Report of the ICCAT 2023 North Atlantic Albacore Data Preparatory Meeting (including MSE)

(hybrid, Pasaia, Spain, 20-23 March 2023)

1. Opening, adoption of agenda and meeting arrangements

The hybrid meeting was held in-person at the AZTI Laboratory in Pasaia, Spain, and online, from 20 to 23 March 2023. The Atlantic Albacore Rapporteur and meeting Chairman Dr Hariz Arrizabalaga (EU-Spain), opened the meeting and welcomed participants. Dr Miguel Neves dos Santos (ICCAT Assistant Executive Secretary) addressed the Group on behalf of the ICCAT Executive Secretary, welcomed the participants, and thanked AZTI for hosting the meeting.

The Chairman proceeded to review the Agenda which was adopted with some changes (**Appendix 1**). The List of Participants is included in **Appendix 2**. The List of papers and presentations presented at the meeting is attached as **Appendix 3**. The abstracts of all SCRS documents and presentations presented at the meeting are included in **Appendix 4**. The following participants served as rapporteurs:

Sections	*Rapporteur*
Items 1 and 10	M. Ortiz and A. Kimoto
Item 2	I. Artetxe-Arrate, V. Ortiz de Zarate, P. Lastra Luque
Item 3	C. Mayor, C. Palma, M. Ortiz, J. Garcia, S. Cass-Calay
Item 4	T. Matsumoto, V. Matter, A. Kimoto, S. Cass-Calay
Item 5	A. Urtizberea, G. Merino
Item 6	G. Merino
Item 7	H. Arrizabalaga
Item 8	H. Arrizabalaga
Item 9	C. Brown

2. Review of historical and new information on biology

Some new information on biology was made available to the Group (SCRS/2023/032). Updated information on the biological parameters for North Atlantic albacore (*Thunnus alalunga*) (N-ALB) stock is provided in **Table 1**.

The last stock assessment carried out with an integrated model (Anon., 2014) for North Atlantic albacore had considered a constant natural mortality (M) of 0.3, as well as an age-specific natural mortality vector. SCRS/2023/032 performed a comprehensive bibliographic review to compile and synthesize current available scientific information up to date on some life history traits of North Atlantic albacore tuna that mostly influence the estimation of M such as growth, longevity, and age-at-maturity (see Table 1 in SCRS/2023/032) and provided updated estimates of M and M-at-age for the albacore tuna from the North Atlantic Ocean using two approaches (1) size-dependent mortality at age following the Chen and Watanabe (1989) equation, and (2) age-dependent mortality-at-age following the Hamel and Cope (2022) equation that included maximum age (A_{max}). For the first approach, parameters were obtained from the growth model equations of Santiago and Arrizabalaga (2005) where $L\infty$ = 122.198 cm; k = 0.21; t_0 = -1.338, and the growth model from Bard (1981) where $L\infty$ = 124.74 cm; k = 0.23; t_0 = -0.9892. For the age-dependent estimation of M, two values of A_{max} were used, 13 and 15 years, being the maximum age observed for North Atlantic albacore tuna and the oldest albacore tuna reported in the literature, observed in the Pacific, respectively. Following the Hamel and Cope (2022) equation, the two estimates of M were 0.415 and 0.36. Then age-dependent vectors were estimated using the Lorenzen (2006) approach using age 6 as reference age. Age 6 corresponds to the age group with 100% maturity for North Atlantic albacore. Overall, results show variations in the estimates, with size-dependent mortality estimates resulting in lower M-at-age, but overall, all the estimates were above 0.2 regardless of the age and approach.
The Group noted that the M at age considering both growth curves (Bard (1981) and Santiago and Arrizabalaga (2005)) did not differ considerably, and the Group agreed to keep the one based on Santiago and Arrizabalaga (2005) parameters in **Table 1**, which is consistent with the growth curve currently used.

It was clarified that M estimates based on Hamel and Cope (2022) were based on the regression for all taxa, as it did not include a specific one for tuna species.

The Group welcomed this study and agreed to use natural mortality at age estimates for North Atlantic albacore tuna instead of a fixed value. For the base case, it was decided to use the Lorenzen curve with A_{max} 15 (*Lorenzen_Hamel_Amax_15*). For sensitivity analysis and to represent the range of uncertainty in these estimates, the curves by Chen and Watanabe (1989) with growth parameters from Santiago and Arrizabalaga (2005) as well as the Lorenzen curve with A_{max} of 13 years (*Lorenzen_Hamel Amax_13*) were agreed as initial option.

The Group also discussed about the necessity of having a good representation of largest sized individuals (100s to 1000s fish) for obtaining better estimates of A_{max} and L_{∞}. In addition to that, the Group suggested to consider the application of new methods that might help to verify A_{max}.

No new information on fecundity was presented, and the Group recommended assuming fecundity to be proportional to weight.

The Group agreed that many of the critical biological parameters for North Atlantic albacore need further study (i.e., reproductive biology). This lack of knowledge underpins the advice of the SCRS since biological parameters are a critical input in the stock assessment models currently used by the Group. The Albacore Year Programme (ALBYP) aims to increase biological knowledge to improve the quality of scientific advice and reduce the uncertainty associated with it.

3. Review of fishery statistics/indicators

The Secretariat presented to the Group the most up-to-date fishery statistics (T1FC: Task 1 fleet characteristics; T1NC: Task 1 nominal catches; T2CE: Task 2 catch and effort; T2SZ: Task 2 size samples; T2CS: Task 2 catch-at-size reports by CPCs) and tagging (CTAG: detailed conventional tagging data; ETAG: electronic tagging data (inventory only)) information on albacore stocks (N-ALB: North Atlantic stock; S-ALB: South Atlantic stock; M-ALB Mediterranean stock). In addition, the latest CATDIS (detailed catch distribution by trimester and 5x5 squares, where T2CE is adjusted to T1NC) estimations, covering the period 1950-2021 for the three species, were provided. Detailed statistics together with various catalogues (SCRS catalogues and detailed catalogues) and dashboards to explore and analyse the information were also presented, aiming to identify data weaknesses (gaps, inconsistencies, etc.) on the northern albacore stock.

No scientific documents with new or revised fisheries statistics for Atlantic albacore were presented to the Group.

3.1 Task nominal catches (T1NC) and spatial distribution of catches (CATDIS)

Both versions of T1NC and CATDIS datasets, covering the period 1950-2021 were fully synchronized with the latest update to CATDIS estimations (as of 2023-01-31). The minor revisions to T1NC arriving afterwards (mostly 2020 and 2021) are not reflected in CATDIS. The total T1NC catch series of N-ALB stock are presented in **Table 2** (**Figure 1** shows the cumulative yearly catches by major gear). The CATDIS maps (spatial catch distribution by decade) are presented in **Figure 2**.

The Secretariat also informed the Group that the T1NC dashboard with all ICCAT species (similar to the one presented during this meeting) is published in the ICCAT website following the SCRS recommendation.

As in previous data preparatory meetings, some stock corrections were made (catches split for N-ALB and S-ALB stocks) to T1NC using the spatial information reported in Task 2 catch and effort, for those catches only reported in a unique stock (Brazil S-ALB for longline and handline, and Panama N-ALB for longline). The Group adopted these updates and requested the Secretariat to contact the respective ICCAT CPCs scientists to verify these corrections and possible additional inconsistencies on the catch allocation by stock.
By looking at the standard N-ALB SCRS catalogue (**Table 3**) for the latest thirty years (1993-2022, being 2022 incomplete) some potential gaps were identified in T1NC, however not on the major N-ALB fisheries (first 13 ranked flag/gear combinations). These potential gaps (fisheries 14 and higher ranks, shaded in "light blue" in **Table 3**) are mostly linked to longline flags (Panama, EU-Spain, China P.R., etc.) and purse seine flags (Venezuela, EU-France) and other gears to a less extent (only seen by looking at the full SCRS version). Some additional information can be obtained from Task 2 datasets (T2CE, T2SZ) after structural

inconsistences (gears, sampling areas, etc.) are resolved. The Secretariat noted that reducing inconsistencies between Task 1 and Task 2 datasets is continuously undergoing and requires active participation of the ICCAT CPC scientists.

3.2 Task 2 catch and effort (T2CE) and size (T2SZ) data

Detailed catalogues and the existing data of Task 2 datasets (T2CE, T2SZ, T2CS) were prepared by the Secretariat for the meeting. In addition, the SCRS catalogue of N-ALB (**Table 3**) provides an overall view of the availability (concatenation of characters) of the three Task 2 dataset types ("a": T2CE; "b": T2SZ; "c": T2CS) by stock for the latest 30 years (2022 still incomplete).

T2CE (Task 2 catch and effort)

For the first 13 ranked fisheries (fleets that account for at least 95% of the total catches), some T2CE datasets are still missing in the last three decades (trawl: EU-France, EU-Ireland; longline: St Vincent and the Grenadines). For the lowest ranked fisheries (14 or superior) the number of missing T2CE datasets is higher. The lack of T2CE information affects the quality of CATDIS spatial-temporal estimations. The Secretariat reminded that the SCRS requires that T2CE information be reported by month and in 1x1 squares or better for surface gears, and in 5x5 squares or better for longlines. The SCRS catalogues do not show highly aggregated T2CE datasets (only seen in the detailed catalogues). All the T2CE datasets reported by month and trimester and/or with larger rectangles (5x10, 10x10, 10x20, 20x20) are all bookmarked for CPCs revisions. Thus, the Secretariat reminded the CPC participants to use the two albacore instruments available (SCRS catalogues and the detailed T2CE catalogue), as recommended by the SCRS, to verify their completeness and report the missing information to ICCAT. Only a detailed revision of T2CE will allow future improvements of CATDIS estimations.

T2SZ (Task 2 size frequency samples)

The availability of complete T2SZ size sample series is of importance in structured stock assessment models, and in particular the stock-synthesis used in the N-ALB stock.

For the first 13 ranked fisheries, some T2SZ datasets are still missing in the last three decades (baitboat: EU-Portugal (Madeira and Azores fleets), EU-Spain (Canary fleet); trawl: EU-France, EU-Ireland; longline: Japan, St Vincent and the Grenadines, Venezuela). For the lowest ranked fisheries (14 or superior) the number of missing T2SZ datasets is higher.

Several T2SZ datasets were recovered before (EU-Spain 2008-2019 for baitboat and trolling) and during the meeting (Venezuela 2013-2018 longline). Using a 2022 version of the SCRS catalogue of N-ALB, it was noticed that for EU-Spain (Cantabric baitboat and trolling fleets) there were some missing years that do not have T2SZ information (period 2008-2019). Those missing years lacking T2SZ information were recently communicated by EU-Spain to ICCAT and already presented to the Group. As observed in **Table 3,** the whole Spanish T2SZ series (baitboat and troll) for N-ALB is now complete. The recovered Venezuela T2SZ information (detailed longline observed data from 2013 to 2018), presented during the meeting, will be soon integrated into the ICCAT database system (ICCAT-DB).

The Group inquired about the apparent low average size of albacore in the US LL, as shown in the ALB detailed catalogue (file: t2sz+cs_detailedCat_ALB_v1.xlsx). The Secretariat explained the US longline is reported in weight (kg) class bins rather than length (cm) classes, thus it is NOT an average "size" as indicated in the table. The Secretariat presented two alternatives for converting the weight samples (T2SZ) provided by the US for the period 2008-2021. The Group discussed these proposals and recommended to wait for the US final submission.

The Secretariat reminded the CPC participants to use the two albacore instruments available (SCRS catalogues and the detailed T2SZ catalogue), as recommended by the SCRS, to verify their completeness and report the missing information to ICCAT.

Average weights by fleet

The Group agreed that calculating average weight by fleets/gear at this meeting was not necessary. It was noted that average weights by fleets are outputted by the stock synthesis model and could be reviewed later on if needed.

3.3 Tagging data

The Secretariat provided a presentation on the albacore conventional tagging data available in ICCAT. **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 summarize geographically the ALB conventional tagging data available in ICCAT: the density of releases in 5x5 squares (**Figure 3**); the density of recoveries in 5x5 squares (**Figure 4**); and the ALB apparent movement (arrows from release to recovery locations, **Figure 5**).

In addition, the Secretariat presented two dashboards of albacore to examine dynamically and interactively the tagging data. The first one (snapshot in **Figure 6**) is for conventional tags, showing a summary of releases and recoveries. The second one (snapshot in **Figure 7**) is about electronic tags, showing a summary with data extracted from metadata. The Secretariat thanked the support of AZTI scientists in the production of the dashboards presented.

The Secretariat also informed about the development of an electronic tagging management system database (ETAGS) with the main goal of integrating into a centralized relational database all the information obtained from electronic tags and metadata. Phase one has been completed including the inventory of data, the creation of the loading files, and the installation of the database. The second phase will work on the consolidation of the metadata and loading the electronic tagging data into the system. The Secretariat thanked the support of AZTI scientists in the production of the ETAG dashboard.

The Group asked about the conventional tagging data correction process. The Secretariat informed that the data should be corrected mainly by CPC scientists (supported by the Secretariat), using all the tools available on the WEB (datasets, dashboards, etc.). The Group recommends revising the current albacore conventional tag dataset by all CPCs in order to verify inconsistencies and correct identified errors.

The Group reviewed the conventional tagging data presented and the tools developed by the Secretariat for the visualization of available data. It was recommended that these tools use standardized data (e.g. standard size unit) and also include some quality control already agreed upon by the Group. It was recommended that the Secretariat works in collaboration with national scientists to verify and correct conventional tagging data. It was further noted that ICCAT conventional tagging data represents information provided by CPCs that includes research-designed tagging programs, as well as opportunistic tagging activities, thus users need to be aware of the limitations and characteristics of the data before attempting scientific analysis that may be invalidated by violation of basic assumptions.

It was further suggested that the ICCAT databases may include a variable that reflects the decision(s) of the Species Groups concerning data quality, thus future Groups do not need to repeat such analyses.

The Group concluded that the tagging data has been previously revised and considered for scientific analyses, for example, in the estimation of the current N-ALB growth model (Santiago and Arrizabalaga, 2005) as well as natural mortality (see section 2). However, in previous assessments, it was generally decided not to use the conventional tagging data directly in the assessment models. Review and conclusions on the electronic tagging of N-ALB would be discussed in section 7.

The Group requested additional information about the identification and removal of errors/outliers in the conventional tagging database. The Secretariat confirmed that suspect data are identified, and that these concerns are communicated to the responsible statistical correspondent. It is typically the responsibility of the CPC to correct data as needed. The Group reflected, and recommended that basic protocols be developed to identify and flag suspicious or erroneous data. Appropriate filters should consider, at a minimum, a review of length/weight pairs and release/recovery locations to infer species misidentification, inconsistent measurement units and/or reporting incorrect locations or times at large.

The Group noted that the database contains a compilation of scientific tagging studies and opportunistic efforts, and the quality and completeness of the records are quite variable. Using tagging data to estimate key model parameters requires high-quality, informative data. In general, the Group agreed that the current conventional tagging data are not useful for direct parameter estimation, but may be useful to explore the plausibility of various biological hypotheses externally to the model.

4. Review of available indices of relative abundance by fleet

The 2023 Albacore Species Group workplan requested the update of the standardized CPUEs from the Japanese longline, Chinese Taipei longline, US longline, and Spanish baitboat up to 2021, of North Atlantic albacore in yearly (for MP iteration) and quarterly scale (for Stock Synthesis model) and by area to be available 1 week before the data preparatory meeting. It was reminded to the Group that during the September 2022 meeting of the Albacore Species Group, it was recommended that two areas in the North and South of 30°N in the North Atlantic be considered in the development of Stock Synthesis models because different size compositions were observed in those areas.

The meeting Chairman acknowledged the efforts made by analysts to meet the requests on time. All requested abundance indices were provided. Yearly indices by area were also requested because the initial Stock Synthesis model trials showed that the fits to the quarterly indices were poor.

Discussions on individual abundance indices

Japanese longline index

SCRS/2023/028 presented a general overview of the catch and effort of the Japanese longline fishery in the North Atlantic for an understanding of the standardization of the CPUE. High catches and CPUE of albacore were observed during the 1960s, and these sharply decreased around 1970. After the 2010s there were few operations North of 30°N. There was clear seasonality of the fishery North of 30°N, with fishing efforts deployed mainly in the first and fourth quarters.

SCRS/2023/029 presented standardized CPUE for albacore by the Japanese longline fishery in the North Atlantic. Annual CPUE in the North Atlantic for MSE and area-specific annual and quarterly CPUE for stock assessment were reported based on the same method as previous studies. The time series was separated into Target (1959-1969), Transition (1969-1975), and Bycatch (1975-2021) as in previous studies taking into consideration the shift of target species of the fishery. A sharp decrease in CPUE was observed between the target and transition periods, whereas it was comparatively stable during the bycatch period.

The standardized indices by area showed very high values in 2010 for the North of 30°N, and 2013 for the South of 30°N in the North Atlantic. It was noted that Japan introduced an IQ system for Atlantic bluefin tuna, and this resulted in fewer albacore catches North of 30°N latitude. The Group recommended removing the 2010 CPUE value from the stock assessment models. Regarding the extremely high CPUE value of 2013 South of 30°N, the Group was reminded that at the 2016 stock assessment the year 2013 CPUE value of the Japanese index for the North Atlantic was removed because the Group concluded that that increase in 2013 did not represent the dynamics of albacore stock and it was biologically implausible.

The Group agreed to continue this treatment for the current stock assessment models. The Group noted that the indices from the Target and Transition periods have not been used in previous stock assessment models in the last 10 years, and only the Bycatch period starting in 1988 has been used. In previous assessments, the exclusion from the Bycatch period of the CPUE values for 1975 to 1987 responded to a concern that important targeting shifts may have occurred in the early years of the Bycatch period (before 1988).

The Group discussed the use of the Japanese longline index in the stock assessment. After a lengthy discussion, the Group agreed to continue using the Japanese longline index after 1988 in the stock assessment. However, the Group noted that there are no other indexes of abundance prior to the 1980s when catches were quite substantial, noticing a concern that without index information there is little chance to estimate the productivity of the stock. Therefore, the Group agreed to include the Target period, and the early Bycatch period (1975 – 1987) in sensitivity runs. The Group also agreed not to use the Transition period in the stock assessment models. If these alternative scenarios improve the model's performance the Group could reconsider its use. Given the value of long-time series for stock assessment, the Group also requested that efforts be made to develop appropriate Japanese longline indices across the longest time possible.

US longline index

SCRS/2023/036 presented standardized CPUE for albacore by US longline fishery in the North Atlantic. Annual CPUE in the North Atlantic for MSE and area-specific quarterly CPUE were reported. Quarterly indices showed a distinct and consistent seasonality in albacore frequency of occurrence and CPUE, with the higher occurrence and catch rates occurring during quarters 3 and 4 in the region North of 30°N, and quarters 1 and 2 showing higher catch rates in the region South of 30°N.

The Group noted the difference in the trend of CPUE between North and South of 30°N, but the reason was not clear. An increase in the CPUE was observed in the recent few years. The Group considered that this could be due to either increase in abundance or an increase in catchability. Hypotheses proposed for the change in the catchability include that only vessels with better catch rates continued in the fishery, or the change in fishing grounds, which in recent years is mainly in the coastal area.

In response to these concerns, the author prepared a supplementary analysis that illustrated the influence of factors that may contribute to changes in catch rates. The annual coefficients of the standardization were strongly influenced by area and quarter, particularly in the southern area. This result suggests that the model was able to adequately account for changes in the spatial distribution of fishing (e.g. recent contraction toward shore). The Group also considered reconstructing the index over a smaller spatial scale where fishing was more consistent across time but agreed that this had a higher risk of hyperstability that would be not indicative of the population as a whole. The author also noted that the current index is essentially a census of US catches of albacore, and recommended against reducing the area considered in the analysis.

Spanish baitboat index

SCRS/P/2023/012 presented the Spanish baitboat targeting albacore standardized CPUEs (number of fish/fishing days) analyzed for the period 1981 to 2021 (no data in 2020, Ortiz de Zárate and Ortiz, 2022). The quarterly and annual standardized indices were estimated. Since 2018 the fishery has taken place mostly in the summer months.

The Group noted that this index has relatively large CVs, which are likely caused by the small sample sizes (<100 cruises per year). The Group also noted that while the Spanish baitboat represents a large fraction of the total catch, indices from other surface fleets (troll fisheries) were constructed in the past, and are no longer available. The Group recommends that efforts be made to recover these historical datasets. The Group also inquired whether it might be possible to create a joint CPUE from the various surface fisheries. In the past, it was considered to combine the Spanish troll, Spanish baitboat, and French and Irish mid-water trawl indices, but it was not a straightforward task to have one single index because of the different effort units and overlap between datasets. The Group recommended continuing to explore possibilities for improving the quality and consistency of indices from those fleets as they are the main fisheries for the North Atlantic albacore stock.

Chinese Taipei longline index

SCRS/2023/035 presented standardized CPUE for albacore by the Chinese Taipei longline fishery in the North Atlantic. Annual index in the North Atlantic and area-specific indices were provided. The standardized CPUE of albacore South of 30°N latitude in the North Atlantic started to increase slightly from late 1999 until 2014 and then decreased to a relatively stable level during 2015-2021. However, the trend of North of 30°N latitude in the North Atlantic Ocean remains relatively consistent over the past decade, with a slightly increasing trend during 1999-2014. The fishing effort in 2021 was greatly reduced compared to 2020 due to COVID.

A spike in the index was observed in 2014, which is one year lag from the Japanese longline index. The Group noted that the difference in the unit of CPUE (in number by Japanese longline and weight by Chinese Taipei longline) and the difference in fish size may have caused this lag.

The Group noted that aggregated data in a 5x5 lat-lon grid including aggregation of the number of hooks between floats were used for the CPUE standardization. Authors indicated that there are only two types of operations, 10 or 13 hooks between floats both targeting albacore tuna. The QQ-plots look non-normal (peaked) and are likely the effect of the aggregated 5x5 grid. However, the author further presented that the standardized index using 5x5 degree aggregated is very similar to the one using set-by-set data.

Venezuelan longline index and catch rates description

The Group was informed that the index based on the observer programme (Arocha *et al.*, 2020) could not be updated because that observer programme ended in 2018. The Group noted that as this is the only index available over a large area (Western Tropical Atlantic and Caribbean Sea), it is of considerable importance. The Group recommended continuing the use of the historical Venezuelan longline index (1991- 2018) in the assessment models and the MP for the N-ALB.

SCRS/P/2023/024 presented a recent trend in albacore nominal catch rates from the Venezuelan pelagic longline fishery off the Caribbean Sea and adjacent waters of the western central Atlantic for the period 2019-2022. The authors informed the Group that they are working on alternative approaches using the logbook programme to re-estimate the full-time series. Specifically, they are working on a machine-learning approach that requires the restoration of historical logbook datasets, some of which are available only in paper records. The Group strongly supported those efforts and the reinstatement of the observer programme.

Summary of abundance indices for the stock assessment and general discussion

The Group discussed the information contained in the evaluation table (**Table 6**). The Group considered whether sufficient diagnostics were available for each index and whether those diagnostics suggested adequate performance of the standardization method. A suite of diagnostics was presented for each index, and while some deviations from expectations were noted, particularly in Q-Q plots, the Group generally agreed that the performance was sufficient to include all of the available indices in stock assessment models.

There was a discussion about the sufficiency of diagnostics in general. It was noted that many informative diagnostics have become available that allow a more comprehensive evaluation of the quality of index construction. The Group noted that the Working Group on the Stock Assessment Methods (WGSAM) is planning to discuss stock assessment best practices, including recommended model diagnostics. In particular, the Group noted that creating influence plots would greatly facilitate the evaluation of future analyses. Influence plots illustrate how CPUE varies by year and model factor and allows a visual inspection of factors that influence catch per unit effort and/or catchability (e.g. changes in fishing location and season, gear configuration, regulatory effects, targeting). The Group recommended discussing this further at the WGSAM meeting.

The Group also noted that for several indices there were important changes in fleet characteristics over time and that these changes can cause shifts in catchability that would be confounded with changes in abundance. The use of vessel effects in the standardization could be useful to account for these changes in the index standardization (e.g. Japanese LL – after 2010 the CPUE dropped; USLL).

The Group was informed on indices of abundance available in previous assessments of the N-ALB stock (2016, 2013). Those include a trolling index, the Chinese Taipei longline index before 1998, and a mid-water trawl index from the EU-Ireland. These indices have not been updated at this meeting and the Group noted that the previous assessment meetings did not include them. It was agreed not to consider those indices for the 2023 stock assessment. After the discussion on all available indices provided to this meeting, the Group made specific suggestions for the 2023 stock assessment base models (**Table 7** and **Figure 8**):

- Use yearly indices by area (North and South of 30°N).
- Use Japanese longline indices after 1988.

- Remove the 2010 point from the Japanese index for North of 30°N area.
- Remove the 2013 point from the Japanese index for South of 30°N area.
- Use the Chinese Taipei, US, and Venezuelan historical longline indices.
- Use the Spanish baitboat index.

The Group suggested using the Japanese longline indices for the periods 1959-1969 (Target) and 1975-1987 (early Bycatch) in sensitivity runs. If those indices improve the model performances, the Group could reconsider its use in base cases.

5. Stock Synthesis: specifications of data inputs and modeling options

5.1 Stock Synthesis: specifications of data inputs

SCRS/2023/033 presented an update of the catch and size frequency data inputs for the Stock synthesis initial configuration for the N-ALB stock. The catch removals and size frequency data include information from 1930 to 2021, split by the fleet structure agreed upon by the Group in September 2022 (Table 3 of Kimoto, *et al.* (2022)).

The length composition data of EU-Spain baitboat and EU-Spain trolling was completed from 2008 until 2019. The length composition of the US longline was revised due to some apparent changes in the length composition calculation from 2008 onwards. However, due to some differences between the early and late periods the Group decided it was better not to use data from 2008+ until an SCRS document is provided with the new data sets.

The Group noted that some length composition data could be influenced by short time size reports of some fleets, and the Group decided not to consider the following data for the stock assessment model:

- In fleet 2 (BB islands), not to include short time series.
- In fleet 3 (TR_GN), not to include the length composition of the gillnets fleet.
- In fleet 4 (MWT), not to include the short-term series.
- In fleet 5 (Japanese fleet for North of 30°N), not to use the length composition data from the Canadian and US Observers of the Japanese charter fleet operating in EEZ waters.
- In fleet 6 (Japanese longline fleet for South of 30°N), not to include years with low sampling size (years 1982 – 2007 (except 1989)).
- In fleets 7 and 8 (Chinese Taipei longline fleet), not to include the years with very few sample sizes (<1000 fish measured in 1975-1979 and 1990-2002).

The Group also decided not to consider some years' length composition data with relatively low sample size and different length composition patterns in comparison to other years.

There were some observations of small fish <50 cm in the length compositions of the Chinese Taipei and Japanese longline fleets, although they were not expected for longline fishing operations. However, national scientists confirmed that in the early years of the longline fishery, small-size albacore were caught by this gear. The Group recommended not removing them and letting the modeling team decide how to deal with them.

The length composition of some of the aggregated fleets is very noisy, representing a mix of data from multiple flags and a few continuous sampling years, so the Group decided not to use them to estimate their selectivity. It was recommended that modelers decide which other fleets' selectivity should be mirrored or linked. These fleets included the Mix LL of Korean, Panama, and Chinese longline (FL12: MIX_KR_PA), Other longline (FL13: Oth LL), and Other surface gear fleets (FL14: Oth Surf).

The length composition of Venezuela's longline fleet (FL11) is available until 2012. The national scientists submitted observer data from 2013 to 2018 during the meeting, and it was requested that if the data are incorporated into the ICCAT database soon, that these be provided to the modelers. However, it was noted that an SCRS document should be provided for the final approval of the size data updates for the Albacore Species Group meeting in September.

Due to the differences in the length composition of quarter 2 in the baitboat island fleet (BB_isl, FL2) (i.e. smaller fish) compared to other quarters, it was decided to split it and treat it as a new fleet (FL15).The updated fleet structure is available in **Table 8.**

5.2 Stock synthesis initial model, diagnostics, and sensitivity analysis

SCRS/P/2023/013 summarizes the current state of development of the Stock Synthesis model for North Atlantic albacore. Overall, the Group noted that the model is in its early stages and the Group is not in a position to adopt or discard modeling options in a definitive manner. Instead, the Group preferred to leave enough flexibility to develop the model even re-defining the current configuration.

The Group noted that the first version of the model converged, which is a positive sign. However, concerns were raised with some of the diagnostics presented.

- Recruitment deviates having a large impact on the stock trend instead of stock productivity.
- The model seems to be driven by the size-frequency-data.
- Problems with the jittering analysis, with the model producing very different outcomes when changing the starting values.
- The estimated recruitment aligns well with the stock-recruitment relationship for relatively low levels of biomass, even in the early years of the assessment period, which may not be realistic.
- Currently, the model shows a very steep early depletion compared to the age structured production model (ASPM).

Overall, the Group noted that considerations on steepness (whether to fix it or leave the model to estimate it) can be postponed as more fundamental issues may need to be understood and solved first. For example, the Group noted the need to prioritize the consistency of the growth model within stock synthesis and the length-at-age key modes informed by the size modes samples for the different gears/fleets.

The modelling team will need to configure the weighting of the CPUE, size, and other data included in the model. There was general agreement that the weight of size-frequency data compared to other input information needs to be reduced. The modelling team also needs to understand what data are driving the scale of the biomass, which seems unrealistic in the current version.

6. Management Strategy Evaluation

6.1 Exceptional Circumstances based on catch and CPUE updates

The Group reviewed the principles that should be considered as a signal indicating the possibility that exceptional circumstances (ECs) exist according to Rec. 21-04. For the "stock dynamics" principle the Group discussed (i) if the recently developed approaches to estimate natural mortality-at-age are substantially different from the values from the Operating Models (OMs) used in the MSE when the accepted MP was tested and, (ii) if the CPUE series presented to this meeting falls outside the 2.5% and 97.5% percentile range of values in any year from the OMs used in the MSE when the accepted MP was tested.

The Group has adopted a new natural mortality-by-age vector (*Lorenzen_Hamel_Amax_15*) for the Stock Synthesis model (section 2). The Group compared the natural mortality values used in the grid of OMs of the MSE and their potential differences with the new adopted vector (Lorenzen, 2022 and Hamel and Cope, 2022). The Group confirmed that the new natural mortality-per-age (*Lorenzen_Hamel_Amax_15*) is not *substantially different from the values of the OMs used in the MSE* (**Figure 9**) (see Rec. 21-04). However, the Group also recommended to further explore the potential implications of the new mortality-at-age vector within the MSE framework under development.

With regards to the CPUEs, SCRS/P/2023/010 showed the abundance indices presented to this meeting superseding the CPUE values estimated from the OMs used in the MSE. Overall, all the CPUE series presented fall within the 2.5% and 97.5% percentiles of the simulated values except for the Spanish baitboat where the CPUE presented to the meeting exceeds the range marginally in the years 2015 and 2018 (**Figure 10**). As the updated CPUE data indicate a larger than the estimated relative abundance (i.e.

above the 97.5% percentile of the simulated OM in the MSE) the Group agreed that this is not a source of concern. However, the Group noted that ideally, if data are available until 2022, the EC on the CPUE will be re-evaluated at the stock assessment meeting.

6.2 Effects of underreporting (Response to Rec. 21-04)

The Group revised the evaluation of the potential effects of underreporting on the performance of the adopted MP (Merino *et al.*, 2022) and discussed potential alternatives to improve this evaluation. Overall, the Group noted that the analysis presented in 2022 should be sufficient to respond to the requirement of Rec. 21-04 underlining that the analysis should be interpreted as a percent (%) of increase of underreporting relative to historical levels. The analysis suggests that a 10% increase above the current level of underreporting would represent an Exceptional Circumstance.

The Secretariat and the SCRS currently have no data or information to suggest that there is substantial underreporting of albacore catches.

7. Albacore Year Programme (ALBYP): achievements and programmed activities for North, South, and Mediterranean stocks

Two presentations related to the northern stock were presented in this section.

SCRS/P/2023/028 informed about the electronic tagging activities conducted between 2019 and 2023, using different tagging platforms. So far 88 archival and 34 PSATs have been deployed in the Bay of Biscay and the Canary Islands. Results revealed some of the challenges as well as the main results obtained so far in relation to the main objective, which is to improve our knowledge of the lifecycle and habitat use by the North Atlantic albacore stock.

The Group thanked and congratulated the team for the results achieved so far. It was mentioned that several tags showed malfunctioning, and it was important to inform the Secretariat of the number of tags that malfunctioned as well as the nature of the problems so that they could negotiate compensation with the tag manufacturers. It was pointed out that, besides the tag cost, there is a lot of effort dedicated to implanting them, which is a considerable source of frustration and should be considered in the negotiation.

The Group also suggested considering deployments in the western Atlantic, noting that this was tried in the past in Canada, with no success. The Group identified potential tagging platforms in the US and Caribbean recreational fisheries and agreed to try to engage further to verify that they represent practicable tagging opportunities.

It was mentioned that tagging albacore with electronic tags was not an easy endeavor, due to its relatively small size and limited experiences (in comparison to other tuna species). Thus, the learning curve might be steeper than for other species. It was pointed out that the programme had already provided some good results with relatively long attachments, but it was necessary to narrow down the causes of malfunction and reduce mortality as much as possible.

The Secretariat mentioned that all the metadata have been updated in the electronic tagging database and thanked participants for their cooperation in keeping ICCAT datasets updated.

On reproductive studies, SCRS/P/2023/011 was presented (Ortiz de Zárate *et al.*, 2022), with an update of the results obtained so far by the consortium studying northern albacore reproduction. Samples were sourced from Venezuela, Chinese Taipei, and Canada longlines. Sampling will be continued and the analysis will be completed as part of a new contract that is being approved. The new samples will include those from the Central Atlantic in the summer, and the collection of spines is contemplated in addition to gonads.

The Group thanked the consortium for having achieved an interesting collaboration among scientists from different countries, and for succeeding in having access to biological samples from the Chinese Taipei longliners that are of great interest to inform about key biological parameters. In this regard, the Group mentioned the interest to start sampling as early as possible, including from March-April. Chinese Taipei scientists confirmed that samples can now be collected between February and August.

This study addressed individuals of relatively large size (above 90 SFL cm), and found a maximum age of 10 years. The Group noted the interest of this and similar samples to study the maximum age of albacore tuna to inform hypotheses about natural mortality (see section 2).

The Group pointed out that a recent workshop on swordfish, billfish, and small tunas aging recommended a multispecies survey in the Sargasso Sea, which could represent an additional source of samples in an interesting area for albacore (Luckhurst and Arocha, 2016). The discussion followed with more general comments on the interest to reconsider the SCRS strategic research plan that included coordinated research programmes, as the SCRS could benefit from e.g. coordinated design, sampling, and data analyses.

Lastly, the Group briefly discussed the potential benefits of genetics for albacore research. Genetics are being explored by other species groups (e.g. billfish, swordfish, bluefin tuna) and can serve different purposes (e.g. population structure, genetic diversity, close kin mark-recapture, etc.). The Group acknowledged that some population structure studies were conducted in the past, which arrived at different conclusions and recommended further revising past genetic studies conducted on albacore, as well as on other species, to be able to assess the potential interest of conducting additional genetic studies.

8. Recommendations on research and statistics

- The Group recommended to conduct research to verify assumptions regarding the maximum age of North Atlantic albacore. This research could be conducted using alternative techniques, including hard part ageing on large-size individuals and/or validation of readings using bomb radiocarbon techniques.

- The conventional tagging database was shown to include some records that might not be accurate (e.g. unplausible positions, individuals way larger than the maximum length for albacore, length-weight pairs that diverge substantially from the albacore length-weight relationship, etc.). This might prevent it from being used for different purposes, so the Group suggested that the Secretariat improve existing protocols of data verification and work together with the national scientists to try to improve the quality of the database.

- The Group continues to recommend the improvement of the set of indices of abundance that remains available for stock assessment purposes. This includes the update of historical indices from areas poorly known (e.g. Venezuelan longline) and the elaboration of new indices of abundance for fisheries that currently do not provide one (e.g. EU trollers, EU mid-water trawlers), as well as, the improvement of indices currently used in the assessment by considering alternative variables and models in the standardization.

- The Group recommended further discussing the sufficiency of diagnostics for CPUE standardization and the format of the CPUE evaluation table at the next WGSAM meeting.

- The Group noted with concern that the Venezuelan longline observer programme has been suspended since 2019. Considering the broad importance of observer data to carrying out the work of the SCRS, including the development of abundance indices, the importance of the Venezuelan longline observer data in the past, as well as the relative lack of other data from other fleets in this region, the Group strongly recommends that the Venezuelan longline observer programme be reinstated promptly and resume reporting the data to the Secretariat through the established mechanisms.

9. Other matters

Update from the SCRS Chair on current efforts to review and improve SCRS processes, communication and coordination

The SCRS Chair informed the Group about ongoing efforts to explore options for improving the SCRS processes and communication/coordination both within the SCRS and between the SCRS and the Commission. The SCRS Chair noted that he has so far met twice this year with the SCRS Officers and relevant Secretariat staff to discuss these topics among others, but that this is intended to be an inclusive process, so other SCRS scientists should bring any concerns or suggestions to the attention of an SCRS officer so that this input can be considered in those discussions.

The SCRS Chair also highlighted a change this year in the process to develop and review the summaries of intersessional meetings that appear in the SCRS Plenary report (note: these should not be confused with the Executive Summaries that appear by species or species group). Previously, these summaries have been developed by the Rapporteurs in collaboration with Secretariat staff and presented to the SCRS at Plenary for review and comments. For the new approach, the draft summary of the meeting will be developed during or soon after the intersessional meeting by the Rapporteur (with assistance as requested) and circulated (by correspondence, if after the conclusion of the meeting) to the meeting participants for review and adoption.

Finally, the SCRS Chair expressed his appreciation for the presentations on the various SCRS documents during the meeting, and for all the hard work undertaken to carry out the research that is so important to the development of scientific advice. The SCRS Chair reminded the authors of all the documents presented at this meeting of the importance of including the SCRS documents within the Collected Volume of Scientific Papers (CVSP), particularly those documents that influenced decisions of the Group or provided inputs to the analyses. It was noted that the proportion of SCRS documents that are eventually submitted to the CVSP has declined substantially, which profoundly weakens the public record of materials supporting the decisions of the Group and the bases for analyses.

10. Adoption of the Report and closure

The report was adopted during the meeting except for section 9 which was adopted by correspondence. The Chair of the Group thanked all the participants for their efforts. The meeting was adjourned.

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Table 1. Biological parameters and conversion factors for the North Atlantic albacore stock.

North Stock	**Parameters**	**Source**
Growth	L∞ = 122.198cm; *k* = 0.21; t0 = -1.338	Santiago and Arrizabalaga (2005)
Length-weight relationship	a=1.339x 10-5 b=3.1066	Santiago (1993)
Maturity	50% of mature fish at 90 cm (age 5)	Bard (1981)
M at age (1 to 15)		
Lorenzen_ Hamel_Amax_15 (base)	0.65; 0.53; 0.46; 0.41; 0.38; 0.36; 0.34; 0.33; 0.32; 0.32; 0.31; 0.31; 0.30; 0.30; 0.30	SCRS/2023/032
Lorenzen_ Hamel_Amax_13 (sensitivity)	0.75; 0.61; 0.53; 0.47; 0.44; 0.42; 0.40; 0.38; 0.37; 0.36; 0.36; 0.35; 0.35; 0.35; 0.34	
Chen and Watanabe (sensitivity)	0.54; 0.42; 0.35; 0.31; 0.29; 0.27; 0.25; 0.25; 0.24; 0.24; 0.24; 0.24; 0.25; 0.26; 0.28	

Table 2. Total Task 1 nominal catches (t, landings and dead discards) of the northern albacore stock (ALB-N) by year, sampling area and major gears.

	ALB-N stock														
	AL31							AL32							TOTAL
Year	Bait boat	Longline	Purse seine	Trawl	Troll	others	Sub-total	Bait boat	Longline	Purse seine	Trawl	Troll	others	Sub-total	
1930					11250		11250								11250
1931					15600		15600								15600
1932					12850		12850								12850
1933					11450		11450								11450
1934					18880		18880								18880
1935					20750		20750								20750
1936					16800		16800								16800
1937					13500		13500								13500
1938					14622		14622								14622
1939					17078		17078								17078
1940					11488		11488								11488
1941					13244		13244								13244
1942					16780		16780								16780
1943					16764		16764								16764
1944					16963		16963								16963
1945					27586		27586								27586
1946					23266		23266								23266
1947					20268		20268								20268
1948					24101		24101								24101
1949					27865		27865								27865
1950					39623		39623								39623
1951					34149		34149								34149
1952					32397		32397								32397
1953	3875				26242		30117								30117
1954	7250				32729		39979								39979
1955	3125				28299		31424								31424
1956	5500				35398		40898		2					2	40900
1957	11959				30028		41987		135					135	42122
1958	17558				33945		51503		945					945	52448
1959	18517				30796		49313		599					599	49912
1960	18139				33072		51211		1658					1658	52869
1961	21120				20907		42027		703					703	42730
1962	21469				30943		52412		6375					6375	58787
1963	20739				24625		45364		14976					14976	60340
1964	20428				28058		48486		16148					16148	64634
1965	19859		0		25544		45403	253	15002					15255	60658
1966	16470		0		22791		39261	287	7815					8102	47363
1967	18033		0		30669		48702	316	10124					10440	59142
1968	13588		0		23993		37581	348	7291					7639	45220
1969	14190		0		17923		32113	379	14238					14617	46730
1970	14138		0		15706		29844	250	15801				0	16051	45895
1971	15277		0		24029		39306	400	17115				0	17515	56821
1972	7471		0		26517		33988	725	14068				0	14793	48781
1973	8833		0		18712		27545		18155				0	18155	45700
1974	13859		0		20958		34817	127	14662				0	14789	49606
1975	17582				9491		27073	2105	12710				0	14815	41888
1976	18998				13918		32916	1229	23090				0	24319	57235
1977	14546				17391		31937	1013	21081				0	22094	54031
1978	10721				23931		34652	1237	14163	68			1	15469	50121
1979	15145				23332		38477	619	12214	59			3	12895	51372
1980	15652				13059		28711	525	9453		0	0	1	9980	38691
1981	12401				10778		23179	1011	9819	51	1	0	470	11352	34531
1982	15171				12831	16	28018	686	13206	84	0	0	678	14655	42673
1983	20159	3			12788		32950	949	16893	364	0	0	334	18540	51490
1984	7014	1			11029	13	18057	1299	19708	555	0	0	2181	23743	41800
1985	10912	1			10654	25	21592	1677	17412	59	2	0	83	19234	40826
1986	14743	1	38		10837	10	25629	459	21231	22		10	203	21925	47554
1987	18546	24	1	262	11451	90	30374	210	7272		0	6	253	7741	38115
1988	15624	53		1693	11325	766	29461	309	2960	97	0	4	228	3598	33059
1989	15194	14		2240	10549	1475	29472	180	2225	12	0	5	177	2599	32071
1990	18439	15		1032	10667	2311	32464	185	2668	1	1	8	1554	4417	36881
1991	8866	15	1	463	8955	3726	22026	102	5300	221	6	4	273	5905	27931
1992	11724	13		2459	7347	4992	26535	712	3139	139	144	1	181	4316	30851
1993	14819	20		1706	6094	7048	29687	827	7073	229	73	15	231	8448	38135
1994	11751	46		1967	5952	7162	26878	216	7262	292	164	7	344	8285	35163
1995	15551	34		2904	10225	3527	32241	860	4825	278	145	1	28	6136	38377
1996	9795	63		2570	6649	2991	22068	1543	4578	263	1	3	346	6735	28803
1997	8563	64		2874	7864	3669	23034	1258	3987	26	3	6	709	5989	29023
1998	7207	122		1316	5888	6083	20616	355	3913	91	2	6	763	5130	25746
1999	6728	155		5342	6845	6618	25688	2052	6555	55	0		199	8861	34549
2000	10817	324		3547	5023	5613	25324	254	6996	191	0		357	7799	33123
2001	3440	76		5374	4312	2673	15875	2663	7296	263			154	10377	26252
2002	3632	396		5375	3976	30	13409	3007	5839	93	0	33	335	9307	22716
2003	6015	143		3846	5363	129	15496	1826	7684	211	0	10	341	10071	25567
2004	7278	215		2366	7494	53	17406	850	6822	344	3	7	525	8551	25957
2005	9548	527	2	7001	10221	242	27542	910	6383	98		3	382	7776	35318
2006	13943	441	0	6384	10293	325	31385	330	4782	162	1	2	301	5578	36963
2007	8140	453		3429	6103	115	18240	356	2784	198	0	3	411	3751	21991
2008	7019	772		4321	5236	135	17483	912	1875	70	0	3	139	3000	20483
2009	4936	592		2811	4439	372	13150	59	2027	101	0	1	55	2242	15391
2010	5589	488	51	2026	7014	191	15358	436	3426	19		132	40	4053	19411
2011	5192	593		6846	3576	358	16565	339	3073	3	6	2	1	3424	19989
2012	7226	1008		6678	5906	338	21155	1590	2502	176		3	6	4277	25432
2013	3777	745		6558	5888	814	17782	1198	5646	40		3	2	6889	24671
2014	2953	1115		9184	6659	158	20069	4388	2140	35		1	5	6569	26638
2015	5648	1216		5771	5596	126	18357	3618	3535	116		1	9	7278	25635
2016	8387	1758	44	6299	3751	65	20303	6069	3990	6		3	29	10097	30400
2017	7706	773	0	6611	4163	42	19296	4490	4553	37		2	97	9179	28475
2018	10598	1242	0	8820	4806	58	25525	732	3486	39		1	4	4261	29786
2019	9269	1183	1	10816	6291	153	27713	3393	3725	64		1	25	7209	34922
2020	9981	1353		7577	5938	108	24958	1874	4621	21			8	6523	31481
2021	10244	1387	2	8309	6249	108	26300	1452	3606	28			8	5094	31393

Table 3. SCRS standard catalogue for northern albacore for the last 30 years. Shaded cells in "light blue" indicate possible Task 1 (T1NC) gaps.

Score: 6.96947

Species	Stock	Status	FlagName	GearGrp	DSet	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	2020	2021	2022	Rank	%	%cum
				T1 Total		38135	35163	38377	28803	29023	25746	34549	33123	26252	22716	25567	25957	35318	36963	21991	20483	15391	19411	19989	25432	24671	26638	25635	30400	28475	29786	34922	31481	31393	3293			
ALB	ATN	CP	EU-España	BB	t1	12277	11041	9953	9640	9401	7346	8448	10774	4929	4712	7325	7893	10067	14182	8375	7403	4940	5841	4676	7753	4473	4740	8353	13394	9687	10836	10203	10268	11215		1	30.3%	30%
ALB	ATN	CP	EU-España	BB	t2	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	a	abc		1		
ALB	ATN	CP	EU-España	TR	t1	6094	5952	10225	6649	7864	5834	6829	5013	4245	3976	5193	7477	10165	10277	6089	5233	4437	7009	3564	5833	5864	6651	5596	3559	4163	4806	6291	5936	6183		2	21.5%	52%
ALB	ATN	CP	EU-España	TR	t2	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	-1	abc		2		
ALB	ATN	CP	EU-France	TW	t1	1706	1967	2904	2570	2874	1178	4723	3466	4740	4275	3252	2194	6743	5878	2842	2806	773	1216	3249	3126	4327	6699	3379	3961	4118	5718	7601	4575	5265		3	13.1%	65%
ALB	ATN	CP	EU-France	TW	t2	a	ab	ac	ac	ac	a	ac	ac	ac	ac	ab	abc	abc	abc	abc	abc	abc	abc	abc	ab	abc	abc	a	-1	a	b	abc	-1	ac		3		
ALB	ATN	NCC	Chinese Taipei	LL	t1	6300	6409	3977	3905	3330	3098	5785	5299	4399	4330	4557	4278	2540	2357	1297	1107	863	1587	1367	1180	2394	947	2857	3134	2385	2926	2770	3549	2896	2817	4	11.5%	76%
ALB	ATN	NCC	Chinese Taipei	LL	t2	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	abc	abc	abc	4		
ALB	ATN	CP	EU-Ireland	TW	t1						57	319	80	634	1100	594	172	258	505	586	1514	1997	785	3595	3551	2231	2485	2390	2337	2492	3102	3213	2938	2879		5	4.8%	81%
ALB	ATN	CP	EU-Ireland	TW	t2						-1	b	a	a	abc	abc	abc	ac	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	ab	abc	abc	a	abc	abc		5		
ALB	ATN	CP	EU-Portugal	BB	t1	3369	926	6458	1622	393	76	281	255	1137	1913	516	224	391	21	80	517	54	179	855	1063	502	2601	912	1061	2509	494	2459	1587	481		6	4.0%	85%
ALB	ATN	CP	EU-Portugal	BB	t2	abc	abc	abc	abc	abc	ab	abc	abc	abc	ab	abc	abc	abc	a	abc	abc	abc	ab	abc	abc	abc	abc	abc	abc	ab	ab	ab	ab	a		6		
ALB	ATN	CP	EU-France	GN	t1	4587	3967	2400	2048	1717	2393	1723	1864	1150	13								2	1		21		7	3	0	0	1	2	0		7	2.7%	88%
ALB	ATN	CP	EU-France	GN	t2	ab	ab	ac	ac	ac	a	ac	ac	ac	a								-1	-1		-1		-1	-1	a	-1	a	-1	a		7		
ALB	ATN	CP	EU-Ireland	GN	t1	1946	2534	918	874	1913	3639	4523	3374	1430																						8	2.6%	90%
ALB	ATN	CP	EU-Ireland	GN	t2	ab	-1	-1	c	c	c	bc	ab	ab																						8		
ALB	ATN	CP	Japan	LL	t1	485	505	386	466	414	446	425	688	1126	711	680	893	1336	781	288	402	288	525	336	400	1745	267	276	297	366	196	334	261	263	295	9	1.9%	92%
ALB	ATN	CP	Japan	LL	t2	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	ab	ab	ab	ab	ab	ab	ab	ab	ab	a	a	9		
ALB	ATN	CP	St Vincent and Grenadines	LL	t1								703	1370	300	1555	82	802	76	263	130	134	174	329	305	286	327	305	291	296	173	180	250	201		10	1.0%	93%
ALB	ATN	CP	St Vincent and Grenadines	LL	t2								-1	-1	a	a	a	-1	a	a	a	a	a	ab	a	ab	a	ab	ab	ab	ab	abc	abc	-1		10		
ALB	ATN	CP	Venezuela	LL	t1	18	0	0	52	49	16	36	106	35	67	135	116	111	155	146	138	290	242	247	292	274	437	560	587	601	326	372	298	419		11	0.7%	94%
ALB	ATN	CP	Venezuela	LL	t2	ab	ab	ab	ab	b	ab	ab	ab	b	b	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	a	a	a	a	a	a	a	a	a		11		
ALB	ATN	CP	USA	RR	t1	224	324	23	309	335	601	90	251	122	323	334	500	356	284	394	125	23	56	117	137	561	137	121	43	28	9	30	45	55		12	0.7%	95%
ALB	ATN	CP	USA	RR	t2	ab	ab	ab	b	ab	ab	ab	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc		12		
ALB	ATN	CP	USA	LL	t1	192	230	373	123	184	179	192	146	191	146	106	120	108	103	127	127	158	160	240	261	255	309	229	203	209	93	190	281	240		13	0.7%	95%
ALB	ATN	CP	USA	LL	t2	ab	ab	ab	ab	ab	ab	ab	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc		13		
ALB	ATN	CP	Belize	LL	t1															22	26	39	366	351	155	230	79	1	399	448	385	216	326	201		14	0.4%	96%
ALB	ATN	CP	Belize	LL	t2															a	a	ab	ab	ab	ab	a	a	ab	ac	ab	abc	ab	abc	abc		14		
ALB	ATN	CP	Venezuela	PS	t1	228	278	278	263	26	91	55	191	260	93	211	341	63	162	198	70	84	16		21		27			2						15	0.4%	96%
ALB	ATN	CP	Venezuela	PS	t2	ab	ab	ab	b	a	ab	a	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab		ab		ab			ab						15		
ALB	ATN	CP	EU-España	LL	t1	8	5	19	35	30	105	86	214		264	12	10	216	80	118	89	240	111	117	133	159	216	177	123	114	49	39	1	9		16	0.3%	97%
ALB	ATN	CP	EU-España	LL	t2	ab	ab	ab	ab	-1	-1	-1	-1		-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	b	b	-1	-1	-1	-1	-1	-1		16		
ALB	ATN	CP	Panama	LL	t1	60	103	73	11	5									96	298	113	45	154	103		246	108		200		196	185	383	183		17	0.3%	97%
ALB	ATN	CP	Panama	LL	t2	-1	-1	-1	-1	-1									a	a	a	a	-1	-1		a	a		-1		-1	a	a	a		17		

Table 4. Summary of albacore conventional tagging data available in ICCAT. Number of albacore releases 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	2019	Unk
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	15			6	5	2	1																																									1
1971	37	37				14	12	8	3																																								
1972	24	22					4	6	6	3			2	1																																			
1973	17	12						3	4	2	1																																						2
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	3															2																																1
1982	56	1																			1																												
1983	290	25																23																															2
1984	226	0																																															
1985	147	0																																															
1986	214	4																		2	2																												
1987	39	0																																															
1988	541	42																			23	7	8	1	1																								2
1989	3106	115																				20	67	20	6	1	1																						
1990	4650	104																					32	25	37	2	1	2	2	1				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	15																																		1	6	7											1
2004	134	1																																				1											
2005	547	19																																				11	6	2									
2006	2770	18																																					3	5	6	3			1				
2007	140	3																																							1	2							
2008	27	1																																							1								
2009	168	0																																															
2010	65	0																																															
2011	170	3																																									1	2					
2012	45	2																																										2					
2013	65	0																																															
2015	7	0																																															
2016	33	2																																												2			
2017	36	0																																															
2018	124	3																																													1	2	
2019	56	0																																															
2020	24	0																																															
2021	2	0																																															
2022	100	0																																															
Unk	9	9										1											1	1							1			1					1		1	2							
Year	20808	709	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	1	4	1	2	1	2	10

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

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	2770	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	124	3	3								2.4%
2019	56	0									
2020	24	0									
2021	2	0									
2022	100	0									
Unk	9	9								9	100.0%
	20808	709	379	191	72	26	5	16	1	19	3.4%

Table 6. Criteria table for available indices of abundance for the northern albacore stock in 2023.

Use in stock assessment?	Adequate	Adequate	Adequate	Adequate	Adequate
SCRS Doc No.	SCRS/2023/029	SCRS/2023/036	SCRS/2022/122 SCRS/P/2023/012	SCRS/2023/035	SCRS/2020/089
Index Name:	JPN LL	US pelagic LL	Spain BB	CTP LL	Venezuela LL
Data Source (state if based on logbooks, observer data etc)	logbooks	logbooks	trip samples	logbook, e-logbook and task2	Observers
Do the authors indicate the percentage of total effort of the fleet the CPUE data represents?	No	Yes, Census	No	Yes	YES
If the answer to 1 is yes, what is the percentage?		91-100%		91-100%	5-11%
Are sufficient diagnostics provided to assess model performance??	Sufficient	Sufficient	Sufficient	Sufficient	Sufficient
How does the model perform relative to the diagnostics ?	Well	Well	Well	Well	Well
Documented data exclusions and classifications?	Yes	Yes	Yes	Yes	Yes
Data exclusions appropriate?	Yes	Yes	Yes	Yes	no exclusions
Data classifications appropriate?	Yes	Yes	Yes	Yes	Yes
Geographical Area	Atl N	Atl NW	Atl NE	Atl N	ATL NW
Data resolution level	OTH	Set	trip	OTH	Set
Ranking of Catch of fleet in TINC database (use data catalogue)	6-10	11 or more	1-5	1-5	11 or more
Length of Time Series	longer than 20 years	longer than 20 years	longer than 20 years	longer than 20 years	longer than 20 years
Are other indices available for the same time period?	None	Few	Few	Few	Few
Are other indices available for the same geographic range?	Few	None	None	Few	Few
Does the index standardization account for Known factors that influence catchability/selectivity? (eg. Type of hook, bait type, depth etc.)	Yes	Yes	Some	Yes	Yes
Estimated annual CV of the CPUE series	Variable	Low	Medium	Low	Medium
Annual variation in the estimated CPUE exceeds biological plausibility	Possible	Possible	Unlikely	Unlikely	Unlikely
Is data adequate for standardization purposes	Yes	Yes	Yes	Yes	Yes
Is this standardised CPUE time series continuous?	Yes	Yes	No	Yes	Yes
For fisheries independent surveys: what is the survey type?					n/a
For 19: Is the survey design clearly described?					n/a
Other Comments	aggregated 5x5 data		gap in 2020	aggregated 5x5 data	Exclude 2018, see SCRS/2020/089

Table 7. Abundance indices a) for the northern albacore stock for the Management Procedure and area-specific abundance indices (b) North and c) South of 30°N) for the stock assessment. The following Japanese longline Bycatch index values were removed for the stock assessment models; 2013 value for the whole North Atlantic, 2013 value for South of 30°N area, and the 2010 value for North of 30°N area.

a) Annual indices in the North Atlantic (for MP).

	US pelagic LL		Japan LL Bycatch*		Chinese-Taipei LL		Spain BB		Venezuela LL	
SCRS Doc No.	SCRS/2023/036		SCRS/2023/029		SCRS/2023/035		SCRS/P/2023/012		SCRS/2020/089	
Age range	3-8		3-8+		2-8+		1-4		5-8+	
Catch Units	Number		Number		Weight		Number		Number	
Effort Units	1000 hooks		1000 hooks		1000 hooks		Fishing days		1000 hooks	
Methods	Delta log-normal		Negative binominal		Log-Normal		Log-Normal		Delta log-normal	
Year	Index	CV	Index	SE	Index	CV	Index	SE	Index	CV
1980										
1981							105.96	0.40		
1982							115.24	0.37		
1983							147.45	0.31		
1984							84.06	0.45		
1985							140.67	0.31		
1986							116.28	0.30		
1987	0.46	0.10					175.57	0.30		
1988	0.54	0.09	0.79	0.12			169.41	0.29		
1989	0.66	0.10	0.74	0.08			122.45	0.28		
1990	0.98	0.09	0.58	0.10			206.79	0.33		
1991	1.00	0.10	0.68	0.10			153.17	0.32	0.35	0.61
1992	0.71	0.10	0.55	0.10			138.24	0.33	0.41	0.63
1993	1.13	0.09	0.52	0.10			163.67	0.35	0.34	0.63
1994	1.25	0.09	0.69	0.08			207.82	0.32	0.68	0.51
1995	1.26	0.09	0.42	0.08			176.44	0.33	0.80	0.51
1996	0.79	0.11	0.39	0.07			190.47	0.34	0.79	0.45
1997	1.01	0.10	0.50	0.07			158.79	0.32	0.86	0.52
1998	1.00	0.11	0.86	0.07			232.04	0.32	1.07	0.42
1999	1.21	0.10	0.49	0.08	307.98	7.78	125.59	0.33	1.05	0.51
2000	1.09	0.10	0.82	0.07	245.76	8.23	181.10	0.32	1.15	0.43
2001	1.25	0.10	1.25	0.07	210.28	7.92	78.65	0.34	0.67	0.44
2002	1.02	0.11	1.17	0.10	200.10	8.18	65.83	0.32	0.84	0.53
2003	0.80	0.12	0.91	0.09	285.52	8.05	161.39	0.32	1.03	0.42
2004	0.80	0.12	0.64	0.08	245.53	8.06	134.84	0.28	1.08	0.45
2005	0.84	0.12	0.81	0.07	275.53	9.39	122.42	0.29	1.15	0.44
2006	0.69	0.12	0.78	0.10	321.23	9.05	270.55	0.30	1.19	0.4
2007	0.72	0.12	0.44	0.11	360.75	10.31	202.88	0.32	1.96	0.42
2008	0.57	0.13	0.42	0.10	268.82	10.14	144.17	0.33	2.01	0.5
2009	0.75	0.12	0.64	0.10	384.53	10.33	173.45	0.32	1.08	0.5
2010	0.94	0.12	0.92	0.10	524.15	9.16	155.52	0.29	0.88	0.54
2011	1.22	0.10	0.66	0.12	505.83	9.33	294.22	0.29	0.51	0.61
2012	1.03	0.11	0.76	0.12	486.08	10.00	310.09	0.30	0.78	0.52
2013	1.29	0.10	8.44*	0.12*	663.15	9.85	200.72	0.32	1.36	0.56
2014	1.66	0.09	1.51	0.13	1029.84	12.19	135.66	0.36	1.86	0.56
2015	1.31	0.10	1.09	0.15	482.80	8.84	407.06	0.33	1.32	0.59
2016	1.29	0.10	1.71	0.13	537.57	9.02	345.30	0.30	0.79	0.56
2017	1.26	0.10	1.53	0.14	414.24	8.07	196.59	0.30	1.48	0.59
2018	0.79	0.12	0.88	0.13	414.95	8.08	671.13	0.37	0.53	0.73
2019	1.24	0.09	1.75	0.13	360.78	8.55	407.94	0.36		
2020	1.45	0.09	1.08	0.14	506.97	8.48				
2021	1.54	0.09	1.08	0.14	462.13	9.39	383.71	0.36		

Table 7. Continued.

b) Annual indices in North of 30°N (stock assessment).

	US pelagic LL		Japan LL Target		Japan LL Bycatch		Chinese-Taipei LL		Spain BB	
SCRS Doc	SCRS/2023/036		SCRS/2023/029		SCRS/2023/029		SCRS/2023/035		SCRS/P/2023/012	
Age rang	3-8		3-8+		3-8+		2-8+		1-4	
Catch Uni	Number		Number		Number		Weight		Number	
Effort Uni	1000 hooks		1000 hooks		1000 hooks		1000 hooks		Fishing days	
Methods	Delta log-normal		Negative binominal		Negative binominal		Log-Normal		Log-Normal	
Year	Index	CV	Index	SE	Index	SE	Index	CV	Index	SE
1959										
1960										
1961										
1962										
1963										
1964										
1965			23.47	0.08						
1966			27.23	0.10						
1967			32.83	0.10						
1968			31.61	0.10						
1969			30.58	0.12						
1970										
1971										
1972										
1973										
1974										
1975					7.07	0.16				
1976					6.77	0.17				
1977					4.55	0.19				
1978					4.00	0.16				
1979					4.00	0.15				
1980					3.44	0.15				
1981					3.98	0.11			105.96	0.40
1982					3.66	0.14			115.24	0.37
1983					2.22	0.15			147.45	0.31
1984					2.72	0.17			84.06	0.45
1985					2.96	0.16			140.67	0.31
1986					1.28	0.15			116.28	0.30
1987	0.62	0.06			1.06	0.14			175.57	0.30
1988	0.73	0.05			1.96	0.16			169.41	0.29
1989	0.85	0.04			1.07	0.13			122.45	0.28
1990	1.62	0.04			0.93	0.15			206.79	0.33
1991	1.32	0.04			1.14	0.14			153.17	0.32
1992	0.88	0.04			1.07	0.12			138.24	0.33
1993	1.28	0.04			1.03	0.15			163.67	0.35
1994	1.22	0.04			1.07	0.15			207.82	0.32
1995	1.02	0.04			0.56	0.14			176.44	0.33
1996	0.79	0.04			0.56	0.12			190.47	0.34
1997	1.21	0.04			0.86	0.16			158.79	0.32
1998	0.94	0.05			1.49	0.15			232.04	0.32
1999	1.05	0.05			0.97	0.18	326.60	9.49	125.59	0.33
2000	1.11	0.05			1.24	0.13	255.35	9.97	181.10	0.32
2001	1.24	0.05			1.58	0.12	197.22	9.69	78.65	0.34
2002	0.96	0.06			1.22	0.17	195.48	9.82	65.83	0.32
2003	0.49	0.06			1.15	0.13	237.36	10.23	161.39	0.32
2004	0.66	0.06			1.09	0.14	236.15	10.43	134.84	0.28
2005	0.64	0.06			1.22	0.13	321.84	11.95	122.42	0.29
2006	0.55	0.06			1.34	0.17	411.12	12.36	270.55	0.30
2007	0.56	0.05			1.45	0.19	346.01	12.44	202.88	0.32
2008	0.48	0.05			1.26	0.18	333.11	12.54	144.17	0.33
2009	0.56	0.05			0.84	0.25	368.04	15.63	173.45	0.32
2010	0.74	0.05			4.48*	0.28*	550.42	14.70	155.52	0.29
2011	1.03	0.05					454.47	16.31	294.22	0.29
2012	0.93	0.05					429.62	15.44	310.09	0.30
2013	1.42	0.05					381.46	14.72	200.72	0.32
2014	1.65	0.05					828.08	15.04	135.66	0.36
2015	0.75	0.05					338.80	11.99	407.06	0.33
2016	0.93	0.05					658.25	12.36	345.30	0.30
2017	1.03	0.05					304.72	12.13	196.59	0.30
2018	0.66	0.06					428.45	11.67	671.13	0.37
2019	1.11	0.05					379.86	13.51	407.94	0.36
2020	2.12	0.05					462.66	13.51		
2021	1.85	0.05					602.66	14.62	383.71	0.36

Table 7. Continued.

c) Annual indices in South of 30°N (stock assessment).

	US pelagic LL		Japan LL Target		Japan LL Bycatch		Chinese-Taipei LL		Venezuela LL	
SCRS Doc	SCRS/2023/036		SCRS/2023/029		SCRS/2023/029		SCRS/2023/035		SCRS/2020/089	
Age rang	3-8		3-8+		3-8+		2-8+		5-8+	
Catch Uni	Number		Number		Number		Weight		Number	
Effort Uni	1000 hooks		1000 hooks		1000 hooks		1000 hooks		1000 hooks	
Methods	Delta log-normal		Negative binominal		Negative binominal		Log-Normal		Delta log-normal	
Year	Index	CV	Index	SE	Index	SE	Index	CV	Index	CV
1959			25.94	0.16						
1960			22.83	0.21						
1961			18.91	0.31						
1962			30.46	0.23						
1963			15.60	0.17						
1964			15.39	0.10						
1965			14.38	0.09						
1966			8.83	0.12						
1967			12.53	0.12						
1968			11.55	0.13						
1969			7.82	0.13						
1970										
1971										
1972										
1973										
1974										
1975					1.64	0.29				
1976					0.55	0.37				
1977					0.44	0.32				
1978					0.37	0.29				
1979					0.49	0.30				
1980					0.47	0.23				
1981					0.70	0.17				
1982					0.65	0.12				
1983					0.95	0.21				
1984					0.53	0.17				
1985					0.66	0.14				
1986					0.46	0.19				
1987	0.34	0.06			0.16	0.24				
1988	0.35	0.06			0.41	0.17				
1989	0.20	0.07			0.51	0.12				
1990	0.27	0.06			0.47	0.15				
1991	0.38	0.07			0.48	0.18			0.35	0.61
1992	0.43	0.06			0.31	0.21			0.41	0.63
1993	0.78	0.05			0.32	0.16			0.34	0.63
1994	0.95	0.05			0.51	0.13			0.68	0.51
1995	1.31	0.04			0.34	0.11			0.80	0.51
1996	0.63	0.05			0.31	0.10			0.79	0.45
1997	0.76	0.05			0.44	0.10			0.86	0.52
1998	0.83	0.05			0.57	0.10			1.07	0.42
1999	0.76	0.07			0.34	0.12	296.25	9.68	1.05	0.51
2000	0.72	0.07			0.72	0.11	240.06	10.15	1.15	0.43
2001	0.79	0.06			1.12	0.11	217.66	9.39	0.67	0.44
2002	0.71	0.05			1.17	0.13	209.59	10.21	0.84	0.53
2003	0.92	0.05			0.79	0.13	326.36	9.88	1.03	0.42
2004	0.73	0.07			0.50	0.11	254.43	9.59	1.08	0.45
2005	0.94	0.06			0.62	0.10	241.07	11.73	1.15	0.44
2006	0.72	0.07			0.52	0.17	282.96	10.89	1.19	0.4
2007	0.68	0.07			0.25	0.16	357.00	13.86	1.96	0.42
2008	0.46	0.05			0.30	0.15	245.47	12.97	2.01	0.5
2009	0.77	0.05			0.57	0.13	381.96	12.07	1.08	0.5
2010	0.97	0.04			0.71	0.13	520.63	10.36	0.88	0.54
2011	1.06	0.04			0.59	0.14	515.63	10.43	0.51	0.61
2012	0.88	0.04			0.64	0.15	492.46	11.54	0.78	0.52
2013	1.14	0.04			7.69*	0.15*	803.88	11.48	1.36	0.56
2014	1.48	0.03			1.42	0.15	1219.56	16.35	1.86	0.56
2015	1.57	0.04			0.97	0.17	574.31	10.50	1.32	0.59
2016	1.99	0.05			1.52	0.15	477.32	10.70	0.79	0.56
2017	1.73	0.05			1.29	0.15	450.57	9.17	1.48	0.59
2018	1.05	0.06			0.73	0.14	404.76	9.18	0.53	0.73
2019	2.21	0.06			1.47	0.15	353.05	9.64		
2020	2.70	0.07			1.01	0.16	518.93	9.53		
2021	2.81	0.08			0.87	0.18	418.56	10.95		

Table 8. Updated Fleet structure of Stock Synthesis for northern albacore in 2023. Codes are FlagName or FleetCode in the ICCAT database (*).

FL	Fishery ID	Description	Time	Gear	Catch (FlagName* or FleetCode*)	Size (FleetCode*)
1	1 BB	Baitboat (Spain, France)	1953-2021	BB	EU.ESP-ES-CANT_ALB, EU.FRA-FR	EU.ESP-ES-CANT_ALB, EU.FRA-FR
2	2 BB isl	Baitboat islands (Portugal Madeira/Azores, Spain Canary)	1958-2021 Quarters 1,3,4	BB	EU.PRT-PT-AZORES, EU.PRT-PT-MADEIRA, EU.ESP-ES-CANARY, EU.ESP-ES-CANT_ALBaz, EU.ESP-ES-CANT_ALBcd	EU.PRT-PT-AZORES, EU.PRT-PT-MADEIRA, EU.ESP-ES-CANARY
3	3 TR+GN	Troll (Spain, France) + Gillnets (France, Ireland)	1930-2021	TR+GN	TR: EU.ESP-ES-CANT_ALB, EU.FRA-FR, EU.IRL. GN: EU.FRA-FR, EU.IRL, GBR	TR: EU.ESP-ES-CANT_ALB, EU.FRA. GN: EU.IRL
4	4 MWT	Mid water trawl (France, Ireland)	1987-2021	TW	EU.FRA-FR, EU.IRL, GBR	EU.FRA, EU.IRL
5	5 JP LL T N	Japan LL target north30	1961-1969	LL	Japan (North of 30N)	JPN (North of 30N)
5	5 JP LL t N	Japan LL transition north30	1970-1975			
5	5 JP LL b N	Japan LL late north30	1976-2021			
6	6 JP LL T S	Japan LL target south30	1956-1969	LL	Japan (South of 30N)	JPN (South of 30N)
6	6 JP LL t S	Japan LL transition south30	1970-1975			
6	6 JP LL b S	Japan LL late south30	1976-2021			
7	7 TW LL e N	Taiwan LL early north30	1968-1986	LL	Chinese Taipei (North of 30N)	CTP (North of 30N)
7	7 TW LL t N	Taiwan LL transition north30	1987-1998			
7	7 TW LL l N	Taiwan LL late north30	1999-2021			
8	8 TW LL e S	Taiwan LL early south30	1962-1986	LL	Chinese Taipei (South of 30N)	CTP (South of 30N)
8	8 TW LL t S	Taiwan LL transition south30	1987-1998			
8	8 TW LL l S	Taiwan LL late south30	1999-2021			
9	9 US CAN LL N	US and Canada LL north30	1981-2021	LL	USA and Canada (North of 30N)	USA-US-Com, USA, Canada (North of 30N)
10	10 US LL S	US LL south30	1981-2021	LL	USA (South of 30N)	USA-US-Com, USA (South of 30N)
11	11 Ven LL	Venezuela LL	1960-2021	LL	Venezuela	VEN
12	12 MIX KR+PA	Mixed flags (KR+PA+CHN) LL	1964-2021	LL	Mixed flags (KR+PA), China PR, Korea Rep., Panama	Not included
13	13 Oth LL	Other LL	1965-2021	LL	all others	Not included
14	14 Oth Surf	Other surface	1978-2021		all others	Not included
15	15 BB isl Qt2	Baitboat islands (Portugal Madeira/Azores, Spain Canary)	1965-2021 Quarter 2	BB	EU.PRT-PT-AZORES, EU.PRT-PT-MADEIRA, EU.ESP-ES-CANARY, EU.ESP-ES-CANT_ALBaz, EU.ESP-ES-CANT_ALBcd	EU.PRT-PT-AZORES, EU.PRT-PT-MADEIRA, EU.ESP-ES-CANARY

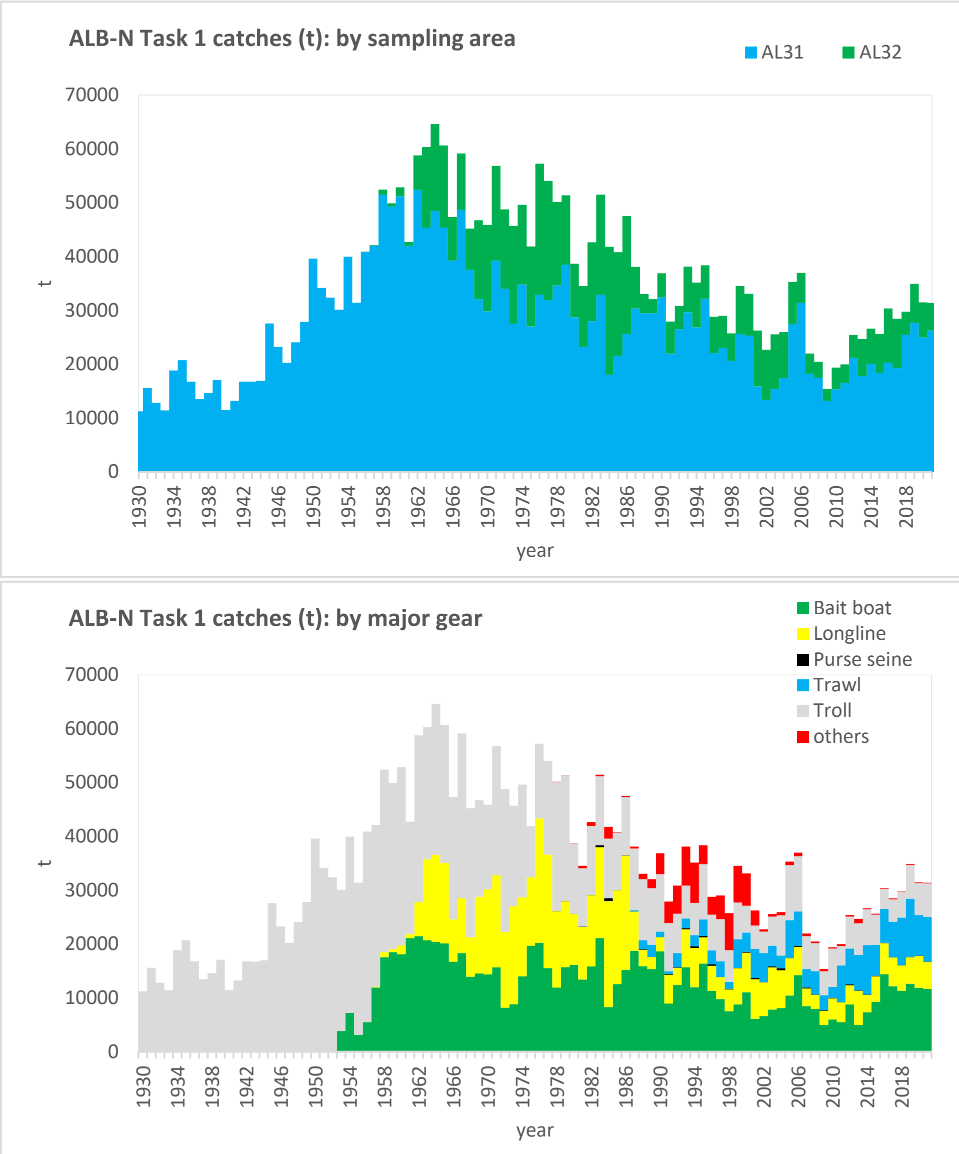


Figure 1. Total Task 1 catches (t) of northern albacore by year and sampling area (top) and major gear (bottom).

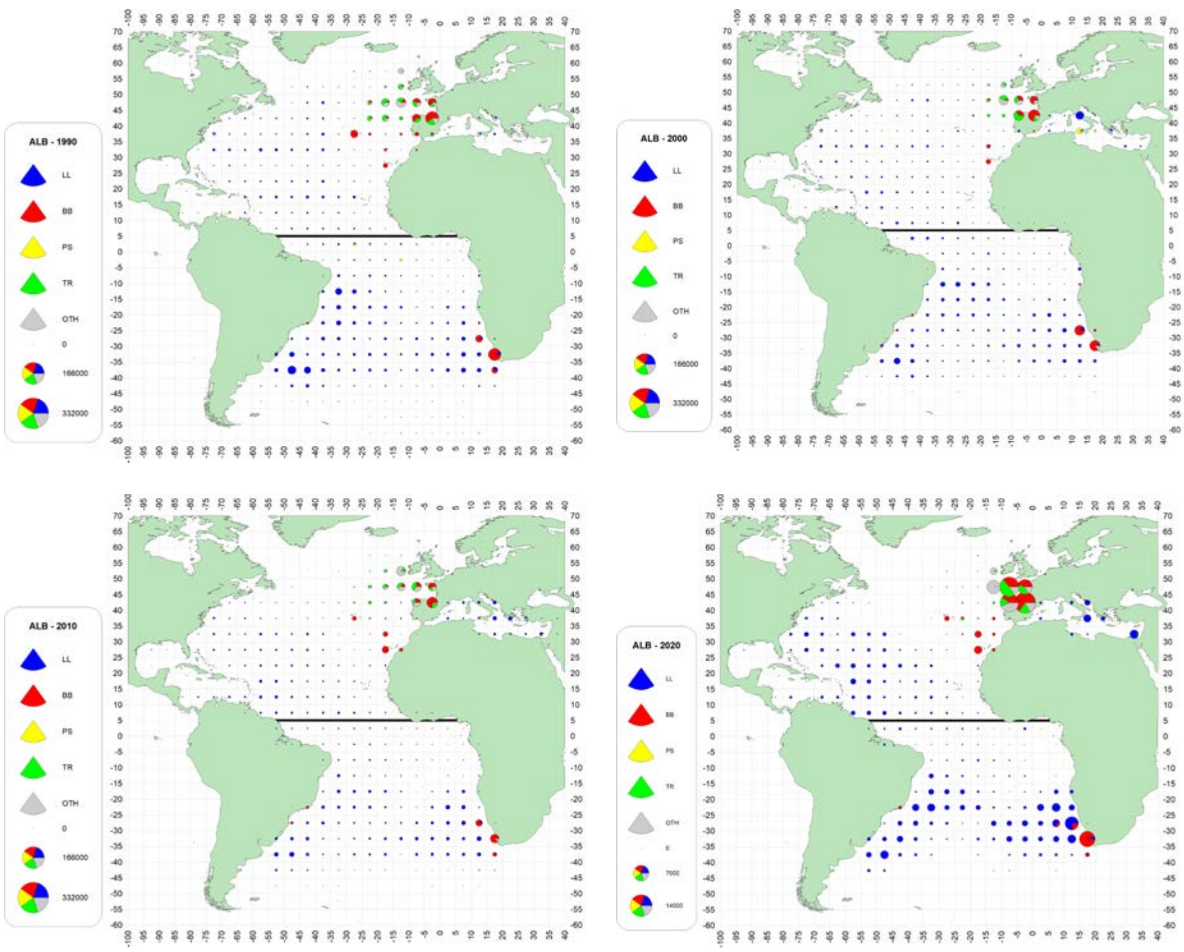


Figure 2. Geographical distribution of albacore catches (landings+dead discards) by major gear and decade (1990 to 2021). For the first three decades the maps are scaled to the maximum catch observed during each decade. The last decade has an independent scale with only two years (2020 and 2021).

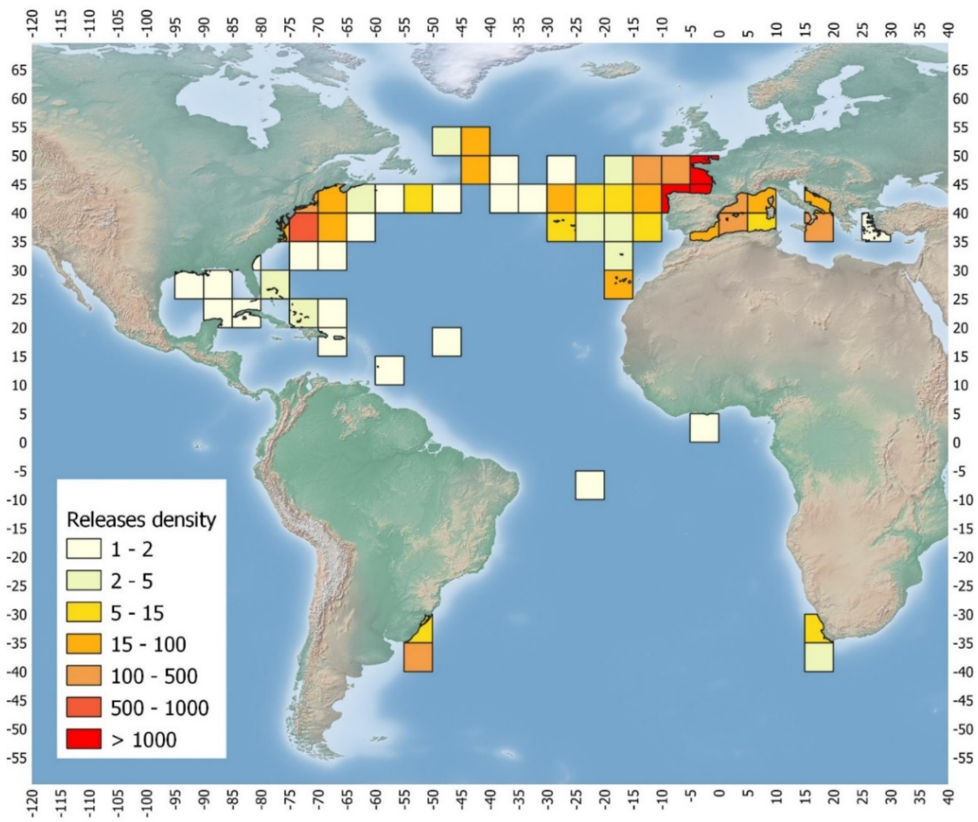


Figure 3. Density of the release positions at 5°x5° latitude - longitude grids in ICCAT conventional tagging for albacore.

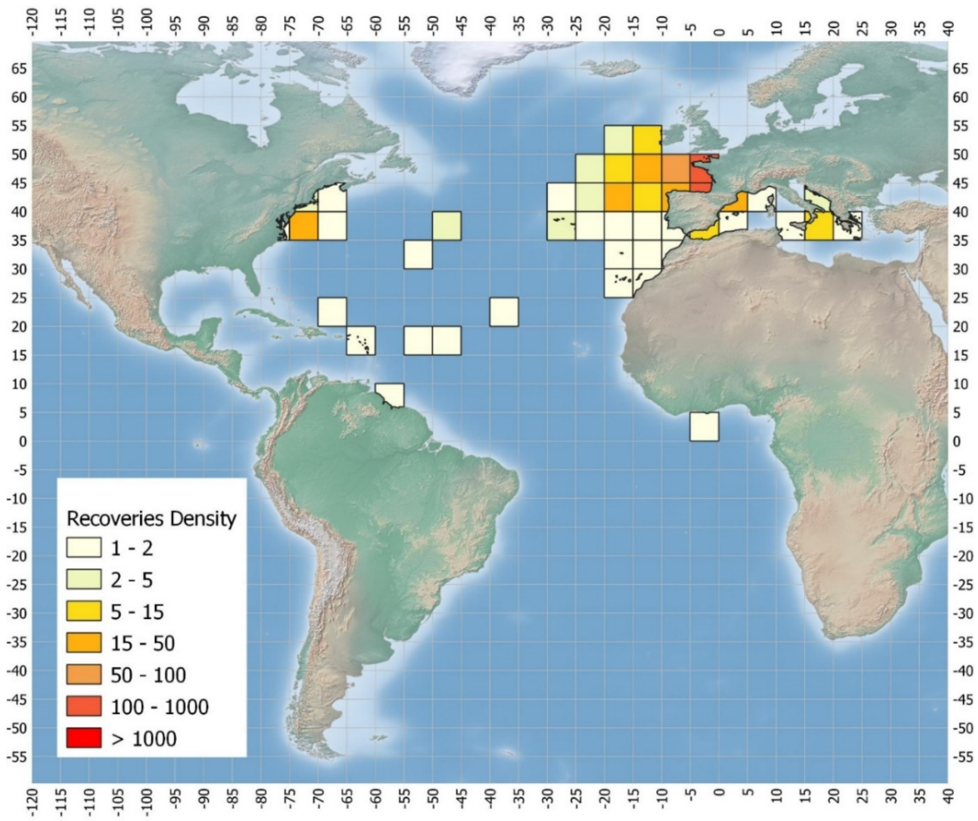


Figure 4. Density of the recovery positions at 5°x5° latitude - longitude grids in ICCAT conventional tagging for albacore.

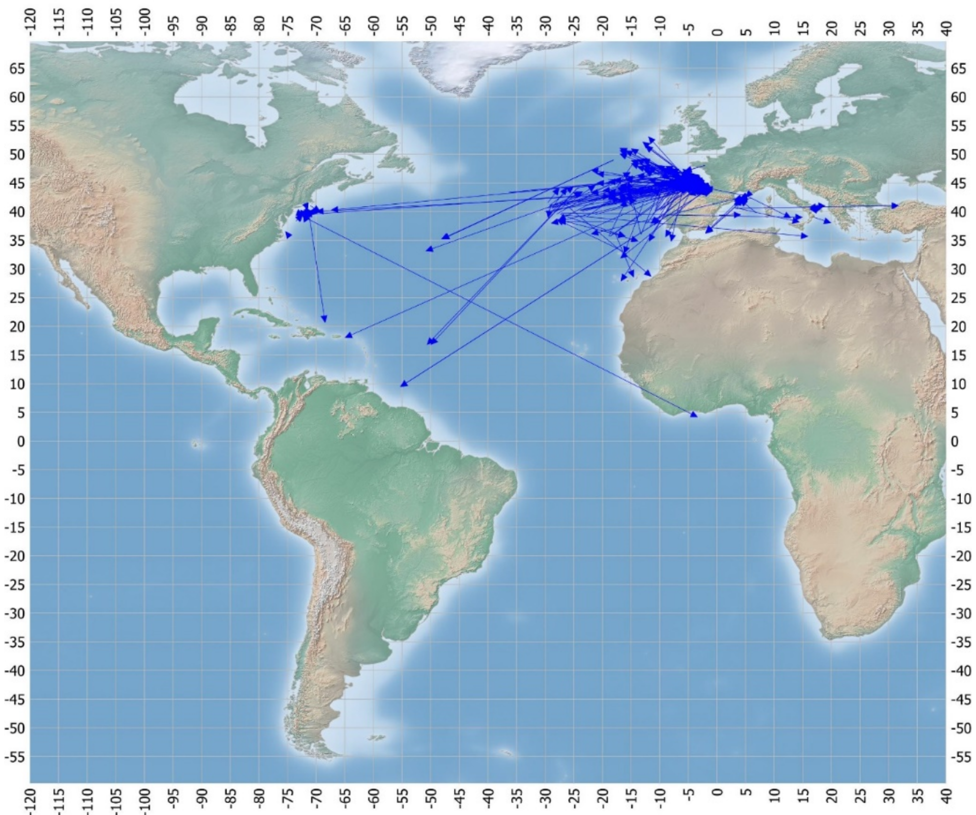


Figure 5. Straight displacement from the release to the recovery position of the recaptured albacore specimens in ICCAT conventional tagging.

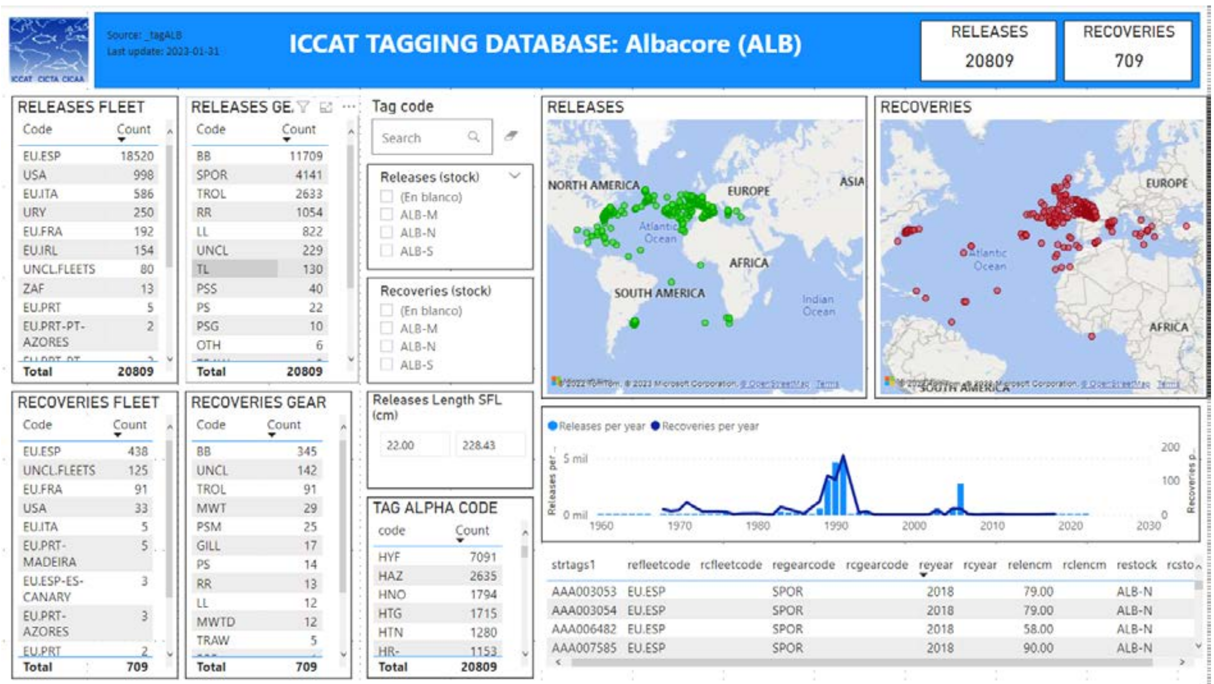


Figure 6. Screenshot of the ICCAT conventional tagging dashboard for albacore.

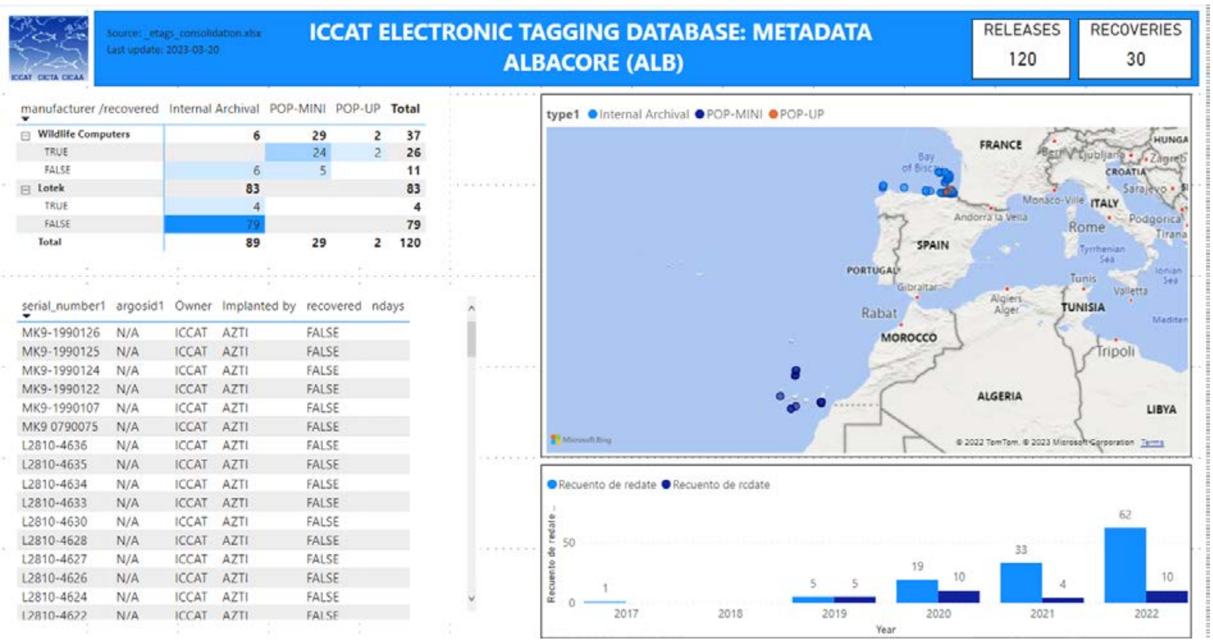
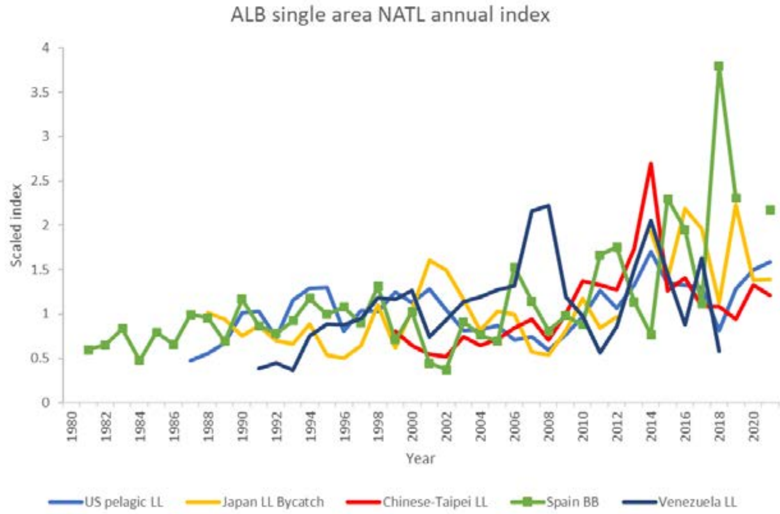
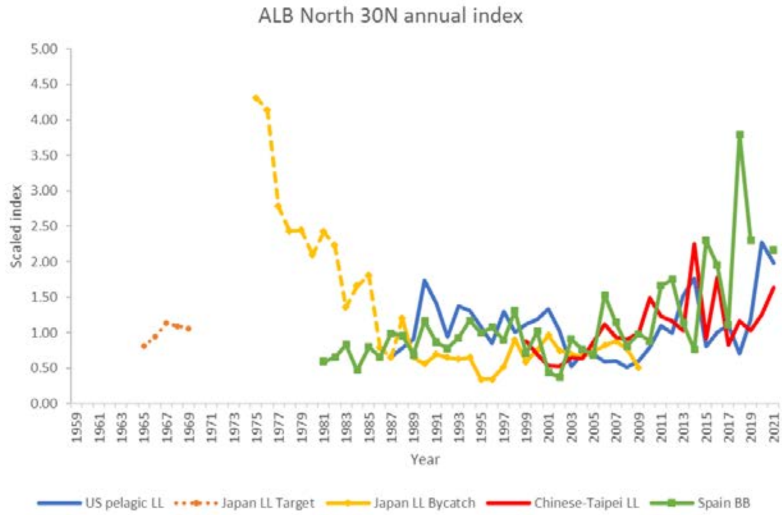


Figure 7. Screenshot of the ICCAT electronic tagging dashboard for albacore.

a) Annual indices for northern albacore (for MP).



b) Annual indices in North of 30°N (for stock assessment).



c) Annual indices in South of 30°N (for stock assessment).

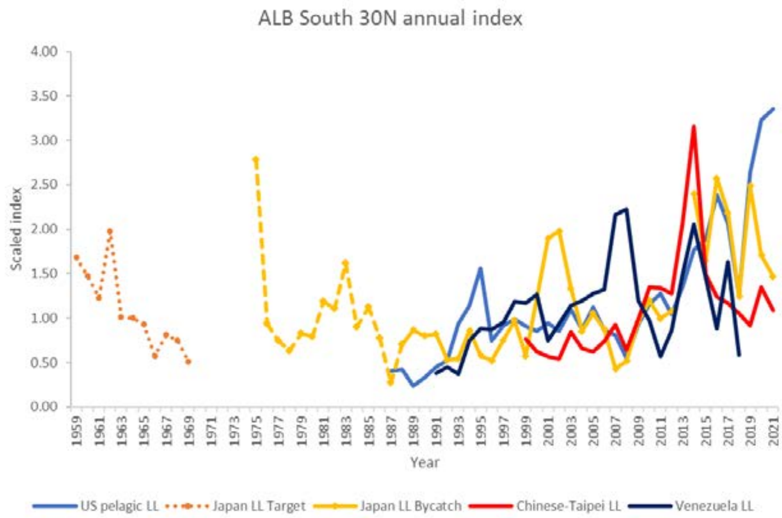


Figure 8. Abundance indices a) for northern albacore for the Management Procedure and area specific abundance indices (b) North and c) South of 30°N) for the stock assessment. Dashed lines for Japanese longline indices were suggested to be used for sensitivity runs.

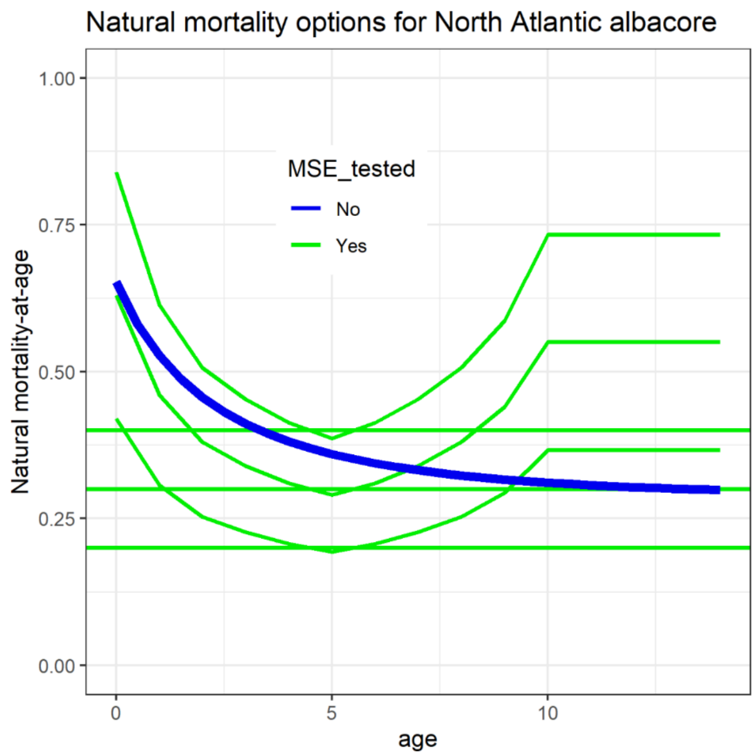


Figure 9. Natural mortality vectors agreed for the Stock Synthesis model (blue line) and the values of natural mortality (green lines) used in the MSE framework.

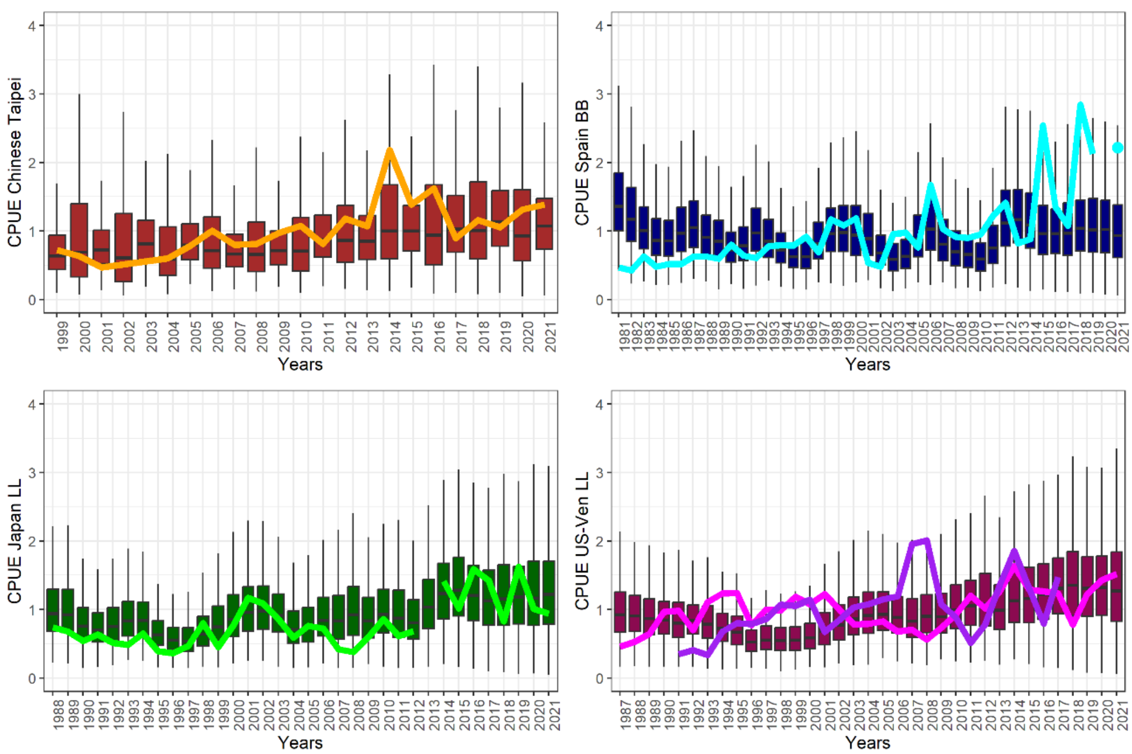


Figure 10. Northern albacore CPUE series presented at the data preparatory meeting (solid lines) and CPUE simulated in the MSE for the same periods.

Appendix 1

Agenda

1. Opening, adoption of agenda and meeting arrangements

2. Review of historical and new information on biology

3. Review of fishery statistics/indicators

   3.1 Task nominal catches (T1NC) and spatial distribution of catches (CATDIS)
   3.2 Task 2 catch and effort (T2CE) and size (T2SZ) data
   3.3 Tagging data

4. Review of available indices of relative abundance by fleet

5. Stock Synthesis: specifications of data inputs and modeling options

   5.1 Stock Synthesis: specifications of data inputs
   5.2 Stock synthesis initial model, diagnostics, and sensitivity analysis

6. Management Strategy Evaluation

   6.1 Exceptional Circumstances based on catch and CPUE updates
   6.2 Effects of underreporting (Response to Rec 21-04)

7. Albacore Year Programme (ALBYP): achievements and programmed activities for North, South, and Mediterranean stocks

8. Recommendations on research and statistics

9. Other matters

10. Adoption of the Report and closure

Appendix 2

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Appendix 3

List of papers and presentations

DocRef	*Title*	*Authors*
SCRS/2023/028	Review of Japanese longline fishery and its albacore catch in the North Atlantic Ocean	Matsumoto T.
SCRS/2023/029	Standardized CPUE for north Atlantic albacore by the Japanese longline fishery	Matsumoto T., Matsubara N., and Tsuda Y.
SCRS/2023/032	Natural mortality of albacore tuna (*Thunnus alalunga*) from the North Atlantic Ocean	Artetxe-Arrate I., Lastra-Luque P., Arrizabalaga H., Cabello M., Merino G., Ortiz-de-Zarate V., Santiago J., and Urtizberea A.
SCRS/2023/033	Update of input data (catch and size) for the North Atlantic Albacore Stock Synthesis in 2023	Kimoto A., Ortiz M., Palma C., and Mayor C.
SCRS/2023/035	Regionally informed abundance indices of albacore tuna in the North Atlantic Ocean for the Chinese Taipei longline fishery	Su N-J., Shiu Y.W., and Huang W.H.
SCRS/2023/036	Standardized indices of albacore, *Thunnus alalunga*, from the United States pelagic longline fishery	Lauretta M.
SCRS/P/2023/010	Evaluation of Exceptional Circumstances for North Atlantic albacore in 2023	Merino G.
SCRS/P/2023/011	Results of the Biology Reproductive Study: 2020-2022	ALB Consortium
SCRS/P/2023/012	Spanish baitboat CPUE index standardization	Ortiz-de-Zarate V., and Ortiz M.
SCRS/P/2023/013	Preliminary Stock Synthesis assessment model for northern Atlantic albacore	Urtizberea A., Merino G., Kimoto A., Ortiz M., Lauretta M., Schirripa M., Brown C., and Arrizabalaga H.
SCRS/P/2023/024	Recent trend in albacore catch rates from the Venezuelan Pelagic Longline fishery off the Caribbean Sea and adjacent water of the western central Atlantic for the period 2019-2022	Narvaez M., Evaristo E., Marcano J.H., and Arocha F.
SCRS/P/2023/028	Updated North Atlantic albacore e-tagging research 2019-2023	Cabello M., Arregui I., Onandia I., Uranga J., Lezama-Ochoa N., Ortiz-de-Zarate V., Delgado de Molina R., Santiago J., Abascal F., and Arrizabalaga H.

Appendix 4

SCRS documents and presentations abstracts as provided by the authors

SCRS/2023/028 - Status of effort, albacore catch and CPUE including seasonality was summarized for Japanese longline fishery operating in the Atlantic Ocean especially for North Atlantic. High catch and CPUE of albacore were observed during 1960s, and these sharply decreased after that. Historical change in geographical distribution of fishing effort is observed. Seasonality of the fishery was observed especially in the area North of 30N, and there were few operations in that area from 2010s onward.

SCRS/2023/029 - Standardized CPUE of north Atlantic albacore (*Thunnus alalunga*) caught by Japanese longline fishery (one area and area specific) was summarized in this document. Areas are divided by 30N. Method for CPUE standardization was same as that in the previous studies. GLM with negative binominal model was used for standardization of CPUE. Considering the availability of logbook database and albacore targeting, CPUE were analyzed by three periods (1959-1969, 1969-1975, 1975-2021). Effects of year, quarter, subarea, fishing gear (number of hooks between floats) and some interactions were considered for analysis of CPUE. Standardized CPUE showed decreasing trend in the early period and then was almost constant with some spikes. Strong seasonality was observed for area specific quarterly CPUE.

SCRS/2023/032 - Natural mortality (M) is considered one of the most influential parameters in fisheries stock assessment and management as it relates directly to stock productivity and reference points used for fisheries management advice. However, M is very uncertain and difficult to be estimated reliably and directly, and modelers have often to make choices about the values, or range of values to be assumed. For the North Atlantic (*Thunnus alalunga*) albacore stock assessment models within the ICCAT framework, constant natural mortality has been considered as 0.3 and natural mortality-at-age has been considered since the 2016 assessment. This document presents updated estimates of M and M-at-age for the albacore tuna from the North Atlantic Ocean using both size dependent and age dependent approaches, after reviewing the available literature of related life-history parameters such as longevity, growth, and age-at-maturity. Results show variations in the estimates, with size-dependent mortality estimates resulting in lower M-at-age, but overall, all the estimates were above 0.2 regardless of the age and approach. The current work also highlights the necessity to revise, update and enhance the estimation of certain life history parameters that mostly influence the estimation of M for the albacore in the North Atlantic Ocean.

SCRS/2023/033 - One of the main 2023 objectives of the Albacore Species Group (ALBSG) is to build a new reference case using Stock Synthesis for the North Atlantic stock assessment 2023. For the preparation of a new reference case by Stock Synthesis, the ALBSG established a small modelers team and the team has started their modelling work in 2022. In the 2023 ALBSG Workplan, the ALBSG requested the Secretariat to provide inputs data up until 2021 for Stock Synthesis based on the agreed fleet structure. This document summarizes the revision and update of the available detailed catch and size data per fleet up to 2021.

SCRS/2023/035 - Catch and effort data of albacore tuna (*Thunnus alalunga*) were standardized for the Chinese Taipei tuna longline fishery in the North Atlantic Ocean using a generalized linear model (GLM). The recent period from 1999 to 2021 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. Regionally based abundance indices of albacore were developed using data in recent years, which showed different trends to those from the other region. The standardized CPUE of albacore in the South of the North Atlantic Ocean started to increase slightly from the late 1999 until 2014 and then decreased to a relatively stable level during 2015-2021. However, the trends for the northern North Atlantic Ocean remain relatively consistent over the past decade, with a slightly increasing trend during 1999-2014.

SCRS/2023/036 - Catch and effort data from the United States pelagic longline fishery operating in the Atlantic Ocean were analyzed to estimate indices of albacore relative abundance. The standardized annual abundance index used in the albacore management procedure was strictly updated, and two quarterly indices were also provided that were spatially separated by regions North and South of 30 degrees North latitude. The updated annual series remained at a relatively high index for 2021 compared to most estimated values in the time series. The results of the spatially separated quarterly indices showed a distinct and consistent seasonality in albacore frequency of occurrence and catch-per-unit-effort, with higher occurrence and catch rates occurring during quarters 3 and 4 in the region North of 30 degrees latitude, and quarters 1 and 2 demonstrating higher catch rates in the region South of 30 degrees latitude.

SCRS/P/2023/010 showed the latest CPUE data available for the North Atlantic albacore superseding the CPUEs estimated in the MSE simulations. Overall, all CPUEs fall within the estimated range (2.5%-97.5%) except for the Spanish Baitboat for the years 2017 and 2014 where the data is slightly above the CPUE estimated in the MSE.

SCRS/P/2023/011 - From early 2020 to summer 2021, albacore fish were sampled following a design sampling plan that covered stratified fishing areas in the Caribbean Sea, Central North Atlantic, and western South Central Atlantic. 262 were available to carry out histological analysis of male and female gonads and 163 spine samples to determine the age of fish collected in the Caribbean Sea. To determine size at first maturity (L_{50}), only 8 fish were immature (7 female and 1 male), therefore it was not possible to estimate maturity. The minimum age of mature fish found was age 4 corresponding to three mature individuals with length (SFL) ranging from 94 to 98 cm. For fecundity estimates, 21 fish were selected for batch fecundity (BF) estimation, with sizes ranging from 102 to 111 cm SFL. The mean batch fecundity (BF) estimate was 1.28 million oocytes, with a range from 0.58 to 2.23 million oocytes. The average relative batch fecundity (BF_{rel}) estimation was 54.3 oocytes per gram of body weight, ranging from 30.4 to 92.8. These values are within the range of estimates for albacore stocks in the Pacific and Indian Oceans. The study indicated reproductive active fish (Stages III and IV) both male and female, mainly in May and June. Also found some fish in a spawning capable stage (III) in February, March, July, and September. Spawning fish (stage IV) were found only in areas 2 and 4 in the Central North Atlantic around parallel 20 ° N in May and June.

SCRS/P/2023/012 - The Spanish baitboat target albacore CPUE was standardized (number of fish/fishing days) for the period 1981 to 2021 (SCRS/2022/123). Analyses were done using the Generalized Linear Random Effects Model factors evaluated were year, month, zone and the interactions terms year*month and year*zone, which were treated as random effects in the final model with log-normal error distribution. The quarterly and annual standardized index was estimated. The third quarter model accounted for 43.5 % of the variability of the observed nominal CPUE. The GLMM model with random components month and zone variables captures the variability observed in the baitboat nominal catch rates. The temporal trend was quite stable. Short periods of increase and decrease alternate with some peak years in the latest years of time series.

SCRS/P/2023/013 - The input data available and an initial stock synthesis model together with the diagnostics for the Atlantic northern albacore were presented to the data preparatory working group. The aim of this study was not to present a reference case or a base case but an initial model run that could help the discussion about the main assumptions and issues that the model development can encounter. And thus, this would facilitate the development of a base case model for the stock assessment meeting in June. One of the main issues of the model, was the very noisy pattern of the length frequency of the fleets that were defined as others LL and other Surface, the differences in the pattern with time of USA LL fleets, and also the differences in BB island fleet between seasons. The model also had difficulties fitting the 8 CPUE indices (BB, JPLL North and South, TAI North and South, US North and South, VEN LL) due to the differences in trends and the differences in SE. The initial run also shows some instability and has difficulties to find the global minimum difficulties or estimating steepness depending on the initial values.

SCRS/P/2023/024 - The Venezuelan pelagic longline fleet primarily targets yellowfin tuna and has as bycatch billfish, sharks, and albacore tuna. Standardized and nominal CPUE data for ALB was presented by Arocha *et al.* (SCRS/2020/089) using data from scientific observer programs for the period of 1991-2018. Since that year, there has been no scientific observer program operating in Venezuela and for this reason, logbooks (which have approximately 100% of trip coverage) were used to explore the recent trend (2019-2022) in ALB nominal CPUE from a total number of 20537 sets of which 51.49% were positive for ALB. Total ALB catch reflected an increasing trend since 2002 with relatively small descending in the recent period. There has also been an increase in the proportion of ALB catch with respect to the target catch (YFT) caught by this fleet since 1999. The standardized and nominal CPUE from scientific observer data (SCRS/2020/089) showed a declining trend for the last year available (2018), which was also found in the nominal CPUE from logbook data. This decline has continued in the most recent years as seen from the nominal CPUE logbook data. The spatial distribution of albacore catch has changed over the years, with most of the catch found in the Guyana-Amazon (Atlantic) area, but with important hotspots in the Caribbean Sea in 2021 and 2022.

SCRS/P/2023/028 **-** We present the results of the ALB tagging operations carried out since 2019 as part of the Albacore Research Programme. The presentation aims to summarise the tagging campaigns, including a brief explanation of the tagging procedures and a summary of the number of tags deployed. Moreover, maps and graphs showing both horizontal and vertical behaviour of the tagged fish are shown, as well as a brief analysis on different behavioural patterns inferred from the data. Finally, the future plan is discussed, as well as a slide analysing tag malfunction issues and reward posters.