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Section contents

11 Norway lobster in divisions 8.a and 8.b, Functional Units 23–24 (northern and central Bay of Biscay)

Nephrops norvegicus – nep.fu.2324

Type of assessment: Update assessment.

The northern and central Bay of Biscay Norway lobster, *Nephrops norvegicus,* in divisions 8a, b (Functional Units 23–24) is classified as a category 1 stock since 2016 (ICES, 2017a; ICES 2021a).

Advice basis: MSY approach. The advice for this stock is annual.

Data and method revisions

Main changes from the last assessment (ICES, 2020): In 2016, the stock was benchmarked (ICES, 2017a) and assessment based on UWTV survey conducted since 2014 was validated as an analytical method. Assessment was updated in September–October 2021, when the UWTV survey results became available and could taken into account.

ICES description: 8a, b

Functional Units (FU): Bay of Biscay North, 8a (FU 23), Bay of Biscay South, 8b (FU 24).

11.1 General

11.1.1 ICES Advice for 2021

Previously, advice for this stock was provided biennially under category 3, with only trends of the annual assessment taken into account for the advice. The UWTV survey, routinely carried out since 2014, was validated as the standard assessment method for this stock during the 2016 benchmark workshop WKNEP (ICES, 2017a). The stock was upgraded to category 1 and the advice is provided annually. The latest ICES advice provided in 2020 recommended that when the MSY approach is applied, catches in 2021 should be no more than 6105 t, corresponding to 3984 t of landings considering the revised survival rate for discards to 50% instead of 30% adopted during the WK*Nephrops* (ICES, 2020b).

11.1.2 Management applicable for 2020 and 2021

The *Nephrops* fishery is managed by a TAC [articles 3, 4, 5(2) of Regulation (EC) No 847/96] along with technical measures. The agreed TAC for 2020 was 3886 t and for 2021, the TAC was fixed at 3984 t.

For a long-time, a minimum landing size (MLS) of 26 mm CL (8.5 cm total length) was adopted by the French producers' organization, which is larger than the EU MLS set at 20 mm CL i.e. 7 cm total length. Since December 2005, a new French MLS regulation (9 cm total length) was established. This change had significantly affected the data used by the WG (see report WGHMM in 2007; ICES, 2007).

A mesh size change was implemented in 2000 and the minimum codend mesh size (MMS) in the Bay of Biscay was 70 mm which replaced the 50 mm mesh size implemented in 1990–1991. Technical regulations have also been introduced to reduce *Nephrops* bycatch in the Bay of Biscay fishery. In 2002, the European Commission (EC) established some technical measures for the

recovery of the northern stock of European hake, under which the minimum codend mesh size (MMS) was increased from 70 to 100 mm in the hake box to reduce the high level of hake discarding by *Nephrops* trawlers in the Bay of Biscay (EU Reg. 2341/2002). In 2006 and 2007, *Nephrops* trawlers were allowed to fish in the hake box with a mesh size smaller than 100 mm once they have adopted a square mesh panel of 100 mm. This derogation was maintained onwards.

As cited in paragraph 24 of the preamble of the European Regulation (EC) No. 41/2007, fixing the fishing opportunities for 2007: *"In order to ensure sustainable exploitation of the hake stocks and to reduce discards, the latest developments on selective gears should be maintained as transitional measures in ICES zones VIIIa, VIIIb and VIIId".* In agreement with this, the National French Committee of Fisheries (deliberations 39/2007, 1/2008) fixed the rules for trawling activities targeting *Nephrops* in the areas 8.a and 8.b applicable from 1 April 2008. All vessels catching more than 50 kg of *Nephrops* per day must use a selective device from at least one of the following: (1) a ventral panel of 60 mm square mesh; (2) a flexible grid or (3) an 80 mm codend mesh size. The majority of *Nephrops* directed vessels (districts of South Brittany) chose the increase of the MMS whereas the ventral squared panel was adopted by multi-purpose trawlers mainly in harbours outside Brittany.

A licence system was adopted in 2004 and, since then, there has been a cap of 250 *Nephrops* trawlers operating in the Bay of Biscay. This limit of *Nephrops* trawlers decreased to 180 in 2018–2020. At the beginning of 2006, the French producers' organizations adopted regulations (e.g. monthly quotas) which had some effects on fishing effort limitation. From 2017 onwards, some additional decisions were implemented by the producers' organizations, such as spreading landings sales over several days, in order to prevent any excess in productivity and/or quota overshot.

Since 1 January 2017, the use of a discarding quick-chute system on-board has become compulsory. There has been an impact on the survival rate of discards which is currently considered higher (50%; Mérillet *et al.*, 2018) than the historical value of 30% (Charuau *et al.*, 1982). This new rate was taken into account during the WK*Nephrops* in 2019 (ICES, 2020b) for future assessment and advice of the stock.

11.2 Data

11.2.1 Commercial catches and discards

Total catches, landings and discards, of *Nephrops* in divisions 8.a, b for the period 1960–2020 are provided in Table 11.1.

During the mid-1960s, the French landings gradually increased to a peak value of 7000 t in 1973–1974, then decreased with values fluctuating between 4500 and 6000 t during the 1980s and the mid-1990s. An increase has been noticeable during the early 2000s. Landings showed a decreasing trend from 3991 t in 2005 to 2987 t in 2019. In 2010 and 2011, total landings increased (3398 and 3559 t, respectively), followed by a strong reduction of landings in 2012 and 2013 (2520 and 2380 t, respectively). During the period 2014–2016, landings increased continuously (2807 t in 2014; 3569 t in 2015; 4091 t in 2016). In 2017, landings decreased again by 17% (3412 t) due to the implementation of more constraining regulations cited above. The lowest levels of landings in the stock time-series were observed in 2018 (2125 t) and 2019 (2154 t), with a slight increase in 2020 (2273 t).

In 2005, when the northern hake stock was under a recovery plan, the use of dorsal mesh square panels became mandatory for the trawlers targeting *Nephrops* in the Bay of Biscay, as this area is is an important nursery area for the hake stock. The implementation of the selective devices previously referred (a ventral panel of 60 mm square mesh or an 80 mm codend mesh size)

coincided with a peak of discarded hake in weight and proportion following a slightly smaller proportion of discarded hake in 2006–2007. Similarly, in 2008, *Nephrops* length distribution in discards remained unchanged despite the mandatory use of the above mentioned selective modifications (Nikolic *et al.*, 2015). The decrease in discarded *Nephrops* weight in recent years may be due to the decreasing fishing mortality imposed on the stock since 2006 which consequently resulted in lower catches (ICES, 2012b), rather than due to a change in selectivity.

Males usually predominate in the landings with the sex ratio (defined as number of females divided by the total number of both sexes) fluctuating between 0.28 and 0.46 for the overall period (1987–2020) with the historically lowest value in 2017. In 2020, the sex ratio of landings was 0.33. The same predominance, although to a lesser degree, was observed for the removals (sex ratio in the range 0.35–0.49) which shows a sex ratio of 0.39 in 2020. Females are less accessible in winter because of their burrowing behaviour during the egg-bearing period.

Discards represent most of the catches of the smallest individuals as indicated by the available data (Figure 11.1). The average weight of discards per year in the period up to the early 2000s (not routinely sampled) is about 1543 t whereas discards estimate for the most recent sampled years (2003–2020) reached a higher level (1932 t). This change in the number of discards could be due to 1) the restriction of individual quotas, 2) the strength of some recruitments in the mid-2000s and 3) the change in the MLS (which tends to increase the discards), although improvements in selectivity may contribute to reducing the discards. The relative contribution of each of these three factors remains unknown. In 2019, the minimum level of discards had been observed (59 million individuals, 634 t) since the start of the European Union Data Collection Framework (DCF; Commission Regulations (EC) Nos. 1639/2001 and 199/2008) and the discard rate had decreased (38% against 58% in 2017 and 65% in 2018). In 2020, discards considerably increased up to 154 million individuals (1908 t).

11.2.2 Biological sampling

Landings

French sampling plan at auction started in 1984, but only from 1987 onwards, the data can be used on a quarterly basis. Since 2003, additional landings database was also provided from onboard routine sampling for estimating discards under the European DCF. As the landed fraction of *Nephrops* is usually size graded, the sampling plan is stratified by time and commercial category vs. size. The numbers of sampling units by quarter and year as well as the numbers of sampled landed individuals of *Nephrops* are presented in Tables 11.2 and 11.3, respectively.

During the first two quarters of 2017, the French onshore sampling program at auctions was discontinued due to a planned shift towards a subcontracted program as already performed for the French on-board sampling. The delay in the call for tenders disrupted the onshore sampling collection for six months. Compared to other onshore species, the Bay of Biscay *Nephrops* was less affected as complementary biological parameters (such as maturity) complementary samples were collected by other ongoing European projects during the first half of the year. In order to compensate for the lack of Q1 and Q2 landings data in 2017, a simulation was performed using the method proposed by Quemar *et al.* (2018) to generate missing auction sampling units from onboard samples using stratified estimators (quarter/harbour/commercial category vs. size). This method was not specifically developed for the FU23–24 *Nephrops* and only actually sampled units were retained for quarterly and global estimates.

The particular problem of lower sampling rate for landings during the first and second quarters of 2017 due to the delay in the sampling shift between operators, as explained above, affected the precision of estimates (decrease of the sampling units and measured *Nephrops* at auction) although it did not change the overall perception for the stock status (LFDs and mean weight for

landings). As shown by unpublished studies on recent DCF sampled years (2014–2017), the LFDs for landings by sex did not significantly change their overall shape when the raising is undertaken on the exclusive database from the sampling onboard despite the higher CVs obtained. This problem was resolved in 2018 and 2019 and the global sampling levels were more satisfactory than previously.

In 2020, the auction and onboard samplings were affected by the COVID-19 pandemic restrictions especially during the first severe lockdown (mid-March/mid-May) enforced in France. The coverage of the most substantial quarter for this fishery (2nd quarter) was consequently reduced to only one month of sampling (June) although sensitivity a first analysis demonstrated that these dataset gaps did not strongly modify the LFDs shape when compared with completely sampled data in previous years. Moreover, this procedure did not increase the uncertainties.

Discards

Discards data from onboard sampling are available for the years 1987, 1991, and 1998 and then from 2003 onwards. Since the former WGNEPH, for the intermediate years up to 2002, discarded numbers-at-length were derived using the "proportional method" where discards by sex for years with no onboard sampling were estimated by applying identical quarterly LFDs of the preceding sampled year raised to the quarterly landings i.e. for years 1992–1997 derivation used quarterly LFDs from 1991. This method was suspected to induce inter-dependence throughout the time-series, therefore, lack of contrast for annual recruitment. IBP*Nephrops* 2012 (ICES, 2012a) investigated the probabilistic (logistic) approach developed for the WGHMM since 2007, although it was not conclusive (Table 11.4; see Stock Annex).

Since 2003, discards have been estimated from catch sampling programmes onboard the *Nephrops* trawlers (706 trips and 1867 hauls have been sampled over 18 years). Despite improvements in the agreement between logbook declarations and auction hall sales since the mid-2000s, the quality of crossed information fluctuates between years. For instance, for years 2007–2020, the percentage of cross-validation item by item between logbooks and sales ranged from 69 to 90% with an improvement in the last period (85% for 2016, 88% in 2017, 90% in 2018 and 88% in 2019 and 2020). Therefore, the total number of trips, not well known in the past, is more accurately provided for the recent years and can be reliably used as raising factor for discards. Nevertheless, the number of trips mostly represented by the number of sales at auction is heterogeneous as the boats in the northern part of the Bay of Biscay conduct daily trips whereas in the southern part, trips last 2 to 3 days with a more diverse profile of catches. Discards sampling from the southern part of the Bay of Biscay fishery was carried out only once in the past (2005), but the sampling plan has been routinely applied since 2010. The numbers of sampled units by quarter and for the whole year and those of discarded sampled *Nephrops* are summarized in Table 11.5. As for the landings, COVID-19 restrictions disrupted the routinely conducted onboard sampling for the major part of the second quarter of 2020. Moreover, the sampling rate onboard during the 1st quarter was also reduced due to meteorological conditions.

The length distribution of landings, discards, and catches from the DCF sampling since 2003 are presented in Table 11.6.a through Table 11.6.c and in Figure 11.1 (for LFDs from years 1987–2002: see Stock Annex). Combined sex mean lengths are presented for catches, landings and discards in Figure 11.2. Figure 11.3 provides the annual LFDs by sex and their CVs for landings and discards in 2020. Similar information for years 2014–2019 is available in the Stock Annex.

11.2.3 Abundance indices from surveys

Trawl survey (LANGOLF)

For many years, abundance indices were not available for this stock. LANGOLF series (see Section 2 of this report and Stock Annex), a specially designed survey to evaluate abundance indices

of *Nephrops*, started in 2006 being conducted during the most appropriate season (2nd quarter), hours (around dawn and dusk) and fishing gear (twin trawl). This survey occurred once a year in May and its sampling design was stratified based on the sedimentary structure. Therefore, based on the investigations carried out during the IBP*Nephrops* in 2012 (ICES, 2012a), the abundance indices were included in the assessments of WGHMM 2012 and 2013 (ICES, 2012c; ICES, 2013) and WGBIE 2014 (ICES, 2014). Nevertheless, the relative improvement in retrospective analysis did not substantially modify the quality of the stock assessment performed by the XSA model. The time-series provided by this survey ended in 2013.

UWTV survey (LANGOLF-TV)

A new experimental survey for counting UWTV burrows, as routinely operated for many *Nephrops* stocks in areas 6 and 7, has been conducted since 2014 on a yearly basis. In the first two years, this UWTV survey, named "LANGOLF-TV", aimed to demonstrate the technical feasibility of such a survey in the local context and to identify the necessary competencies and equipment for its sustainable use. Burrow counting was carried out by the Irish research vessel "Celtic Voyager" on the basis of a systematic sampling plan. In this period, UWTV experiments were combined with trawling operations by two commercial vessels applying the same sampling plan (stratified random) and using the same twin trawls (20 mm codend mesh size) as those of the former LANGOLF trawl survey with the purpose of providing *Nephrops* LFDs by sex and estimating the proportion of other burrowing crustaceans (mainly *Munida sp.*) which can induce bias in the burrows counting.

From 2016 onwards, the trawling operations were cancelled as these were considered no longer necessary for further analytical investigations on the stock exclusively based on the UWTV tools. A longer survey duration in the period 2016–2020 allowed to cover the area within the outline of the central mud bank not belonging to any sedimentary stratum (Figure 11.4). This area is not trawled due to the rough seabed crossed by muddy channels and concentrates a moderate fishing effort targeting *Nephrops*. Investigations based on stratified statistical estimators (Table 11.7) as well as on geostatistics (Table 11.8; Figure 11.5 and 11.6) were carried out and then examined during the WKNEP (ICES, 2017a) which validated the UWTV approach. The number of sampled stations decreased between 2016 and 2017 (from 196 validated ones to 124) although a larger area than the Central Mud Bank was covered in 2017 in order to accurately delimit the actual outline of the stock following the recommendations of the WGNEPS in 2016 (ICES, 2017b). In 2018 and 2019, 184 and 145 valid stations were respectively sampled in the area. Between 2016 and 2017, the total number of burrows decreased by −19% (3373 billion in 2017 against 4168 in 2016) whereas an increase (+12%) was observed in 2018 (3788 billion) and (+9%) in 2019 (4113 billion).

The annual survey occurred in different seasons for the years 2014–2019 (September 2014, July 2015, May 2016, 2017 and 2019, end April 2018) as sampling period was constrained and determined by the availability of the UWTV equipment and staff from the Marine Institute of Ireland.

In 2020, due to the COVID-19 pandemic, the survey initially scheduled in late April to early May was strongly compromised, before being rescheduled to the end of July. During the 2020 UWTV survey, only two Irish experienced scientists were able to participate in order to respect the social distancing obligation on board (31 m vessel: "Celtic Voyager"; Irish company P&O). This also led to the reduction of the sampling plan to around 130 stations (134 finally validated) but still with an acceptable statistical precision level of estimates and all the video interpretations by Ifremer agents were carried out in the laboratory after the end of the survey. As the survey occurred later in the season and exploration of the footage could not be completed before late summer, schedule constraints linked to the stock assessment and advice in late September/early October implied a first investigation of samples by only one reader. The number of burrows was estimated at 3425 billion (−17% against 2019's survey) and the stock was advised on this basis. According to WGNEPS 2020 recommendations (ICES, 2021b), a second reader per sample is needed, and in

several cases a third one will be necessary, in case of divergence between experts vs. the statistical Lin's concordance correlation coefficient (CCC; Lin, 1989; Lin, 2000) test value occurs. The revised estimate recently provided gave the current number of burrows as equal to 3602 billion which is –12% compared to the 2019 estimate.

11.2.4 Commercial catch-effort data

Up to 1998, the majority of the vessels were not obliged to keep logbooks because their size and fishing forms were established by inquiries. Since 1999, logbooks became compulsory for all vessels longer than 10 m. The available logbook data cannot be currently considered as representative of the fishing effort of the whole fishery during the overall time-series. Hence, since 2004, attempts to define a better effort index were done.

Effort data indices, landings and LPUE for the "Le Guilvinec District" *Nephrops* trawlers in the second quarter (noted GV-Q2) are available for the overall time-series (Table 11.9; Figure 11.7). Effort increased from 1987 to 1992, but there has been a decreasing trend since then. In recent years, the lowest fishing effort value for the whole period was observed.

In 2019, the fishing effort slightly decreased compared to 2018 (−2%) which further decreased in 2020 (−12%) mainly because of the COVID-19 disruptions. The overall downward trend in effort can be explained by the reduction in the number of fishing vessels following the decommissioning schemes implemented by the EU. The LPUEs of the GV-Q2 fleet were reasonably stable for a long period, fluctuating around a long-term average of 14.0 kg/h (Figure 11.7), with four peaks (1988, 2001, 2010 and 2017). LPUE reached the historically highest level in the middle of the last decade (2015: 19.5 kg/h; 2016: 19.7 kg/h; 2017: 21.9 kg/h), but declined in 2018 (−22%; 17.0 kg/h) then was reduced again in 2019 (−7%, 15.7 kg/h) and remained at the same level in 2020 (15.6 kg/h).

Changes in fishing gear efficiency and individual catch capacities of vessels imply that the time spent at sea may not be a good indicator of effective effort and, hence, the LPUE trends are possibly biased. Since the early1990s, the number of boats using twin-trawls increased (10% in 1991, more than 90% in recent years, almost 100% in the northern part of the fishery) and also the number of vessels using rock-hopper gear on the rough seabed of the extreme NW part of the central mud bank of the Bay of Biscay. Moreover, an increase in onboard computer technology has occurred. The effects of these changes are difficult to quantify as twin-trawling is not always recorded explicitly in the fisheries statistics and improvement due to computing technology is not continuous for the overall time-series.

11.3 Assessment

An analytical assessment based on the adopted UWTV survey was carried out for the first time in November 2016 after the WKNEP benchmark (ICES, 2017a) in order to propose advice for 2017 for the stock. An update of the stock data is performed in spring each year covering the LFDs and mean weights for landings and discards of the three preceding years but the results from the UWTV survey of the same year are not yet available. The estimated *status quo* harvest rates for 2016, calculated as the removals divided by the UWTV abundance, was equal to 7.3% under the historical value of 30% for the survival rate of discards. After the adoption of the survival rate of 50% as a consequence of the compulsory quick chute system for discards since January 2017, the harvest rates for years 2017–2020 were 7.2%, 4.2%, 3.1% and 4.9%, respectively which are much below the MSY target (7.7%), with the exception of the year 2017.

The summary from the assessment 2020 is provided in the table below (ICES, 2020a).

Variable	Value	Source	Notes
Abundance in TV assessment	3425.061 3601.500	ICES (2020a)	UWTV 2020 (end of July) 1st value: one reader per sample (used for assessment and advice for 2021) 2nd value: two readers per sample (revised estimate)
Mean weight in landings	23.820	ICES (2020a)	Average 2017–2019
Mean weight in discards	10.990	ICES (2020a)	Average 2017–2019
Discard rate (total)	53.57%	ICES (2020a)	Average 2017–2019 (proportion by number)
Discard survival rate	50%	ICES (2020a)	Only applies in scenarios where discarding is allowed.
Dead discard rate (total)	37.38%	ICES (2020a)	Average 2017–2019 (proportion by number), only applies in scenarios where discarding is allowed.

11.4 Catch options and prognosis

For 2021, the catch options containing updated information on the fishery (mean weight for landings and discards, discard rate, the survival rate for discards) is given below.

Variable	Value	Source	Notes
Abundance in TV assessment	3430.992	ICES (2021b)*	UWTV 2021 (late April/early May 2021; exploration of footage in lab).
Mean weight in landings	23.417	ICES (2021b)	Average 2018–2020
Mean weight in discards	11.144	ICES (2021b)	Average 2018–2020
Discard rate (total)	54.32%	ICES (2021b)	Average 2018–2020 (proportion by number)
Discard survival rate	50.00%	ICES (2021b)	Only applies in scenarios where discarding is allowed.
Dead discard rate (total)	38.14%	ICES (2021b)	Average 2018–2020 (proportion by number), only applies in scenarios where discarding is allowed.

*** This Working Group report, updated in October 2021**

11.5 Biological reference points

The F_{MSY} reference point (harvest rate of 7.7%; ICES, 2017a) is based on the average realized harvest rates (HR) of *Nephrops* functional units with an observed history of sustainable exploitation, while also taking into account the low harvest rates applied to the FUs 23–24 stock in the recent past. As the WK*Nephrops* 2019 (ICES, 2020b) was not conclusive at the aim of defining new reference points for this stock exclusively based on the SCA outputs and the scenarios under $F_{0.1}$ provided irrelevant results, the current reference value of HR = 7.7% was kept.

11.6 Comments on the assessment

The French *Nephrops* trawlers onboard sampling programme avoids the use of "derived" data for missing years (14 over 34 years). Since 2009, there has been a relevant improvement of the

sampling design as many trips were sampled in the Southern part of the fishery. Derivations based on the probabilistic approach should improve knowledge of further analytical retrospective investigations on this stock.

The upgrade to category 1 stock is the consequence of a representative sampling survey on the whole Central Mud Bank of the Bay of Biscay as performed in 2016–2020. In addition to the unbiased spatial fishery information, such as the VMS data, these results demonstrate the accurate knowledge of the stock area and its sedimentary heterogeneous structure.

11.7 Information from the fishing industry

Several meetings were held between scientists and the fishing industry prior to the WG in order to discuss the partnership for the UWTV survey conducted on years 2017–2019 and the possibility of extending this for the period 2020–2022 (scientific methodological and financial supporting project). Many discussions prior to the WG underlined the steep decrease of landings in the period 2016–2020 which was considered by the industry as a temporary status and not as a signal of a declining trend. As prior to the WG of the two last years, they devalued such a decrease and pointed out many additional regulations aiming to control the productivity of *Nephrops* trawlers and to avoid quotas overshot. They argued that this situation had already been observed in the recent past: the positive dynamics in 2014–2016 occurred after the downwards moving in 2011–2013. The impact of the COVID-19 pandemic and the first lockdown in France in spring 2020 were emphasized during the more crucial period of the year for targeting *Nephrops*. The industry underlined the heterogeneous feature of the whole area of the stock and debated about the overall declining trend for the southern part of the Bay of Biscay which is considered problematic. Divergent interpretations were advanced for this decline although all of them converge that it might be the consequence of a gradual modification of the sedimented nature of this area from a typically muddy to a more mixed one.

The industry was satisfied by the realization of the UWTV survey in 2020 allowing an actual update on the stock status. The survey was maintained after modification from the initial scheduled plan and the industry praised the efficient and flexible partnership between the French and Irish scientists who participated in the survey. Currently and under a similar context to last year's, it was also possible to carry out the survey in 2021 which will provide results for the stock assessment and advice in autumn.

11.8 Management considerations

Some positive signals in the mid-2010s (increase of LPUEs, landings, removals) and relative stability of burrow indices from the 2014–2016 UWTV surveys suggested a stock status within safe limits. However, the oscillating trends of UTWV indices since 2017, i.e. the steep decrease in 2017 followed by an increase in 2018–2019 and a slight decline in 2020, combined with the historically lowest landings level in 2018–2020 suggest considering cautiously the current situation which will be examined after including the 2021 UWTV survey results.

11.9 References

Charuau, A., Morizur, Y., Rivoalen, J. J. 1982. Survie des rejets de *Nephrops norvegicus* dans le Golfe de Gascogne et en Mer Celtique (survival of discarded *Nephrops norvegicus* in the Bay of Biscay and in the Celtic Sea). ICES CM 1982/B:13. 6 pp.

Commission Regulation (EC) No 1639/2001. 2001. Establishing the minimum extended community programs for the collection of data in the fisheries sector and laying down detailed rules for thee application of Council regulation (EC) No 1543/2000.

Council Regulation (EC) No 847/96. 1996. Introducing additional conditions for year-to-year management of TACs and quotas. Articles 3, 4, 5(2),e Official Journal of the European Commission, No. L 115/3, 3p.

Council Regulation (EC) No. 2341/2002. 2002. Fixing for 2003 the fishing opportunities and associated conditions fish stocks and groups of fish stocks applicable in community waters and, for community vessels, in waters where catch limitations are required.

Council Regulation (EC) No 41/2007. 2007. Fixing for 2007 the fishing opportunities and associated conditions fish stocks and groups of fish stocks applicable in community waters and, for community vessels, in waters where catch limitations are required.

Council Regulation (EC) No 199/2008. 2008. The establishment of a Community framework for the collection, management and use of data in the fisheries sector and support scientific advice regarding the Common Fishery Policy.

ICES, 2007. Report of the Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim (WGHMM), 8 - 17 May 2007, Vigo, Spain. ICES CM 2007/ACFM: 21, 700 pp.

ICES, 2012a. Report of the Inter Benchmark Protocol on *Nephrops* (IBP*Nephrops* 2012), March 2012. By correspondence. ICES CM 2012/ACOM: 42, 5 pp.

ICES, 2012b. Report of the ICES Advisory Committee 2012. ICES Advice, 2012. Book 7. section 7.4.10. 1–7.

ICES, 2012c. Report of the Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim (WGHMM), 10–16 May 2012, ICES Headquarters, Copenhagen. ICES CM 2012/ACOM: 11, 617 pp.

ICES, 2013. Report of the Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim (WGHMM), 10 - 16 May 2013, ICES Headquarters, Copenhagen. ICES CM 2013/ACOM: 11A, 11 pp.

ICES, 2014. Report of the Working Group for the Bay of Biscay and the Iberian waters Ecoregion (WGBIE), 7–13 May 2014, Lisbon, Portugal. ICES CM 2014/ACOM: 11, 714 pp.

ICES, 2017a. Report of the Benchmark Workshop on *Nephrops* Stocks (WKNEP), 24–28 October 2016, ICES CM 2016/ACOM: 38, 221 pp.

ICES, 2017b. Interim Report of the Working Group on *Nephrops* Surveys (WGNEPS). WGNEPS 2016 Report 7–8 November 2016. Reykjavik, Iceland. ICES CM 2016/SSGIEOM:32. 67 pp.

ICES. 2020a. Working Group for the Bay of Biscay and the Iberian Waters Ecoregion (WGBIE). ICES Scientific Reports. 2:49. 845 pp. http://doi.org/10.17895/ices.pub.6033.

ICES. 2020b. Workshop on Methodologies for *Nephrops* Reference Points (WK*Nephrops*; outputs from 2019 meeting). ICES Scientific Reports. 2: 3. 106 pp. http://doi.org/10.17895/ices.pub.5981.

ICES. 2021a. Advice on fishing opportunities. In Report of the ICES Advisory Committee, 2021. ICES Advice 2021, Section 1.1.1. https://doi.org/10.17895/ices.advice.7720.

ICES. 2021b. Working Group on *Nephrops* Surveys (WGNEPS; outputs from 2020). ICES Scientific Reports. 03:36. 114pp. https://doi.org/10.17895/ices.pub.8041.

Lin, L. 1989. A concordance correlation coefficient to evaluate reproducibility. Biometrics 45: 255–268.

Lin, L. 2000. A note on the concordance correlation coefficient. Biometrics 56: 324–325.

Mérillet, L., Méhault, S., Rimuad, T., Piton, C., Morandeau, F., Morfin, M., Kopp, D. 2018. Survivability of discarded Norway lobster in the bottom trawl fishery of the Bay of Biscay. Fisheries Research 198, 24–30.

Nikolic, N., Diméet, J., Fifas, S., Salaün, M., Ravard, D., Fauconnet, L., Rochet, M-J. 2015. Efficacy of selective devices in reducing discards in the *Nephrops* trawl fishery in the Bay of Biscay. ICES Journal of Marine Science, 72: 1869–1881.

Quemar, T., Vigneau, J., Dubroca, L. 2018. Estimation of quarterly length distribution of landings in the context of a 6-months disruption in the French onshore sampling. Working Document in ICES WGBIE 2018.

11.10 Tables and figures

Table 11.1. *Nephrops* in FUs 23–24 Bay of Biscay (8.a, 8.b). Estimates of catches (t) by FU for 1960–2020.

	Landings (1)					Total Discards		Catches
Year	FU 23-24 (2)	FU 23	FU 24	Unallocated (MA N)(3)	Total VIIIa,b	FU 23-24		Total
	VIIIa,b	VIIIa	VIIIb		used by WG	VIIIa,b		VIIIa,b
1960	3524	-	-	-	3524	-		3524
1961	3607	-	-	-	3607	-		3607
1962	3042	-	-	-	3042	-		3042
1963	4040	-	-	-	4040	-		4040
1964	4596	-	-	-	4596	-		4596
1965	3441	-	-	-	3441	-		3441
1966	3857	-	-	-	3857	-		3857
1967	3245	-	-	-	3245	-		3245
1968	3859	-	-	-	3859	-		3859
1969	4810	-	-	-	4810	-		4810
1970	5454	-	-	-	5454	-		5454
1971	3990	-	-	-	3990	-		3990
1972	5525	-	-	-	5525	-		5525
1973	7040	-	-	-	7040	-		7040
1974	7100	-	-	-	7100	-		7100
1975	-	6460	322	-	6782	-		6782
1976	-	6012	300	-	6312	-		6312
1977	-	5069	222	-	5291	-		5291
1978	-	4554	162	-	4716	-		4716
1979	-	4758	36	-	4794	-		4794
1980	-	6036	71	-	6107	-		6107
1981	-	5908	182	-	6090	-		6090
1982	-	4392	298	-	4690	-		4690
1983	-	5566	342	-	5908	-		5908
1984	-	4485	198	-	4683	-		4683
1985	-	4281	312	-	4593	-		4593
1986	-	3968	367	99	4335	-		4335
1987	-	4937	460	64	5397	1767	*	7164
1988	-	5281	594	69	5875	4123		9997
1989	-	4253	582	77	4835	2634		7470
1990	1	4613	359	87	4972	627		5599
1991	1	4353	401	55	4754	1213	*	5967
1992	0	5123	558	47	5681	1354		7034
1993	0	4577	532	49	5109	1007		6116
1994	0	3721	371	27	4092	741		4833
1995	0	4073	380	14	4452	706		5159
1996	0	4034	84	15	4118	495		4614
1997	2	3450	147	41	3610	805		4415
1998	2	3565	300	40	3865	1453	*	5318
1999	2	2873	337	26	3209	1148		4357
2000	0	2848	221	36	3069	1455		4523
2001	1	3421	309	22	3730	2537		6267
2002	2	3323	356	36	3679	2620		6299
2003	1	3564	322	49	3886	1977	*	5863
2004	na	3223	348	5	3571	1932	*	5503
2005	na	3619	372	na	3991	2698	*	6689
2006	na	3026	420	na	3447	4544	*	7990
2007	na	2881	292	na	3176	2411	*	5587
2008	na	2774	256	na	3030	2123	*	5154
2009	na	2816	212	na	2987	1833	*	4820
2010	na	3153	245	na	3398	1275	*	4673
2011	na	3240	319	na	3559	1263	*	4822
2012	na	2290	230	na	2520	1012	*	3532
2013	na	2195	185	na	2380	1521	*	3900
2014	na	2699	108	na	2807	1326	*	4133
2015	na	3425	144	na	3569	1822	*	5391
2016	na	3873	217	na	4091	2531	*	6622
2017	na	3283	129	na	3412	2387	*	5799
2018	na	2038	86	na	2125	1571	*	3696
2019	na	2065	89	na	2154	634	*	2789
2020	na	2200	73	na	2273	1908	*	4181

(1) WG estimates (2) landings from VIIIa and VIIIb aggregated until 1974 (3) outside FU 23-24

Table 11.2. *Nephrops* in FUs 23–24 Bay of Biscay (8.a, 8.b). Quarterly and yearly number of sampled units in the landings sampling program.

Year	Q1			Q2			Q3			Q4		
	auction	sea	Σ	auction	sea	Σ	auction	sea	Σ	auction	sea	Σ
2014	96	23	119	122	82	204	107	64	171	106	30	136
2015	119	37	156	119	71	190	123	70	193	114	12	126
2016	108	30	138	139	93	232	112	109	221	142	23	165
2017	26	30	56	27	36	63	63	47	110	92	19	111
2018	70	14	84	90	45	135	86	43	129	70	16	86
2019	86	18	104	92	46	138	64	29	93	80	17	97
2020	68	6	74	30	24	54	31	12	43	28	31	59
Total	**573**	**158**	**731**	**619**	**397**	**1016**	**586**	**374**	**960**	**632**	**148**	**780**

Table 11.3. *Nephrops* in FUs 23–24 Bay of Biscay (8.a, 8.b). Quarterly and yearly number of sampled landed individuals.

year	Q1			Q2			Q3			Q4		
	auc-tion	sea	Σ	auction	sea	Σ	auction	sea	Σ	auction	sea	Σ
2014	3774	855	4629	5400	3662	9062	4957	2321	7278	4642	1115	5757
2015	5347	1488	6835	5520	2760	8280	5695	2835	8530	4905	345	5251
2016	4562	1130	5692	6367	3340	9707	4801	3751	8552	6150	765	6915
2017	951	949	1900	1191	1606	2797	2863	1259	4122	4080	670	4750
2018	3528	554	4082	4285	1911	6196	3630	1661	5291	2991	470	3461
2019	3669	635	4304	3770	1554	5324	2632	819	3451	3257	566	3823
2020	2669	228	2897	1222	970	2192	1217	435	1652	1185	1061	2246
Total	**24500**	**5839**	**30339**	**27755**	**15803**	**43558**	**25795**	**13081**	**38876**	**27210**	**4992**	**32203**

Table 11.4. *Nephrops* in FUs 23–24 Bay of Biscay (8.a, 8.b). Derivation and estimation of discards.

1987	sampled
1988-1990	from 1987's logistic function of sorting by quarter+density of probability
1991	sampled
1992-1997	from 1991's logistic function of sorting by quarter+density of probability
1998	sampled
1999-2002	from 1998's logistic function of sorting by quarter+density of probability
since 2003	sampled

Table 11.5. *Nephrops* in FUs 23–24 Bay of Biscay (8.a, 8.b). Quarterly and yearly discards from onboard sampling program.

year	quarter	sampled FO	total FO	nb_trips	total trips	Nb *Nephrops*
2014	1	7	13	4	2689	377
	2	25	91	13	5615	1146
	3	21	99	12	5274	712
	4	10	27	8	3973	436
	total	**63**	**230**	**37**	**17551**	**2671**
2015	1	16	28	7	2785	655
	2	36	124	14	5598	1334
	3	28	131	13	4999	747
	4	7	31	3	3480	194
	total	**87**	**314**	**37**	**16862**	**2930**
2016	1	16	39	7	3441	549
	2	40	119	15	6207	1168
	3	46	153	17	5443	1135
	4	15	85	8	3906	256
	total	**117**	**396**	**47**	**18997**	**3108**
2017	1	20	97	9	3719	516
	2	29	138	12	6139	932
	3	23	55	9	4850	793
	4	10	26	17	3498	332
	total	**82**	**316**	**37**	**18206**	**2573**
2018	1	8	25	6	3015	237
	2	28	65	11	5784	1222
	3	25	67	14	4895	898
	4	9	29	8	3058	215
	total	**70**	**186**	**39**	**16752**	**2572**
2019	1	10	24	8	3366	367
	2	24	58	14	5610	1076
	3	16	42	9	4381	360
	4	8	20	5	2791	234
	total	**58**	**144**	**36**	**16148**	**2037**
2020	1	3	6	3	2622	118
	2	12	27	8	5178	527
	3	6	14	5	4660	280
	4	16	50	9	2768	476
	total	**37**	**97**	**25**	**15228**	**1401**

Table 11.6.a. *Nephrops* in FUs 23–24 Bay of Biscay (8.a, 8.b) landings length distributions in 2003–2020.

Landings CL mm/	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
10																		
11																		
12																		
13																		
14																		
15																		
16																		
17	20	7																
18	14		25	5	4	12									6			
19		14	27						1		5				18			
20	87	47	82	5	4	77	37	14	22	35	31	1	16	21	24	18		81
21	280	249	270	70	14	191	73	75	6	25	151	74	130	138	320	106	15	232
22	661	899	771	131	18	208	288	252	11	235	682	180	575	532	368	90	153	230
23	1614	2194	2588	227	48	322	473	386	111	334	1002	764	1121	772	1155	185	331	480
24	3966	5664	6511	822	188	721	1929	1238	515	1399	3162	1836	2523	1341	1787	410	1166	1479
25	8164	10930	13678	2844	1201	2742	3670	3940	1803	3843	7873	4419	3478	3842	3845	1823	4325	3502
26	13297	13998	17811	6376	5684	6319	8258	8499	4773	7875	13242	7910	6651	7285	9264	4362	8273	7187
27	17614	16094	22006	12010	9439	10891	12759	14173	7520	11079	14926	12869	9702	12566	14413	6905	11811	11125
28	18572	15350	21879	14647	13248	12640	15732	15390	8991	11920	13260	13788	14431	16617	14546	7753	12245	12670
29	16843	14808	18027	14591	12516	12890	13524	15340	9602	11120	13397	14560	13726	18269	17209	9186	11409	10421
30	17264	14143	15570	13690	12219	10726	13271	15736	8821	9636	10296	12662	13690	16596	16695	8812	10076	11320
31	13345	12353	12634	11814	10698	9772	10859	12749	8253	8393	9137	11051	12456	16820	12979	8307	7377	10397
32	11276	10322	9907	9694	9274	8845	9310	11366	6954	7414	7116	10354	12021	13096	12950	6417	6352	7660
33	8253	8020	7800	8421	7859	7436	7086	8851	6175	6069	5558	6509	9882	12519	7752	7079	5178	6198
34	6195	6298	6537	7112	6539	6425	5985	7140	5467	4505	4123	6657	7881	8416	7638	4991	4882	3911
35	4653	4673	5100	5135	6529	5366	4568	5852	4541	3507	2783	4961	6122	6809	5052	3676	4423	3802
36	3818	3308	3369	4104	4735	3867	3697	3626	4260	2649	1978	3264	5219	6474	4829	3537	2292	3126
37	3075	2875	2597	3196	3839	3121	2565	3024	3648	1976	1472	2682	4511	4785	2620	2263	1749	1718
38	2660	2098	2380	2662	2639	2398	1871	2247	3911	1563	998	1783	3311	3342	2005	1890	1189	1684
39	2174	1683	1650	1956	2245	2043	1491	1630	3472	1314	936	1844	2726	2850	2176	1775	946	696
40	1936	1555	1628	1599	1711	1633	1190	1280	3296	1103	518	843	2676	1976	1294	1232	942	788
41	1423	1188	1154	1171	1227	1190	878	966	2740	878	438	669	1635	1394	1020	652	530	441
42	1403	889	953	990	1111	1015	742	742	2497	635	351	412	1284	1185	779	329	329	374
43	1054	774	842	741	710	805	540	560	2157	558	320	343	883	749	585	388	330	317
44	810	707	640	633	746	706	473	509	1762	536	249	234	637	658	471	319	129	192
45	808	613	605	595	518	536	396	442	1177	478	177	206	467	708	442	296	107	151
46	535	485	415	479	373	405	307	305	1024	441	181	159	236	368	271	153	79	118
47	456	388	353	440	311	361	262	290	858	378	88	151	216	332	261	86	80	113
48	339	313	339	382	257	294	245	237	656	381	98	87	149	230	143	80	46	77
49	206	318	288	319	237	262	196	204	557	212	74	72	200	195	100	51	30	66
50	253	306	276	287	190	228	156	160	501	160	46	63	108	123	126	68	36	53
51	170	214	176	246	163	201	115	135	383	132	37	58	68	83	53	32	27	26
52	150	152	184	201	138	116	110	120	296	128	32	24	46	88	96	36	24	26
53	120	111	142	137	140	121	98	97	198	96	24	42	33	56	37	21	13	12
54	80	90	104	156	115	95	63	95	271	93	17	18	29	59	49	18	11	6
55	57	47	109	137	79	73	75	79	152	58	15	11	26	23	38	10	5	8
56	23	86	69	117	60	67	54	75	132	46	8	5	15	21	24	8	2	2
57	47	49	58	134	70	41	31	67	98	48	22	10	18	7	12	6	1	3
58	22	27	43	134	45	40	48	47	105	52	3	8	5	7	12	11	3	3
59	10	32	41	85	33	19	23	48	79	33	12	3	3	8	6	1	2	1
60	8	10	19	115	33	23	14	42	48	22	3	2	3	5	7	3		3
61	5	5	28	40	23	7	8	30	39	15	8	1		3	2	1	1	
62	4	3	16	21	9	9	9	16	55	18	1	1	7	3	6	3		2
63	1	5	9	19	9	7	10	7	23	11	2	1			1	1		
64		8	8	18	10	6	3	16	12	8			1	1	2	72		
65		1	14	11	9	1	3	9	11	7			1	1	3			1
66	1	1	6	10	1		2	3	11	3				1	1			
67		1	5	8	1		2	3	6	1								
68		2	4	7	3			4	7									
69	1		1	6	2		1	1	2	2								
70			2	4				1	2					1	1			
71	1		1	5				1	1									
72			1	5											1			
73				2	1										1			
74				4					1			1			1			
75			1	4						1				2	5			
Total	**163771**	**154405**	**179758**	**128777**	**117273**	**115274**	**123504**	**138120**	**108011**	**101424**	**114853**	**121594**	**138920**	**161371**	**143502**	**83463**	**96919**	**100704**
Weights	**3886**	**3571**	**3991**	**3447**	**3176**	**3030**	**2987**	**3398**	**3559**	**2520**	**2380**	**2807**	**3569**	**4091**	**3412**	**2125**	**2154**	**2273**

Table 11.6.b. *Nephrops* in FUs 23–24 Bay of Biscay (8.a, 8.b) discards length distributions in 2003–2020.

Total Discards CL mm/	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
10	28				22		82								26			55
11			94		171	38	135	2								23	8	
12	70	363	413	70	202	98	79		237				75	76	54		8	
13	294	1722	1085	234	122	235	177	97	596	532		28	184	76	111	47	110	83
14	636	3152	3190	1138	900	389	291	83	834	665	229	101	606	327	384	31	428	249
15	1198	5548	7287	3102	1288	189	1157	155	941	1425	870	281	1476	578	1228	533	583	457
16	3386	6784	13528	7810	2959	1027	2315	822	1230	4544	1313	1300	2354	569	1668	1029	606	75
17	5927	8836	15094	11655	3636	1832	3059	1333	2430	4737	4179	1647	3242	2717	3697	3499	741	506
18	8078	10161	19795	16139	4590	2626	4843	2309	3630	8066	3372	2808	5073	5207	4175	6531	1456	1598
19	11506	17361	19522	25891	5244	6473	6485	3532	4546	8024	8730	3822	8084	9685	8517	7534	1951	3456
20	12142	19250	22265	39742	8735	11444	12766	5692	7227	10125	9682	6457	9246	9420	13805	9555	3042	5479
21	18597	25898	32409	54220	11585	15630	16772	7699	10393	12145	15281	9195	10952	12022	16601	13562	4330	8770
22	21416	25210	35523	69870	17930	24730	18701	11689	15161	14034	20618	11284	11324	15704	16245	17648	6379	11969
23	28429	26756	40041	70094	24086	27560	21693	13672	13837	12904	26287	15130	14109	18312	20400	20617	6817	17291
24	26501	21343	36279	55408	30615	29638	24105	16963	15551	14889	21750	14000	16820	19435	21961	16825	8875	20577
25	23211	20085	30222	52660	32917	28007	20736	14670	16545	10873	17823	18051	18746	22159	21886	18966	8383	22133
26	17357	12006	19003	38812	27376	23127	14205	11852	10047	7747	10188	11947	15874	24994	21474	12621	6065	21676
27	9680	6436	8498	20124	20567	10129	9188	8558	8127	4304	5439	8155	11931	17139	13660	8548	3506	14931
28	6187	3487	4603	10263	10365	5893	5927	5986	3201	919	2824	5026	8056	11441	11298	5719	2625	8239
29	2537	2115	1201	4188	4464	3225	3163	3360	2086	588	2146	2316	5771	10887	5361	3151	913	5056
30	1605	1901	1600	2578	2868	1923	3261	1876	2011	680	945	1672	4714	5283	5464	1457	885	3741
31	1326	1115	1417	1109	1316	925	1824	1274	1246	125	922	1263	2033	4343	3766	1135	517	2567
32	574	735	526	592	737	454	839	716	492	200	684	1482	1745	2458	2470	513	181	1657
33	313	503	296	544	484	421	671	350	265	13	365	384	812	3193	814	1014	183	2332
34	261	385	553	411	537	1025	830	274	272	145	494	433	1108	1071	1132	744	146	439
35	176	424	260	230	265	206	332	242	174	24	233	125	147	874	1540	296	163	186
36	113	108	46	73	336	78	197	55	59	3	260	391	243	774	503	140	74	10
37	83	74	246	25	299	153	188	162	149	146	130	45	298	573	681	11	8	333
38	93	31	116	99	40	93	269	16	97	68	81	71	246	576	320	18	8	115
39	15	139	147		3	369	55	33	24		33	230	65	598	409	60	35	
40	37	73	37	169	47		66	38	25	3		122	175	72	235	39	64	261
41	34	60	20		40		8	4				7	46	148	126	40		
42	4	12	31		20	53		4	157				508	186	139		8	161
43	14	13			11		38		4	4		152	199		202	20		
44		13					14	6					12		164			
45	13			36					5				56		38			
46								6					44	77				
47									6			7			23			
48							8				36							
49													23					
50					11													
51																		
52																		
53																		
54																		
55															23			
56																		
57																		
58						39												
59																		
60																		
61																		
62																		
63																		
64																		
65																		
66																		
67																		
68																		
69																		
70																		
71																	3	
72																		
73																		
74																		
75																		
Total	**201841**	**222102**	**315346**	**487288**	**214788**	**198031**	**174480**	**113530**	**121603**	**117935**	**154914**	**117930**	**156400**	**200973**	**200600**	**151926**	**59102**	**154401**
Weights	**1977**	**1932**	**2698**	**4544**	**2411**	**2123**	**1833**	**1275**	**1263**	**1012**	**1521**	**1326**	**1822**	**2531**	**2387**	**1571**	**634**	**1908**

Table 11.6.c. *Nephrops* in FUs 23–24 Bay of Biscay (8.a, 8.b) catches length distributions in 2003–2020.

Total catches																		
CL mm/	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
10	28				22		82								26			55
11			94		171	38	135	2								23	8	
12	70	363	413	70	202	98	79		237				75	76	54		8	
13	294	1722	1085	234	122	235	177	97	596	532		28	184	76	111	47	110	83
14	636	3152	3190	1138	900	389	291	83	834	665	229	101	606	327	384	31	428	249
15	1198	5548	7287	3102	1288	189	1157	155	941	1425	870	281	1476	578	1228	533	583	457
16	3386	6784	13528	7810	2959	1027	2315	822	1230	4544	1313	1300	2354	569	1668	1029	606	75
17	5947	8843	15094	11655	3636	1832	3059	1333	2430	4737	4179	1647	3242	2717	3697	3499	741	506
18	8092	10161	19820	16144	4593	2638	4843	2309	3630	8066	3372	2808	5073	5207	4181	6531	1456	1598
19	11506	17376	19549	25891	5244	6473	6485	3532	4546	8024	8735	3822	8084	9685	8535	7534	1951	3456
20	12229	19297	22348	39747	8738	11521	12803	5706	7249	10160	9713	6458	9262	9441	13829	9573	3042	5560
21	18877	26146	32679	54289	11598	15820	16845	7775	10398	12170	15433	9269	11082	12160	16921	13668	4346	9001
22	22077	26109	36293	70001	17948	24938	18989	11941	15171	14269	21300	11464	11899	16237	16613	17738	6531	12199
23	30042	28950	42629	70322	24134	27882	22167	14058	13948	13238	27289	15894	15231	19084	21554	20802	7148	17771
24	30467	27006	42790	56230	30803	30359	26034	18202	16065	16288	24913	15836	19343	20775	23747	17236	10041	22055
25	31376	31015	43900	55504	34119	30750	24406	18610	18348	14716	25696	22470	22223	26001	25731	20789	12708	25635
26	30654	26004	36814	45189	33060	29446	22463	20352	14820	15622	23430	19857	22526	32279	30738	16983	14338	28863
27	27294	22530	30504	32134	30006	21020	21948	22730	15647	15383	20365	21024	21633	29705	28073	15453	15317	26056
28	24759	18837	26482	24909	23613	18533	21659	21375	12191	12838	16084	18814	22487	28058	25844	13471	14869	20909
29	19381	16923	19228	18779	16980	16115	16687	18700	11687	11708	15543	16876	19498	29156	22570	12337	12322	15476
30	18868	16044	17170	16268	15087	12649	16531	17612	10832	10315	11241	14334	18403	21879	22159	10269	10961	15061
31	14672	13469	14051	12923	12014	10697	12682	14024	9500	8518	10059	12314	14489	21163	16745	9442	7893	12964
32	11849	11057	10433	10286	10011	9299	10150	12082	7447	7614	7801	11836	13766	15554	15419	6930	6533	9317
33	8566	8523	8095	8965	8343	7857	7757	9201	6440	6082	5923	6892	10695	15712	8566	8093	5362	8530
34	6456	6684	7090	7524	7076	7449	6815	7414	5739	4649	4617	7091	8990	9487	8770	5735	5028	4350
35	4829	5097	5361	5366	6793	5573	4900	6094	4715	3531	3016	5087	6270	7683	6592	3972	4586	3989
36	3931	3416	3415	4177	5071	3945	3894	3681	4319	2652	2237	3654	5462	7247	5332	3677	2366	3136
37	3158	2949	2844	3221	4138	3273	2753	3186	3797	2122	1602	2727	4809	5358	3302	2274	1758	2052
38	2752	2129	2496	2760	2679	2491	2139	2263	4007	1632	1079	1854	3556	3918	2325	1908	1197	1799
39	2189	1822	1797	1956	2247	2412	1546	1662	3496	1314	968	2075	2791	3448	2585	1835	981	696
40	1973	1628	1665	1768	1758	1633	1257	1318	3321	1107	518	965	2851	2048	1529	1271	1006	1049
41	1457	1248	1174	1171	1267	1190	886	971	2740	878	438	676	1681	1542	1146	691	530	441
42	1407	901	984	990	1130	1069	742	746	2654	635	351	412	1792	1370	918	329	337	535
43	1068	787	842	741	722	805	578	560	2161	563	320	495	1082	749	787	407	330	317
44	810	719	640	633	746	706	487	515	1762	536	249	234	649	658	636	319	129	192
45	821	613	605	631	518	536	396	442	1182	478	177	206	523	708	480	296	107	151
46	535	485	415	479	373	405	307	312	1024	441	181	159	280	445	271	153	79	118
47	456	388	353	440	311	361	262	290	865	378	88	158	216	332	284	86	80	113
48	339	313	339	382	257	294	254	237	656	381	134	87	149	230	143	80	46	77
49	206	318	288	319	237	262	196	204	557	212	74	72	223	195	100	51	30	66
50	253	306	276	287	201	228	156	160	501	160	46	63	108	123	126	68	36	53
51	170	214	176	246	163	201	115	135	383	132	37	58	68	83	53	32	27	26
52	150	152	184	201	138	116	110	120	296	128	32	24	46	88	96	36	24	26
53	120	111	142	137	140	121	98	97	198	96	24	42	33	56	37	21	13	12
54	80	90	104	156	115	95	63	95	271	93	17	18	29	59	49	18	11	6
55	57	47	109	137	79	73	75	79	152	58	15	11	26	23	61	10	5	8
56	23	86	69	117	60	67	54	75	132	46	8	5	15	21	24	8	2	2
57	47	49	58	134	70	41	31	67	98	48	22	10	18	7	12	6	1	3
58	22	27	43	134	45	80	48	47	105	52	3	8	5	7	12	11	3	3
59	10	32	41	85	33	19	23	48	79	33	12	3	3	8	6	1	2	1
60	8	10	19	115	33	23	14	42	48	22	3	2	3	5	7	3		3
61	5	5	28	40	23	7	8	30	39	15	8	1		3	2	1	1	
62	4	3	16	21	9	9	9	16	55	18	1	1	7	3	6	3		2
63	1	5	9	19	9	7	10	7	23	11	2	1			1	1		
64		8	8	18	10	6	3	16	12	8			1	1	2	72		
65		1	14	11	9	1	3	9	11	7			1	1	3			1
66	1	1	6	10	1		2	3	11	3				1	1			
67		1	5	8	1		2	3	6	1								
68		2	4	7	3			4	7									
69	1		1	6	2		1	1	2	2								
70			2	4				1	2					1	1			
71	1		1	5				1	1								3	
72			1	5											1			
73				2	1										1			
74				4					1			1			1			
75			1	4						1				2	5			
Total	365612	376507	495103	616065	332060	313304	297984	251649	229614	219358	269766	239522	295318	362344	344101	235388	156020	255104
Weights	5863	5503	6689	7990	5587	5154	4820	4673	4822	3532	3900	4133	5391	6622	5799	3696	2789	4181

Table 11.7. Total number of burrows (10^6), densities (nb/m²) and CVs (%) by spatial stratum for the whole Bay of Biscay. In years 2016–2020, the rough seabed (noted RO) within the outline of the central mud bank (16 164 km² instead of 11 67 km² for the five sedimentary strata *sensu stricto*) was included. For the year 2020, estimates are provided for two datasets: (1) upper: initial estimates after the first exploration of the footage by only one reader per sample (time constraint due to the delay of the UWTV survey caused by the COVID-19 pandemic up to late summer with assessment and advice expected in early autumn) and (2) lower: final estimates after the addition of a second reader per sample in accordance with the standard procedure (WGNEPS, ICES, 2020).

	2016 (196 stations)				*2017 (124 stations)*			
	nb/m²	total burrows	CV (%)	%burrows	nb/m²	total burrow	CV (%)	%burrows
	0.258	**4167.48**	**7.84**		**0.209**	**3372.54**	**9.87**	
CB	0.208	527.75	19.84	12.66%	0.122	310.07	20.10	9.19%
CL	0.191	219.94	20.87	5.28%	0.211	243.57	14.76	7.22%
LI	0.228	1063.80	13.86	25.53%	0.169	789.10	14.75	23.40%
VS	0.677	428.37	17.92	10.28%	0.925	585.84	27.94	17.37%
VV	0.518	1393.62	14.52	33.44%	0.342	921.58	19.82	27.33%
RO	0.119	533.99	29.61	12.81%	0.116	522.38	34.23	15.49%

	2018 (184 stations)				*2019 (145 stations)*			
	nb/m²	total burrows	CV (%)	%burrows	nb/m²	total burrow	CV (%)	%burrows
	0.234	**3787.77**	**8.30**		**0.254**	**4113.42**	**8.34**	
CB	0.209	529.78	19.56	13.99%	0.139	351.89	25.39	8.55%
CL	0.417	480.33	23.64	12.68%	0.325	374.86	43.28	9.11%
LI	0.184	858.15	13.27	22.66%	0.236	1099.78	14.34	26.74%
VS	0.678	429.38	23.30	11.34%	0.473	299.14	21.46	7.27%
VV	0.397	1067.54	17.30	28.18%	0.533	1433.90	12.12	34.86%
RO	0.094	422.59	31.79	11.16%	0.123	553.85	28.17	13.46%

	2020 (134 stations)					
	nb/m²	total burrows	CV (%)	%burrows	Δ(2019-2020)	% surf
	0.212	**3425.06**	**12.74**		-16.73%	
CB	0.058	147.05	24.46	4.29%	-58.21%	15.69%
CL	0.184	212.69	44.46	6.21%	-43.26%	7.13%
LI	0.158	735.12	18.76	21.46%	-33.16%	28.85%
VS	0.728	461.04	20.14	13.46%	54.12%	3.92%
VV	0.424	1140.33	16.96	33.29%	-20.47%	16.65%
RO	0.162	728.84	46.57	21.28%	31.60%	27.76%

	2020 (134 stations)					
	nb/m²	total burrows	CV (%)	%burrows	Δ(2019-2020)	% surf
	0.223	**3601.50**	**12.04**		-12.45%	
CB	0.070	177.93	19.18	4.94%	-49.44%	15.69%
CL	0.191	219.71	43.03	6.10%	-41.39%	7.13%
LI	0.164	765.40	17.91	21.25%	-30.40%	28.85%
VS	0.748	473.70	18.91	13.15%	58.35%	3.92%
VV	0.431	1161.13	16.51	32.24%	-19.02%	16.65%
RO	0.179	803.63	42.10	22.31%	45.10%	27.76%

Table 11.8. Estimation of the abundance of *Nephrops* burrows (10^6) by UWTV. Example of years 2014 and 2015 (rough numbers of burrows with no correction by cumulative bias factor equal to 1.24*;* WKNEP (ICES, 2017a)).

Year	2014		2015	
Number of data	204	204	114	114
Method of estimate for average (A = arithmetic; KO = ordinary kriging)	A	KO	A	KO
Estimation	0.415930	0.425463	0.410321	0.414796
CV geo	0.052829	0.046598	0.180002	0.183475
CV iid	0.072647	-	0.082643	-
Surface (km²)	11 676	11 676	11 676	11 676
Abundance (Estimation * Surface)	4856	4968	4791	4843

Table 11.9. *Nephrops* in FUs 23–24 Bay of Biscay (8.a, 8.b). Effort and LPUE values of commercial fleets.

	Le Guilvinec District Quarter 2		
Year	Landings(t)	Effort(100h)	LPUE(Kg/h)
1987	603	437	13.81
1988	777	471	16.52
1989	862	664	12.99
1990	801	708	11.31
1991	717	728	9.84
1992	841	757	11.12
1993	805	735	10.96
1994	690	671	10.30
1995	609	627	9.72
1996	715	598	11.97
1997	638	539	11.83
1998	622	489	12.72
1999	505	423	11.93
2000	438	405	10.82
2001	697	417	16.71
2002	527	371	14.20
2003	487	356	13.68
2004	410	321	12.74
2005	455	336	13.57
2006	414	306	13.50
2007	401	291	13.76
2008	410	271	15.15
2009	384	279	13.78
2010	471	253	18.61
2011	422	279	15.13
2012	348	229	15.17
2013	288	224	12.83
2014	252	198	12.73
2015	451	231	19.52
2016	475	241	19.74
2017	520	238	21.88
2018	374	220	16.98
2019	338	216	15.66
2020	296	190	15.61

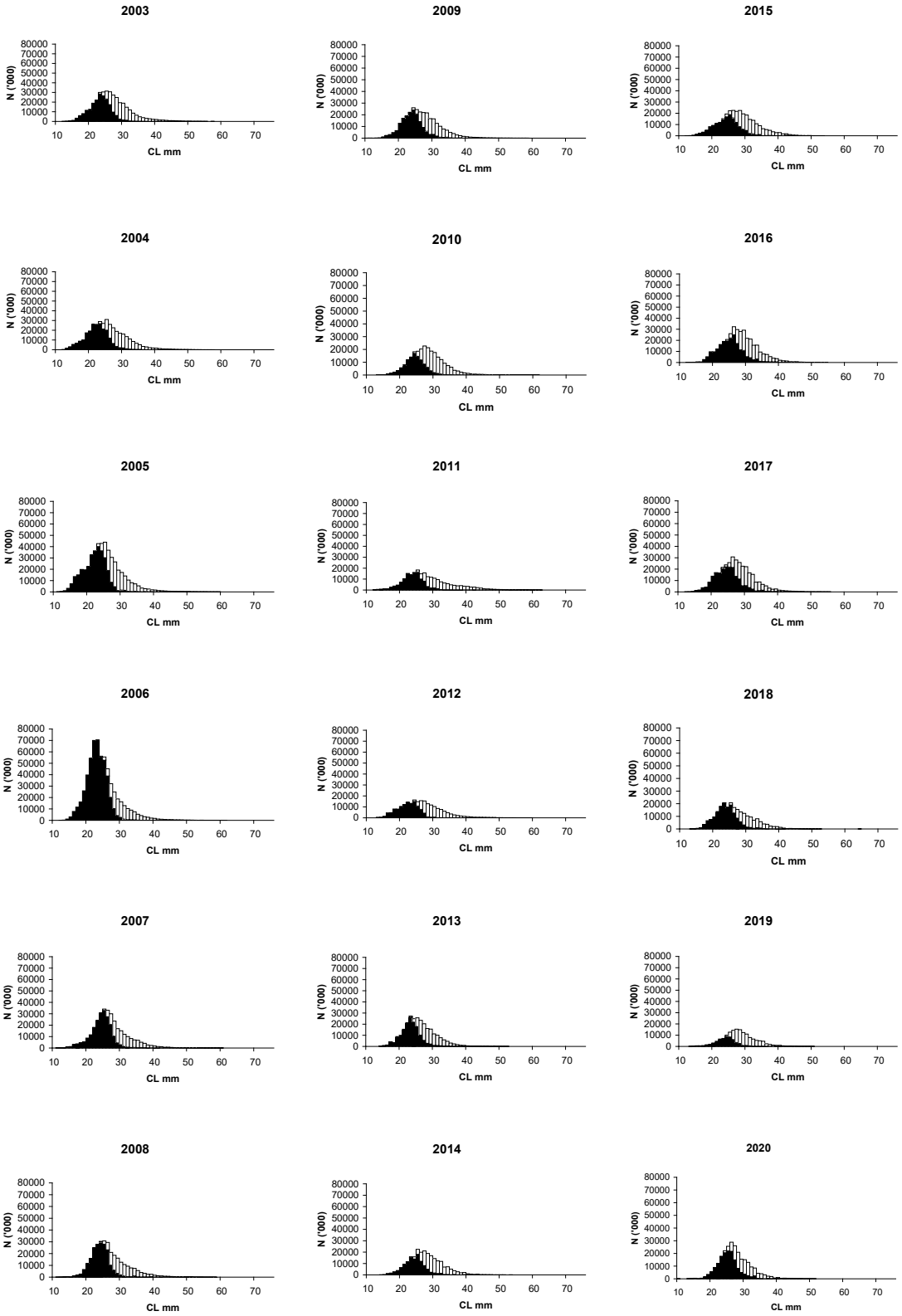


Figure 11.1. *Nephrops* in FU23–24 Bay of Biscay (8.a, 8.b). Catches (landings in white, discards in black) in 2003–2020.

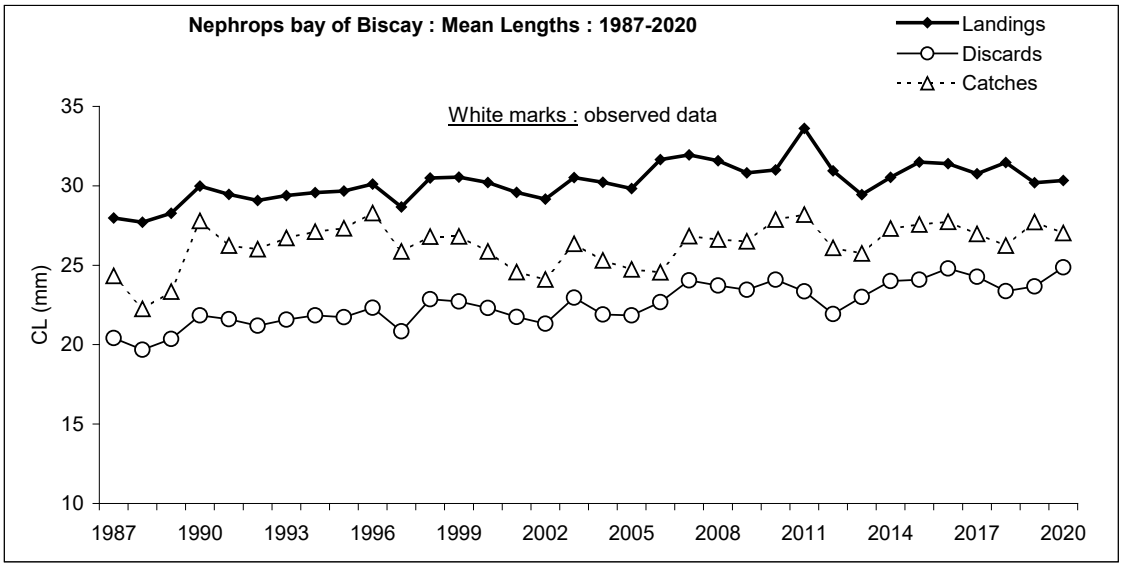
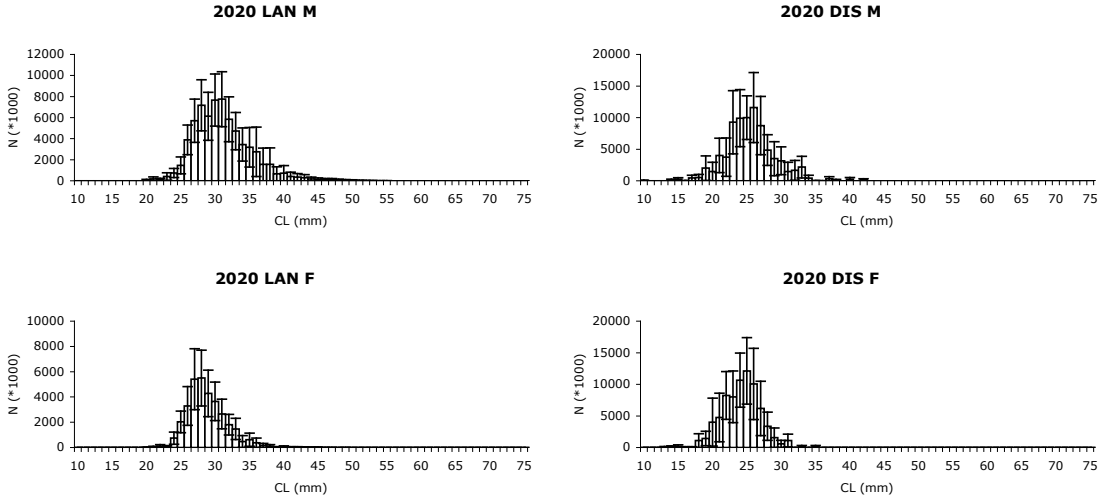


Figure 11.2. ***Nephrops*** **in FUs 23–24 Bay of Biscay (8.a, 8.b). Mean length of landings, discards and catches (in mm).**



		males		females				males		females	
2014	LAN	21.5	13.4	22.7	19.0	2018	LAN	24.3	12.9	20.5	15.0
	DIS	29.9	28.4	35.6	35.0		DIS	20.7	19.8	21.0	20.4
2015	LAN	13.5	10.8	14.4	14.3	2019	LAN	11.2	11.3	13.2	14.1
	DIS	16.9	15.9	15.9	15.9		DIS	20.1	18.2	22.4	19.5
2016	LAN	15.0	13.5	13.7	13.9	2020	LAN	13.6	14.4	16.7	16.0
	DIS	24.9	25.2	22.6	25.0		DIS	16.5	14.3	17.6	16.3
2017	LAN	17.3	18.8	19.5	24.2						
	DIS	25.2	25.5	20.5	19.4						

Figure 11.3. ***Nephrops*** **in FU23–24 Bay of Biscay (8.a, 8.b). LFDs and confidence intervals for landings and discards by sex in 2020.**

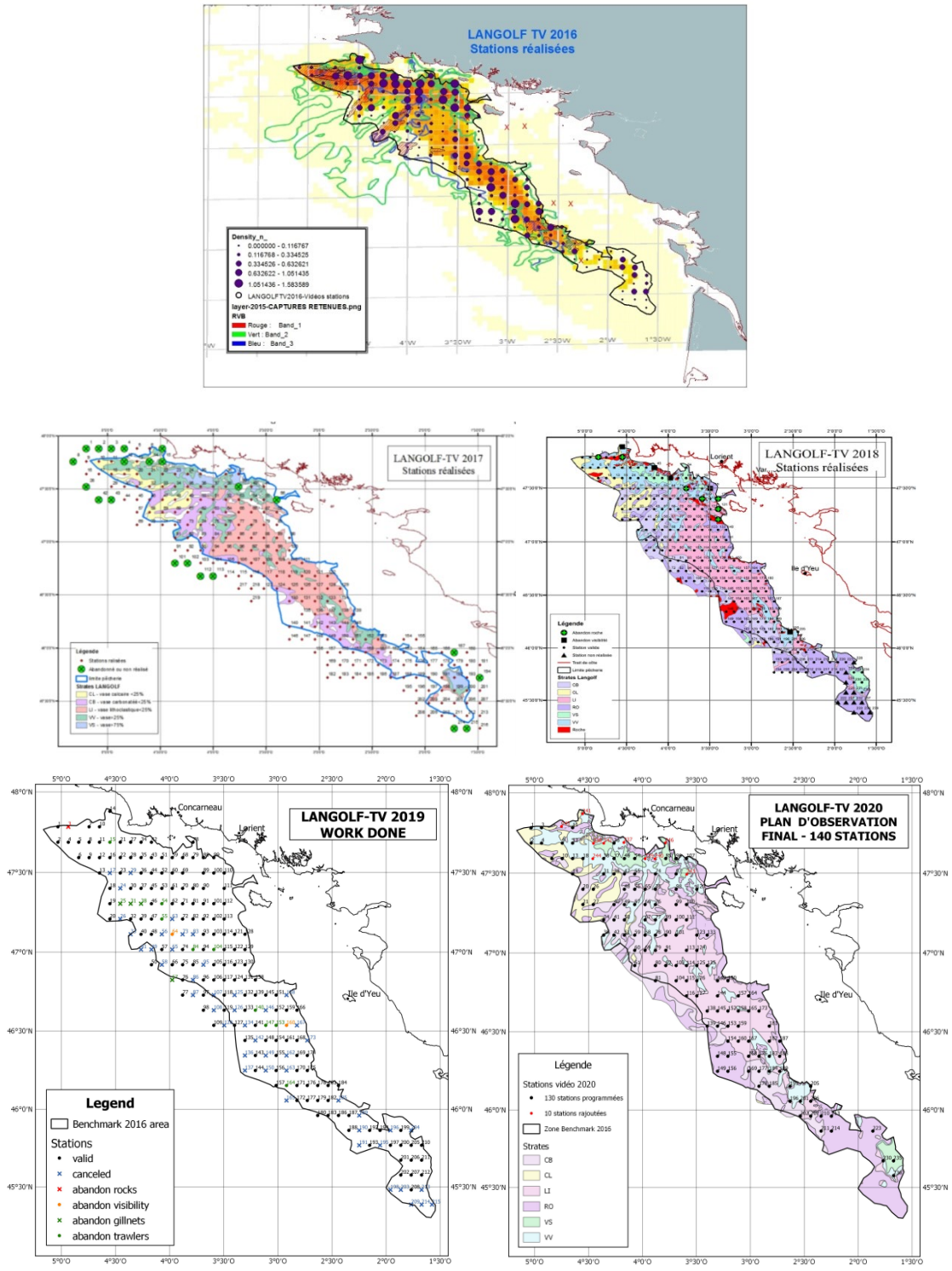


Figure 11.4. *Nephrops* in FU23–24 Bay of Biscay (8.a, 8.b). Systematic grids for the UWTV surveys from 2016–2020. For 2016 the grid was combined with VMS data on 3 min*3 min rectangles. (Source: National Fisheries Direction; compilation: SIH Ifremer).

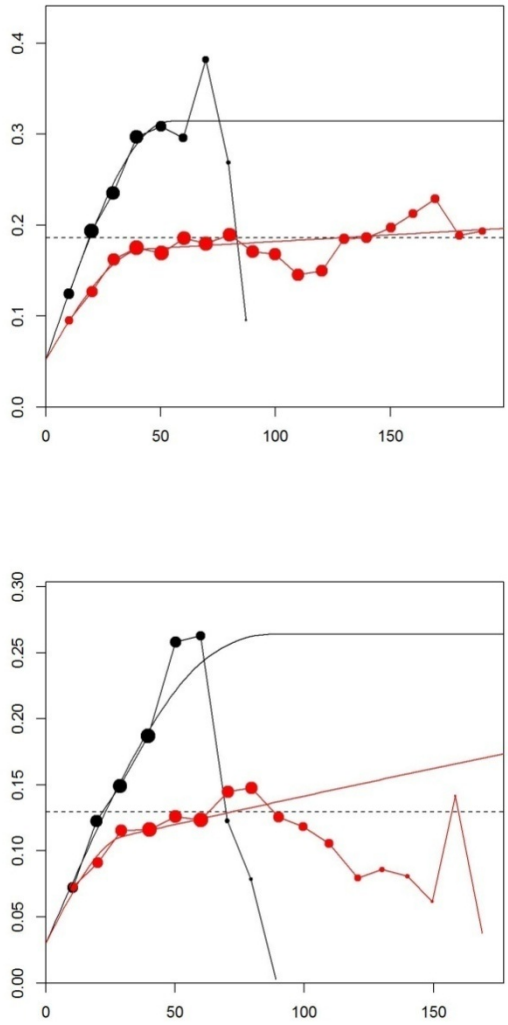


Figure 11.5. *Nephrops* in FU23–24 Bay of Biscay (8.a, 8.b). Experimental variograms (circles proportional to the number of pairs) and models (continuous curves) for the main anisotropic directions (red: NW->SE, black: SW->NE).

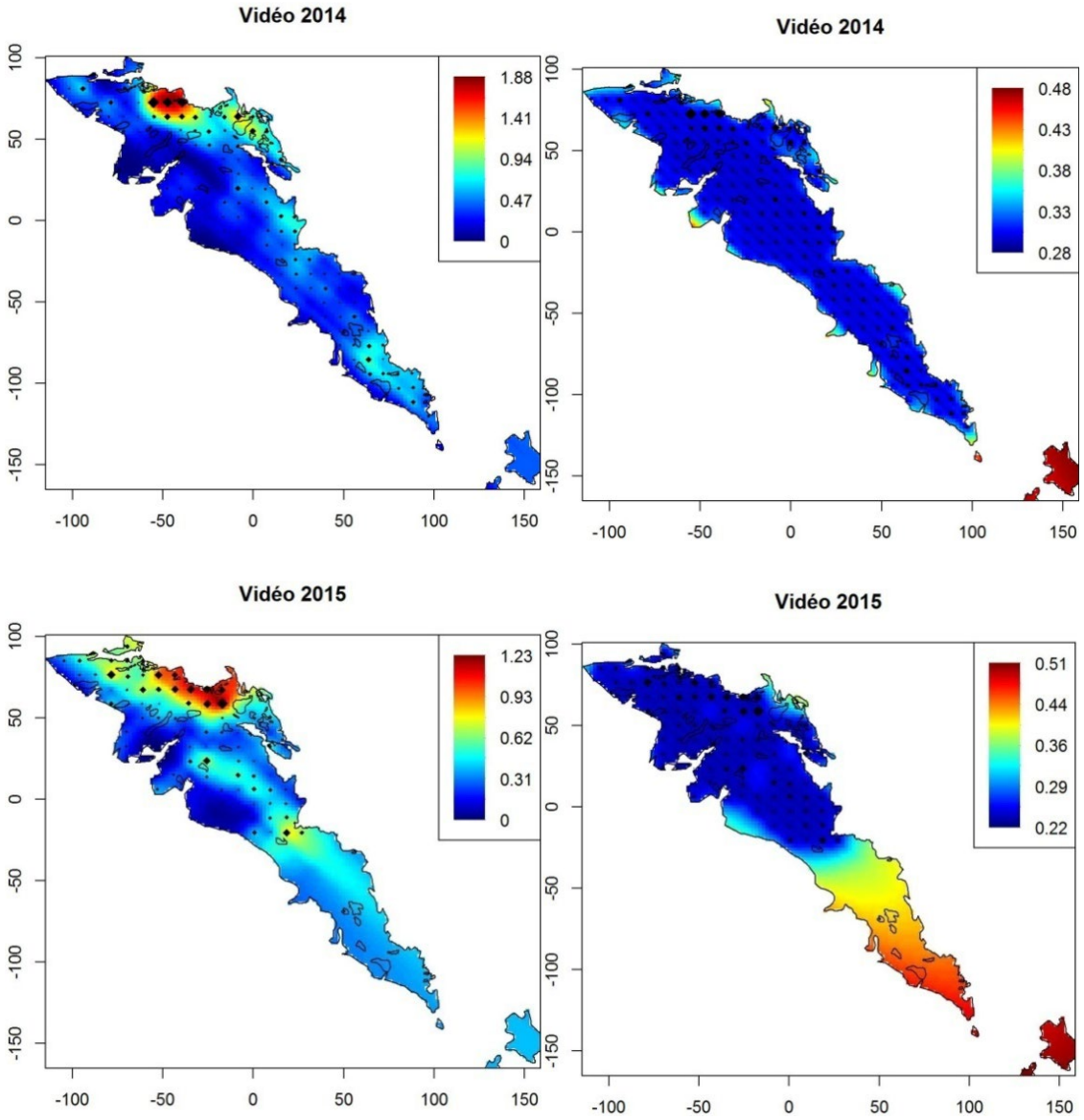


Figure 11.6. *Nephrops* in FU23–24 Bay of Biscay (8.a, 8.b). Estimation of the burrows densities (nb/m²) using ordinary kriging (left column) and error of kriging (right column) in 2014 and 2015.

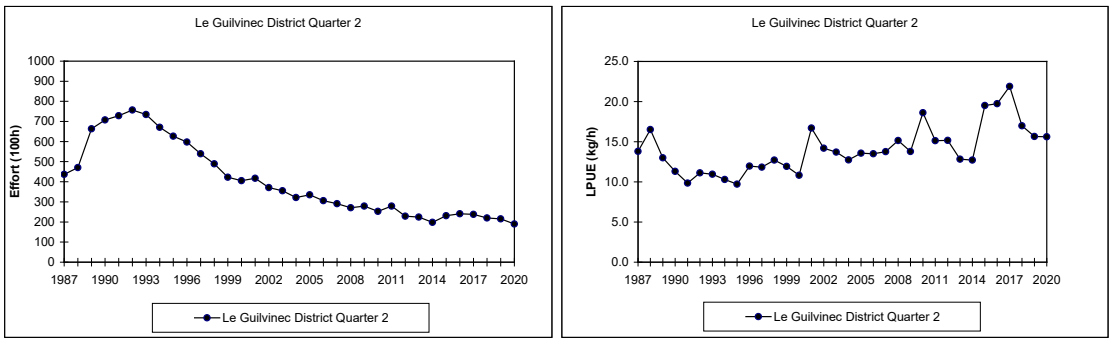


Figure 11.7. *Nephrops* in FUs 23–24 Bay of Biscay (8.a, 8.b). Effort and LPUE values for standardized commercial fleets.