	11.4	43.98	39.95	42
2020	1.82	30.18	43.4	39.31	41.51

Table 13.1.6. *Nephrops* in FUs 26–27, West Galicia and North Portugal. SPICT input data.

Year	Catch (t)	New combined survey index (G2784_G8899) (g/h)
1975	622	
1976	603	
1977	620	
1978	575	
1979	580	
1980	599	
1981	823	
1982	736	
1983	786	0.030
1984	618	0.016
1985	765	0.012
1986	694	0.037
1987	742	na
1988	727	0.064
1989	708	0.039
1990	449	0.090
1991	603	0.166
1992	636	0.058
1993	522	0.020
1994	448	0.010
1995	511	0.064
1996	331	0.011
1997	433	0.030
1998	345	0.022
1999	248	0.017
2000	132	0.019
2001	132	0.029
2002	87	0.003
2003	73	0.006
2004	71	0.002
2005	43	0.001
2006	44	0.003
2007	47	0.001
2008	42	0.003
2009	37	0.001
2010	26	0.006
2011	19	0.001
2012	7	0.000
2013	3	0.003
2014	3	0.001
2015	2	0.016
2016	5	0.006
2017	3	0.003
2018	2	0.002
2019	7	0.002
2020	5	0.001

Table 13.1.7. *Nephrops* in FU 26–27, West Galicia and North Portugal. Summary SPiCT results.

Parameter estimates W 95% CI

	estimate	cilow	ciupp	log.est
alpha	58.083	0.077	43604.620	4.062
beta	0.188	0.112	0.317	-1.671
r	0.191	0.131	0.280	-1.654
rc	0.139	0.073	0.265	-1.975
rold	0.109	0.042	0.281	-2.218
m	507.576	369.115	697.977	6.230
K	13029.563	7913.568	21452.965	9.475
q	0.001	0.001	0.002	-7.094
n	2.757	1.501	5.066	1.014
sdb	0.015	0.000	11.098	-4.209
sdf	0.509	0.388	0.668	-0.676
sdi	0.864	0.685	1.088	-0.147
sdc	0.096	0.065	0.141	-2.347

Stochastic Reference Points W 95% CI

	estimate	cilow	ciupp	log.est
B_{MSY}	7309	3822.415	13977.373	8.897
F_{MSY}	0.069	0.036	0.132	-2.670
MSYs	506	368.377	696.197	6.227
$B_{trigger}$ = 0.5*B_{MSY}	3655	1911	6989	
B_{lim} = 0.3*B_{MSY}	2193	1147	4193	
F_{lim} =1.7*F_{MSY}	0.12	0.06	0.23	

Estimated states W 95% CI

	estimate	cilow	ciupp	log.est
B_2020.94	156	70	348	5.049
F_2020.94	0.030	0.011	0.079	-3.523
B_2020.94/B_{MSY}	0.021	0.007	0.061	-3.848
F_2020.94/F_{MSY}	0.426	0.132	1.381	-0.853

Predictions W 95% CI

	prediction	cilow	ciupp	log.est
B_2023.00	183	75	446	5.212
F_2023.00	0.030	0.005	0.168	-3.523
B_2023.00/B_{MSY}	0.025	0.007	0.085	-3.685
F_2023.00/F_{MSY}	0.426	0.067	2.718	-0.853
Catch_2022.00	5.2	1.4	18.7	1.6
E(B_inf)	10856	NA	NA	9.293

Table 13.1.8. *Nephrops* in FUs 26–27, West Galicia and North Portugal. SPiCT estimates for B/B_{MSY} and F/F_{MSY}. CI, 95% confidence intervals.

Year	B/B_{MSY}			F/F_{MSY}		
	Estimate	CI low	CI high	Estimate	CI low	CI high
1975	0.909	0.581	1.424	1.351	0.719	2.538
1976	0.893	0.574	1.389	1.367	0.732	2.554
1977	0.878	0.568	1.357	1.358	0.728	2.533
1978	0.863	0.562	1.327	1.348	0.722	2.515
1979	0.851	0.556	1.302	1.425	0.762	2.663
1980	0.838	0.550	1.276	1.821	1.044	3.175
1981	0.815	0.538	1.235	1.997	1.204	3.313
1982	0.770	0.513	1.158	2.090	1.261	3.464
1983	0.732	0.490	1.093	1.939	1.171	3.211
1984	0.689	0.464	1.023	2.042	1.224	3.404
1985	0.662	0.447	0.982	2.343	1.412	3.889
1986	0.619	0.419	0.914	2.428	1.455	4.052
1987	0.579	0.393	0.853	2.724	1.636	4.537
1988	0.531	0.361	0.781	3.087	1.863	5.116
1989	0.481	0.328	0.704	2.420	1.453	4.029
1990	0.432	0.296	0.632	2.411	1.420	4.093
1991	0.410	0.278	0.607	3.496	2.073	5.898
1992	0.369	0.249	0.548	3.615	2.141	6.104
1993	0.318	0.215	0.472	3.288	1.926	5.614
1994	0.278	0.186	0.414	4.060	2.369	6.957
1995	0.243	0.162	0.365	3.895	2.275	6.670
1996	0.199	0.133	0.299	4.289	2.464	7.463
1997	0.172	0.113	0.261	6.035	3.543	10.279
1998	0.132	0.088	0.198	6.135	3.682	10.223
1999	0.097	0.066	0.142	4.540	2.768	7.446
2000	0.073	0.051	0.104	4.253	2.597	6.965
2001	0.061	0.043	0.087	4.291	2.672	6.892
2002	0.050	0.035	0.070	3.522	2.175	5.701
2003	0.043	0.030	0.060	4.058	2.533	6.499
2004	0.037	0.026	0.052	3.386	2.119	5.410
2005	0.031	0.022	0.043	2.891	1.778	4.702
2006	0.028	0.020	0.040	3.641	2.241	5.915
2007	0.025	0.018	0.036	4.099	2.507	6.703
2008	0.021	0.015	0.031	4.438	2.670	7.379
2009	0.018	0.012	0.027	4.100	2.354	7.141
2010	0.015	0.009	0.023	3.684	1.964	6.911
2011	0.013	0.007	0.022	1.950	0.955	3.979
2012	0.011	0.006	0.022	0.668	0.311	1.435
2013	0.012	0.006	0.023	0.481	0.221	1.047
2014	0.012	0.006	0.025	0.323	0.144	0.724
2015	0.013	0.007	0.028	0.427	0.186	0.983
2016	0.015	0.007	0.031	0.543	0.228	1.294
2017	0.016	0.007	0.035	0.233	0.091	0.596
2018	0.017	0.007	0.040	0.388	0.145	1.037
2019	0.019	0.008	0.046	0.650	0.226	1.872
2020	0.020	0.008	0.053	0.426	0.128	1.417
2021	0.021	0.007	0.062			
Average	**0.305**	**0.202**	**0.462**	**2.581**	**1.508**	**4.456**

Table 13.1.9. *Nephrops* in FUs 26–27, West Galicia and North Portugal. Estimates of catch, B/B_{MSY} and F/F_{MSY} for the scenarios proposed and CI 95%.

SPiCT timeline:

Observations	Intermediate	Management
1975.00 - 2021.00	2021.00 - 2022.0(	2022.00 - 2023.00

Management evaluation: 2023.00

Predicted catch for management period and states at management evaluation time:

	C	B/Bmsy	F/Fmsy	B	F	perc.dB	perc.dF
1 F=0	0	0.03	0	188.9	0	12	-100
2 F=Fsq	5.2	0.03	0.43	183.4	0.03	8.8	0
3 F=Fmsy	0	0.03	0	188.9	0	12	-100
4 F=Fmsy_C_fr	0	0.03	0	188.9	0	12	-100

95% confidence intervals for states:

	B/Bmsy.lo	B/Bmsy.hi	F/Fmsy.lo	F/Fmsy.hi	B.lo	B.hi	F.lo	F.hi
1 F=0	0.01	0.09	0	0	79.6	448.3	0	0
2 F=Fsq	0.01	0.09	0.07	2.72	75.5	445.9	0.01	0.17
3 F=Fmsy	0.01	0.09	0	0	79.6	448.3	0	0
4 F=Fmsy_C_fr	0.01	0.09	0	0	79.6	448.3	0	0

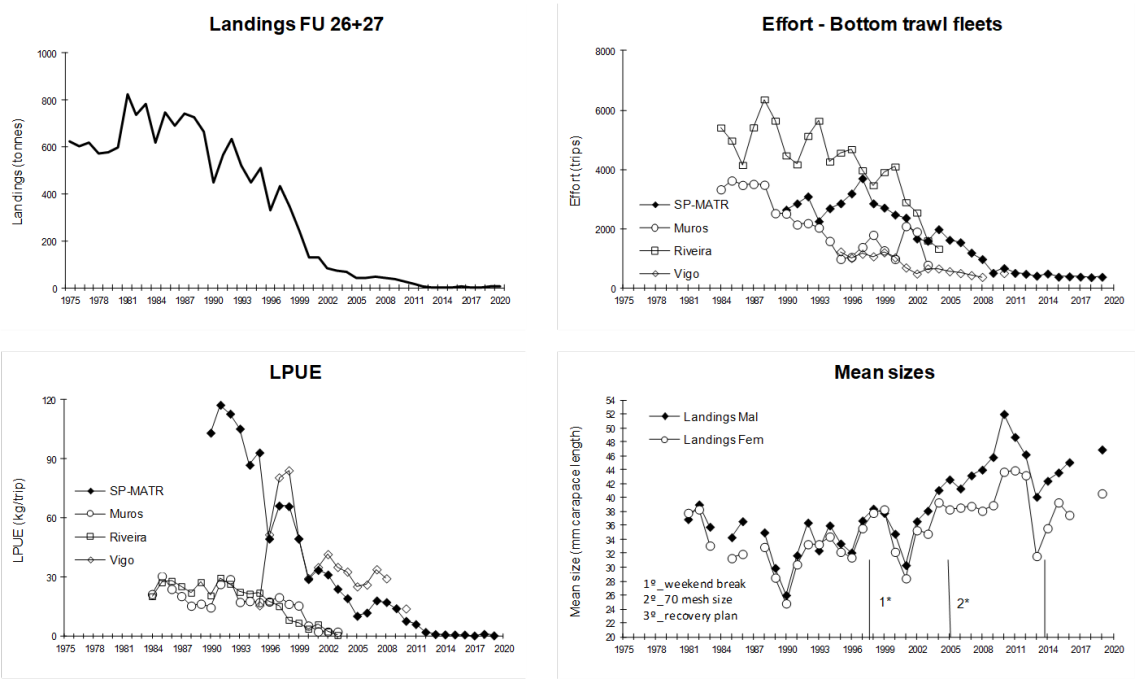

Figure 13.1.1. Figure 13.1.1. Nephrops in FUs 26–27. West Galicia and North Portugal. Long-term trends in landings, effort and mean sizes. Effort, LPUE and mean sizes for 2020 are not available.

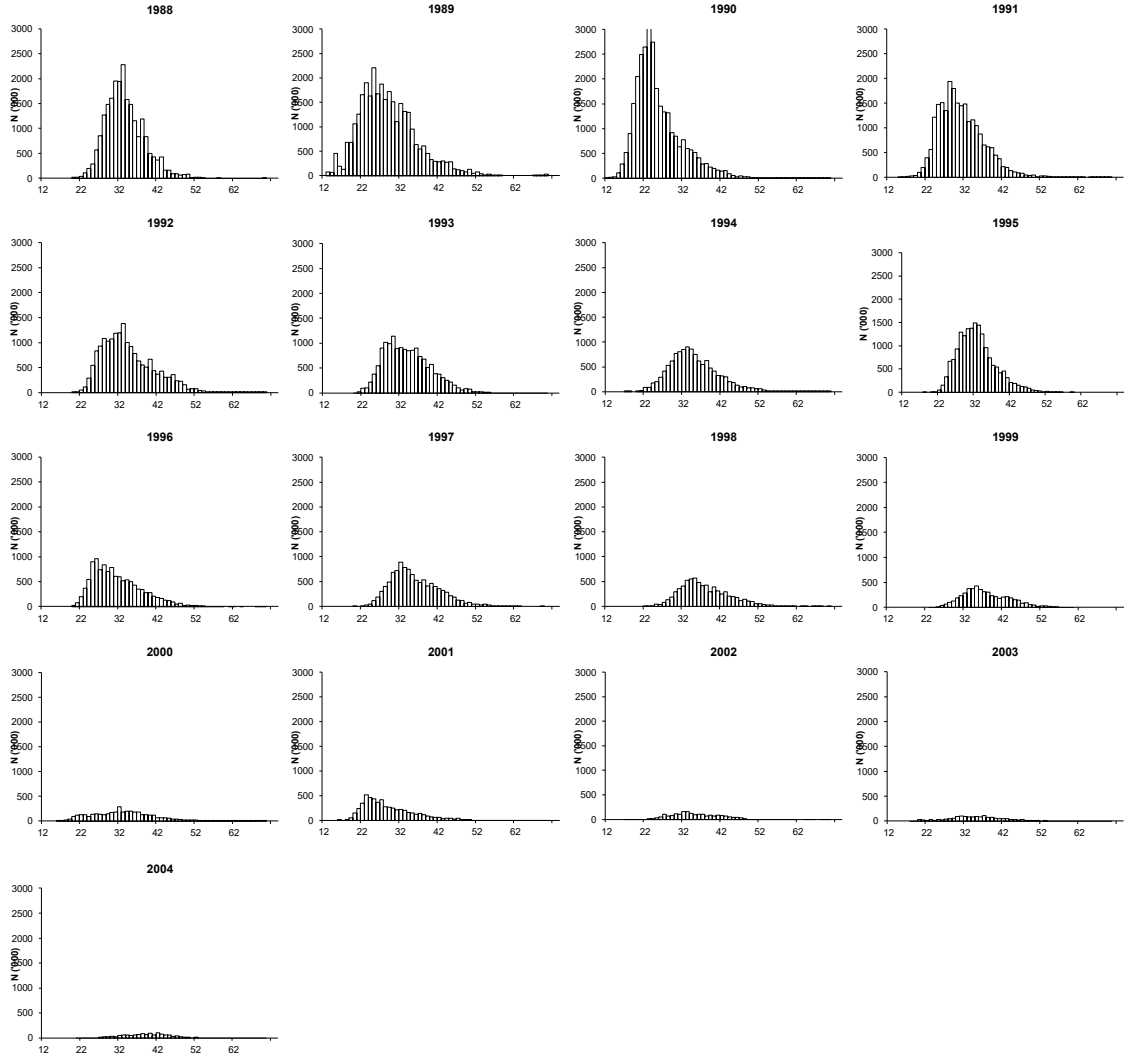

Figure 13.1.2a. *Nephrops* in FUs 26–27. West Galicia and North Portugal. Length–frequency distributions in landings for the 1988–2004 period.

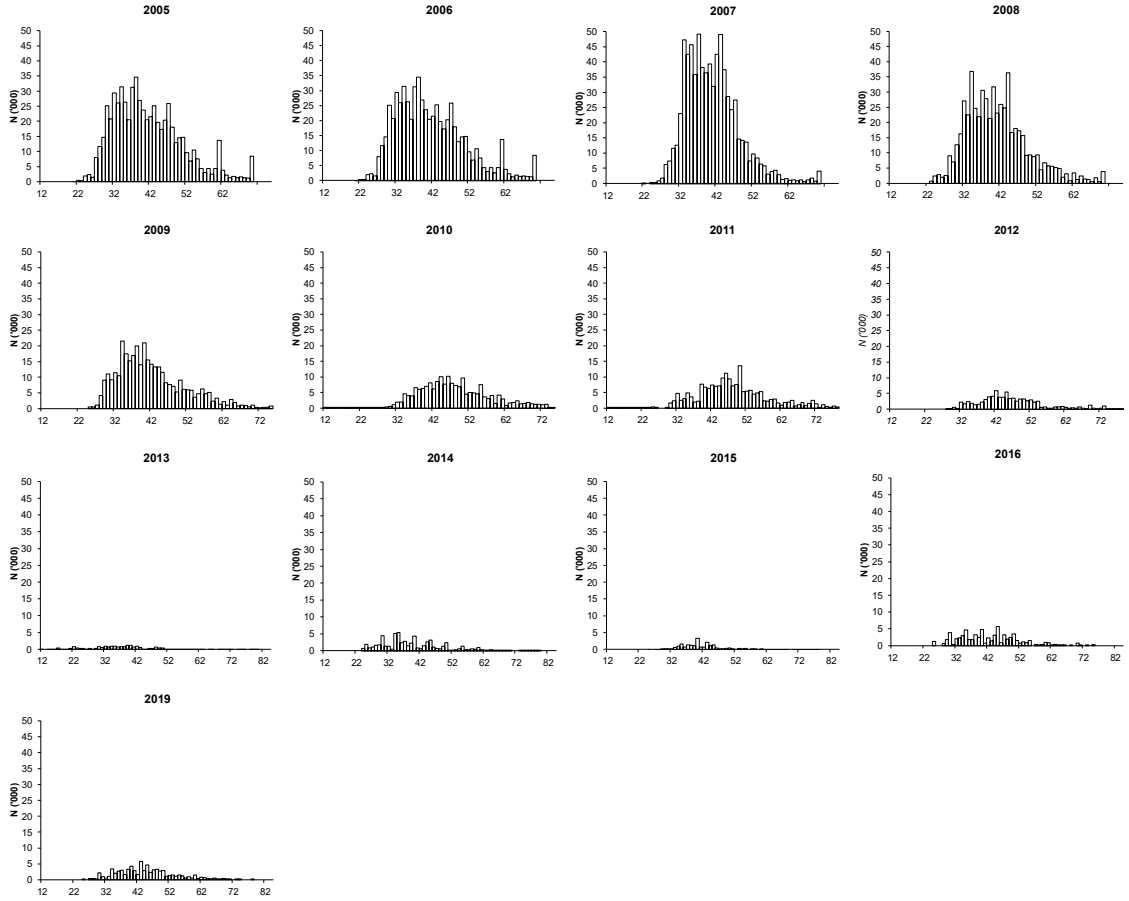

Figure 13.1.2b. *Nephrops* in FUs 26–27. West Galicia and North Portugal. Length–frequency distributions in landings for the 2005–2019 period. Data not available for 2017, 2018 and 2020.

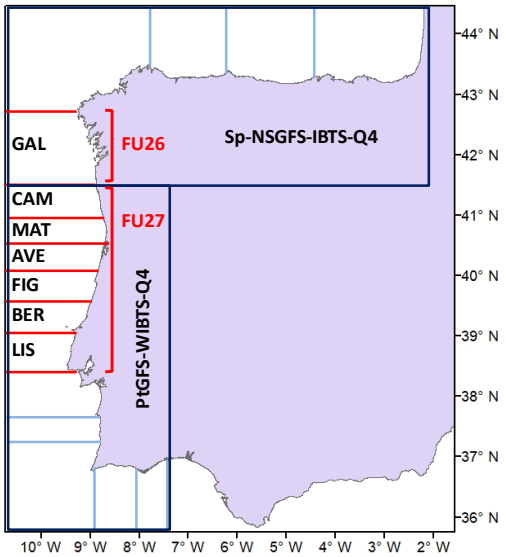

Figure 13.1.3. *Nephrops* in FUs 26–27. West Galicia and North Portugal. Area sectors covered by the Spanish International Bottom Trawl Survey-Q4 (G2784) in FU 26 and the Portuguese International Bottom Trawl Survey-Q4 (G8899) in FU 27. (GAL:Miño-Fisterra; CAM: Caminha; MAT: Matosinhos; AVE: Aveiro; FIG: Figueira da Foz; BER: Berlengas; LIS: Lisbon).

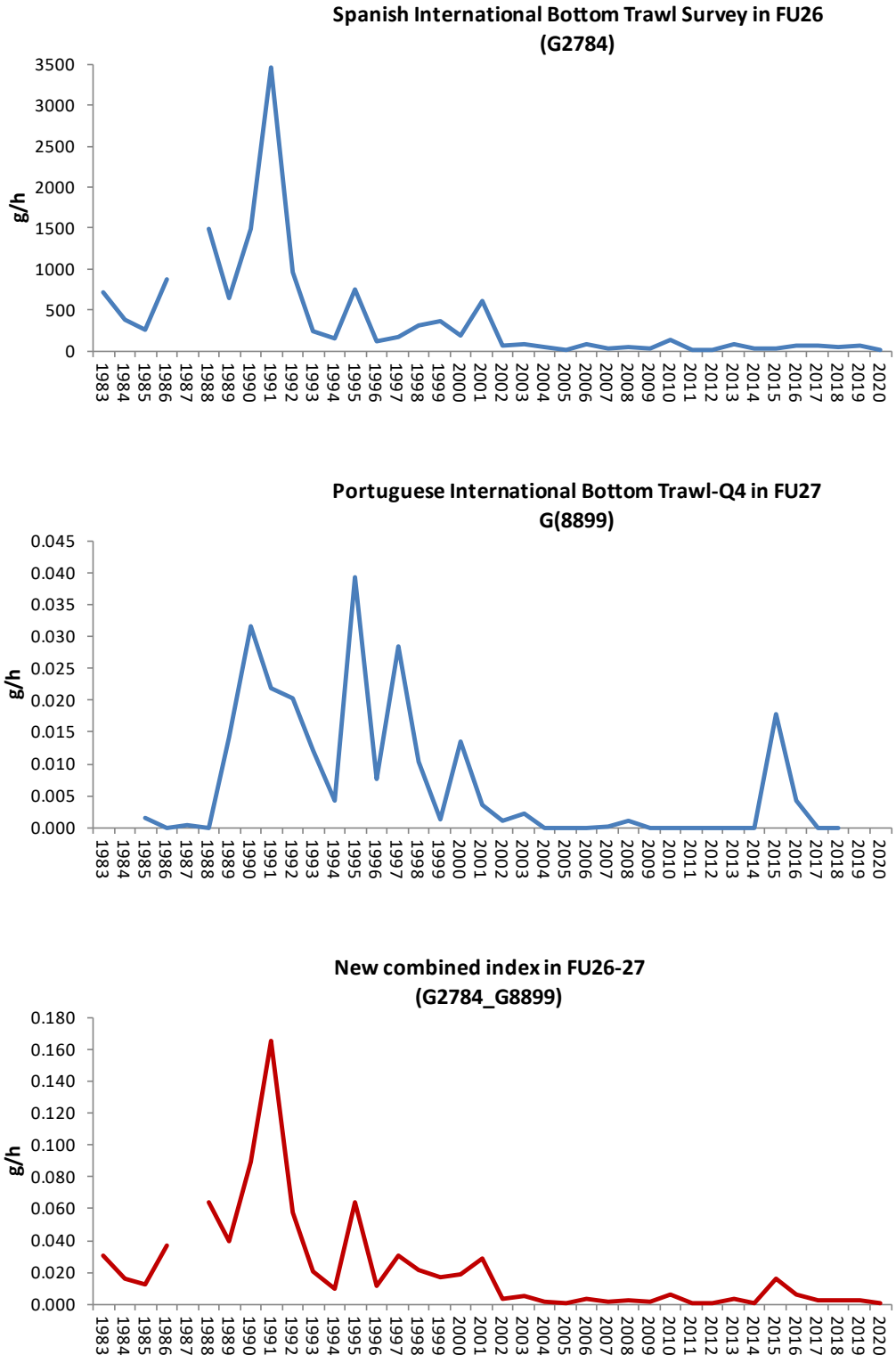

Figure 13.1.4. ***Nephrops*** **in FUs 26–27. West Galicia and North Portugal. Biomass index (g/h) from Spanish International Bottom Trawl Survey-Q4 (G2784) in FU 26 (top panel), Portuguese International Bottom Trawl Survey-Q4 (G8899) in FU 27 (middle panel) and the new combined index from both surveys in FUs 26–27 (G2784_G8899) (bottom panel).**

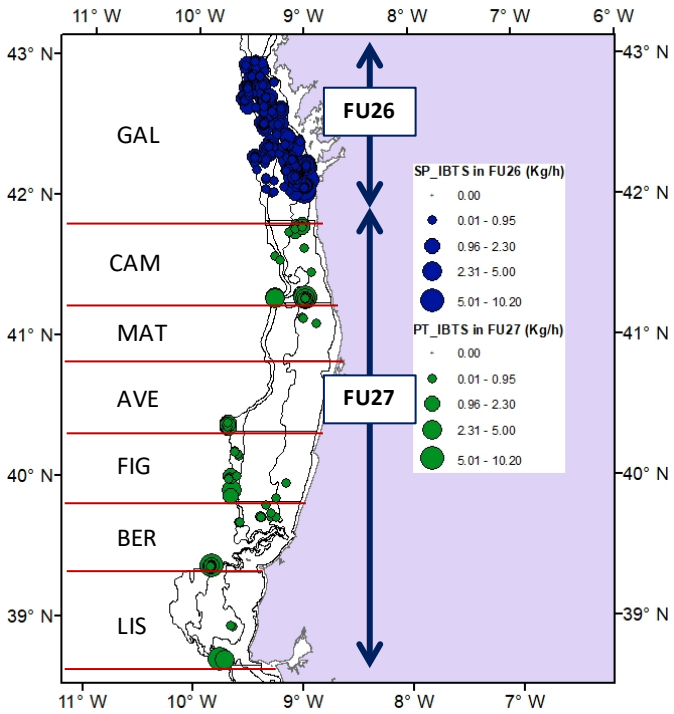

Figure 13.1.5. *Nephrops* in FU 26–27. West Galicia and North Portugal. *Nephrop*s spatial distribtion in FUs 26–27 from the Spanish (G2784) and Portuguese (G8899) International Bottom Trawl Surveys (blue and green, respectively) for the entire period (1983–2020). (GAL:Miño-Fisterra; CAM: Caminha; MAT: Matoshinhos; AVE: Aveiro; FIG: Figueira da Foz; BER: Berlengas; LIS: Lisbon).

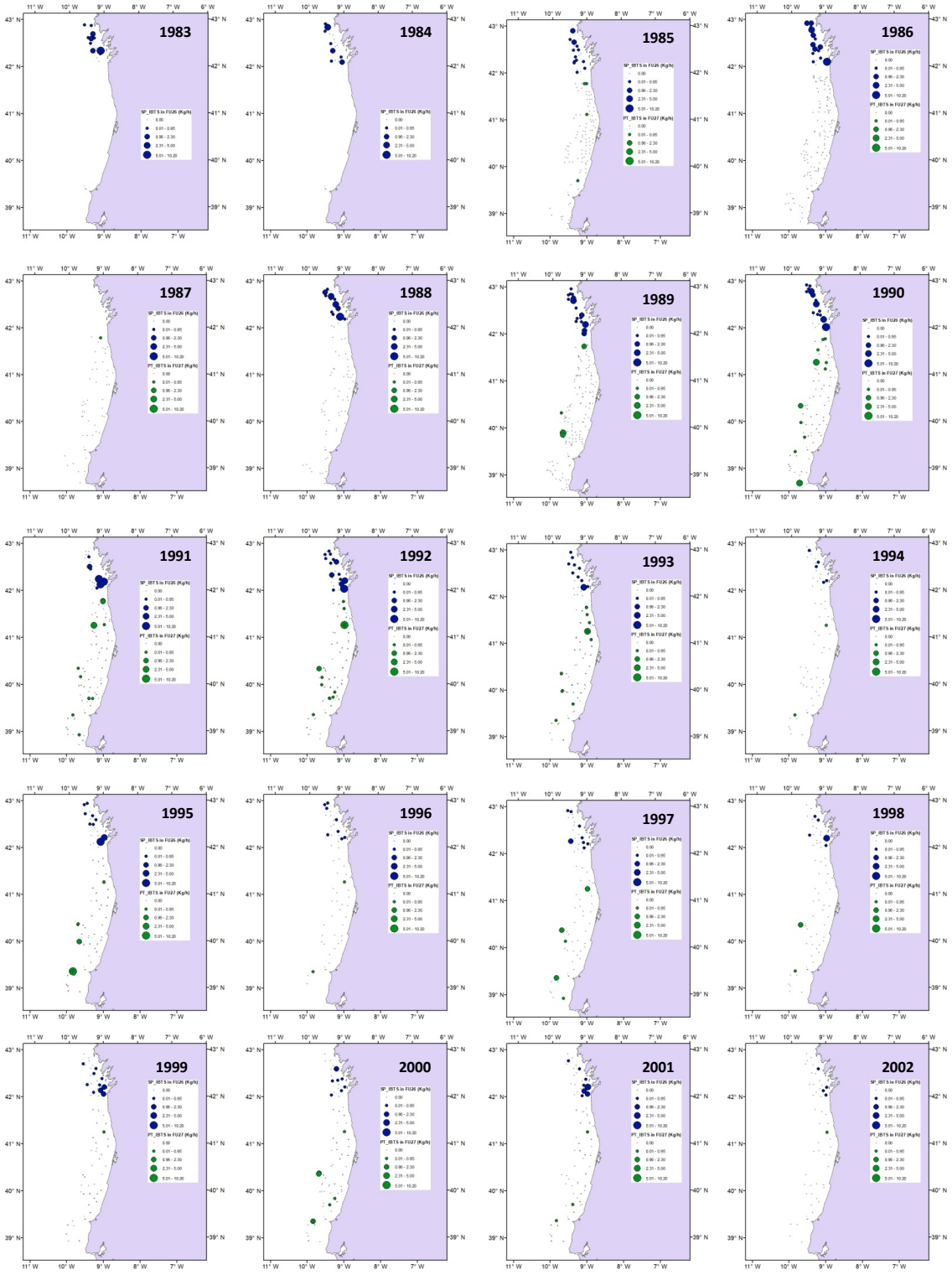

Figure 13.1.6a. *Nephrops* in FUs 26–27. West Galicia and North Portugal. Annual *Nephrops* spatial distribution from Spanish (G2784) and Portuguese (G8899) International Bottom Trawl Surveys (blue and green, respectively) for 1983–2002 period.

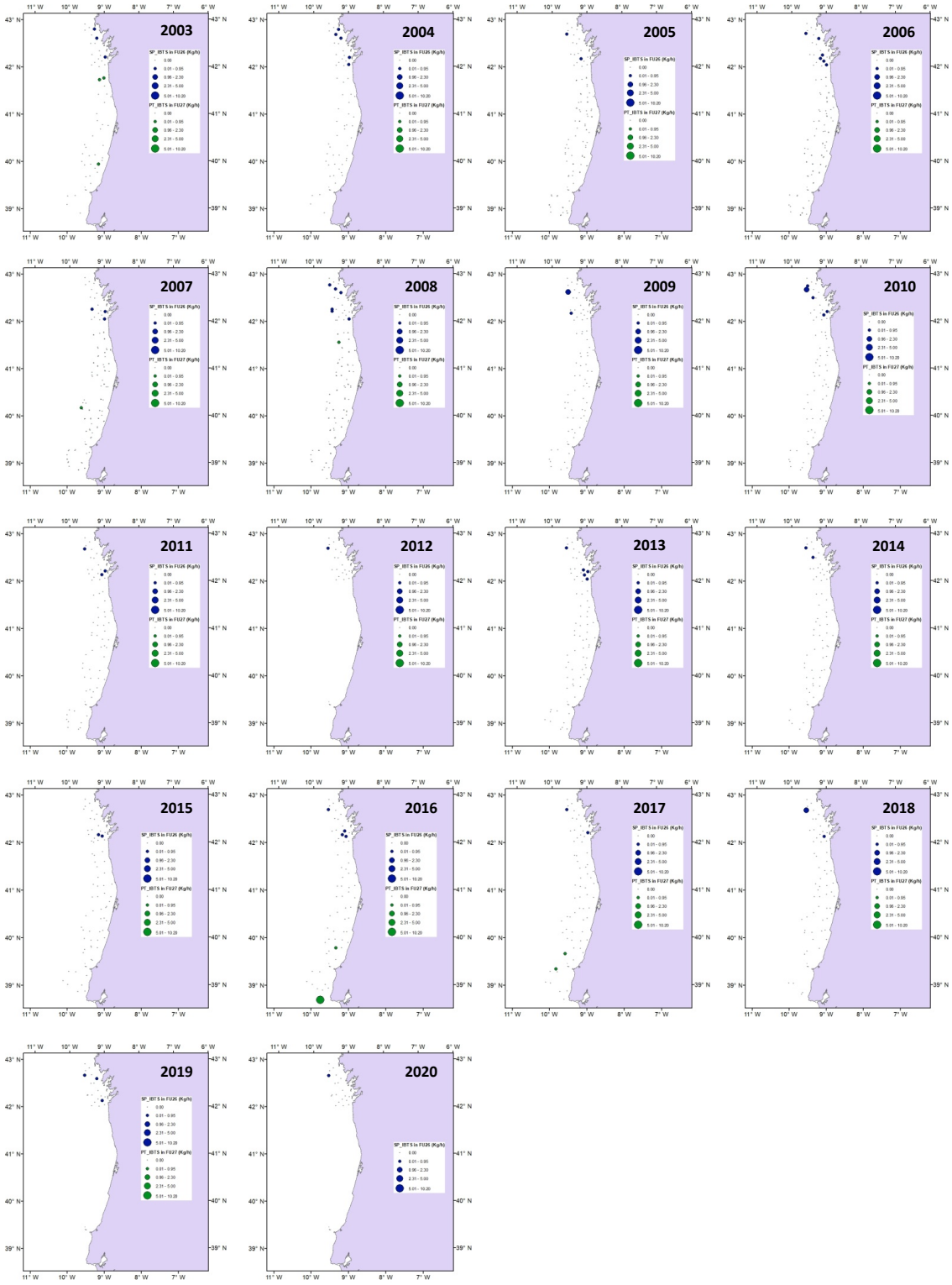

Figure 13.1.6b. *Nephrops* in FUs 26–27. West Galicia and North Portugal. Annual *Nephrops* spatial distribution from Spanish (G2784) and Portuguese (G8899) International Bottom Trawl Surveys (blue and green, respectively) for 2003–2020 period.

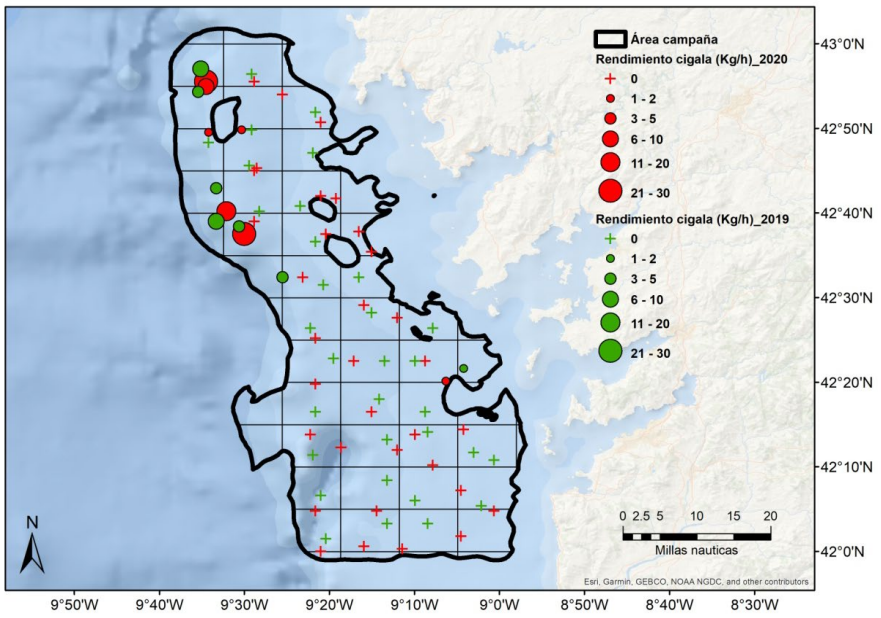

Figure 13.1.7. *Nephrops* in FUs 26–27. West Galicia and North Portugal. *Nephrops* biomass spatial distribution from the 2019 (green bubble) and 2020 (red bubble) GALNEP_26 survey in FU 26.

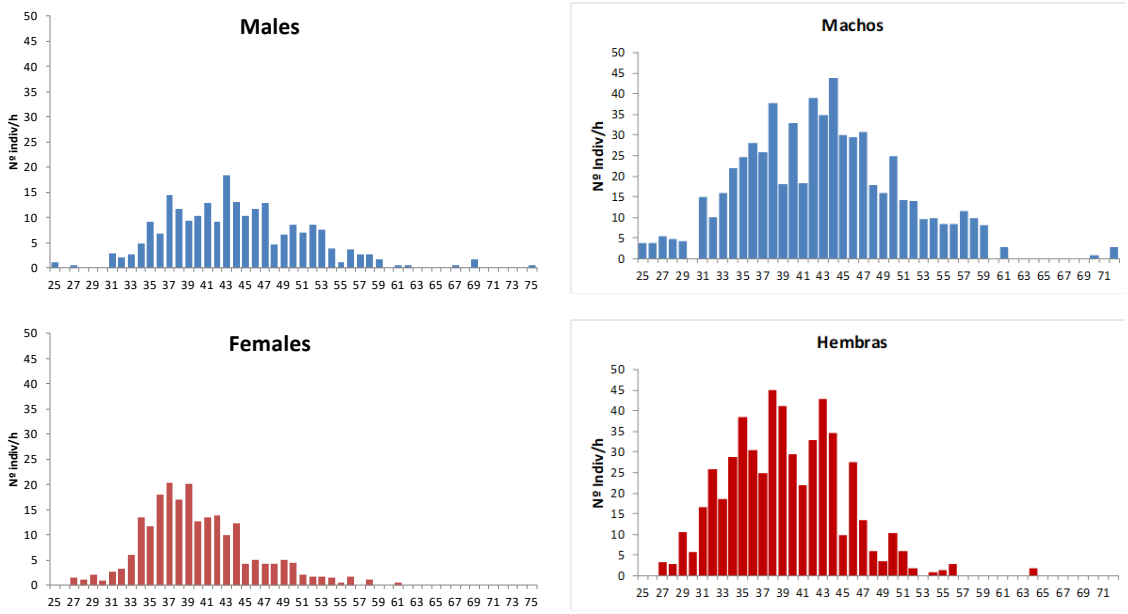

Figure 13.1.8.*Nephrops* in FUs 26–27. West Galicia and North Portugal. Length–frequency distribution by sex from GALNEP-26 survey.

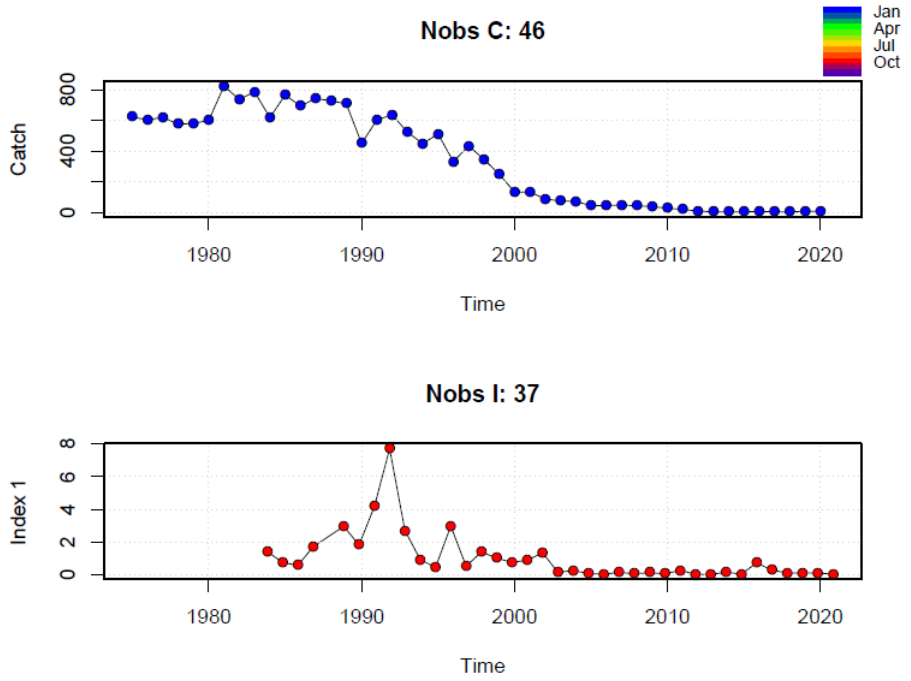

Figure 13.1.9. ***Nephrops*** **in FUs 26–27. West Galicia and North Portugal Input data in the SPiCT Model. Total landings (tonnes) in FUs 26–27 (1975–2020, top panel) and new combined index (G2784_G8899) in FUs 26–27 (1983 – 2020, lower panel).**

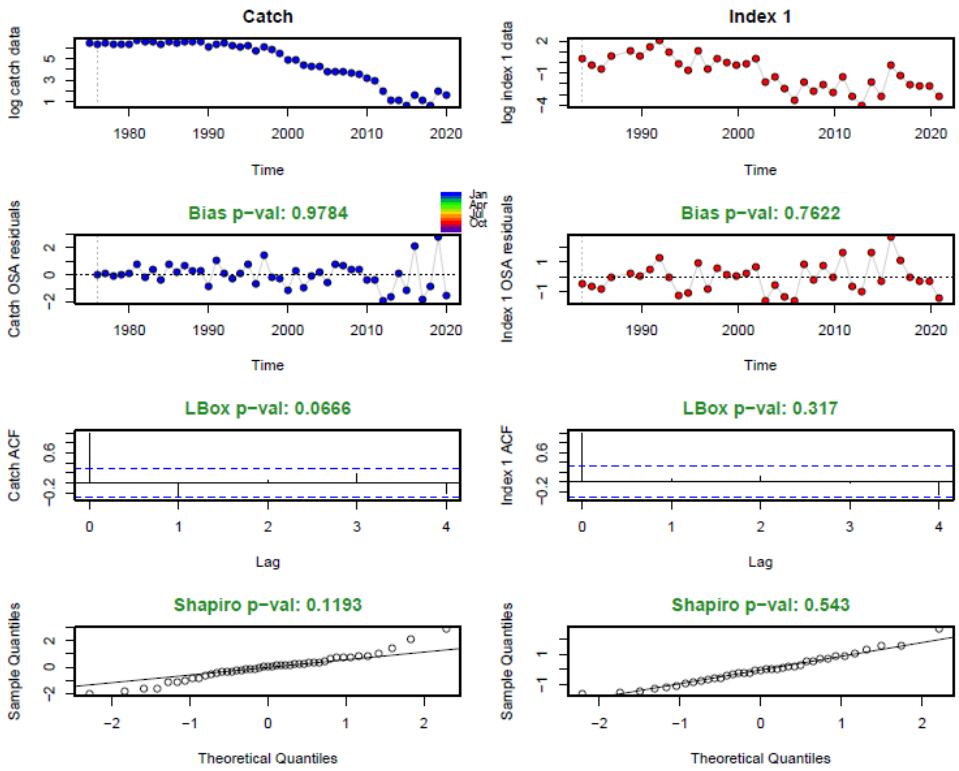

Figure 13.1.10. ***Nephrops*** **in FUs 26–27. West Galicia and North Portugal. SPiCT Model: Diagnostics. Row1, Log of the input dataseries. Row 2, OSA residuals with the p-value of a test for bias. Row 3, Empirical autocorrelation of the residuals with tests for significant autocorrelation. Row 4, Tests for normality of the residuals, QQ-plot and Shapiro test.**

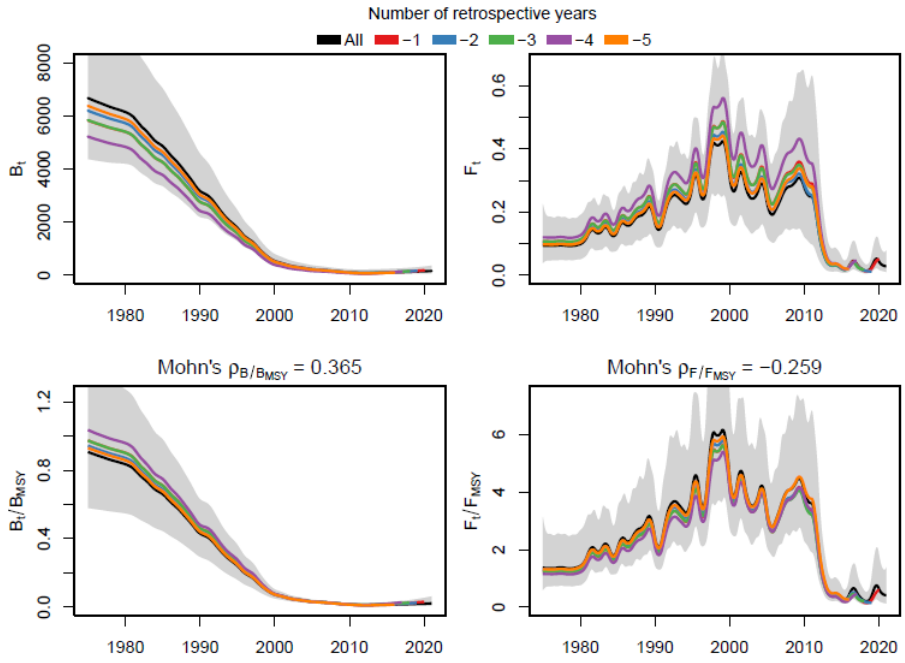

Figure 13.1.11. ***Nephrops*** **in FUs 26–27. West Galicia and North Portugal. SPiCT Model: 5 years' retrospective pattern. Absolute biomass and fishing mortality. (top panel); Relative biomass and fishing mortality (Bottom panel). Grey regions represent the 95% CIs.**

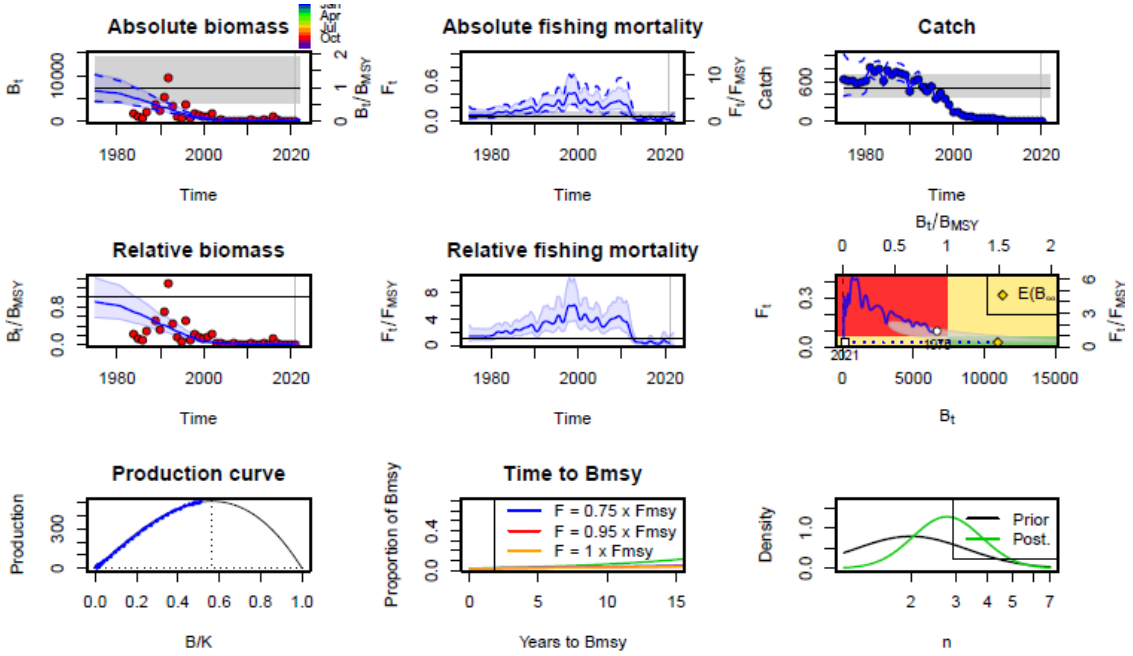

Figure 13.1.12. ***Nephrops*** **in FUs 26–27. West Galicia and North Portugal. SPiCT Model: Results. Absolute biomass, fishing mortality and catch (top panel); Relative biomass, fishing mortality and Kobe plot (middle panel), Production curve and n density plot (bottom panel). Solid blue lines are estimated values; vertical grey lines indicate the time of the last observation beyond which dotted lines indicate forecasts; dashed lines are 95% CIs for absolute estimated values; shaded blue regions are 95% CIs for relative estimates; grey regions represent 95% CIs for estimated absolute reference.**

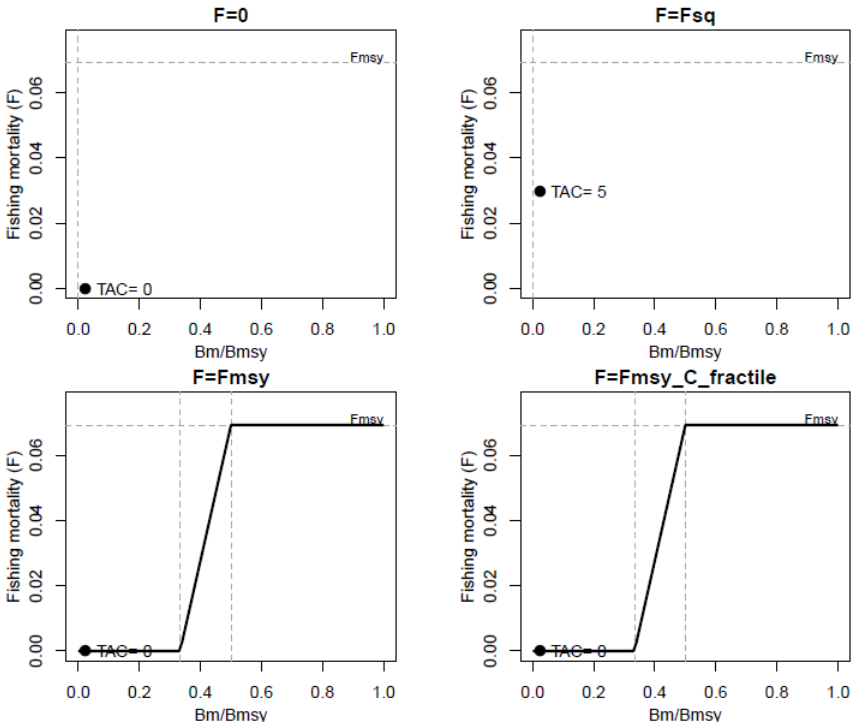

Figure 13.1.13. *Nephrops* in FUs 26–27. West Galicia and North Portugal. Harvest control rule for the four scenarios used in the forecast.

13.2 *Nephrops* in Functional Units (FUs) 28–29 (SW and S Portugal)

13.2.1 General

13.2.1.1 Ecosystem aspects

See Stock Annex.

13.2.1.2 Fishery description

See Stock Annex (in Annex L of this WG report)

13.2.1.3 ICES Advice for 2021 and management applicable for 2020 and 2021

ICES Advice for 2021

The advice for this stock is biennial and valid for 2020 and 2021. Based on the ICES approach for data-limited stocks (DLSs), ICES advises that catches in 2021 for FUs 28 and 29 should be no more than 309 t.

To ensure that the stock in FUs 28 and 29 are exploited sustainably, ICES advises that management should be implemented at the FU level.

Management applicable for 2020 and 2021

A recovery plan for southern hake and Iberian *Nephrops* stocks was enforced since the end of January 2006. The aim of the recovery plan was to rebuild the stocks within 10 years, with a reduction of 10% in F relative to the previous year and the TAC set accordingly (Council Regulation (EC) No 2166/2005, 2005). ICES did not evaluate the recovery plan for *Nephrops* in relation to the precautionary approach. This plan was based on precautionary reference points for

southern hake that are no longer appropriate. A new Management Plan for Western Waters (Regulation (EU) 2019/472, 2019a) was established in 2019 for demersal species including *Nephrops* in these FUs and the former recovery plan was repealed. In the current Management Plan for Western Waters, applied to 2020 onwards, no effort limitations were established.

In order to further reduce the fishing pressure on *Nephrops* stocks in Division 9.a, seasonal restrictions were introduced in the trawl and creel fishery for two boxes (geographic areas) located in FUs 26 and 28, during the peak of the *Nephrops* fishing season. These restrictions are applied to *Nephrops* fishing in these boxes in June–August and May–August, respectively, which is an amendment by the Council Regulation (EC) No 2166/2005 (2005) of the previous one issued in 1998 (Council Regulation (EC) No 850/98, 1998). The latter was also repealed by a recent regulation (Regulation (EU) 2019/1241, 2019b) but kept the two boxes allowing fishing *Nephrops* only as bycatch.

The TAC set for the whole Division 9.a was 386 and 374 t for 2020 and 2021, respectively, of which no more than 6% may be taken in FUs 26 and 27, and no more than 77 t in 2020 and 65 t in 2021 may be taken in FU 30 (Council Regulation (EU) 2021/92, 2021).

13.2.2 Data

13.2.2.1 Commercial catches and discards

Table 13.2.1 and Figure 13.2.1 show the landings dataseries for these FUs. For the period 1984 to 1992, the recorded landings from FUs 28 and 29 have fluctuated between 420 and 530 t, with a long-term average of about 480 t, falling drastically down to 132 t in the period 1990–1996. From 1997 to 2005, landings increased to similar levels observed during the early 1990s then decreased until 2009. The landings values were approximately at the same level (≈ 150 t) for the years 2009–2011, presenting an increasing trend in the last period of the series. In recent years, the reduced TAC has limited the fishing activity, and the fishery has been closed for 1–2 months in the second semester from 2013 onwards.

Since 2011, landings include the Spanish official landings. Spanish vessels are licensed to fish for crustaceans in these FUs under a bilateral agreement since 2004. No data from these vessels' operations is available prior to 2011.

Spanish official landings are derived from logbooks. This source of information allows landings disaggregation by ICES statistical rectangles. In 2012 and 2013, *Nephrops* catches were recorded in statistical rectangles outside the FUs in Division 9.a were allocated to the closest rectangles in each FU. In 2014–2017, 100% of the caches were from FUs 28–29.

Males are the dominant component in most of the years in the time-series with an exception for 1995 and 1996 when total female landings exceeded male landings (ICES, 2006). The male:female ratio in 2019 and 2020 were 1.8:1.0 and 1.6:1.0, respectively.

Information on discards and on the sampling program was sent to the WG through the ICES Accessions. The frequency of *Nephrops* occurrence in discards samples is very low. Discards are negligible in this fishery and mostly due to quality and not related to the minimum landing size (MLS = 20 mm of carapace length). It was only in 2013 when the occurrence of *Nephrops* in discards samples was greater than 30% and a total amount of 3 t was estimated, with a high coefficient of variation (CV = 58%). In 2020, the Portuguese on-board sampling programme was compromised by the COVID-19 pandemic situation and the sampling only occurred during the first quarter of the year. Since discards were considered negligible for *Nephrops* during the whole sampling period 2004–2019, this was also assumed to be the case for the 2020 assessment.

13.2.2.2 Biological sampling

Length distributions for both males and females for the Portuguese trawl landings are obtained from samples taken weekly at the main auction port, Vila Real de Santo António. Sampling frequency in 2019 was at the same level as in previous years and occurred in months when the Norway lobster fishing was open. The sampling data were raised to the total landings by market size category, vessel, and month.

The length compositions by sex of the landings are presented in Tables 13.2.2a-b and Figures 13.2.2a-b. The number of samples and measured individuals are presented in Table 1.4a.

Length compositions for the period 2017–2019 were revised in 2020 due to a problem in the extraction process.

In 2020, *Nephrops* sampling in Portuguese markets was affected by the COVID-19 pandemic and no sampling was conducted during April, May, July, and August. Raising of the length compositions for the missing months was based on the mean length composition of the last three years (2017–2019) in each of those months.

13.2.2.3 Biomass indices from surveys

Trawl surveys

Since 1997, groundfish (PtGFS-WIBTS-Q4; G8899) and crustacean trawl surveys (NepS (FU 28–29)) were carried out every year, covering FUs 28 and 29. Table 13.2.3 and Figure 13.2.1 shows the average *Nephrops* cpues (kg/h trawling) from the crustacean trawl surveys, which can be used as an overall biomass index. As the surveys were performed with a smaller mesh size than the commercial fishery, this information provides a better estimation of the abundance for small-sized individuals. There was an increase in the overall biomass index in the period 2003–2005, and of small individuals in a particular juvenile concentration area in 2005, which could be an indication of higher recruitment.

The R/V "NORUEGA" had some technical problems in 2010 and could not trawl in areas deeper than 600 m. The survey plan had to be adapted accordingly. The cpue value estimated for 2010, the highest value for the whole series, was probably affected by this change. In 2011, due to an engine failure, the survey did not cover the whole area of *Nephrops* distribution. No cpue index was presented for this year. The following year, budgetary constraints of national scope led to the unfeasibility of the R/V NORUEGA to be repaired as well as the chartering of a replacement research vessel and, therefore, no survey was conducted in 2012.

The biomass index estimated from the 2013 survey is only comparable to the value of 2009, which covered the same area. Comparing the fraction of the area covered in 2011 and the same area in 2013, the biomass of *Nephrops* increased in the area of Alentejo (FU 28). The survey in 2011 did not cover the main area of concentration in Algarve (FU 29).

The survey area was adapted in 2014, taking into account the information from the fishing grounds obtained from the VMS data. Figure 13.2.3 shows the spatial distribution of the survey biomass index in the last 4 years.

In 2019, the survey was not conducted due to issues external to IPMA.

In 2020, the survey was also not conducted due to legal constraints at the national level that made it unfeasible for hiring fishing and vessel crews on time to undertake the survey. This was not due to the COVID-19 pandemic disruptions.

UWTV experiments

In 2005 and 2007, some experiments to collect UWTV images from the *Nephrops* fishing grounds were made with a camera hanging from the trawl headline. In 2008, the images collected from 9

stations in FU 28 with the same procedure showed very promising results. During the 2009 survey, a two-beam laser pointer was attached to the camera and UWTV images were recorded from 58 of the 65 sampled stations. The trawling speed and the water turbidity were the main problems affecting image clarity and the high variation of the camera height to the ground. Both factors contributed to significant variations in the field of view. It was not possible to guarantee that this method can be used for abundance estimation, mainly due to these uncertainties (information presented to SGNEPS 2012–Study Group of *Nephrops* Surveys (ICES, 2012b).

13.2.2.4 Mean sizes

Mean carapace length (CL) data for males and females in the landings and surveys are presented for the period 1994-2020 (Table 13.2.4). Figure 13.2.1 shows the mean CL trends since 1984. The mean sizes of males and females have fluctuated along the period with no apparent trend.

13.2.2.5 Commercial catch-effort data

The effort in 2003–2004 corresponds to only eleven months of fleet operations for each year as the crustacean fishery was experimentally closed in January 2003 and 30 days for *Nephrops* fishery in September–October 2004.

A Portuguese national regulation (Portaria no. 1142/2004, 2004) closed the crustacean fishery in January-February 2005 and enforced a ban in *Nephrops* fishing for 30 days in September – October 2005. As a result, the effort in 2005 corresponds only to nine months.

The recovery plan for southern hake and Iberian *Nephrops* stocks was approved in December 2005 and entered into force at the end of January 2006. This recovery plan includes a reduction of 10% in F relative to the previous year (Council Regulation (EC) No 2166/2005, 2005). As a result, the number of fishing days per vessel was progressively reduced. Additional days were allocated in 2010 to Spanish and Portuguese vessels within divisions 8.c and 9.a excluding the Gulf of Cádiz, on the basis of the permanent cessation of vessels from each country (Commission Decision No 2010/370/EU, 2010a; Commission Decision No 2010/415/EU, 2010 b).

Besides this effort reduction, the Council Regulation (EC) No 850/98 (1998) was amended by the Council Regulation (EC) No 2166/2005 (2005), with the introduction of two boxes in Division 9.a, with one of them located in FU 28. In the period of higher catches (May-August), this box is closed for *Nephrops* fishing. By way of derogation, fishing with bottom-trawls in these areas and periods is authorized provided that the bycatch of Norway lobster does not exceed 2% of the total weight of the catch. The same applies to creels that do not catch *Nephrops*.

The effort reduction measures were combined with a national regulation closing the crustacean fishery every year in January (Portaria no. 43/2006, 2006). In 2016, this period was extended until February. Besides the closed season in 2013–2016, the Portuguese vessels had to stop fishing for 1.5 to 2 months, in October-November, due to quota limitations. With regards to the Spanish fleet, the number of fishing days was reduced due to sanctions imposed by EC related to the catches exceeding the quota in 2012. The operation of this fleet was also affected in the Portuguese fishing grounds for the period 2013–2015.

Crustacean vessels target two main species, rose shrimp and Norway lobster, which have different market values. Depending on their abundance and availability, the effort is mostly directed at one species or the other (Figure 13.2.4). A standardized cpue series for *Nephrops* (Figure 13.2.5) based on Portuguese crustacean trawlers' logbooks and VMS records, is used to estimate the fishing effort in standard hours. The model used to standardize the cpue is described in the Stock Annex. In 2020, a new approach for the standardization of the cpue series to incorporate both positive and null catches of *Nephrops* was presented and accepted during the WKMSYSPiCT (ICES, 2021). Other improvements made to the model, include i) the incorporation of a variable to account for the spatial dimension of the *Nephrops* distribution (fishing ground), ii) the

replacement of the variables used to mimic the target fishing in the previous model, that was not truly independent from the response variable, by a cluster-based variable estimated from the catch composition of the main crustacean species caught by the fishery; iii) the inclusion of the 'vessel' variable as a random effect, and iv) the estimation of the mean standardized annual cpue considering all the factor levels and not only for a reference set of levels like in the previous model. The variability explained by the model increased from 51% to 60%, although both the previous and the new model produced similar trends (Figure 13.2.5).

Standardized effort in trawling hours is estimated based on the latest modelled series, dividing the total catch by the standardized cpue. In the period 2008–2020, the standardized fishing effort has fluctuated around an average of approximately 199 thousand hours (Table 13.2.5).

13.2.3 Assessment

The advice for this stock is biennial. The stock data were updated with the new information for 2020.

The advice is based on the standardized commercial cpue trend and the relative F obtained from Mean Length-Z (MLZ) model. According to the ICES data-limited approach, this stock is classified as category 3.2.0 (ICES, 2012).

The standardized effort (Figure 13.2.1) shows a consistent declining trend since 2005 reaching a historic low in 2009–2010. Since then, the effort has fluctuated at a low level due to a quota reduction derived from the application of the former recovery plan rules.

The standardized commercial cpue (Figure 13.2.5), used as an index of biomass, shows an overall increasing trend since 2014. Despite the decreasing values in the last three years, this index is still above the levels from 2014–2017. The crustacean survey biomass index also showed an increasing trend in 2014–2018 (Figure 13.2.3).

Length-based indicators (LBIs), defined at WKLIFE V (ICES, 2015), were used to assess the status of the stock conservation. The ratios L_c/L_{mat} and $L_{25\%}/L_{mat}$ indicate that immature individuals are preserved. However, $P_{mega} < 30\%$ indicates a truncated length distribution of the female catch which may be explained by their reproductive behaviour of not leaving the burrows during the egg-bearing period (Table 13.2.6 and Figure 13.2.6).

Assuming a constant M of 0.3 for males and 0.2 for females, F was estimated using the MLZ method as defined in WKLIFE-V (ICES, 2015) and WKProxy (ICES, 2016). The input data and the output of Gedamke and Hoenig (G&H; Gedamke and Hoenig, 2006) and Then, Hoenig and Gedamke (THoG; Then, 2014) models are summarized in Table 13.2.7. Figures 13.2.7 and 13.2.8 show the model diagnostics for G&H model and the F series estimated by the THoG model.

G&H model with two periods gives a better fit and a lower AIC. For the last period, fishing mortality was estimated at 0.17 for males and 0.10 for females.

The results indicate that the stock is exploited at a level below the F_{MSY} proxy, either with the Gedamke & Hoenig or the THoG model, although the latter gives much lower F values. The M value estimated by the THoG model is also greater than the fixed M, historically assumed for *Nephrops* stocks. The results of the models were accepted using fixed values for M (0.3 for males and 0.2 for females) which give higher F values, although still below F_{MSY}.

Length-based Stock Potential Ratio (LBSPR), defined at WKLIFE V (ICES, 2015), was used to estimate the values of ratio F/M, selectivity-at-length, and the resulting SPR (Hordyk *et al*., 2015) (Figure 13.2.9). As one of the assumptions of the model is parity of the sex ratio of the catch, and males are more abundant in catches than females, the recommendation is to only consider the model for females (Hordik *et al*., 2015). The lowest F/M and highest SPR are observed since 2000.

The SPR estimates are above SPR target (30–40%) which indicate that the spawning-stock biomass (SSB) is maintained at a sustainable level (ICES, 2015).

In February 2021, a Benchmark workshop (WKMSYSPiCT) on the application of SPiCT to produce MSY advice for selected stocks including *Nephrops* in FUs 28–29 was conducted (ICES, 2021). Given the input data available for the stock, different model configurations produced contradictory results and it was not possible to distinguish between two alternative stock statuses. For this reason, the SPiCT model was not accepted to provide assessment and advice for this stock. Thus, the stock remains in category 3.

13.2.4 Biological reference points

Proxies of MSY reference points were reviewed in WGBIE 2017 (ICES, 2017) using the methods developed in WKLIFE V and WKProxy (ICES, 2015; 2016). From length-based analysis of the period 1984–2016, the values of $F_{0.1}$ were updated at 0.23 for males and 0.24 for females, as proxies of F_{MSY}. No proxy for B_{MSY} was identified (ICES, 2017).

In November 2019, a workshop on methodologies for *Nephrops* reference points was held in Lisbon to evaluate reference point estimation methods for stocks with UWTV surveys and to evaluate the utility of other modelling frameworks to assess and provide reference points for *Nephrops* stocks (ICES, 2020). Besides the LBIs and MLZ models (WKLIFE V, ICES, 2015) which are already used in the assessment of this stock, other approaches as Separable Cohort Analysis (*SCA* R package, version 1.2.0; Bell, 2019), Separable Length Cohort Analysis (SLCA – *nepref* R package, version 0.2.2; Dobby, 2019), Length-based Stock Potential Ratio (LBSPR, Hordyk *et al*., 2015) and Surplus Production in Continuous Time (SPiCT, Pedersen and Berg, 2017) were tested.

13.2.5 Management considerations

Nephrops is caught by a multispecies and mixed bottom-trawl fishery.

A recovery plan for southern hake and Iberian *Nephrops* stocks was approved in December 2005 and in action since the end of January 2006 (Council Regulation (EC) No 2166/2005, 2005). This recovery plan includes a reduction of 10% in the hake F relative to the previous year and TAC set accordingly, within the limits of ± 15% of the previous year TAC. Although no clear targets were defined for Norway lobster stocks in the plan, the same 10% reduction has been applied to these stocks' TAC. The number of allowed fishing days is set in each year by EU regulation fixing the fishing opportunities for fish stocks, applicable in Union waters. The recovery plan target and rules have not been changed since it was implemented. In March 2019, a new multiannual plan (MAP) for stocks fished in the Western Waters (including the *Nephrops* stocks in these FUs) and adjacent waters was established, repealing the previous recovery plan (Regulation (EU) 2019/1241, 2019b).

Besides the recovery plan, the Council Regulation (EC) No 850/98 (1998) was amended with the introduction of two boxes in Division 9.a, one of them located in FU 28 (Council Regulation (EC) No 2166/2005, 2005). In the period of higher catches (May-August), this box is closed for *Nephrops* fishing. By derogation, fishing with bottom-trawls in these areas and periods are authorized provided that the bycatch of Norway lobster does not exceed 2% of the total weight of the catch. The same applies to creels that do not catch *Nephrops*. Recently, a new Regulation (Regulation (EU) 2019/1241, 2019b) repealed the one implemented in 1998 but kept the two boxes allowing fishing *Nephrops* only as bycatch.

With the aim of reducing effort on crustacean stocks, a Portuguese national regulation (Portaria no. 1142/2004, 2004) closed the crustacean fishery in January-February 2005 and enforced a ban in *Nephrops* fishing for 30 days in September–October 2005 in FUs 28–29. This regulation was

revoked in January 2006, after the entry in force of the recovery plan and the amendment to the 1998' management plan, keeping only one month of closure of the crustacean fishery in January (Portaria no. 43/2006, 2006). This one-month closure period was extended for another month, until 29 February in 2016 (Portaria no. 8-A/2016, 2016). The national regulations are only applicable to the Portuguese fleet.

Portugal and Spain have bilateral agreements for fishing in each other's waters. The agreement for the period 2004–2013 was reviewed and extended for the period 2014–2016. Under this agreement, a number of Spanish trawlers are licensed to fish crustaceans in Portuguese waters. No information from landings of these vessels is available for the years prior to 2011.

Unwanted catches from *Nephrops* are regulated by the discard plan for demersal fisheries in South-Western waters for the period 2019–2021 (Commission Delegated Regulation (EU) 2018/2033, 2018 replaced by Commission Delegated Regulation (EU) 2019/2237, 2019), under which they are exempted from the landing obligation based on the species' high survival rates as provided for in Article 5(4b) of Regulation (EU) No 1380/2013 (2013). This exemption applies to all catches of Norway lobster from ICES subareas 8 and 9 with bottom-trawls, and where all *Nephrops* discards shall be released immediately, and in the area where they were caught (Commission Delegated Regulation (EU) 2019/2237, 2019).

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13.2.7 Tables and figures

Table 13.2.1. *Nephrops* in South-West and South Portugal (FUs 28–29). Total landings (tonnes) per country.

Year	FU 28+29 SW+S Portugal					
	28* Spain Trawl	29 Spain Trawl	Artisanal	Trawl	28+29 Portugal Total	Total
1975	137	1510		34	34	1681
1976	132	1752		30	30	1914
1977	95	1764		15	15	1874
1978	120	1979		45	45	2144
1979	96	1532		102	102	1730
1980	193	1300		147	147	1640
1981	270	1033		128	128	1431
1982	130	1177		86	86	1393
1983				244	244	244
1984				461	461	461
1985				509	509	509
1986				465	465	465
1987			11	498	509	509
1988			15	405	420	420
1989			6	463	469	469
1990			4	520	524	524
1991			5	473	478	478
1992			1	469	470	470
1993			1	376	377	377
1994				237	237	237
1995			1	272	273	273
1996			4	128	132	132
1997			2	134	136	136
1998			2	159	161	161

Year	FU 28+29 SW+S Portugal					
	28* Spain Trawl	29 Spain Trawl	Artisanal	Trawl	28+29 Portugal Total	Total
1999			5	206	211	**211**
2000			4	197	201	**201**
2001			2	269	271	**271**
2002			1	358	359	**359**
2003			35	335	370	**370**
2004			31	345	375	**375**
2005			31	360	391	**391**
2006			17	274	291	**291**
2007			18	274	291	**291**
2008			35	188	223	**223**
2009			17	133	151	**151**
2010			16	131	147	**147**
2011		17	16	117	133	**150**
2012	0	14	3	211	214	**229**
2013		10	1	198	199	**209**
2014		8	3	183	186	**193**
2015		12	4	231	235	**247**
2016		21	8	254	262	**283**
2017		26	9	241	249	**275**
2018		25	10	263	273	**299**
2019		31	8	245	253	**284**
2020**		31	7	209	216	**247**

* **Spanish landings from FU 28 are included in FU 29.**

** **Preliminary values.**

Table 13.2.2.a. *Nephrops* in FUs 28–29. Length composition of males from 1984–2020.

Landings (thousands)														
Length/Year	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
17														
18														
19					4	21					0			
20			0	16	4			6	4					
21		17	9			84		16	37	9				
22	7	5	14	15		97	9	29	96	38	9			
23	24	7	7	8		143	5	19	55	34			8	4
24	14	40	121	209	51	272	27	53	202	42	18		17	9
25	109	83	115	81	97	229	116	69	181	149	34	3	23	6
26	250	170	137	446	128	205	182	111	263	72	68	0	36	43
27	282	326	170	718	208	269	149	94	185	95	77	0	54	95
28	374	500	289	871	399	280	337	139	506	272	157	0	56	78
29	439	559	341	727	456	283	415	159	462	382	95	28	38	88
30	412	742	328	584	442	317	695	239	725	548	187	11	68	104
31	277	670	389	742	457	230	813	325	755	548	231	24	92	172
32	373	784	680	806	446	367	866	260	670	674	383	108	151	283
33	339	531	213	236	428	265	702	133	345	365	149	83	70	90
34	389	635	609	721	656	328	785	239	451	655	270	215	159	251
35	478	525	590	245	664	291	755	171	296	475	224	169	147	169
36	378	463	519	342	572	295	449	138	399	639	221	147	78	154
37	528	346	322	406	424	356	465	77	351	391	107	262	172	149
38	496	383	606	355	571	302	479	120	378	344	179	134	113	58
39	353	309	361	240	326	332	611	126	348	306	95	151	62	46
40	447	337	323	156	366	316	829	200	248	174	144	232	83	82
41	247	230	316	335	164	314	797	141	243	158	93	247	78	37
42	371	246	507	264	215	360	628	174	246	170	168	293	85	33
43	199	156	198	62	102	364	335	121	242	107	127	65	31	21
44	194	233	422	215	128	481	553	125	371	179	150	88	42	28
45	165	144	233	206	93	339	324	90	220	150	87	27	22	21
46	148	178	189	170	72	231	228	128	167	55	79	58	21	33
47	129	161	140	74	76	191	202	122	191	96	68	31	38	20
48	176	212	149	79	85	193	121	62	178	102	78	25	15	9
49	89	138	104	58	43	73	92	78	111	47	47	16	20	4
50	91	142	50	34	53	94	58	67	69	30	50	12	9	3
51	66	120	63	27	34	114	59	44	50	38	29	4	6	7
52	64	135	66	44	38	77	33	40	35	15	46	11	16	7
53	45	99	32	37	23	40	19	16	29	18	22	5	6	6
54	73	101	35	45	22	35	27	29	50	23	18	5	8	16
55	20	67	25	31	22	37	30	26	29	19	9	3	4	10
56	20	35	14	20	16	20	30	19	5	5	11	2	4	3
57	10	33	5	15	12	22	7	10	6	5	11	3	7	16
58	13	14	8	14	11	17	14		11	4	6		5	3
59	7	10	3	9	4	16	5	2	9	3	10	0	5	2
60	3	6	3	4	3	13	2		10	8	1	1	1	4
61	3	1	4	4	1	5		1	3	2	1	0	1	9
62	3	1	2	1	2	3		1	7	5	1		2	7
63	1	1		1	1	4		5	0	1	0		2	3
64		2	0	2	1			1	3	1	2		0	4
65	0	0		2	2				3	1	1		0	4
66	0			0	1					1			0	4
67	0			0	0	0			6	5				6
68					0	2				0	1			0
69				0										0
70	0			1		0				2				0
71										0				
72				0		0				1				
73														0
74	0									1				
75														
76														
77														
78		0			0									
79														
80									0					
81														
82														
83														
Total	8106	9897	8709	9679	7925	8329	12255	4023	9249	7463	3766	2466	1854	2200
Landings (t)	292	353	315	277	249	318	351	345	304	232	139	98	65	74

Table 13.2.2.a. *Nephrops* in FUs 28–29. Length composition of males from 1984–2020 (continued).

Landings (thousands)														
Length/Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
17														
18														
19						0				2	0			
20		4				0		4		3	1	0	0	
21		3	3	0	2	0	0	33		5	0	0	0	
22	2	0	16	1	2	13	4	51	10	20	8	2		0
23		5	8	3	1	3	15	32	22	31	10	4		1
24	8	9	20	5	2	11	20	107	53	53	26	29	8	0
25	16	39	13	6	3	40	45	120	46	65	28	30	10	1
26	32	33	58	8	11	56	126	153	75	121	32	38	8	3
27	81	49	85	24	24	87	187	206	94	111	52	63	22	6
28	65	68	44	24	48	62	205	286	144	141	60	89	14	4
29	65	109	148	53	60	147	246	330	220	189	62	83	33	5
30	160	133	87	74	139	248	300	533	290	297	60	129	44	5
31	129	272	111	92	123	188	277	573	270	256	93	116	75	22
32	289	88	161	274	233	325	475	757	378	295	129	135	116	32
33	95	182	92	139	281	248	352	437	247	246	108	80	78	21
34	269	152	160	224	257	264	352	574	311	327	150	94	104	52
35	118	175	100	173	274	275	347	333	194	252	121	76	83	31
36	166	143	158	163	265	195	224	263	168	256	83	59	77	34
37	167	128	162	167	247	234	167	293	172	224	109	57	78	64
38	85	75	106	99	254	197	147	226	164	265	73	58	125	69
39	47	180	81	109	229	174	93	175	100	173	75	61	71	39
40	83	83	96	159	254	215	165	152	100	188	77	63	84	44
41	53	184	102	130	163	163	108	129	125	163	102	53	55	49
42	167	58	91	195	163	168	177	152	190	198	128	105	75	68
43	43	102	47	181	167	172	113	118	95	82	76	38	51	45
44	69	63	86	173	122	121	122	176	144	90	61	51	65	43
45	34	111	61	140	113	103	131	140	96	83	60	25	39	19
46	38	67	85	144	106	76	103	117	118	71	38	25	26	15
47	34	59	88	120	111	75	97	113	61	60	48	25	43	18
48	24	40	55	80	104	83	90	66	54	65	48	23	35	12
49	13	50	37	79	86	59	58	52	41	38	34	24	23	12
50	33	32	65	93	103	94	82	69	28	42	36	20	25	11
51	14	32	34	71	72	65	41	40	30	37	27	17	20	15
52	31	8	53	88	94	73	65	45	37	48	29	32	30	24
53	11	13	18	41	69	58	31	22	22	21	24	13	16	9
54	19	15	31	54	53	57	50	24	33	27	23	19	21	24
55	8	9	19	34	28	46	26	12	15	10	20	12	14	15
56	6	13	19	29	43	29	57	14	11	8	15	13	8	25
57	8	8	19	37	37	25	16	9	6	6	17	11	9	25
58	5	4	13	23	26	21	12	9	7	7	20	7	11	45
59	3	4	10	15	16	13	15	8	9	5	11	4	6	19
60	1	1	8	15	25	16	24	12	6	3	9	7	5	13
61	1	2	14	9	11	8	11	8	8	4	8	4	5	7
62	1	3	6	10	11	15	16	8	8	3	15	8	6	22
63	0	2	1	4	11	11	7	7	7	1	8	4	6	7
64	0	1	1	9	11	8	10	10	7	1	10	6	5	17
65		0	4	6	5	4	3	10	7	1	9	2	3	9
66	0		1	5	8	3	7	3	4	2	11	1	3	5
67	0			4	3	5	2	2	6	1	6	1	3	3
68	0			1	6	6	2	3	4	0	8	0	4	3
69	0		0	3	3	2	2	2	4	1	4	1	0	2
70	0		0	6	2	4	3	4	5	0	4	1	0	1
71	0			2	2	4	1	1	3	1	2	0	0	0
72	0			2	2	4	1	3	4	0	3	1	0	1
73			0	0	1	1	1	2	2		1	0	0	1
74				0	1	1	1	3	1		1	1	0	1
75				0	1	0	0	1	1		1	1	2	0
76				0	0	0	0	0	1		1	0		0
77					0	0	0	0	1		1	0	0	0
78							0	1			0			0
79					0		0	1	0		0	0		
80								0			0			0
81									0		0	0		
82					0				0		0	0		
83											0			
Total	2491	2811	2680	3602	4486	4575	5233	7036	4259	4598	2280	1822	1649	1018
Landings (t)	88	116	117	190	222	205	205	231	162	159	114	73	79	72

Table 13.2.2.a. *Nephrops* in FUs 28–29. Length composition of males from 1984–2020 (continued).

Landings (thousands)									
Length/Year	2012	2013	2014	2015	2016	2017	2018	2019	2020
17									
18									
19				1					
20									
21			0				1		
22	3		1				1		
23	0	3	1	0		8	20		0
24	8		1	1		4	28		11
25	27	8	6	5		8	180	22	16
26	37	6	7	3		23	89	19	10
27	47	27	15	8		68	162	70	30
28	37	25	12	10		109	201	34	30
29	143	55	35	27	10	149	241	86	80
30	158	84	36	71	27	324	321	163	149
31	248	82	49	112	51	293	382	188	131
32	573	217	120	138	36	345	433	189	169
33	329	109	47	96	75	207	281	124	163
34	436	276	119	162	166	277	334	222	195
35	356	155	144	263	128	295	387	325	290
36	248	191	119	202	173	138	146	115	101
37	211	145	108	191	155	145	191	158	112
38	206	216	144	179	240	82	89	136	82
39	126	95	129	125	300	71	116	106	59
40	112	162	160	139	247	114	128	174	88
41	114	113	90	117	179	86	69	119	66
42	140	171	129	142	185	101	112	138	76
43	79	64	58	85	182	64	45	89	43
44	87	89	104	127	222	94	82	105	70
45	52	42	59	92	187	108	64	111	57
46	46	81	59	62	211	75	23	59	64
47	47	89	83	61	129	53	42	49	66
48	30	67	26	28	157	18	26	26	21
49	32	53	36	48	92	32	33	25	30
50	19	59	25	58	69	41	53	48	43
51	17	37	32	56	58	27	47	28	34
52	33	47	64	70	26	46	57	33	37
53	22	18	25	45	34	38	34	26	29
54	32	36	44	48	52	46	54	37	46
55	15	16	24	60	41	38	45	36	47
56	24	20	20	43	51	30	30	29	38
57	20	15	20	27	36	22	33	32	34
58	7	12	10	14	45	5	19	12	10
59	7	8	9	16	38	12	18	15	19
60	4	10	7	10	30	10	15	9	11
61	9	7	4	4	21	4	10	5	5
62	3	1	12	4	10	5	8	2	2
63	2	4	3	3	14	2	3	1	1
64	2	3	8	3	10	2	4	4	1
65	1	1	2	1	9	2	9	5	4
66	3	2	3	2	6	3	5	5	2
67	3	1	2	1	4	2	5	4	3
68	3	1	1	0	4	1	2	3	11
69	1		1	0	8	1	3	4	9
70	3	1	1	0	3	1	4	3	8
71	1		1	0	3	1	0	1	3
72	3	0	1		2	0	2	1	0
73	1		1		0	0	0	2	3
74	1		1		0	0	0	2	0
75	1		0		0	0	3	2	0
76	0			0			0	0	2
77	0				0		0	0	0
78					0	0	0		1
79	0				0		0		1
80							0		0
81									
82									
83									
Total	4170	2928	2217	2959	3725	3632	4693	3204	2615
Landings (t)	149	132	114	147	166	139	169	150	151

Table 13.2.2.b. *Nephrops* in FUs 28–29. Length composition of females from 1984–2020.

Landings (thousands)															
Length/Year	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
17															
18					4										
19		0				35					0				
20	3	1	7		8	21				18					
21	1	1	22	3	21	102		21	9	49					
22	8	21	30	78		88	19	11	102	63			0	13	2
23	66	21	7	31	28	135	15	69	38	21	2		0	0	4
24	79	102	118	270	153	258	38	173	164	41	22	2	11	20	15
25	228	205	104	357	163	197	138	198	203	191	73		13	20	25
26	272	284	186	684	220	282	140	436	361	111	92	1	35	102	74
27	345	491	359	902	429	326	247	418	448	235	134	0	37	77	91
28	431	523	322	1421	471	231	345	598	597	413	170	6	36	152	148
29	443	672	419	1253	516	285	491	590	514	523	269	31	45	178	114
30	422	588	381	928	499	317	575	771	599	775	326	104	50	199	199
31	487	593	418	948	482	501	639	414	736	752	427	182	95	394	168
32	485	653	700	946	766	306	859	807	617	824	558	322	198	502	376
33	613	415	406	227	527	314	596	375	430	449	283	251	53	163	116
34	618	467	654	774	813	511	734	310	369	359	353	641	209	278	298
35	562	563	447	447	460	435	519	284	287	194	246	674	184	150	112
36	469	329	316	386	489	274	243	130	267	203	237	811	142	135	166
37	505	353	400	223	206	318	189	108	333	154	147	692	267	129	171
38	383	284	330	269	265	285	207	135	251	100	128	348	151	39	48
39	274	142	211	146	288	148	216	74	176	150	66	194	67	35	59
40	171	119	80	119	132	131	230	131	147	110	114	344	120	21	89
41	58	106	55	65	128	149	73	39	68	108	77	361	63	31	64
42	50	36	133	54	43	127	210	62	69	95	73	165	111	18	84
43	30	27	21	40	28	109	58	82	26	43	23	64	29	2	34
44	17	13	47	147	27	91	77	6	46	42	43	88	90	18	71
45	14	11	27	84	19	27	41	21	40	34	13	54	36	8	22
46	7	6	5	40	14	38	31	45	25	37	11	13	15	4	28
47	5	3	3	26	9	24	16	7	12	29	7	18	23	3	23
48	4	1		71	11	29	7	15	18	15	4	15	8	2	6
49	1	0	3	17	4	9	1	17	17	23	4	1	6	7	6
50	1	0		2	6	3	1	2	32	8	17	1	2	1	6
51	0	0	3	4	3	7	2	4	4	5	0			1	2
52	1			5	5	8	1		5	6	1	1	0	1	1
53	2			2	3	1			9	6	0			0	0
54				4	1	1			1	1			1	0	1
55				0	1	1			6	2					
56				3	0	2		5	14	5					0
57				0	0	1			4	1			0		0
58				0		0			4	1					
59				1	0	0									
60					0				1	0					
61						1									
62															
63									4	1					
64															
65															
66															
67															
68									4	1					
69															
70															
71															
72															
73															
74															
75															
76															
77															
78															
79															
80															
81															
82															
83															
Total	7052	7032	6218	10978	7243	6126	6962	6358	7059	6198	3920	5385	2095	2702	2621
Landings (t)	169	156	150	232	171	151	174	134	165	145	97	174	67	62	72

Table 13.2.2.b. *Nephrops* in FUs 28–29. Length composition of females from 1984–2020 (continued).

Landings (thousands)													
Length/Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
17						0								
18							0				0			
19						1				2	0			
20				0		0	0	8		4	1			
21			3	1	0	3	12	48	3	15	2	1		
22	2	5	18	0		3	10	88	14	26	12	1	0	
23	4	4	6	7	0	9	43	54	37	34	11	4	1	1
24	15	25	49	7	10	19	62	135	44	53	25	22	10	1
25	25	27	24	15	11	36	101	129	55	130	23	23	11	1
26	74	94	81	24	15	67	211	272	113	227	38	80	12	3
27	91	76	139	34	34	67	266	294	152	298	73	138	20	7
28	148	100	64	44	107	98	336	242	179	355	81	170	26	7
29	114	121	171	90	127	173	395	420	392	458	123	149	51	4
30	199	236	152	131	237	241	406	654	321	365	145	205	67	7
31	168	263	131	167	195	152	334	565	305	317	129	132	99	26
32	376	485	283	316	296	360	530	857	510	409	252	209	145	45
33	116	187	153	184	467	270	433	448	272	253	182	110	91	51
34	298	346	235	252	429	314	400	462	341	386	177	122	140	96
35	112	287	193	158	470	255	324	254	249	351	187	103	120	56
36	166	317	225	174	351	194	222	203	162	213	103	83	144	60
37	171	201	213	144	302	203	178	182	142	240	121	90	119	73
38	48	184	85	108	300	206	151	178	152	247	134	83	106	151
39	59	151	92	112	213	160	113	89	173	138	123	86	95	113
40	89	111	79	133	186	284	136	84	114	109	125	62	80	68
41	64	81	66	79	110	170	82	73	129	73	95	83	65	65
42	84	73	67	91	80	192	122	116	112	56	75	94	52	80
43	34	38	41	55	87	132	70	70	44	16	30	25	28	80
44	71	34	49	56	57	75	66	61	46	21	24	43	40	41
45	22	18	23	29	51	68	66	50	35	18	28	17	25	21
46	28	18	38	33	40	37	51	39	54	19	14	22	19	11
47	23	7	52	26	25	25	44	35	23	9	26	16	18	15
48	6	9	25	12	24	28	37	18	11	8	20	7	12	9
49	6	4	21	15	19	18	24	24	7	7	13	6	7	7
50	6	5	10	15	26	24	20	23	7	3	13	8	7	2
51	2	2	10	9	22	14	13	17	11	5	11	3	6	5
52	1	3	16	6	19	21	13	17	7	3	7	3	4	4
53	0		6	6	10	13	8	10	2	1	8	3	2	3
54	1		5	2	2	14	7	6	9	1	8	1	2	5
55			1	2	3	10	4	5	1	1	3	4	0	5
56	0		3	1	3	7	6	2	1	0	3	0	0	2
57	0		1	0	2	4	2	3	1		1	0	0	1
58				1	1	1	2	0	1	0	1	1	0	4
59			0	1	0	0	1	1	1			0	0	2
60				0		0		2			1		0	2
61			3	1		0	1					0	0	1
62					0	0	0	1	0				0	0
63				0	0			0				0	0	2
64							1	0		0	0	0		
65							0	0						0
66			0	0				0						
67														0
68														
69														
70							0					0		
71														
72														
73														
74														
75														
76														
77														
78														
79														
80														
81														
82														
83														
Total	2621	3509	2829	2540	4332	3969	5304	6240	4229	4871	2449	2211	1628	1138
Landings (t)	72	95	84	79	135	130	140	151	112	114	74	60	52	45

Table 13.2.2.b. *Nephrops* in FUs 28–29. Length composition of females from 1984–2020 (continued).

Landings (thousands)									
Length/Year	2012	2013	2014	2015	2016	2017	2018	2019	2020
17									
18									
19				0					
20									
21	7				4				
22		3	1		4		19		0
23		7	1	0	1		4	10	1
24	5	7	3		2	13	66	14	5
25	8	18	10	5	19	91	150	32	25
26	17	7	10	7	19	23	87	47	13
27	40	36	17	13	46	100	110	145	55
28	51	33	23	23	44	134	125	76	49
29	130	59	60	39	57	169	203	86	124
30	164	119	80	85	219	464	351	336	246
31	330	129	99	143	149	290	260	310	146
32	397	290	203	208	307	462	327	560	306
33	195	194	105	146	214	290	247	251	167
34	297	278	202	167	325	353	235	435	215
35	165	232	188	303	362	365	381	316	430
36	138	166	153	203	193	196	138	199	172
37	98	199	151	162	203	142	149	202	127
38	76	206	148	171	125	81	78	140	110
39	46	61	121	136	112	105	75	146	79
40	46	67	145	134	130	108	89	131	89
41	37	41	66	104	82	56	51	70	34
42	35	65	90	87	112	72	94	75	48
43	33	9	27	54	59	55	33	55	49
44	27	13	40	58	48	53	35	50	52
45	10	9	17	56	25	45	38	34	42
46	10	11	17	36	28	36	15	24	30
47	11	13	18	16	14	21	22	15	67
48	5	7	5	8	3	14	9	4	8
49	6	5	7	8	5	7	14	3	23
50	6	5	4	8	14	7	16	6	6
51	6	1	3	7	4	7	12	3	10
52	9	5	4	9	8	6	13	2	8
53	5	1	3	6	0	5	7	1	4
54	5	3	8	12	2	4	6	3	5
55	2	1	3	12	2	3	4	1	3
56	1	1	6	10	1	1	6	2	2
57	3	2	2	4	0	1	5	0	1
58	2	0		1	0	0	5	0	1
59	0	1	1	3	0	0	2		0
60	0		2	3	1	1	3	0	1
61	0					0	1		0
62	0	0	0	0			0		0
63	0						0		0
64	0			0			2		0
65				0		0			0
66				0		0	0		0
67				0					
68							0		0
69				0					
70				0					
71									
72									
73									
74									
75									
76									
77									
78									
79									
80									
81									
82									
83									
Total	2424	2306	2044	2446	2946	3782	3487	3783	2755
Landings (t)	65	66	66	85	88	102	94	95	96

Table 13.2.3. *Nephrops* in SW and S Portugal (FUs 28–29). cpues (kg/h) estimated from research trawl surveys from 1994–2020.

Year	Demersal surveys			Crustacean surveys	
	CPUE (kg/hour)			Month and year of survey	CPUE (kg/hour)
	Summer	Autumn	Winter		
1994	ns	0.40	ns	May-94	2.3
1995	1.3	0.26	ns	ns	ns
1996	ns	0.03	ns	ns	ns
1997	0.7	0.06	ns	Jun-97	2.7
1998	0.7	0.02	ns	Jun-98	1.4
1999	0.3	0.02	ns	Jun-99	2.5
2000	1.0	0.92	ns	Jun-00	1.6
2001	0.6	0.35	ns	Jun-01	0.8
2002	ns	0.02	ns	Jun-02	2.8
2003	ns	0.19	ns	Jun-03	2.9
2004	ns	0.51	ns	Jun-04	nr
2005	ns	0.09	0.16	Jun-05	5.3
2006	ns	0.19	0.06	Jun-06	2.8
2007	ns	0.04	0.73	Jun-07	2.9
2008	ns	0.13	0.25	Jun-08	5.4
2009	ns	0.13	ns	Jun-09	2.8
2010	ns	0.34	ns	Jun-10	8.1
2011	ns	0.11	ns	Jun-11	nc
2012	ns	ns	ns	ns	ns
2013	ns	0.64	ns	Jun-13	2.5
2014	ns	0.06	ns	Jul-14	1.0
2015	ns	0.21	ns	Jul-15	3.2
2016	ns	0.69	ns	Jun-16	4.9
2017	ns	1.21	ns	Jul-17	5.0
2018	ns	0.46	ns	Aug-18	5.0
2019	ns	ns	ns	ns	ns
2020	ns	ns	ns	ns	ns

ns = no survey nr = not reliable nc = whole area not covered

Table 13.2.4. *Nephrops* in SW and S Portugal (FUs 28–29): Mean sizes (mm CL) of male and females in Portuguese landings and surveys from 1994–2020.

Year	Landings		Demersal surveys						Crustacean surveys	
			Summer		Autumn		Winter			
	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females
1994	37.4	33.6	ns	ns	39.0	33.6	ns	ns	ns	ns
1995	39.3	37.0	42.1	35.6	42.0	34.9	ns	ns	ns	ns
1996	36.9	36.6	ns	ns	38.6	32.2	ns	ns	ns	ns
1997	35.9	32.8	40.4	36.9	39.1	31.7	ns	ns	43.7	41.9
1998	36.8	34.5	36.0	33.9	40.6	35.9	ns	ns	39.5	36.7
1999	38.7	34.6	45.1	40.4	43.8	32.8	ns	ns	39.7	37.5
2000	38.9	35.2	40.8	37.1	39.0	35.1	ns	ns	41.7	40.2
2001	41.6	36.1	40.5	34.5	47.2	41.6	ns	ns	44.5	39.9
2002	40.7	36.2	na	na	35.0	39.0	ns	ns	44.8	40.7
2003	39.1	36.4	ns	ns	37.5	32.3	ns	ns	39.7	36.7
2004	37.3	33.8	ns	ns	36.7	31.3	ns	ns	39.0	37.0
2005	35.6	33.0	ns	ns	40.6	39.1	40.6	40.9	37.3	35.7
2006	37.2	34.1	ns	ns	36.1	32.8	31.7	35.0	37.7	35.2
2007	36.5	32.8	ns	ns	42.0	38.5	39.0	36.2	38.3	35.0
2008	40.1	35.5	ns	ns	43.2	41.4	46.7	40.6	40.1	36.7
2009	37.4	34.2	ns	ns	45.3	39.8	ns	ns	41.4	36.6
2010	40.1	36.5	ns	ns	39.7	33.7	ns	ns	37.7	36.6
2011	45.0	39.2	ns	ns	43.1	40.0	ns	ns	nc	nc
2012	36.9	34.4	ns	ns	ns	ns	ns	ns	ns	ns
2013	39.7	35.3	ns	ns	42.6	37.3	ns	ns	39.1	39.5
2014	41.3	36.7	ns	ns	46.5	39.2	ns	ns	37.8	35.2
2015	40.9	37.4	ns	ns	42.4	35.2	ns	ns	39.2	37.3
2016	39.5	35.8	ns	ns	43.7	41.6	ns	ns	38.7	36.1
2017	37.7	34.6	ns	ns	45.2	45.3	ns	ns	40.6	34.5
2018	36.2	33.8	ns	ns	43.5	37.9	ns	ns	37.7	34.0
2019	39.1	34.6	ns	ns	ns	ns	ns	ns	ns	ns
2020	39.7	35.6	ns	ns	ns	ns	ns	ns	ns	ns

ns = no survey nr = not reliable nc = whole area not covered

Table 13.2.5. *Nephrops* in SW and S Portugal (FUs 28–29). Effort and cpues (kg/h) of Portuguese trawlers from 1994–2020.

Year	No. of trawlers	CPUE (t/vessel)	Estimated hours	CPUE** (kg/hour)
1994	31	7.6		
1995	30	9.1		
1996	25	5.3		
1997	25	5.5		
1998	25	6.4	676 134	0.2
1999	26	8.1	507 697	0.4
2000	27	7.4	707 654	0.3
2001	33	8.2	318 189	0.9
2002	31	11.5	176 609	2.0
2003	32	10.5	124 979	3.0
2004	23	15.0	261 393	1.4
2005	25	15.3	204 234	1.9
2006	25	11.0	140 731	2.1
2007	26	10.5	151 912	1.9
2008	27	7.0	95 974	2.3
2009	27	4.9	58 359	2.6
2010	25	5.2	72 243	2.0
2011	26	4.5	77 328	1.9
2012	21	10.2	90 508	2.5
2013	24	8.2	107 295	2.0
2014	24	7.5	112 153	1.7
2015	22	10.5	134 999	1.8
2016	22	11.5	117 035	2.4
2017	22	11.0	131 405	2.1
2018	24	11.0	104 406	2.9
2019	25	9.8	104 524	2.7
2020*	24	8.7	96 048	2.6
* provisional; ** standardized CPUE				

Table 13.2.6. Length-based indicators for Nephrops males and females in FUs 28–29.

Sex	Year	Conservation				Optimizing Yield	MSY
		L_c/L_{mat}	$L_{25\%}/L_{mat}$	$L_{max5\%}/L_{inf}$	P_{mega}	L_{mean}/L_{opt}	$L_{mean}/L_{F=M}$
		>1	>1	>0.8	>30%	~1 (>0.9)	≥1
Males	2018	0.95	1.11	0.84	0.07	0.79	0.98
	2019	1.02	1.18	0.86	0.09	0.85	1.01
	2020	1.02	1.11	0.90	0.14	0.86	1.02
Females	2018	0.90	1.02	0.74	0.02	0.80	0.94
	2019	0.97	1.05	0.71	0.01	0.81	0.93
	2020	0.97	1.08	0.76	0.03	0.83	0.95

Table 13.2.7. Results from the application of the Mean Length Z approach.

		Males	Females
Input:			
LFD period		1984-2019	1984-2019
Effort series		1998-2019	1998-2019
Growth			
	Linf =	70	65
	K =	0.2	0.065
	t0 =	-0.15	-0.15
W~L relationship			
	a =	0.00028	0.00056
	b =	3.2229	3.0288
External M		0.3	0.2

Method	**Results**		
Gedamke & Hoenig	Z =	0.47	0.31
	F* =	0.17	0.11
THoG	q estimate =	0.0004	0.0002
	q estimate* =	0.005	0.002
	M estimate =	0.46	0.28
	F_{2020} estimate =	0.004	0.002
	F_{2020} estimate* =	0.05	0.02
Y/R	F_{MSY} proxy: $F_{0.1}$ =	0.23	0.24

* indicates estimates with external fixed M

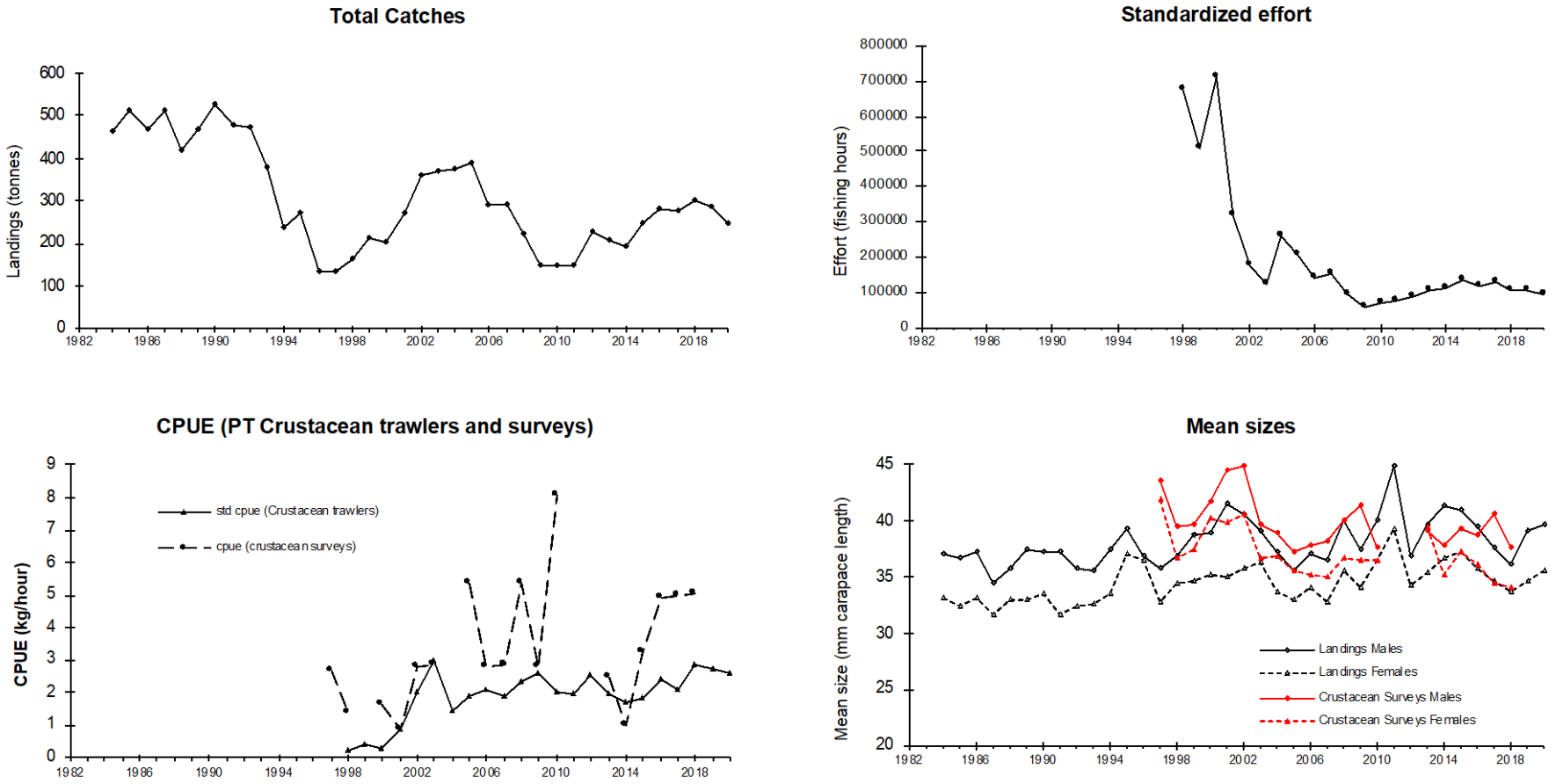

Figure 13.2.1. *Nephrops* in SW and S Portugal (FU 28+29). Annual landings, effort, biomass indices and mean sizes in Portuguese landings and surveys. Note: Values of cpues and effort updated with the new cpue standardization.

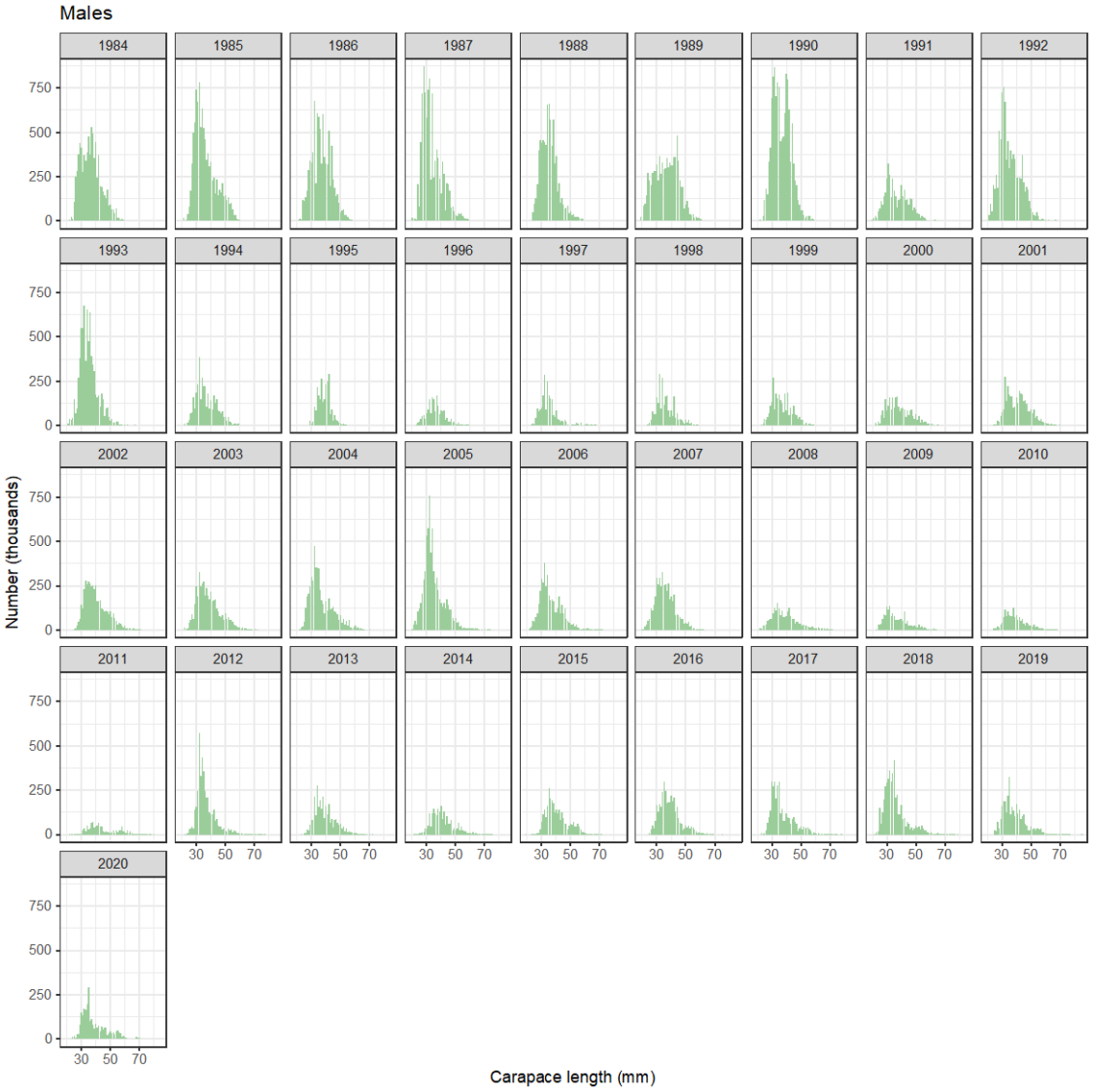

Figure 13.2.2.a. *Nephrops* in SW and S Portugal (FUs 28–29). Males length distributions for the period 1984–2020.

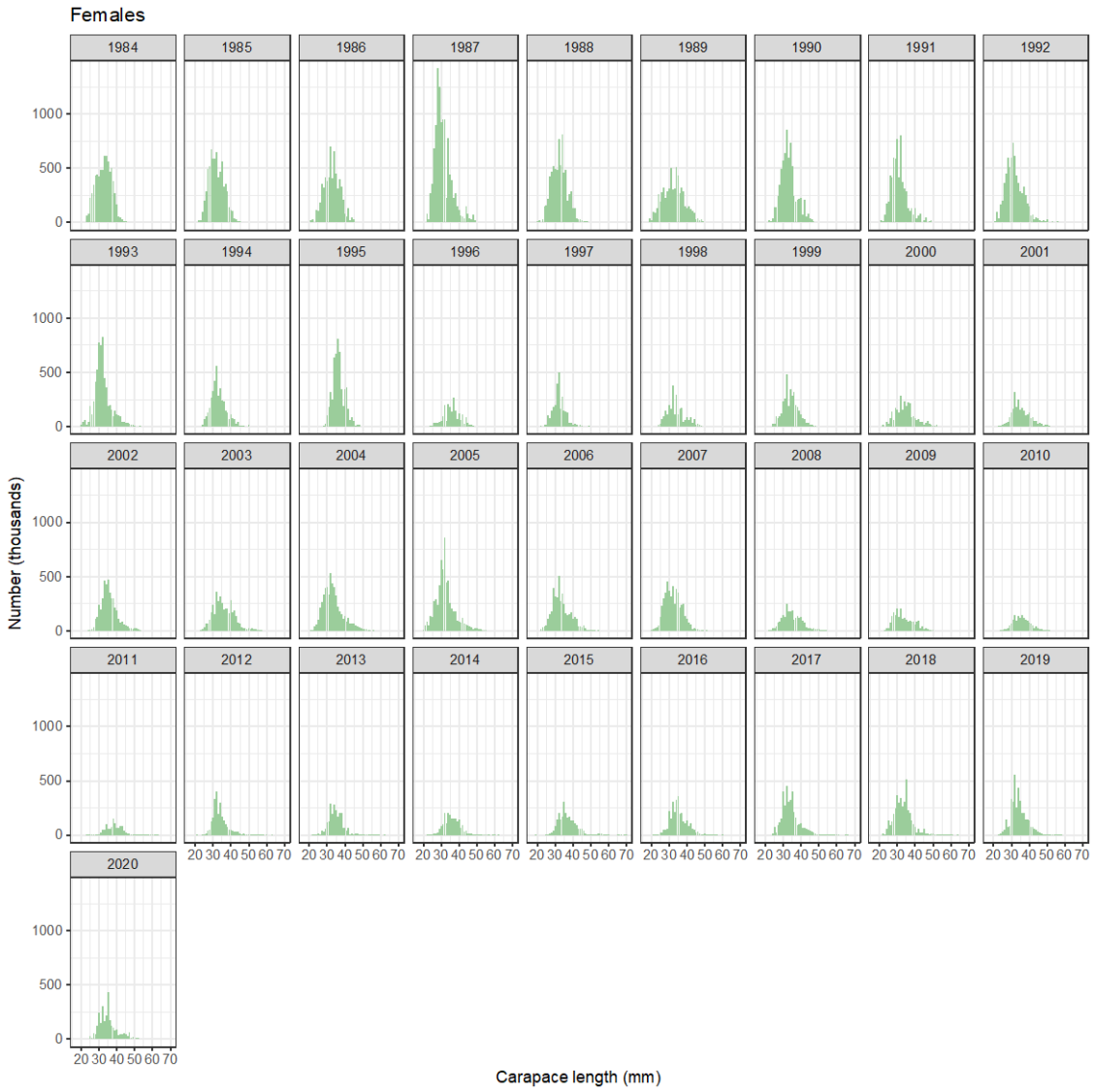

Figure 13.2.2.b. *Nephrops* in SW and S Portugal (FUs 28–29). Females length distributions for the period 1984–2020.

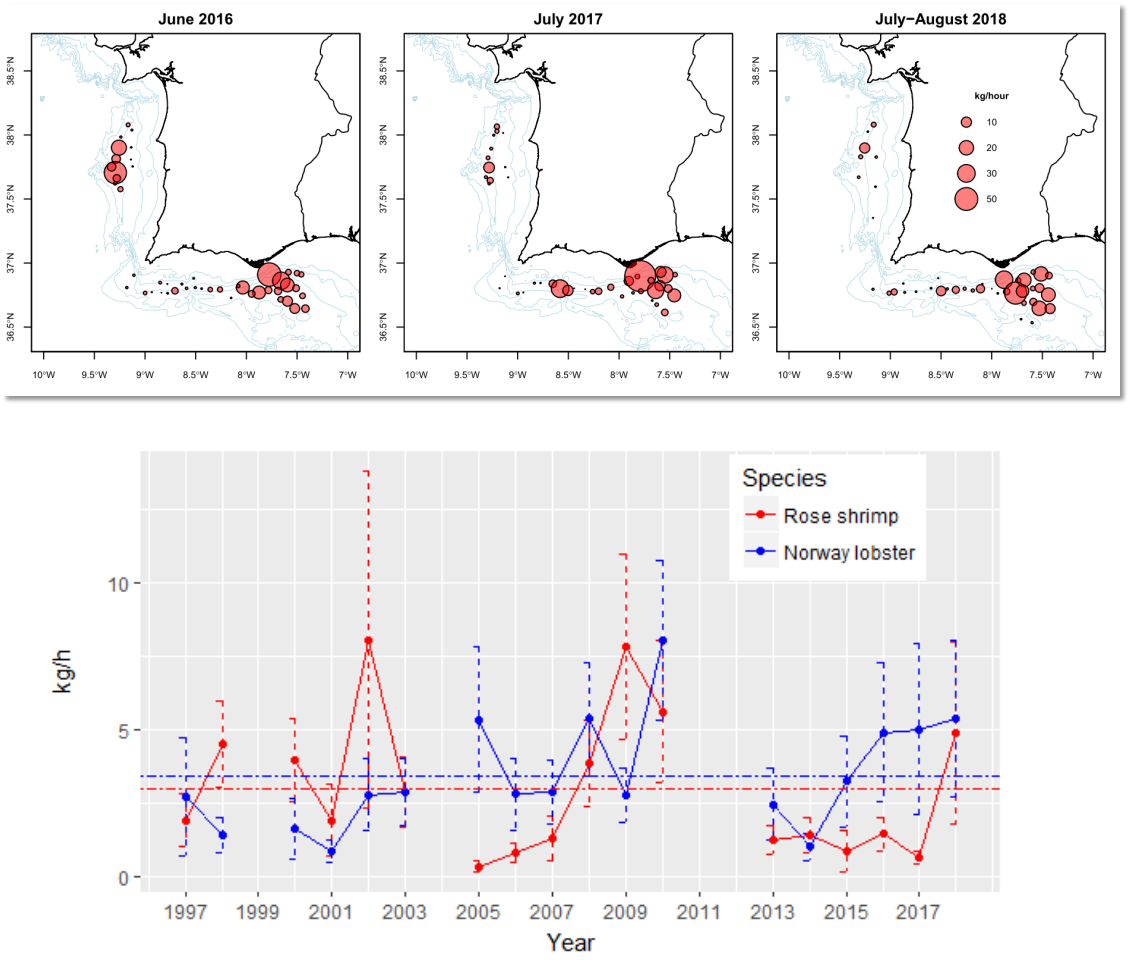

Figure 13.2.3. Spatial distribution of Norway lobster's biomass survey index in the period 2016–2018 (upper panel). Stratified mean biomass time-series (lower panel) with 95% confidence interval of Norway lobster (blue) and deep-water rose shrimp (red).

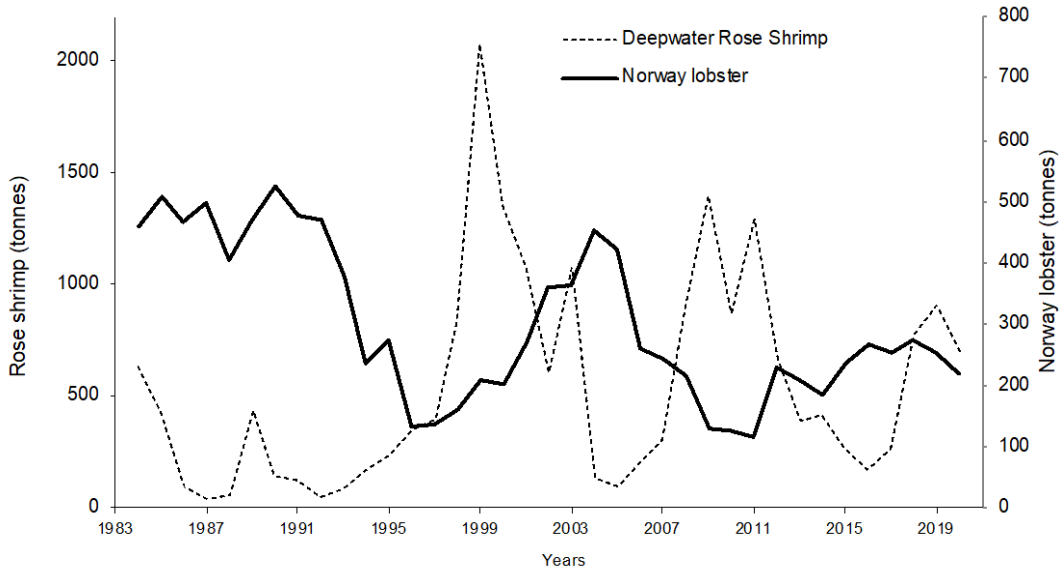

Figure 13.2.4 *Nephrops* in FUs 28–29. Landings (tonnes) of the two main target species of the crustacean fisheries in the period 1984–2020.

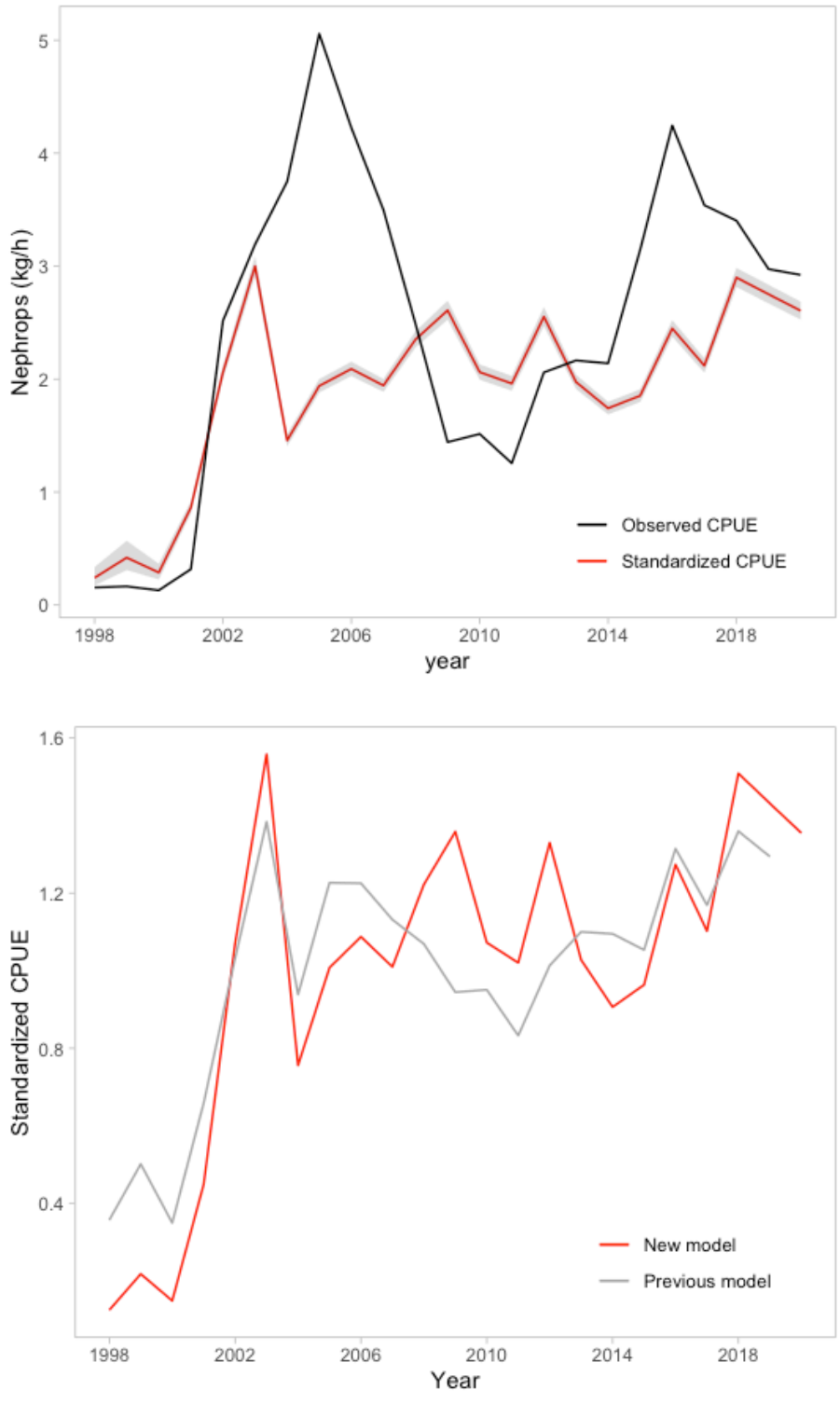

Figure 13.2.5. Comparison of the observed and standardized *Nephrops* cpue trends using the new model (above). Comparison between the output from the new and previous cpue standardization models, normalized to the overall mean (below). The shaded area represents the 95% confidence intervals.

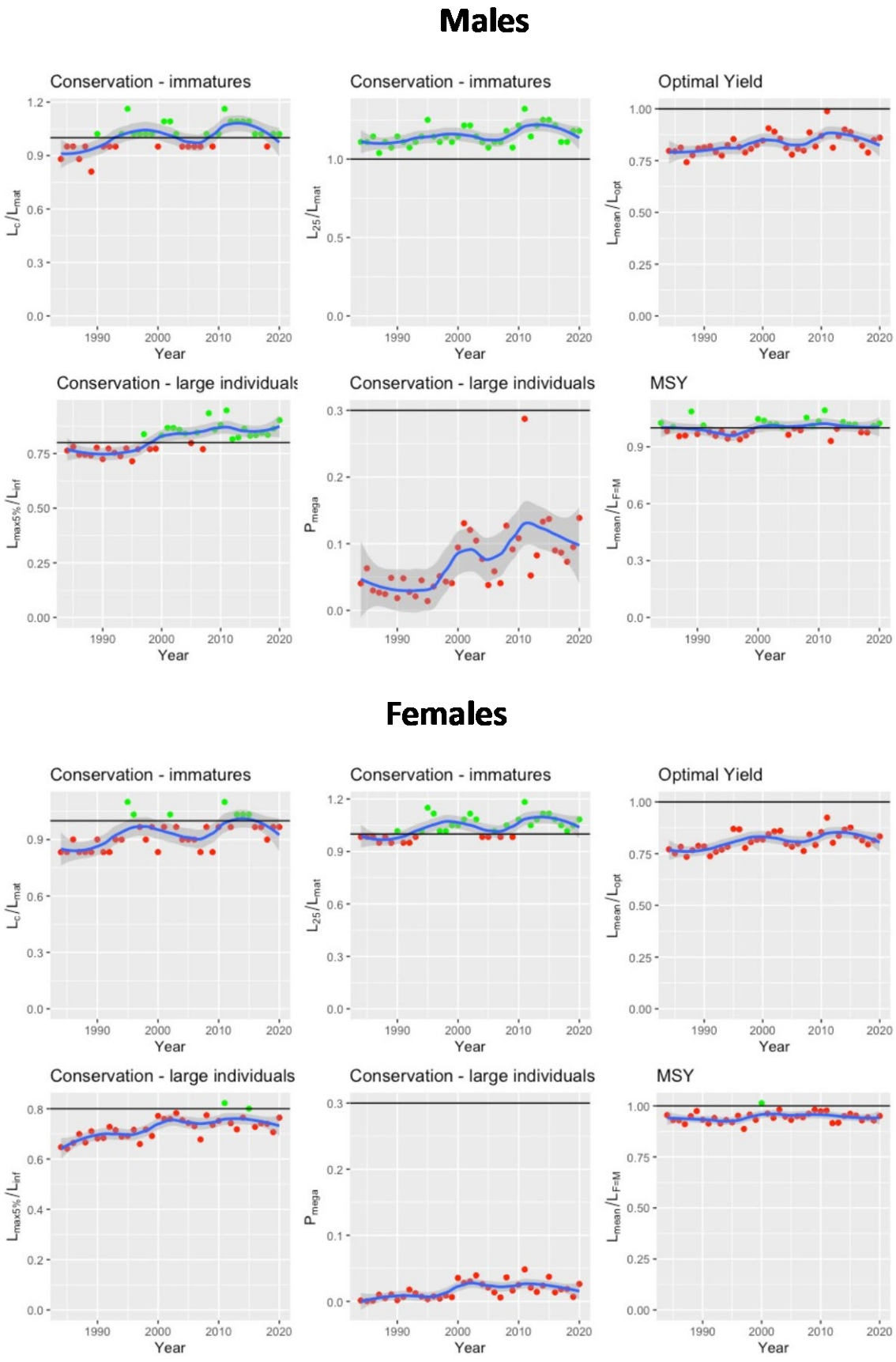

Figure 13.2.6. Length-based indicator ratios for *Nephrops* males (above) and females (below) in FUs 28–29.

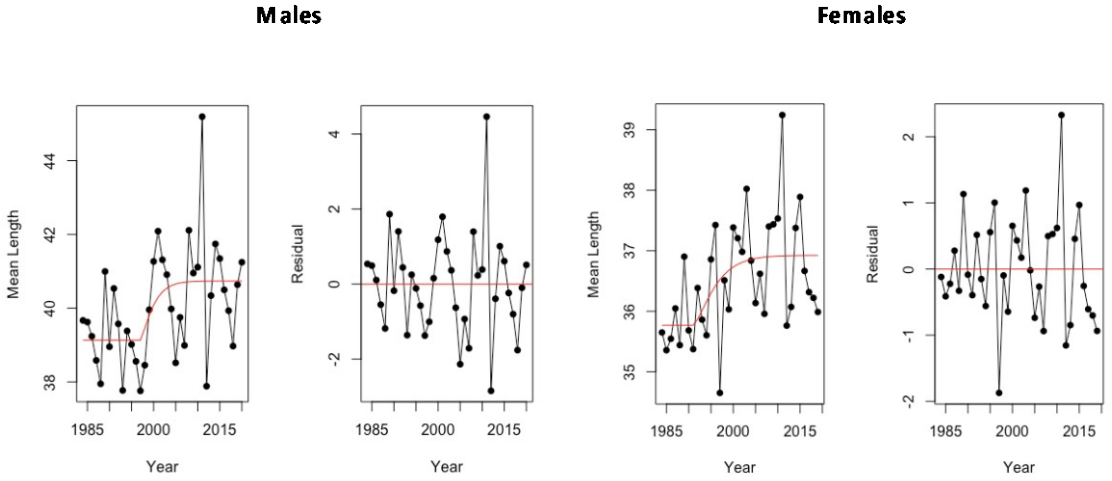

Figure 13.2.7. ***Nephrops*** **in FUs 28–29. Gedamke & Hoenig Mean Length-Z model diagnostics for males (2 graphs on the left side) and females (2 graphs on the right side).**

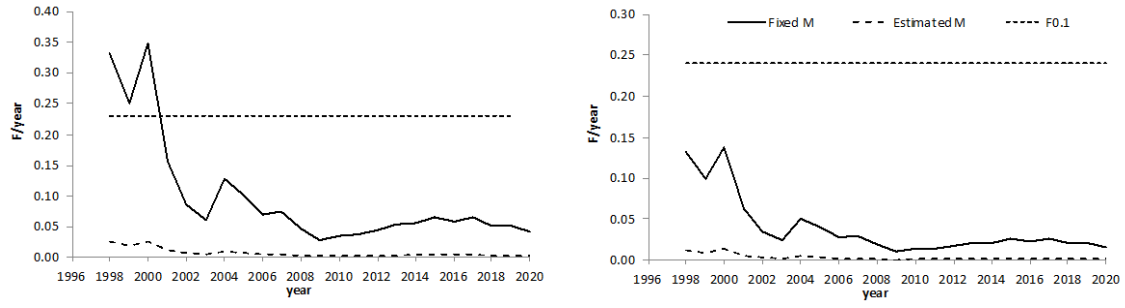

Figure 13.2.8. ***Nephrops*** **in FUs 28–29. Fishing mortality from the THoG model using an external fixed M or an M estimated by the model. Left panel: males, right panel: females.**

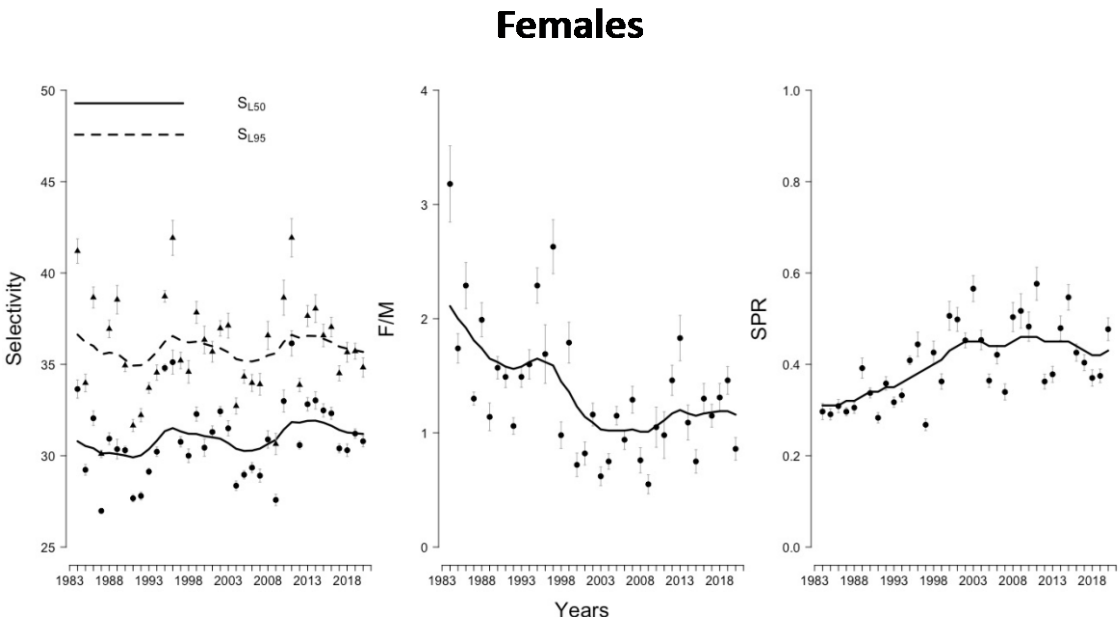

Figure 13.2.9. ***Nephrops*** **in FUs 28–29. LB-SPR outputs showing Selectivity (left), F/M (centre) and Spawning Potential Ratio (SPR, right) for females with 95% confidence intervals and a smoother.**

13.3 *Nephrops* in FU 30 (Gulf of Cádiz)

Nephrops FU 30 was benchmarked by WKNEP 2016 (ICES, 2017a). A UWTV survey-based approach was considered appropriate to provide scientific advice on the stock abundance in this FU. However, a stock-specific MSY harvest rate could not be derived. The basis of advice for this stock follows a category 3 using the 2-over-3 rule. When the stock-specific MSY reference points could be estimated, *Nephrops* FU 30 will meet the requirements for category 1 assessment.

13.3.1 General

13.3.1.1 Ecosystem aspects

See Stock Annex.

13.3.1.2 Fishery description

See Stock Annex.

13.3.1.3 ICES advice for 2020 and management applicable for 2020 and 2021

ICES Advice for 2021

ICES advises that when the precautionary approach is applied, catches in 2020 should be no more than 62 t.

To ensure that the stock in FU 30 is exploited sustainably, ICES advises that management should be implemented at the FU level.

Management applicable for 2020 and 2021

The European Parliament and the Council have published a multiannual management plan (MAP) for the Western Waters (EU, 2019a). This plan applies to demersal stocks including *Nephrops* in FU 30.

An increase of mesh size to 55 mm was established starting September 2009 (Orden ARM/2515/2009) for the bottom-trawl fleet.

The TAC set for the whole Division 9.a was 386 t for 2020 and 374 t for 2021, of which no more than 6% may be taken in FUs 26 and 27, and no more than 77 t in 2020 and 65 t in 2021 may be taken in FU 30.

A modification of the Fishing Plan for the Gulf of Cádiz was established in 2014 (AAA/1710/2014). This new regulation establishes an assignment of *Nephrops* quotas by vessel. A closed season in autumn for the bottom-trawl fleet of the Gulf of Cádiz is implemented since 2004. Since 2018, this closed season is from 16 September to 31 October (APM/453/2018).

13.3.2 Data

The sampling programs coordinated by the IEO (onshore, observers at sea and biological sampling) were partially suspended in 2020 due to administrative problems and to the COVID-19 disruption. This affected all stocks. Details of the impact on each individual stock are provided in the templates provided by ICES and in each stock-specific section.

13.3.2.1 Commercial catch and discard

Landings in this FU are reported by Spain, and in minor quantities, by Portugal. Spanish landings are based on sales notes which are compiled and standardized by IEO. Since 2013, trips from

sales notes are also combined with their respective logbooks, which allow georeferencing the catches.

The total landings have been estimated by this WG since 2016 when the concurrent sampling was satisfactorily implemented. The Spanish concurrent sampling is used to raise the FU 30 observed landings to total effort by *métier*. When the estimated landings exceed the official landings, the difference is provided to InterCatch as non-reported landings.

Since the WGHMM meeting in 2010 (ICES, 2010), *Nephrops* landings in Ayamonte port were incorporated in the Gulf of Cádiz landings time-series, as well as, directed effort and LPUE from 2002 (Table 13.3.1 and Table 13.3.5). *Nephrops* total landings in FU 30 decreased from 108 t in 1994 to 49 t in 1996. After that, there has been an increasing trend, reaching 307 t in 2003 but sharply declined to 147 t in 2004, which is more than a 50% drop. After a new increase in 2005 (246 t), landings trend declined up to 120 t in 2008. In 2008–2012, landings remained relatively stable at around 100 t. Landings declined again in 2013–2015 up to a mean value of 22 t. Since the quota in 2012 was exceeded, the European Commission applied a sanction to be paid within 3 years, 2013–2015 (Figure 13.3.1). The TAC was limiting the fishery during this period. Moreover, the *Nephrops* fishery was closed in 2013 and vessels could only go *Nephrops* fishing for only a few days during summer and winter. Total estimated landings increased in 2016 and 2017 (124 t and 140 t, respectively), representing almost six times the landings observed in 2013–2015. Landings estimations were 75 t in 2018, representing 46% less than the previous year (Figure 13.3.1). In 2019, landings slightly decreased, recording a total of 65 t. Landings in 2020 were only 2 t lower than in 2019 (63 t). Estimates since 2016 are considered the best information available.

A modification of the regulation implemented for the Spanish Administration for the Gulf of Cádiz grounds in 2014 (Orden AAA/1710/2014) established the assignment of *Nephrops* quotas by vessel. This regulation may have caused unreported *Nephrops* landings in the period 2016–2018. The highest value of non-reported landings was recorded in 2017. In 2019, the non-reported landings were lower than 10% of the official landings and were considered zero. Non-reported landings were not recorded in 2020.

Information on discards is submitted to the WG through InterCatch. The discard rate of *Nephrops* in this fishery fluctuates annually but is always very low or zero and thus, discards are considered negligible (Table 13.3.2). In 2019, the percentage of discards was 1.6%, lower than in the last two years. The mean carapace length of the discarded fraction was also lower than that observed in previous years (21.4 mm). Figure 13.3.2 shows the estimated length–frequency distributions (LFDs) of the discarded and retained *Nephrops* by trip for the annual discarding program (2005–2019). The discard sampling program in 2020 was suspended partially due to pandemic and administrative issues and, therefore, no information on *Nephrops* discards was obtained. This has not affected the stock assessment this year because the discard rate in *Nephrops* FU 30 is considered negligible.

13.3.2.2 Biological sampling

The sampling level for the species is given in Table 1.4. The number of samples was much reduced due to the COVID-19 disruption.

Figure 13.3.3 shows the annual landings length distribution for males, females and both sexes combined during the period 2001–2020. The length composition of landings was considered biased from 2001 to 2005 since the sampling of landings was not stratified by commercial categories (Silva *et al*., 2006). A new sampling scheme was applied from 2006 to 2008, making information more reliable. The mean sizes for both sexes remained relatively stable after the sampling scheme was changed, around 29 mm CL for both sexes combined.

Since 2009, onboard concurrent sampling is carried out, as required by the Data Collection Framework (DCF; EU, 2007). Outside the *Nephrops* fishing season, a larger proportion of observer

trips are likely not sufficient to cover *Nephrops* catches, whereas, when the directed *Nephrops* sampling was carried out in harbours during the past, the length distribution of landings were covered for all months. This fact could reduce the consistency of the catch-at-length distribution data. The number of samples between 2013 and 2015 was influenced by the EU sanction in this period coupled with the closure of *Nephrops* fishery in 2013. The sampling effort has been increasing since summer of 2016 due to the additional *Nephrops*-directed sampling to improve the quality of the commercial length distributions. In 2019, the sampling level decreased in the third quarter and was zero during the fourth quarter. This fact could have some impact on the annual estimation of the sex ratio, the mean length and the mean weight in landings. Summer is the main *Nephrops* fishing season, when females are out from their burrows for reproduction, making them more accessible to the fishery. So, sex ratio and mean weight might be affected by the sampling effort distribution along the year.

Onboard sampling was partially conducted in 2020 because of the COVID-19 disruption and administrative issues. Only one *Nephrops* sample was carried out in the third quarter of 2020, but it was not considered representative of the stock size composition. The total annual landings in number in 2020 were used to estimate the harvest rate (%) for that year, so it might have certain impacts on the stock assessment. As an approach, the landings size composition in 2020 has been estimated from the average length–frequency distribution of the last three years (2017–2019 period) and raised to the total landings in 2020.

Mean size of males and females in *Nephrops* landings in 2001–2020 are shown in Figure 13.3.1. The mean sizes show a slightly increasing trend from 2006 to 2013 (35.3 mm CL in males and 31.9 mm CL in females). In 2014 and 2015, the mean size in females was higher than for males, the opposite of what should be expected. It could be due to sampling problems. This fact was investigated in collaboration with the observers. The number of samples and the number of individuals sampled were low in both years which could distort the sex ratio and the mean size in both sexes. The length frequency distribution in both sexes improved since 2016 when additional directed *Nephrops* sampling was implemented. The mean sizes remained relatively stable in 2016–2018. Thus, the average for that period was 32 mm CL in males and 30 mm in females (31.1 mm for combined sexes). Length–frequency distribution shows an increase of small size individuals in 2017 and 2018 (see Figure 13.3.3). In 2019, mean sizes increased, mainly in males (36.9 mm CL in males, 31.9 mm CL in females and 35 mm CL for combined sexes). The male mean size was 32.6 mm CL while the female mean size was 29.5 mm CL, similar to the period 2016–2018.

The proportion of males in the sex ratio of the landings is shown in Figure 13.3.4. The proportion of males remained stable, around 50% since 2009, despite an increase of males observed in 2017 and 2019 (representing 60% and 65% of the landings, respectively). Nevertheless, the proportion of males in 2017 and 2019 might be influenced by the low sampling level during the third quarter. Females are more accessible to the fishing gear in summer (the main *Nephrops* fishing season) when they are out of their burrows for reproduction. In 2020, the sex ratio was estimated as the average from the last three years (2017–2019).

13.3.2.3 Mean weight in landings

The mean weights in landings are shown, for the whole time-series, in Figure 13.3.5. Since 2009, an increasing trend of the mean weight was observed. In 2013, it declined but remained stable to about 31 g until 2015 (period affected by the sanction and TAC limitation). In 2016, a decline in the mean weight in landings was observed again then remained stable in 2017 and 2018, reaching a mean value of 23.4 g during these last three years. The mean weight increased up to 32.4 g in 2019. The low level of sampling when females are more accessible to the *Nephrops* fishery could have caused an increment in the mean weight of the annual landings as males tend to be larger and heavier than females. Mean weight in 2020 has been estimated from the average length–

frequency distribution in the period 2017–2019 due to the pandemic and administrative problems explained before.

13.3.2.4 Abundance indices from surveys

Trawl surveys

The biomass and the abundance indices of *Nephrops* by depth strata, estimated from the Spanish Gulf of Cádiz International Bottom Trawl Surveys Q1 (G7511) (1993–2020 time-series) are shown in Table 13.3.3.

The overall abundance index trend decreased from 1993 to 1998 and remained stable from 1999 to 2009 despite the occurrence of strong fluctuations in some years. The lowest values in the time-series were recorded in 2004 and 2012. In 2010, the deeper strata (500–700 m) were not sampled due to a reduction in the number of fishing days, as a consequence of adverse weather conditions. Therefore, only the abundance index for the strata 200–500 m is available for 2010 (and its value is similar to the corresponding strata in previous years. The abundance index increased significantly in 2013 and 2014 (Table.13.3.3). The survey index has fluctuated since 2015 then declined in 2017 and 2018. Results in 2019 and 2020, show an increasing trend of the abundance survey index achieving the highest value recorded in 2020 (Figure 13.3.6). It should be noted that this survey is not specifically directed to *Nephrops* and is not carried out during the main *Nephrops* fishing season.

The length distributions of *Nephrops* obtained in the Spanish Gulf of Cádiz International Bottom Trawl Surveys Q1 (G7511) during the period 2001–2020 are presented in Figure 13.3.7 In 2015 and 2016, an increase of smaller individuals was observed. The mean size for both sexes increased in 2017 while remaining relatively stable in 2018 and 2019 (~ 36 mm CL in males and ~ 30 mm CL in females). In 2020, the mean size decreased to 33.9 mm CL in males while remained stable at around 30 mm CL in females. The *Nephrops* mean sizes time-series for males, females and combined sexes obtained in this survey are shown in Figure 13.3.8. No apparent trends are observed. The mean size ranged between 28.3 and 32.7 mm CL for females and 31.9 and 42.9 mm CL for males.

UWTV surveys

An exploratory *Nephrops* UWTV survey on the Gulf of Cádiz fishing grounds (U9111), named ISUNEPCA survey, was carried out within the framework of a project supported by Biodiversity Foundation (Spanish Ministry of Agriculture, Food and Environment) and European Fisheries Fund (EFF) in 2014 (Vila *et al*., 2014). This survey was considered exploratory in 2014 and, currently, five UWTV surveys are available (2015 to 2019). UWTV survey was not conducted in 2020 due to the COVID-19 disruption.

The ISUNEPCA UWTV surveys (U9111) surveys are based on a randomized isometric grid design with stations spaced by 4 nm. The methods used during the surveys are according to WKNEPHTV (ICES, 2007), WKNEPHBID (ICES, 2008), and SGNEPS (ICES, 2012) and WGNEPS (ICES, 2020b). A description of UWTV surveys carried out in FU 30 since 2014 is documented in the Stock Annex.

UWTV surveys results were evaluated in WKNEP, the Benchmark Workshop on *Nephrops* Stocks in 2016 (ICES, 2017a). WKNEP concluded that the UWTV survey in FU 30 is appropriate to providing scientific advice on stock abundance.

The highest mean burrow density (adjusted to the cumulative bias) was obtained in 2017 (0.13 burrows/m^2). This value slightly decreased in 2018 (0.12 burrows/m^2) and has declined considerably in 2019 (0.04 burrows/m^2) and it reaching the lowest value in 2021 (0.02 burrows/m2) (Table 13.3.4).

The final modelled density surfaces for the time-series (2015–2021; 2020 not available) are shown as heat maps and bubble plots in Figure 13.3.9. The abundance estimate derived from the krigged burrow surface (and adjusted for the cumulative bias) increased from 298 in 2015 to 371 million burrows in 2017 with a lower value recorded in 2016 of 232 million burrows. The coefficient of variation was about 7% in 2015 and 2016 but this increased in 2017 (CV = 8.7%). In 2018, the geostatistic abundance estimate was slightly lower than the previous year (329 million burrows) with a CV of 6%. However, the heat map of the abundance estimates in the main patch within the *Nephrops* distribution area, where the commercial bottom-trawl operates, shows an increase compared to 2017. In 2019, the geostatistical abundance estimate was 113 million burrows, representing 65% less than the previous year (Table 13.3.4). The CV was 9.7%, higher than the previous year. In 2020, the Nephrops abundance is unknown and the value obtained in 2021 was the lowest one of the time series (73 millions burrows). The CV in 2021 was 11.5%.

The total number of TV stations was increased up to 65 in 2017 and raised to 70 in 2018 and 2019 but it was lower in 2021 (65 stations). However, the stations used in the geostatistical abundance estimate were 62, 60, 65 and 59, respectively. Deviation of the planned stations is usually due to the poor visibility related to recent fishing activity in some stations or due to the uncertainty generated by the presence of other crustaceans burrows.

In 2019, many technical problems occurred in the UWTV survey, which was related to the communication between the sledge and the desk unit by the vessel coaxial cable. This resulted in a reduction of the effective survey time. So, the planned stations had to be prioritized. In the shallowest edge, besides the very poor visibility, the available VMS data from the *Nephrops*-directed trips and the Spanish Gulf of Cádiz International Bottom Trawl Survey series (G7511 and G4309) indicate a very low density which generates a high uncertainty in the *Nephrops* burrows identification. Additional information obtained from the beam trawl hauls carried out in the 2017–2019 period indicated the absence of *Nephrops* in the hauls at depths lower than 200 m. Therefore, it was decided to sacrifice the 12 stations located at lower depths, which were considered *Nephrops* zero density stations although still included in the geostatistical analysis (Figure 13.3.9).

The final modelled density surfaces in the ISUNEPCA UWTV surveys (U9111) time-series (2015–2021; 2020 not available) are shown as heat maps and bubble plots in Figure 13.3.9 UWTV survey in 2020 could not be conducted due to the COVID-19 disruption.

Data compiled during ISUNEPCA UWTV survey series (U9111) suggest that the survey area is probably smaller than the current area and, therefore, should be reviewed during the next benchmark. New and more accurate information is available for this issue. The Andalusia Regional Government has installed its own vessel monitoring system on vessels using GPRS/GSM, a cellular network technology that sends vessel positions and speed data every three minutes instead of two hours in the traditional VMS. Additionally, information obtained from beam trawl and sediment samples obtained in the ISUNEPCA UWTV survey (U9111) during 2017–2019, as well as, the more detailed seabed morphology information and new information about the relationship between sediments and habitats in the Gulf of Cádiz (Lozano *et al.*, 2019; Lozano *et al.*, 2020) could also be very useful to redefine the survey area in FU 30. A provisional new survey area was presented during the WGNEPS 2020 (ICES, 2021). The WGNEPS recommended finalizing this analysis and reviewing footage that are out of the new provisional survey area before the 2021 WGBIE. Unfortunately, this work has not been finished on time for this WG but it is planned to be presented in WGNEPS 2021 and WGBIE 2022.

13.3.2.5 Commercial catch and effort data

Figure 13.3.1 and Table 13.3.5 show directed *Nephrops* effort estimates and LPUE series modified after the incorporation of data from Ayamonte port since 2002. Directed effort is estimated from trips that land at least 10% *Nephrops*. The directed fishing effort trend is clearly increasing from

1994 to 2005, where the highest value of the time-series was recorded (4336 fishing days). After that, the effort declined up to 2008 (73%) remaining relatively stable during the 2009–2012 period. As a consequence of the sanction in 2012, the effort dropped (mean value 283 fishing days) in 2013–2015. Fishing effort increased from 2016 (443 fishing days) to 2019 (675 fishing days). In 2020, a slight decrease was observed (625 fishing days) (Figure 13.3.1).

LPUE obtained from the directed effort shows a gradual decrease from 1994 to 1998. After 1998, the trend slightly increased until 2003. In 2004, the LPUE decreased to the lowest value recorded (44.3 kg/fishing day) in the time-series. LPUE then increased until 2008 to around 60% higher. In the following years, the LPUE declined to 50 kg/fishing day in 2009 (about 30% less with respect to 2008) and 45.5 kg/fishing day in 2010. The increased abundance of rose shrimp in 2008 is believed to have led to a change in the fishery objectives as rose shrimp achieves a higher market value and is caught in shallower fishing grounds (90–380 m) which are closer to the coast. Since 2010, LPUE shows an increasing trend with a high rise in 2013. After a drop in the LPUE in 2014, the commercial abundance index showed an increasing trend up to 2016. The commercial index declined in 2017 and remained relatively stable in 2018 compared to the previous year. In 2019, commercial LPUE increased by 57% in relation to the previous year but in 2020, this index reduced about 20% (Figure 13.3.1). LPUE in the period 2013–2015 must be taken with caution as during this period a penalty for exceeding the quota in 2012 was applied, which increases the uncertainty associated with the LPUE index. Moreover, the assignment of *Nephrops* quotas by vessel implemented in 2014 might have caused unreported landings and contributed to increasing the uncertainties around the commercial index estimate since this date. On the other hand, LPUE was estimated using the official landings (reported landings) and not the total landings estimated by the WG since 2016. This fact might contribute to increase the uncertainty of the commercial abundance index.

13.3.3 Assessment

This stock was benchmarked in October 2016 (ICES, 2017a). The assessment is based on UWTV survey trends according to category 3 for *Nephrops* stocks, following the 2-over-3 rule.

13.3.4 Catch options

Table 13.3.6 shows the UWTV (U9111) abundance, estimates of the mean weight and harvest rate (HR) for the period 2017–2021 (2020 data not available). A decreasing trend of the HR was observed from 2016 to 2018 but it increased in 2019. HR in 2020 is not available and abundance was not estimated as the UWTV survey was not carried out because of COVID-19 disruption.

The prediction of landings for the FU 30, using the procedure agreed upon at WKNEP 2016 (ICES, 2017a) and outlined in the Stock Annex, is usually made on the basis of the UWTV survey estimated abundance obtained in the advice year and is presented in October for the provision of advice. Input table for the catch options in 2021 is given below:

Variable	Value	Source	Notes
Stock abundance	73.2 millions	ICES (2021)	UWTV survey 2021
Mean weight in landings	26.8 g	ICES (2020)	Average 2018-2020
Mean weight in discards	-	ICES (2020)	Not relevant
Discard proportion	0%	ICES (2020)	Negligible
Discard survival rate	-	ICES (2020)	Not relevant
Dead discard rate	0%	ICES (2020)	Negligible

13.3.5 Biological reference points

F_{MSY} proxy ($F_{0.1}$) derived from the SCA (Separable Cohort Analysis; Pope and Shepherd, 1982) model during WKNEP 2016 (ICES, 2017a), corresponds to a harvest rate of 9.5% but this resulted in much higher catch advice than the historically observed values. WKNEP 2016 decided to derive the HR from historical catches of this stock and the exploitation in similar stocks as an interim solution until a more consolidated basis for generating advice from UWTV survey abundance estimates can be developed (ICES, 2017a). Taking into account the history of the fishery in *Nephrops* FU 30, HR was estimated to range between 1.5% in 2010–2012 and 4% when landings achieved the highest value (2003). The 2013–2015 period was not considered because TAC was limiting the fishery as a consequence of the penalty applied for exceeding the TAC in 2012. So WKNEP 2016 recommended setting an initial F_{MSY} proxy to 4% and moving gradually towards this level despite the absence of a current transition scheme definition. As the UWTV survey approach was just recently initiated for the FU 30 during WKNEP 2016, caution was recommended in the definition of the transition scheme towards F_{MSY} proxy (ICES, 2017a).

WKNEP 2016 also recommended a new EG on reference points that will examine the methodology for all *Nephrops* reference points with focus on M and growth.

ADGNEP agreed in October 2017 that in the absence of stock-specific MSY harvest rate in *Nephrops* FU 30 (due to poor fits in length–frequency model analyses), normally used for calculating F_{MSY} for category 1 in *Nephrops* stocks, that the basis of advice for this stock should follow the category 4 approach for Norway lobster stocks and not category 1. ADGNEP recommended that when stock-specific MSY reference points can be estimated, *Nephrops* FU 30 will meet the requirements for category 1 assessment.

The WGBIE 2017 supported the proposal of a specific workshop before the 2018 WGs assessment (ICES, 2017b). The WK*Nephrops* was finally held in November 2019 (ICES, 2020c). Different models were applied to *Nephrops* in FU30 during WK*Nephrops*. Some of them are methods developed for data-limited stocks as Length-Based Indicators (LBI) or Mean Length-Z at WKLIFE V (ICES, 2015) while others are used for calculating MSY Reference Points for Category 1 *Nephrops* stocks, such Separable Cohort Analysis (*SCA* R package, version 1.2.0, Bell, 2019) and Separable Length Cohort Analysis (SLCA–*nepref* R package, version 0.2.2, Dobby, 2019) (Leocádio *et al.*, 2018). SCA model gave FU 30 stock estimates far below those estimated from the UWTV survey. Factors as the uncertainties around natural mortality and growth parameters can affect the shape of the catch-at-length distribution and can produce different magnitudes of stock abundance. On the other hand, the abundance from UWTV input value in the model for FU 30 seems to be very sensitive, where lower UWTV survey input resulted in a model with a better fit. Some exploratory runs were carried out using SLCA but the resulting HRs were also very high.

To conclude, the MSY reference point could not be properly derived for FU 30 during the WK*Nephrops* in 2019 (ICES, 2020c). Other methods need to be explored in order to obtain specific FU 30 MSY reference points and upgrade this *Nephrops* stock to category 1.

Estimates from Length-Based Indicators (LBIs) and Mean Length-Z method as defined in WKLIFE-V (ICES, 2015) and WKProxy (ICES, 2016) were updated during the WK*Nephrops* in 2019 (ICES, 2020c) and presented in WGBIE 2020 (ICES, 2020a). Results are included in the stock annex. Estimates from LBIs were updated in 2021 (Table 13.3.7). Results show the ratios L_c/L_{mat} and $L_{25\%}/L_{mat}$ indicate that immature individuals are not preserved. P_{mega} is lower <30% indicates a truncated length distribution in the catch. The optimizing yield (L_{mean}/L_{opt}) is below the desirable value of 0.9, i.e. catch is below the theoretical length L_{opt}. MSY indicator is lower than 1, so fishing is above F_{MSY}.

However, reference points resulting from the application of these methods are not suitable to use for *Nephrops* Stocks assessed using UWTV surveys because they use a harvest rate, expressed as a percentage, and not a fishing mortality reference point.

13.3.6 Management considerations

Nephrops fishery is taken in mixed bottom-trawl fisheries; therefore the harvest control rules (HCRs) applied to other species will affect this stock.

In 2013 and 2014, the *Nephrops* fishery was closed for most of the year because the quota in 2012 was exceeded and the European Commission applied a sanction to be paid in 3 years.

A Recovery Plan for the Iberian stocks of hake and *Nephrops* was approved in December 2005 (EU, 2005). This recovery plan was based on a precautionary reference point for southern hake that is considered no longer appropriate. By derogation, a different method for effort management was applied to the Gulf of Cádiz. A multiannual management plan (MAP) for the Western Waters was published by the European Parliament and the Council (EU, 2019a). This plan applies to demersal stocks including *Nephrops* in FU 30 in ICES Division 9.a.

Different Fishing Plans for the Gulf of Cádiz have been established by the Spanish Administration since 2004 in order to reduce the fishing effort of the bottom-trawl fleet (ORDENES APA/3423/2004, APA/2858/2005, APA/2883/2006, APA/2801/2007, ARM/2515/2009, ARM/58/2010, ARM/2457/2010; AAA/627/2013). These plans established a closed fishing season of 45 days, between September and November, plus 5 additional days to be selected by the shipowner during the duration of this Plan. The potential effect of the closed seasons on the *Nephrops* population has not been evaluated. Additionally, an increase of the mesh size to 55 mm or more was implemented at the end of 2009 in order to reduce discards of individuals below the minimum landing size. In 2014, a modification of the last Fishing Plan for the Gulf of Cádiz was established (AAA/1710/2014, modified by AAA/1406/2016). This new regulation establishes the assignment of *Nephrops* quotas by fishing vessel. The Fishing Plan for the Gulf of Cádiz (APM/453/2018) changes the closed season for the bottom-trawl fleet to the period from 16 September to 31 October.

Several regulations were established by the Regional Administration with the aim of distributing the fishing effort throughout the year (Resolutions: 13 February 2008, BOJA nº 40; 16 February 2009, BOJA nº 36; 23 November 2009, BOJA nº 235; 15 October 2010, BOJA nº 209). These regional regulations control the days and time when the Gulf of Cádiz bottom-trawl fleet can enter or leave the fishing ports. Although the regulations varied among them, they generally allowed large flexibility during late spring and summer (e.g. the 2010 Regulation established a continuous period from Monday 3 am to Thursday 9 pm during May–August, that was implemented in 2011), which is the main *Nephrops* fishing season, and a more restricted period in other months. This fishing flexibility during summer might have induced fleets from the ports closer to *Nephrops* grounds, such as Ayamonte or Isla Cristina, to direct their fishing effort to this species between 2008 and 2011. Currently, this regulation is not implemented.

Unwanted catches from *Nephrops* are regulated by the discard plan for the demersal fisheries in South-Western waters for the period 2019–2021 (EU, 2018 replaced by EU, 2019b), under which they are exempted from the landing obligation based on the species' high survival rates. This exemption applies to all catches of Norway lobster from ICES subareas 8 and 9 with bottom-trawls, with the immediate release of all discards in the area where they were caught.

13.3.7 References

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13.3.8 Tables and figures

Table 13.3.1. *Nephrops* in FU 30. Gulf of Cádiz: Landings (in tonnes) by country.

Year	Spain**	Portugal	Non-reported	Total
1994	108			**108**
1995	131			**131**
1996	49			**49**
1997	97			**97**
1998	85			**85**
1999	120			**120**
2000	129			**129**
2001	178			**178**
2002	262			**262**
2003	303	4		**307**
2004	143	4		**147**
2005	243	3		**246**
2006	242	4		**246**
2007	211	4		**215**
2008	117	3		**120**
2009	117	2		**119**
2010	106	1		**107**
2011	93	3		**96**
2012	115	1		**116**
2013	26	< 1		**27**
2014	14	< 1		**15**
2015	25	< 1		**25**
2016	35	< 1	89	**124**
2017	38	< 1	101	**140**
2018	49	< 1	27	**75**
2019	65	0	0	**65**
2020	55	8	0	**63**

**** Ayamonte landings are included since 2002.**

Table 13.3.2. *Nephrops* in FU 30. Gulf of Cádiz. Mean carapace length (in mm) of the discarded and retained fraction and percentage of discard in weight and number (2005–2020) for the annual discarding program.

	MEAN CARAPACE LENGTH (mm)		% DISCARDED	
	Discarded fraction	Retained fraction	Weight	Number
2005	23.4	33.5	5.2	15.2
2006	20.5	29.4	4.6	11.8
2007	23.2	33.7	0.5	1.4
2008	20.8	35.2	2.5	7.7
2009	21.2	30.2	2.7	4.0
2010	21.9	31.7	1.3	4.5
2011	-	32.7	0.0	0.0
2012	-	32.6	0.0	0.0
2013	23.9	32.7	3.7	10.9
2014	-	34.5	0.0	0.0
2015	21.2	33.6	2.0	5.4
2016	20.5	31.0	0.0	0.1
2017	24.2	29.8	2.5	3.0
2018	23.5	32.0	2.9	7.6
2019	21.4	35.6	1.6	7.2
2020*	na	na	na	na

*** Discard sampling was only partially conducted due to the COVID-19 pandemic and administrative problems in IEO.**

Table 13.3.3. ***Nephrops*** in **FU 30**. **Gulf of Cádiz. Abundance index from Spanish Gulf of Cádiz Bottom Trawl Surveys Q1 (G7511).**

Spanish Gulf of Cádiz International bottom trawl surveys Q1 (G7511)						
Year	200–500 meters		500–700 meters		200–700 meters	
	kg/60'	Nb/60'	kg/60'	Nb/60'	kg/60'	Nb/60'
1993	0.77	19	1.16	34	0.95	26
1994	1.23	31	0.60	8	0.94	21
1995	0.55	8	**	**	na	na
1996	0.56	10	1.33	29	0.93	19
1997	0.08	2	0.70	23	0.38	12
1998	0.40	16	0.23	7	0.30	11
1999	0.50	15	0.28	7	0.41	12
2000	0.22	7	0.57	15	0.37	10
2001	0.32	8	0.61	14	0.44	11
2002	0.49	17	0.45	11	0.47	14
2003	ns	ns	ns	ns	ns	ns
2004	0.15	5	0.15	4	0.15	5
2005	0.54	18	0.76	25	0.64	21
2006	0.24	6	0.66	20	0.42	12
2007	0.44	16	0.23	9	0.35	13
2008	0.88	26	0.81	14	0.85	20
2009	0.64	18	0.30	4	0.37	9
2010	0.63	20	**	**	na	na
2011	0.35	11	0.08	2	0.23	7
2012	0.15	4	0.22	4	0.18	4
2013	0.36	13	1.39	51	0.79	29
2014	2.97	84	0.50	9	1.92	52
2015	1.04	45	1.58	52	1.27	48
2016	4.38	194	0.5	15	2.73	118
2017	2.27	79	0.86	20	1.67	54

Spanish Gulf of Cádiz International bottom trawl surveys Q1 (G7511)						
Year	200–500 meters		500–700 meters		200–700 meters	
	kg/60'	Nb/60'	kg/60'	Nb/60'	kg/60'	Nb/60'
2018	0.49	15	0.23	5	0.38	11
2019	1.49	46	1.14	27	1.34	38
2020	7.07	262	4.93	405	6.16	323

ns = no survey.

** = no simple.

Table 13.3.4. *Nephrops* in FU 30. Gulf of Cádiz. Summary table of results from the geostatistical analysis for ISUNEPCA UWTV survey (U9111).

Year	Nª stations	Mean density adjusted	Area Surveyed	Domine area	Geoestatistical Abundance estimate adjusted	CV on burrow estimate
		Burrow/m2	Km2	Km2	Millions burrows	%
2015	58	0.0905	3000	3000	298	7.6
2016	58	0.0776	3000	3000	233	7.3
2017	62	0.1336	3000	3000	371	8.7
2018	60	0.1197	3000	3000	329	6.0
2019	65	0.0377	3000	3000	113	9.7
2020*	NA	NA	NA	NA	NA	NA
2021	59	0.0238	3000	3000	73	11.5

* UWTV Survey in 2020 was not carried out due the COVID-19 disruption.

Table 13.3.5. *Nephrops* in FU 30. Gulf of Cádiz. Total landings and landings, LPUE and effort of the bottom trawl fleet making fishing trips with at least 10% of *Nephrops* catches.

Year	*Total landings (t)	**Landings (t)	**LPUE (kg/day)	**Effort (Fishing days)
1994	108	90	98.6	915
1995	131	107	99.4	1079
1996	49	40	88.2	458
1997	97	75	79.2	943

Year	*Total landings (t)	**Landings (t)	**LPUE (kg/day)	**Effort (Fishing days)
1998	85	51	62.3	811
1999	120	83	66.2	1259
2000	129	90	60.6	1484
2001	178	130	67.7	1924
2002	262	196	69.4	2827
2003	307	214	75.4	2840
2004	147	98	44.3	2206
2005	246	228	52.7	4336
2006	246	227	64.0	3555
2007	215	198	63.7	3105
2008	120	84	72.9	1150
2009	119	83	50.0	1653
2010	107	73	45.5	1603
2011	97	62	54.6	1135
2012	116	80	58.0	1380
2013	27	24	92.1	262
2014	15	12	40.1	293
2015	25	17	58.8	294
2016***	124	29	64.6	443
2017	140	24	45.5	535
2018	76	31	47.1	658
2019	65	50	73.7	675
2020	63	37	59.0	625

***Ayamonte landings are included since 2002.**

****Landings, LPUE and fishing effort from fishing trips with at least 10% of *Nephrops* catches.**

***** Since 2016, total landings were estimated by WGBIE. Official landings are used for LPUE estimation.**

Table 13.3.6. *Nephrops* in FU 30. Gulf of Cádiz. Summary for the assessment.

Year	Landing in number	Total discard in number*	Removals in number	UWTV Abundance estimates	95% conf. intervals	Harvest Rate	Mean weight in landings	Mean weight in discard	Discard rate	Dead discard rate
	millions	millions	millions	millions	millions	%	g	g	%	%
2014**	0.48	0	0.48	282		0.2	31.2	0	0	0
2015	0.80	0	0.80	298	45	0.3	30.8	0	0	0
2016	5.35	0	5.35	233	34	2.3	23.2	0	0	0
2017	5.95	0	5.95	370	63	1.6	23.3	0	0	0
2018	3.21	0	3.21	329	39	1.0	23.4	0	0	0
2019	1.99	0	1.99	113	21	1.8	32.5	0	0	0
2020***	2.55	0	2.55	NA	NA	-	24.6	0	0	0
2021				73	17	0.03				

*** Discards are considered negligible and are not included in the assessment.**

**** UWTV survey in 2014 is considered exploratory. UWTV abundance estimate is not adjusted by the cumulative bias.**

***** UWTV survey in 2020 was not carried out due to the COVID-19 disruption.**

***** Landings length distribution sampling in 2020 was not carried out because of the COVID-19 pandemic disruption and administrative issues.**

***** Landings in number in 2020 estimated as the average of the length distribution for 2017–2019 period raised to the total landings in 2020.**

Table 13.3.7. Nephrops in FU 30. Gulf of Cádiz. Estimates from Length-Based Indicators (LBIs) for both sexes.

Females

	Conservation				Optimizing Yield	MSY
Year	L_c / L_{mat}	$L_{25\%}$ / L_{mat}	$L_{max\ 5}$ / L_{inf}	P_{mega}	L_{mean} / L_{opt}	L_{mean} / $L_{F = M}$
2018	1.11	1.11	0.71	0.01	0.82	0.92
2019	1.19	1.26	0.77	0.04	0.87	0.94
2020	1.00	1.04	0.62	0.00	0.72	0.87

Males

	Conservation				Optimizing Yield	MSY
Year	L_c / L_{mat}	$L_{25\%}$ / L_{mat}	$L_{max\ 5}$ / L_{inf}	P_{mega}	L_{mean} / L_{opt}	L_{mean} / $L_{F = M}$
2018	1.04	1.04	0.66	0.00	0.76	0.89
2019	1.11	1.18	0.72	0.01	0.81	0.92
2020	0.93	1.00	0.68	0.01	0.74	0.93

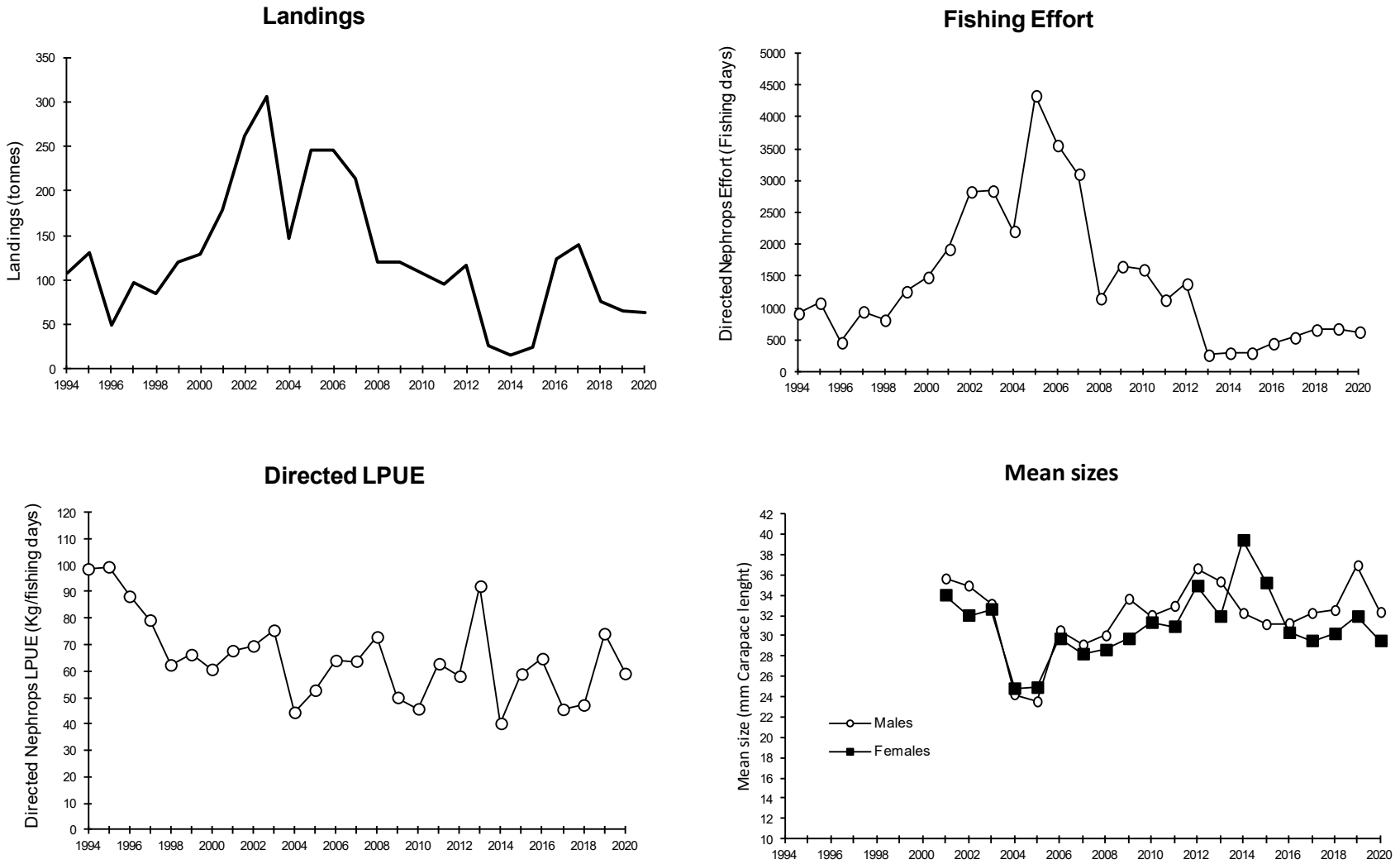


Figure 13.3.1. *Nephrops* in FU 30. Gulf of Cádiz. Long-term trends in the landings, *Nephrops*-directed effort and LPUE and mean sizes.

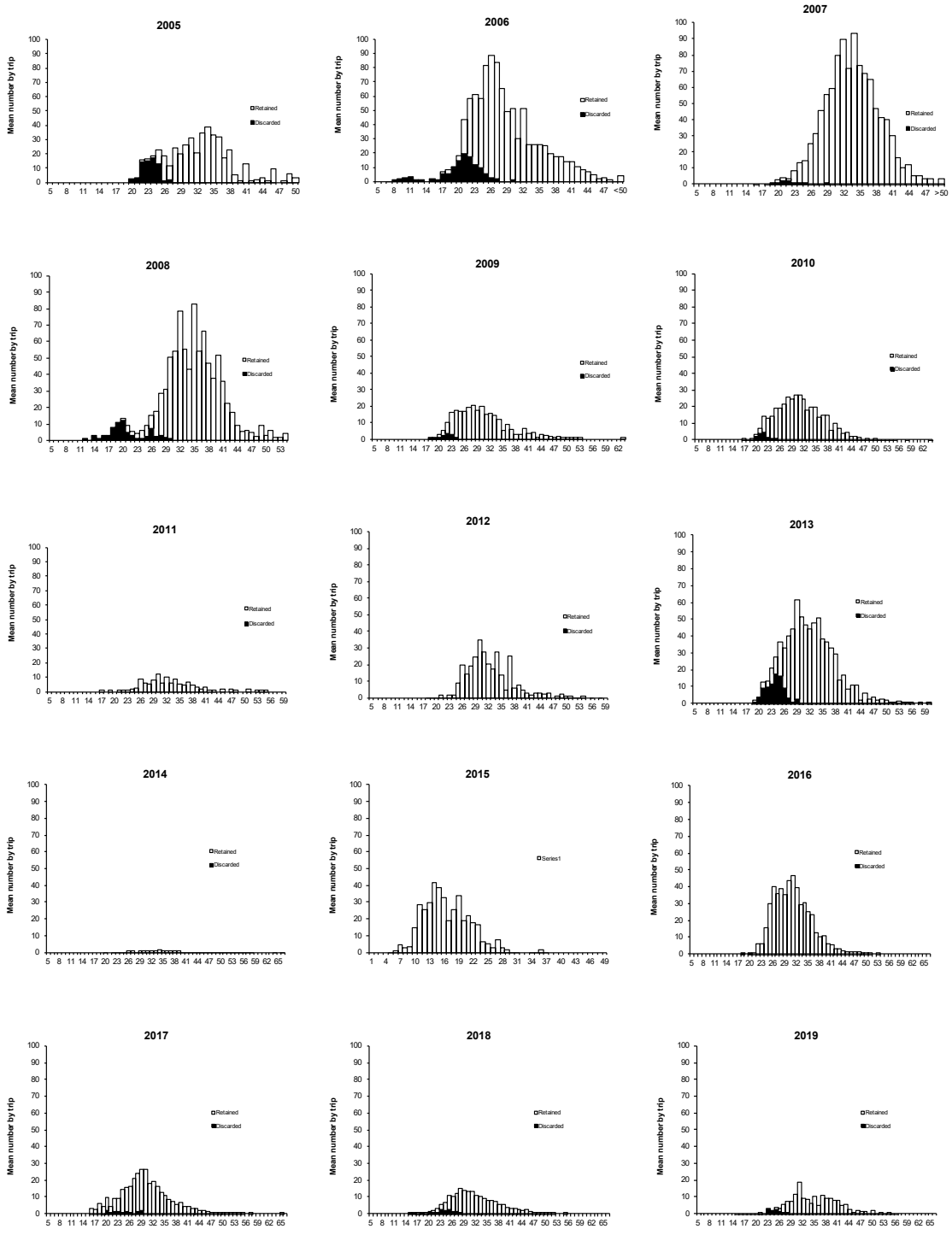


Figure 13.3.2. *Nephrops* in FU 30. Gulf of Cádiz. Length–frequency distribution of retained and discarded fractions *Nephrops* from discards program (2005–2019 period). Discard sampling was partially carried out due to pandemic and administrative problems in 2020. No data were available in 2020.

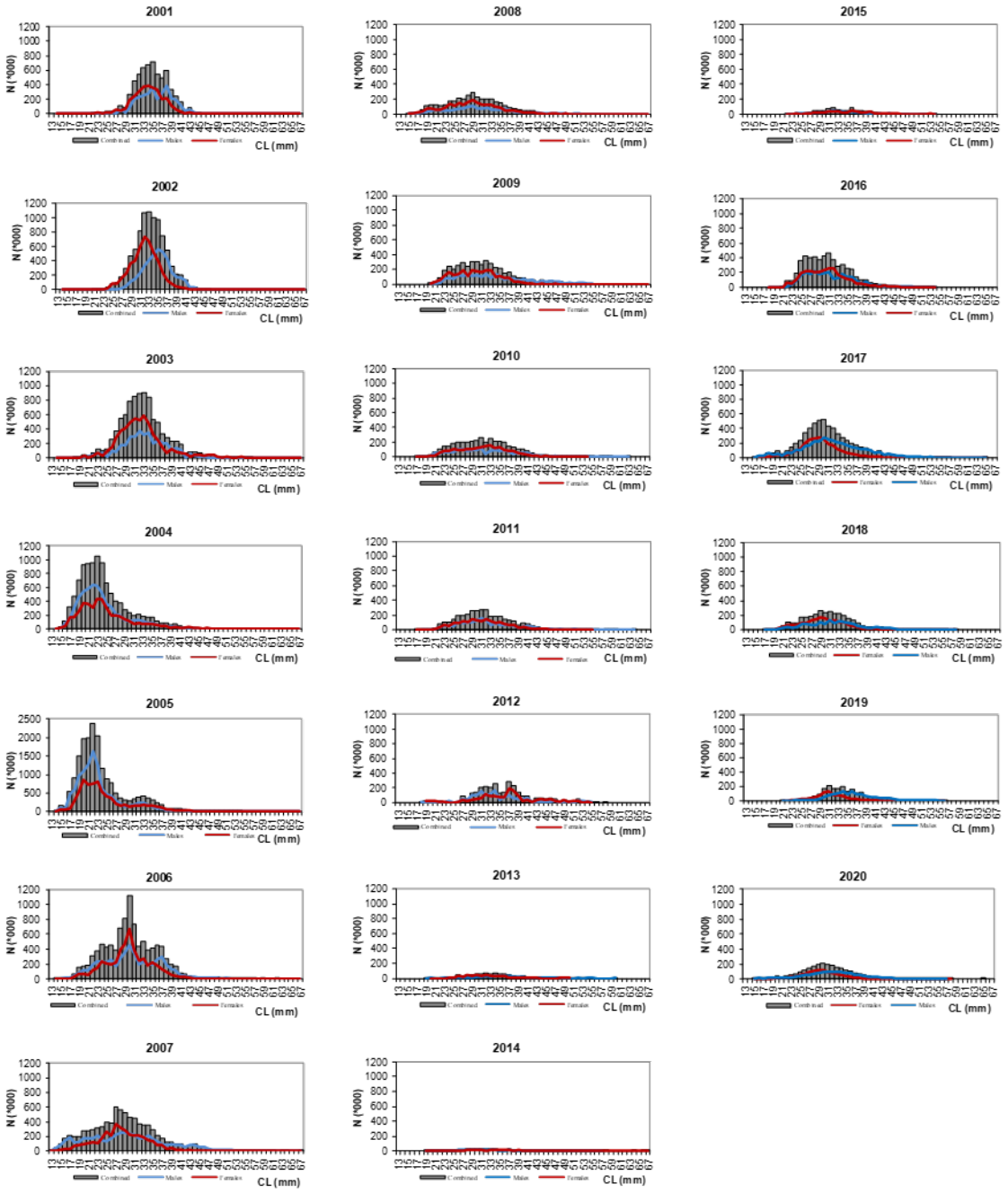


Figure 13.3.3. ***Nephrops*** **in FU 30. Gulf of Cádiz. Length distributions of landings for the period 2001–2020. Landings size composition in 2020 has been estimated from the average length frequency distribution of the last three years (2017–2019 period) and raised to the total landings in 2020.**

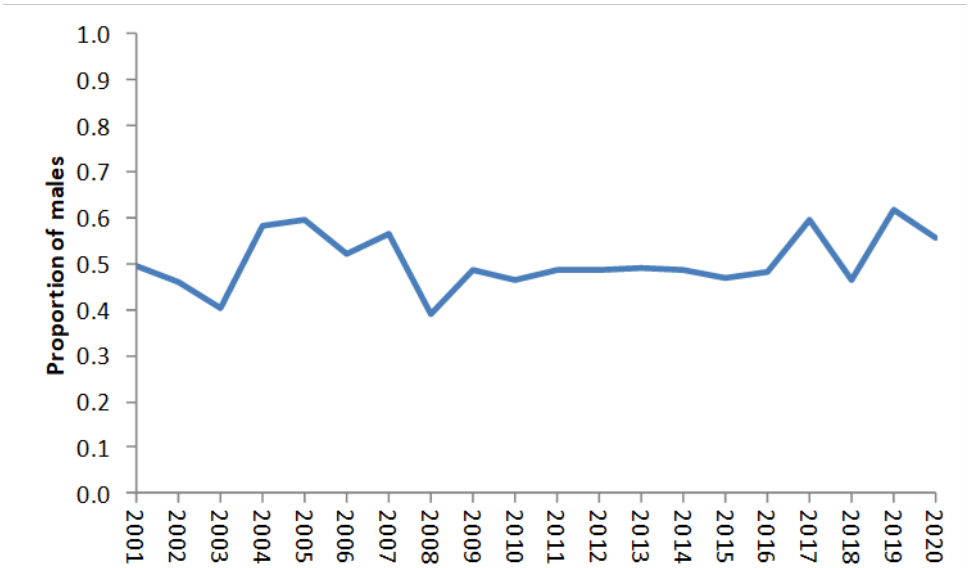


Figure 13.3.4. *Nephrops* in FU 30. Gulf of Cádiz. Proportion of males in landings for the time-series. Sex-ratio in 2020 has been estimated using the average length–frequency distribution of the last three years (2017–2019 period).

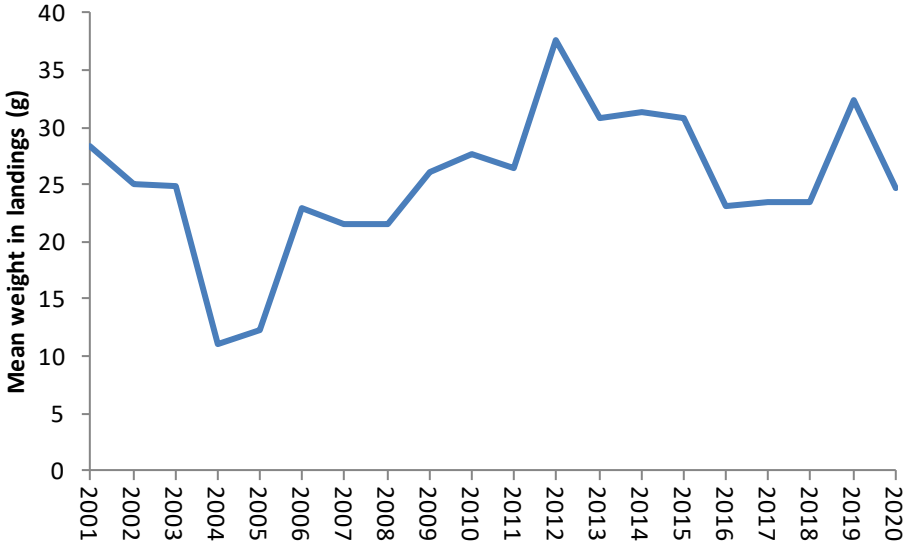
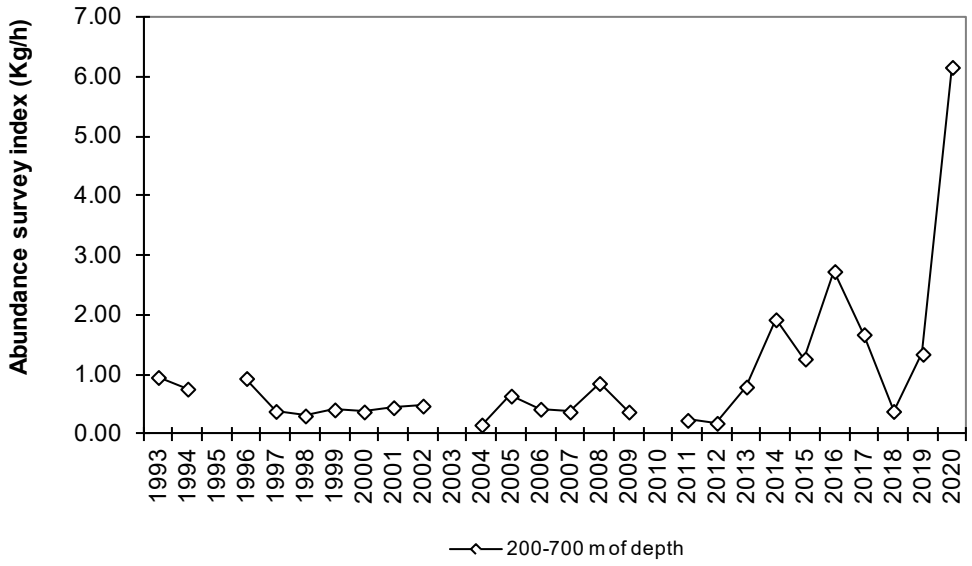


Figure 13.3.5. *Nephrops* in FU 30. Gulf of Cádiz. Time-series of the mean weight trend in commercial landings. Data in 2020 has been estimated using the average length–frequency distribution of the last three years (2017–2019 period).



* 1995 and 2010: strata 500-700 m no sampled

** 2003: no survey

Figure 13.3.6. *Nephrops* in FU 30. Gulf of Cádiz, Abundance index from Spanish International Gulf of Cádiz Bottom Trawl Surveys Q1 (G7511).

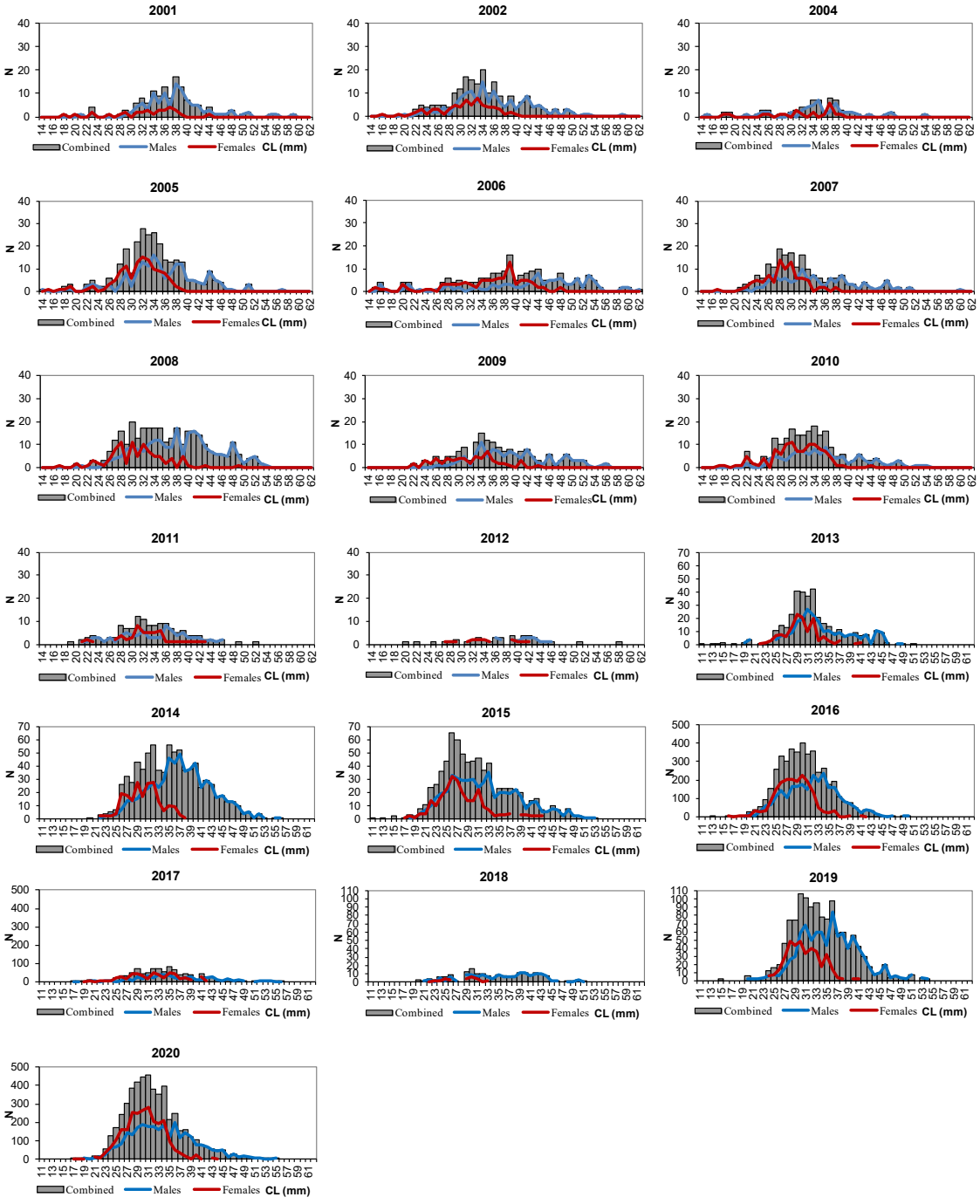


Figure 13.3.7. *Nephrops* in FU 30. Gulf of Cádiz. Length–frequency distributions from Spanish International Gulf of Cádiz Bottom Trawl Surveys Q1 (G7511) for the period 2001–2020.

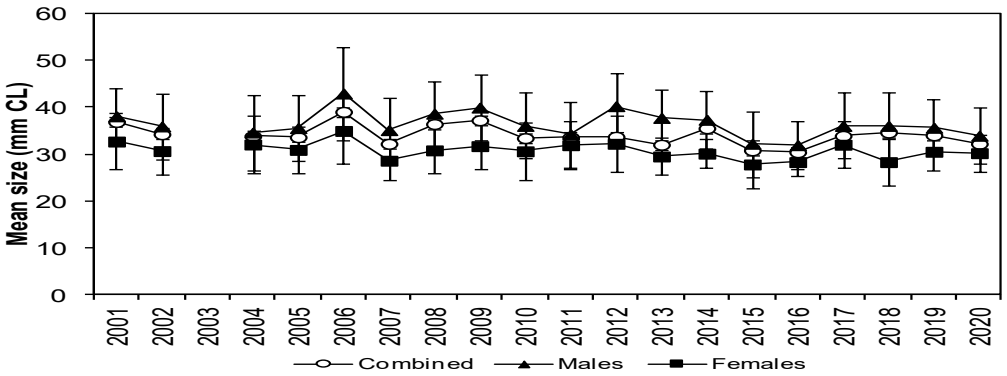


Figure 13.3.8. *Nephrops* in FU 30, Gulf of Cádiz. Mean size in Spanish International Gulf of Cádiz Bottom Trawl Surveys Q1 (G7511) for the period 2001–2020.

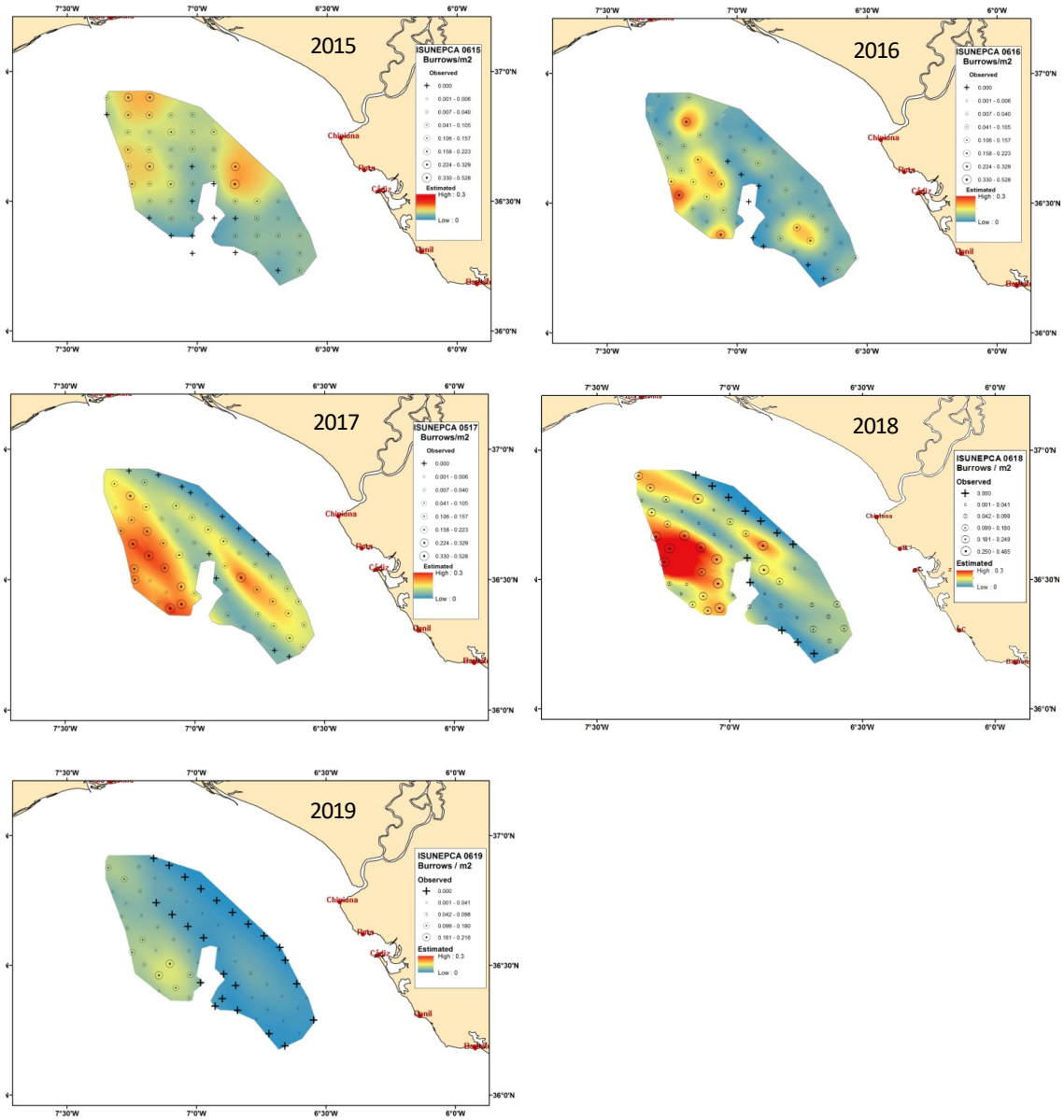


Figure 13.3.9. *Nephrops* in FU 30. Gulf of Cádiz. Contour plots of the krigged density estimates for the ISUNEPCA UWTV surveys (U9111) time-series (2015–2019). No UWTV survey was conducted in 2020 due to the COVID-19 disruption. This figure will be updated after the UWTV survey in 2021.