**Ref STECF 2572 – Ad hoc contract data preparation before STECF EWG 25-09 for stock NEP 9 & 5**

**Report – NEP 9**

**Compiled by**: Enrico Nicola Armelloni

**Date**: 04/09/2025

**ToR 1**

To compile and provide the most updated information on stock identification and boundaries, length and age composition, growth, maturity, feeding, essential fish habitats including spawning grounds and seasonality as well as natural mortality.

**ToR 2**

To compile and provide complete sets of annual data on landings and discards as well as the standardized MEDITS Index for the longest time series available up to and including 2024, including length frequency distribution over time. To provide a complete and updated stock assessment input file in the format of those used in 2024.

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ToR 1

## Material and methods

Essential Fish Habitat and spatial distribution of the spawning grounds

A summary of the main life history traits influencing the distribution of Norway lobster (NEP) is provided based on literature. In addition, it is reported the results of a request of STECF in 2023 to map the persistent hot spot for NEP in the Western Mediterranean. The methodology and results were reported to STECF-PLEN-23-02. The hotspot map is based on model predictions. A spatial distribution model for NEP spawners was implemented under model as a Zero-altered (or hurdle) models - with a binomial presence-absence model (i.e., binomial(link = "logit") and another model for the positive catches only with a Gamma observation distribution and a log link (i.e., Gamma(link = "log")). Predictions were made on a grid of 2.5 nm x 2.5 nm and intersecting the western Mediterranean GSAs and the bathymetric contour of 850 m (MEDITS bottom trawl survey data do not exceed a depth of 800 m). The Getis’ G statistic was calculated for each year with a radius of 2.5-5 km, and hotspots were identified in grid cells with Z values greater than the 90° percentile by year. An Index of Persistence (PIx) - measuring the relative persistence of the cell i as an annual hotspot - was calculated by counting the number of times grid cell i was identified as a hotspot and classified in 5 levels: 1 (0-20%]; 2 (20-40%]; 3 (40; 60%]; 4 (60;80%]; 5 (80-100%]. Models were implemented by sub-areas: Balearic (ESP), Tyrrhenian (TYR), and Sardinia (SAR).

Stock identification and boundaries

Stock identification information base on the results of a recent genetic population study conducted at Mediterranean scale (MED\_units, (Spedicato, 2022), which compared the genetic structure of Norway lobster samples across the European GSAs. This information is complemented with literature on spatial connectivity.

Biological parameters

To the present report we briefly review factors influencing life history traits of Norway lobster. The sets of parameters reported in the DCF database are summarized and, when possible, we propose re-analysis and additional parameters from literature.

***Growth parameters:*** The sets of VBGF parameters reported in the medbs dataset are summarised accounting for sampling size and the correlation between parameters. We labeled and excluded from following analysis those sets of parameters which sample size was below the 25th percentile of the available sampling intensity (number of individuals measured). The internal correlation in the VBGP is addressed by treating them as multivariate distributions (Scott et al., 2016). Mean of each parameter and their covariance matrix were calculated from those sets with sampling intensity higher than the entry threshold. Mean and covariances were then used to draw 2000 multivariate samples from a multivariate normal (MVN) distribution. Summary statistics are generated by calculating the median values, the 5th and the 95th percentiles. We also report and summarize other sets of growth parameters found in literature by applying the same method (MVN).

***Length weight relationship:*** The sets of lenght-weigth (LW) parameters reported in the medbs dataset are summarised accounting for sampling size and the correlation between parameters. We labeled and excluded from following analysis those sets of parameters which sample size was below the 25th percentile of the available sampling intensity (number of individuals measured). The internal correlation is addressed by treating them as multivariate distributions (Scott et al., 2016). Mean of each parameters and their covariance matrix were calculated from those sets with sampling intesity higher than the entry threshold. Mean and covariances were then used to draw 2000 multivariate samples from a multivariate normal distribution. Summary statistics are generated by calculating the median values, the 5th and the 95th percentiles. Single draws from the MVN distribution can be used to perform sensitivity test.

***Sex ratio: a***nnual sex ratio vectors were also filtered by sampling intensity, borrowing the numbers available in the lw distribution dataset. Those sets with sampling intesity higher than the entry threshold were analyzed using a generalized additive model (GAM). The response variable, sex ratio, was modelled as a smooth function of size class to account for the non-linear response.

***Maturity (maturity at age, spawning seasonality, other fecundity data):*** We summarize the maturity at length and maturity at age data provided in the medbs datasets, along with some re-analysis and data from literature. An overall maturity at size curve is calculated from the annual maturity at size (proportion of mature individuals) provided in the medbs dataset. A number *n* of individual observations per year and length class are generated for each year and as *Xi ~ Bernoulli(p*), *i= 1, … , n*, where *n* is the sample size and *p* is the proportion of mature reported in the data. A generalised linear model for proportion of mature as a function of length class, with binomial link function (link = logit), is fit to the individual observations using the glm function from the mgcv R package. The predicted proportion of mature by lengthclass is used as a maturity at size curve. L50 is also calculated from the model. Maturity at age vectors reported in the medbs data were summarised by calculating the mean proportion of mature at age over the dataset. A new vector was also re-estimated after estimating numbers at age based on the VBGP calculated in the present report, to check for coherency with medbs data. The annual length frequency distributions were divided by sex based on the aggregated sex-ratio vector. To each size class *l* it was associated a probability to fall in one or more age classes based on the VBGP estimation. Number of mature individuals at age *a* for each year *y* was obtained as , where is the probability to be mature at length *l* and is number at length *l* in year *y*.

***Natural mortality:*** natural mortality by sex and age are calculated using the Chen and Wattanabe method. A natural mortality vector was estimated by sex using the Chen and Watanabe equation and the growth parameters described above. A combined natural mortality vector was then computed as a weighted average of the vectors by sex. In addition, point estimates of natural mortality by sex were computed using the Barefoot ecologist toolbox[[1]](#footnote-1), by taking the median value of several methods (Then, Hamel, Jensen, ZM).

***Other relevant biological parameters:*** this section includes any additional source of information that might be relevant for the stock assessment.

Results

Essential Fish Habitat and spatial distribution of the spawning grounds

Norway lobster highest concentrations can be found between 200 and 500 m (SIBM, 2017). Distribution is influenced by hydrological conditions and bottom types, more than depth, with a preference for cold waters with relatively high oxygen concentrations (SIBM, 2017). Muddy-sandy bottoms characterized by the presence of compact mud are preferred by the species, since they represent the optimal substrate for the construction of burrows. It digs burrows in such substrates and spends most of its time lying in such burrows. Its behavior when it emerges, makes it vulnerable to bottom trawling. The spatial distribution model fitted on the MEDITS data were used to build hotspot persistency maps. It emerges that in the Thyrrenian Sea, persistent spawning ground have been mostly identified on the deeper part of the continental shelf in the western and northern area of the GSA 9 and at the boundary between GSA 8 and 9. Some minor spawning grounds have been identified in GSA 11. The southern portion of GSA 9 is less rich in spawner density, which gradually decreases transitioning to GSA 10. One of the spawning grounds happens therefore to be at the borders between the contiguous GSAs 8 and 9.

A screenshot of a map

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Figure 1 Persistent spawning areas of Norway lobster in the Thyrrenian Sea

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Figure 2: model spatial uncertainty and mean predictions

Stock boundaries

The results of the MED\_units project suggested genetic continuity over the western Mediterranean from the Alboran Sea to the Thyrrenian Sea. Nevertheless, studies performed in other areas of the Mediterranean suggests that the ecological characteristics of the species might favor the existence of sub-populations that are even smaller than the current statistical areas (GSAs) (Melaku Canu et al., 2021). The spatial distribution of Spawner grounds suggests the presence of spatial continuity over the continental platform of the thyrrenian Sea connecting GSAs 8 (eastern coast), 9 and 10. In particular, the largest spawning hotspot is shared between GSAs 8 and 9. The present stock assessment has historically considered the population confined in the GSA 9. It is here highlighted that this division might not necessarily matches the population structure of Norway lobster, at least for what it concerns the spatial distribution of the spawning grounds. Nevertheless, there is no detailed study that confirms alternative configurations of the population structure to support a revision of the stock boundaries. In the present document, it is provided a comparison of trends observed in GSAs 8, 9 and 10. This information is used to comment on the stock assessment results.

Biological parameters

***Growth parameters:*** The estimation of the Von Bertalanffy growth parameters (VBGP) poses challenges in Norway lobseter. Methods commonly used to indirect estimations of size at age (i.e.: tracking modal progression in length frequency data) are of difficult because of the absence of clear cohorts (Castro et al., 1998; Chiarini, 2023). The spawning behavior (continuous recruitment) cause the length frequency distribution to be the sum of multiple overlapping cohorts with poor or absent modal distinction (Castro et al., 1998; Chiarini, 2023). All the VBGP that we could identify in literature and in the medbs dataset base on some variation of modal progression tracking. Other challenges associated with VBGP calculation are linked to species ecology and spawning behavior. Literature highlights that growth parameters can vary depending on local environmental conditions and density of burrows (negative correlation). The decreased catchability of berried females, which mainly remains in their burrows, implies less vulnerability to bottom trawl and to the sampling. The low representation of females in trawling samples can have an effect on the estimation of female growth parameters (SIBM, 2017). Due to the challenges here summarized it is recommended to include explicit considerations of growth parameters uncertainty in the stock assessment.

Growth parameters are available as sex separated for GSA 9. We include in table the values used in the most recent stock assessment, the estimates produced for this report and literature estimations for the same GSA from early MEDITS data (Mytilineou et al., 1998). It is highlighted great variability among the sources, especially for what concerns females. It is also evidenced how the Linf parameter for females shows a trend in the time series, with smaller values in recent years.

A graph of different numbers

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Figure 3: time series of the VBGP. Colors indicate whether the sample size was below (blue) or above (red) the 25th percentile of the overall sampling intensity

Table 1: sets of VBGP from the official data collection and from literature, along with summaries elaborated in the present report. Values in bracket are 5% and 95% confidence intervals.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Source** | **Id** | **Sex** | **Linf (mm)** | **k** | t0 \* |
| STECF 24-09 (from recfish project) | 1 | M | 72.1 | 0.17 | 0 |
| 1 | F | 56 | 0.21 | 0 |
| Summary of DCF (from figure 3) | 2 | M | 69.46 (63.52 – 75.58) | 0.17 (0.13 -0.21) | -0.1 (-0.18 - -0.01) |
| 2 | F | 62.49 (55.6 – 70.38) | 0.17 (0.13 – 0.22) | -0.08 (-0.19 – 0.4) |
| (Mytilineou *et al.*, 1998) | 3 | M | 65.2 | 0.16 | -0.96 |
| 3 | F | 54.5 | 0.22 | 0.03 |
| 4 | M | 80.8 | 0.13 | 0.07 |
| 4 | F | 69.4 | 0.12 | -0.64 |
| (Sardà *et al.*, 1998) | 5 | F | 63.2 | 0.15 | -0.89 |
| 5 | M | 83.2 | 0.12 | -0.87 |
| Summary of literature (sets 3-5) | 6 | F | 61.6 (43.4-85.03) | 0.16 (0.07-0.39) | -0.31 (-1.2-0.66) |
| 6 | M | 72.24 (53.8-97.7) | 0.14 (0.11-0.19) | -0.47 (-1.88-0.98) |

***Length weight (LW) relationship:*** parameters are available as sex separated for GSA 9. We include in table the values used in the most recent stock assessment and the estimates produced for this report. Male parameters are comparable, while paraneters for females are less similar. Observing the values estimated every year it emerges a trend in females parameters.

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Figure 4 time series of the LW parameters. Colors indicate whether the sample size was below (blue) or above (red) the 25th percentile of the overall sampling intensity

Table 2: sets of LW parameters from the official data collection, along with summaries elaborated in the present report. Values in bracket are 5% and 95% confidence intervals.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Source** | **Id** | **Sex** | **a (mm/g)** | **b (mm/g)** |
| STECF 23-09 | 1 | M | 0.00038 | 3.18164 |
| 1 | F | 0.00032 | 3.24848 |
| This report | 2 | M | 0.00035 (0.00021 – 0.0005) | 3.199 (3.08 – 3.31) |
|  | 2 | F | 0.00049 (0.00035 – 0.00021) | 3.121 (2.9 – 3.36) |

***Sex ratio***: The sex ratio shows a decline of female individuals after 30 mm CL and an very low values after 50 mm CL. The annual variation is high for small sizes (<20 mm), which tend to be females in prevalence.

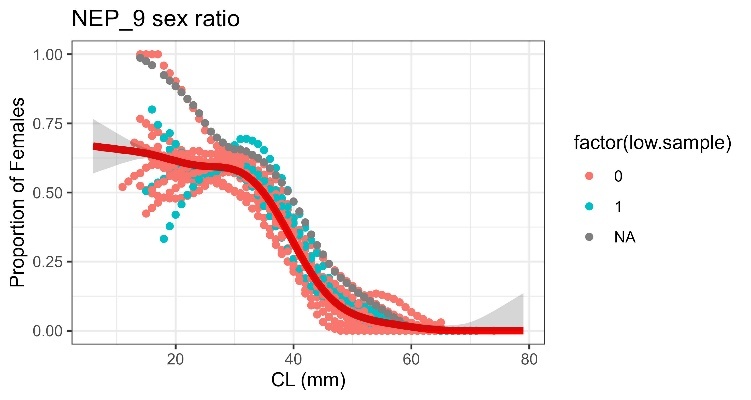
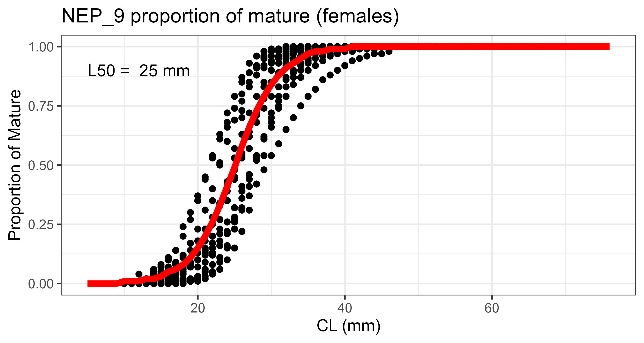


Figure 5: observed and modeled sex ratio at length. Colors indicate whether the sample size was below (blue) or above (red) the 25th percentile of the overall sampling intensity.

***Maturity (maturity at age, spawning seasonality, other fecundity data):*** Norway lobster females follow seasonal maturation cycles, while spermatogenesis in males occur throughout the year. Orsi Relini et al., 1998 summarizes the main reproductive features of Norway lobster in the Mediterranean Sea, taking the Ligurian Sea (GSA 9) as a key study. Maturation of the ovary starts in late spring and peaks during summer, and spawning peak in late summer (Orsi Relini et al., 1998; SIBM, 2017). For the purpose of the stock assessment, a key feature of the Norway lobster reproductive cycle is the long (4-6 months in the Mediterranean) incubation period. After spawning the “berried” females carries the eggs and spend most of the time burrowed. The hatching takes place between october and march of the following year (Orsi Relini et al., 1998). As a result, the individuals are born over a large time window that spans over different calendar years. When the population has to be divided into age classes it is recommended to use the conventional birthday at January 1st (Orsi Relini et al., 1998). Fecundity (number of eggs) increases with animal size, a summary of fecundity parameters is extracted from literature (Orsi Relini et al., 1998). The construction of a maturity-at-age vector is complicated by the difficulty of estimating age in first principle. Based on empirical observations, Orsi Relini et al., 1998 concludes that maturity onset in age 2+ females and that majority of females are capable to spawn at the age of 4 years. From the of maturity at size summary emerges a L50 equal to 25 mm, which is smaller than what reported in literature (Orsi Relini et al., 1998). Estimations in the late ‘90s for this area suggested a first maturity size around 30 mm CL (Orsi Relini et al., 1998). The maturity at age as summarised from the available data and as re-estimated accounting for updated VBGP shows coherent patterns among themselves, while they differ from the maturity vector used in previous assessments. Based on literature information it is expected that female start to mature at age 2+. It is observed that these values are much different from the vector used in previous stock assessments.

A graph of age and age

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Figure 6: left) observed and modeled maturity at length; maturity at age from medbs (red) and estimated in this report (blue).

Table 3: sets of maturity vectors from the official data collection, along with summaries elaborated in the present report.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Source/Age** | **Id** | **0** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9+** |
| STECF 24-10 | 1 | 0.1 | 0.4 | 0.75 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **Average of medbs** | 2 | 0 | 0.07 | 0.29 | 0.62 | 0.89 | 0.98 | 1 | 1 | 1 | 1 |
| **This report - reanalysis** | 3 | 0 | 0.02 | 0.17 | 0.58 | 0.85 | 0.94 | 0.98 | 1 | 1 | 1 |

***Natural mortality (compilation of sources):*** natural mortality was estimated using the Chen Wattanabe formula as a vector of mortality at age based on set of VBGP 1, and in barefoot ecologist as a point estimate. The barefoot ecologist value was obtained using the set 2 of VBGP, setting age at maturity = 3 (used only for females), longevity 12 years and water temperature = 12°. Error was set = 0.1. We acknowledge that natural mortality can deserve more detailed exploration in the stock assessment, including additional parameters and testing the sensitivity of the stock assessment model.

Table 4: natural mortality vectors and point estimates.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Mortality** | **Point** | **0** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9+** |
| **Males** | 0.461 | 1.75 | 0.71 | 0.48 | 0.37 | 0.31 | 0.28 | 0.25 | 0.23 | 0.22 | 0.21 |
| **Females** | 0.518 | 1.8 | 0.72 | 0.48 | 0.37 | 0.31 | 0.28 | 0.25 | 0.23 | 0.22 | 0.21 |

***Other relevant biological parameters:*** Stock recruitment (beverton-holt) parameters for Norway lobster in the Mediterranean Sea are only available from the Southern Adriatic Sea (GSA 18[[2]](#footnote-2)). These values are *h* = 0.8 and *sigmaR* = 0.9.

ToR 2

Material and Methods

The data on landings, discards and MEDITS index are checked and standardized following methodology proposed by EWG 2501, reported in Figure 7. The only difference that we adopt is the use of growth parameters calculated within this ad hoc contract (see ToR 1). The issues identified are addressed and, when possible, solved. Additional checks, as well as other relevant data that are not part of the *medbs* data call are also eventually introduced. Stock assessment input files are also prepared following the guidelines proposed by EWG 2501, along with a few additional consistency checks. The stock assessment input are compared to the most recent available stock assessment files and briefly described.

A diagram of data processing

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Figure 7: workflow diagram illustrating the data review process and object creation preceding the stock assessment

### Commercial data

The commercial data are processed using the script “Checking\_DCF\_NEP\_9.Rmd”. The resulting document contains all the relavant figures and numbers, and is provided as Annex 1. In this report are only addressed the inconsistencies detected. These are manually inspected, and when possible solved. Reconstruction of LFD (filling gaps) is implemented when necessary, justification is provided otherwise. The effect of eventual residual data inconsistency is addressed and discussed. Additional checks are performed to evaluate for the effect of fishing vessel mobility: in recent year the catches are reported by GSA of fishing. In the available dataset, the data are divided as such from 2019 onward. The magnitude of change due to the data revision is evaluated to understand the potential effect on stock assessment results. Lastly, eventual additional sources of data used in the stock assessment are described.

### Survey

The medits survey data are processed using the script “Checking\_SURVEY\_NEP\_9.Rmd The resulting document contains all the relavant figures and numbers, and is provided as Annex 2. In this report are only addressed the inconsistencies detected, and any other sort of data issue that can have a negitive impact on the stock assessment. The inconsistencies detected are manually inspected, and when possible solved. The effect of eventual residual data inconsistency is discussed. Seasonality and sampling distribution are commented. Additional checks are performed, when considered necessary, to evaluate for trend of the stock in neighbouring areas.

Stock Assessment inputs

The Stock synthesis modeling platform has considered a promising by EWG 24 09, and the a4a modeling platform has been also proposed for comparison and consistency with previous work. For both model, input files are provided for a base run and a few candidate sensitivity runs. Stock assessment inputs for the a4a model are created and compared to the stock assessment inputs used in EWG 24 10. Eventual differences are discussed. In this report is provided a brief summary of the model assumptions and an exploration of the cohort consistency. The “base run” is considered the starting point for the stock assessment and the terminology used to save the files follows recommendations provided by the JRC (i.e.: [STK]\_[GSA]\_STK.rds; [STK]\_[GSA]\_IDX.rds). When considered necessary are also provided alternative versions to be used for sensitivity analysis. These follows the nomenclature [STK]\_[GSA]\_STK\_S1.rds; [STK]\_[GSA]\_STK\_S2.rds etc.).

## Results

### Commercial data

**DTMT**

Table 1 reports the DTMT file originated from the commercial data checks (only relevant columns shown) and highlights the need to follow up with these (column “To be transmitted”).

Table 5: relevant columns from the DTMT file. The column “to be transmitted” indicates whether these issues should be included in the final DTMT.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Issue Id | Data\_request | Issue | Issue\_type | To be transmitted |
| 1 | Landings | NEP\_9. There are years for which data are expected but are not provided | QUALITY | No |
| 2 | Landings | NEP\_9. Check before report. 65 cases in which length class number are zero if landing>0 | QUALITY | No |
| 3 | Landings | NEP\_9. There are double landings reported assigned to different gear | QUALITY | No |
| 4 | Discards | NEP\_9. Check before report. 2 cases in which length class number are zero if discards>0 | QUALITY | No |
| 5 | Discards | NEP\_9. There are double discards reported assigned to different gear | QUALITY | No |
| 6 | Catch | NEP\_9. Check before report. There are 97 cases of landings >0 but not nb or weight. | QUALITY | No |
| 7 | Catch | NEP\_9. Check before report. There are SOP values above and/or below threshold | QUALITY | Yes |
| 8 | Catch | NEP\_9. Check before report. There are 11 cases of discards >0 but not nb or weight. | QUALITY | No |
| 9 | Catch | NEP\_9. Check before report. There are SOP values above and/or below threshold | QUALITY | Yes |

***Id 1***

*Status*: solved

*Explanation:* Missing DCF data in 2002 is solved by using historical time series from the RECFISH project (1994-2002).

***Id 2***

*Status:* checked, potential warning

*Explanation:* 34 out of the 65 records identified refers to set gears or OTM, for which the catches reported are negligible. Additional 21 records are linked to OTB DWS, a gear that does not target NEP specifically and for which the catches are very low. It is expected that NEP can be completely missed in commercial samplings for this metier. The remaining 10 records are more carefully inspected. It is highlighted that no length frequency distributions were available for the 4th quarter of 2022 and first of 2023 (Figure 2), due to issues in the Italian Data Collection Framework already discussed in previous EWGs (missing sampling, Figure 3). To evaluate for potential bias in the aggregate LFD data we compared the contribute of seasonal LFD (Figure 4). To prepare data for Figure 4, the LFDs where transformed in relative frequencies (N) by dividing the observed frequency of the length class l from year y and season *s* as . It is evidenced a lack of strong seasonal differences in the LFD. Therefore no major issue is raised, nevertheless, if possible, it is recommended to try to account for the uneven sampling with data weighting or variance adjustment.

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Figure 8: length frequency distributions reported by quarter, or annual (-1) when quarterly data are not available. Vertical bar is L50 (2.5 cm)

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Figure 9: sampling intensity by year (from 2016) and season for OTB metiers in GSA 9. The left panel shows the number of samplings by metier; the right panel shows the number of NEP individuals sampled.

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Figure 10: relative contribution of data by quarters to the total length frequency distribution. Data are standardised by season, as Nl,y = Nl,y,s/max(Nl,y,s). . Vertical bar is L50 (2.5 cm)

***Id 3***

*Status*: checked and not relevant

*Explanation:* This issue is detected by the script because seasonal data reporting started in different years for different OTB metiers. It does not represent a concern.

***Id 4***

*Status:* checked and not relevant

*Explanation*: Discards for this species are negligible, and length composition is only available for a limited number of years. This issue is not considered a concern for the stock assessment.

***Id5***

*Status:* checked and not relevant

*Explanation*: this issue is detected by the script because seasonal data reporting started in different years for different OTB metiers. It does not represent a concern.

***Id6***

*Status:* checked and not relevant

*Explanation*: This issue has the same origin of Id2. This source of data (catches.csv) is not used in the assessment.

***Id7 & 9***

*Status:* checked and not relevant BUT to be fixed

*Explanation*: In the file catches.csv, year 2019 quarter 1 OTB DEF is misreported: aggregated weight reported in the landing column (~ 16 tons); the weight at age assigned to discards.

***Id8***

*Status:* checked and not relevant

*Explanation*: This issue has the same origin of Id4. This source of data (catches.csv) is not used in the assessment.

**Data reconstruction**

No data reconstruction was performed

**Additional checks**

We inspected data per GSA of fishing, including neighbouring GSA 8. It is evidenced that some tens of tonnes are fished by Italian fleet in GSA 8. This pattern is mainly observed in 2019, the first year in the time series where data are reported by area of fishing. The pattern diminishes in 2020-2024. It is not possible to known if year 2019 was a sporadic event, or if the pattern was more consistent in the past. Nevertheless, it has already been reported that Italian vessels registered in GSA 9 can occasionally deploy their gear in neighbouring GSAs (Armelloni *et al.*, 2021). These observations suggests that a certain degree of territorial continuity can exists between fishing grounds located in GSA 8 and 9.

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Figure 11: landings data reported by GSA of fishing.

**Additional data sources**

In previous EWGs, landings of NEP in GSA 9 in the period 1994-2002 were gathered from the Italian official statistics (prior to DCR/DCF) which were collected and stored under the RECFISH project (Ligas, 2019). Landings in 1997 were considered misreported. In previous EWGs it was pointed out that the landings reported in two ports were unreliably high compared to the other ports and the time series. Therefore the value was re-estimated to 327 t with a moving average, 3 years, for being used in the assessment. LFDs for the period 1994-2002 were also provided by the results of the RECFISH project (Ligas, 2019), who collected historical fishery information from previous projects and studies performed in the Mediterranean and Black Sea. The LFD for 1997 was also adjusted to the reestimated landings.

Table 6: NEP landings in GSA 9 estimated during the RECFISH project. \* This value has been revised. See text for details

|  |  |
| --- | --- |
| Year | OTB |
| 1994 | 376.4 |
| 1995 | 345.4 |
| 1996 | 359.5 |
| 1997 | **727.6\*** |
| 1998 | 225.5 |
| 1999 | 178.6 |
| 2000 | 334.9 |
| 2001 | 269.5 |
| 2002 | 276.8 |

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Description automatically generated

Figure 12: length frequency distributions from the RECFISH project.

### Survey

**DTMT**

Table 7 reports the DTMT file originated from the survey data checks (only relevant columns shown) and highlights the need to follow up with these (column “To be transmitted”).

Table 7: relevant columns from the DTMT file. The column “to be transmitted” indicates whether these issues should be included in the final DTMT.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Issue Id | Data\_request | Issue | Issue\_type | To be transmitted |
| 1 | Medits TA | NEP\_9. Check before report. There are 139 cases of diferences between distances declared and estimated | QUALITY | Yes |
| 2 | Medits TC | NEP\_9. Check before report. There are 30 cases of lengths below minimum and above maximum values observed | QUALITY | No |

***Id 1***

*Status*: checked, not addressed

*Explanation*: the dataset resulting from the data checks was inspected. 51 records were clear cases of coordinates misreporting (estimated speed > 4 knots). There where 88 records with large (>30%) but plausible differences between the expected and observed distance covered in the haul. It is recommended to have the unit involved in data collection to check for this issue.

***Id 2***

Status: solved

*Explanation*: the dataset resulting from the data check was inspected. There are occasionally small values (8mm CL), there are no objective reason to discard them.

**Additional comments**

Seasonality oscillation in MEDITS survey is a known issue. The issue does not apply to 2024, when the survey was conducted in time (Figure 14). It was not possible given the allowed time to attempt for a model-based reconstruction of the survey index, especially considering the issue of aligning the length composition.

A chart of a number of months

AI-generated content may be incorrect.

Figure 13: seasonality of the MEDITS survey in GSA 9

NEP in GSA 9 has a continuous distribution with eastern GSAs 8 (Corsica island) and northern GSA 10 (South thyrrenian Sea). This especially applies on the continental shelf between the north of the Corsica island (GSA 8) and the Tuscan archipelago (GSA 8), where according to ToR 1 it exists one of the largest spawning grounds in the Tyrrhenian Sea. Figure 9 reports the MEDITS distribution across 30 years for the entire Tyrrhenian Sea. Figure 10 shows the indices calculated over the GSAs 8, 9 and 10, as well as the combined index for GSAs 8 and 9. It is known that NEP is a territorial species with limited connectivity among distant areas, and that management can benefit by the evaluation of small functional units. Nevertheless, considering the spatial continuity between GSAs 8 and 9, as well as the clear synchronicity observed in the indices, it is argued that this area at the border between two GSAs can have an important role for the status of the stock in GSA 9 as well as for GSA 8. It is suggested to attempt a sensitivity run merging GSAs 8 and 9.

A map of italy with red dots

AI-generated content may be incorrect.

Figure 14: biomass by haul from the medits survey in the thyrrenian sea

A graph showing the growth of the stock market

AI-generated content may be incorrect.

Figure 15: biomass indices by GSA 8, 9, 10 and by 8-9 combined.

### Stock assessment input files

**Stock synthesis**

Base Run

The base run uses the same parameters used in the reference run from previous EWG, with the difference of revised growth parameters described in ToR 1. The data used for catches timeseries, as well as for the length composition of survey and catches, were gathered from the same data sources used for the reference model (a4a). Density index was used as tuning index. Length composition by sex, in the case of fishery dependent information, was reconstructed by splitting the length composition observed in year x using the modelled sex ratio described in ToR 1. The catch composition for year previous to 2003 were provided for combined sexes and splitted by the model. Medits length composition by sex was used. The mean month of the survey was provided as input data. Plus group was set as 9+ in analogy with the a4a model. Natural mortality was derived from the barefoot ecologist toolbox. Spawning was set at the middle of the year. The ss3 model was structured as annual model, sex separated, with one commercial fishery (OTB) and one survey density index (MEDITS). The time series used was 1994-2024. Selectivity is logistic. VBGP used where the set 2 from Table 1. Length at age 0 was estimated externally and fixed in the model. Recruitment deviations were limited to the year 2019 as in the best run from previous EWG: this decision was justified by the timing of the survey, which was systematically shifted to the autumn period from 2020 onward. It was therefore decided to exclude from recruitment estimations these years. The model .exe file used is SS3.30.24. Here are reported the lists of fixed and estimated parameters used in the base model.

Fixed parameters: Biological parameters by sex Linf, k, t0, (set 2, Table 1) a, b (set 2, Table 2) and fecundity (Orsi Relini et al., 1998); Length at 50% maturity = 2.5 cm (Figure 6); Point estimate of natural mortality from composite estimator (Table 4); Stock recruitment (beverton-holt) parameters h (0.8) and sigmaR (0.9) from the stock assessment of Norway lobster in Southern Adriatic Sea (GSA 18)

Estimated parameters and quantities: Logistic selectivity peak and inflection parameters; Initial F (in year 1993); R0; Recruitment deviations (1994-2019)

*A collage of graphs

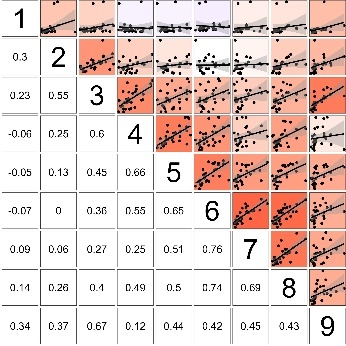
AI-generated content may be incorrect.*

Figure 16: model outputs and fit to data from the base run. Fleet 1 is commercial OTB and fleet 2 is MEDITS survey. panel a show the cumulative observed (grey shaded) and estimated selectivty, where blue line is for males, red for females and green combined; panel b show residuals of length composition by length, year, fleet and sex, where grey contours are for combined sexes, blue contours are for males and red for females; panel c show the observed and fitted (blue line) density index; Panel d shows the estimated selectivity by fleet

**A4a**

***Base run***

The base run considers sex separated and time series 1994-2024. The biological parameters are revised and equal to the stock synthesis base run: VBGP set 2 (Table 1); LW set 2 (Table 2), maturity set 2 (Table 3). Sex ratio from figure 5. The t0 correction was not applied. Discards were included.

A screenshot of a graph

AI-generated content may be incorrect.

Figure 17: cohort consistency of catch at age (left) and survey (right)

***Sensitivity 1***

The base run considers the same setting of the base run, except for the VBGP, which considers set 6 from Table 1.

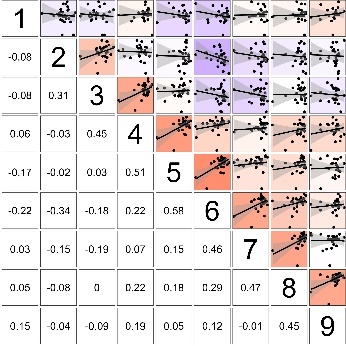
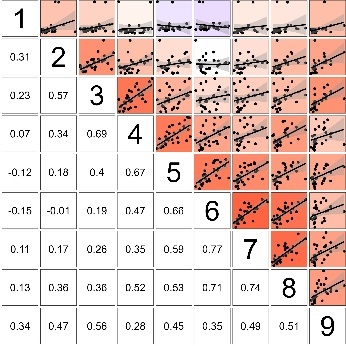


Figure 18: cohort consistency of catch at age (left) and survey (right)

***Sensitivity 2***

The base run considers the same biological parameters used in the previous assessment: VBGP set 1 (Table 1); LW set 1 (Table 2). Maturity set was changed to 2 (Table 3). Sex ratio from figure 5.The t0 correction was not applied.

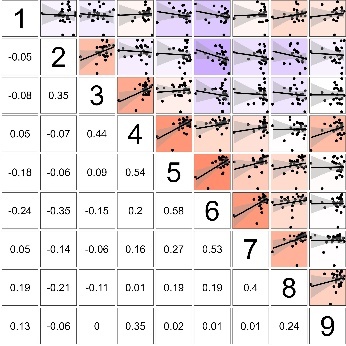


Figure 19: cohort consistency of catch at age (left) and survey (right)

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