REPORT OF THE INTERSESSIONAL MEETING OF THE ALBACORE SPECIES GROUP INCLUDING THE MEDITERRANEAN ALBACORE STOCK ASSESSMENT

(Online, 21- 30 June 2021)

1. Opening, adoption of agenda, and meeting arrangements

The meeting was held online due to the current pandemic situation. Drs. Haritz Arrizabalaga and Jose Maria Ortiz de Urbina (EU), the Albacore Species Group ("the Group") coordinators and meeting Chairs, opened the meeting and welcomed participants. Mr. Camile JP Manel (ICCAT Executive Secretary) welcomed the participants and thanked them for their efforts to remotely attend the meeting. The Executive Secretary requested a minute of silence in remembrance of Dr. Fabio Hazin, who recently passed away.

The Secretariat provided information on how to use the online platform for the meeting (Zoom application). The Chair reviewed the Agenda, which was adopted with changes (**Appendix 1**).

The List of Participants is included in **Appendix 2**. The List of Documents and Presentations provided to the meeting is attached as **Appendix 3**. The abstracts of all SCRS documents and presentations provided at the meeting are included in **Appendix 4**. The following served as rapporteurs:

Sections	Rapporteur
Items 1, 10	M. Ortiz
Item 2	C. Mayor, C. Palma, J. Garcia,
Item 3	F. Garibaldi, J. Ortiz de Urbina, C. Pinto, H. Winker, A. Kimoto
Item 4	G. Merino, J. Ortiz de Urbina, A. Parrilla, N. Taylor
Item 5	G. Merino, N. Taylor, M. Lauretta, M. Ortiz
Item 6	H. Arrizabalaga, J. Ortiz de Urbina, V. Ortiz de Zarate, P. Travassos,
Item 7	H. Arrizabalaga
Item 8	H. Arrizabalaga, J. Ortiz de Urbina
Item 9	H. Arrizabalaga

2. Review of fishery statistics

The Group reviewed the most up-to-date albacore (ALB) fishery statistics: Task 1 nominal catches (T1NC), Task 2 catch & effort (T2CE), Task 2 size frequencies (T2SZ), Task 2 catch-at-size reported (T2CS) and conventional tagging data. All this information is available in the ICCAT database system, ICCAT-DB. The three albacore stocks (ALB-N: North Atlantic; ALB-S: South Atlantic; ALB-M: Mediterranean) were presented individually. **Tables 1** A/B/C are the corresponding SCRS catalogues on fisheries data availability for the period 1990-2019 (2020 statistics were still preliminary and incomplete at the start of the meeting).

2.1 Task 1 (nominal catches) data

For the three albacore stocks (ALB-N, ALB-S and ALB-M) only minor revisions were made to the most recent years when compared to the corresponding ALB statistics adopted at the 2020 SCRS annual meeting. In line with the work done with other ICCAT species, the Secretariat continues its progressive work aiming to eliminate ALB catches with unclassified gears (gear codes: UNCL, SURF) by reclassifying them with the correct gear. In addition, the reclassification of the "old" Task 1 areas without geographical delimitation by the ALB sampling areas has seen an improvement in the entire series of Chinese Taipei, who presented a full split of their ALB catch series (1962-2019: north into AL31 and AL32; south: AL33 and AL34) to the Group. The Secretariat will continue working on this task to fully replace the former Task 1 areas with ALB sampling areas alongside the ICCAT CPCs.

No gap completion analyses have been performed this time to the current T1NC on the three ALB stocks. The Group adopted the ALB Task 1 catches presented by the Secretariat noting that 2020 catches are preliminary and incomplete.

Likewise, a preliminary dashboard being developed by the ICCAT Secretariat with Microsoft Power BI on T1NC data was presented to the Group. The source of the information is the same as that provided to the

Group in the regular Excel file, but through this tool, complex queries can be performed using a simple visual language. One of the key points of this tool is that all the charts presented in it are linked and filtered by the options available on the dashboard. The Group noted that this tool is useful to better understand the information provided in Task 1. The Secretariat will report this dashboard to the SCRS for inclusion in subsequent statistics reports.

Table 2 presents the final ALB T1NC estimations by stock/gear group and year. **Figure 1** presents the T1NC estimations by gear group and year for the three albacore stocks.

ALB-N (North Atlantic Albacore stock)

Nominal catches in the ALB-N stock for the last completely reported year (2019) are 34,773 tt, which is above the TAC set for this stock of 33,600 tt. Regarding data quality in this stock, it was highlighted that there are 119 records of unclassified gears, which corresponds to 2,601 t in the 1950-2020 period.

ALB-S (South Atlantic Albacore stock)

The situation of the ALB-S stock in the last completely reported year (2019) shows a sum of 15,640 t, which is below the TAC set for this stock of 24,000 t. It was noted that there are 22 records (1,118 t) assigned to NEI flags as well as 57 unclassified gears records (5,654 t) for the 1950-2020 period.

ALB-M (Mediterranean Albacore stock)

Due to the effort made by the Group in previous years, there is only one record classified as NEI flag in 1993 with 500 t catches; however, there are 144 records (65,583t) attributed to unclassified gears (UNCL). These unclassified gear catches are focused on the 1957-2002 period and mainly belongs to the flags: EU-Italy, Turkey, and EU-Greece (**Table 2**). Gear discrimination work needs to continue in the future.

Total catches are mostly due to longlines (56%), purse seiners (15%) and gillnets (14%) in the 1990-2020 period. Gillnet catch series are residual since 2011, mostly due to the drift gillnet ban in the Mediterranean.

2.2 Task 2 (catch-effort and size samples) data

The ICCAT standard scorecard adopted by the SCRS in 2019 (**Table 3**) allows for a comparison between three data series scales (10, 20 and 30 years) among all ICCAT managed species/stocks.

As shown in the albacore SCRS catalogues (**Tables 1A, 1B** and **1C**), the North Atlantic stock is reasonably well covered (score = 7.1) in the last 30 years (1990-2019) in a better shape than ALB-S (score = 5.65) and much better than ALB-M (score = 2.52). However, the Albacore Mediterranean stock has significantly improved coverage in the last year (12%) for the 30-year period due to the cooperative efforts made by this Group and the corresponding CPCs, but it remains in a poor shape.

Important gaps still exist in both T2CE and T2SZ datasets. As for other ICCAT species, the Secretariat has had a long-term project in place since 2014, aiming to (a) recover missing Task 2 datasets and (b) improve the level of Task 2 resolution and harmonization (replacing year/trimester by month, replacing 20x20/10x20/10x10 grids by 1x1 and 5x5, harmonise efforts by gear, harmonise/improve size/weight classes, etc). This work supported by the SCRS (committed to a long-term improvement of ICCAT statistics) requires the participation and full commitment of the ICCAT CPC scientists. The Secretariat is using the SCRS catalogues as one of the important instruments to request revisions from ICCAT CPCs.

2.3 Tagging data

The Secretariat presented an updated excel file with all the albacore conventional tagging. **Table 4** shows releases and recoveries per year and **Table 5** shows the number of recoveries grouped by number of years at liberty. Three additional figures geographically summarise ALB conventional tagging available in ICCAT. The density of releases in 5x5 squares (**Figure 2**), the density of recoveries in 5x5 squares (**Figure 3**), and the apparent movement of ALB (arrows from release to recovery locations) shown in **Figure 4**.

In addition, the secretariat presented an albacore dashboard to dynamically and interactively examine conventional tagging data for both releases and recoveries. The Group was informed that this version is a prototype and has been submitted for feedback from meeting attendees. The Group noted that this tool is useful to better understand the information provided in tagging.

It was noted that conventional tagging data for albacore represents information from opportunistic tagging as well scientific programs. Hence, the potential use of these data should carefully consider the objectives of the analysis to include or not include all conventional data. It was noted, for example, that high recovery rates in 1970s are due to the fact that the data provided only included tags recovered with corresponding release information; unfortunately, the full dataset of tag releases from this research program is not available.

2.4 Scientific documents

Two scientific documents were presented on statistics: SCRS/2021/ 105 and SCRS/2021/110.

SCRS/2021/105: this document presented a review of the size frequency data of the Mediterranean albacore reported to ICCAT. A preliminary analysis was performed for potential use within the stock evaluation models. The size samples were revised, standardized and aggregated to size frequencies samples by main gear type, calendar year and quarter. Preliminary analyses use the number of size samples and indicators of distribution shape (skewness and kurtosis) to evaluate the suitability of a size-frequency sample. Limited size samples are available before the 1990s, and the number of samples has reduced significantly in recent years. Overall, most of the fishes caught are between 58 and 90 cm SFL, with a median of 73 cm SFL. For the Mediterranean albacore stock, currently the size-frequency samples from the major target fishing gear suggest a passing of annual cohorts in the fishery.

SCRS/2021/110: this document reported the unusual albacore size frequencies found in Sicily, both in the Ionian Sea and in the Tyrrhenian Sea. For decades, Mediterranean albacore showed size distribution, modes and average lengths with almost stable values over the years, with slightly bigger individuals in the southern Tyrrhenian Sea, compared to those fished south of the Strait of Messina. In 2019 and 2020 there was the unusual presence of big size classes in all areas, without any clear explanation. The paper reports the size details of all individuals, the modes, and the mean size over the years, showing the unusual situation. The records for the two years were specimens of 131 and 133 cm SFL. The paper also includes some useful notes about the important changes of the fishing strategies for albacore in the most important Mediterranean fishing fleet for these species and some relevant changes in the albacore distribution over the last decades.

3. Mediterranean Sea albacore

3.1 Review of available and new information on biology and life-history

No documents or presentations regarding this agenda item were presented during the meeting.

3.2 Evaluation of relative indices of abundance for use in the stock assessment and final indices to use in the assessment.

During the meeting, updates of the three indices of abundance already used for the previous Stock Assessment session in 2017 (Anon. 2018a) and other additional standardized indices were presented.

Indices of abundance of albacore from different Italian seas and periods were presented in document SCRS/2021/115. The Italian longline fishery index presented in 2017 was updated using new data up to 2019 (2011-2019). Additionally, three new indices, were obtained from old data collected in the past, respectively from the Ligurian Sea (1994-1997), the Ionian Sea (1995-2003) and Southern Mediterranean waters (2004-2009). Annual standardized indices were estimated applying Generalized Linear Modelling techniques including the Year, Month and Area (when meaningful) of fishing as predictor variables, to be consistent with the method used in 2017. The update of the “Italian LL index” covering the period between 2015 and 2019 shows an increasing CPUE rate in the last two years.

Document SCRS/2021/102 presented an update of the standardized index (already used in 2017) for the Spanish surface longline (LLALB) targeting albacore in the western Mediterranean Sea for the period 2009-2019. The index used set-based information of catches and fishing effort collected by scientific observers on board. Both Spanish indices showed a relatively stable trend for the most recent period (2014-2019).

Document SCRS/2021/103 presented an update standardized index of relative abundance for the Spanish sport fishery in the Balearic Sea, for the period 2005-2019. The index used trip-based information of catches and fishing effort collected by scientific observers. The effort, for this set of data, is calculated in lines and rods and the catch time series is reported both in numbers and weights and individual lengths are reported as well.

The nominal CPUEs were standardized through a mixed GLM (GLMM) with a negative binomial distribution due to overdispersion found in the data. The predictors in the model were year, month and an interaction between year and month. The authors reported that together with the number of boats also the number of gears was taken into account in the analysis.

Document SCRS/2021/117 presented a larval index for albacore caught around the Balearic Sea. Larval abundance indices express standardized abundances of larval densities from ichthyoplankton surveys as a proxy for SSB. The index covered the period from 2001 to 2019 with some gaps (2002-2003, 2006-2011 and 2018). Results show a decreasing trend in albacore larval abundance resulting in the lowest value in 2015, when compared to the previous and following years.

The Group noted although the larval survey has been used for Atlantic bluefin tuna larvae, it can be used to enumerate Mediterranean albacore. In addition, the Group discussed on several technical aspects regarding larval surveys at sea, especially for the standardization process in relation to different nets used, different depths of the tows and the possible influence of environmental parameters that can influence the yearly index values used in the assessment, raising some concerns. For this reason, although the authors provided further studies supporting their approach, the Group recommended to keep a closer look at these before the next assessment.

A detailed summary of the available indices after the presentation of these papers is reported in **Table 6**, including the Nominal CPUE from Italian drifting longlines fishery in the southern Adriatic Sea from FAO-MiPAF document (Marano *et al*., 2005), covering years 1984 to 2000 (no data for 1988-89 and 1996-97), already used in 2017.

Final indices to use in the assessment

After the presentation of the indices, the Group discussed their suitability for use in the model. The available information regarding indices for their evaluation is included in **Table 7**, using the same criteria proposed by other SCRS Groups for other species. **Figure 5** shows a comparison of the trends in indices from the 2017 and present assessment.

Greater attention was paid to the update of the three standardized indices already used in the 2017 assessment (Italian longline, Spanish longline, and western Mediterranean larval index). It was noted that for the years 2011-2019, all indices exhibit negative trends up to 2015, except for the Italian one, which shows an increase in the last two years (**Figure 6**).

This discrepancy was discussed by the Group. The recovery showed by the Italian index in 2018 and 2019 is not observed in the trends of the two Spanish indices. Their trend is more consistent with the total reported catches trend in the ICCAT DB, which shows a decrease starting from the mid-2000s.
It was noted that this decrease in the total reported catches and the uncertainty about actual catch levels could be due to many different reasons. Over the last 15 years, many changes occurred in the albacore fishery in the Mediterranean that might have influenced the total reported catches: in the past, other gears other than longline were used (i.e. driftnets); a highly productive fishing area, such as the Cyrenaica area (off Libya coast) exploited by the Italian longline fleet, was no longer available due to operational constraints in this area; a possible shift in the geographical distribution of the albacore population towards the eastern Mediterranean due to environmental changes could have occurred; the two months closure in October and November enforced by the ICCAT Rec. 17-06 in order to protect juvenile swordfish actually stopped the albacore fishery in a period of traditionally high CPUE values.

During the discussion, the great uncertainty related to misreporting or underreporting of the catches was also highlighted, also reflected in the decline in the number of countries reporting albacore catches, especially for the southern part of the Mediterranean and eastern Mediterranean basin in general.

At the end of the discussion, it was stated by the Group that all the indices used for this SA session (**Figure 6**) presented serious different problems, mainly related to the high uncertainty of the data collected. Nevertheless, the whole Group agreed to use all the indices presented in this session, both historical and recent ones updated up to 2019, given that they are the best data available so far and represent a huge improvement compared to the previous session in 2017.

Regarding the eastern Mediterranean area, a possible improvement could be obtained in the near future if the index of the albacore fishery carried out by the Cyprus fleet is standardized. Finally, the Group recommends that all CPCs implement efforts regarding monitoring and data collection of the albacore fishery in the Mediterranean Sea as a whole.

3.3 Mediterranean albacore stock assessment update

3.3.1 Bayesian State-Space Surplus Production Model (JABBA)

SCRS/2021/116 presented the preliminary stock assessment results for Mediterranean albacore stock applying the Bayesian state-space production model JABBA (Winker *et al*., 2018) with similar model settings as the 2017 stock assessment (Anon. 2018a). Four JABBA candidate scenarios were presented by fitting the catch time series (1980-2019) and different combinations among available indices: six longline CPUEs, the Spanish tournament index, and the western Mediterranean larval index. These models were evaluated for model plausibility using four objective model diagnostics: (1) model convergence, (2) fits to the data, (3) consistency (e.g., retrospective patterns), and (4) prediction skill as described in Carvalho et al. (2020).

Following the 2017 final JABBA setting (Anon., 2018b), a Fox production function ($B_{MSY}/K = 0.37$), a lognormal prior distribution for r with a mean of log(0.153), and a standard deviation for log(*r*) of 0.457, and a beta prior for the initial relative biomass ($\varphi= B_{1980}/K$) with a mean = 0.85 and a CV of 10% were assumed for all models. All catchability parameters were formulated as uninformative uniform priors, while the process error of $\log(B_y)$ in year *y* was estimated "freely" by the model using an uninformative inverse-gamma distribution with both scaling parameters set at 0.001. A fixed observation error approach was considered by assuming a standard error for log(CPUE) of 0.25 for the three most recent indices, while slightly down-weighting the historical indices by setting the standard error to 0.35. Each model was run with three Monte-Carlo Markov Chains (MCMCs), each comprising 30,000 iterations sampled with a burn-in period of 5,000 for each chain and thinning rate of five iterations. Accordingly, the marginal posteriors were represented by a total of 15,000 iterations for each model.

The Group reviewed four JABBA models with different sets of abundance indices.

- S1: Use Spanish and Italian longline indices, and western Mediterranean (W-Med) larval-index that were used in the 2017 assessment,
- S2: Based on S1, add Ionian, Ligurian, Med-South, and historical Italian Adriatic longline indices,
- S3: Based on S2, remove W-Med larval index, after exploring Jackknife influence.
- S4: Based on S2, add the Spanish Tournament index.

The Group focused on the discussion on the treatment of two abundance indices: W-Med larval and Italian longline indices. The Group clarified that the W-Med larval index updated in 2021 shows a similar trend to the one used in the 2017 assessment, with a continuously decreasing trend until 2015 and no clear trend in recent years. It was questioned if the W-Med larval index needs to be split after 2012 because of differences in sampling methodologies, which could explain the index's strong decrease. However, the Group considered that it was not necessary to split because the index is standardized by taking into account the changes in sampling methods, the split index would be much shorter and there is no other index in that time period. It was noted that the authors have been improving the standardization methods on this index, including calibration standardization between sampling methods (Alvarez-Berastegui *et al*., 2018).

It was also discussed that scenario S3 showed higher B/B_{MSY} values since 2010 than the other scenarios (**Figure 7**), showed a steeper increase since 2016, and estimated lower *K* and higher *r* indicating a more productive stock. Scenario S3 fitted well to the data, however, it showed a stronger retrospective bias for all evaluated key quantities. The Group suggested keeping the fisheries-independent W-Med larval index without splitting it in the final model.

The Italian longline index shows an increasing trend in 2018 and 2019, which is contrary to the trend in Spanish longline and the W-Med larval indices (**Figure 6**). The Group was concerned that the jump of catch rates from 2016 (14 kg/1,000 hooks) to 2017 (42 kg/1,000 hooks) in the Italian longline index might not be due to the increase in the size of individuals caught. The authors observed that the mean weight of individuals does not show a median increase in 2018 and 2019, therefore they suggest that the increase of the CPUE is just due to an increase in total catch. It was noted that the authors observed that the number of hooks and number of hauls has decreased since 2018, and the value in 2020 is at the same level as or higher than the 2019 value, therefore the increase in CPUE does not seem to be due to an increase in effort. They have tried investigating the source of data; however, the investigation would take longer. It was also noted that the ICCAT database does not show the increase of the size caught by Italian longline in recent years. It was further commented that 2018 values are not available in the Spanish longline and the W-Med larval index, and the removal of the last 2 points from the Italian longline index further reduces stock information in the model. Therefore, the Group suggested using the whole series of the Italian longline index in the final model.

The Group was informed that there were some indications of non-reported Mediterranean albacore catches by CPCs, but the details and magnitude of these catches remained unknown. Hence, it was difficult to provide an alternative catch scenario without detailed information during this meeting, and the Group suggested preparing them before the next assessment meeting if the situation continues. The Secretariat will investigate and formally communicate with those CPCs.

The Group acknowledged that the preliminary results suggest that scenarios S2 and S4 represent the most plausible candidate models (**Figure 7**), and the inclusion of the Spanish Tournament index in scenario S4 (Mohn's *rho* 0.17) improved the retrospective pattern of F/F_{MSY} compared to scenario S2 (Mohn's *rho* 0.26).

The Group felt that more discussions and investigations could be done with some more scenarios for the abundance indices, the uncertainty in the reported catch, and the effects of the management regulations over the recent decades (e.g., driftnet bans by the European Union (1998), and closed seasons as per Rec. 16-05; Rec. 17-05). However, given the time constraints during the meeting and the lack of a data preparatory meeting, the Group agreed to use scenario S4 as a final base case model for the 2021 albacore Mediterranean stock assessment and advice.

In the 2017 stock assessment (Anon., 2018a), the SCRS did not recommend conducting projection on this stock because the model was highly sensitive to the last 2015 CPUE point. The current assessment has improved the fit to the individual indices and provides adequate and acceptable model diagnostics. The Group considered it is feasible to conduct future stock projections based on scenario S4.

The Group agreed on the following settings for the projections.

- Stock projections based on scenario S4
- Use 3 recent years (2017-2019) average as estimated catches for 2020 and 2021 (2,700 t)
- Projection years: 2022-2035
- Catch scenarios: between 0 and 4,000 t including approximate values of recent catch levels and MSY.

Uncertainty is characterized in the form of Monte-Carlo Markov Chain (MCMC) posteriors of B/B_{MSY} and F/F_{MSY} (15,000 iterations using three MCMC chains of 5,000 each) which are stochastically forward projected over the range of alternative fixed catch scenarios within the JABBA model using JAGS.

3.3.2 Final Stock Status Advice

The final JABBA model (S4) was fitted to the total catch from 1980 to 2019 (**Figure 1** ALB-M) and 8 indices: Spanish, Italian, Ionian, Ligurian, Med-South, and historical Italian longline indices, western Mediterranean larval index, and the Spanish Tournament index (**Figure 6**). The MCMC convergence tests by Heidelberger and Welch (Heidelberger and Welch, 1992), Geweke (1992) and Gelman and Rubin (1992) were passed for all estimable key parameters. The fits to the abundance trends were reasonably good, and run tests conducted on the log-residuals provided no evidence to reject the hypothesis of randomly distributed residual patterns for the eight indices (**Figures 8** and **9**). Summary of posterior quantiles (**Table 8**) and prior and posterior distributions (**Figure 10**) were provided.

Figure 11 and **Table 9** show the times series with confidence intervals for various estimates including F relative to F_{MSY} and B relative to B_{MSY}. The estimated B/B_{MSY} showed a continuous decreasing trend over the assessment time period since 1980 with a large decrease from the early 2000s to the mid-2010s. The median of B/B_{MSY} was around 2.0 in the 1980s and 1990s, but it has been around 0.4-0.5 since 2013 after the decrease. The estimated F/F_{MSY} showed a gradual increase since 1980, and the median of F/F_{MSY} has been over 1.0 after the early 2000s with some large peaks.

A retrospective analysis for five years indicates no evidence of strong patterns with Mohn's *rho* statistic being within the acceptable range (**Figure 12**). The Jackknife sensitivity analysis of CPUE indices showed that the W-Med larval index was highly influential with regard to stock status trajectories in recent years and the productivity of the stock, resulting in the current estimate of B2019 being approximately at B_{MSY} and F_{2019} below F_{MSY} associated with a larger *r* and smaller *K* (**Figure 13**). The second most influential effect was the removal of the Italian longline CPUE (2011-2019), resulting in a more pessimistic estimate of B_{2019}/B_{MSY} and higher F_{2019} that corresponded to almost two times that of F_{MSY} (**Figure 13**). The Group noted that the relatively strong influence of the Italian longline index was due to the sharp increase in standardized CPUE in 2018-2019, which is contrary to the recent trends in the Spanish longline CPUE and the W-Med larval index. The Italian historical longline index affected the estimates from the mid-1980s to the mid-1990s. Hindcasting cross-validation results indicated that only the Spanish and Italian longline indices have some prediction skill as judged by the MASE scores (**Figure 14**).

A surplus production phase plot and Kobe phase plot are shown in **Figures 15** and **16.** The surplus production phase plot shows the typical anti-clockwise pattern with the stock status moving from underexploited through a period of unsustainable fishing to the overexploited phase (**Figure 15**). The estimated current fishing level, F_{2019}/F_{MSY}, with 95% credibility intervals was 1.21 (0.62-2.18), and the current stock level, B_{2019}/B_{MSY}, was 0.57 (0.32-1.00). The distribution of F_{2019}/F_{MSY} is wider and more uncertain than the estimate of B_{2019}/B_{MSY}. The current status of the Mediterranean albacore stock (2019) is estimated to be overfished and overfishing is occurring, although it was noted that not all potential sources of uncertainty were considered in the assessment model. (**Figure 16**).

The Group agreed to provide advice recommendations, including future projections of the current stock status, and to produce the Kobe-2-Strategy Matrices based on the final JABBA scenario (S4). The projected B/B_{MSY} (**Figure 17** and **Table 10**) shows that the current catch level (2,700 t) would recover biomass to the B_{MSY} level with more than 50% probability within a time frame of around ten years (approximately twice the estimated generation time for this stock). It should be noted that some projections with catch levels above MSY (3,600 t), predicted exceptionally small biomass ratios and extremely high F ratios indicating the potential risk of the stock collapsing (**Figure 18**).

3.4 Management Recommendations for Mediterranean albacore

In contrast to the assessment carried out in 2017 (Anon. 2018a), in this year's assessment (2021) it was possible to implement and run an assessment model that fitted all available relative abundance indices adequately and, overall, was consistent in terms of the retrospective pattern. The model made it possible to obtain plausible estimates of the current state of the Mediterranean albacore stock and captures the uncertainty for the parameters estimated.

Notwithstanding the foregoing, it must be stressed that the data input to the models remains uncertain, including possible under-reporting of the catch, limitations both in space and time coverage of available indices of abundance, the fact that these indices are limited to the most recent years of the fisheries and conflicting trends among these indices. As the result, the quantitative characterization of the current status of the stock remains uncertain for the Mediterranean stock, in particular for the fishing mortality.

Results indicate that current fishing mortality levels (2019) are above F_{MSY} (1.2; 0.62-2.17), and the current biomass is below the B_{MSY} level (0.57; 0.32-1.00).

Considering the uncertainty of the assessment results, current (2019) stock status projections show that catches to the order of those observed in the first decade of the 2000s (5,000 t) are not sustainable and catches exceeding 4,000 t would lead to a high probability of driving the stock to extremely low levels, risking stock collapse. By comparison, a catch level to the order of 2,700 t, close to the average of the last 3 years (2017-2019), would allow the stock to recover to the green quadrant of the Kobe plot with a probability of over 50% within a time frame of around ten years (approximately twice the estimated generation time for this stock). Reducing the catch level to around 2,000 t would allow the stock to recover to the green quadrant of the Kobe plot with a probability of over 60% within a time frame of around eight years. Larger decreases would allow for faster recoveries and/or higher probabilities of being in the green quadrant.

4. North Atlantic albacore

4.1 Evaluation of Exceptional Circumstances using proposed indicators

4.1.1 Catch

The Secretariat reviewed recommendations for North Atlantic albacore that address the total allowable catch (TAC) and the provisions of underage or overage of catch from previous years that define a maximum 25% carry over from one year to another (underage) or the payback in subsequent years if the allocated quota is overpassed (overage) Rec. 16-06/17-04. The presentation reviewed the initial catch limits, the current reported catches (2019), and the adjusted catch limit for 2020 for each CPC.

The document "NALB_2019-2020.xlsx" details the North Atlantic Albacore data extracted from the Compliance tables submitted by the CPCs for the annual ICCAT meeting. The document detailed all the calculations made in compliance with the appropriate ICCAT recommendations, Rec. 16-06 and Rec. 17-04: According to Rec. 17-04 Para 8 the TAC is allocated among the CPCs as follows:

CPC	*Quota (t) for the period 2018-2020*
European Union	25,861.6
Chinese Taipei	3,926.0
United States	632.4
Venezuela	300.0

According to Rec. 16-06 Para 5, CPCs other than those included in the previous table shall limit their annual catches to 200 t in 2017-2018 and to 215 t in 2019-2020. According to Rec. 16-06 Para 7, any unused portion or excess of a CPC's annual quota/catch limit may be added to/shall be deducted from (the carry-over), according to the case, the respective quota/catch limit during or before the adjustment year, in the following way:

Year of Catch	*Adjustment Year*
2015	2017
2016	2018
2017	2019
2018	2020
2019	2021
2020	2022

The Group noted that the total catch for 2019 was 34,124 t, which exceeded the catch limit of 33,600 t by 1.15%, but that the total catch for 2019 did not exceed the catch plus the permitted underage from previous years. If all CPCs made use of their potential adjusted catch limit, the total catch could have been as large as 39,916 t in 2019 and still be within the allowed limits.

The Group noted that the N-ALB MSE evaluated total catch deviations up to 20% from the catch limits with the Harvest Control Rule adopted in ICCAT Resolution 17-04. Also, the carry overs had already been tested in the MSE and the current catch falls within the deviations observed in the MSE simulations. The Group made no determinations regarding the existence of exceptional circumstances as final indicators have not been adopted; however, no concerns were noted.

4.1.2 CPUEs (EU-Spain baitboat, Japanese longline, Venezuela longline, US longline, Chinese Taipei longline)

For the purposes of determining exceptional circumstances, several CPUEs were reviewed. Updates and further discussion about some of the same CPUE indices (and other data) as they pertain to use for a new reference case for stock assessment and MSE are further discussed in Section 5.1 below.

Anon. 2021 provided a summary of the main features of the 2019 Spanish albacore fishery. Main features of the Spanish albacore (*Thunnus alalunga*) surface fishery in 2019 were summarized for offshore waters of the Northeast Atlantic and in the Bay of Biscay. Catch of the bait boat fleet decreased 11%, while the troll fleet increased 31% compared to the catch in 2018. The fishery was closed once the national quota had been reached.

Documents SCRS/2021/104, 111, 112, and 114 updated the CPUE indices for Spanish Bait Boat, Japanese Longline, US longline, and Chinese Taipei longline respectively. They are discussed in more detail below in Section 5.1

The Group noted that for the years 2013-2014, several CPUEs showed relatively large values. The Group also noted that the Venezuelan index (based on observer data) has not been updated due to lack of observer coverage and that the perspective is that it will be difficult to update this index in the near future.

After reviewing the presentations of CPUE updates, the Group reviewed a boxplot (**Figure 19**) of all the normalized CPUE values used to run the closed-loop simulations and the most recent normalized standardized CPUE series reviewed at this meeting. All the updated indices (excluding data points not considered for the assessment) fall within the values that had been simulated in the MSE.

The Group discussed if units were important to review. In response, it was noted that the plots were standardized for each index, so the units were removed so that they could be compared.

The Group discussed if there were a rigorous mathematical definition(s) of when exceptional circumstances are triggered, how terms such as the "the full range" of the data were defined, and how specific CPUE data points were excluded or not. This discussion was reflected in the review of the Exceptional Circumstances protocol (Section 7).

5. Towards a new reference case North Atlantic Albacore

5.1 Data: catch, effort, CPUE, size, and tagging

The Secretariat provided an overview of Catch, Effort, and Tagging data. Summaries of the data available were provided in Catch at Size, CATDIS, Task 1 and Task 2 catch and effort, and size data. Data summaries were provided in the Statistics folder of the meeting's OwnCloud. Data available for the North Atlantic Albacore stock were discussed in section 2 of this report.

SCRS/2021/090 presented a preliminary analysis of the data for North Atlantic albacore input for the Stock Synthesis model. Following the Group recommendation in 2020, a new benchmark assessment is being developed for this stock using Stock Synthesis, this configuration will also be used to build a new set of Operating Models for the North Atlantic albacore MSE. The data reviewed includes catch, size frequency, catch-per-unit of effort and, tagging data. This examination aims to contribute to the specifications of the Stock Synthesis configuration, including the definition of fisheries, spatial-temporal stratification, and identification of key sources of information.

The Group inquired about size data versus catch-at-size (CAS) data, it was clarified that CAS is normally based on size sampling raised to the total CPC/Fleet(s) catch and that some CPCs provided both, original size sampling and the CAS for their fisheries, but not in all cases. It was noted that for Stock Synthesis data inputs, size samples are commonly evaluated to determine appropriate size-frequency sampling, e.g., minimum number of samples, representativeness of samples, etc., and those analyses are normally performed with size data, not with the CAS. The Group agreed to focus on the major fisheries of the total catch of NATL-albacore and review the fleet structure to match the main fleet/gear fisheries. It was also noted that selectivity patterns can be associated with fleets with similar catch at size distributions and sufficient size information when available.

It was noted that for the US longline fishery, a drastic change in the size distributions around the 1980s towards smaller fish was not correct and it represents a change in the size measurement units submitted for those years (weight vs. length units). It was recommended that the Secretariat, in collaboration with national scientists, review the size, catch and effort, and other available data for the new North Atlantic albacore reference casein advance.

SCRS/2021/111 presented an update of the standardization of CPUE for North Atlantic albacore by the Japanese longline fishery from 1959 to 2019. Standardized CPUE was calculated based on the same methods from the previous studies. Considering the availability of logbook database and albacore targeting, CPUE were analysed by three periods (1959-1969, 1969-1975, 1975-2019). Effects of year, quarter, subarea, fishing gear (number of hooks between floats), and some interactions were considered for analysis of CPUE. Recent trends (2016-2019) of the updated North Atlantic albacore CPUE of Japanese longline were slightly higher than the average of the last decade (2009-2019).

The authors indicated that the high catch rates of 2013 were revised and confirmed, indicating unusual higher catches in three of the quarters of this year, with similar fishing effort as previous years. It was indicated that changes in the targeting and fishing strategies of the fleet supported splitting the index series into three time periods of target, transition, and bycatch catches of North Atlantic albacore.

SCRS/2021/112 presented the standardized indices of albacore from the United States pelagic longline fishery 1987 to 2020. The index was updated using the same methods from previous years. Overall, the index indicated an upward trend since the last analysis, with a strong effect of the standardization in 2020 to account for low sampling effort in quarter 2 and shift in spatial coverage of longline sets, in part likely due to the impact of the pandemic on high seas fisheries.

SCRS/2021/114 presented the updated standardized CPUE of albacore tuna caught in the Chinese Taipei tuna longline fishery in the North Atlantic Ocean from 1999 to 2020. The index included the factors latitude, longitude, and its interaction to possible address changes in targeting in the period. The standardized CPUE of albacore started to increase slightly from 1999 until 2014, and then decrease to a relatively stable level during 2015-2020. The Group inquired on the size selectivity of the catch and if as seen in the Japan longline fishery, North of the 30° latitude smaller sizes were in general caught compared to catches below the 30° lat. The authors provided a catch at size analysis during the meeting, indicating that similar size trends were also observed in the Chinese Taipei fisheries.

SCRS/2021/104 presented the standardized CPUE of albacore in the northeast Atlantic from the Spanish baitboat fleet for the period 1981 – 2019. Data on catch and fishing effort by trip was used to estimate an index of abundance using a GLMM with lognormal error distribution. Season migration of immature albacore to the northeast Atlantic waters and the Bay of Biscay during the summer determined the spatial and temporal activity of the EU-Spain baitboat fleet. The index showed a rather stable trend from 1988, with a moderate increase towards 2000-2010, while in the latest years (2018/19) the catch rates had increased more noticeably. It was noted that in the latest years the national quotas for the fleet were reached in the shortest amount of time ever.

The updated indices of abundance for the North Atlantic albacore stock were reviewed and considered for the update of the new reference case of the Stock Synthesis model. It was noted that the previously available index from the Venezuela longline fishery was not updated, and it is expected that this index will not be available in the near future due to the partial suspension of the monitoring observer program in Venezuela.

SCRS/2021/109 provided a detailed analysis of the historic size data for the North Atlantic albacore caught by the Japanese longline fishery 1957-2019. Size sampling was conducted by fishers and scientific observers. The fish caught mainly ranged between 70 cm and 120 cm SFL. Information on sex was not available for most samples, but the proportion of males increased around 75 cm and 120 cm SFL. Fish size became smaller as latitude got higher and a large difference was observed between north and south of 30°N. There was also a difference in fish size by decade and quarter, which may be due to differences in sampling areas.

The Group acknowledged the detailed analysis and inquired regarding the sex-ratio observations. Sex proportions at size were different compared to previous studies (Santiago, 2004), where larger females (> 120 cm FL) were present in the catch, in contrast to early research where fish greater than 120 cm were all males. It was indicated that the size range is much broader in the Japanese fishery, including much larger size samples. Hence, it was recommended that sex ratios should be reviewed and updated by combining all sex-at-size information from the main fisheries for North Atlantic albacore. It was further noted that in the past Stock Synthesis models used different natural mortality vectors by sex-age was used to adjust for differential sex ratio at size. It was recommended to evaluate alternative model approaches to account for the different growth by sex that may explain the larger proportion of males at larger sizes. It was also noted that the difference in the size of fish caught by area and season should be taken into account for the new model and fleet structure, indicating that the 30°N latitude can be used for reference for the longline fleets (SCRS/2021/109). To confirm differences in catch size by area and season, similar catch-at-size analyses were requested for the major fleets, such as the Chinese Taipei and USA longline fleets. The Group inquired if there were differences noted between the size sampling by observers vs. fishers, the authors indicated that their analysis shows no difference in the size distributions.

SCRS/2021/106 presented Age Length Keys (ALKs) of North Atlantic albacore for use in the assessment models. Based on aging the first dorsal fin rays collected from the commercial catches of the Spanish surface fleets, pairs of length-at-age observations were used to construct annual ALK for 2008 to 2012 years. This information has been provided for the new reference case of the Stock Synthesis model for North Atlantic albacore.

The samples include ages 1 to 6, with most of the samples in ages 1, 2, and 3. The Group noted the relatively small confidence bounds for the mean length at age in each quarter. The Group also recommended that the ALK information be used to evaluate growth and/or selectivity bias within the Stock Synthesis configuration.

In addition, the Group reviewed a standardized CPUE for the South Atlantic albacore stock caught by the Japanese longline fishery from 1994-2020 (SCRS/2021/108). Standardization was conducted using a GLM with a lognormal error structure, based on revised methods from the previous studies. The effect of the month was the largest followed by the year and mainline material effects. Albacore zero catch ratio was low after the mid-2000s and the proportion in the catch and CPUE of albacore were high from 2008 in the core area. Standardized CPUE sharply increased during 2004-2008 and remained at a high level with fluctuation after that.

5.2 Stock Synthesis model structure

Based on the previous discussions of size, CPUE, sex-ratios, and size-at-age, the Group considered the model structure for the new reference case using Stock Synthesis. It was noted that the base model of Multifan-CL 2013 assessment has been used as a baseline to construct the reference case in Stock Synthesis. Following the document SCRS/2021/090 and the 2013 Reference Case fleet structures (Table 6 in Anon. 2014), it was recommended to review the input data of catch, size, size-frequency samples, size at age (ALKs), and sex ratios, at the highest resolution possible, for the modelers to evaluate the appropriate fleet structure, spatial and temporal structure of the data for the new reference model. The specific recommendations are detailed below.

Stock Synthesis Base Case and Sensitivities.

The Group discussed the structure of a revised Reference Case to be developed using Stock Synthesis 3 to replace 2013 Multifan-CL operating models that provided the basis for OM development. The following list provides an overview of the recommendations of SS model development:

- One area model for North Atlantic albacore (North of 5°N)
- Fleets as areas to include: 1) Surface fleets in the Bay of Biscay (BB, Troll, and mid-water trawl), 2) Longline fleets in the Atlantic (JPN, CTP, and USA), separated North and South of 30° latitude,

with observed differences in size composition of fish landed and species targeted, and 3) Other fleets.

- Consistent size structures were observed (potentially to assume constant selectivity) for both the bait boat and JPN longline fleets across the time series. The Group recommended evaluating which fleets can be linked in selectivity, for example, CTP, USA, and JPN longline North versus south of the 30N.
- Some modifications were suggested based on the fleet structure in the 2013 MFCL (Table 6 in Anon. 2014): to combine BB Cantabria (ESP) before and after 1980 as one fleet, to separate USA LL and Venezuela LL from CTP LL as different fleets, and to keep other surf fisheries.
- Discussion of sex-specific model to account for some observed difference in sex ratio across size, however, little information is available to parameterize this model (e.g., time series of sex ratios, size-at-age, or age composition data by sex). It was pointed out that small differences in growth by sex, would not be likely to have major impacts on the operating models, thus the sex specific models would be a low priority.
- Tagging data are available for a long time period. Earlier periods in the 70s clearly lack data on releases. Some recent years showed a substantial number of releases, mostly by recreational fishers. Thus, the most reliable period (for potential assessment use) continues to be the one used in the 2013 ICCAT North and South Atlantic Albacore Stock Assessment (Anon. 2014) for sensitivity analyses (years 1988-1991).

6. Albacore research update and proposals

6.1 North Atlantic stock

Electronic tagging update

The presentation SCRS/2021/P/043 summarized the progress made so far on North Atlantic albacore pop-up tagging research. The authors stressed that, generally, retaining tags on albacore for long periods is a challenge. In spite of using the same methods (only the season differed between the two years), results in 2020 were more pessimistic than those in 2019, which was hypothesized to be due to different fish conditions and/or predation (as observed in Cosgrove *et al*., 2015). On the positive side, so far this tagging programme has produced more information than was available in the literature, with the longest PSAT attachment periods known to the members of the working group, providing unique information on part of the life cycle around the feeding migration, spatial distribution, connectivity, and vertical habitat of albacore tuna.

The authors stressed that yet there is very limited knowledge about wintering areas, alternative feeding grounds and spawning areas, and that larger sample sizes as well as year-round tracks would be desired to be able to map albacore habitat and life cycle throughout the North Atlantic. For this, it was suggested to extend the pop-off time for future PSAT deployments from 9 to 12 months, to tag later in time in order to better cover the overwintering period, to deploy internal archival tags to try to get some multiyear recoveries, and to deploy tags in the west Atlantic.

The ongoing activities during 2021 include the deployment of 85 internal archival tags and 17 miniPATs using a variety of tagging platforms, including scientific surveys, commercial baitboats, charters and recreational vessels. Given the interest in maximizing notification of recoveries of archival tags, the authors produced awareness posters advertising substantial (€1,000) rewards in three languages that were considered to cover the main surface fisheries in the NE Atlantic (where the tags are being deployed). However, after a few months the recoveries could take place in other fisheries and, with the help of WG members, it was agreed to translate the posters into other languages suitable for other important fleets (mostly Chinese Taipei, Portuguese, and Japanese). The logos and local contact details should also be amended, and posters should be distributed in all countries to try to maximize archival tag reporting rates.

The Group noted that the chance of recovering archival tags is low (see dummy archival tagging experiment by Cosgrove *et al*. (2010), and thus it is important that the rewards are very substantial, and that fishermen are made aware of them by widely distributing the posters. In addition, it was noted that electronic tagging of albacore tuna was challenging in general, as PSATs also proved to be challenging for this species, and that archival tags could provide unique insights through multiyear tracks (the mean time at liberty for the dummy archival tags recovered in Cosgrove *et al*. 2010 was 545 days, ranging between 62 and 810 days).

Reproduction research studies update

In response to the communication S21-01104: "Quote request for services. Terms of Reference – North Atlantic Albacore Tuna Reproductive Biology Study" a consortium of researchers developed the description of work to support the objectives of the Research Program of North Atlantic Albacore stock of the Albacore Species Group of SCRS. This quote addressed sampling strategy and analysis for growth, reproduction, and maturity. The consortium and consortium sub-contractor members are 6 institutions from 6 ICCAT CPCs. The contract was signed in March 2021 for a short-period ending in December 2021.

The main objectives to be achieved are:

i. A sampling program for the collection of biological samples (spines and gonads) for the study areas in the program – reproduction (maturity ogives and size/age related fecundity). The sampling programs implemented by observers on board fishing longline fleets and sampling at landing ports must be cost effective.
ii. A reproduction and maturity study for the North Atlantic albacore stock. Define sex-specific maturity ogives for North Atlantic albacore, spatial and temporal spawning grounds, estimate of L50 and size/age related fecundity.

In Presentation SCRS/2021/P/044, the main achievements concerning gonad sampling from December 2020 to May 2021 were summarized to the Group. Samples were collected by Chinese-Taipei and Venezuelan longline fleets, following the designed plan.

Some samples were processed, and histological analyses were performed to determine the stage of development of albacore. In December and January, all the males and females were inactive, with signs of having been spawning previously. All were spawners in regressing stage with signs of past spawning or regenerating stage. Some male albacore in earlier spermiogenesis were found.

It was agreed that the study will continue in 2022, if possible all year round, to accomplish a meaningful number of samples, determine the spawning season and estimate fecundity by age, ogive profiles and batch fecundity.

6.2 South Atlantic stock

The research proposal was presented by Paulo Travassos (Brazil), which was submitted to respond to the ICCAT Communication S21-03869: "Quote request for services. Terms of Reference – South Atlantic Albacore Tuna Reproductive Biology Study".

The coordinator of the proposal mentioned that it was elaborated by a consortium of researchers from Brazil, Uruguay, South Africa, and Chinese Taipei, detailing the aspects related to the different items that integrate this work. The research proposal aims to fill the gaps on the reproductive biology of South Atlantic albacore, generating important and necessary information for the conservation and management of this species' fisheries. The proposal involves the following tasks:

A. The provision of the following gonadal samples:
    a) Promote the collection of biological samples (gonads), associated biological (fork length, total weight, gonad weight, sex) and environmental/oceanographic (e.g., date, lat/lon, SST) data.
    b) Promote the collection of fish gonads from different areas and sizes.
    c) Provision of gonad samples in formalin and prepared slides suitable for histological analysis for the classification of the reproductive stages. Explore the possibility of using frozen gonads for reproductive studies.
B. The sampling analysis:
    a) Estimate the size at maturity (L50, when 50% of the population reaches maturity), Sex-Ratio and different fecundity parameters (batch fecundity and spawning frequency) at size.

b) Evaluate whether South Atlantic albacore performs skipped spawning (delayed maturation and non-annual spawning), identifying the possible environmental factors and/or physiological conditions of the fish that influence the occurrence of such strategy.
c) Assess the area and spawning season of the reproductive activity (gonadosomatic index, GSI; reproductive stages).

With a total budget of €20,000 for 2021, the priority this year will be sample collection and shipping, with their respective analyses beginning as they become available, according to the schedule of activities established for July-December/2021. The methodology adopted will be the same used for the North Atlantic albacore reproduction study. The samples will be collected based on a sampling design that ensures appropriate coverage from the spatial-temporal point of view and by size of the fish sampled. It was mentioned that throughout the development of the research, documents and presentations will be made to the ALB Species Group, the SCRS and Secretariat to fulfil contract obligations, including the delivery of a final report.

The expectation that this research will fill the existing gaps on the reproductive dynamics of the species in the South Atlantic was stressed and it was agreed that it should continue next year, complementing the activities initiated in these first six months of work in 2021.

It was also reported that besides these studies on the reproductive biology, a new one on migration and habitat use will also start this year. For this purpose, 6 miniPAT tags (Wild-Life Computers) already purchased by the ICCAT Secretariat will be used to tag the South Atlantic albacore in spring/summer 2021/2022.

6.3 Mediterranean stock

Following the presentation of a draft of the albacore research plan, the Group agreed that further discussion was needed with a view to identifying in more detail the research priorities, the laboratories involved, those responsible for coordinating the specific tasks, and the detailed economic valuation of these tasks; in essence, a more consensual work plan among scientists involved in albacore research in the Mediterranean. It was agreed that, given the time constraints, a detailed plan could not be worked out during this meeting. Taking the foregoing into account, it was agreed that the research proposal for 2022 would include the start of a collaborative network between Mediterranean scientists working on albacore tuna with the objective, among others, of developing a detailed research plan.

7. Responses to the Commission

7.1. Panel 2 Exceptional Circumstances protocol

Panel 2 requested that the SCRS:

1. Review the “ALB EC Protocol for SCRS review.doc”.
2. Provide its plan to formalize i) a set of data to be used; and ii) stock assessment methods.

In response to item 1, the Albacore Species Group meeting held in June revised the draft EC protocol distributed by the PA2 Chair. The review consisted mostly of specific edits and comments directly on the file “ALB EC Protocol for SCRS review.doc”.

During the review of the protocol, the ALB SG tried to use the available scientific basis to inform the different alternatives proposed by Panel 2 in the indicators table. However, although the SCRS has made substantial efforts on the ALB MSE, the tests conducted so far are not enough to fully determine the number of CPUE series that need to be available and the percentage by which catch data are underreported, that would trigger an exceptional circumstance. While future tests could further inform these indicator values, the albacore Species Group is confident that the proposed indicators would efficiently detect exceptional circumstances.

MSE testing was able to report on the indicator for TAC implementation. A scenario (Bank and Borrow, Table 4 in **Appendix 5**), in which the TAC is alternately 20% higher (“borrowing”) and 20% lower (“banking”) than the TAC, has been tested within the MSE. Stock status objectives were achieved in this scenario, albeit with decreased stability in yield. On this basis, exceptional circumstances would be triggered if annual catch exceeded the TAC by more than 20%. It should be noted that successive years with catch exceeding TAC by 20% or more has not been tested in the MSE.

In response to item 2, an extract from Table 3 of the ALB Executive Summary (Anon., 2021) is shown below with the data and assessment specifications required to adopt the Management Procedure that has been tested through MSE. These two components combined with the harvest control rule (HCR) and EC protocol provide the necessary technical specifications to assemble a full MP.

North Atlantic albacore specifications for the management procedure (MP) (from **ALB-Table 3** Executive Summary; Anon., 2021):

- Indices:

Index	*First year*
Chinese Taipei LL late	1999
Japan bycatch LL	1988
Spanish baitboat	1981
US LL	1987
Venezuelan LL	1991

- Software: *mpb*
- Model: Fox (biomass dynamic), with the following specifications:
- Catch time series start year: 1930
- Catch and CPUE time series final year: t-1 preferably (t-2 otherwise) where *t* is the year of the MP iteration (when the TAC is set for year *t*+1, *t*+2 and *t*+3).
- Biomass at the start of the time series = K
- Variance treatment for the CPUE indices: model weighted

7.2. *Revise MSE Roadmap N-AL*B

The Group discussed and amended the MSE Roadmap that will be included in the final SCRS report. The Group noted that a review of the interim HCR by PA2 to recommend a long-term MP to the Commission for adoption at the annual meeting (in plenary) did not occur in 2020. Therefore, the Group moved this task to 2021.

8. Recommendations on research and statistics.

Recommendations with financial implications

The Group recommends continued funding of the albacore research program for North and South Atlantic stocks, as well as starting to fund research for the Mediterranean stock. For the next three-years, research on the North and South Albacore stocks will be focused on three main research areas (biology and ecology, monitoring of stock status, and management strategy evaluation).

1) For 2022 the Group recommended continuing electronic tagging and reproductive biology studies (with associated aging of samples) in the North and South Atlantic, and progressing on the North Atlantic albacore MSE. These are all considered to be high priority tasks, with an estimated cost of:

   i) €40,000 for tagging, €20,000 and €20,000 for the N and S stocks, respectively.
   ii) €45,000 for reproductive biology and related aging, €22,500 for each of the two, N and S stocks.
   iii) Following the ICCAT MSE roadmap adopted by the Commission, the Group recommends that the Commission provide the necessary financial means for the continuity of N-ALB MSE work. This high priority task requires €20,000 funding for 2022.

More details of the proposed research and economic plan are provided in the Albacore 2022 Workplan.

2) The Group supports the continuation of larval data collection in the Balearic Sea and other spawning areas (e.g., central and eastern Mediterranean), and recommends further research related to the use

of larval indices to complement fisheries dependent data in stock assessments, including the development of larval habitat models, corrected abundance indices and their impact on the assessment. This is considered a secondary priority task, with an estimated cost of €33,000 for 2022.

Albacore	2022	2023	2024
Tagging, rewards and awareness	**40,000***	**40,000**	**20,000**
Biological studies:			
Reproduction	35,000	25,000	
Age and growth	10,000		
Sample collection and shipping	**5,000**	**5,000**	
Other fisheries related studies (including data recovery, etc.)			
Mediterranean ALB larval index related studies	33,000	33,000	
Workshops/meetings			
Equipment			
MSE	20,000	30,000	30,000
TOTAL	143,000	133,000	50,000

*Funds to be evenly split between North/South stocks. In case of budget reduction, the southern stock has priority.

Recommendations without financial implication

Due to the current limitations of the Mediterranean Albacore stock assessment, the Group recommends a network of researchers be established and work intersessionally on the development of a comprehensive and coherent research plan for this stock. In addition, the Group recommends that research plans for North and South Atlantic stocks be revised and integrated, together with the Mediterranean Research Plan, within a single document – Albacore Year programme (ALBYP), following the practice of other Species groups (e.g., small tunas, sharks, Billfishes, etc.).

The Group recommends increasing efforts to complete Task 1 data for Mediterranean albacore, this being one of the main uncertainties not quantified in the assessment. The Group recommends that CPCs and the Secretariat work together to complete Task 1 data in the ICCAT database before the next assessment, and to consider methods developed by the WGSAM to estimate unreported catches.
Given the conflicting trends of some abundance indices affecting the assessment, the Group recommends making additional efforts to gather new indices, and trying to reconcile the available ones. The Group recognized the lack of standardized CPUE data from the eastern Mediterranean as a potential source of uncertainty when assessing Mediterranean albacore. The Group recommended that the CPCs predominantly fishing in this area (EU-Greece, EU-Cyprus, and Turkey) make a concerted effort to generate and submit standardized CPUE data.

The Group recommends that CPCs with important Mediterranean albacore fisheries increase size sampling to facilitate the implementation of alternative age structured stock assessment models.

The Group recommends that the WGSAM revise and try to standardize current SCRS practice to provide advice with regard to the potential for stock collapse, including the identification of Limit Reference Points and probability thresholds.

The Group recommends conducting a review and collation of all the available data on age-length from the various studies that have estimated age from spines, with a view to updating the estimate of the growth curve for Mediterranean albacore. It is also recommended that methods of accounting for selectivity in the year 1 cohort in von Bertalanffy growth function (VBGF) be explored to ensure accurate parameter estimation.

9. Other matters

Performance of the interim HCR and alternatives.

The Group noted that the Executive Summary **ALB-Figure 10** illustrates the relative performance of the HCR adopted in Rec. 17-04, as well as different variants that have been tested. However, the ellipses in that figure overlap substantially with each other and it is not straightforward to see the relative merits of alternative HCRs in each of the performance metrics. Thus, the Group decided to provide a table with the performance metrics of the interim HCR and tested alternatives (**Table 11**). This table can also be found as Table 4 of the ALB MSE document (**Appendix 5**). Note that the "banking and borrowing" scenario is not plotted in **ALB-Figure 10** of the Executive Summary.

10. Adoption of the report and closure.

The report was adopted during the meeting. The Chairs and the Secretariat thanked all the participants for their efforts to work effectively and efficiently throughout the meeting. The meeting was adjourned.

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Table 1 [A/B/C]. Standard SCRS catalogues on statistics (Task 1 and Task 2) of ALB by stock, major fishery (flag/gear combinations ranked by order of importance) and year (1990 to 2019). Only the most important fisheries (representing ±97.5% of Task 1 total catches in this period) are shown. For each data series, Task 1 (DSet= "t1", in t) is visualised against its equivalent Task 2 availability (DSet= "t2") scheme. The Task 2 colour scheme, has a concatenation of characters ("a"= T2CE exists; "b"= T2SZ exists; "c"= T2CS exists) that represents Task 2 data availability in the ICCAT-DB system.

A. ALB-N (1990-2019)

Species	Stock	Status	FlagName	GearGrp	DSet	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
			T1 Total			36881	27931	30851	38135	35163	38377	28803	29023	25746	34549	33124	26252	22716	25567	25957
ALB	ATN	CP	EU-España	BB	t1	15442	8267	10814	12277	11041	9953	9640	9401	7346	8448	10774	4929	4712	7325	7893
ALB	ATN	CP	EU-España	BB	t2	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc
ALB	ATN	CP	EU-España	TR	t1	10342	8955	7347	6094	5952	10225	6649	7864	5834	6829	5013	4245	3976	5193	7477
ALB	ATN	CP	EU-España	TR	t2	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc
ALB	ATN	CP	EU-France	TW	t1	1032	463	2459	1706	1967	2904	2570	2874	1178	4723	3466	4740	4275	3252	2194
ALB	ATN	CP	EU-France	TW	t2	abc	abc	ab	a	ab	ac	ac	ac	a	ac	ac	ac	ac	ab	abc
ALB	ATN	NCC	Chinese Taipei	LL	t1	1651	4318	2209	6300	6409	3977	3905	3330	3098	5785	5299	4399	4330	4557	4278
ALB	ATN	NCC	Chinese Taipei	LL	t2	ab	ab	ab	ab	ab	ab	ab	abc	abc	abc	ab	ab	ab	ab	ab
ALB	ATN	CP	EU-Portugal	BB	t1	3182	700	1622	3369	926	6458	1622	393	76	281	255	1137	1913	516	224
ALB	ATN	CP	EU-Portugal	BB	t2	abc	abc	abc	abc	abc	abc	abc	abc	ab	abc	abc	abc	ab	abc	abc
ALB	ATN	CP	EU-Ireland	TW	t1									57	319	80	634	1100	594	172
ALB	ATN	CP	EU-Ireland	TW	t2									-1	b	a	a	abc	abc	abc
ALB	ATN	CP	EU-France	GN	t1	2268	3660	4465	4587	3967	2400	2048	1717	2393	1723	1864	1150	13		
ALB	ATN	CP	EU-France	GN	t2	abc	abc	ab	ab	ab	ac	ac	ac	a	ac	ac	ac	a		
ALB	ATN	CP	EU-Ireland	GN	t1	40	60	451	1946	2534	918	874	1913	3639	4523	3374	1430			
ALB	ATN	CP	EU-Ireland	GN	t2	-1	-1	-1	ab	-1	-1	c	c	c	bc	ab	ab			
ALB	ATN	CP	Japan	LL	t1	737	691	466	485	505	386	466	414	446	425	688	1126	711	680	893
ALB	ATN	CP	Japan	LL	t2	ab	ab	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc
ALB	ATN	CP	St Vincent and Grenadines	LL	t1											703	1370	300	1555	82
ALB	ATN	CP	St Vincent and Grenadines	LL	t2											-1	-1	a	a	a
ALB	ATN	CP	USA	RR	t1	175	251	103	224	324	23	309	335	601	90	251	122	323	334	500
ALB	ATN	CP	USA	RR	t2	ab	ab	ab	ab	ab	ab	b	ab	ab	ab	abc	abc	abc	abc	abc
ALB	ATN	CP	Venezuela	LL	t1	93	75	51	18	0	0	52	49	16	36	106	35	67	135	116
ALB	ATN	CP	Venezuela	LL	t2	b	b	ab	ab	ab	ab	ab	b	ab	ab	ab	b	b	ab	ab
ALB	ATN	CP	USA	LL	t1	148	201	116	192	230	373	123	184	179	192	146	191	146	106	120
ALB	ATN	CP	USA	LL	t2	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	abc	abc	abc	abc	abc
ALB	ATN	CP	Venezuela	PS	t1	1	221	139	228	278	278	263	26	91	55	191	260	93	211	341
ALB	ATN	CP	Venezuela	PS	t2	a	b	-1	ab	ab	ab	b	a	ab	a	ab	ab	ab	ab	ab
ALB	ATN	CP	EU-España	LL	t1	8	11	13	8	5	19	35	30	105	86	214		264	12	10
ALB	ATN	CP	EU-España	LL	t2	ab	ab	ab	ab	ab	ab	ab	-1	-1	-1	-1		-1	-1	-1
ALB	ATN	CP	Belize	LL	t1															
ALB	ATN	CP	Belize	LL	t2															
ALB	ATN	NCO	Vanuatu	LL	t1															414
ALB	ATN	NCO	Vanuatu	LL	t2															a

FlagName	GearGrp	DSet	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Rank	%	%cum
T1 Total			35318	36963	21991	20483	15391	19411	19989	25681	24887	26655	25630	30395	28462	29728	34773			
EU-España	BB	t1	10067	14182	8375	7403	4940	5841	4676	7753	4473	4740	8353	13394	9687	10836	10203	1	30.8%	31%
EU-España	BB	t2	abc	abc	abc	abc	abc	abc	abc	ac	ac	ac	ac	ac	ac	abc	abc	1		
EU-España	TR	t1	10165	10277	6089	5233	4437	7009	3564	5833	5864	6651	5596	3559	4163	4806	6291	2	22.4%	53%
EU-España	TR	t2	abc	abc	abc	abc	ac	abc	abc	ac	ac	ac	ac	ac	ac	ac	ac	2		
EU-France	TW	t1	6743	5878	2842	2806	773	1216	3249	3126	4327	6699	3379	3961	4118	5718	7601	3	12.0%	65%
EU-France	TW	t2	abc	abc	abc	abc	abc	abc	abc	ab	abc	abc	a	-1	a	b	bc	3		
Chinese Taipei	LL	t1	2540	2357	1297	1107	863	1587	1367	1180	2394	947	2857	3134	2385	2926	2770	4	10.9%	76%
Chinese Taipei	LL	t2	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	abc	abc	abc	abc	abc	4		
EU-Portugal	BB	t1	391	21	80	517	54	179	855	1063	502	2601	912	1061	2509	494	2459	5	4.3%	80%
EU-Portugal	BB	t2	abc	a	abc	abc	abc	ab	abc	abc	abc	abc	abc	abc	ab	ab	ab	5		
EU-Ireland	TW	t1	258	505	586	1514	1997	785	3595	3551	2231	2485	2390	2337	2492	3102	3213	6	4.0%	84%
EU-Ireland	TW	t2	ac	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	ab	abc	abc	a	6		
EU-France	GN	t1						2	1		21		7	3	0	0	1	7	3.8%	88%
EU-France	GN	t2						-1	-1		-1		-1	-1	a	-1	-1	7		
EU-Ireland	GN	t1																8	2.5%	91%
EU-Ireland	GN	t2																8		
Japan	LL	t1	1336	781	288	402	288	525	336	400	1745	267	276	297	366	196	350	9	2.0%	93%
Japan	LL	t2	abc	abc	abc	abc	abc	abc	abc	ab	ab	ab	ab	ab	ab	ab	ab	9		
St Vincent and Grenadines	LL	t1	802	76	263	130	134	174	329	305	286	327	305	291	296	173	180	10	0.9%	94%
St Vincent and Grenadines	LL	t2	-1	a	a	a	a	a	ab	a	ab	a	ab	ab	ab	ab	abc	10		
USA	RR	t1	356	284	394	125	23	56	117	137	561	137	121	43	28	9	30	11	0.7%	94%
USA	RR	t2	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	ab	11		
Venezuela	LL	t1	111	155	146	138	290	242	247	292	274	437	560	587	601	326	372	12	0.7%	95%
Venezuela	LL	t2	ab	ab	ab	ab	ab	ab	ab	ab	a	a	a	a	a	a	a	12		
USA	LL	t1	108	103	127	127	158	160	240	261	255	309	229	203	209	93	190	13	0.6%	96%
USA	LL	t2	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	13		
Venezuela	PS	t1	63	162	198	70	84	16		21		27			2			14	0.4%	96%
Venezuela	PS	t2	ab	ab	ab	ab	ab	ab		ab		ab			ab			14		
EU-España	LL	t1	216	80	118	89	240	111	117	133	159	216	177	123	114	49	39	15	0.3%	96%
EU-España	LL	t2	-1	-1	-1	-1	-1	-1	-1	-1	-1	b	b	-1	-1	-1	-1	15		
Belize	LL	t1			22	26	39	366	351	155	230	79	1	399	448	385	216	16	0.3%	97%
Belize	LL	t2			a	a	ab	ab	ab	ab	a	a	ab	ac	ab	abc	ab	16		
Vanuatu	LL	t1	507	235	95	20	140	187	196	172	228	195						17	0.3%	97%
Vanuatu	LL	t2	a	a	-1	-1	-1	a	ab	ab	a	a						17		

B. ALB-S (1990-2019)

Species	Stock	Status	FlagName	GearGrp	DSet	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Rank	%	%cum
				T1 Total		28714	26016	36564	32814	35301	27554	28426	28022	30595	27656	31387	38795	31746	28005	22545	18882	24453	20283	18867	22248	19225	24126	25272	19424	13705	15201	14383	13825	17098	15640			
ALB	ATS	NCC	Chinese Taipei	LL	t1	20442	19883	23063	19400	22573	18351	18956	18165	16106	17377	17221	15833	17321	17351	13288	10730	12293	13146	9966	8678	10975	13032	12813	8519	6675	7157	8907	9090	9227	9626	1	57.8%	58%
ALB	ATS	NCC	Chinese Taipei	LL	t2	ab	ab	ab	ab	ab	ab	ab	abc	abc	abc	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	abc	abc	abc	abc	abc	1		
ALB	ATS	CP	South Africa	BB	t1	5220	3355	6306	6845	6842	5204	5425	6581	8401	5010	3463	6715	6057	3323	4153	2856	3365	2024	2334	2967	2446	2029	3466	3395	3620	3898	2001	1640	2353	2190	2	16.8%	75%
ALB	ATS	CP	South Africa	BB	t2	ab	ab	ab	ab	ab	ab	ab	ab	b	ab	abc	ab	abc	abc	abc	abc	ab	ab	ab	a	a	ab	ab	ab	ab	ab	ab	a	a	a	2		
ALB	ATS	CP	Namibia	BB	t1					915	950	982	1192	1422	1072	2240	2969	2858	2432	3079	2031	2426	1058	1856	4936	1263	3711	2275	838	1016	1008	893	205	874	206	3	6.1%	81%
ALB	ATS	CP	Namibia	BB	t2					abc	abc	-1	-1	-1	abc	c	ab	ac	-1	abc	abc	abc	abc	abc	abc	abc	abc	ab	abc	abc	ab	abc	abc	abc	abc	3		
ALB	ATS	CP	Brazil	LL	t1	485	1095	2710	3600	835	723	807	589	3013	1478	3758	6240	2865	1844	285	359	267	222	233	150	207	920	824	778	326	431	494	383	311	412	4	5.0%	86%
ALB	ATS	CP	Brazil	LL	t2	a	a	ab	ab	ab	ab	a	ab	ab	ab	ab	a	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	a	a	a	a	a	ab	ab	4		
ALB	ATS	CP	Japan	LL	t1	587	654	583	467	651	389	435	424	418	601	554	341	231	322	509	312	316	238	1370	921	973	1194	2903	3106	1131	1752	1096	1189	2985	1566	5	3.8%	89%
ALB	ATS	CP	Japan	LL	t2	ab	ab	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	ac	abc	abc	abc	abc	abc	abc	ab	ab	ab	ab	ab	ab	ab	ab	5		
ALB	ATS	CP	EU-España	LL	t1	0	1	127	135	149	202	180	190	20	871	282	573	829	183	81	261	358	758	908	997	266	250	235	369	256	354	195	259	301	186	6	1.3%	91%
ALB	ATS	CP	EU-España	LL	t2	ab	ab	ab	-1	ab	ab	ab	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	b	b	b	b	b	b	6		
ALB	ATS	CP	South Africa	RR	t1	60	55	54	36	89	10	209	127		73	58	377	323	82	201	288	324	1696	1028	1855	1529	1268									7	1.3%	92%
ALB	ATS	CP	South Africa	RR	t2	a	a	a	a	a	-1	a	a		-1	-1	-1	-1	-1	-1	a	a	a	a	a	a	-1									7		
ALB	ATS	CP	Brazil	BB	t1	29	18		13	392	200	12	63	405	394	627	619	363	803	235	197	85	293	156	18	34	198	1190	979	129	60	55	0	1	457	8	1.1%	93%
ALB	ATS	CP	Brazil	BB	t2	a	a		a	-1	a	a	a	a	a	-1	a	a	a	a	a	a	ab	a	a	a	a	a	a	a	a	a	a	a	a	8		
ALB	ATS	CP	St Vincent and Grenadines	LL	t1											2116	4292	44				65	160	71	51	31	94	92	97	110	100	107	101	98	31	9	1.0%	94%
ALB	ATS	CP	St Vincent and Grenadines	LL	t2											-1	-1	a		a		a	a	a	a	a	a	-1	ab	a	ab	ab	ab	ab	abc	9		
ALB	ATS	CP	EU-Portugal	BB	t1	732	81	184	483	1185	655	494	256	124	232	486	40	433	415	9																10	0.8%	95%
ALB	ATS	CP	EU-Portugal	BB	t2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	a	a	a	a																10		
ALB	ATS	CP	Namibia	LL	t1					196			7	7	90	178	450	105	721	250	313	2674	138	102	0	57	80	145	10	41	54	101	8	14	55	11	0.8%	96%
ALB	ATS	CP	Namibia	LL	t2					a			-1	-1	a	-1	ab	ac	-1	ab	ab	ab	ab	a	ab	ab	abc	a	ab	a	a	a	a	abc	abc	11		
ALB	ATS	CP	EU-España	PS	t1		279	1816	648	682	255	4	66	173	156	7		7	193		24	9		25	64	28	64	116		3	64		88	2		12	0.6%	96%
ALB	ATS	CP	EU-España	PS	t2	b	abc	abc	abc	abc	abc	abc	abc	abc	ac	abc	abc	abc	abc		abc	abc		abc	abc	abc	abc	abc	b	ac	ac		abc	a		12		
ALB	ATS	CP	EU-France	PS	t1		50	451	565	130	83	191	39	40	13	23	11	18	63	16	443	347	12	50	43	109	50	151	40	41	54	64	79	16	3	13	0.4%	97%
ALB	ATS	CP	EU-France	PS	t2	a	ac	ac	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	ac	ac	ac	abc	ab	abc	13		
ALB	ATS	NCO	Vanuatu	LL	t1															0	684	1400	96	131	64	104	85	35	83	91						14	0.4%	97%
ALB	ATS	NCO	Vanuatu	LL	t2															a	a	a	-1	-1	-1	a	ab	ab	a	a						14		

C. ALB-M (1990-2019)

Species	Stock	Status	FlagName	GearGrp	DSet	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Rank	%	%cum
				T1 Total		1896	2379	2202	2138	1349	1587	3150	2541	2698	4856	5577	4870	5608	7898	4874	3529	5965	6520	2970	4024	2124	4628	2047	1503	2400	3554	4319	2780	2863	2484			
ALB	MED	CP	EU-Italy	LL	t1	624	523	436	402	347	81	366	172	172	307	2712	2445	3631	3786	1555	1189	1995	2721	2083	1497	1109	1634	1117	605	1342	1356	1480	1322	1029	1268	1	37.3%	37%
ALB	MED	CP	EU-Italy	LL	t2	-1	-1	-1	b	a	a	a	a	a	a	ab	ab	a	ab	b	b	ab	b	bc	abc	abc	abc	abc	abc	abc	abc	abc	abc	bc	abc	1		
ALB	MED	CP	EU-Italy	GN	t1	565	668	1025	873	759	1027	1383	1222	1222	2254	916	379	397																		2	12.0%	49%
ALB	MED	CP	EU-Italy	GN	t2	a	a	a	ab	a	-1	-1	-1	-1	-1	ab	b	-1	b		b															2		
ALB	MED	CP	EU-Italy	PS	t1														3079	2100	1046	2589	1249	15	1230		866		10	9	244	4	26	13	17	3	11.9%	61%
ALB	MED	CP	EU-Italy	PS	t2														-1	-1	-1	b	-1	-1	-1		-1		-1	-1	-1	-1	abc	-1	-1	3		
ALB	MED	CP	EU-Greece	UN	t1	500	500	500	1	1		952	741	1152	1950	1735	1786	1304																		4	10.6%	72%
ALB	MED	CP	EU-Greece	UN	t2	-1	-1	-1	-1	-1		-1	-1	-1	-1	-1	-1	-1																		4		
ALB	MED	CP	EU-Cyprus	LL	t1														17	243	337	451	695	204	220	206	247	321	357	385	505	558	568	624	652	5	6.3%	78%
ALB	MED	CP	EU-Cyprus	LL	t2														a	a	a	ab	abc	abc	abc	abc	abc	ab	a	abc	abc	abc	abc	abc	abc	5		
ALB	MED	CP	EU-Greece	LL	t1										35	33	40	36	445	427	323	242	257	191	116	125	126	126	165	287	541	1332	608	522	297	6	6.0%	84%
ALB	MED	CP	EU-Greece	LL	t2										-1	-1	-1	-1	a	a	ab	ab	-1	a	a	-1	-1	-1	b	b	a	-1	a	ab	ab	6		
ALB	MED	CP	EU-España	LL	t1		1	6	8	3	6	25	176	22	74	51	112	37	1	109	148	322	421	208	204	277	338	385	238	270	52	48	206	70	60	7	3.7%	88%
ALB	MED	CP	EU-España	LL	t2		ab	ab	ab	ab	ab	ab	ab	ac	ac	ab	ac	ac	-1	-1	a	a	a	abc	abc	abc	a	abc	ab	abc	abc	ab	abc	abc	abc	7		
ALB	MED	CP	Turkey	GN	t1																			208	631	402	1396									8	2.5%	90%
ALB	MED	CP	Turkey	GN	t2																			a	a	ab	ab									8		
ALB	MED	CP	EU-España	BB	t1	83	499	171	231	81	163	205		33	96	88	77	29			0		0													9	1.7%	92%
ALB	MED	CP	EU-España	BB	t2	ac	ac	ac	c	ac	ac	ac		ac	ac	a	-1	ac			-1		a													9		
ALB	MED	CP	Libya	LL	t1																										750	800		30	21	10	1.5%	93%
ALB	MED	CP	Libya	LL	t2																										-1	-1		-1	-1	10		
ALB	MED	CP	EU-Greece	PS	t1														478	326	287	141	123													11	1.3%	95%
ALB	MED	CP	EU-Greece	PS	t2														-1	-1	-1	-1	-1													11		
ALB	MED	CP	EU-España	TR	t1		48	50	59	129	306	119	202	45	73			117										2							6	12	1.1%	96%
ALB	MED	CP	EU-España	TR	t2		abc	abc	abc	abc	abc	abc	abc	abc	abc			abc							b			a							ab	12		
ALB	MED	CP	Turkey	PS	t1															27	30	73	852					62	71							13	1.1%	97%
ALB	MED	CP	Turkey	PS	t2															-1	-1	-1	-1					-1	-1							13		
ALB	MED	NCO	NEI (MED)	PS	t1				500																											14	0.5%	97%
ALB	MED	NCO	NEI (MED)	PS	t2				-1																											14		

Table 2 Albacore Task 1 nominal catches in tons (landings and dead discards) by stock, major gear, and year. Catches for 2020 are preliminary and incomplete.

ALB-N															
YearC	BB	GN	HL	HP	HS	LL	PS	RR	TL	TN	TP	TR	TW	UN	TOTAL
1950												39623			39623
1951												34149			34149
1952												32397			32397
1953	3875											26242			30117
1954	7250											32729			39979
1955	3125											28299			31424
1956	5500					2						35398			40900
1957	11959					135						30028			42122
1958	17558					945						33945			52448
1959	18517					599						30796			49912
1960	18139					1658						33072			52869
1961	21120					703						20907			42730
1962	21469					6375						30943			58787
1963	20739					14976						24625			60340
1964	20428					16148						28058			64634
1965	20112					15002	0					25544			60658
1966	16757					7815	0					22791			47363
1967	18349					10124	0					30669			59142
1968	13936					7291	0					23993			45220
1969	14569					14238	0					17923			46730
1970	14388		0			15801	0					15706			45895
1971	15677		0			17115	0					24029			56821
1972	8196		0			14068	0					26517			48781
1973	8833		0			18155	0					18712			45700
1974	13986		0			14662	0					20958			49606
1975	19687		0			12710						9491			41888
1976	20227		0			23090						13918			57235
1977	15559		0			21081						17391			54031
1978	11958		0			14163	68					23931		1	50121
1979	15764		3			12214						23332		59	51372
1980	16177	1	0			9453					0	13059	0	0	38691
1981	13412	2				9819		398			63	10778	1	58	34531
1982	15857	4	7			13206	84	667			0	12831	0	16	42673
1983	21108	0	5	1		16896	364	322			3	12788	0	3	51490
1984	8313	1	4			19709	555	2176			0	11029	0	13	41800
1985	12589	3	2			17413	59	75			3	10654	2	25	40826
1986	15202	3	10			21232	60	190			0	10847		10	47554
1987	18756	90	21			7296	1	230			0	11457	262	2	38115
1988	15933	758	9			3013	97	214			0	11329	1693	13	33059
1989	15374	1481	12	0	0	2239	12	133	22		0	10554	2240	3	32071
1990	18624	3682	5	0		2683	1	175			0	10675	1033	3	36881
1991	8968	3732	6		2	5315	222	251			2	8959	469	6	27931
1992	12436	4984	4		54	3152	139	103			8	7348	2603	20	30851
1993	15646	7034	2			7093	229	224			0	6109	1779	19	38135
1994	11967	7122	8			7309	292	324			1	5959	2131	50	35163
1995	16411	3518	1			4859	278	23	1			10226	3049	12	38377
1996	11338	3002	2			4641	263	309	10		3	6652	2571	11	28803
1997	9821	3706	5			4051	26	337	3		1	7870	2877	325	29023
1998	7562	6108	0			4035	91	601	3		1	5894	1318	133	25746
1999	8780	6315	18			6710	55	94	10		0	6845	5343	379	34549
2000	11072	5254	77			7321	191	258	12		0	5023	3547	370	33124
2001	6103	2585	86	0		7372	263	126	5		0	4312	5374	24	26252
2002	6638	17	9			6235	93	335	2		1	4009	5376	1	22716
2003	7840	1	55			7826	211	352	6		1	5373	3846	55	25567
2004	8128	5	46	0		7037	344	501	3		6	7501	2369	16	25957
2005	10458	12	225	0		6911	99	367	1		2	10224	7001	17	35318
2006	14273	6	309	0		5223	162	297	2		1	10296	6385	10	36963
2007	8496	6	114	0		3237	198	399	0		0	6105	3429	6	21991
2008	7931	10	123	3		2647	70	130	1		0	5239	4321	6	20483
2009	4994	30	30	1		2619	101	24	0		0	4440	2811	342	15391
2010	6026	27	133	0		3913	70	57	0	0	0	7146	2026	14	19411
2011	5530	1	48	1		3666	3	123	0	26	0	3578	6852	160	19989
2012	8816	6	17	1		3759	176	143	0		0	5909	6678	177	25681
2013	4975	21	5	1		6607	40	563	0	0	0	5891	6558	226	24887
2014	7341	4	6	1		3272	35	142	2		0	6660	9184	8	26655
2015	9265	8	4	0		4746	116	122	0			5597	5771	1	25630
2016	14455	19	26	1		5744	50	44	0	2		3753	6299	3	30395
2017	12196	90	17	0		5315	38	29	0	1		4165	6611	0	28462
2018	11330	4	47	0		4670	39	10		0		4807	8820	1	29728
2019	12662	1	125			4782	65	30	0	0		6292	10816	1	34773
2020	1115		3	0		34	20	0				0			1173
TOTAL	851598	59652	1629	12	56	532128	5280	10899	85	30	97	1084299	141444	2601	2689811
Ratios (%)	31.7	2.2	0.1	0	0	19.8	0.2	0.4	0	0	0	40.3	5.3	0.1	100.0

ALB-S									
YearC	BB	GN	HL	LL	PS	RR	TW	UN	TOTAL
1950								0	0
1951								0	0
1952								0	0
1953								0	0
1954								0	0
1955								0	0
1956				21				0	21
1957				725				0	725
1958				1047				0	1047
1959				4715				0	4715
1960				10475				0	10475
1961				10365				400	10765
1962				17171				1800	18971
1963				17385					17385
1964	22			25977					25999
1965				29845					29845
1966				27296					27296
1967				15883				0	15883
1968	38			25650				0	25688
1969				28493				0	28493
1970				23653				0	23653
1971				24885				0	24885
1972				33079	10	100			33189
1973	1			28134	3	96			28234
1974	97			19553	13	53			19716
1975	46			17456	1	104			17607
1976				19178	47	150			19375
1977	66			20982	114	150		143	21455
1978	43			22800	51	162		39	23095
1979	53			21855	188	410		134	22640
1980	1346			20671	480	264		185	22946
1981	1721			20426	1804	69		20	24040
1982	2575			25255	1349	467		26	29672
1983	1794			11941	699	429		55	14918
1984	4166			9834	365	20		214	14599
1985	7909	0		22672	182	181		153	31097
1986	6829			29815	244	38		362	37288
1987	8181			30964	948	60		477	40630
1988	7696			21894	185	45		353	30173
1989	7393			19407		57		354	27212
1990	5982	927		21590	4	60		151	28714
1991	3459			22025	417	55		60	26016
1992	6518			27167	2518	54		306	36564
1993	7379			23950	1450	36		0	32814
1994	9339			24806	1065	89		2	35301
1995	7091			20040	413	10			27554
1996	6960			21000	258	209	0		28426
1997	8110			19547	118	127	120		28022
1998	10353			19799	434		9		30595
1999	6709			20640	183	73	52		27656
2000	6873			24398	58	58	0		31387
2001	10355			28039	25	377			38795
2002	9712			21671	39	323	0		31746
2003	6976		0	20626	308	82	12		28005
2004	7477		96	14735	16	201	18	2	22545
2005	5119			12977	499	288	0	0	18882
2006	5938			17740	442	324		9	24453
2007	3421			15087	58	1696		21	20283
2008	4443			13218	81	1028		98	18867
2009	8007		96	12113	144	1855		34	22248
2010	3750		89	13471	355	1529		30	19225
2011	6058	41	104	16445	205	1268		5	24126
2012	6933		64	17847	428			0	25272
2013	5213		264	13888	58				19424
2014	4765		7	8888	44				13705
2015	4965		0	10104	131				15201
2016	2949			11243	83			108	14383
2017	1846			11674	191			114	13825
2018	3228		84	13767	19				17098
2019	2852		134	12650	3				15640
2020									
TOTAL	232757	968	940	1190648	16728	12596	211	5654	1460502
Ratios (%)	15.9	0.1	0.1	81.5	1.1	0.9	0	0.4	100.0

ALB-M														
YearC	BB	GN	HL	HS	LL	PS	RR	SP	TN	TP	TR	TW	UN	TOTAL
1950													0	0
1951													0	0
1952													0	0
1953													0	0
1954													0	0
1955													0	0
1956													0	0
1957													1700	1700
1958													2900	2900
1959													2900	2900
1960													1300	1300
1961													1400	1400
1962													1200	1200
1963													1600	1600
1964													1600	1600
1965													2200	2200
1966													3000	3000
1967													2300	2300
1968													2600	2600
1969						200							3200	3400
1970													500	500
1971													500	500
1972					1								700	701
1973													500	500
1974													500	500
1975													500	500
1976					41								520	561
1977					130								483	613
1978					150								440	590
1979													833	833
1980													500	500
1981	900												600	1500
1982	539										33		700	1272
1983	535												700	1235
1984	1331	191	37		226	141							1525	3451
1985	243	385			375	274					264		2588	4129
1986		100			324	10	10				310		2958	3712
1987		107			164	50	10						3665	3996
1988		110			168	16	15						3754	4063
1989		110			165	16	15						3754	4060
1990	83	565			624	91	30			3			500	1896
1991	499	668	0		524	110	30				48		500	2379
1992	171	1025			442	6	5			3	50		500	2202
1993	231	873			410	559	5				59		1	2138
1994	81	759			350	23	5				129		2	1349
1995	163	1027			87	0	3				306		1	1587
1996	205	1383	80		391			20			119		952	3150
1997		1222	2		348		5	20			202		742	2541
1998	33	1222	24		194		5	20		2	45		1153	2698
1999	96	2254	61		416					0	73		1956	4856
2000	88	916	23		2796		6	2		8			1739	5577
2001	77	379	26		2597	0		2					1790	4870
2002	29	397	38		3704	1	12	4			117		1306	5608
2003		0	27		4248	3557	13	1				48	5	7898
2004			49		2335	2452	6	1	7				25	4874
2005	0		53		1997	1362	30	2	58				26	3529
2006		0	78		3026	2803					1		56	5965
2007	0		163		4101	2237	2			0	0		17	6520
2008	0	208	31		2694	24			1	0	1	5	5	2970
2009	0	631	0		2160	1230				0	0	0	3	4024
2010	0	402	2		1719				0	0	1			2124
2011	0	1396	10		2352	869				0	0	0	2	4628
2012	0	0	5		1965	68				0	6		3	2047
2013	0	0	11		1399	86				0	0	0	6	1503
2014	0	0	15		2351	14				5	3	5	8	2400
2015	0	0	4	0	3245	247			0	0	0	4	54	3554
2016		0	3		4274	7			0		0	9	26	4319
2017		0	2		2706	26			0		2	0	44	2780
2018		0	2		2378	443			0		1	2	38	2863
2019			5		2386	18	3		0		67	1	4	2484
2020					570									570
TOTAL	5304	16331	749	0	60533	16940	209	72	67	21	1838	73	65583	167719
Ratios (%)	3.2	9.7	0.4	0	36.1	10.1	0.1	0	0	0	1.1	0	39.1	100.0

Table 3. Standard ICCAT scorecard on data availability by species and stock covering the period 1990 to 2019.

SCORECARD on Task 1/2 availability for the main ICCAT fisheries (final year: 2019)

FisheryID	Spc. Group	Species	Species/stock	SCORES (by time series) 30 years (1990-19)	20 years (2000-19)	10 years (2010-19)	N. flag fisheries ranked 30 years (1990-19)	20 years (2000-19)	10 years (2010-19)	Change (%) agains't 1989-18 (30 yrs)
1	Temperate tunas	ALB	ALB-N stock	7.10	7.42	7.40	12	14	11	-1%
2			ALB-S stock	5.65	5.98	6.09	10	10	9	2%
3			ALB-M stock	2.52	3.58	6.24	11	10	7	12%
4		BFT	BFT-E stock (ATE region)	6.00	7.16	8.78	10	8	8	2%
5			BFT-E stock (MED region)	3.38	4.46	5.85	28	21	17	2%
6			BFT-W stock	8.68	8.88	9.68	9	8	7	1%
7	Tropical tunas	BET	BET-A stock (AT + MD)	6.44	7.28	7.63	29	28	27	0%
8		YFT	YFT-E region	6.53	7.48	8.00	23	20	16	0%
9			YFT-W region	4.57	5.01	5.18	25	24	22	0%
10		SKJ	SKJ-E stock	6.89	7.79	7.92	18	16	15	-1%
11			SKJ-W stock	4.09	4.70	4.44	4	4	3	-12%
12	SWO & billfish	SWO	SWO-N stock	7.87	8.66	8.62	11	10	10	4%
13			SWO-S stock	7.03	7.26	7.09	9	9	9	3%
14			SWO-M stock	4.46	5.30	6.76	11	10	8	1%
15		BUM	BUM-A stock (AT + MD)	4.08	3.91	3.58	30	30	31	-1%
16		WHM	WHM-A stock (AT + MD)	5.29	5.37	5.71	17	18	16	-1%
17		SAI	SAI-E stock	3.07	3.66	3.42	14	13	11	2%
18			SAI-W stock	3.58	3.52	4.14	18	16	11	1%
19		SPF	SPF-E stock	2.92	5.45	5.00	3	4	3	30%
20			SPF-W stock	3.28	3.71	3.19	6	6	6	-1%
21	Major shark species	BSH	BSH-N region	3.74	4.98	7.00	5	5	4	6%
22			BSH-S region	4.18	5.81	6.82	6	6	7	6%
23		POR	POR-ANE stock	0.39	0.63	1.08	8	12	11	4%
24			POR-ANW stock	2.73	2.86	3.18	4	6	8	3%
25			POR-ASE stock	0.70	1.13	2.67	4	3	2	2%
26			POR-ASW stock	0.44	0.77	1.42	6	5	3	0%
27		SMA	SMA-N region	3.02	4.55	5.95	6	7	7	9%
28			SMA-S region	3.85	6.27	7.33	7	8	6	6%
29	Small tuna species	BLF	ATL	3.04	3.72	4.05	15	12	10	1%
30		BLT	A+M	0.94	1.51	2.78	22	20	18	17%
31		BON	ATL	2.16	2.66	3.04	35	28	22	12%
32			MED	0.74	1.26	1.51	8	8	8	-11%
33		BRS	A+M	0.92	1.38	2.50	3	3	1	0%
34		DOL	A+M	1.82	2.42	3.42	14	14	15	7%
35		FRI	ATL	4.45	5.38	5.74	28	23	21	3%
36		KGM	A+M	1.34	1.46	2.65	7	7	4	3%
37		LTA	ATL	3.77	4.67	5.26	32	25	21	4%
38			MED	0.54	0.82	1.12	18	15	12	21%
39		MAW	A+M	2.05	2.23	2.07	21	15	12	2%
40		SSM	A+M	0.50	0.00	0.00	4	3	3	-14%
41		WAH	A+M	1.71	2.24	2.13	36	28	20	1%

Score card – with ALB

Table 4. Summary of ALB conventional tagging data available in ICCAT. Number of ALB releases by year and associated recoveries by year.

			Recoveries (year)																																												
Year	Releases	Recoveries	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1986	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2012	2011	2013	2016	2018
1960	15	0																																											
1961	3	0																																											
1962	2	0																																											
1963	12	0																																											
1964	21	0																																											
1965	1	0																																											
1966	11	0																																											
1968	18	16	8	4	3	1																																							
1969	11	11		5	1	3	1	1																																					
1970	15	14			6	5	2	1																																					
1971	37	37				14	12	8	3																																				
1972	24	22					4	6	6	3			2	1																															
1973	17	10						3	4	2	1																																		
1974	3	0																																											
1975	10	10								4	1		5																																
1976	241	9									1	3	3	1		1																													
1977	48	2										1		1																															
1978	10	4											1		2				1																										
1979	35	0																																											
1980	227	5													2	2			1																										
1981	20	2															2																												
1982	56	1																			1																								
1983	290	23																23																											
1984	226	0																																											
1985	147	0																																											
1986	214	4																		2	2																								
1987	39	0																																											
1988	541	40																			23	7	8	1	1																				
1989	3106	115																				20	67	20	6	1	1																		
1990	4650	103																					32	25	37	2	1	2	2	1				1													
1991	4745	174																						54	91	17	6	3			1	2															
1992	68	0																																											
1993	221	7																								4		3																			
1994	341	10																									5	3		1			1														
1995	19	1																										1																			
1996	20	0																																											
1997	6	0																																											
1998	75	0																																											
1999	3	0																																											
2000	19	1																																1													
2001	51	1																																		1											
2002	122	2																																	1		1										
2003	546	14																																		1	6	7									
2004	134	1																																				1									
2005	547	19																																				11	6	2							
2006	2771	18																																					3	5	6	3			1		
2007	140	3																																							1	2					
2008	27	1																																							1						
2009	168	0																																													
2010	65	0																																													
2011	170	3																																									2	1			
2012	45	2																																									2				
2013	65	0																																													
2015	7	0																																													
2016	33	2																																												2	
2017	36	0																																													
2018	122	1																																													1
Year	20616	688	8	9	10	23	19	19	13	9	3	5	11	3	4	3	2	23	2	2	26	27	108	101	135	24	13	12	2	2	2	2	1	3	1	2	7	19	10	7	9	7	4	1	1	2	1

Table 5. Summary of ALB conventional tagging data: number of recoveries grouped by number of years at liberty in each release year. The last column shows the recovery rate (%) in each release year.

Number of tag Albacore (*Thunnus alalunga*)											
			Years at liberty								
Year	Releases	Recaptures	< 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 10	10+	Unk	% recapt*
1960	15	0									
1961	3	0									
1962	2	0									
1963	12	0									
1964	21	0									
1965	1	0									
1966	11	0									
1968	18	16	10	3	2	1					88.9%
1969	11	11	6	2	2		1				100.0%
1970	15	15	7	4	2	1				1	100.0%
1971	37	37	20	11	4	2					100.0%
1972	24	22	4	6	6	3		3			91.7%
1973	17	12	5	3	2					2	70.6%
1974	3	0									
1975	10	10	4	1	3	2					100.0%
1976	241	9	1	6		1		1			3.7%
1977	48	2	1		1						4.2%
1978	10	4	1		2			1			40.0%
1979	35	0									
1980	227	5	4				1				2.2%
1981	20	3	2							1	15.0%
1982	56	1						1			1.8%
1983	290	25	23							2	8.6%
1984	226	0									
1985	147	0									
1986	214	4	2	1	1						1.9%
1987	39	0									
1988	541	42	30	7	2	1				2	7.8%
1989	3106	115	58	40	11	5	1				3.7%
1990	4650	104	42	41	12	2		5	1	1	2.2%
1991	4745	174	108	46	9	6	2	3			3.7%
1992	68	0									
1993	221	7	4		3						3.2%
1994	341	10	8			1		1			2.9%
1995	19	1	1								5.3%
1996	20	0									
1997	6	0									
1998	75	0									
1999	3	0									
2000	19	1		1							5.3%
2001	51	1			1						2.0%
2002	122	2	1	1							1.6%
2003	546	15	6	6	2					1	2.7%
2004	134	1		1							0.7%
2005	547	19	13	4	2						3.5%
2006	2771	18	7	5	4	1		1			0.6%
2007	140	3	1	1	1						2.1%
2008	27	1	1								3.7%
2009	168	0									
2010	65	0									
2011	170	3	2	1							1.8%
2012	45	2	2								4.4%
2013	65	0									
2015	7	0									
2016	33	2	2								6.1%
2017	36	0									
2018	122	0									
	20616	697	376	191	72	26	5	16	1	10	3.4%

Table 6. Available abundance indices for the stock assessment of Mediterranean albacore in 2021.

Name	Spanish LLALB		Larval W-Med		Italian LL				Ionian LL				Ligurian LL bycatch				Med South LL				Spanish Tournament		Italy LL South Adriatic	
SCRS Doc	SCRS/2021/102		SCRS/2021/117		SCRS/2021/115		SCRS/2021/115		SCRS/2021/115		SCRS/2021/115		SCRS/2021/115		SCRS/2021/115		SCRS/2021/115		SCRS/2021/115		SCRS/2021/103		Marano et al.,	
index	Std. index	SE	Std. index	CV	Std. index	SE	Std. index	SE	Std. index	SE	Std. index	SE	Std. index	SE	Std. index	SE	Std. index	SE	Std. index	SE	Std. index	SE	Nominal	CV
Unit	Number				Weight		Number		Weight		Number		Weight		Number		Weight		Number		Number			
Use in 2021 for final model																								
1980																								
1981																								
1982																								
1983																								
1984																							85.02	
1985																							105.59	
1986																							112.81	
1987																							248.77	
1988																								
1989																								
1990																							220.61	
1991																							181.67	
1992																							188.89	
1993																							124.44	
1994													19.91	0.19	2.48	0.2							169.3	
1995									45.3	0.05	7.44	0.05	25.78	0.17	2.4	0.19							136.44	
1996													25.42	0.11	2.78	0.12								
1997									56.01	0.06	8.5	0.06	17.11	0.15	2.03	0.16								
1998									141.77	0.05	21.14	0.05											98.56	
1999									43.68	0.04	6.63	0.04											105.78	
2000									78.55	0.09	11.86	0.1											133.64	
2001			7.92	0.293					99.61	0.08	14.14	0.08												
2002									55.08	0.17	8.56	0.17												
2003									53.63	0.12	7.63	0.13												
2004			8.79	0.222													164.75	0.17	24.76	0.18				
2005			8.84	0.174													130.98	0.24	16.08	0.26	0.7	0.18		
2006																	273.55	0.23	32.6	0.25	0.94	0.24		
2007																					0.62	0.15		
2008																	62.16	0.32	10.15	0.33	1.17	0.21		
2009	14.81	2.26															257.37	0.35	43.18	0.37	1.09	0.27		
2010	23.39	2.84																			0.52	0.14		
2011	29.22	4.33			22.07	0.09	2.79	0.09													1.22	0.31		
2012	13.58	1.14	5.72	0.221	26.19	0.12	3.13	0.12													0.49	0.13		
2013	8.58	0.96	1.72	0.349	26.51	0.2	2.78	0.21													2.28	0.56		
2014			2.1	0.373	17.05	0.17	2.11	0.18													1.71	0.42		
2015	12.58	5.51	0.67	0.342	26.71	0.19	2.57	0.2													0.65	0.12		
2016	4.99	3.85	1.37	0.389	15.19	0.17	1.57	0.17													0.94	0.16		
2017	12.14	2.08	2.65	0.255	13.91	0.19	1.53	0.2													1.09	0.19		
2018					42.05	0.2	4.68	0.21													0.89	0.16		
2019	8.7	3.91	1.47	0.348	55.97	0.31	4.81	0.31													0.72	0.13		

Table 7. Criteria table for available abundance indices for the Mediterranean albacore stock assessment in 2021.

Document	SCRS/2021/102	SCRS/2021/117	SCRS/2021/115	SCRS/2021/115	SCRS/2021/115	SCRS/2021/115	SCRS/2021/103	Marano et al., 2005
Index	Spanish LLALB	Larval W-Med	Italian LL	Ionian LL	Ligurian LL bycatch	Med South LL	Spanish Tournament	Italy LL South Adriatic
Diagnostics	Qq-plots, residuals patterns, type II and III		Residuals, type III test included.	Residuals, type III test included.	Residuals, type III test included.	Residuals, type III test included.	Qq-plots, residuals patterns, type II and III	Nominal cpue
Appropriateness of data exclusions and classifications (e.g. to identify targeted trips).	scientific observer on board data	Data follow a specific filtering process, identifying sistematic surveys, fishing operationa anomalies (ej dates, volumenes filtered), environmental outlayers (salinity,temepetature,...)	only ALBLL data selected	only ALBLL data selected	ALBLL and SWOLL data selected	only ALBLL data selected	scientific observer on board data	no data selection methods described
Geographical Coverage (East or west Atlantic? Or Med)	Spanish Mediterranean coast (Western Mediterranean)	Balearic Sea	Thyrrenian Sea and Ionian Sea (North and South)	Ionian Sea	Ligurian Sea	South Thyrrenian, North and South Ionian Sea, Lybia, South of Sicily	Majorca Island sorroundings	Southern Adriatic
Catch Fraction to the total catch weight	variable, depending on the year (5%-60%; 20% on average)	larval	substantial	substantial	by-catch	substantial	low fraction of total reported Task 1	substantial
Length of Time Series relative to the history of exploitation.	2009-2019 (11 years; 30 history)	2001-2019	2011-2019	1995-2003	1994-1997	2004-2009	2005-2019 (15 years)	1984-2000
Are other indices available for the same time period?	yes	no other fisheries independent index	Larval index, Spanish longline, Spanish tournament	Italy LL south adriatic	Italy LL south adraitic	Spanish tournament	yes	Ionian LL and Ligurian LL bycatch
Does the index standardization account for Known factors that influence catchability/selectivity?	seasonality and spatial distribution	yes (gear, towdepth, volume filtered,habitat distribution)	Fishing effort, temporal and spatial factors	Fishing effort and temporal factors	Fishing effort and temporal factors	Fishing effort, temporal and spatial factors	seasonality and spatial distribution	nominal cpue
Are there conflicts between the catch history and the CPUE response?	no	No, very high correlated (Alvarez-Berastegui et al.2018, supp. Documents,own cloud)	yes, in the last two years 2018-2019	yes in the last three years	no	no	no	
Is interannual CV high, and is there potential evidence of unaccounted process error (trends in deviations from production model dynamics, high peaks, multiple stanzas, increasing or decreasing catchability)	high interannual variability	relatively high interannual variability, mean CV = 0.29	0.5	0.47	0.19	0.49	high interannual variability	
Assessment of data quality and adequacy of data for standardization purpose (e.g. sampling design, sample size, factors considered)	sample number, nominal data (catch, effort), data exclusions	Scientific survey dessign with systematic sampling, spatailly and geographically. Data quality assessment at variosu steps, data callection, data [illegible]	limited information (only landings information)	Sampling specifically designed to collect information on albacore both on landings and observations on board	by-catch data from tuna and swordfish fisheries (only landings information)	Sampling specifically designed to collect information on albacore both on landings and observations on board	sample number, nominal data (catch, effort), data exclusions	No specific assessment of data adequacy, metier combined with Swordfish
Is this CPUE time series continuous?	Gaps for 2014 and 2018	no	yes	no (1996 missing)	yes	no (2007 missing)		no (1988,1989,1996,1997 missing)
Other Comment							Spatial and temporal limited	

Table 8 Summary of posterior quantiles presented in the form of marginal posterior medians and the associated 95% credibility intervals of parameters for the JABBA base-case model (S4) for Mediterranean albacore.

Estimate	Median	95% LCI	95% UCI
K	53240.7	31551.1	99528.3
r	0.186	0.093	0.339
B_{MSY}/K	0.37	0.37	0.37
F_{MSY}	0.184	0.091	0.335
B_{MSY}	19703.1	11676.3	36833.0
MSY	3653.9	2445.9	5090.1
B_{1980}/K	0.805	0.527	1.153
B_{2019}/K	0.211	0.119	0.372
B_{2019}/B_{MSY}	0.57	0.322	1.004
F_{2019}/F_{MSY}	1.213	0.618	2.175

Table 9. Estimates of biomass, fishing mortality and biomass relative to B_{MSY}, and fishing mortality relative to F_{MSY} between 1980 and 2019 of the JABBA base-case model (S4) for Mediterranean albacore, with 95% credibility intervals.

	Biomass			Fishing Mortality			B/Bmsy			F/Fmsy		
Year	Median	95%LCI	95%UCI	Median	95%LCI	95%UCI	Median	95%LCI	95%UCI	Median	95%LCI	95%UCI
1980	42712	22312	85391	0.012	0.006	0.022	2.174	1.424	3.117	0.064	0.039	0.110
1981	41553	21621	84146	0.036	0.018	0.069	2.117	1.314	3.187	0.196	0.116	0.350
1982	39585	20116	79796	0.032	0.016	0.063	2.016	1.204	3.131	0.175	0.101	0.322
1983	37924	19405	74742	0.033	0.017	0.064	1.927	1.145	3.011	0.178	0.103	0.324
1984	36257	18806	70535	0.095	0.049	0.184	1.835	1.125	2.801	0.520	0.309	0.922
1985	36445	18855	70792	0.113	0.058	0.219	1.853	1.121	2.824	0.616	0.368	1.094
1986	38211	19669	75483	0.097	0.049	0.189	1.947	1.169	2.944	0.530	0.316	0.947
1987	43187	22286	84958	0.093	0.047	0.179	2.199	1.314	3.303	0.504	0.300	0.908
1988	42996	21213	85994	0.094	0.047	0.192	2.193	1.264	3.332	0.516	0.300	0.954
1989	43428	20979	87948	0.093	0.046	0.194	2.211	1.266	3.342	0.512	0.298	0.958
1990	44306	22129	87805	0.043	0.022	0.086	2.257	1.336	3.341	0.234	0.139	0.428
1991	44212	22846	86068	0.054	0.028	0.104	2.259	1.345	3.340	0.293	0.174	0.534
1992	42653	21885	82886	0.052	0.027	0.101	2.178	1.287	3.267	0.282	0.166	0.515
1993	39041	20170	77151	0.055	0.028	0.106	1.996	1.184	3.025	0.298	0.175	0.541
1994	37306	19448	73367	0.036	0.018	0.069	1.908	1.138	2.887	0.196	0.116	0.352
1995	36063	19153	69510	0.044	0.023	0.083	1.838	1.094	2.767	0.240	0.143	0.429
1996	36570	19222	70486	0.086	0.045	0.164	1.867	1.081	2.917	0.468	0.274	0.848
1997	34350	17985	66431	0.074	0.038	0.141	1.757	1.031	2.678	0.403	0.237	0.720
1998	36762	19808	69298	0.073	0.039	0.136	1.872	1.113	2.842	0.401	0.237	0.704
1999	34936	19024	65944	0.139	0.074	0.255	1.780	1.079	2.664	0.760	0.458	1.310
2000	36525	20227	68777	0.153	0.081	0.276	1.861	1.138	2.814	0.836	0.492	1.430
2001	36154	19977	68475	0.135	0.071	0.244	1.841	1.124	2.849	0.740	0.430	1.250
2002	33122	17863	62853	0.169	0.089	0.314	1.676	1.006	2.684	0.931	0.534	1.586
2003	30787	16970	58892	0.257	0.134	0.465	1.558	0.938	2.491	1.415	0.803	2.387
2004	26811	14084	52884	0.182	0.092	0.346	1.351	0.791	2.248	1.012	0.550	1.708
2005	22618	11877	45918	0.156	0.077	0.297	1.142	0.662	1.932	0.862	0.463	1.458
2006	20299	11090	40555	0.294	0.147	0.538	1.029	0.604	1.760	1.615	0.876	2.697
2007	15964	8578	32633	0.408	0.200	0.760	0.811	0.468	1.406	2.249	1.206	3.769
2008	13271	6519	28855	0.224	0.103	0.456	0.670	0.374	1.225	1.241	0.623	2.145
2009	15309	7893	31647	0.263	0.127	0.510	0.771	0.441	1.366	1.468	0.755	2.480
2010	14616	7338	30435	0.145	0.070	0.289	0.733	0.415	1.311	0.812	0.412	1.393
2011	15349	8298	30764	0.302	0.150	0.558	0.779	0.452	1.346	1.668	0.877	2.814
2012	12841	6633	26401	0.159	0.078	0.309	0.647	0.372	1.134	0.886	0.457	1.512
2013	11156	5865	22647	0.135	0.066	0.256	0.563	0.323	0.970	0.751	0.391	1.269
2014	10450	5626	20849	0.230	0.115	0.427	0.529	0.307	0.904	1.273	0.679	2.140
2015	8977	4915	17656	0.396	0.201	0.723	0.453	0.269	0.759	2.192	1.199	3.602
2016	8420	4607	16554	0.513	0.261	0.937	0.426	0.254	0.708	2.846	1.562	4.636
2017	9558	5065	19294	0.291	0.144	0.549	0.483	0.283	0.832	1.617	0.839	2.700
2018	11682	6115	23881	0.245	0.120	0.468	0.591	0.340	1.057	1.357	0.686	2.361
2019	11292	5926	22979	0.220	0.108	0.419	0.570	0.322	1.004	1.213	0.618	2.175

Table 10. Estimated probabilities of the Mediterranean Albacore (a) stock being below F_{MSY} (overfishing not occurring), (b) stock being above B_{MSY} (not overfished), and (c) stock being above B_{MSY} and below F_{MSY} (green Kobe plot quadrant) shown for a range of fixed catch scenarios of 0 – 4,000 metric tons (MSY 3,600t, average current catch 2017-2019 2,700t) over the fixed catch projection horizon 2022-2035 based on joint projection MCMC posteriors of JABBA base-case model run (S4).

(a) $F<F_{MSY}$

TAC | Year	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
0	100	100	100	100	100	100	100	100	100	100	100	100	100	100
500	99	100	100	100	100	100	100	100	100	100	100	100	100	100
1000	94	96	97	98	98	98	99	99	99	99	99	99	99	99
1500	81	85	88	89	91	92	93	94	95	95	95	96	96	96
2000	64	69	73	76	78	80	81	82	84	84	85	86	87	87
2500	47	52	55	58	61	63	65	66	68	69	70	70	71	72
2600	44	48	52	55	57	59	61	63	64	65	66	67	68	68
2700	41	46	49	52	54	56	58	60	61	62	63	64	64	64
2800	39	43	46	48	50	52	54	55	57	58	58	59	60	60
2900	36	40	43	45	47	49	51	52	53	54	55	55	56	57
3000	34	37	40	42	45	46	47	48	50	51	51	52	52	53
3600	22	24	25	26	27	28	28	28	29	29	29	29	29	30
4000	16	17	18	19	19	19	19	19	19	19	19	19	19	19

(b) $B>B_{MSY}$

TAC | Year	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
0	18	35	52	66	76	83	88	91	94	95	97	97	98	98
500	18	32	47	60	71	78	83	87	90	92	94	95	96	97
1000	18	30	42	54	63	70	76	80	84	87	89	90	92	93
1500	18	28	38	48	55	61	67	71	75	78	81	83	84	86
2000	18	27	35	41	48	53	57	61	65	67	70	72	73	75
2500	18	24	30	35	39	43	47	50	52	55	57	58	60	61
2600	18	24	29	34	38	41	44	47	50	52	54	56	57	58
2700	18	23	28	32	36	40	42	45	48	49	51	53	54	55
2800	18	23	28	31	35	38	41	43	45	46	48	49	50	52
2900	18	23	26	30	33	36	39	41	42	44	45	47	48	49
3000	18	22	26	30	32	34	37	39	40	41	43	44	45	45
3600	18	20	21	23	24	25	25	25	26	26	27	27	27	27
4000	18	18	19	20	20	20	20	19	19	19	19	19	19	19

(c) $F<F_{MSY}$ and $B>B_{MSY}$ (Green Kobe quadrant)

TAC | Year	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
0	18	35	52	66	76	83	88	91	94	95	97	97	98	98
500	18	32	47	60	71	78	83	87	90	92	94	95	96	97
1000	18	30	42	54	63	70	76	80	84	87	89	90	92	93
1500	18	28	38	48	55	61	67	71	75	78	81	83	84	86
2000	18	27	34	41	48	53	57	61	65	67	70	72	73	75
2500	18	24	30	35	39	43	47	50	52	54	57	58	60	61
2600	18	24	29	34	37	41	44	47	50	52	54	56	57	58
2700	18	23	28	32	36	40	42	45	48	49	51	53	54	55
2800	18	23	28	31	34	38	41	42	44	46	48	49	50	51
2900	17	22	26	30	33	36	38	41	42	44	45	46	47	48
3000	18	22	26	29	32	34	36	39	40	41	43	44	44	45
3600	16	18	20	21	22	23	24	24	25	25	26	26	26	27
4000	13	14	16	16	17	17	18	18	18	18	18	18	18	17

ALB-Table 11. Performance of the HCR adopted in Rec. 17-04, as well as different variants, namely the effect of the carry over as allowed in Rec 17.04, the effect of a TAC implementation error scenario (“*Banking and borrowing*”), the effect of setting a lower TAC limit of 15,000 t, the effect of applying the 20% stability clause when BCUR>BLIM, and the effect of 20% maximum TAC reduction and 25% maximum TAC increase when BTHR>BCUR>BLIM and when BCUR>BLIM. Performance is described according to the performance statistics defined by Panel 2 (only one performance indicator per block is shown, which represents median values across 132 operating models). pGR% = probability of being in the green quadrant of the Kobe plot; pBint% = probability of BTHRESHOLD>B>BLIM; LongY (kt) = mean yield for the period 2030-2045 in thousands of tons; MAP = mean absolute proportional change in catch.

	Stock Status	**Safety**	**Catch**	**Stability**
HCR	pGr%	pBint%	LongY (Kt)	MAP (%)
Adopted	78,3	13,1	29,7	8,4
20% when B>Blim	65,5	15,5	28,8	7,0
Cmin=15kt	66,6	15,0	31,0	8,4
25%up-20% down when B>Blim	64,9	15,0	30,1	7,8
25%up-20% down when Blim<B<Bmsy	69,3	14,8	29,8	7,4
Carry over	89,9	7,1	28,0	29,4
Banking and borrowing	66.4	17.1	30.05	36.56

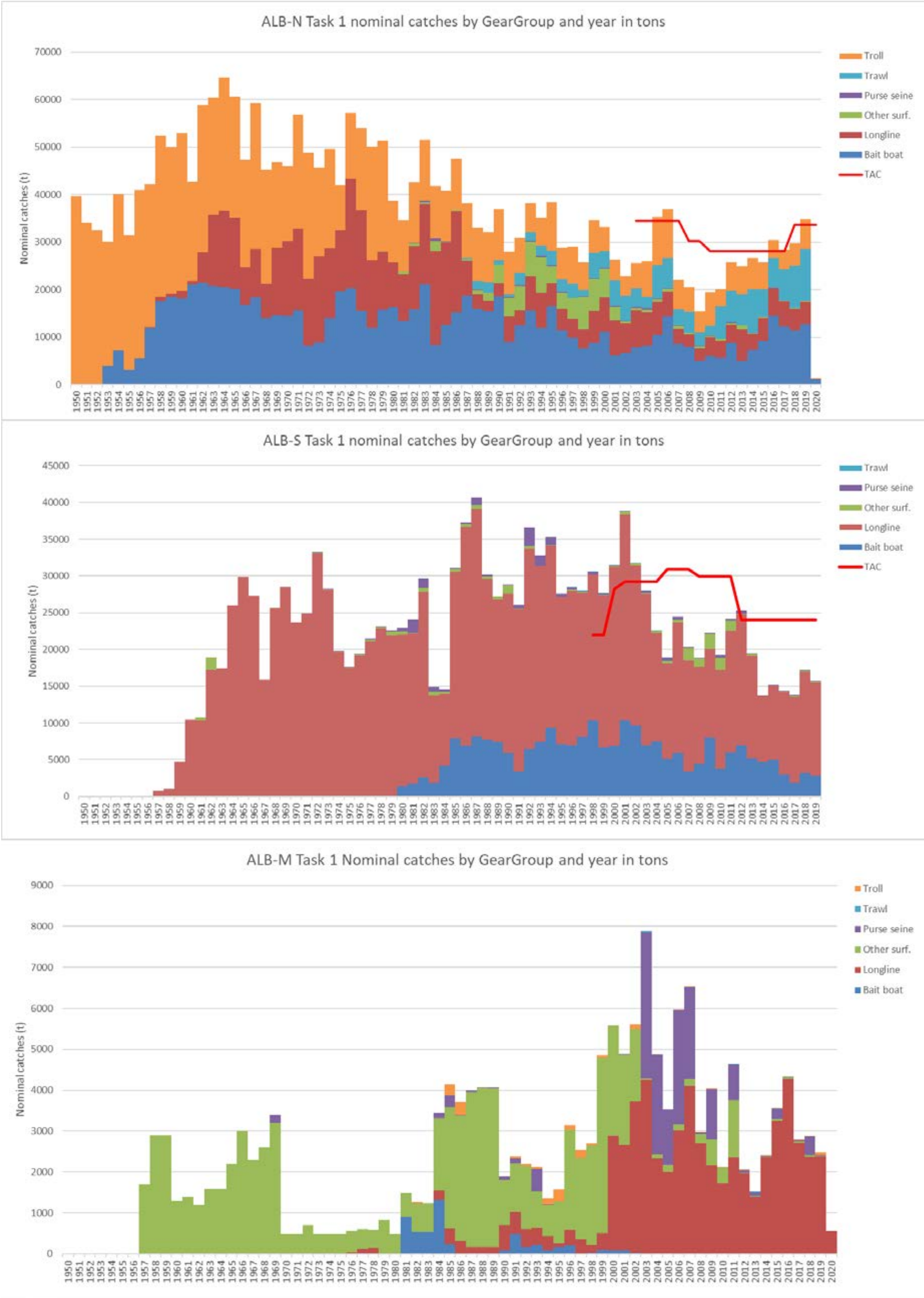


Figure 1 Albacore Task 1 nominal catches (T1NC, t) of each stock (ALB-N top, ALB-S centre, ALB-M bottom) by gear group and year. Data for 2020 are preliminary and incomplete.

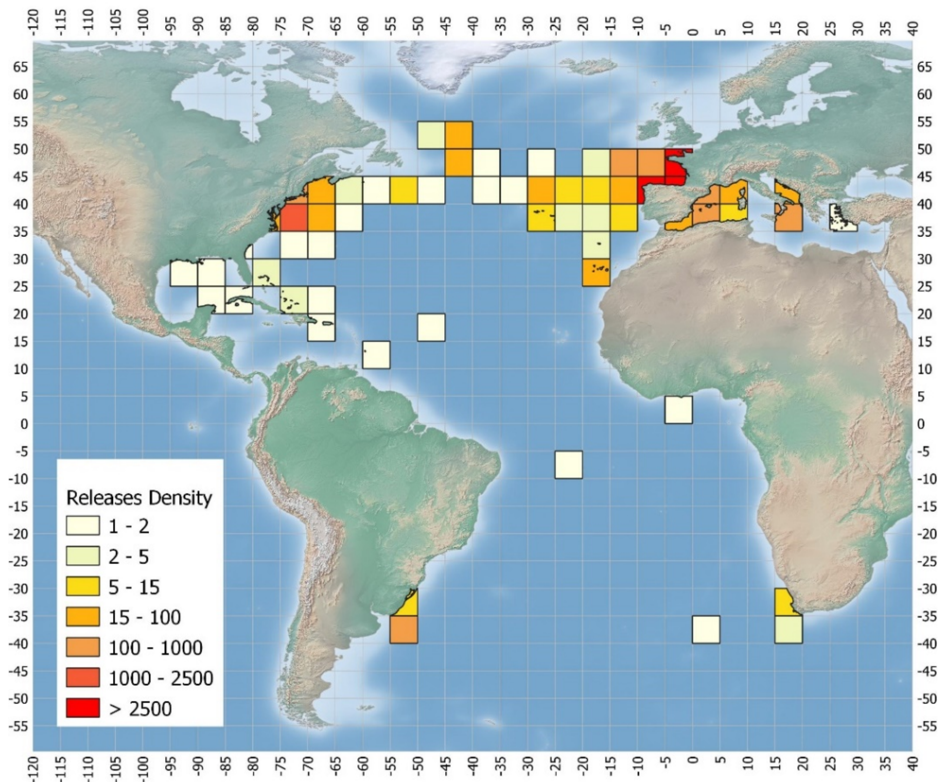


Figure 2 Density of ALB releases (5x5 square grid) in conventional tagging available in ICCAT.

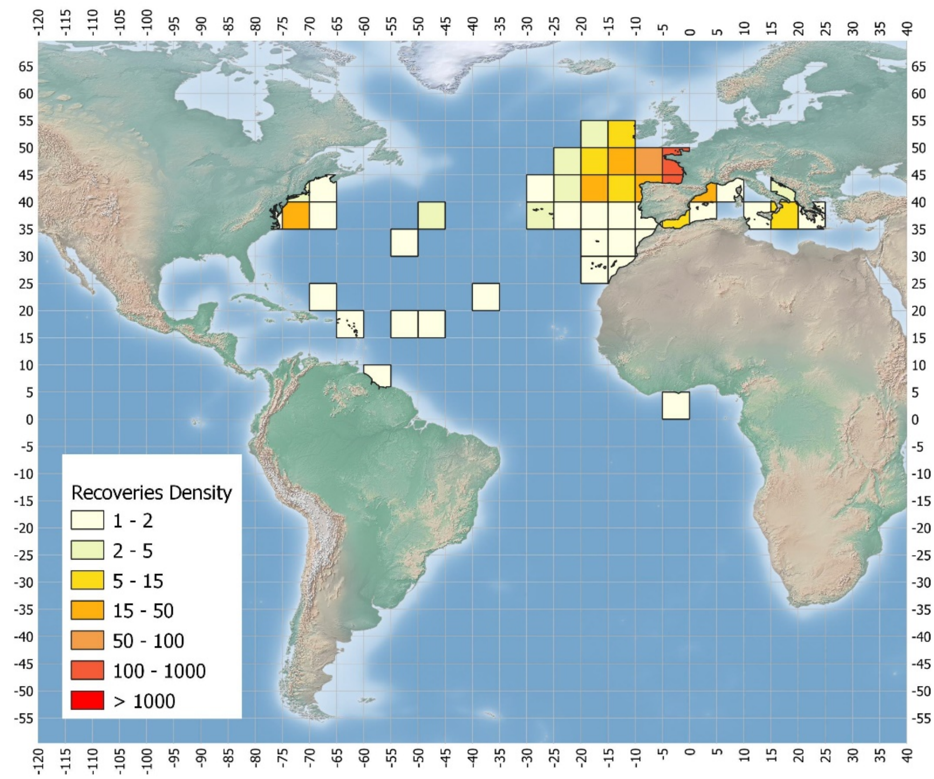


Figure 3. Density of ALB recoveries (5x5 square grid) in conventional tagging available in ICCAT.

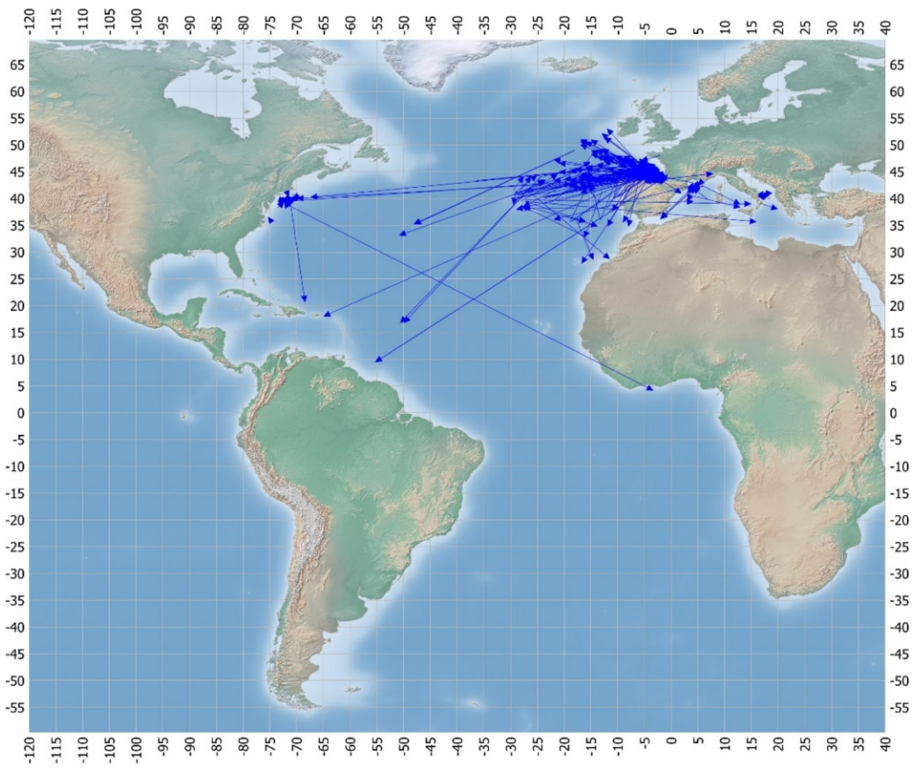


Figure 4. Straight displacement from the release to the recovery position (apparent movement) of the recaptured ALB specimens in the ICCAT conventional tagging database.

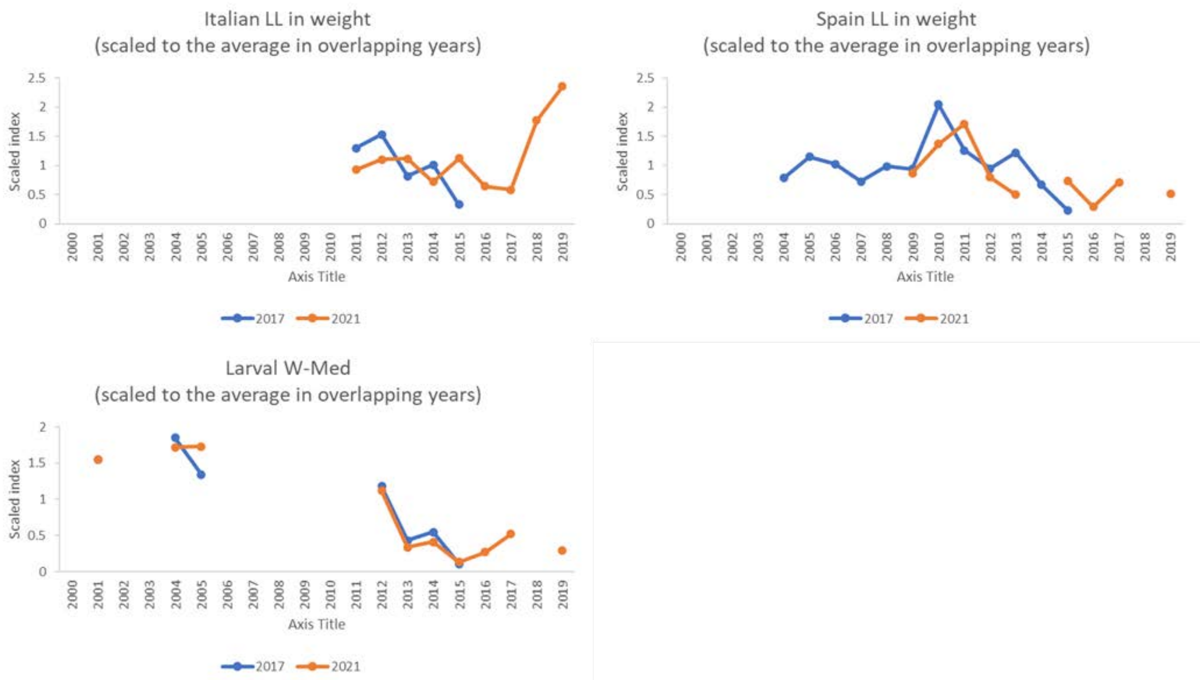


Figure 5. Comparisons of abundance indices used in the 2017 assessment (Italian longline, Spanish longline, and western Mediterranean larval index) between the 2017 values and the 2021 updated values.

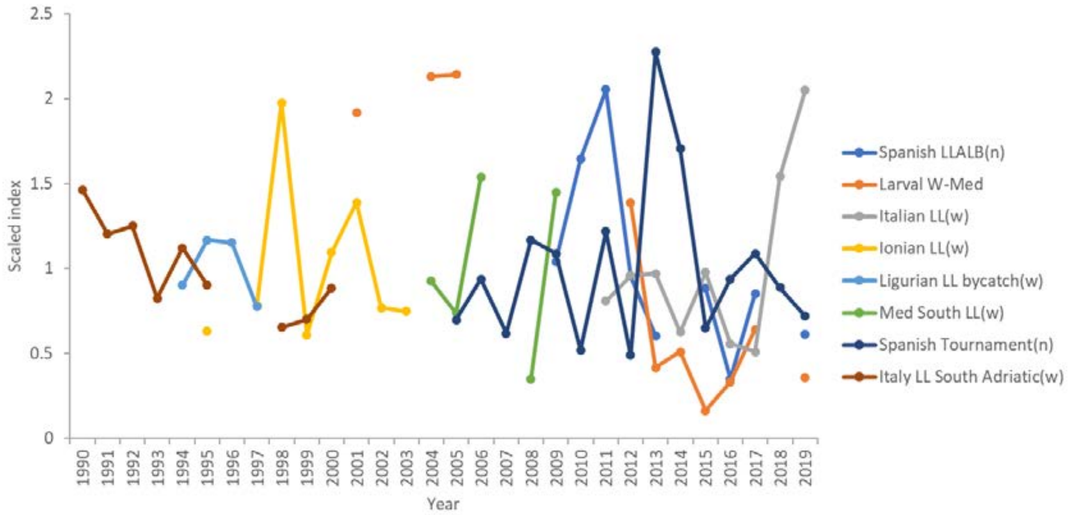


Figure 6. Abundance indices used in the final model for the 2021 Mediterranean albacore stock assessment.

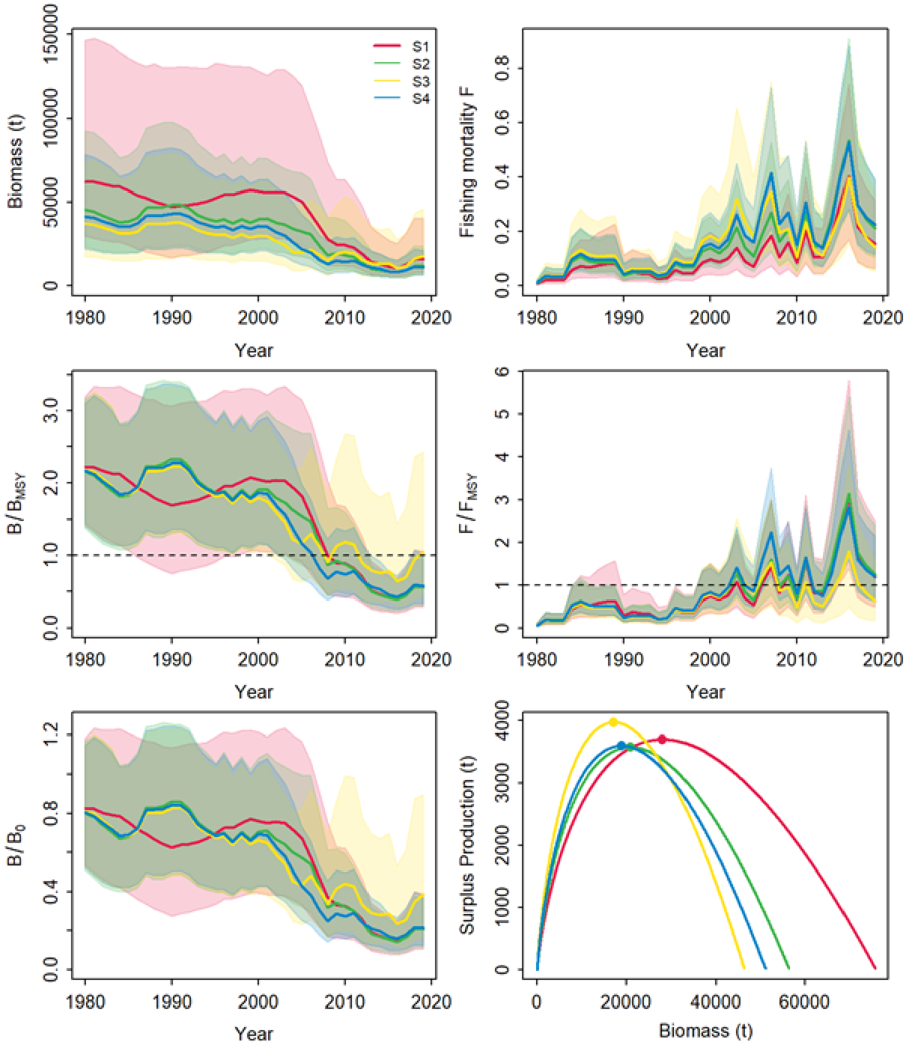


Figure 7. Comparisons of main results using JABBA for scenarios 1 to 4 for Mediterranean albacore.

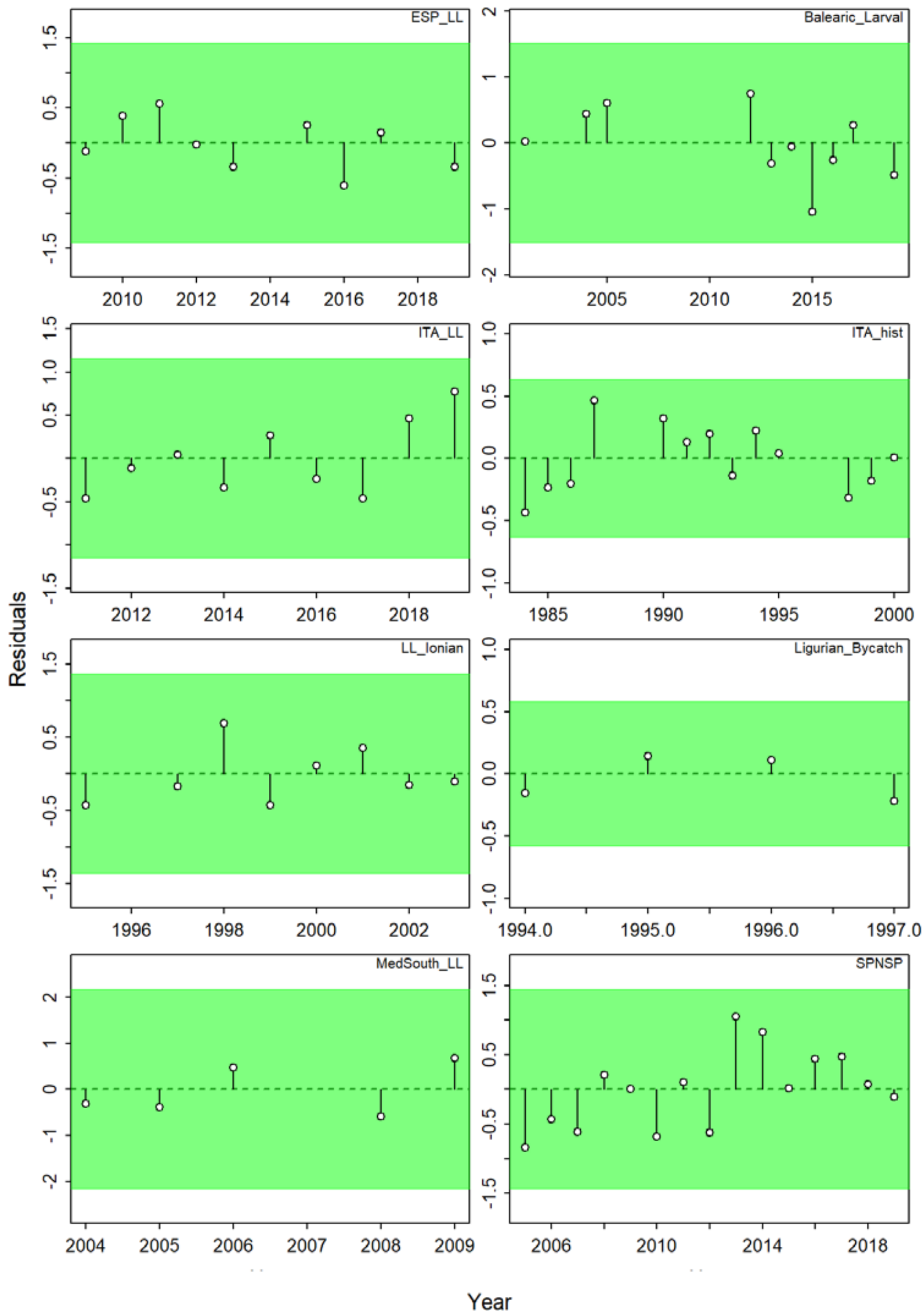


Figure 8. Runs tests to quantitatively evaluate the randomness of the time series of CPUE residuals for the final Mediterranean albacore model (S4). Green areas indicate no evidence of lack of randomness of time-series residuals (*p*>0.05), while red panels (not shown here) indicate the opposite. The inner shaded area shows three standard errors from the overall mean and red circles identify a specific year with residuals greater than this threshold value (3- sigma rule).

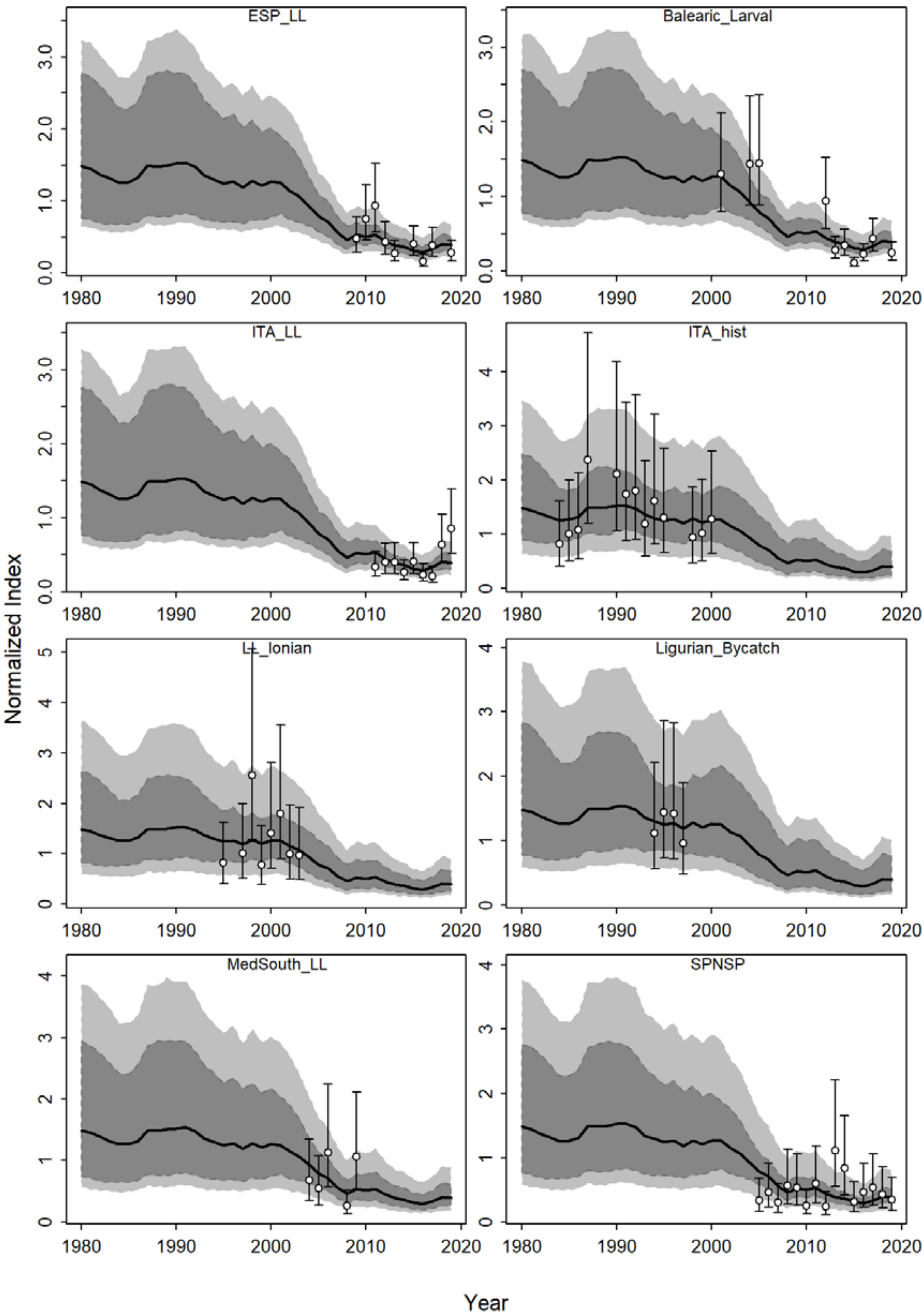


Figure 9. Time-series of observed (circle) with error 95% CIs (error bars) and predicted (solid line) CPUE. Dark shaded grey areas show 95% credibility intervals of the expected mean CPUE and light shaded grey areas denote the 95% posterior predictive distribution intervals.

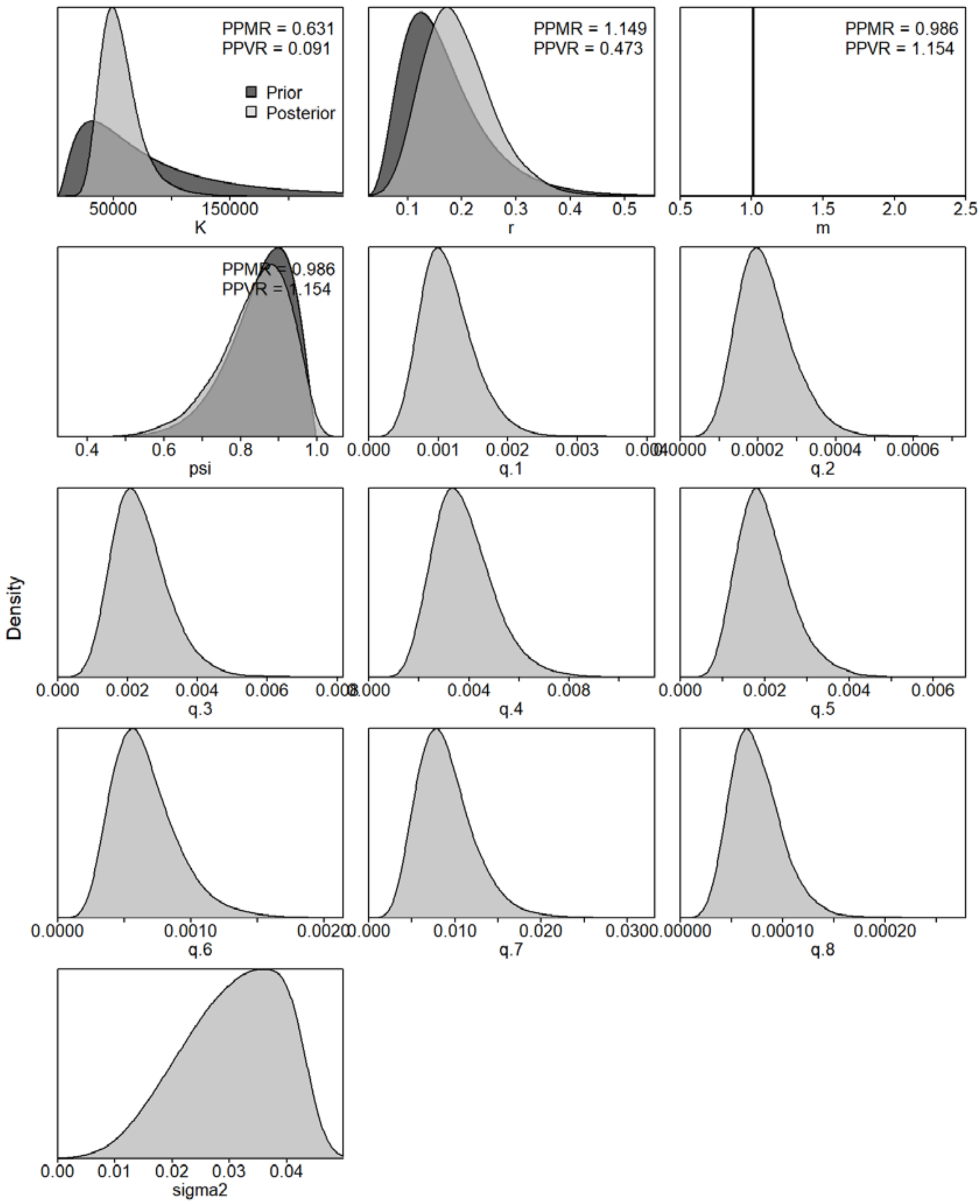


Figure 10. Prior and posterior distributions of the final model for Mediterranean albacore. PPRM: Posterior to Prior Ratio of Means; PPRV: Posterior to Prior Ratio of Variances.

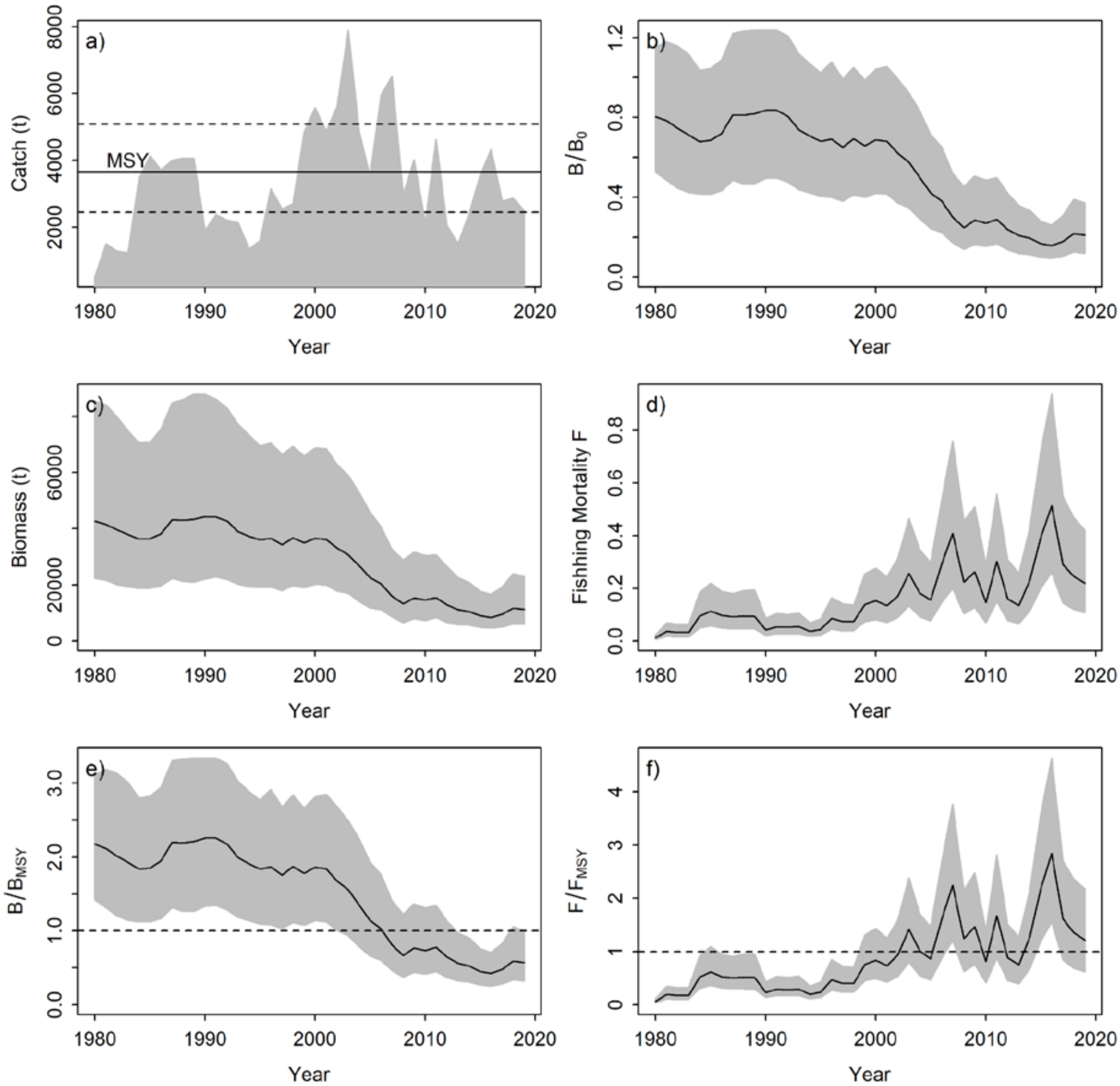


Figure 11. JABBA assessment final model (S4) results for the Mediterranean albacore. (a) Catch time series depicting the *MSY* estimate with associated 95% credibility interval (dashed line); (b) biomass relative to *B0* (B/B_0) (upper panels); (c) trends in biomass and (d) fishing mortality; (e) trends of biomass relative to *BMSY* (B/B_{MSY}); and (f) fishing mortality relative to *FMSY* (F/F_{MSY}).

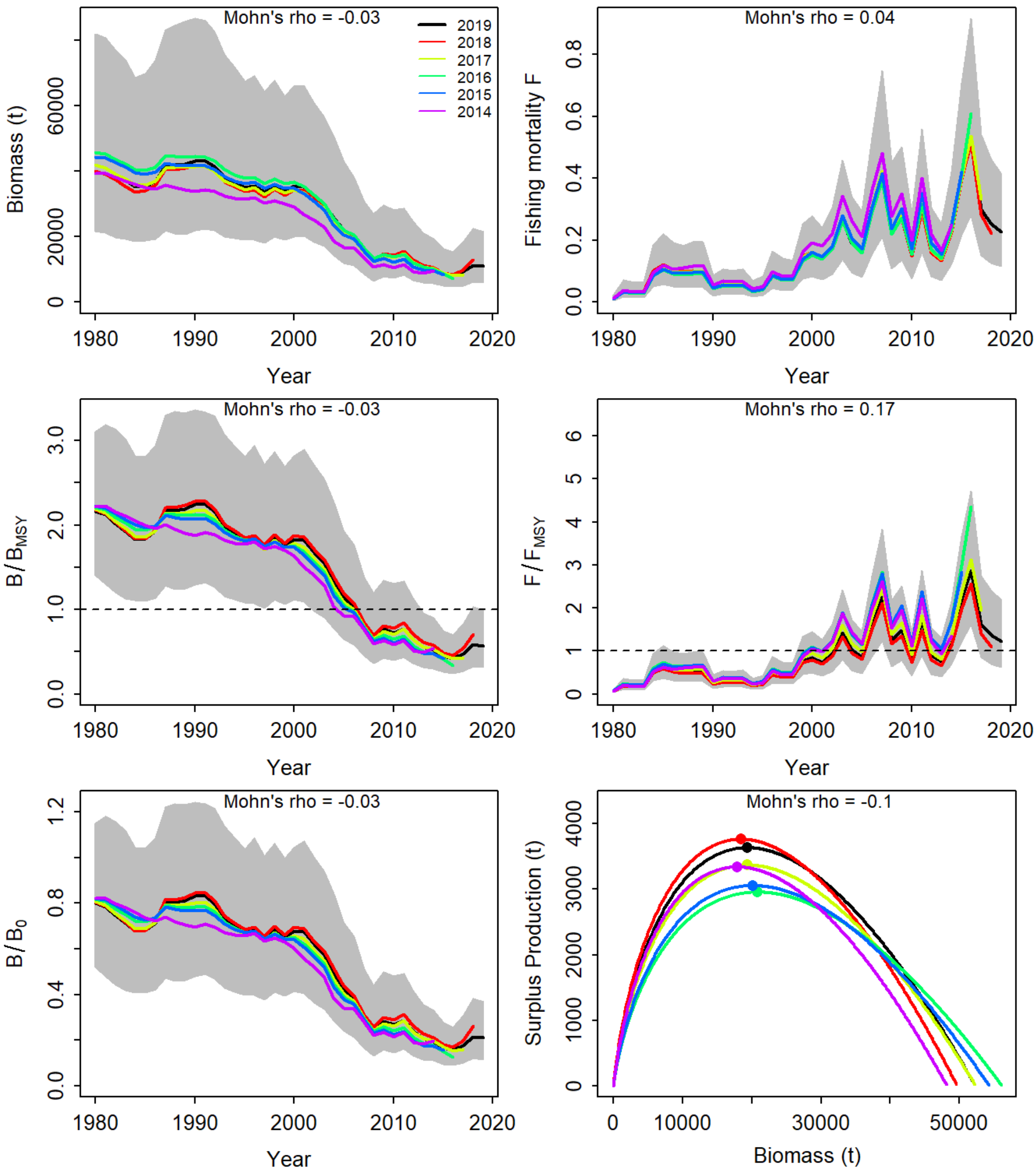


Figure 12. Retrospective analysis by removing one year at a time sequentially (n=5) and predicting the trends in biomass and fishing mortality (upper panels), biomass relative to B_{MSY} (B/B_{MSY}) and fishing mortality relative to F_{MSY} (F/F_{MSY}) (middle panels) and biomass relative to K (B/K) and surplus production curve (bottom panels) for each scenario from the Bayesian state-space surplus production model fits to Mediterranean albacore.

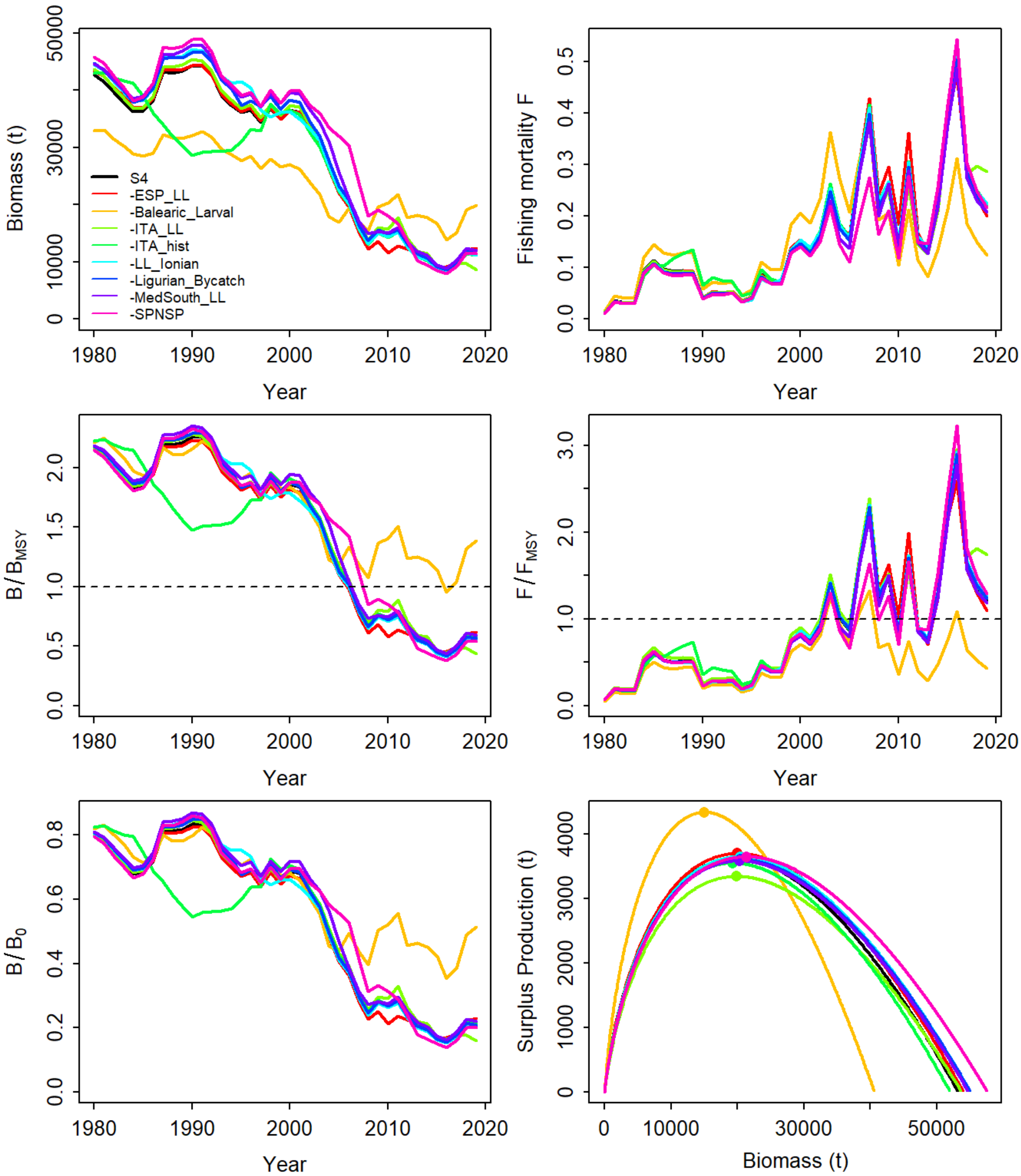


Figure 13. Jackknife index analysis by removing one CPUE fleet at a time and predicting the trends in biomass and fishing mortality (upper panels), biomass relative to B_{MSY} (B/B_{MSY}) and fishing mortality relative to F_{MSY} (F/F_{MSY}) (middle panels) and biomass relative to K (B/K) and surplus production curve (bottom panels) for each scenario from the Bayesian state-space surplus production model fits to Mediterranean albacore.

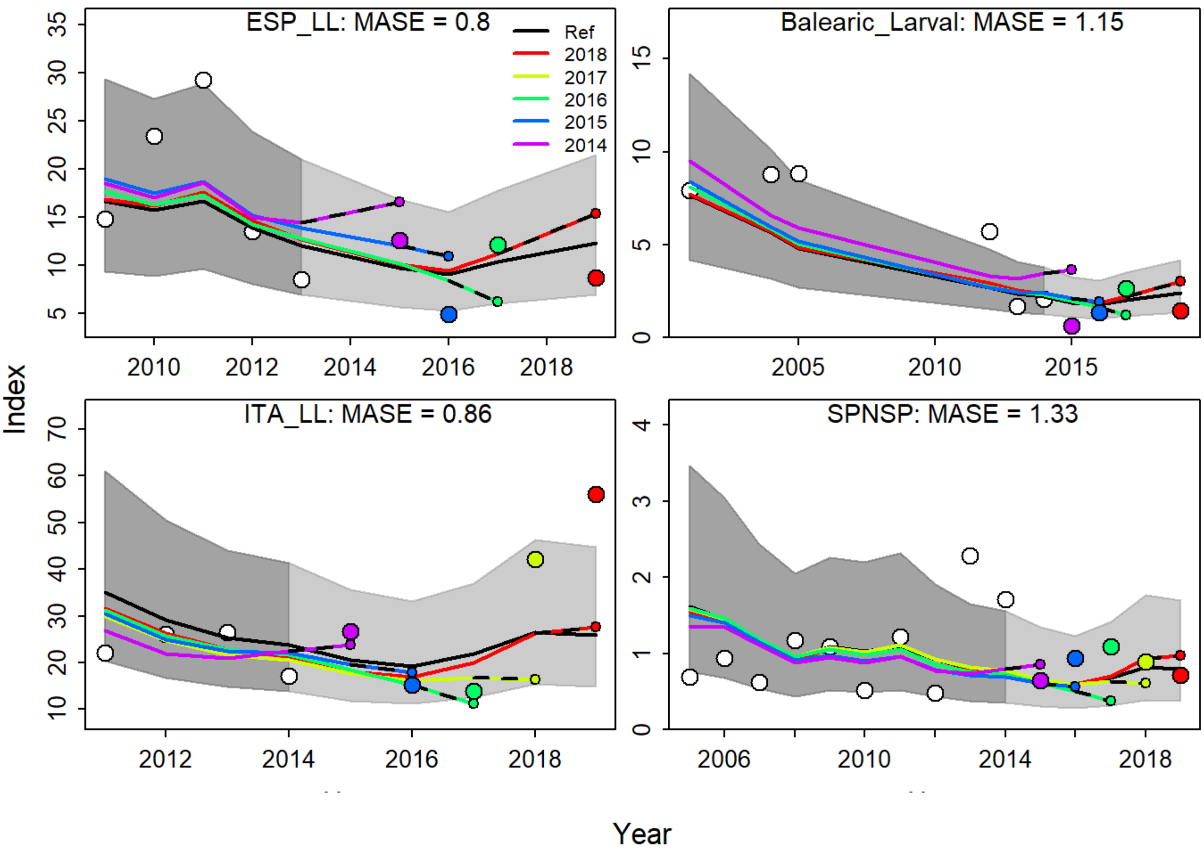


Figure 14. Hindcasting cross-validation results (HCxval) for Mediterranean albacore, showing one-year-ahead forecasts of CPUE values (2015-2019), performed with five model hindcast runs. The CPUE observations, used for cross-validation as prediction residuals, are highlighted as color-coded solid circles with an associated light-grey shaded 95% confidence interval. The model reference year refers to the end points of each one-year-ahead forecast and the corresponding observation (i.e., year of peel + 1).

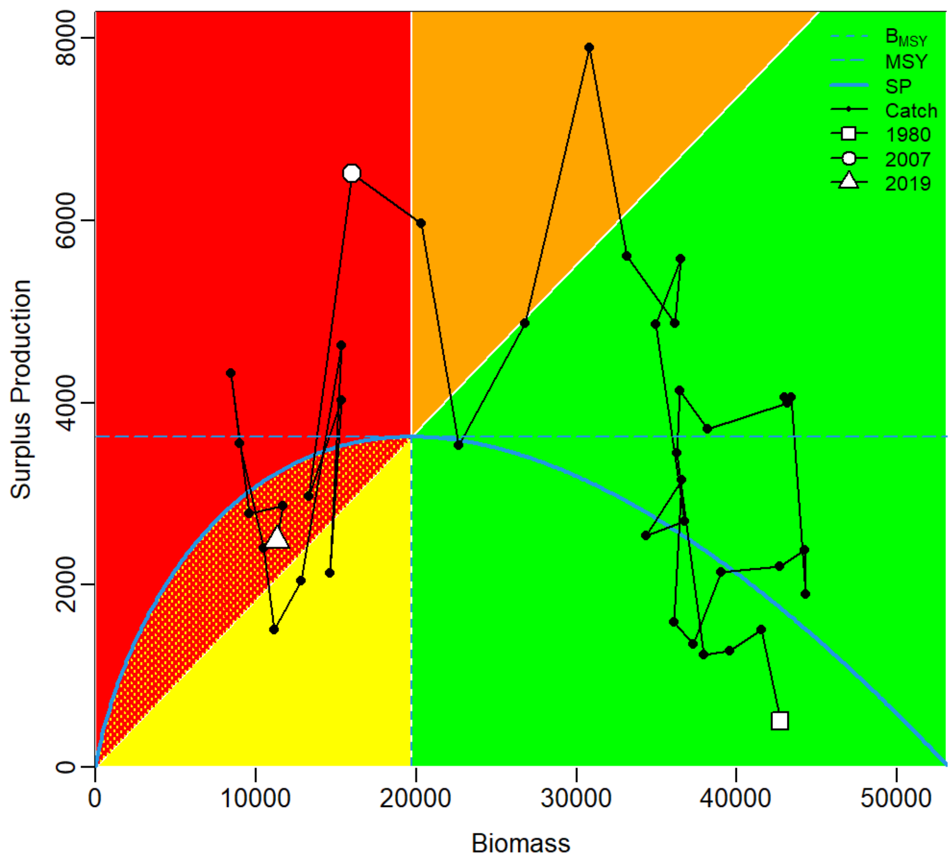


Figure 15. Surplus Production phase plot for Mediterranean albacore tuna stock showing estimated surplus production curve (SP) and catch/biomass trajectories relative to the reference points MSY and BMSY based on the JABBA base-case model S4). The plot shows that the current catch in 2019 is below the stock surplus production potential, for which the biomass is expected to increase on average under constant 2019 catches, although the stock is currently overfished and overfishing is occurring.

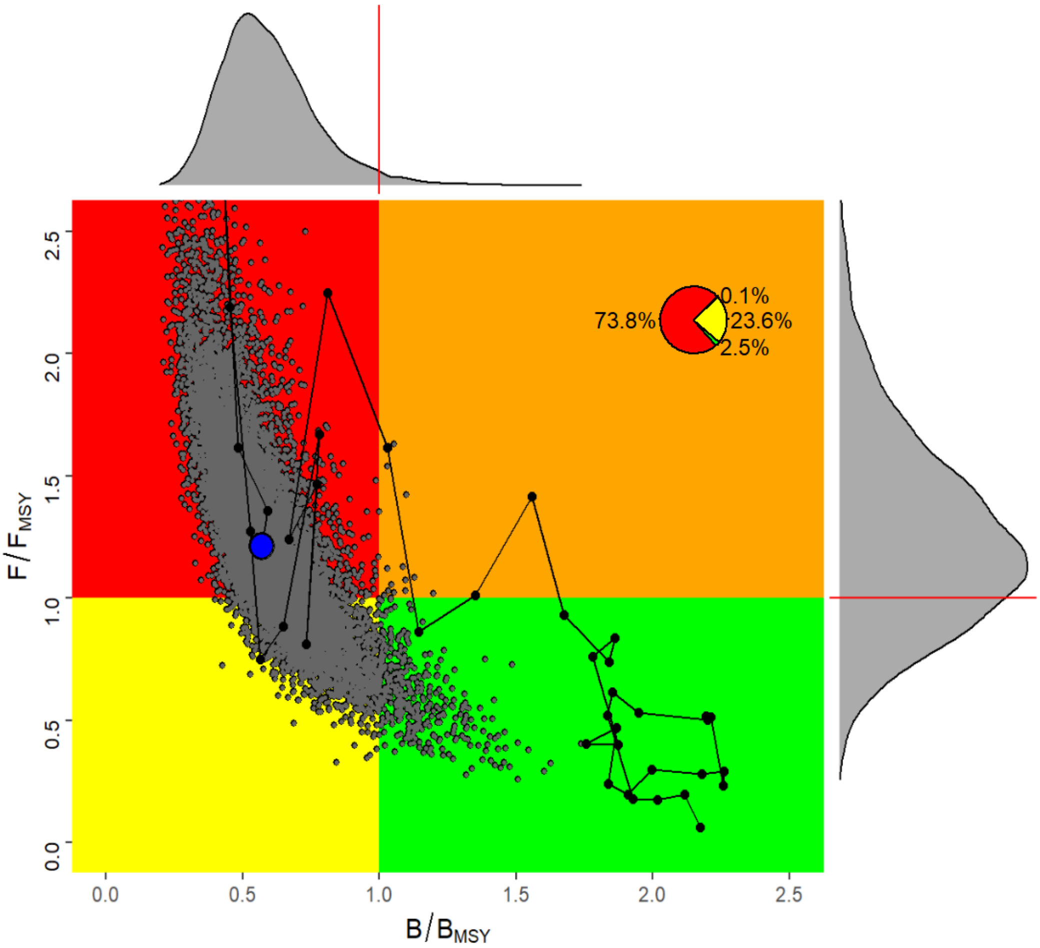


Figure 16. Mediterranean albacore. Stock status trajectories of B/B_{MSY} and F/F_{MSY} over time (1980-2019) with uncertainty around the current estimate (Kobe plots) for Bayesian surplus production model, as well as probability of being overfished and overfishing (red, 73.8%), of being neither overfished nor overfishing (green (2.5%), of being overfished but not overfishing (yellow, 23.6%) and of overfishing but not overfished (orange, 0.1%).

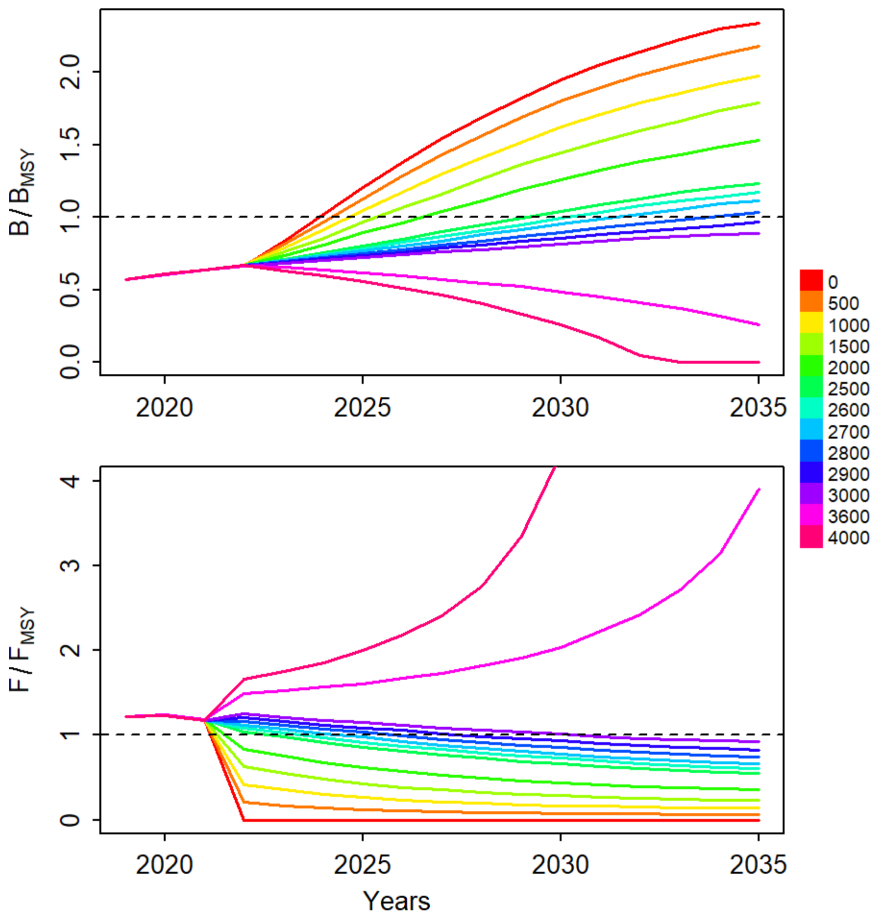
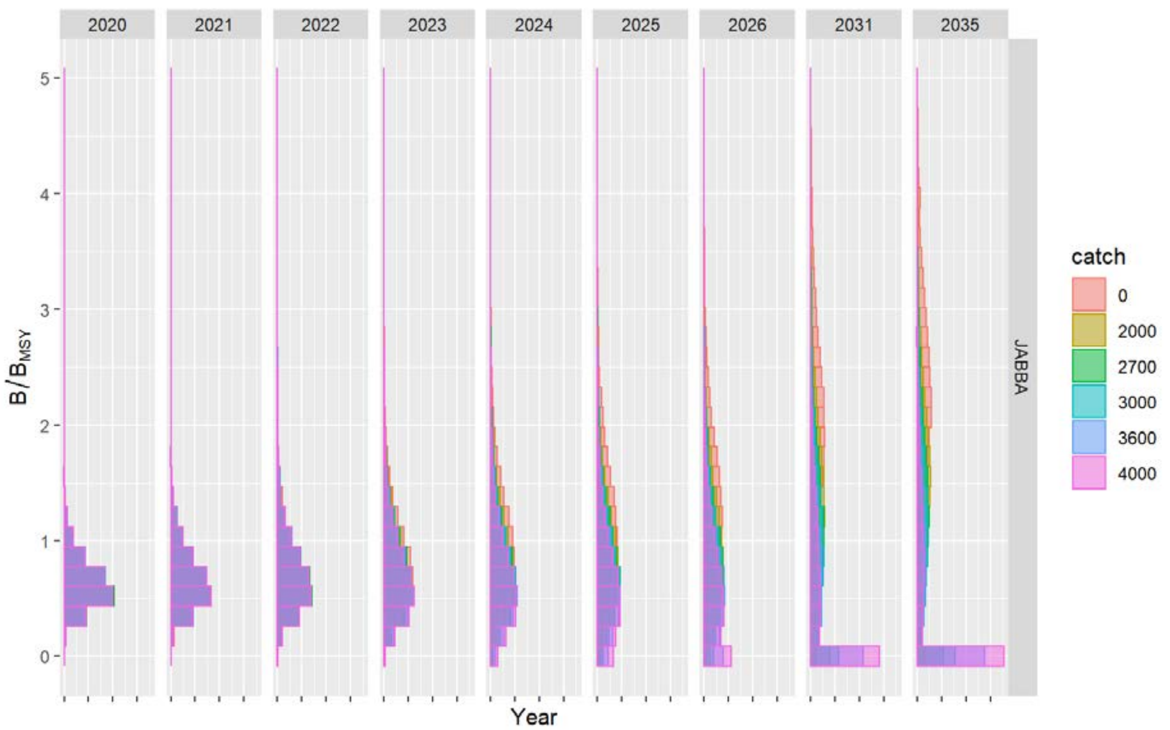


Figure 17. Trends of projected relative stock biomass (upper panel, B/BMSY) and fishing mortality (bottom panel, F/FMSY) for Mediterranean albacore under different fixed catch scenarios of 0 – 4,000 tons (MSY 3,600t, average catch 2017-2019 2,700t), based upon the projections of the JABBA final model (S4). Each line represents the median of 15,000 MCMC iterations by projected year.



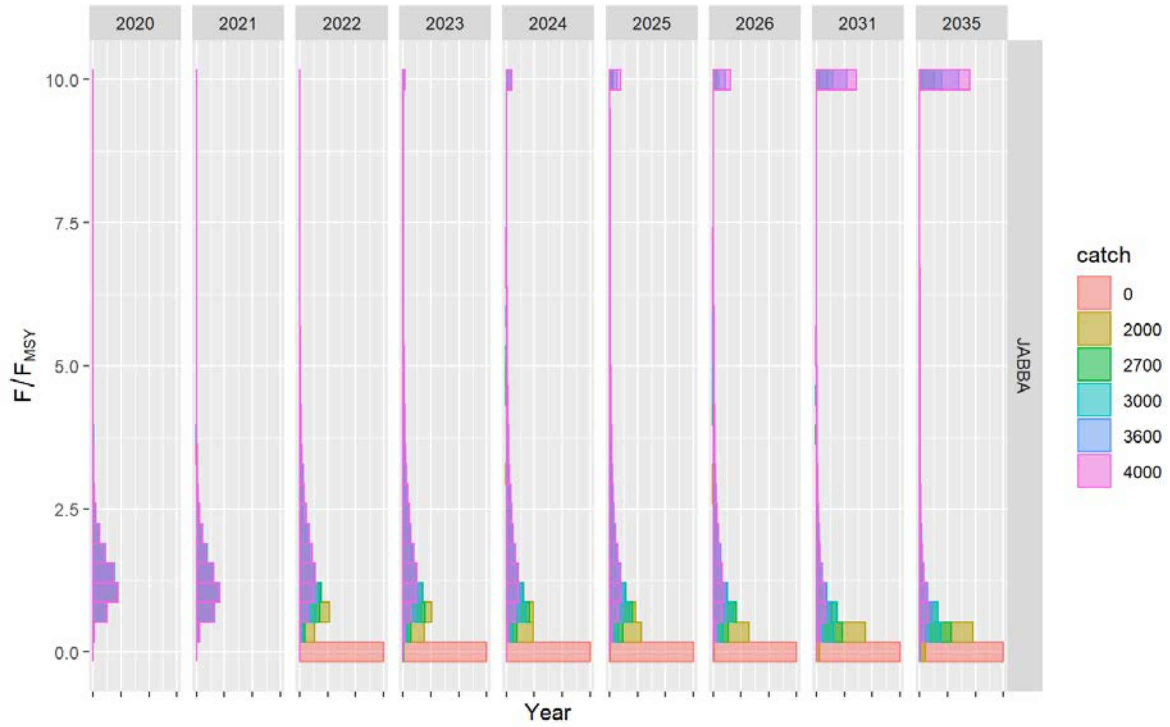


Figure 18. Posterior distribution of projected relative stock biomass (upper panel, B/B_{MSY}) and fishing mortality (bottom panel, F/F_{MSY}) of Mediterranean albacore for selected projection years of 2020-2035 and for selected fixed catch scenarios of 0 – 4,000 tons, based upon the projections of the JABBA final model (S4).

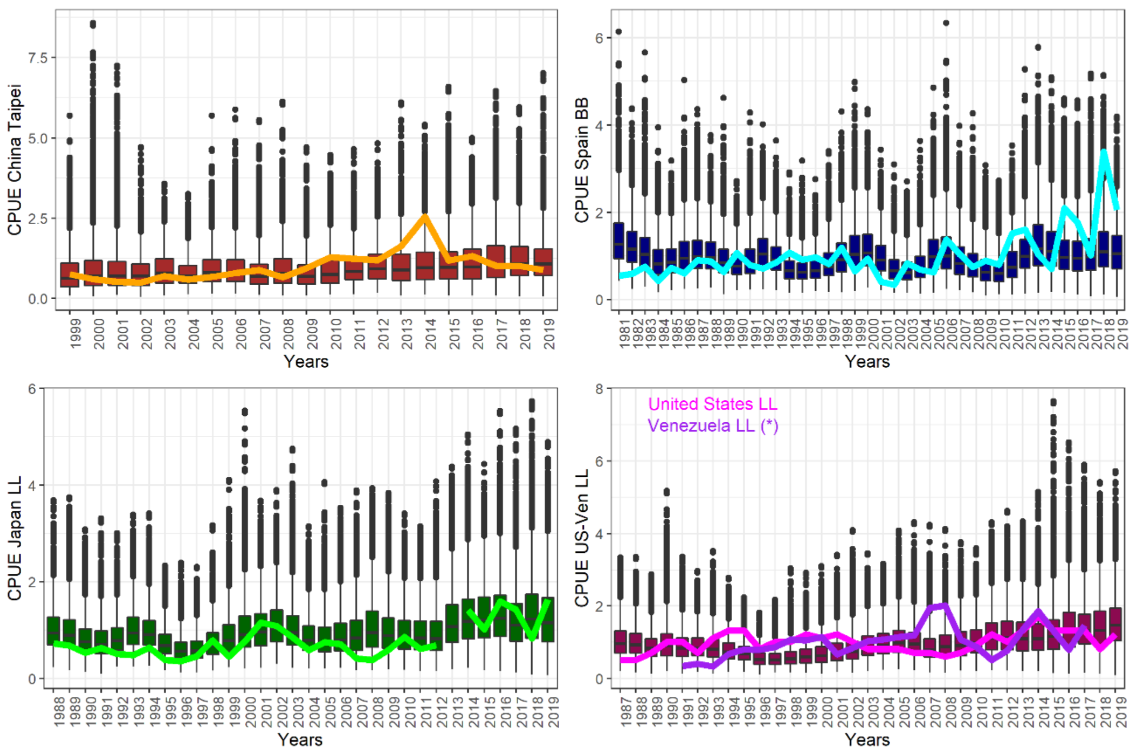


Figure 19. Boxplots of simulated CPUE values with overlaid updated CPUE time series.

Appendix 1

Adopted Agenda

1. Opening, adoption of the Agenda, and meeting arrangements

2. Review of fisheries statistics (Task 1 and Task 2) for Albacore stocks
   2.1. Secretariat database summary

3. Mediterranean Sea albacore
   3.1. Review of available and new information on biology and life-history
   3.2. Evaluation of relative indices of abundance for use in the stock assessment and final indices to use in the assessment.
   3.3. Mediterranean albacore stock assessment update
      3.3.1. Bayesian State-Space Surplus Production Model (JABBA)
      3.3.2. Final Stock Status Advice
   3.4. Management recommendations for Mediterranean albacore

4. North Atlantic albacore
   4.1. Evaluation of Exceptional Circumstances using proposed indicators.
      4.1.1. Catch
      4.1.2. CPUEs (Spanish baitboat, Japanese longline, Venezuela longline, US longline, Chinese Taipei longline)
   4.2. Towards a new reference case North Atlantic Albacore
      4.2.1. Data: catch, effort, CPUE, size, tagging, biology
      4.2.2. Stock Synthesis model structure
      4.2.3. Revised MSE Road Map N-ALB

5. Albacore research update and proposals:
   5.1. North Atlantic stock
      - Electronic tagging update
      - Update reproduction research studies
   5.2. South Atlantic stock
   5.3. Mediterranean stock

6. Responses to the Commission
   6.1. Panel 2 Exceptional Circumstances protocol

7. Recommendations on research and statistics.

8. Other matters

9. Adoption of the report and closure.

Appendix 2

List of Participants

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Appendix 3

List of SCRS Papers and Presentations

Reference	Title	Authors
SCRS/2021/090	Examination of Data Available for Developing a Benchmark Assessment and Operating Models for North Atlantic Albacore	Merino G., H. Arrizabalaga, A. Urtizberea, and Ane Laborda.
SCRS/2021/102	Standardized catch rates of albacore (*Thunnus alalunga* Bonnaterre, 1788) in the Spanish surface longline fishery in the western Mediterranean in the period 2009-2019	García-Barcelona S., Macías D., Saber S., Gómez-Vives M.J., Rioja P., and Ortiz de Urbina J.
SCRS/2021/103	Standardized catch rates of albacore (*Thunnus alalunga* Bonnaterre, 1788) in the Spanish recreational fishery in the western Mediterranean in the period 2005-2019	Saber S., D. Macías, S. García-Barcelona, M.J. Meléndez, M.J. Gómez-Vives, P. Rioja, D. Godoy, Miguel A. Puerto, J. Ortiz de Urbina
SCRS/2021/104	Standardized Catch Per Unit of Effort of Albacore (*Thunnus Alalunga*) in the North East Atlantic from the Spanish Bait Boat Fleet for Period: 1981-2019	Ortiz-de-Zarate V., and Ortiz M.
SCRS/2021/105	Review and Preliminary Analyses of Size-Frequency Samples of Mediterranean Albacore Tuna (*Thunnus alanlunga*)	Ortiz M., Mayor C., and Palma C.
SCRS/2021/106	Use of ALKs (Age Length Keys) of North Atlantic Albacore (*Thunnus Alalunga*) for Assessment Purposes	Ortiz-de-Zarate V., and Castillo I.
SCRS/2021/107	Main features of the Spanish albacore (*Thunnus alalunga*) fishery during 2019 in the north east Atlantic area.	Ortiz-de-Zarate V., and Parejo A.
SCRS/2021/108	Standardization of Albacore CPUE for South Atlantic Core Area by the Japanese Longline Fishery	Matsumoto T., Tsuda Y., and Matsubara N.
SCRS/2021/109	Review of Size Data for North Atlantic Albacore by Japanese Longline Fishery	Matsumoto T.
SCRS/2021/110	Unusual length frequencies in Mediterranean albacore (Thunnus alalunga) in 2019 and 2020	Di-Natale A.
SCRS/2021/111	Standardization of CPUE for North Atlantic Albacore by the Japanese Longline Fishery from 1959 to 2019	Matsubara N., Aoki Y., Tsuda Y., and Matsumoto T.
SCRS/2021/112	Standardized Indices of Albacore, *Thunnus alalunga*, from the United States Pelagic Longline Fishery	Lauretta M.
SCRS/2021/114	Updated Standardized CPUE of Albacore Tuna (*Thunnus alalunga*) caught in the Chinese Taipei Tuna Longline Fishery in the North Atlantic Ocean to 2020	Cheng C.Y., Su N.J., and Shiu Y.W.
SCRS/2021/115	Standardized Albacore Catch Rates from Italian Drifting Longline Fisheries	Pinto C., Mariani A., Camolese C., Dell'Aquila M., Di Natale A., Mangano A., Valastro M., De Florio M., and Garibaldi F.
SCRS/2021/116	Preliminary Stock Assessment of Mediterranean Albacore (*Thunnus alalunga*) Using	Winker H., Pinto C., and Kimoto A.

	the Bayesian State-Space Surplus Production Model JABBA	
SCRS/2021/117	Assessing the Spawning Stock Biomass of Albacore (Thunnus Alalunga) In the Western Mediterranean Sea From A Non-Linear Larval Index (2001-2019)	Alvarez-Berastegui D., Tugores M.P., Martín M.,Leyva L., Balbín R., Saber S., Macías D.1, Ortiz de Urbina J., Reglero P.
Number	Title	Authors
SCRS/P/2021/043	Updated North Atlantic albacore pop-up tagging research	Cabello M., Arregui I., Onandia I., Uranga J., Lezama N., Ortiz de Zarate V., Delgado de Molina R., Santiago J., Abascal F. and Arrizabalaga H
SCRS/P/2021/044	Reproductive Biology Study of North Atlantic Albacore (*Thunnus alalunga*), achievement summary.	V. Ortiz de Zárate, F. Arocha, Su, N-J, D. Macías, R. Delgado de Molina, D. Busawon, K. Gillespie, A. Hanke, H. Arrizabalaga

Appendix 4

SCRS Documents and Presentation Abstracts as provided by the authors

SCRS/2021/090. Examination of data available for developing a benchmark assessment and operating models for north Atlantic albacore. In 2020, the albacore working group recommended that a new benchmark assessment is developed for the North Atlantic albacore stock using Stock Synthesis. This benchmark configuration will also be used to build a new set of Operating Models for the North Atlantic albacore MSE. For this, we examine the information provided by the ICCAT Secretariat for different fisheries. The data available includes catch, size frequency, catch-per-unit of effort and tagging data. This examination aims to contribute to the specifications of the Stock Synthesis configuration, including the definition of fisheries, spatio-temporal stratification, and identification of key sources of information.

SCRS/2021/102. Standardized catch rates of albacore (Thunnus alalunga Bonnaterre, 1788) in the Spanish surface longline fishery in the western Mediterranean in the period 2009-2019. Standardized relative abundance indices of albacore (*Thunnus alalunga* Bonnaterre, 1788) caught by the Spanish surface longline (LLALB) in the western Mediterranean Sea were estimated for the period 2009-2019. Yearly standardized CPUE were estimated through Generalized Linear Mixed Effects Models (GLMM) under a negative binomial error distribution as-sumption. The main factors in the standardization analysis were year and season (quarter). The index shows an incresing trend from the beginning of the series (2009) to a maximum in 2011; following a decrease up to 2013, and a relatively stable trend fluctuating around a level three and a half times lower compared to the maximum abundance for the period 2013-2019.

SCRS/2021/103. Standardized catch rates of albacore (Thunnus alalunga Bonnaterre, 1788) in the Spanish recreational fishery in the western Mediterrarrean in the period 2005-2019. Catch and effort data from the Spanish recreational fishery in the Balearic Sea (Western Mediterranean) were analysed to estimate an index of relative abundance for albacore for the years 2005-2019. Standardized catch per unit effort (CPUE) in number were estimated through a General Linear Mixed Modeling (GLMM) approach under a negative binomial (NB) error distribution assumption. Nominal catch rates and a standardized abundance index are presented along with estimates of 95% confidence limits of the predicted means. These indices show an upward trend from the start of the series 2005 peaking in 2013; followed by a decrease until 2015. For the latest four-year period (2016-2019), the index shows a relatively stable trend fluctuating around a level two times lower than the maximum abundance recorded in the time series.

SCRS/2021/104. Standardized cath per unit of effort of albacore (Thunnus alalunga) in the north east Atlantic from the Spanish bait boat fleet for period: 1981-2019. Nominal catch of number of fish per unit of effort (CPUEs) of the North Atlantic albacore (*Thunnus alalunga*) caught by the Spanish bait boat fleet in the North Eastern Atlantic were collected by trip for the period 1981-2019. Standardized index was estimated using Generalized Linear Random Effects Model (GLMM) with log-normal error distribution. The year*month interaction term and year*zone interaction term were included in the model as random effects to derive the annual standardized catch rates as relative index of abundance for 1981 - 2019.

SCRS/2021/105. Review and preliminary analyses of size-frequency samples of Mediterranean albacore tuna (Thunnus alanlunga). Size frequency data of the Mediterranean albacore was reviewed, and a preliminary analysis was performed for its potential use within the stock evaluation models. The size samples were revised, standardized, and aggregated to size frequencies samples by, main gear type, calendar year, and quarter. Preliminary analyses use the number of size samples and indicators of distribution shape (skewness and kurtosis) to evaluate the suitability of a size-frequency sample. Limited size samples are available before the 1990s, and the number of samples has reduced significantly in recent years. Overall, most of the fish caught is between 58 and 90 cm

SFL, with a median of 73 cm SFL. For the Mediterranean albacore stock, currently, the size-frequency samples from the major target fishing gear suggest a passing of annual cohorts in the fishery

SCRS/2021/106. Use of ALKs (Age Length Keys) of north Atlantic albacore (Thunnus alalunga) for assessment purposes. First dorsal fin rays were collected at certain fishing ports during stratified random sampling of length (SFL, cm) of albacore commercial catches landed by the Spanish surface fleets, bait boat and troll vessels operating in the Bay of Biscay and North eastern Atlantic fishing grounds Fin ray sections were processed and aged by direct reading and counting of annual annuli to obtain the age structure for the albacore age sample. The pair of length-age observations obtained were used to construct annual age-length keys (ALKs) for those years. Albacore matrices (ALKs) were derived for some selected years: 2008, 2009, 2010, 2011and 2012, to be used in the Stock Synthesis for modeling of the North Atlantic albacore stock in the assessment session in 2021.

SCRS/2021/107. Spanish albacore (Thunnus alalunga) surface fishery in the northeastern Atlantic, summary description in 2019. The main features of the Spanish albacore (*Thunnus alalunga*) surface fishery in 2019 were summarized. Fishing activity took place during summer from June to August operating in offshore waters of the Northeast Atlantic and in the Bay of Biscay. Albacore was targeted by the troll fleet from June to August, mostly in offshore waters of the Northeast Atlantic and bait boats in the Bay of Biscay. In 2019, the catch of the bait boat fleet decreased 11 % while the troll fleet increased 31% compared to the catch in year 2018. The size composition of catches taken by bait boats and troll fleets in 2019, showed a high proportion of age 2 group, followed by higher proportion of age 3 and a lowest proportion of age 1 group albacore. Monthly spatial distribution of nominal catch rates were presented for both fleets. The fishing season was short, at the end of August it came to an end due to consumption of quota.

SCRS/2021/108. Standardization of albacore CPUE for south Atlantic core area by the Japanese longline fishery. Standardization of CPUE for south Atlantic albacore (*Thunnus alalunga*) caught by the Japanese longline fishery from 1994-2020 was conducted using GLM with lognormal error structure, based on revised methods from the previous studies. The core area (main fishing ground for albacore, in the southeast Atlantic) was selected and used, which is different from those in the previous studies. Effects of year, month, five-degree latitude and longitude blocks, fishing gear (number of hooks between floats), line material and vessel ID were incorporated. The effect of month was largest followed by year and main line material effects. The albacore zero catch ratio was low after mid 2000s and the proportion in the catch and CPUE of albacore were high from 2008 in the core area. Standardized CPUE sharply increased during 2004-2008, and remained at a high level with fluctuation after that.

SCRS/2021/109. Review of size data for north Altantic albacore by Japanese longline fishery. The status of data collection and fish size was summarized for the size of albacore caught by Japanese longline fishery operating in the north Atlantic Ocean. Size sampling of albacore is conducted on board by fishermen and scientific observers. Annual number of fish sampled and main sampling area differed depending on periods. The fish mainly ranged between 70cm and 120cm FL. Information on sex is not available for most of the fish, but the proportion of males increased around 75cm and 120cm. Fish size became smaller as latitude got higher and a large difference was observed between north of and south of 30°N. There was difference of fish size by decade and quarter, which may have been induced by different sampling areas.

SCRS/2021/110. Unusual length frequencies in Mediterranean albacore (Thunnus alalunga) in 2019 and 2020. For decades,Mediterranean albacore showed size distribution, modes and average lengths with almost stable values over the years, with slightly bigger individuals in the southern Tyrrhenian Sea, compared with those fished south of the Strait of Messina. In 2019 and 2020 there was the presence of unusally big size classes in all areas, without any clear motivation. This short paper reports the details of these size frequencies, also adding some useful notes about the important changes of fishing strategies for albacore in the most important Mediterranean fishing fleet for these species.

SCRS/2021/111. Standardization of CPUE for north Atlantic albacore by the Japanese longline fishery from 1959 to 2019. Standardized CPUE of north Atlantic albacore (*Thunnus alalunga*) caught by the Japanese longline fishery was summarized in this document. Standardized CPUE was calculated based on the same methods from the previous studies. Considering the availability of logbook database and albacore targeting, CPUE were analyzed by three periods (1959-1969, 1969-1975, 1975-2019). Effects of year, quarter, subarea, fishing gear (number of hooks between floats) and some interaction were considered for analysis of CPUE. Recent trends (2016-2019) of updated north Atlantic albacore CPUE of Japanese longline were slightly higher than the average of last ten decade (2009-2019).

SCRS/2021/112. Standardized indices of albacore, Thunnus alalunga, from the United States pelagic longline fishery. Catch and effort data from the United States pelagic longline fishery operating in the Atlantic Ocean were analyzed to estimate an index of albacore relative abundance. The standardized index was updated for the period 1987 to 2020, with no change in methods from the previous analysis. The updated time series and model diagnostics are presented. Overall, the index indicated an upward trend since the last analysis, with a strong effect of the standardization in 2020 to account for low sampling effort in quarter 2 and shift in spatial coverage of longline sets.

SCRS/2021/114. Updated standardized CPUE of albacore tuna (Thunnus alalunga) caught in the Chinese Taipei tuna longline fishery in the north atlantic ocean to 2020. Catch and effort data of albacore tuna (*Thunnus alalunga*) were standardized for the Chinese Taiepei tuna longline fishery in the North Atlantic Ocean using a generalized linear model (GLM). The recent period from 1999 to 2020 was considered in the CPUE (catch per unit of effort) standardization for albacore, which potentially takes the issue of historical change in targeting for this fishery into account. Standardized CPUE of albacore developed using data in recent years showed almost identical trends to those derived from the previous one. The standardized CPUE of albacore in the North Atlantic Ocean started to increase slightly from late 1999 until 2014 and then decreased to a relatively stable level during 2015 2020. In general, the trend remains stable over the recent decade from 2010 to 2020.

SCRS/2021/115. Standardized albacore catch rates from Italian drifting longline fisheries. Indices of abundance of albacore (*Thunnus alalunga*) from different Italian seas and periods are presented. Three new indices, respectively from the Ligurian Sea (1994-1997), the Ionian Sea (1995-2003) and Southern Mediterranean waters (2004-2009) were obtained. The Italian longline fishery index presented in 2017 is updated using the time series up to 2019 (2011-2019). Annual standardized indices were estimated applying Generalized Linear Modelling techniques including the Year, Month and Area (when meaningful) of fishing as predictor variables to be consistent with the method used in 2017. The index covering the period between 2015 and 2019 shows an increasing Catch Per Unit Effort (CPUE) rate in the last two years.

SCRS/2021/116. Preliminary stock assessment of Mediterranean albacore (Thunnus alalunga) using the bayesian state-space surplus production model JABBA. Bayesian State-Space Surplus Production Models were fitted to Mediterranean albacore (Thunnus alalunga) catch and relative abundance indices using the 'JABBA' R package. This document presents details on the model diagnostics and stock status estimates for two preliminary scenarios, S1 and S2. S1 was fitted to the three indices used in 2017 and S2 also included fits to four historical indices. The prior assumptions in and a Fox production function were kept consistent with the last assessment in 2017. We evaluated model plausibility using four objective model diagnostics: (1) model convergence, (2) fits to the data, (3) consistency (e.g., retrospective patterns) and (4) prediction skill. Our results suggest that S2 represents the most plausible candidate model. The most notable improvement compared to the alternative scenarios is a substantially reduced retrospective bias and reduced uncertainty about the absolute biomass estimates. Additional sensitivity runs indicated that the S2 model was robust to alternative productivity and variance assumptions, while a Jackknife analysis revealed that either removing Balearic larval index or the Italian long-line index had the strong effects on the stock status estimates.

SCRS/2021/117. Assessing the spawning stock biomass of albacore (thunnus alalunga) in the western Mediterranean Sea from a non-linear larval index (2001-2019). Larval abundance indices express retrocalculated abundances of larval densities at hatching time. They provide a proxy for assessing spawning stock biomass and are applied to assess population status of various species in the Gulf of Mexico and in the Balearic Sea. Recently, the methodological approach to calculate the indices was improved to accomodate for non-linear responses of environmental effects on catchability. This improved methodology is routinely applied in the Balearic Sea to assess the bluefin tuna (Thunnus thynnus) spawning stock biomass. Here we apply the same methodology to update the larval index of albacore (Thunnus alalunga) from surveys conducted from 2001 to 2019 in the Balearic Sea, the most relevant spawning ground of this species in the Western Mediterranean. Albacore larval abundances show a decreasing trend and significant lower abundances from 2013 onwards, despite a slight recovery between 2016 and 2017. This larval index, standardized for gears, sampling coverage, salinity, date and sea surface temperature, provides information on the dynamics of the western Mediterranean stock of albacore, which is considered a data poor stock.

Appendix 5

Consolidated Report for North Atlantic Albacore Management Strategy Evaluation Version 21-1: June, 2021

The consolidated report for the North Atlantic albacore MSE is a living document that is under constant modification. The most recent version of the document (Version 21-1: June, 2021) can be found here.