REPORT OF THE 2016 ICCAT NORTH AND SOUTH ATLANTIC ALBACORE STOCK ASSESSMENT MEETING

(Madeira, Portugal – April 28 to May 6, 2016)

1. Opening, adoption of agenda and meeting arrangements

The meeting was held in Madeira (Portugal), April 28 to May 6, 2016. Dr Haritz Arrizabalaga (EU-Spain), the Albacore Species Group Rapporteur, chaired the meeting. Dr Arrizabalaga thanked (in the name of ICCAT) the Regional Government of Madeira for hosting the meeting and providing all the logistical arrangements, and welcomed meeting participants ("the group"). He invited Ms. Lidia Gouveia to, on behalf of the Regional Government of Madeira, open the meeting and welcome the participants.

Dr Arrizabalaga proceeded to review the Agenda which was adopted with minor changes (**Appendix 1**).

The List of Participants is included in **Appendix 2**. The List of Documents presented at the meeting is attached as **Appendix 3**. The following participants served as Rapporteurs:

P. de Bryun	Item 1
V. Ortiz de Zarate	Item 2.1
C. Palma, L. Gouveia and G. Scott	Item 2.2
J. Ortiz de Urbina and H. Arrizabalaga	Item 2.3
D. Die, G. Merino	Item 3
G. Merino, L. Kell, J. Ortiz de Urbina and H. Arrizabalaga	Item 4.1
K. Yokawa, M. Kanaiwa and T. Matsumoto	Item 4.2
L. Kell, J. Ortiz de Urbina G. Merino and H. Arrizabalaga	Item 5.1
K. Yokawa, M. Kanaiwa and T. Matsumoto	Item 5.2
H. Arrizabalaga and D. Die	Item 6
G. Scott	Item 7

2. Summary of available data for assessment

2.1 Biology

Some new information on biology was made available to the group. However, the biological parameters for both stocks remain the same as in previous assessments (**Tables 1** and **2**).

In a past document (Nikolic and Bourjea, 2014), the authors presented results of a bibliographical review on the identification of albacore populations among and within oceanic regions (Atlantic, Pacific, and Indian Oceans, and Mediterranean Sea). They concluded that, due to the divergence of the results, the concept of stock and its delimitation remains a controversial issue. The authors indicated that there is an urgent need in most regions of the world for further albacore studies to review and improve the current management units used by Regional Fishery Management Organizations.

According to SCRS/2016/033, albacore (*Thunnus alalunga*) has been caught as by-catch of the tuna catch of the Venezuelan large pelagic fisheries over the past 25 years. The document analysed the spatial and temporal size distribution of northern albacore recorded by the Venezuelan pelagic longline observer programs (1991-2014) of which a total of 27,472 fish records were collected. Sizes ranged between 42 and 132 cm FL. Three distinct areas were identified: Caribbean Sea, Guyana-Amazon, and SW Sargasso Sea. In SW Sargasso Sea, the size distribution was stable with average sizes of 105-110 cm FL; while in the Caribbean Sea and Guyana-Amazon a larger size variability and wider range in size was recorded, but average sizes were similar across all areas. The overall age distribution consisted primarily of ages 6 and larger, and in which age 10 represented the 10+ group. The age frequency distributions reflected variability of albacore catches over the time period, from older fish in the SW Sargasso Sea during 1995-2003, to younger fish in the Caribbean Sea and Guyana-Amazon area during the recent period (after 2007).

Based on opportunistic observations of albacore that had been caught and was being dressed, visual observations of running mature eggs (hydrated oocytes) were considered an indication of spawning. Based on the information recorded by the observers on board, spawning time and area was determined to occur from March to April in the area SW of the Sargasso Sea (as presented in Luckhurst and Arocha, 2016). In the area of Guyana-Amazon, also based on sporadic observations, ovaries were in the maturing or in the regressing phases. No seasonal information was indicated. The group recommended further research in order to better understand reproduction of northern albacore in the area.

A new study on North Atlantic albacore growth was published (Ortiz de Zárate and Babcock, 2015) that describes the individual growth variability in North Atlantic albacore. Growth is assumed to follow the von Bertalanffy model with the assumption that growth parameters are constant over time and the same for all fish. However, individual growth variability is an important factor not considered and affecting the input into the modelling of the population. This study describes a Bayesian hierarchical model applied to model the individual variability in the parameters asymptotic length (L_∞) and growth rate (K) of the von Bertalanffy growth model for North Atlantic albacore. The method assumes that the L_∞ and K values for each individual fish are drawn from a random distribution centred on the population mean values, with estimated variances. Multiple observations of spine diameter at age for individual fish were obtained by direct reading of spine sections collected in 2011 and 2012. Three different back calculation methods were then applied to the measurements of annuli diameters in the aged individual observed to back-calculate lengths at each age. The von Bertalanffy model was fitted to the measured and back-calculated lengths. Models with and without individual growth variability were compared using the deviance information criterion (DIC) to find the best model. Normal and lognormal error distribution models were used to analyse the data. The growth modelling approach allowed accounting for individual variability in asymptotic length and growth rate. For albacore, it represents a new way to study growth based on back-calculation length from spine annuli measurements. It was found that the North Atlantic albacore asymptotic length (L_∞) varies significantly between individual fish but not the individual growth rate (K). Furthermore, negatively correlated relationships (-0.85) between von Bertalanffy growth parameters of asymptotic mean (L_∞) and growth rate (K) were estimated for North Atlantic albacore with the array of models explored. The estimated values of K (0.21) and population mean L_∞ (120.2 cm) parameters were similar to values estimated in previous North Atlantic albacore studies.

The group agreed that many of the critical biological parameters for Atlantic albacore are still poorly known. Knowledge of the biology of the albacore stocks underpins the advice of the SCRS since biological parameters are a critical input in the stock assessment models currently used by the group. Hence, substantially more biological research is required to improve the quality of the scientific advice and to reduce the uncertainty associated with it.

2.2 Catch, effort and size

Two documents on fishery data were presented in the meeting. Document SCRS/2016/082 provides an update on the tuna statistics of the EU-Portugal (Madeira) baitboat fishery operating in Madeira and Azores regions between 1999 and 2015, including the total catch by species, the baitboat fleet composition and the respective size frequencies for the main tuna species (BET, SKJ and ALB). It also describes in detail the geographical fishing grounds used by this fleet in the recent years (2010-2015) in Madeira and Azores regions.

Document SCRS/2016/033 analyses the spatial and temporal size distribution of Venezuelan LL fleet fishing for the northern albacore stock (sources: ICCAT/EPBR sponsored Venezuelan Pelagic Longline Observer Program (1991-2011), and the National Observer Program on pelagic longline vessels [2012-2014]). It covers the Caribbean Sea, Guyana-Amazon, and SW Sargasso Sea.

Next, the Secretariat presented to the group the most up-to-date albacore (ALB) fisheries information (T1NC: Task I nominal catch; T2CE: Task II catch & effort; T2SZ: Task II size samples; T2CS: Task II catch-at-size reported) available in ICCAT, for the northern (ALB-N) and southern (ALB-S) albacore stocks, covering the period 1950 to 2014. Preliminary T1NC statistics for 2015 were also presented. The ALB conventional tagging, and the CATDIS (1950 to 2013) estimations, were also made available to the group but not discussed in detail since not many changes were incorporated to these datasets that were more thoroughly scrutinized in 2013.

For a consolidated view of the available Task I and Task II statistics, the SCRS standard data catalogues (ALB-N in **Table 3** and ALB-S in **Table 4**) covering the period 1990-2015, were also presented. In these catalogues, fisheries are ranked according to their contribution to the total ALB Task I landings (average weight across all the time series shown in the mentioned tables).

2.2.1 Task I (catches)

The T1NC of ALB-N and ALB-S detailed catches are presented in **Table 5**. **Figure 1** (ALB-N) and **Figure 2** (ALB-S) show the accumulated catches by major gear for the entire period (1930-2014). The geographical distribution (grid of 5x5 squares) of the catches by decade and major gear (using CATDIS, a Task I equivalent estimation by trimester and 5x5 squares) are presented in the maps of **Figure 3**. These maps only cover the period 1950 to 2013. The Secretariat informed that an updated CATDIS (including 2014) estimation is in preparation, and, it will be available for the SCRS annual meeting.

There are no major differences in T1NC when compared with the version approved by the SCRS in September 2015, despite some updates presented later on by Japan and Chinese Taipei.

The overall ALB-N catches show a decreasing trend since 2006 (~37000 t) reaching a minimum of about 20000 t in 2011. This decline in catches, was mostly due to the decrease in the catches of the baitboat (~60% reduction in weight) and troll (~65% reduction) fisheries in the Cantabrian Sea (Spanish fleet). The catch of longline fisheries (mostly Chinese Taipei and Japan) have also shown a reduction of about 25% in weight. Since 2012, the overall catches increased slightly to a maximum of about 26500 t in 2014, caused mostly by an increase in the catches of the European trawl and baitboat fisheries of Canarias, Azores and Madeira, as well as, Japanese and Chinese Taipei longline fisheries (especially in 2013).

For ALB-S, the overall catch have oscillated around 24,000 t between 2006 and 2012, showing afterwards a large drop reaching less than 14,000 t (more than 40% reduction) in 2014. This decrease is linked to a catch reduction of the major fisheries (Longline: Chinese Taipei, Japan, and Brazil; Baitboat: South Africa, Namibia, and Brazil). The Secretariat recalled that Brazilian catches since 2012 are still preliminary and possibly underestimated.

The report of the 2015 catches was optional for this meeting, and in consequence only a few CPCs (EU-Spain, EU-Ireland, EU-United Kingdom, EU-Portugal, Japan, Venezuela and Chinese Taipei) presented provisional 2015 statistics. For the projections, a preliminary estimation of the 2015 total yield for each stock (**Table 6**) was obtained by carrying over the average catch of three previous years for each flag/gear combination without 2015 catches available.

2.2.2 Task II (catch and effort and size)

The data catalogues of ALB-N (**Table 3**) and ALB-S (**Table 4**) summarise the availability of T2CE, T2SZ, and T2CS datasets (respectively characters, “a”, “b”, “c” within each Task II row, i.e. when field DSet=“t2”). By default, the catalogues do not show datasets (which are available in the ICCAT-DB system) with poor resolution in time (by year), poor or no geographical detail (must have at least ALB sampling areas), and several other specific datasets usually not used by the SCRS (T2CE with no effort, non-standard frequencies in T2SZ, size/weight frequencies intervals in T2SZ larger than 5 cm/kg, etc.).

The ALB-N catalogue shows that nearly 90% of the total yield is caught by only seven fleets (EU-Spain BB and TR fleets, Chinese Taipei LL, EU-France TW and GN, EU-Portugal BB, and EU-Ireland TW). For those fleets, T2CE and T2SZ series are almost complete (EU-France TW recently recovered) for the last 15 years. There are, however, some minor gaps in T2CE and T2SZ series (EU-France TW, EU-Portugal BB, and, EU-Ireland TW) that need to be recovered. Some of the remaining 10% of the ALB-N fisheries still have important gaps in Task II data (both T2CE and T2SZ). The series with important gaps (at least two missing years of Task II data) are the surface LL fisheries of Vanuatu, Venezuela, EU-Spain, Panama, China PR and Korea.

The ALB-S catalogue shows that 90% of the total yield is caught by only five major fleets (Chinese Taipei LL, South Africa and Namibia BB, Brazil LL, and Japan LL). In terms of Task II (T2CE and T2SZ) availability, there are important gaps in South African, Namibian and Brazilian series. For the remainder 10% of the fleets, the Brazilian BB fleet and the most important LL fleets catching ALB as by-catch (Korea, Philippines, Vanuatu, EU-Spain and China PR) have important gaps in the Task II series. The tropical BB and PS fisheries (Ghana, EU-France, EU-Spain, Guatemala, Curacao, etc.) that catch ALB as by-catch also have incomplete Task II series.

In terms of Task II historical recoveries, Uruguay has reported a 14 year ALB-S historical series on T2SZ. Those size samples correspond to the national longline surface fleet (1998 to 2012), and to the samples obtained under the Uruguayan observer program on board Japanese longliners (2009 to 2013).

The group continues to observe the decreasing number of fish sampled by the Japanese fleet in the southern stock since 2008, with only 44 fish measured in 2014. This low coverage ratio (less than 1% of the catches in weight) was also observed for various other fleets fishing for ALB-S stock. The Brazilian BB and LL fleets have virtually no samples reported since 2012 (less than 100 fish sampled in total).

The group recommended that the Secretariat work together with the Statistical Correspondents of the CPCs that have Task II gaps in the data catalogues. For ICCAT CPCs with no scientific representation at the meeting, the Secretariat should request that these CPCs report missing datasets as soon as possible.

2.2.3 Catch-at-size

The overall catch-at-size (CAS) matrix was updated (full revision of 2011 and the inclusion of years 2012 to 2014) during the meeting to properly estimate the weighted mean weights by major gear and stock. This update was made only with this purpose in mind and should be revised in the future with the full set of substitution rules and extrapolation criteria used in ALB Atlantic stocks. The CAS matrices are presented in **Table 7** for ALB-N (histograms in **Figure 4**) and **Table 8** for ALB-S (histograms in **Figure 5**). The average weights obtained from the CAS, by stock (overall and by major gear) are presented in **Figure 6** (ALB-N) and **Figure 7** (ALB-S). The new size data from Uruguay were included in these estimations.

2.3 Relative abundance indices

2.3.1 North Atlantic

Document SCRS/2016/032 presented standardized CPUE for northern albacore in the southwestern North Atlantic from Venezuelan longline observer programs (1991-2014). The index was estimated by using Generalized Linear Mixed Models under a delta lognormal approach. The analysis included 'year', 'vessel category', 'area', 'season', 'fishing depth', 'bait', and 'bait condition' as categorical explanatory variables. Diagnostic plots showed no strong departures from the expected pattern, and checks for indication of influential observations showed no strong variations. The standardized time series showed a relatively slow increasing trend since the early period, reaching its highest value in 2008; thereafter the series drops to a low value in 2011. In the final years of the series, a strong increasing trend in the catch rates is observed, displaying the highest value in the last year.

It was noted that based on the results of the analysis of the age composition of the Venezuelan catch (SCRS/2016/033), two groups of ages appear to be separated by area. It was suggested that this potential effect should be taken into consideration in the standardization process. However, it was decided that this index could overall reflect the abundance of relatively large fish sizes.

Document SCRS/2016/073 reported updated standardized indices of albacore from the Spanish baitboat fleet for the period 1981-2014. Trips sampled from the commercial baitboat fishery recorded information on the date of landing, number of fishing days, area of effort, catch in number, and catch in weight (kg). Nominal catch rates (number of fish per fishing day) were modeled by a generalized linear model assuming a lognormal error distribution. In addition to the 'Zone' and 'Quarter' main factors, 'year*quarter' and 'year*zone' interactions were evaluated and included as random effects to provide annual estimates of the standardized index. The Generalized Linear Mixed Model accounted for about 30.81 % of the variability on the observed CPUE; better accounting for the variability observed in the baitboat nominal catch rates used in the last assessment, related to annual temporal and spatial distribution of catches per unit of effort.

The group noted that since there are three fleets (Spanish, Irish and French) targeting albacore in the North East Atlantic area, it would be worth trying a joint analysis in order to better account for the variability related to spatial and temporal changes in the availability of the resource.

Document SCRS/2016/074 presented updated standardized indices of albacore from the EU-Spain troll fleet for the period 1981-2014, based on individual trips sampled from the commercial troll fishery, and including information on the date of landing, number of fishing days, area of effort, catch in number, and catch in weight (kg). Nominal catch rates in number of fish per fishing day were modeled by a generalized linear model assuming a lognormal error distribution. The final model accounted for 45.6 % of the variability in the recorded CPUE and included 'year*quarter' and 'year*zone' interaction terms as random effects. The results from the GLMM represent an improvement on model fit as compared to the GLM fitted to standardize the troll nominal catch rates used in the last assessment. The GLMM model seems to better capture the variability observed in the catch rates of the troll fleet in regards to the temporal and spatial annual distribution.

Document SCRS/2016/078 presented standardized CPUE of Northern Atlantic albacore caught by Taiwanese longliners for the period 1967 to 2015, based on information from logbooks (since 1981) and Task II (since 1967). Data were scrutinized taking into account three periods (1967-1987, 1987-1999 and 1999-2015) and 5x5 areas for the distribution of the four major tuna species (albacore, bigeye tuna, yellowfin tuna, and swordfish) in order to identify appropriate sampling subareas. For standardization purposes only datasets within the proposed sampling subareas were used. CPUEs for albacore in the appropriate sampling subareas were standardized for three periods (1967-1987, 1987-1999, and 1999-2015). A GLM with lognormal error distribution was assumed for the standardization of both yearly and quarterly CPUE trends. Factors 'year', 'quarter', 'subarea' (5x5), 'bycatch effects' of bigeye tuna, yellowfin tuna and swordfish, and interactions were included in the model for obtaining yearly standardized abundance series. Factors 'quarter-series', 'subarea' (5x5), and 'bycatch effects' of bigeye tuna, yellowfin tuna and swordfish were constructed into the model for obtaining quarterly standardized abundance trends. The results showed that the yearly standardized CPUE continuously declined up to mid-1980s, highly fluctuated before early 2000s, and increased thereafter. Similar trends were also obtained for the quarterly standardized CPUE series. It was noted that splitting of the series to define the three periods for standardization purposes was based on changes in fishing operations (from traditional to deeper longline), stabilization of the fleet, and the improvement in the data collection system.

Document SCRS/2016/080 presented an index of abundance of albacore tuna estimated from catch and effort data from the United States pelagic longline fishery operating in the Atlantic. The standardized index was updated for the period 1987 to 2014, with no changes in the methodology used to estimate the same index for the previous 2013 assessment. The updated annual index and model diagnostics were presented in the document. The updated estimate showed the same trend as the previous index with 2011 as the terminal year. The new index showed a decline in 2012 with respect to 2011, but an increasing trend the following 2 years with the terminal year (2014) having the highest value of the entire time series. The group noted that the standardized series seemed to show a fairly strong signal for the period 2006-2014.

Document SCRS/2016/068 reported updated CPUEs for north Atlantic albacore caught by Japanese longline fishery. CPUEs were separately standardized into three periods (1959-69, 1969-75 and 1975-2014) using negative binominal model, based on the same methods as those in the previous studies.

The reliability of the strong up and down trends of the standardized CPUEs in most recent years in both north and south stocks were questioned. The group agreed to exclude them from the stock assessment because they have large confidence intervals and are recognized not to represent the dynamics of albacore stocks. The authors suggested the possibility that a temporal target shift from bigeye tuna to albacore in the years when unnaturally large CPUEs were obtained could be the reason for these CPUE values, although the CPUE standardization model could not sufficiently account for its effect. The group finally agreed to eliminate the standardized CPUE values for 2013 and 2014 from the northern ALB stock assessment.

Documents SCRS/2016/085 and SCRS/2016/086 suggest that the large decrease of standardized CPUEs of the Japanese longline prior to 1993 are biased mainly due to the shortage of data coverage and information on targeting. In the period analyzed, target shift from albacore to bluefin tuna occurred within same area and gear configuration which caused the sudden large decrease of albacore nominal CPUE. The decrease of albacore catchability of Japanese longliners, which is due to the fact that target shift caused a drastic decrease in the amount of effort in the traditional albacore fishing ground of Japanese longliners, is also shown when nominal CPUE of albacore decreased. Albacore CPUE in the place where larger amounts of effort deployed are shown to be apparently higher than those in the place where small amounts of effort are deployed. Because no relevant way to standardize these effects were found, authors proposed not to use Japanese indices before 1988 for the northern stock.

Document SCRS/2016/087 shows alternative abundance indices for the northern stock using data obtained from the core area (20N – 40N, west of 30N) of the Japanese longline fishery. Although CPUE standardization were successfully conducted for the periods 1964-1974, 1975-1993 and 1994-2006, the authors indicated the only suitable standardized CPUE for the stock assessment was that of the period between 1964 and 1971, as Japanese longliners operated in a constant manner.

Combining results of SCRS documents 085, 086 and 087, the authors proposed to consider the following Japanese indices for the northern stock assessment: Standardized CPUE for the period 1964 – 1971 from the core area, and the period 1988 – 2012 of the original updated “bycatch period”. The group generally supported the authors’ proposals, but at the same time, recovery of standardized CPUE in the lost period was recommended. The development of the method to standardize the effect of targeting shift not using hook per basket information is necessary for this purpose. There are multiple methods to adjust the effect of targeting without using hooks per basket information, such as use of species composition and CPUE of other species, but no consensus yet exists in the SCRS on the best use of these methods. Thus, the group requested that the Working Group on Stock Assessment Methods (WGSAM) evaluate the different CPUE standardization methods used in each species group and develop guidelines for CPUE standardization applicable to all species.

2.3.2 South Atlantic

Document SCRS/2016/079 presented the CPUE for the longline fleet from Chinese Taipei. Both the logbooks (since 1981) and the Task II catch/effort (since 1967) datasets of Taiwanese longliners were scrutinized, by decadal period and 5º-square block, for the geographical distribution characteristics of four major tuna species (albacore, bigeye tuna, yellowfin tuna and swordfish). This allowed to identify the most appropriate sampling area for South Atlantic albacore, which was from 10°S to 45°S and from 55°W to 20°E, yet excluding the small block of 10°S-15°S/10°W-15°E. In the most appropriate albacore area, standardized abundance indices of South Atlantic albacore, dating from 1967 to 2015, based on Taiwanese longline catch and effort statistics by using the GLM procedure were carried out. Factors as year, quarter, subareas (5°x5° blocks), bycatch effects of bigeye tuna, yellowfin tuna, swordfish and interactions were used to obtain the yearly standardized Catch Per Unit Effort (CPUE) trend from 1967 to 2015. The quarterly standardized CPUE series from the 3rd quarter of 1967 to the 4th quarter of 2015 were also obtained. Estimated standardized CPUE trends indicated that the abundance in weight of the most appropriate South Atlantic albacore area declined from late 1960s to 1990, then increased till mid-1990s, and leveled off since early 2000s up to 2015.

The group discussed the cluster analysis conducted from 1967 to 2015 and made suggestions for potential improvement (e.g. considering different numbers of clusters). However, it was clarified that this analysis was only used to identify the area to be considered in the standardization, rather than as an explanatory variable in the GLM. The small CV values, relatively large number of explanatory variables used in the model, and quite similar trend between nominal and standardized CPUE could suggest potential overfitting. Further improvement of the CPUE standardization model, especially for explanatory variables, could improve the estimation of the index and its CV. Traditional longline has always concentrated on a large area of the southern region and as such there was no need to split the series in this region. The group also noted that the small CVs do not necessarily reflect a precise abundance index, since estimated variance depends on the dataset and the method used. Extensive discussions have been held in the SCRS on the potential alternative uses of the CVs to weight different CPUE series. Although in the stock assessment models currently used, series are given equal weight or a weight proportional to the catch they represent, the estimated CVs can be used in alternative stock assessment model formulations.

Document SCRS/2016/067 presented a review of the Japanese longline fishery effort, albacore catch and CPUE in the Atlantic. Japanese longline vessels targeted albacore around 1960s, albacore became non-target after that, but the proportion of albacore is increasing in recent years, and is one of the target species again. Historical changes in the proportion of fishing effort by area, as well as the number of hooks per basket are observed. Albacore nominal CPUE was high during the early period (until around 1970), sharply decreased around early 1970s, kept comparatively constant in a low level until early or mid-2000s, and increased after that. In some areas the proportion of albacore in the catch is constantly high. A historical change in the number of hooks per basket was observed. The working group considered that in recent years albacore is targeted again, and so it is not appropriate to call this last period “bycatch period”. High catch and catch rate of albacore was observed even in the tropical area in 2013, but the reason is not clear.

Document SCRS/2016/068 presented the standardized CPUEs of south Atlantic albacore caught by the Japanese longline fishery, split into three periods (1959-69, 1969-75 and 1975-2014), using a negative binominal model and same methods as in the last assessment. Effects of quarter, area, fishing gear (number of hooks between floats) and several interactions were tested, although the effect of fishing gear could be used only from 1975 onwards. The effect of area was greatest for all three periods. Standardized CPUE in the South Atlantic declined during the 1960s to late 1980s. After that the CPUE fluctuated and showed no clear trend except for recent years, when a sharp spike was observed. According to the authors, CPUE indices in recent years seem to be less reliable due to e.g. changes in targeting. In recent years, the proportion of second deepest gear (12-15 hooks per basket) is increasing, indicating increasing targeting of albacore.

It was assumed that the recent sharp spike in CPUE might at least partially be due to increased albacore targeting. Thus, there might be a need to split this “bycatch period” series again in the future. But, for the time being, the group decided to keep it as one series and not consider the information of the last 3 years. The group also pointed out that the effect of fishing gear (number of hooks per basket) differs depending on the area, and so it considered it necessary to examine this effect in more detail.

Document SCRS/2016/085 discussed the trends of Japanese longliners CPUE between 1959 and 1975. Abundance indices of the Atlantic albacore estimated by standardizing CPUEs of Japanese longliners show a sharp decreasing trend in the period between 1959 and 1975 for both northern and southern stocks. The result of this study indicate the fact that consistent decreasing trends of albacore CPUE during the period before 1975 for both north and south stocks are largely biased by the change of target species that occurred in same areas. Shift of target species from albacore to other tunas could not be adjusted in the CPUE standardization model as no explanatory variables could be introduced into the model (i.e. lack of set by set data with hook per basket information prior to 1975). Thus, according to the authors, the trend of standardized CPUE largely overestimates the decreasing trend and should not be used in the assessment.

Document SCRS/2016/077 showed the CPUE index for South African pole and line fishery. Albacore is the main target of the South African tuna pole-line (baitboat) fleet operating along the west and south west coast of South Africa and the South African catch is the second largest in the region with annual landings of around 4000 t. A standardization of the CPUE of the South African baitboat fleet for the time series 2003 – 2015 was carried out with a Generalized Additive Mixed-Model (GAMM) with a *Tweedie* distributed error. Explanatory variables of the final model included year, month, geographic position, vessel power, included as a random effect, and targeting. The standardized CPUE mostly trails the nominal CPUE with no overall significant upward or downward trends. The analyses indicate that the CPUE for the South African baitboat fishery for albacore has been stable over the last decade.

The group noted that this document presents a different methodology (GAMM, compared to normally used GLM/GLMM), and that seasonality was modelled with a spline function instead of as a factor. Thus, the group recommended that the WGSAM provide some advice on the merits of the alternative procedures that can be used to standardize nominal CPUE series. It was also noted that an "early South African baitboat" series exists, from 1975-1998. During the 2013 stock assessment, the "late South African baitboat" series started in 1999, while in document SCRS/2016/077 it only starts in 2003. According to the authors, the years 1999-2003 were excluded because data reporting was more consistent after 2003.

Document SCRS/2016/089 showed the standardized catch rates by the Brazilian longline fleet. Catch and effort information from the Brazilian tuna longline fleet (national and chartered) in the equatorial and Southwestern Atlantic Ocean were collected during the period from 1978 to 2012 and data from more than 75,000 sets were analyzed. The CPUE of albacore tuna was standardized by a Generalized Linear Mixed Models (GLMM) using a Delta Lognormal approach. The factors used in the model were: quarter, year, area, and fleet strategy. The standardized CPUE series shows a significant oscillation over time, with a general increasing trend from the late 1980s to 2000, then a sharp decrease until 2003, remaining low until 2010, and after this period, an increasing behavior was observed again.

The dataset used to standardize the CPUE includes many different fleets. Thus, the authors use a cluster analysis to characterize fleet strategy, but there might not be enough overlap in the dataset to properly standardize for this variable. In fact, as noted during the 2013 stock assessment, this series shows a dome during the 1990s, which might be due to a larger influence of some fleets during this period of time. The group noted that the variance of the residuals was not homogeneous, and recommended to explore CPUE trends for specific fleets, rather than using the whole set of fleets in the analysis.

2.2.3 Summary of available CPUEs for North and South stocks

The table developed by the WGSAM in 2012 to evaluate the different CPUE series was updated in the light of the new information presented to the group. The group reviewed and discussed the updated scores (**Table 9**). It was acknowledged, as in the 2013 assessment, that the scoring is rather subjective and provides an indication of the relative nature of the CPUE series that can inform decisions about their effective use in the assessments. The various standardized CPUEs presented in documents described above as well as any other historical series that were not updated in this working group meeting are presented in **Tables 10** and **11** for the northern and southern stocks, respectively. The yearly values are also plotted in **Figures 8** and **9**, respectively. These series were also plotted against a GAM fitted to all the series together to look for correlations and, therefore, what series provide similar or conflicting information. This could then be used to inform the decision on what series should be used in the assessments. These plots are provided in **Figures 10a** and **10b** and **Figures 11a** and **11b** for the North and South Atlantic, respectively.

For the North Atlantic, the group already agreed in 2013 not to use transition periods for the Japanese or the Taiwanese series either. The remaining CPUEs were scrutinized by the group to decide which ones should be considered in the production models. At this point, and considering the difficulties to properly standardize historical indices (see above), it was agreed to follow the procedure indicated in SCRS/2016/028, thus considering individual indices in a production model framework starting in 1975. Thus, older CPUE series were discarded. The Irish Midwater trawl index and the French troll index were also discarded given that they were relatively short. The following series were considered, initially, as potentially reflecting trends in stock abundance: Chinese Taipei longline late, Japanese longline late (for the period 1988-2012), EU-Spain troll, EU-Spain baitboat, Venezuela longline and U.S. longline. These indices show, in general, a declining trend at the beginning of the time series (starting in 1975), followed by an increasing trend in the latest years. The EU-Spain troll index, however, is negatively correlated with most of the others showing a slightly continuously decreasing trend. This, together with the fact that this index reflects juvenile age classes (mostly ages 2 and 3), made the group to not consider it further in the analyses (except for sensitivity analyses). The final CPUE series considered are plotted in **Figures 12a** and **12b**.

For the South, the group revised the decisions that were made in 2013 regarding their use in the stock assessment. These included not to use the Japanese transition period (since transitions periods are more difficult to standardize and thus are more likely not to reflect stock abundance), nor the South African baitboat index, given that it represents just a few age groups and thus might violate the assumptions of production models. The group also agreed that the Brazilian CPUE should not be included in the production models due to the previously discussed issues with this series. For the 2016 stock assessment update, it was decided to keep the Uruguayan longline index (that shows a steeper decline than the other indices over the last years), the Chinese Taipei longline index, as well as the Japanese longline index. Regarding the latter, based on the documents presented suggesting that the early drop in the “Japan early” series might not reflect real trends in abundance (see above), the group agreed to use the “Japan late” series (though excluding the spike over the last 3 years), but conduct sensitivity analyses with the “Japan early” CPUE series.

3. Reference Points, Harvest Control Rules and Management Strategy Evaluation

The group noted that the ongoing work on Management Strategy Evaluation (MSE), Reference Points (RP) and Harvest Control Rules (HCR) aims to contribute not only to the potential decisions that the Commission may take with regards to a candidate HCR for the North Atlantic Albacore but also to the decisions to be taken during this WG in order to ensure that stock assessment advice is robust to uncertainty.

The group noted that other tRFMOs are also progressing on MSE for albacore and that the ICCAT efforts could benefit from shared experience among the other ongoing efforts. This interaction could best be conducted under the Kobe Joint MSE Working Group, which was formulated after the Kobe III meeting (La Jolla, 2011 - http://www.tuna-org.org/kobe3.htm) as an electronic discussion group open to interested practitioners and stakeholders. The group discussed the current situation of the plans for a face-to-face meeting of the tRFMO Joint MSE Working Group to accelerate the MSE processes across the tRFMOs. The group was informed that, although such a meeting was not yet formally announced, a query about timing amongst a group of scientists nominated by the tRFMO Executive Secretaries/Directors indicated that a meeting in the last quarter of 2016 would be possible. The group was informed that a Steering Committee from amongst the scientists contacted so far will further develop a meeting agenda, organize work plans for the meeting, and take steps to assure the process is both transparent and inclusive, as envisioned by the Kobe process.

This section has three sub-sections. The first sub-section briefly reviews the recent progress in the North Atlantic albacore MSE and the evaluation of HCRs as described by a variety of papers presented at the meeting. The second sub-section presents a synthesis on the discussions on how this work may be presented to the upcoming Commission Panel 2 meeting in Sapporo, Japan, and the SCRS annual meeting in September. The third sub-section presents results of other simulation work being done to inform calculations of how we may calculate the risks associated with management decisions for the North Atlantic albacore.

3.1 Update of the progress of the North Atlantic albacore MSE

The group noted that the work on RP and HCR for the North Atlantic albacore have progressed since 2009 (and probably earlier). The group noted that the MSE process had been incorporated as a component of the SCRS Strategic Plan adopted in 2014. Finally, the group also noted that the MSE results provided in 2013 with regards to projections with a subset of candidate HCRs and the probabilities of achieving management objectives partially guided the drafting by the Commission of Rec. 15-04.

The group was informed that most of the work on MSE presented at this meeting was presented earlier this year to the WGSAM which provided input to the MSE team working on the North Atlantic albacore simulations. The group was informed of the feedback provided by the WGSAM and discussed it. Details of the outcomes of the discussions are provided below.

The main steps when conducting an MSE are i) identification of management objectives and mapping these into statistical indicators of performance or utility functions; ii) selection of hypotheses for considering in the OM that represent the simulated versions of reality; iii) conditioning of the OM based on data and knowledge, and weighting of model hypotheses depending on their plausibility; iv) identifying candidate management strategies and coding these as MPs; v) projecting the OM forward in time using the MPs as a feedback control in order to simulate the long-term impact of management; and vi) identifying the MP (or set of MPs) that robustly meet management objectives. This cycle of steps may have to be repeated more than once, in response to the interactions between the SCRS and the Commission, and when new knowledge on the simulated system is made available (for example as the result of a new full assessment of the stock).

The work done with regards to North Atlantic albacore, documentation, code and data can be downloaded and run from http://iccat-mse.github.io/. At this meeting a series of new documents describing the recent progress in the implementation of MSE for the North Atlantic albacore were presented: SCRS/2016/015, SCRS/2016/023, SCRS/2016/024, SCRS/2016/025, SCRS/2016/026, SCRS/2016/027 and SCRS/2016/028. These papers were not presented in detail, but were used to illustrate the steps required to conduct an MSE. A summary of the results and methods was provided during the meeting as a single presentation. This was thought to be an appropriate way of providing the information on the progress of MSE required by the group, without taking too much time from the meeting. The presentation clarified the steps already taken to build an MSE for North Atlantic albacore. It was also reported that the analysis of the data used in the conditioning of the operating model suggested there may have been a change in the production dynamics of the stock prior to 1975. For that reason and for the purposes of MSE, the observation sub-model does not simulate data prior to 1975.

The document SCRS/2016/015 was presented in more detail. ICCAT's management objective is to maintain high long-term catch with a high probability of stocks not being overfished or overfishing occurring. If overfishing were occurring or the stock was overfished, ICCAT's objective is to bring it back to the zone where stocks are not being overfished and overfishing is not occurring (green quadrant of the Kobe plot) with a high probability in as short a time as possible (Rec. 11-13). To achieve this, Harvest Control Rules (HCRs) are sets of agreed to pre-defined rules that can be used to determine management actions (e.g. annual quotas). These HCRs need to be agreed to by policymakers, and understood and accepted by stakeholders, which is often difficult due to the many uncertainties inherent to fisheries. Due to these reasons, Management Strategy Evaluation (MSE) is used to estimate different levels of probability of achieving management objectives by alternative HCRs taking into account the existing uncertainties that affect fisheries' dynamics. In this study the authors developed an MSE for North Atlantic albacore and simulated the impact of alternative HCRs, concluding that stable high long-term catches and conservation objectives are achievable with certain levels of precaution. The group noted that the performance indicators included in the document SCRS/2016/015 were based on Rec. 15-04.

The group discussed and made a number of observations regarding the latest progress of the MSE work on North Atlantic albacore. The group made the following suggestions according to the individual components of the MSE process:

3.1.1 General suggestions

The group noted that this work is not only a step forward in the current dialogue between the SCRS and the Commission, but also a significant research effort from the scientists involved in it. Even if the Commission was to agree to implement a management procedure soon, including a HCR, for North Atlantic Albacore, the expertise to run MSE would still be required to be available within the SCRS for a number of years. That is because once an HCR has been agreed upon, there will be a need to review it periodically. Additionally, the Commission made it clear through Rec. 15-07 that it wishes to use the MSE concept to manage other ICCAT stocks.

The group also noted that the aim of these types of analyses is to explore HCRs that are most robust to a range of uncertainties. Even though the work to date considers already a number of uncertainty sources, further uncertainties beyond the ones considered in this study can always be considered in the future.

The group noted that the MSE modelling team provided before the meeting all code, outputs and inputs of this research through the share point and the *github* site to ensure transparency as requested by the WGSAM.

3.1.2 Operating sub-model

The group agreed that the main uncertainties quantified by the Multifan CL model were incorporated in the MSE simulations. However, the document SCRS/2016/025 identifies possible improvements that could be incorporated into the operating sub-model. The group discussed these improvements and proposed others.

The group suggested that the assumption of using a single selectivity for the fleets that have fished albacore in a wide range of its habitat and from juvenile to adults may be inappropriate. In such case, the change of ratio in the amount of effort between temperate and tropical areas can largely change selectivity of the fleet. It was pointed out that within the MSE such changes in selectivity could be initially represented through the observation error model without having to structure the operating model to be spatially explicit.

It was also suggested to examine the autocorrelation in recruitment that is apparent from the recruitment time series estimated from Multifan CL in 2013. Once this autocorrelation is examined the group suggested that the operating sub-model be used to model additional scenarios of autocorrelation in recruitment. Additional scenarios related to changes in the recruitment regime must also be tested.

3.1.3 Observation error sub-model

The group noted that the CV for CPUEs used in this analysis were based on the CV from the 2013 Multifan CL assessment and that these CV values are comparable to other MSE studies in tuna RFMOs. It was noted, however, that for larger CVs the simulated MP could not fit the surplus production model to the abundance index and failed to provide feasible solutions.

The group suggested that the assumption of a constant catchability to generate an abundance index directly, needs to be reviewed. It was suggested to include in the MSE simulations an effort creep scenario. In this scenario, indices would have a historical tendency to always underestimate changes in abundance and for that underestimation to grow continuously with time. This is in contrast to the hyperstability scenario, currently considered, where the underestimation depends on biomass level.

3.1.4 Management procedure[1]

MSE cannot answer the question on which estimated CPUE series available for the different fleets should be used in an assessment or in the management procedure. At most, it can inform about what kind of characteristics a relative abundance index must have to be effective in the context of a management procedure. Indices with a lot of uncertainty or indices that only track certain portions of the population could be tested.

Additionally, it was suggested that an assessment model other than a production model should be tested as part of the management procedure. A possible candidate assessment model could be a delay-difference model which can predict the dynamics of recruitment separate from those of the mature stock. Such a model could use more effectively the relative abundance indices available for juveniles of North Atlantic albacore. Such delay difference models have proven to be higher performers in the context of MSE (Carruthers *et al*., 2016) than many other assessment models, including production models. Adopting such a new assessment model would have to be evaluated given that it would represent a change from the current practice used by the group.

The group noted that the reference points obtained from surplus production models assume that there is no change in selectivity through the time series. This implies that changes in productivity related to changes in selectivity may not be fully captured with a choice of a surplus production model as the assessment model. Issues related to bias and correction of yield targets as obtained from surplus production models should be evaluated in future work.

The group also recommended to focus on the causes of some runs of the analysis failing (the assessment model could not fit the simulated observations). It would be relevant to learn if these run failures related to convergence problems in the estimation or reflected failures in the structure of the operating model or observation error model.

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[1] Also referred to as management strategy.

At the request of the working group the MSE team clarified that the probabilities and timeframes included in Rec. 15-04 were incorporated in the MSE work completed so far.

3.1.5 Implementation sub-model

The possibility of adding a bias in the implementation of management measures, i.e. systematically fishing more or less than TAC, should be considered. It was pointed out that since the Commission adopted TACs for albacore, catches have been generally below the TAC, thus directional bias in implementation error could be examined.

3.2 Implications for current assessment

The current MSE assessment model is a surplus production model. The results of the MSE and other previous work (e.g. see Maunder, 2003) suggest that a non-symmetrical production model (Pella and Tomlinson, Fox, etc.) better explains the dynamics of the north Atlantic albacore stock and such model should be used in the assessment (this is probably the result of the conditioning of the OM with the specific Multifan CL scenarios from 2013). The MSE simulations also highlighted the benefits of having priors on r and K, parameters that are hard to estimate given the datasets available for the production model.

Changes in selectivity of fleets that fish in a wide area of the stock and from juveniles to adults are better handled by alternative fleet definitions that may account for differences in the spatial distribution of effort (e.g. tropical and temperate longline fleets).

The simulation suggested that given potential changes in productivity in the past a production model fit to a recent period (since 1975) was able to mimic abundance trends of the operating model since 1975.

3.3 Input to the upcoming Commission Panel 2 meeting in Sapporo

The group reviewed Rec. 15-04 and Rec. 15-07 to evaluate the potential input that this group and the SCRS could provide to the Commission Panel 2 July meeting in Sapporo. The group noted that the Commission Panel 2 meeting is intended to be an opportunity to continue the dialogue, on the subject of MSE, between scientists, stakeholders and the Commission. Over the last two years, this dialogue had been conducted as part of the ICCAT SWGSM meeting. In 2015, the Commission decided that stock specific MSE discussions should be part of the different Commission Panel meetings.

The Chair of the SCRS presented ideas of what may be included in a presentation about the albacore MSE to the Sapporo meeting of the Commission Panel 2. The group provided ample feedback on the content of the presentation including suggestions on:

- explaining better the history of the MSE work in ICCAT;
- properly acknowledging the breadth of scientists involved in the current ICCAT MSE work on North Atlantic albacore;
- simplifying the content of some ideas presented, including proposals for using simpler analogies on the idea of managing risk;
- adding a mention to progress related to the MSE tuna RFMO working group:

    - related to the participation of experts from other disciplines, such as engineering, to help develop candidate HCRs
    - related to attempts to unify the terminology used to describe the MSE process, to facilitate communication across and within tuna RFMOs

- proposing to the Commission Panel 2 to include in the meeting a game seeking to understand how stakeholders perceive performance trade-offs, as it was done in the 2015 meeting of the SWGSM;
- providing suggestions on the next steps that ICCAT may follow after the Panel 2 meeting.

The SCRS Chair accepted all suggestions and proposed to prepare two different presentations on the MSE work, a simpler one for the Commission Panel 2 meeting with fewer technical details and a more elaborate one for the SCRS plenary.

3.4 Assessing risks of errors in management decisions

A presentation was made (SCRS/P/2016/021) on work based on a simulation approach developed using the life-history characteristics of albacore and testing limit and target reference points based respectively on B_{MSY}, and operating at F_{MSY} levels. The presenter argued that managers eventually have to evaluate a trade-off on the risk to the resource and the optimal catch levels in the long-term for the stock being managed. The effect of aiming at fish at target levels, and the risk of going below limit reference points was evaluated as trade-offs in the presence of auto-correlation on process error. The time for recovery towards the target reference point and beyond the limit reference points were calculated as a performance indicator. The approach presented displays the probability of adverse events occurring and evaluates different outcomes based on the specified thresholds and rates at which the stocks are fished. A concept of type I and type II errors is introduced, primarily defining the probability of taking a management action when it was not needed (a false positive, risk of taking a management action on a fishery) versus failing to take a management action when it was needed (a false negative, risk of failing to protect the resource when needed).

For illustration the presenter demonstrated how well this approach would work for a theoretical north Atlantic albacore stock conditioned on the results obtained in 2013 using Multifan CL. The group noted the relevance of this presentation and welcomed the results showing the probability of errors type I and II. The group discussed how the impact of autocorrelation has an impact on the resilience of the stock, i.e. the time required to recover above B_{LIM} when it falls below this reference point. The group also noted that the autocorrelation analysis shown in this presentation can contribute to the current MSE work being developed for North Atlantic albacore and other ICCAT stocks. The group encouraged the presenter to prepare an SCRS paper on this topic and to present it at the Albacore Species Group meeting in late September.

4. Stock assessment

4.1 North Atlantic albacore stock

In the 2013 assessment, several model formulations (MFCL, SS3, VPA and ASPIC) with varying degrees of complexity were used. This allowed to model different scenarios that represented different hypotheses, and to characterize the uncertainty around the stock status. The results showed that although the range of estimated management benchmarks was relatively wide, most models were in agreement that the stock was overfished, but not currently undergoing overfishing (Anon., 2014). These models from all the various platforms showed a drop in stock biomass from 1930 to about 1990 and an increasing trend in biomass starting in around 2000. Likewise, most models within all configurations showed a peak in fishing mortality in around 1990 with a decreasing trend thereafter. The analyses conducted in 2013 took a large amount of data preparation and scrutiny, and the group suggested that future assessment updates be conducted using simpler models (e.g. production models).

The projections of the 2013 assessment were conducted using 7 ASPIC scenarios (considering different sets of CPUE indices) and predicted the stock to rebuild by 2019 with 53% probability under current TAC of 28,000 t, and faster if catches remained lower. During the last three years (2012-2014) catches were below TAC (on average, 25658 t).

In 2016, the *Biodyn* algorithm for a biomass dynamic model based on ADMB, which is available in the *mpb* package of the FLR project (www.flr-project.org) repository was used to conduct stock assessment of the North Atlantic albacore. Biodyn was validated against ASPIC in Document SCRS/2016/027, as it provided the same results using the 2013 assessment inputs and assumptions, and it is the algorithm that is used in the MSE framework (e.g. SCRS/2016/015).

For the 2016 assessment, the group selected 5 CPUE series to be used in a production model framework (see section 2.3). These indices showed an overall increasing trend towards the end of the time series (**Figure 12**), which could be reflecting the increasing trend of the stock during this period of relatively low catch. Following document SCRS/2016/28, the group initially considered individual index fits to the catch time series. However, the group lacked a basis to decide which CPUE series could be best representing abundance. In fact, the group recognized that different fleets operating in different parts of the North Atlantic could jointly provide a better signal of the stock trend compared to the individual fleet CPUEs. On this basis, the group agreed to consider to use all the 5 CPUEs jointly in the base case scenario, and to weight them equally.

Subsequently, the group discussed whether to consider the catch series starting in 1975 or in 1930. The simulations conducted in the document SCRS/2016/028 suggest that a production model is better able to mimic the MFCL abundance trends since 1975 compared to those since 1930. This can be explained because the production model assumes constant productivity over the whole time period, and cannot explain some abundance patterns derived from regime shifts that produce large recruitment variations over time. However, fitting the production model since 1930 is consistent with the practice used in the 2013 stock assessment, and fitting to catch data since 1975 would require an additional assumption regarding the stock condition in 1975, while the assumption about the stock condition in 1930 could be more easily justified. For the Base Case, an unexploited biomass level in 1930 was assumed, and a Fox model (i.e., B_{MSY}=0.36*K) was used, in contrast to the 2013 stock assessment (see section 3).

The results of the Base Case scenario for North Atlantic albacore are shown in **Table 12** and **Figure 13**. The group noted that the estimated intrinsic growth rate (r=0.09) was very low compared to e.g. that estimated in the operating models considered for the MSE, the 2013 assessment, or the southern stock. Partial likelihood profiles suggested that the indices contained little and sometimes conflicting information about this parameter (**Figure 14**). Estimated carrying capacity (K) was beyond 10^6 t, and maximum sustainable yield was estimated at 37082 t. The CPUE residuals showed some patterns (**Figures 15** and **16**). The residuals for the Chinese Taipei longline index showed the strongest residual trend. The US LL and Venezuelan LL indices also showed some temporal pattern, while the Japanese longline and Spanish baitboat residuals were more randomly distributed around zero, with relatively constant variance. These residual patterns reflect the different signals provided by these fisheries CPUEs in the different areas they operate.

Figure 17 shows the trends of biomass and fishing mortality over time as estimated for the Base Case. Results suggest a biomass drop between the 1930s and the 1990s and a recovery since then. Relative to MSY benchmarks, the Base Case scenario estimates that the stock has recovered to levels above B_{MSY}. The Kobe phase plot of the bootstrapped Base Case scenario shows a typical pattern of development, overexploitation and recovery of this stock (**Figure 18**). The uncertainty around the current stock status has a clear shape determined by the strong correlation between r and K estimated by the production model. The probability of the stock currently being in the green area of the Kobe plot (not overfished and not undergoing overfishing, $F<F_{MSY}$ and $B>B_{MSY}$) is 96.8% while the probability of being in the yellow area (overfished or undergoing overfishing, $F>F_{MSY}$ or $B<B_{MSY}$) is 3.2%. The probability of being in the red area (overfished and undergoing overfishing, $F>F_{MSY}$ and $B<B_{MSY}$) is 0% (**Figure 19**).

The group conducted several sensitivity analyses, namely considering a logistic production function, the information content of the data, i.e. length of the catch time series (truncated at 1975), and the impact of dropping one of the five CPUE indices at a time. Historical absolute biomass estimates were not very sensitive to the effect of truncating the time series in 1975 and the production functions estimated in both scenarios resulted in a similar increase in biomass in the recent years (**Figure 20**). However, other scenarios demonstrated higher sensitivity of historical absolute biomass trends (in the period prior to 1975 for which only catch information was considered) as well as K and r, to the data used (**Figure 21**). Relative to MSY benchmarks, the historic sensitivities were reduced, but recent status indicators were more sensitive. When a logistic function was assumed in the biomass dynamic assessment model lower values of B/B_{MSY} were predicted for the trajectory over the whole time series, while excluding the Chinese Taipei longline resulted in much larger values of B/B_{MSY} in the recent period. The sensitivity analyses with respect to the other indices did not show strong deviations from the Base Case and all predicted the stock to be in the green quadrant (**Figure 22**), although the recent status varied across scenarios.

Finally, the group noted that while the B/B_{MSY} trajectory showed a strong retrospective pattern (**Figure 23**), all the retrospective trajectories showed an improvement in stock status in the most recent period. Although the retrospective pattern was not clearly systematic and the influence of the individual data points was heterogeneous, it suggested that the estimate of the current stock status could be strongly overestimated, and thus, it might not be appropriate to project forward and to give advice based on such projection, since the outcome of such projection could prove to be incorrect in the future. To address this concern, the group decided to analyze the effect of such observed retrospective pattern on the projected Kobe matrix itself, as a way to assess the robustness of the advice (based on projecting the Base Case) against the observed retrospective pattern. This issue is addressed in section 5.1.

In summary, the available information indicates that the stock has improved and is most likely in the green area of the Kobe plot, although the exact condition of the stock is not well determined.

4.2 South Atlantic albacore stock

4.2.1 ASPIC

Methods

The Document SCRS/2016/069 presented a non-equilibrium surplus-production model for the albacore stock in the southern Atlantic Ocean using the software package ASPIC v. 5.34. Fleet categorization (**Table 13**) was similar to that used in the 2013 assessment. Catch for each fleet (**Table 14**) was calculated based on Task I data as of April 19 2016. **Table 15** shows CPUE indices used for the models. CPUE indices for the same fleets as those in the last assessment were used in the base case scenarios, which is based on the decisions made at the 2013 Albacore Data Preparatory Meeting. Several fleets do not have a CPUE index. Four models, which are the same configurations as those in the last assessment, were examined (**Table 16**).

After the discussions, the Group agreed that Japanese longline CPUE before 1975 and after 2012 should not be included in the model due to the change in albacore targeting (see section 2.3). Other specifications in the ASPIC model are the same as those in the last assessment.

Status and diagnostics

In general, all the models predicted that at some stage in the recent past the southern albacore stock had been undergoing overfishing and had been overfished. In recent years, B-ratio is increasing and F-ratio is decreasing. It appears that the fishing pressure has declined in recent years which translated into a subsequent increase in stock biomass.

The results based on the four base cases suggested that the exploitation level in recent years was similar among the 4 cases (B_{2015}/B_{MSY} ranged from 0.937 to 1.147 and F_{2014}/F_{MSY} from 0.489 to 0.573, **Figure 24** and **Table 17**). To generate confidence intervals, 500 bootstrap trials were conducted for each model. The bootstrapped results for the four cases are shown in **Figure 25** (Kobe I plot). For all the scenarios, a portion of the realizations ended up in the green quadrant of the Kobe plot (not overfished nor overfishing). MSY was estimated to range from 25,080 t to 26,920 t (**Table 17**) which was around twice the total catch for 2014 (13,677 t).

Several sensitivity and retrospective analyses were conducted for one scenario (Run08) of the ASPIC model (**Table 18**, **Figure 26**). In the scenario that starts in year 1975, B1/K was set at 0.63 which was calculated from K and the biomass in 1975 estimated in the Base Case. As a result of the sensitivity analyses, the B-ratio of the initial period changed with different B1/K, and using only Japanese longline by-catch period index made the results more optimistic. The scenario that starts in year 1975 was also more optimistic. The scenario with South African baitboat CPUE did not converge. The results of other sensitivity analysis were very similar to that for the base case. As for retrospective analyses, only slight differences were observed when data for the last 1 to 6 years were removed. The models which removed data for the last 7 or 8 years did not converge. Slight overestimation of the B-ratio was observed in recent years, but the difference was within 10% and so the model indicated comparatively robust results.

4.2.2 Bayesian Surplus Production Model (BSP)

The Bayesian Surplus Production (BSP) model that was applied to the South Atlantic albacore stock in the 2013 assessment using an additional three years of catch data (1956-2014) and the CPUE series recommended by the group, i.e. Taiwanese longline between 1967 and 2014, Japanese longline between 1976 and 2011 and Uruguay longline between 1983 and 2011. The same informative priors were used as in 2013. Kobe plots were also produced. Estimates of current status were strongly dependent on which method was used to weight the CPUE data points, with equal weighting scenarios attaining better convergence. Equal weighting produced more optimistic results, while catch weighting results were more pessimistic.

Methods

The Bayesian Surplus Production Model (BSP) was applied to South Atlantic albacore for the same four base case model scenarios that were used for ASPIC. The models were: (1) equal weighting of indices, Schaefer model; (2) catch weighting, Schaefer model; (3) equal weighting, Fox model with $B_{MSY}/K=0.37$; and (4) catch weighting, Fox model with $B_{MSY}/K=0.37$. Because under equal weighting of indices, there were issues on model convergence, the total weight was reduced to 1/100. For all four base case models the same Bayesian prior distributions were used as in the 2013 assessment. The prior for the biomass in 1956 relative to K was lognormal with a mean of 0.9 and a log standard deviation of 0.1 implying that the population was close to unfished in the first year of the fishery. The prior for K was uniform in log space. An informative prior for the intrinsic rate of population increase r was developed as shown in Babcock (2012) and the 2013 assessment, and was approximated by a t distribution with mean 0.2, variance 0.025 and df 10.

The BSP program using R and JAGS which is the improved version of the one available from the ICCAT catalog of methods, was used to estimate the marginal posterior distributions using the MCMC algorithm.

Status and diagnostics

Likewise ASPIC four base cases, the two equal weighting models of BSP estimated increasing biomass and decreasing fishing mortality since the early 2000s (**Figure 24** and **25**). Two catch weighted base cases estimated decreasing harvest rate since last stock assessment while biomass was slightly decreased. The current status, however, relative to B_{MSY} and H_{MSY} (Harvest ratio at MSY) depended on the model formulation (**Figure 26**, **Tables 17** and **19**), two equal weighting and one catch weighting base cases estimated that the stock is not overfished and is not undergoing overfishing, and one catch weighting base case scenario estimated stock is overfished but not undergoing overfishing. All four base cases estimated higher intrinsic growth rate (r) and lower initial biomass than ASPIC (see also **Figures 27** and **28**). Three of four base cases indicated increased B-ratio and decreased Harvest ratio (H-ratio) from those in last stock assessment, and only catch weighted Fox model results in decreasing B-ratio and increased H-ratio would be due to the large decrease of estimated MSY (**Table 17**). The confidence intervals of the estimates of B/B_{MSY} and F/F_{MSY} tend to be wider in the equally weighted models than the catch weighted models (**Figure 24**). Some convergence diagnostics, e.g. R_{HAT} and N_{EFF} for r and K, looked fine (see **Figures 29** and **30**) but some trends were also found. Thus, the model convergence may have some issue and this might necessitate further investigation in the future.

4.2.3 Summary of stock status

Six of eight scenarios indicated that the stock is not overfished and not undergoing overfishing, and two other scenarios indicated that the stock is overfished but not undergoing overfishing (**Table 17**). All ASPIC scenarios and 2 BSP scenarios estimated higher B-ratio than in the last stock assessment, and all ASPIC scenarios as well as 3 BSP scenarios estimated lower F-ratio/H-ratio than in the last stock assessment (**Table 17**). This indicated that current stock status of southern stock has improved since the last stock assessment and the stock is in the green quadrant of the Kobe plot with a high probability.

5. Projections

5.1 North Atlantic albacore stock

The results shown in this section were produced by projecting forward the estimated 2014 population presented in section 4.1. For 2015 and 2016, the catch of 26000 t was assumed (see section 2.2). The population from 2017 onwards was projected with alternative TAC and harvest control rules (HCR, as combinations of target fishing mortality (F_{TAR}), threshold biomass (B_{THRESH}) and the interim biomass limit reference point (B_{LIM}). The 500 bootstrap outcomes of the Base Case were projected. The alternative harvest control rules include alternative target fishing mortalities [F_{TARGET}=(0.7, 0.75, 0.8, 0.85, 0.9 and 1) x F_{MSY}], threshold biomass levels of (0.6, 0.8 and 1) x B_{MSY} and a biomass limit reference point of B_{LIM}=0.4 x B_{MSY}. In the forward projections, the HCRs are evaluated every three years and the fishing mortality is projected assuming perfect implementation.

The outcomes of the projections of the base case are shown in **Figure 31** and **Tables 20** and **21**, which indicate the projected probability of being in the green quadrant of the Kobe plot within the time-frame indicated. In the case of the HCR projections, expected average catch for the first 3 years, as well as cumulated catch for each future 5 year period are also shown. **Figure 32** shows the probability of the stock being in the green quadrant of the Kobe plot and the effect of the retrospective pattern on the management advice based on the projected Base Case. This analysis suggests a negligible effect of the retrospective pattern on the status of the stock. The Kobe matrices obtained from all the retrospective scenarios projected are fairly similar and do not show any systematic pattern, even if the current stock status that is being projected varies quite significantly among scenarios (see **Figure 23**).

These K2SM project substantially higher sustainable catch levels compared to most of the previous assessments. During discussion, the group noted that the projections did not fully account for many other sources of uncertainty (i.e. model uncertainty, such as model structure and assumptions) that need evaluation through MSE. As such, the group did not place high confidence in the probabilities projected from this assessment (K2SM).

5.2 South Atlantic albacore stock

5.2.1 ASPIC projections

Based on bootstrapping (500 times) of each scenario, projections were conducted. The chosen projection period was 16 years (2015-2030). Constant future catch was set between 12,000 and 34,000 t (at 2,000 t interval) or constant F at $0.75*F_{MSY}$ to $1.00*F_{MSY}$ (at $0.05*F_{MSY}$ interval) was assumed. Catch for 2015 (15,570 t) was estimated based on reported catch or the average for the last three years, and catch for 2016 was assumed to be equal to 2013-2015 average (16,170 t) for both constant catch and constant F scenarios.

Software package ASPICP ver. 3.16 was used to make the projections. The results of these projections under constant catch and constant F are provided in **Figures 33** and **34**, respectively, which show the median trajectory of the different scenarios. **Figure 35** shows predicted yield under constant F scenario. Kobe II matrixes showing the probabilities of $B>B_{MSY,}$ $F<F_{MSY,}$ and $B>B_{MSY,} + F<F_{MSY}$ (green quadrant of the Kobe plot) under different constant catch and F levels are shown in **Table 22** for each ASPIC run. Under a constant catch, the median biomass is expected to be in the Kobe green zone in 2020 with at least 60% probability for TACs of 26,000 t or less in three out of the four scenarios, and 24,000 t or less for equal weighting Fox scenario. For the constant F projections, 90–95 % or less of F_{MSY} level attained Kobe green zone in medium and long term in the probability higher than 60%.

5.2.2 BSP projections

Basically projection scenarios are the same as those for ASPIC for the south Atlantic. Under constant catch , the median biomass is expected to be in Kobe green zone in 2020 with at least 60% probability for TACs from 18,000 to 34,000 t depending on the scenario (**Tables 23** and **24**, **Figures 36** and **37**). With constant harvest rates, harvest rates below HMSY allowed the population to stay above B_{MSY} with a high probability. When H is equal to H_{MSY}, all scenario but the “catch weighted logistic” one allowed the population to stay above B_{MSY}.

5.2.3 Projections for the South Atlantic

Combining all eight ASPIC and BSP model scenarios with equal weights, the Kobe matrix (**Tables 24** and **25**) indicates that catches which enable the stock to be in the Kobe green zone in 2020 with at least a 60% probability ranged from 18,000 to 34,000 t; the average is 25,750 t and median is 26,000 t.

6. Management recommendations

6.1 North Atlantic albacore stock

Recommendation 15-04 sets the objective of maintaining the stock in the green area of the Kobe plot with a 60% probability while maximizing long-term yield, and, if $B<B_{MSY}$, to recover it by 2020 at the latest, while maximizing average catch and minimizing inter-annual fluctuations in TAC levels. The simulations conducted so far suggest that HCRs with combinations of F targets below F_{MSY} together with $B_{THRESHOLD}$ values below B_{MSY} allow for reasonably good compromises between sustainability targets and fishery profit and stability. However, although some of these Harvest Control Rules have been tested in an MSE framework against these sometimes conflicting objectives, further work is needed to fully test them against a fuller range of uncertainties.

The group has noted that the abundance of north Atlantic albacore has continued to rebuild over the last decades and is likely somewhere in the green area of the Kobe plot. However, without additional information (see section 7), the magnitude of the recovery is not well determined and remains sensitive to many different assumptions. This undermines the ability of the group to reliably quantify the effects of future TAC or HCR scenarios on the status of the stock, until more sources of uncertainty and the robustness of the advice are evaluated in the future through MSE and/or benchmark stock assessment after accumulating sufficient new information. Based on the analyses conducted in 2016 as well as in 2013, the group believes that the current TAC would maintain the long-term objectives of the Commission as specified in Rec. 15-04. Given the uncertainty around the current stock status and the projections, the group is unable to advice on risks associated with an increase in the TAC. Therefore, the group does not recommend an increase of the TAC. Should the Commission decide to increase the TAC, the group recommends that this be done with a high level of precaution, and with the requirement for improved monitoring of stock indicators (operational level catch, effort, and size information from all of the fleets). Further, the group reminds the Commission that our ability to monitor changes in stock abundance is currently limited to fishery dependent information and it is desirable to evaluate alternative fishery independent tools to provide improved bases for monitoring stock condition.

6.2 South Atlantic albacore stock

The different model scenarios considered in the south Atlantic albacore stock assessment provide different views on the future effects of alternative management actions. The Kobe matrix shows that catches which enable the stock to be in the green area of the Kobe plot in 2020 with at least a 60% probability range from 18,000 and 34,000 t, depending on the scenario considered. Considering all the scenarios equally likely, the average catch is 25,750 t and the median is 26,000 t.

Projections at a level consistent with the 2016 TAC (24,000 t) showed that probabilities of being in the green quadrant of the Kobe plot across all scenarios would increase to 63% by 2020. Further reductions in TAC would increase the probability of being in the green zone in those timeframes. On the other hand, catches above 26,000 t will not permit maintaining the stock in the green area with at least 60% probability by 2020.

7. Recommendations on research and statistics

- The group recognizes the need to incorporate environmental studies in albacore and other species assessments. The group was exposed to new information suggesting that the mixed layer depth might impact catchability of surface fisheries. The group recommends further research to confirm this, as well as to inspect sources of historical environmental information that might help integrate this information in CPUE standardizations of surface fisheries.
- The group recommends increasing efforts to obtain French mid-water trawl and other fisheries historical series of catch, effort, catch at size, geographical distribution and other related fisheries information.
- The group recommended that the Secretariat contact Chinese Taipei to obtain the revised catch at size by month and 5x5.
- The group expressed concern that spatial and targeting shifts in longline fisheries might have affected the trends of their standardized CPUE series. Thus, the group recommends to more fully explore better ways to incorporate spatial and targeting effects into CPUE standardization. The group noted that more credence should be given to CPUE indices based on operational data, since analyses of these data can take more factors into account, and analysts are better able to check the data for inconsistencies and errors. Examining operational level data across all Atlantic longline fleets taking albacore (Rep. of Korea, Japan, Chinese Taipei, EU-Spain, EU-Portugal, USA, Uruguay, Brazil, Venezuela) will give a better idea of what is going on with the stock especially if some datasets have low sample sizes or effort in some years, and others have higher sample sizes and effort, so we have a representative sample covering the broadest areas in the Northern and Southern Atlantic Ocean. This will also avoid having no information in certain strata if a fleet were not operating there, and avoid combining two indices in that case. As such, the group recommended joint analysis of operational catch and effort data from multiple fleets be undertaken under the general guidance by the *ad hoc* Working Group on Stock Assessment Methods, to further develop methods and to provide indices of abundance for Atlantic stock assessments, as is already underway in other ICCAT species groups and other tRFMOs.
- The group recommended that the flags noted above should take steps to assure that Task II catch and effort information for their fleets are provided at the appropriate time-space scales and in time for the next albacore stock assessment. Further, the catch effort time series from these fleets should be standardized to support the next albacore assessment.
- As noted in the most recent series of scientific meetings of the Albacore Species Group, several countries with important albacore fisheries were not represented at the meeting. This limited the ability of the group to properly revise the basic fishery data and some standardized CPUEs that were submitted electronically. This continues to result in unquantified uncertainties and negatively affected successfully achieving the objective of the meeting. To overcome this, the group continues to recommend that CPCs make additional efforts to participate and be made aware of capacity building funds available for participation in and contributing to working group meetings.

- Several research lines should be pursued as part of the yet unfunded Albacore Substantially Advanced Program (ASAP). First, the biological research should be accelerated. Accurate biological parameters are very important for stock assessment purposes and for the process of evaluating albacore stock capacity for rebounding from limit reference points. Albacore biological parameters are in many cases based on limited research and it is important to assess whether these parameters have changed over time or if current observations are consistent with estimates from those limited studies. Second, the group recommended further studies on the effect of environmental variables on CPUE trends of surface and other fisheries. Finally, the group also recommended further elaboration of the MSE framework be developed for albacore. Among other things, work should be promoted towards including a more complete range of uncertainties, including observation, process, model, and implementation errors. This would permit better characterization of uncertainty in current and future stock condition, providing an improved basis for providing management advice. The group recommended that a prioritized list of research lines with budgeting requirements be prepared for the next meeting of the Albacore Species Group.
- The group recommended that results of ongoing research on stock structure in the South Atlantic and Indian Ocean be reported upon as soon as possible.
- As noted in Section 3, to conduct an MSE is an iterative process and requires the involvement of a broad range of expertise and regular dialogue. The upcoming Joint MSE Technical Working Group meeting, established under Kobe Framework, is an excellent opportunity to progress the albacore MSE. The meeting will be held in the first week of November and the group recommended that interested scientists be encouraged to participate in the group, by conducting intersessional work using the *github* repository (see http://iccat-mse.github.io/albn-mse.html) and then reporting on these activities at the meeting.
- The Kobe matrix has been a valuable tool for promoting a dialogue on uncertainty between managers and scientists. As the SCRS starts to use MSE, however, additional communication tools should be investigated e.g. decision tables and Pareto plots, to help identify the uncertainties that matter, and associated risks and trade-offs between alternative management actions.
- The Kobe phase plots and matrices depend on reliable quantification of uncertainty for decision-making, however, different methods are often used to estimate probabilities (e.g. Bayesian and bootstrap simulation or the delta method). The benefits of the different approaches need to be evaluated, through simulation testing as part of MSE.
- The group expressed concern about the different approaches being used to attempt to account for targeting effects in estimation of standardized CPUEs. Previously the SCRS has recommended the need for simulation testing of these different approaches, especially those which utilize catch of other species as a measure of targeting effect, which has yet to be achieved. The Working Group on Stock Assessment Methods should take up on this topic to advance the process for testing the different methods.
- During discussions, it was noted that the CPUE checklist proposed by the Working Group on Stock Assessment Methods (Anon., 2013, also see Brodziak and Dreyfus, 2011) and used by various SCRS species groups, provides a basis for discussion of the pros and cons of each of the available catch rate time series, but that the scoring method should not be used as the sole basis for accepting/rejecting any particular time series. The group noted that *a priori* logic for acceptance/rejection of a time series has a much stronger basis than does model fit criteria, especially when multiple competing time series are involved. The group recommended that the Working Group on Stock Assessment Methods further consider the checklist with an eye to clarifying its objective.

8. Adoption of the Report and closure

The Report was adopted and the meeting adjourned.

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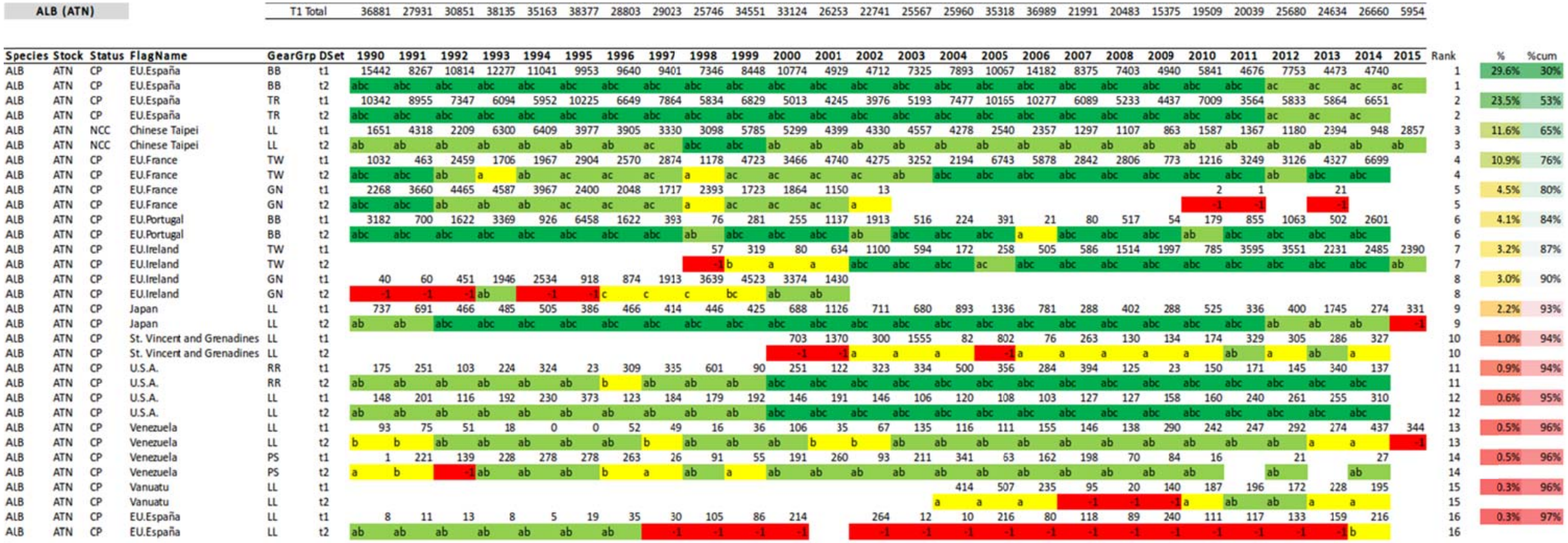
Table 1. Biological parameters and conversion factors for the North Atlantic albacore stock.

North Stock	*Parameters*	*Source*
Growth	$L\infty = 122.198$cm; $k = 0.21$; $t_0 = -1.338$	Santiago and Arrizabalaga, 2005
	$L\infty = 124.74$cm; $k = 0.23$; $t_0 = -0.9892$	Bard, 1981
Length-weight relationship	$a=1.339 \times 10^{-5}$ $b=3.1066$	Santiago, 1993
Maturity	50% of mature fish at 90 cm (age 5)	Bard, 1981
Natural mortality	$M = 0.3$ per year	
M at age (1 to 15)	0.63; 0.46; 0.38; 0.34; 0.31; 0.29; 0.31; 0.34; 0.38; 0.44; 0.55; 0.55; 0.55; 0.55; 0.55	Anon., 2010

Table 2. Biological parameters and conversion factors for the South Atlantic albacore stock.

South Stock	*Parameters*	*Source*
Growth	$L\infty = 147.5$ cm; $k = 0.209$; and $t_0 = - 1.89$	Lee and Yeh, 2007
Length-weight relationship	$a=1.3718 \times 10^{-5}$ $b=3.0973$	Penney, 1994
Maturity	50% of mature fish at 90 cm (age 5)	Bard, 1981
Natural mortality	$M = 0.3$ per year	

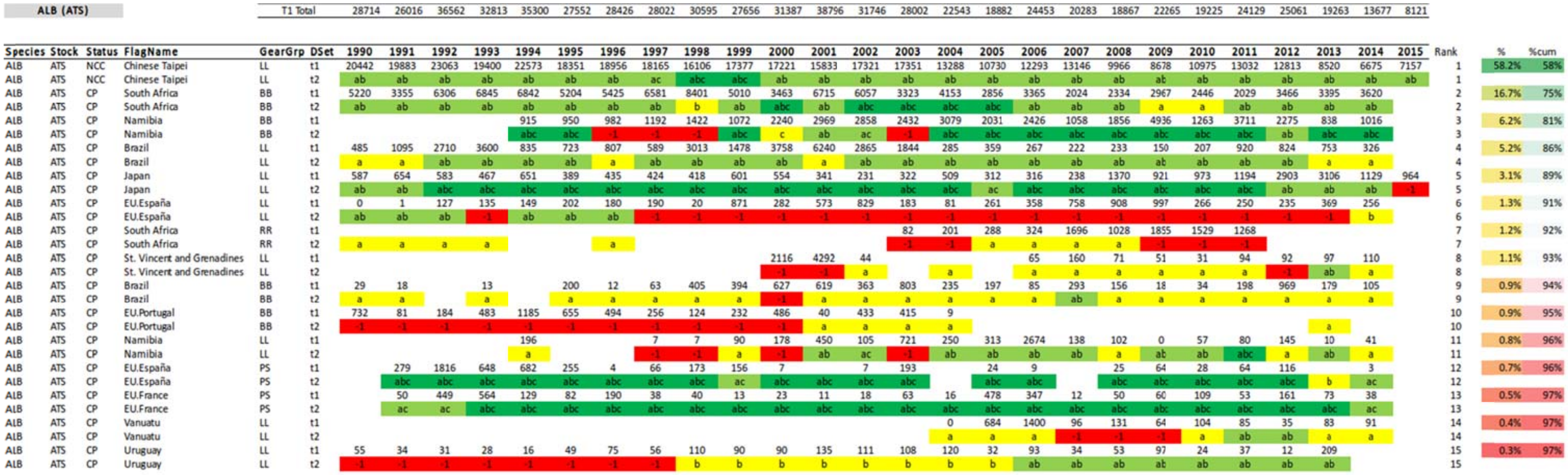
Table 3. SCRS catalogue for ALB-N (1990-2015): Task I and Task II by fishery (flag/gear combination, ranked in descending by order of importance) and year. Only the 16 most important fisheries (representing 97% of Task I catch) are shown. For each data series, Task I (DSet= "t1", in tonnes) is visualised against its equivalent Task II availability (DSet= "t2") scheme. The Task II colour scheme, combined with a concatenation of characters ("a"= T2CE exists; "b"= T2SZ exists; "c"= CAS exists) represents the Task II data availability in ICCAT-DB. The colour scheme pattern, starts with red ("-1" = no Task II available) and ends with dark green ("abc"= all Task II datasets available).



ALB (ATN)

Species	Stock	Status	FlagName	GearGrp	DSet	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Rank	%	%cum
				T1 Total		36881	27931	30851	38135	35163	38377	28803	29023	25746	34551	33124	26253	22741	25567	25960	35318	36989	21991	20483	15375	19509	20039	25680	24634	26660	5954			
ALB	ATN	CP	EU.España	BB	t1	15442	8267	10814	12277	11041	9953	9640	9401	7346	8448	10774	4929	4712	7325	7893	10067	14182	8375	7403	4940	5841	4676	7753	4473	4740		1	29.6%	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	ac	ac	ac	ac	1		
ALB	ATN	CP	EU.España	TR	t1	10342	8955	7347	6094	5952	10225	6649	7864	5834	6829	5013	4245	3976	5193	7477	10165	10277	6089	5233	4437	7009	3564	5833	5864	6651		2	23.5%	53%
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	ac	ac	ac		2		
ALB	ATN	NCC	Chinese Taipei	LL	t1	1651	4318	2209	6300	6409	3977	3905	3330	3098	5785	5299	4399	4330	4557	4278	2540	2357	1297	1107	863	1587	1367	1180	2394	948	2857	3	11.6%	65%
ALB	ATN	NCC	Chinese Taipei	LL	t2	ab	ab	ab	ab	ab	ab	ab	ac	abc	abc	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	3		
ALB	ATN	CP	EU.France	TW	t1	1032	463	2459	1706	1967	2904	2570	2874	1178	4723	3466	4740	4275	3252	2194	6743	5878	2842	2806	773	1216	3249	3126	4327	6699		4	10.9%	76%
ALB	ATN	CP	EU.France	TW	t2	abc	abc	ab	a	ab	ac	ac	ac	a	ac	ac	ac	ac	ab	abc	abc	abc	abc	abc	abc	abc	abc	ab	abc	abc		4		
ALB	ATN	CP	EU.France	GN	t1	2268	3660	4465	4587	3967	2400	2048	1717	2393	1723	1864	1150	13								2	1		21			5	4.5%	80%
ALB	ATN	CP	EU.France	GN	t2	abc	abc	ab	ab	ab	ac	ac	ac	a	ac	ac	ac	a								-1	-1		-1			5		
ALB	ATN	CP	EU.Portugal	BB	t1	3182	700	1622	3369	926	6458	1622	393	76	281	255	1137	1913	516	224	391	21	80	517	54	179	855	1063	502	2601		6	4.1%	84%
ALB	ATN	CP	EU.Portugal	BB	t2	abc	abc	abc	abc	abc	abc	abc	abc	ab	abc	abc	abc	ab	abc	abc	abc	a	abc	abc	abc	ab	abc	abc	abc	abc		6		
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	7	3.2%	87%
ALB	ATN	CP	EU.Ireland	TW	t2									-1	b	a	a	abc	abc	abc	ac	abc	abc	abc	abc	abc	abc	abc	abc	abc	ab	7		
ALB	ATN	CP	EU.Ireland	GN	t1	40	60	451	1946	2534	918	874	1913	3639	4523	3374	1430															8	3.0%	90%
ALB	ATN	CP	EU.Ireland	GN	t2	-1	-1	-1	ab	-1	-1	c	c	c	bc	ab	ab															8		
ALB	ATN	CP	Japan	LL	t1	737	691	466	485	505	386	466	414	446	425	688	1126	711	680	893	1336	781	288	402	288	525	336	400	1745	274	331	9	2.2%	93%
ALB	ATN	CP	Japan	LL	t2	ab	ab	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	ab	ab	ab	-1	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		10	1.0%	94%
ALB	ATN	CP	St. Vincent and Grenadines	LL	t2											-1	-1	a	a	a	-1	a	a	a	a	a	ab	a	ab	a		10		
ALB	ATN	CP	U.S.A.	RR	t1	175	251	103	224	324	23	309	335	601	90	251	122	323	334	500	356	284	394	125	23	150	171	145	340	137		11	0.9%	94%
ALB	ATN	CP	U.S.A.	RR	t2	ab	ab	ab	ab	ab	ab	b	ab	ab	ab	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc		11		
ALB	ATN	CP	U.S.A.	LL	t1	148	201	116	192	230	373	123	184	179	192	146	191	146	106	120	108	103	127	127	158	160	240	261	255	310		12	0.6%	95%
ALB	ATN	CP	U.S.A.	LL	t2	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc		12		
ALB	ATN	CP	Venezuela	LL	t1	93	75	51	18	0	0	52	49	16	36	106	35	67	135	116	111	155	146	138	290	242	247	292	274	437	344	13	0.5%	96%
ALB	ATN	CP	Venezuela	LL	t2	b	b	ab	ab	ab	ab	ab	b	ab	ab	ab	b	b	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	a	a	-1	13		
ALB	ATN	CP	Venezuela	PS	t1	1	221	139	228	278	278	263	26	91	55	191	260	93	211	341	63	162	198	70	84	16		21		27		14	0.5%	96%
ALB	ATN	CP	Venezuela	PS	t2	a	b	-1	ab	ab	ab	b	a	ab	a	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab		ab		ab		14		
ALB	ATN	CP	Vanuatu	LL	t1															414	507	235	95	20	140	187	196	172	228	195		15	0.3%	96%
ALB	ATN	CP	Vanuatu	LL	t2															a	a	a	-1	-1	-1	a	ab	ab	a	a		15		
ALB	ATN	CP	EU.España	LL	t1	8	11	13	8	5	19	35	30	105	86	214		264	12	10	216	80	118	89	240	111	117	133	159	216		16	0.3%	97%
ALB	ATN	CP	EU.España	LL	t2	ab	ab	ab	ab	ab	ab	ab	-1	-1	-1	-1		-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	b		16		

Table 4. SCRS catalogue for ALB-S (1990-2015): Task I and Task II by fishery (flag/gear combination, ranked in descending by order of importance) and year. Only the 15 most important fisheries (representing 97% of Task I catch) are shown. For each data series, Task I (DSet= "t1", in tonnes) is visualised against its equivalent Task II availability (DSet= "t2") scheme. The Task-II colour scheme, combined with a concatenation of characters ("a"= T2CE exists; "b"= T2SZ exists; "c"= CAS exists) represents the Task II data availability in ICCAT-DB. The colour scheme pattern, starts with red ("-1" = no Task II available) and ends with dark green ("abc"= all Task II datasets available).



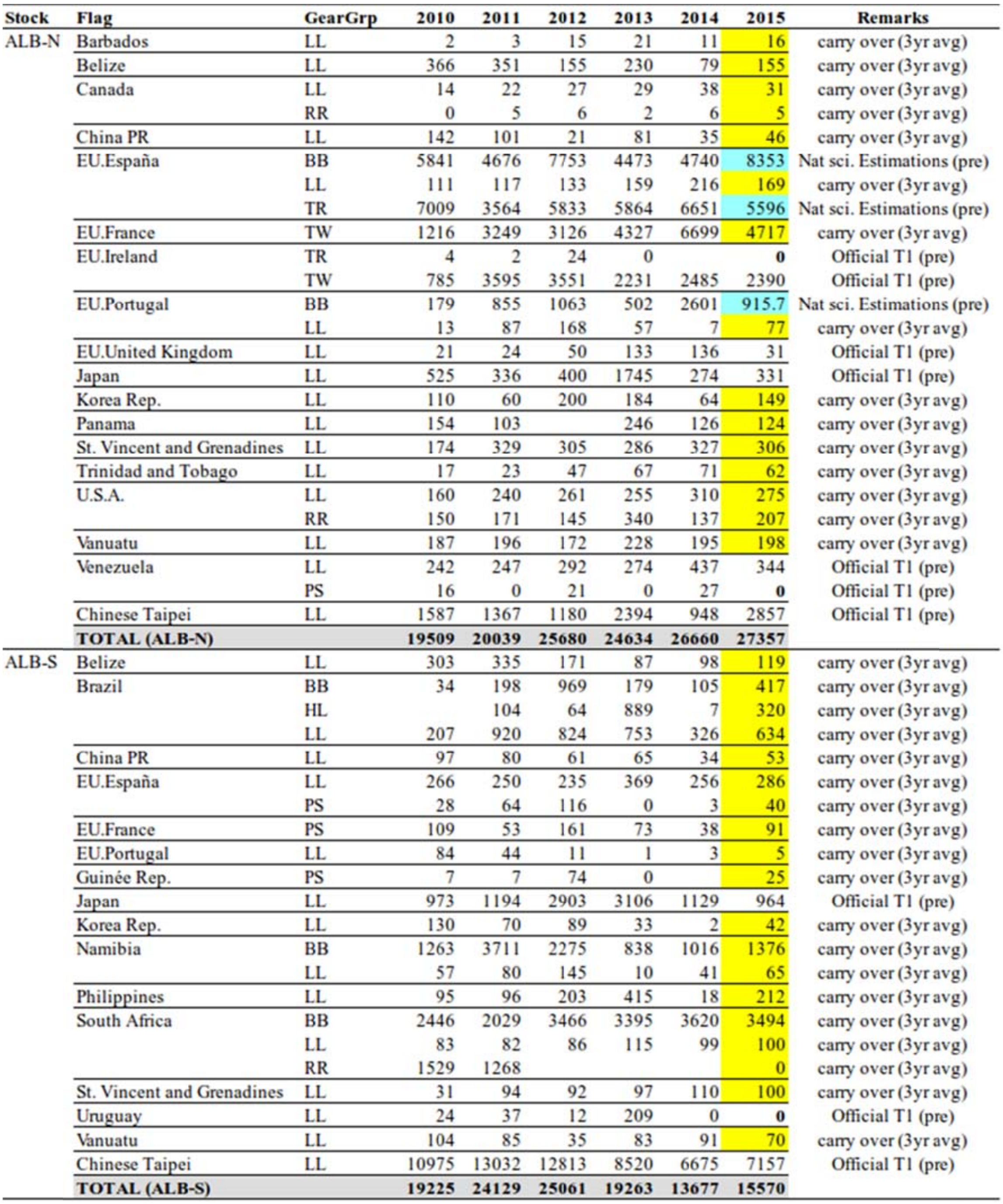
ALB (ATS)

Species	Stock	Status	FlagName	GearGrp	DSet	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Rank	%	%cum
				T1 Total		28714	26016	36562	32813	35300	27552	28426	28022	30595	27656	31387	38796	31746	28002	22543	18882	24453	20283	18867	22265	19225	24129	25061	19263	13677	8121			
ALB	ATS	NCC	Chinese Taipei	LL	t1	20442	19883	23063	19400	22573	18351	18956	18165	16106	17377	17221	15833	17321	17351	13288	10730	12293	13146	9966	8678	10975	13032	12813	8520	6675	7157	1	58.2%	58%
ALB	ATS	NCC	Chinese Taipei	LL	t2	ab	ab	ab	ab	ab	ab	ab	ac	abc	abc	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	1		
ALB	ATS	CP	South Africa	BB	t1	5220	3355	6306	6845	6842	5204	5425	6581	8401	5010	3463	6715	6057	3323	4153	2856	3365	2024	2334	2967	2446	2029	3466	3395	3620		2	16.7%	75%
ALB	ATS	CP	South Africa	BB	t2	ab	ab	ab	ab	ab	ab	ab	ab	b	ab	abc	ab	abc	abc	abc	abc	ab	ab	ab	a	a	ab	ab	ab	ab		2		
ALB	ATS	CP	Namibia	BB	t1					915	950	982	1192	1422	1072	2240	2969	2858	2432	3079	2031	2426	1058	1856	4936	1263	3711	2275	838	1016		3	6.2%	81%
ALB	ATS	CP	Namibia	BB	t2					abc	abc	-1	-1	-1	abc	c	ab	ac	-1	abc	abc	abc	abc	abc	abc	abc	abc	ab	abc	abc		3		
ALB	ATS	CP	Brazil	LL	t1	485	1095	2710	3600	835	723	807	589	3013	1478	3758	6240	2865	1844	285	359	267	222	233	150	207	920	824	753	326		4	5.2%	86%
ALB	ATS	CP	Brazil	LL	t2	a	a	ab	ab	ab	ab	a	ab	ab	ab	ab	a	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	ab	a	a		4		
ALB	ATS	CP	Japan	LL	t1	587	654	583	467	651	389	435	424	418	601	554	341	231	322	509	312	316	238	1370	921	973	1194	2903	3106	1129	964	5	3.1%	89%
ALB	ATS	CP	Japan	LL	t2	ab	ab	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	ac	abc	abc	abc	abc	abc	abc	ab	ab	ab	-1	5		
ALB	ATS	CP	EU.España	LL	t1	0	1	127	135	149	202	180	190	20	871	282	573	829	183	81	261	358	758	908	997	266	250	235	369	256		6	1.3%	91%
ALB	ATS	CP	EU.España	LL	t2	ab	ab	ab	-1	ab	ab	ab	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	b		6		
ALB	ATS	CP	South Africa	RR	t1														82	201	288	324	1696	1028	1855	1529	1268					7	1.2%	92%
ALB	ATS	CP	South Africa	RR	t2	a	a	a	a			a							-1	-1	a	a	a	a	-1	-1	-1					7		
ALB	ATS	CP	St. Vincent and Grenadines	LL	t1											2116	4292	44				65	160	71	51	31	94	92	97	110		8	1.1%	93%
ALB	ATS	CP	St. Vincent and Grenadines	LL	t2											-1	-1	a		a		a	a	a	a	a	a	-1	ab	a		8		
ALB	ATS	CP	Brazil	BB	t1	29	18		13		200	12	63	405	394	627	619	363	803	235	197	85	293	156	18	34	198	969	179	105		9	0.9%	94%
ALB	ATS	CP	Brazil	BB	t2	a	a		a		a	a	a	a	a	-1	a	a	a	a	a	a	ab	a	a	a	a	a	a	a		9		
ALB	ATS	CP	EU.Portugal	BB	t1	732	81	184	483	1185	655	494	256	124	232	486	40	433	415	9												10	0.9%	95%
ALB	ATS	CP	EU.Portugal	BB	t2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	a	a	a	a									a			10		
ALB	ATS	CP	Namibia	LL	t1					196			7	7	90	178	450	105	721	250	313	2674	138	102	0	57	80	145	10	41		11	0.8%	96%
ALB	ATS	CP	Namibia	LL	t2					a			-1	-1	a	-1	ab	ac	-1	ab	ab	ab	ab	a	ab	ab	abc	a	ab	a		11		
ALB	ATS	CP	EU.España	PS	t1		279	1816	648	682	255	4	66	173	156	7		7	193		24	9		25	64	28	64	116		3		12	0.7%	96%
ALB	ATS	CP	EU.España	PS	t2		abc	abc	abc	abc	abc	abc	abc	abc	ac	abc	abc	abc	abc		abc	abc		abc	abc	abc	abc	abc	b	ac		12		
ALB	ATS	CP	EU.France	PS	t1		50	449	564	129	82	190	38	40	13	23	11	18	63	16	478	347	12	50	60	109	53	161	73	38		13	0.5%	97%
ALB	ATS	CP	EU.France	PS	t2		ac	ac	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	abc	ac		13		
ALB	ATS	CP	Vanuatu	LL	t1															0	684	1400	96	131	64	104	85	35	83	91		14	0.4%	97%
ALB	ATS	CP	Vanuatu	LL	t2															a	a	a	-1	-1	-1	a	ab	ab	a	a		14		
ALB	ATS	CP	Uruguay	LL	t1	55	34	31	28	16	49	75	56	110	90	90	135	111	108	120	32	93	34	53	97	24	37	12	209			15	0.3%	97%
ALB	ATS	CP	Uruguay	LL	t2	-1	-1	-1	-1	-1	-1	-1	-1	b	b	b	b	b	b	b	b	ab	ab	ab	ab	ab	ab	ab	ab			15		

Table 5. Atlantic ALB Task I summary table. Estimated total catches (t) by year (1970 to 2015) of albacore (*Thunnus alalunga*) by area, gear and flag. The last three years are still preliminary.

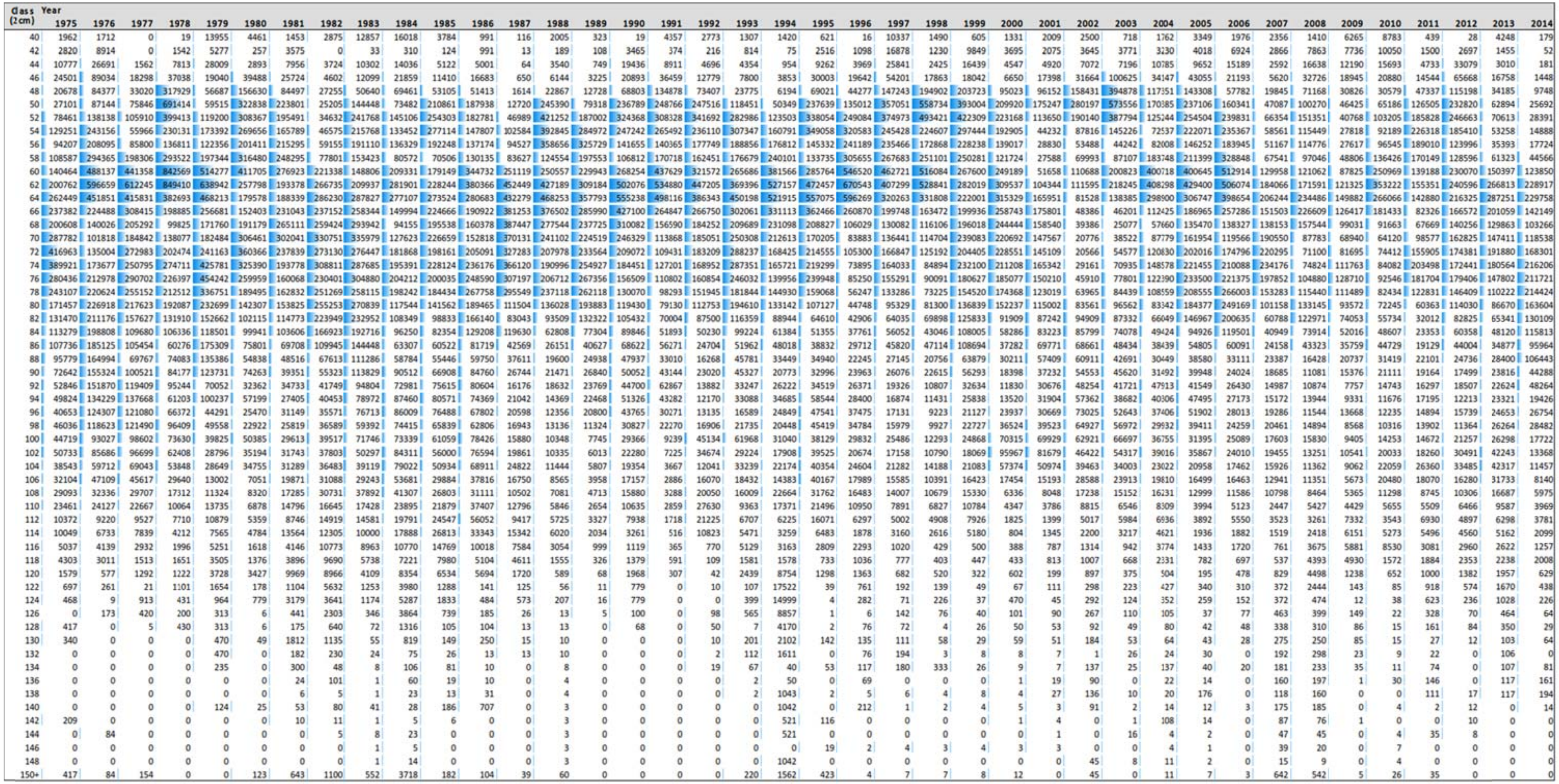
			1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
TOTAL			69548	81706	81970	73934	69322	59495	76610	75486	73216	74012	61637	58571	72345	66408	56399	71923	84842	78745	63232	59282	65595	53947	67413	70948	70463	65930	57228	57044	56341	62207	64511	65049	54487	53569	48504	54199	61442	42274	39350	37640	38734	44168	50741	43897	40337	14075
	ATN		45895	56821	48781	45700	49606	41888	57235	54031	50121	51372	38691	34531	42673	51490	41800	40826	47554	38115	33059	32071	36881	27931	30851	38135	35163	38377	28803	29023	25746	34551	33124	26253	22741	25567	25960	35318	36989	21991	20483	15375	19509	20039	25680	24634	26660	5954
	ATS		23653	24885	33189	28234	19716	17607	19375	21455	23095	22640	22946	24040	29672	14918	14599	31097	37288	40630	30173	27212	28714	26016	36562	32813	35300	27552	28426	28022	30595	27656	31387	38796	31746	28002	22543	18882	24453	20283	18867	22265	19225	24129	25061	19263	13677	8121
Landings	ATN	Bait boat	14388	15677	8196	8833	13986	19687	20227	15559	11958	15764	16177	13412	15857	21108	8313	12589	15202	18756	15933	15374	18624	8968	12436	15646	11967	16411	11338	9821	7562	8780	11072	6103	6638	7840	8128	10458	14273	8496	7931	4994	6026	5530	8816	4975	7341	
		Longline	15801	17115	14068	18155	14662	12710	23090	21081	14163	12214	9453	9819	13206	16896	19709	17413	21232	7296	3013	2239	2683	5315	3152	7093	7309	4859	4641	4051	4035	6710	7321	7372	6180	7699	6917	6911	5223	3237	2647	2619	3913	3666	3759	6514	3099	3564
		Other surf.	0	0	0	0	0	0	0	0	1	62	1	521	694	334	2194	108	213	343	994	1652	3865	3999	5173	7279	7506	3555	3337	4378	6846	6817	5971	2828	422	551	697	624	625	525	274	427	324	412	352	596	162	0
		Purse seine	0	0	0	0	0	0	0	0	68	0	0	0	84	364	555	59	60	1	97	12	1	222	139	229	292	278	263	26	91	56	191	264	118	211	348	99	188	198	70	84	74	0	167	7	35	
		Trawl	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2	0	262	1693	2240	1033	469	2603	1779	2131	3049	2571	2877	1318	5343	3547	5374	5376	3846	2369	7001	6385	3429	4321	2811	2026	6852	6678	6558	9184	2390
		Troll	15706	24029	26517	18712	20958	9491	13918	17391	23931	23332	13059	10778	12831	12788	11029	10654	10847	11457	11329	10554	10675	8959	7348	6109	5959	10226	6652	7870	5894	6845	5023	4312	4007	5419	7501	10224	10296	6105	5239	4440	7146	3578	5909	5891	6660	
	ATS	Bait boat	0	0	0	1	97	46	0	66	43	53	1346	1721	2575	1794	4166	7909	6829	8181	7696	7393	5981	3454	6490	7379	8947	7091	6960	8110	10353	6709	6873	10355	9712	6973	7475	5084	5876	3375	4350	7926	3748	5938	6710	4411	4741	
		Longline	23653	24885	33079	28134	19553	17456	19178	20982	22800	21855	20671	20426	25255	11941	9834	22672	29815	30964	21894	19407	21590	22008	27162	23947	24806	20040	21000	19547	19799	20640	24398	28039	21671	20626	14735	12977	17740	15087	13218	12113	13471	16445	17846	13863	8887	8121
		Other surf.	0	0	100	96	53	104	150	293	201	544	449	89	493	484	234	334	400	537	398	411	1139	137	393	39	483	10	209	127	0	73	58	377	323	82	299	288	395	1762	1219	2066	1651	1538	66	897	7	0
		Purse seine	0	0	10	3	13	1	47	114	51	188	480	1804	1349	699	365	182	244	948	185	0	4	416	2517	1448	1064	412	257	117	434	183	58	25	39	309	16	534	442	58	81	160	355	208	437	91	42	
		Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	120	9	52	0	0	0	12	18	0	0	0	0	0	0	0	0	0	0	
Discards	ATN	Longline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	93	180	
	ATS	Longline	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	
Landings	ATN	Barbados	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	2	5	8	10	13	9	7	7	4	6	4	20	22	13	
		Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	26	39	416	351	155	230	79	
		Brazil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Canada	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	21	47	22	6	5	1	9	32	12	24	31	23	38	122	51	113	56	27	52	27	25	33	11	14	28	34	32	47	
		Cape Verde	0	0	0	0	0	0	0	0	0	0	0	0	0	10	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		China PR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	8	20	0	0	21	16	57	196	155	32	112	202	59	24	27	142	101	21	81	35	
		Chinese Taipei	4675	2871	4410	9501	9538	8130	14837	13723	9324	6973	7090	6584	10500	14254	14923	14899	19646	6636	2117	1294	3005	4318	2209	6300	6409	3977	3905	3330	3098	5785	5299	4399	4330	4557	4278	2540	2357	1297	1107	863	1587	1367	1180	2394	947	2857
		Cuba	0	0	36	12	0	87	85	83	89	7	31	48	82	38	69	20	31	15	4	1	2	0	0	0	0	0	0	0	0	0	0	0	1	322	435	424	527	0	0	0	0	0	0	0	0	
		Côte d'Ivoire	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	53	39	146	0	0	
		Dominican Republic	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	323	121	73	95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		EU.España	23731	30196	25121	19799	25290	22601	26735	25155	25404	29630	25202	20819	25478	29557	15656	20672	24387	28206	26738	25424	25792	17233	18175	18380	16998	20197	16324	17295	13285	15363	16000	9177	8952	12530	15379	20447	24538	14582	12725	9617	12961	8357	13719	10502	11607	
		EU.France	6163	9210	9158	6859	8425	5666	6800	7733	10400	9320	3955	2929	2855	2391	2797	1860	1200	1921	2805	4050	3625	4123	6924	6293	5934	5304	4694	4618	3711	6888	5718	6006	4345	3456	2448	7266	6585	3179	3009	1122	1298	3348	3361	4592	6716	
		EU.Ireland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40	60	451	1946	2534	918	874	1913	3750	4858	3464	2093	1100	755	175	306	521	596	1517	1997	788	3597	3575	2231	2485	2390
		EU.Netherlands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	
		EU.Portugal	200	300	434	887	1229	911	610	62	85	149	79	442	321	1778	775	657	498	433	184	169	3185	709	1638	3385	974	6470	1634	395	91	324	278	1175	1953	553	513	556	119	184	614	108	202	1046	1231	567	2609	
		EU.United Kingdom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	59	499	613	196	49	33	117	343	15	0	0	0	0	6	19	30	50	67	118	57	50	133	136	31
		FR.St Pierre et Miquelon	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	7	2	0	3	0	0	0	0	0	0	0	
		Grenada	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	6	7	6	12	21	23	46	25	29	19	20	15	18	18	18	0	0	0	
		Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	
		Iceland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Japan	5875	6472	1319	1467	2059	1331	1345	825	531	1219	1036	1740	781	1156	576	844	470	494	723	764	737	691	466	485	505	386	466	414	446	425	688	1126	711	680	893	1336	781	288	402	288	525	336	400	1745	274	331
		Korea Rep.	5011	7707	7922	4794	2823	2843	5379	5579	3048	2997	797	938	1326	478	967	390	373	18	16	53	34	1	0	8	0	2	2	1	0	0	0	0	0	0	0	59	45	12	59	82	110	60	200	184	64	
		Maroc	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	55	81	120	178	98	96	99	130	0	0	0	0	0	
		Mexico	0	0	0	0	0	0	0	0	0	0	2	0	0	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	
		NEI (Flag related)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	19	13	10	8	11	3	8	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Panama	0	0	240	2366	217	226	1227	557	768	425	193	177	494	357	2551	601	525	44	0	0	0	0	29	60	117	73	11	5	0	0	0	0	0	0	0	0	96	298	113	45	154	103	0	246	126	
		Philippines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	151	4	0	0	0	0	0	9	0	8	19	54	0	0	83	0	0	
		Sierra Leone	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	91	0	0	0	0	0	0	0	0	0	0	0	0	0	
		St. Vincent and Grenadines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	1	704	1370	300	1555	89	802	76	263	130	135	177	329	305	286	328	
		Sta. Lucia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	0	0	0	1	3	2	10	0	2	2	2	2	0	130	2	3	2	0	
		Suriname	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	249	216	0	
		Trinidad and Tobago	0	0	0	0	0	0	0	0	0	0	0	0	0	268	194	318	0	0	0	0	4	0	247	0	0	0	0	2	1	1	2	11	9	12	12	9	12	18	32	17	17	23	47	67	71	
		U.S.A.	0	0	0	0	0	0	0	0	1	0	6	472	699	347	2206	98	251	301	288	243	357	479	438	509	741	545	472	577	829	315	406	322	480	444	646	488	400	532	257	189	315	422	418	599	459	
		U.S.S.R.	0	0	0	0	0	0	84	212	74	59	0	51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		UK.Bermuda	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	2	2	0	0	1	1	0	0	0	0	0	1	0	0	1	
		UK.Turks and Caicos	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	
		Vanuatu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	414	507	235	95	20	140	187	196	172	228	195	
		Venezuela	240	65	141	14	25	93	133	102	397	593	300	331	137	823	1076	467	172	26	137	41	94	302	193	246	282	279	315	75	107	91	299	348	162	346	457	175	321	375	222	398	288	247	312	181	285	344
	ATS	Angola	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	168	0	5	
		Argentina	500	281	100	44	13	97	48	80	8	0	4	2	7	55	209	153	356	469	344	354	151	60	306	0	2	0	0	120	9	52	0	0	0	12	18	0	0	0	0	0	130	43	0	0	0	
		Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	8	2	0	0	0	0	0	54	32	31	213	303	365	171	87	98	
		Brazil	0	63	16	60	169	170	296	688	494	515	476	276	800	731	732	382	520	395	421	435	514	1113	2710	3613	1227	923	819	652	3418	1872	4411	6862	3228	2647	522	556	361	535	487	202	271	1269	1857	1821	438	
		Cambodia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Cape Verde	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	46	24	0	5	0	5	0	0	0	
		China PR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	39	89	26	30	26	112	95	100	35	25	89	97	80	61	65	34	
		Chinese Taipei	12225	17491	24985	22157	16686	13384	14600	16092	20467	20340	18710	18187	22800	9502	7889	19643	27592	28790	20746	18386	21369	19883	23063	19400	22573	18351	18956	18165	16106	17377	17221	15833	17321	17351	13288	10730	12293	13146	9966	8678	10975	13032	12812	8519	6675	7157
		Cuba	0	0	64	21	0	13	15	17	11	12	27	53	29	36	67	27	24	10	2	1	2	17	5	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Curaçao	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	192	0	2	0	0	0	0	0	0	0	0	21	4	4	24	0	0	
		Côte d'Ivoire	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	47	43	45	50	0	0	
		EU.España	0	0	0	0	0	0	0	0	0	0	0	889	106	295	307	155	200	807	185	0	0	280	1943	783	831	457	184	256	193	1027	288	573	836	376	81	285	367	758	933	1061	294	314	351	369	259	
		EU.France	0	0	0	0	0	0	47	112	40	172	457	912	947	372	7	18	35	100	0	0	0	50	449	564	129	82	190	38	40	13	23	11	18	63	16	478	347	12	50	60	109	53	161	73	38	
		EU.Portugal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	741	1357	1029	899	1153	557	732	81	184	483	1185	655	494	256	124	232	486	41	433	415	9	43	8	13	49	254	84	44	11	1	3	
		EU.United Kingdom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	
		Ghana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	10	14	25	0	0	0	0	
		Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40	0	0	0	56	0	0	15	0	
		Guinea Ecuatorial	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0
		Guinée Rep.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	7	74	0	0	
		Honduras	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	29	0	0	2	0	7	1	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Japan	5898	3218	2087	280	109	306	73	107	135	105	333	558	569	188	224	623	739	357	405	450	587	654	583	467	651	389	435	424	418	601	554	341	231	322	509	312	316	238	1370	921	973	1194	2903	3106	1129	964
		Korea Rep.	5030	3832	5655	3731	2393	3230	3376	3829	1413	878	803	682	563	599	348	511	321	383	180	54	19	31	5	20	3	3	18	4	7	14	18	1	0	5	37	42	66	56	88	374	130	70	89	33	2	
		Maroc	0	0	0	0	0	0	0	0	2	0	0	0	113	0	0	0	0	41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		NEI (ETRO)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	8	122	68	55	63	41	5	27	0	0	10	14	53	0	7	0	0	0	0	0	0	0	0	0	
		NEI (Flag related)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	149	262	146	123	102	169	47	42	38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Namibia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1111	950	982	1199	1429	1162	2418	3419	2962	3152	3328	2344	5100	1196	1958	4936	1320	3791	2420	848	1057	
		Panama	0	0	172	1841	183	256	770	377	354	125	167	129	210	0	0	0	280	924	0	0	0	240	482	318	458	228	380	53	60	14	0	0	0	0	0	17	0	87	5	6	1	0	12	3	0	
		Philippines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	4	0	0	0	0	0	52	0	13	79	45	95	96	203	415	18	
		Seychelles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		South Africa	0	0	100	100	150	150	150	150	150	480	1850	2320	3180	2760	3540	6697	5930	7275	6636	6890	5280	3410	6360	6881	6931	5214	5634	6708	8412	5101	3610	7236	6507	3469	4502	3198	3735	3797	3468	5043	4147	3380	3553	3510	3719	
		St. Vincent and Grenadines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2116	4292	44	0	0	0	65	160	71	51	31	94	92	97	110	
		U.S.A.	0	0	10	0	13	1	0	2	9	11	16	2	102	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	1	1	1	2	8	2	1	0	0	0	0	0	0	0	0	0	0	
		U.S.S.R.	0	0	0	0	0	0	0	0	0	0	99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		UK.Sta Helena	0	0	0	0	0	0	0	1	12	2	4	7	11	7	9	0	0	2	1	1	1	5	28	38	5	82	47	18	1	1	58	12	2	0	0	0	62	46	94	81	3	120	2	2	0	
		Uruguay	0	0	0	0	0	0	0	0	0	0	0	23	235	373	526	1531	262	178	100	83	55	34	31	28	16	49	75	56	110	90	90	135	111	108	120	32	93	34	53	97	24	37	12	209	0	
		Vanuatu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	684	1400	96	131	64	104	85	35	83	91	
Discards	ATN	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
		Venezuela	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	93	179	
	ATS	Chinese Taipei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	
		Korea Rep.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		South Africa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Table 6. Series (flag and major gear) used to obtain preliminary overall estimations of 2015 total catches by stock (for projections). Origin and technique described in “remarks”.



Stock	Flag	GearGrp	2010	2011	2012	2013	2014	2015	Remarks
ALB-N	Barbados	LL	2	3	15	21	11	16	carry over (3yr avg)
	Belize	LL	366	351	155	230	79	155	carry over (3yr avg)
	Canada	LL	14	22	27	29	38	31	carry over (3yr avg)
		RR	0	5	6	2	6	5	carry over (3yr avg)
	China PR	LL	142	101	21	81	35	46	carry over (3yr avg)
	EU.España	BB	5841	4676	7753	4473	4740	8353	Nat sci. Estimations (pre)
		LL	111	117	133	159	216	169	carry over (3yr avg)
		TR	7009	3564	5833	5864	6651	5596	Nat sci. Estimations (pre)
	EU.France	TW	1216	3249	3126	4327	6699	4717	carry over (3yr avg)
	EU.Ireland	TR	4	2	24	0		**0**	Official T1 (pre)
		TW	785	3595	3551	2231	2485	2390	Official T1 (pre)
	EU.Portugal	BB	179	855	1063	502	2601	915.7	Nat sci. Estimations (pre)
		LL	13	87	168	57	7	77	carry over (3yr avg)
	EU.United Kingdom	LL	21	24	50	133	136	31	Official T1 (pre)
	Japan	LL	525	336	400	1745	274	331	Official T1 (pre)
	Korea Rep.	LL	110	60	200	184	64	149	carry over (3yr avg)
	Panama	LL	154	103		246	126	124	carry over (3yr avg)
	St. Vincent and Grenadines	LL	174	329	305	286	327	306	carry over (3yr avg)
	Trinidad and Tobago	LL	17	23	47	67	71	62	carry over (3yr avg)
	U.S.A.	LL	160	240	261	255	310	275	carry over (3yr avg)
		RR	150	171	145	340	137	207	carry over (3yr avg)
	Vanuatu	LL	187	196	172	228	195	198	carry over (3yr avg)
	Venezuela	LL	242	247	292	274	437	344	Official T1 (pre)
		PS	16	0	21	0	27	**0**	Official T1 (pre)
	Chinese Taipei	LL	1587	1367	1180	2394	948	2857	Official T1 (pre)
	TOTAL (ALB-N)		**19509**	**20039**	**25680**	**24634**	**26660**	**27357**	
ALB-S	Belize	LL	303	335	171	87	98	119	carry over (3yr avg)
	Brazil	BB	34	198	969	179	105	417	carry over (3yr avg)
		HL		104	64	889	7	320	carry over (3yr avg)
		LL	207	920	824	753	326	634	carry over (3yr avg)
	China PR	LL	97	80	61	65	34	53	carry over (3yr avg)
	EU.España	LL	266	250	235	369	256	286	carry over (3yr avg)
		PS	28	64	116	0	3	40	carry over (3yr avg)
	EU.France	PS	109	53	161	73	38	91	carry over (3yr avg)
	EU.Portugal	LL	84	44	11	1	3	5	carry over (3yr avg)
	Guinée Rep.	PS	7	7	74	0		25	carry over (3yr avg)
	Japan	LL	973	1194	2903	3106	1129	964	Official T1 (pre)
	Korea Rep.	LL	130	70	89	33	2	42	carry over (3yr avg)
	Namibia	BB	1263	3711	2275	838	1016	1376	carry over (3yr avg)
		LL	57	80	145	10	41	65	carry over (3yr avg)
	Philippines	LL	95	96	203	415	18	212	carry over (3yr avg)
	South Africa	BB	2446	2029	3466	3395	3620	3494	carry over (3yr avg)
		LL	83	82	86	115	99	100	carry over (3yr avg)
		RR	1529	1268				0	carry over (3yr avg)
	St. Vincent and Grenadines	LL	31	94	92	97	110	100	carry over (3yr avg)
	Uruguay	LL	24	37	12	209	0	**0**	Official T1 (pre)
	Vanuatu	LL	104	85	35	83	91	70	carry over (3yr avg)
	Chinese Taipei	LL	10975	13032	12813	8520	6675	7157	Official T1 (pre)
	TOTAL (ALB-S)		**19225**	**24129**	**25061**	**19263**	**13677**	**15570**	

Table 7. ALB-N catch-at-size (CAS) matrix. Estimations of the size (2 cm lower limit classes) composition of the catches by year (1975 to 2014).



Class (2cm)	Year																																							
	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
40	1962	1712	0	19	13955	4461	1453	2875	12857	16018	3784	991	116	2005	323	19	4357	2773	1307	1420	621	16	10337	1490	605	1331	2009	2500	718	1762	3349	1976	2356	1410	6265	8783	439	28	4248	179
42	2820	8914	0	1542	5277	257	3575	0	33	310	124	991	13	189	108	3465	374	216	814	75	2516	1098	16878	1230	9849	3695	2075	3645	3771	3230	4018	6924	2866	7863	7736	10050	1500	2697	1455	52
44	10777	26691	1562	7813	28009	2893	7956	3724	10302	14036	5122	5001	64	3540	749	19436	8911	4696	4354	954	9262	3969	25841	2425	16439	4547	4920	7072	7196	10785	9652	15189	2592	16638	12190	15693	4733	33079	3010	181
46	24501	89034	18298	37038	19040	39488	25724	4602	12099	21859	11410	16683	650	6144	3225	20893	36459	12779	7800	3853	30003	19642	54201	17863	18042	6650	17398	31664	100625	34147	43055	21193	5620	32726	18945	20880	14544	65668	16758	1448
48	20678	84377	33020	317929	56687	156630	84497	27255	50640	69461	53105	51413	1614	22867	12728	68803	134878	73407	23775	6194	69021	44277	147243	194902	203723	95023	96152	158431	394878	117351	143308	57782	19845	71168	30826	30579	47337	115198	34185	9748
50	27101	87144	75846	691414	59515	322838	223801	25205	144448	73482	210861	187938	12720	245390	79318	236789	248766	247516	118451	50349	237639	135012	357051	558734	393004	209920	175247	280197	573556	170385	237106	160341	47087	100270	46425	65186	126505	232820	62894	25692
52	78461	138138	105910	399413	119200	308367	195491	34632	241768	145106	254303	182781	46989	421252	187002	324368	308328	341692	282986	123503	338054	249084	374973	493421	422309	223168	113650	190140	387794	125244	254504	239831	66354	151351	40768	103205	185828	246663	70613	28391
54	129251	243156	55966	230131	173392	269656	165789	46575	215768	133452	277114	147807	102584	392845	284972	247242	265492	236110	307347	160791	349058	320583	245428	224607	297444	192905	44232	87816	145226	72537	222071	235367	58561	115449	27818	92189	226318	185410	53258	14888
56	94207	208095	85800	136811	122356	201411	215295	59155	191110	136329	192248	137174	94527	358656	325729	141655	140365	177749	188856	176812	145332	241189	235466	172868	228238	139017	28830	53488	44242	82008	146252	183945	51167	114776	27617	96545	189010	123996	35393	17724
58	108587	294365	198306	293522	197344	316480	248295	77801	153423	80572	70506	130135	83627	124554	197553	106812	170718	162451	176679	240101	133735	305655	267683	251101	250281	121724	27588	69993	87107	183748	211399	328848	67541	97046	48806	136426	170149	128596	61323	44566
60	140464	488137	441358	842569	514277	411705	276923	221338	148806	209331	179149	344732	251119	250557	229943	268254	437629	321572	265686	381566	285764	546520	462721	516084	267600	249189	51658	110688	200823	400718	400645	512914	129958	121062	87825	250969	139188	230070	150397	123850
62	200762	596659	612245	849410	638942	257798	193378	266735	209937	281901	228244	380366	452449	427189	309184	502076	534880	447205	369396	527157	472457	670543	407299	528841	282019	309537	104344	111595	218245	408298	429400	506074	184066	171591	121325	353222	155351	240596	266813	228917
64	262449	451851	415831	382693	468213	179578	188339	286230	287827	277107	273524	280683	432279	468253	357793	555238	498116	386343	450198	521915	557075	596269	320263	331808	222001	315329	165951	81528	138385	298900	306747	398654	206244	234486	149882	266066	142880	216325	287251	229758
66	237382	224488	308415	198885	256681	152403	231043	237152	258344	149994	224666	190922	381253	376502	285990	427100	264847	266750	302061	331113	362466	260870	199748	163472	199936	258743	175801	48386	46201	112425	186965	257286	151503	226609	126417	181433	82326	166572	201059	142149
68	200608	140026	205292	99825	171760	191179	265111	259424	293942	94155	195538	160378	387447	277544	237725	310082	156590	184252	209689	231098	208827	106029	130082	116106	196018	244444	158540	39386	25077	57660	135470	138327	138153	157544	99031	91663	67669	140256	129863	103266
70	287782	101818	184842	138077	182484	306461	302041	330751	335979	127623	226659	152818	370131	241102	224519	246329	113868	185051	250308	212613	170205	83883	136441	114704	239083	220692	147567	20776	38522	87779	161954	119566	190550	87783	68940	64120	98577	162825	147411	118538
72	416963	135004	272983	202474	241163	360366	237839	273130	276447	181868	198161	205091	327283	207978	233564	209072	109431	183209	288237	168425	214555	105300	166847	125192	204405	228551	145109	20566	54577	120830	202016	174796	220295	71100	81695	74412	155905	174381	191880	168301
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78	243107	220624	255152	212512	336751	189495	162832	251269	258115	198242	184434	267758	295549	237118	262118	130070	98293	151945	181844	144930	159068	56247	133286	73225	154520	174368	123019	63965	84439	108559	208555	266003	153283	115440	111489	82434	122831	146409	110222	214424
80	171457	226918	217623	192087	232699	142307	153825	255253	270839	117544	141562	189465	111504	136028	193883	119430	79130	112753	194610	133142	107127	44748	95329	81300	136839	152237	115002	83561	96562	83342	184377	249169	101158	133145	93572	72245	60363	114030	86670	163604
82	131470	211176	157627	131910	152662	102115	114773	223949	232952	108349	98833	166140	83043	93509	132322	105432	70004	87500	116359	88944	64610	42906	64035	69898	125833	91909	87242	94909	87332	66049	146967	200635	60788	122971	74053	55734	32012	82825	65341	130109
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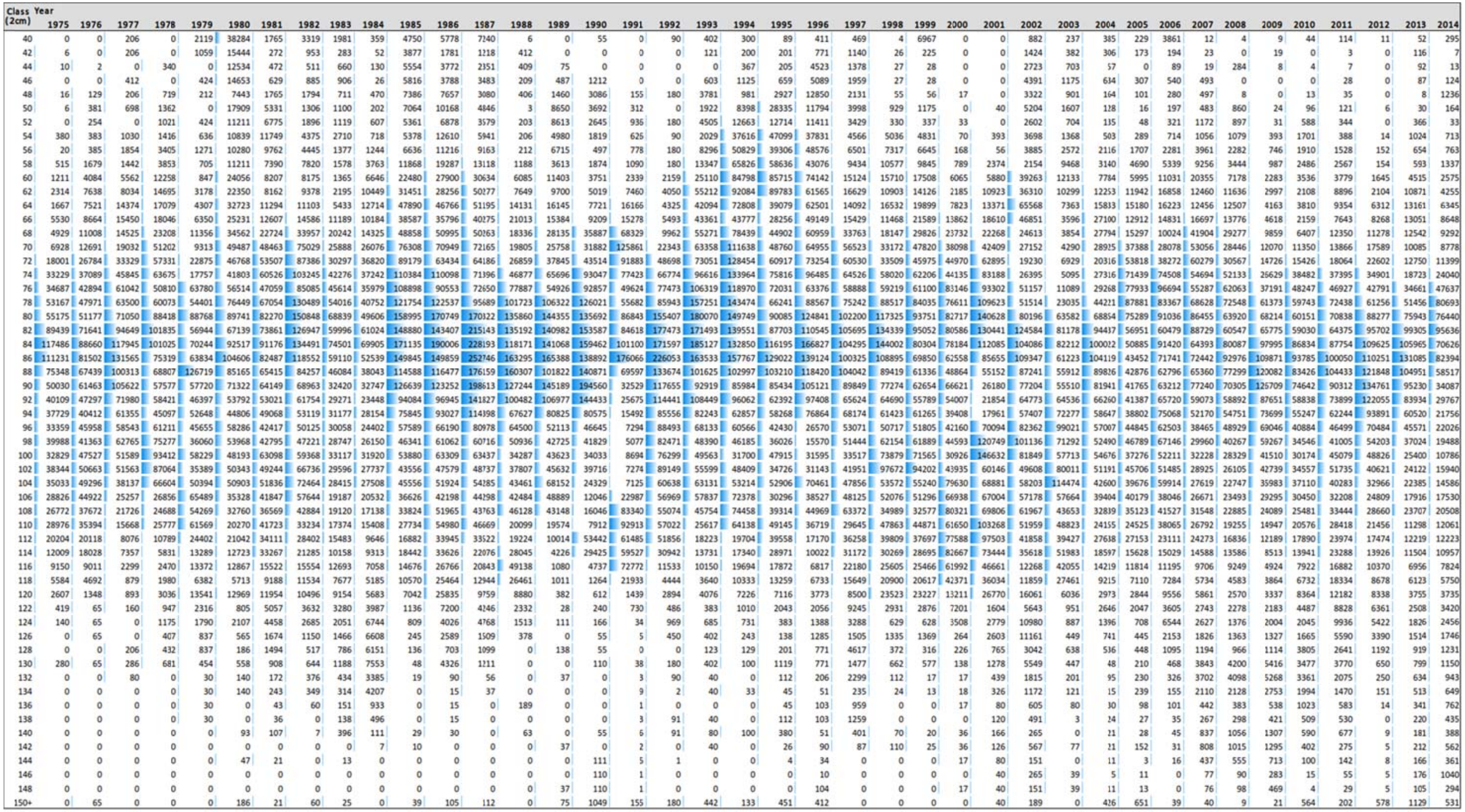
114	10049	6733	7839	4212	7565	4784	13564	12305	10000	17888	26813	33343	15342	6020	2034	3261	516	10823	5471	3259	6483	1878	3160	2616	5180	804	1345	2200	3217	4621	1936	1882	1519	2418	6151	5273	5496	4560	5162	2099
116	5037	4139	2932	1996	5251	1618	4146	10773	8963	10770	14769	10018	7584	3054	999	1119	365	770	5129	3163	2809	2293	1020	429	500	388	787	1314	942	3774	1433	1720	761	3675	5881	8530	3081	2960	2622	1257
118	4303	3011	1513	1651	3505	1376	3896	9690	5738	7221	7980	5104	4611	1555	326	1379	591	109	1581	1578	733	1036	777	403	447	433	813	1007	668	2331	782	697	537	4393	4930	1572	1884	2353	2238	2008
120	1579	577	1292	1222	3728	3427	9969	8966	4109	8354	6534	5694	1720	589	68	1968	307	42	2439	8754	1298	1363	682	520	322	602	199	897	375	504	195	478	829	4498	1238	652	1000	1382	1957	629
122	697	261	21	1101	1654	178	1104	5632	1253	3980	1288	141	125	56	11	779	0	10	107	17522	39	761	192	139	49	67	111	298	223	427	340	310	372	2444	143	85	918	574	1670	438
124	468	9	913	431	964	779	3179	3641	1174	5287	1833	484	573	207	16	779	0	0	399	14999	4	282	71	226	37	470	45	292	124	352	259	152	372	474	12	38	623	236	1028	226
126	0	173	420	200	313	6	441	2303	346	3864	739	185	26	13	5	100	0	98	565	8857	1	6	142	76	40	101	90	267	110	105	37	77	463	399	149	22	328	70	464	64
128	417	0	5	430	313	6	175	640	72	1316	105	104	13	13	0	68	0	50	7	4170	2	76	72	4	26	50	53	92	49	80	42	48	338	310	86	15	161	84	350	29
130	340	0	0	0	470	49	1812	1135	55	819	149	250	15	10	0	0	0	10	201	2102	142	135	111	58	29	59	51	184	53	64	43	28	275	250	85	15	27	12	103	64
132	0	0	0	0	470	0	182	230	24	75	26	13	13	10	0	0	0	2	112	1611	0	76	194	3	8	8	7	1	26	24	30	0	192	298	23	9	22	0	106	0
134	0	0	0	0	235	0	300	48	8	106	81	10	0	8	0	0	0	19	67	40	53	117	180	333	26	9	7	137	25	137	40	20	181	233	35	11	74	0	107	81
136	0	0	0	0	0	0	24	101	1	60	19	10	0	4	0	0	0	0	2	50	0	69	0	0	0	1	19	90	0	22	14	0	160	197	1	30	146	0	117	161
138	0	0	0	0	0	0	6	5	1	23	13	31	0	4	0	0	0	0	2	1043	2	5	6	4	8	4	27	136	10	20	176	0	118	160	0	0	111	17	117	194
140	0	0	0	0	124	25	53	80	41	28	186	707	0	3	0	0	0	0	0	1042	0	212	1	2	4	5	3	91	2	14	12	3	175	185	0	4	2	12	0	14
142	209	0	0	0	0	0	10	11	1	5	6	0	0	3	0	0	0	0	0	521	116	0	0	0	0	1	4	0	1	108	14	0	87	76	1	0	0	10	0	0
144	0	84	0	0	0	0	0	5	8	23	0	0	0	3	0	0	0	0	0	521	0	0	0	0	0	0	1	0	16	4	2	0	47	45	0	4	35	8	0	0
146	0	0	0	0	0	0	0	0	1	5	0	0	0	3	0	0	0	0	0	0	19	2	4	3	4	3	3	0	0	4	1	0	39	20	0	7	0	0	0	0
148	0	0	0	0	0	0	0	0	1	14	0	0	0	3	0	0	0	0	0	1042	0	0	0	0	0	0	0	45	8	11	2	0	15	9	0	4	0	0	0	0
150+	417	84	154	0	0	123	643	1100	552	3718	182	104	39	60	0	0	0	0	220	1562	423	4	7	7	8	12	0	45	0	11	7	3	642	542	5	26	35	0	0	0

Table 8. ALB-S catch-at-size (CAS) matrix. Estimations of the size (2 cm lower limit classes) composition of the catches by year (1975 to 2014).



Class (2cm)	Year																																							
	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
40	0	0	206	0	2119	38284	1765	3319	1981	359	4750	5778	7240	6	0	55	0	90	402	300	89	411	469	4	6967	0	0	882	237	385	229	3861	12	4	9	44	114	11	52	295
42	6	0	206	0	1059	15444	272	953	283	52	3877	1781	1218	412	0	0	0	0	121	200	201	771	1140	26	225	0	0	1424	382	306	173	194	23	0	19	0	3	0	116	7
44	10	2	0	340	0	12534	472	511	660	130	5554	3772	2351	409	75	0	0	0	0	367	205	4523	1378	27	28	0	0	2723	703	57	0	89	19	284	8	4	7	0	92	13
46	0	0	412	0	424	14653	629	885	906	26	5816	3788	3483	209	487	1212	0	0	603	1125	659	5089	1959	27	28	0	0	4391	1175	614	307	540	493	0	0	0	28	0	87	124
48	16	129	206	719	212	7443	1765	1794	711	470	7386	7657	3080	406	1460	3086	155	180	3781	981	2927	12850	2131	55	56	17	0	3322	901	164	101	280	497	8	0	13	35	0	8	1236
50	6	381	698	1362	0	17909	5331	1306	1100	202	7064	10168	4846	3	8650	3692	312	0	1922	8398	28335	11794	3998	929	1175	0	40	5204	1607	128	16	197	483	860	24	96	121	6	30	164
52	0	254	0	1021	424	11211	6775	1896	1119	607	5361	6878	3579	203	8613	2645	936	180	4505	12663	12714	11411	3429	330	337	33	0	2602	704	135	48	321	1172	897	31	588	344	0	366	33
54	380	383	1030	1416	636	10839	11749	4375	2710	718	5378	12610	5941	206	4980	1819	625	90	2029	37616	47099	37831	4566	5036	4831	70	393	3698	1368	503	289	714	1056	1079	393	1701	388	14	1024	713
56	20	385	1854	3405	1271	10280	9762	4445	1377	1244	6636	11216	9163	212	6715	497	778	180	8296	50829	39306	48576	6501	7317	6645	168	56	3885	2572	2116	1707	2281	3961	2282	746	1910	1528	152	654	763
58	515	1679	1442	3853	705	11211	7390	7820	1578	3763	11868	19287	13118	1188	3613	1874	1090	180	13347	65826	58636	43076	9434	10577	9845	789	2374	2154	9468	3140	4690	5339	9256	3444	987	2486	2567	154	593	1337
60	1211	4084	5562	12258	847	24056	8207	8175	1365	6646	22480	27900	30634	6085	11403	3751	2339	2159	25110	84798	85715	74142	15124	15710	17508	6065	5880	39263	12133	7784	5995	11031	20355	7178	2283	3536	3779	1645	4515	2575
62	2314	7638	8034	14695	3178	22350	8162	9378	2195	10449	31451	28256	50277	7649	9700	5019	7460	4050	55212	92084	89783	61565	16629	10903	14126	2185	10923	36310	10299	12253	11942	16858	12460	11636	2997	2108	8896	2104	10871	4255
64	1667	7521	14374	17079	4307	32723	11294	11103	5433	12714	47890	46766	51195	14131	16145	7721	16166	4325	42094	72808	39079	62501	14092	16532	19899	7823	13371	65568	7363	15833	15180	16223	12456	12507	4163	3810	9354	6312	13161	6345
66	5530	8664	15450	18046	6350	25231	12607	14586	11189	10184	38587	35796	40275	21013	15384	9209	15278	5493	43361	43777	28256	49149	15429	11468	21589	13862	18610	46851	3596	27100	12912	14831	16697	13776	4618	2159	7643	8268	13051	8648
68	4929	11008	14525	23208	11356	34562	22724	33957	20242	14325	48858	50995	50263	18336	28135	35887	68329	9962	55271	78439	44902	60959	33763	18147	29826	23732	22268	24613	3854	27794	15297	10024	41904	29277	9859	6407	12350	11278	12542	9292
70	6928	12691	19032	51202	9313	49487	48463	75029	25888	26076	76308	70949	72165	19805	25758	31882	125861	22343	63358	111638	48760	64955	56523	33172	47820	38098	42409	27152	4290	28915	37388	28078	53056	28446	12070	11350	13866	17589	10085	8778
72	18001	26784	33329	57331	22875	46768	53507	87386	30297	36820	89179	63434	64186	26859	37845	43514	91883	48698	73051	128454	60917	73254	60530	33509	45975	44970	62895	19230	6929	20316	53818	38272	60279	30567	14726	15426	18064	22602	12750	11399
74	33229	37089	45845	63675	17757	41803	60526	103245	42276	37242	110384	110098	71396	46877	65696	93047	77423	66774	96616	133964	75816	96485	64526	58020	62206	44135	83188	26395	5095	27316	71439	74508	54694	52133	26629	38482	37395	34901	18723	24040
76	34687	42894	61042	50810	63780	56514	47059	85085	45614	35979	108898	90553	72650	77887	54926	92857	49624	77473	106319	118970	72031	63376	58888	59219	61100	83146	93302	51157	11089	29268	77933	96694	55287	62063	37191	48247	46927	42791	34661	47637
78	53167	47971	63500	60073	54401	76449	67054	130489	54016	40752	121754	122537	95689	101723	106322	126021	55682	85943	157251	143474	66241	88567	75242	88517	84035	76611	109623	51514	23035	44221	87881	83367	68628	72548	61373	59743	72438	61256	51456	80693
80	55175	51177	71050	88418	88768	89741	82270	150848	68839	49606	158995	170749	170122	135860	144355	135692	86843	155407	180070	149749	90085	124841	102200	117325	93751	82717	140628	80196	63582	68854	75289	91036	86455	63920	68214	60151	70838	88277	75943	76440
82	89439	71641	94649	101835	56944	67139	73861	126947	59996	61024	148880	143407	215143	135192	140982	153587	84618	177473	171493	139551	87703	110545	105695	134339	95052	80586	130441	124584	81178	94417	56951	60479	88729	60547	65775	59030	64375	95702	99305	95636
84	117486	88660	117945	101025	70244	92517	91176	134491	74501	69905	171135	190006	228193	118171	141068	159462	101100	171597	185127	132850	116195	166827	104295	144002	80304	78184	112085	104086	82212	100012	50885	91420	64393	80087	97995	86834	87754	109625	105965	70626
86	111231	81502	131565	75319	63834	104606	82487	118552	59110	52539	149845	149859	252746	163295	165388	138892	176066	226053	163533	157767	129022	139124	100325	108895	69850	62558	85655	109347	61223	104119	43452	71741	72442	92976	109871	93785	100050	110251	131085	82394
88	75348	67439	100313	68807	126719	85165	65415	84257	46084	38043	114588	116477	176159	160307	101822	140871	69597	133674	101625	102997	103210	118420	104042	89419	61336	48864	55152	87241	55912	89826	42876	62796	65360	77299	120082	83426	104433	121848	104951	58517
90	50030	61463	105622	57577	57720	71322	64149	68963	32420	32747	126639	123252	198613	127244	145189	194560	32529	117655	92919	85984	85434	105121	89849	77274	62654	66621	26180	77204	55510	81941	41765	63212	77240	70305	125709	74642	90312	134761	95230	34087
92	40109	47297	71980	58421	46397	53792	53021	61754	29271	23448	94084	96945	141827	100482	106977	144433	25675	114441	108449	96062	62392	97408	65624	64690	55789	54007	21854	64773	64536	66260	41387	65720	59073	58892	87651	58838	73899	122055	83934	29767
94	37729	40412	61355	45097	52648	44806	49068	53119	31177	28154	75845	93027	114398	67627	80825	80575	15492	85556	82243	62857	58268	76864	68174	61423	61265	39408	17961	57407	72277	58647	38802	75068	52170	54751	73699	55247	62244	93891	60520	21756
96	33359	45958	58543	61211	45655	58286	42417	50125	30058	24402	57589	66190	80978	64500	52113	46645	7294	88493	68133	60566	42430	26570	53071	50717	51805	42160	70094	82362	99021	57007	44845	62503	38465	48929	69046	40884	46499	70484	45571	22026
98	39988	41363	62765	75277	36060	53968	42795	47221	28747	26150	46341	61062	60716	50936	42725	41829	5077	82471	48390	46185	36026	15570	51444	62154	61889	44593	120749	101136	71292	52490	46789	67146	29960	40267	59267	34546	41005	54203	37024	19488
100	32829	47527	51589	93412	58229	48193	63098	59368	33117	31920	53880	63309	63437	34287	43623	34033	8694	76299	49563	31700	47915	31595	33517	73879	71565	30926	146632	81849	57713	54676	37276	52211	32228	28329	41510	30174	45079	48826	25400	10786
102	38344	50663	51563	87064	35389	50343	49244	66736	29596	27737	43556	47579	48737	37807	45632	39716	7274	89149	55599	48409	34726	31143	41951	97672	94202	43935	60146	49608	80011	51191	45706	51485	28925	26105	42739	34557	51735	40621	24122	15940
104	35033	49296	38137	66604	50394	50903	51836	72464	28415	27508	45556	51924	54285	43461	68152	24329	7125	60638	63131	53214	52906	70461	47856	53572	55240	79630	68881	58203	114474	42600	39676	59914	27619	22747	35983	37110	40283	32966	22385	14586
106	28826	44922	25257	26856	65489	35328	41847	57644	19187	20532	36626	42198	44298	42484	48889	12046	22987	56969	57837	72378	30296	38527	48125	52076	51296	66938	67004	57178	57664	39404	40179	38046	26671	23493	29295	30450	32208	24809	17916	17530
108	26772	37672	21726	24688	54269	32760	36569	42884	19120	17138	33824	51965	43763	46128	43148	16046	83340	55074	45754	74458	39314	44969	63372	34989	32577	80321	69806	61967	43653	32839	35123	41527	31548	22885	24089	25481	33444	28660	23707	20508
110	28976	35394	15668	25777	61569	20270	41723	33234	17374	15408	27734	54980	46669	20099	19574	7912	92913	57022	25617	64138	49145	36719	29645	47863	44871	61650	103268	51959	48823	24155	24525	38065	26792	19255	14947	20576	28418	21456	11298	12061
112	20204	20118	8076	10789	24402	21042	34111	28402	15483	9646	16882	33945	33522	19224	10014	53442	61485	51856	18223	19704	39558	17170	36258	39809	37697	77588	97503	41858	39427	27618	27153	23111	24273	16836	12189	17890	23974	17474	12219	12223
114	12009	18028	7357	5831	13289	12723	33267	21285	10158	9313	18442	33626	22076	28045	4226	29425	59527	30942	13731	17340	28971	10022	31172	30269	28695	82667	73444	35618	51983	18597	15628	15029	14588	13586	8513	13941	23288	13926	11504	10957
116	9150	9011	2299	2470	13372	12867	15522	15554	12693	7058	14676	26766	20843	49138	1080	4737	72772	11533	10150	19694	17872	6817	22180	25605	25466	61992	46661	12268	42055	14219	11814	11195	9706	9249	4924	7922	16882	10370	6956	7824
118	5584	4692	879	1980	6382	5713	9188	11534	7677	5185	10570	25464	12944	26461	1011	1264	21933	4444	3640	10333	13259	6733	15649	20900	20617	42371	36034	11859	27461	9215	7110	7284	5734	4583	3864	6732	18334	8678	6123	5750
120	2607	1348	893	3036	13541	12969	11954	10496	9154	5683	7042	25835	9759	8880	382	612	1439	2894	4076	7226	7116	3773	8500	23523	23227	13211	26770	16061	6036	2973	2844	9556	5861	2570	3337	8364	12182	8338	3755	3735
122	419	65	160	947	2316	805	5057	3632	3280	3987	1136	7200	4246	2332	28	240	730	486	383	1010	2043	2056	9245	2931	2876	7201	1604	5643	951	2646	2047	3605	2743	2278	2183	4487	8828	6361	2508	3420
124	140	65	0	1175	1790	2107	4458	2685	2051	6744	809	4026	4768	1513	111	166	34	969	685	731	383	1388	3288	629	628	3508	2779	10980	887	1396	708	6544	2627	1376	2004	2045	9936	5422	1826	2456
126	0	65	0	407	837	565	1674	1150	1466	6608	245	2589	1509	378	0	55	5	450	402	243	138	1285	1505	1335	1369	264	2603	11161	449	741	445	2153	1826	1363	1327	1665	5590	3390	1514	1746
128	0	0	206	432	837	186	1494	517	786	6151	136	703	1099	0	138	55	0	0	123	129	201	771	4617	372	316	226	765	3042	638	536	448	1095	1194	966	1114	3805	2641	1192	919	1231
130	280	65	286	681	454	558	908	644	1188	7553	48	4326	1211	0	0	110	38	180	402	100	1119	771	1477	662	577	138	1278	5549	447	48	210	468	3843	4200	5416	3477	3770	650	799	1150
132	0	0	80	0	30	140	172	376	434	3385	19	90	56	0	37	0	3	90	40	0	112	206	2299	112	17	17	439	1815	201	95	230	326	3702	4098	5268	3361	2075	250	634	943
134	0	0	0	0	30	140	243	349	314	4207	0	15	37	0	0	0	9	2	40	33	45	51	235	24	13	18	326	1172	121	15	239	155	2110	2128	2753	1994	1470	151	513	649
136	0	0	0	0	30	0	43	60	151	933	0	15	0	189	0	0	1	0	0	0	45	103	959	0	0	17	80	605	80	30	98	101	442	383	538	1023	583	14	341	762
138	0	0	0	0	30	0	36	0	138	496	0	15	0	0	0	0	3	91	40	0	112	103	1259	0	0	0	120	491	3	24	27	35	267	298	421	509	530	0	220	435
140	0	0	0	0	0	93	107	7	396	111	29	30	0	63	0	55	6	91	80	100	380	51	401	70	20	36	166	265	0	21	28	45	837	1056	1307	590	677	9	181	388
142	0	0	0	0	0	0	0	0	0	7	10	0	0	0	37	0	2	0	40	0	26	90	87	110	25	36	126	567	77	21	152	31	808	1015	1295	402	275	5	212	562
144	0	0	0	0	0	47	21	0	13	0	0	0	0	0	0	111	5	1	0	0	4	34	0	0	0	17	80	151	0	11	3	16	437	555	713	100	142	8	166	361
146	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	110	1	0	0	0	0	10	0	0	0	0	40	265	39	5	11	0	77	90	283	15	55	5	176	1040
148	0	0	0	0	0	0	0	0	0	0	0	0	0	0	37	110	1	0	0	0	0	104	0	0	0	17	40	151	39	11	13	0	76	98	469	4	29	5	105	294
150+	0	65	0	0	0	186	21	60	25	0	39	105	112	0	75	1049	155	180	442	133	451	412	0	0	0	0	40	189	0	426	651	39	40	9	21	564	202	578	1129	531

Table 9. Evaluation of the CPUE series on North and South Atlantic albacore stocks presented to the group. The evaluation was made using the protocol established by the WGSAM in 2012 to evaluate CPUE series.

North Atlantic stock

Paper	SCRS/2016/068	Cosgrove *et al.*, 2014	SCRS/2016/080	SCRS/2016/074	SCRS/2016/073	SCRS/2016/078	SCRS/2016/032	SCRS/16/087
Index	Japan LL	Irish trawl	US pelagic LL	Spain Trol	Spain BB	Taiwan LL	Venezuela LL	Japan Core Area
Diagnostics	4	4	4	4	4	4	5	4
Appropriateness of data exclusions and classifications (e.g. to identify targeted trips)	5 (data exclusion are identified and justified, model explicitly covers targeting)	4 (data exclusions are clearly identified and justified)	4 (data exclusions are clearly identified and justified)	4 (apparently no need to exclude any data)	4 (data exclusions are clearly identified and justified)	4 (data exclusions identified and justified)	4 (analysis of influential data conducted and decisions not to exclude any data justified)	4 (data exclusions identified and justified)
Geographical coverage	4 (extensive coverage and distribution areas provided in a map)	2 (limited to north eastern Atlantic. Good distribution of effort maps provided)	3 (large area of operation but only in northwest Atlantic)	3	2	4	3	4
Catch fraction	2	2	1	3	3	2	1	2
Length of time series relative to the history of exploitation	5 (series runs from 1959)	2 (time series only available from 2003)	3 (1987-2014)	3 (since 1981)	3 (since 1981)	4 (1967-2015)	3 (1991-2014)	4 (1964-2006)
Are other indices available for the same time period?	4	3	3	3	3	4	3	4

Does the index standardization account for known factors that influence catchability/selectivity?	4 (gear, area, hooks and other factors that may influence catchability and selectivity are included, as are interaction terms)	3 (the model includes few factors, although including vessels may address aspects of catchability or selectivity)	3 (operating procedure, gear configuration)	2 (only year, quarter, area and interactions are considered)	2 (only year, quarter, area and interactions are considered)	4 (year, quarter, area, other species)	4 (gear, area, hooks and other factors that may influence catchability and selectivity are included, as are interaction terms)	4 (gear, area, hooks and other factors that may influence catchability)
Is the interannual variability within plausible bounds (e.g. Walter and Cass-Calay, 2013)	4	3	4	3	3	4	3	4
Are biologically implausible interannual deviations severe? (e.g. Walter and Cass-Calay, 2013)	5	3	5	3	3	5	3	5
Assessment of data quality and adequacy of data for standardization purpose (e.g. sampling design, sample size, factors considered)	2 (not enough observations to properly standardize for all the factors believed to be affected)	3 (data quality is explicitly addressed, model includes interactions to obtain more info from the data and model structured to account for possible changes. Size data for portion of population covered by this CPUE is not provided)	3 (nº observations per variable factor category not shown)	3 (sampling design and size appropriate, not many factors included)	3 (sampling design and size appropriate, not many factors included)	3 (nº observations per each variable factor category not shown)	3 (nº observations per variable factor category not shown)	2 (not enough observations to properly standardize for all the factors believed to be affected)
Is this CPUE time series continuous?	5	5	5	5	5	5	5	5

South Atlantic stock

Paper	SCRS/2016/068	Pons and Domingo, 2014	SCRS/2016/089	SCRS/2016/079	SCRS/16/077
Index	Japan LL	Uruguay LL	Brazil LL	Taiwan LL	South African BB
Diagnostics	3	3	4	3	2 (no residual patterns shown)
Appropriateness of data exclusions and classifications (e.g. to identify targeted trips)	4 (data exclusion are identified and justified, model explicitly covers targeting)	4 (data exclusions are clearly identified and justified, vessel targeting also covered)	3 (fishing strategy addressed, but apparently no data exclusion is conducted)	4 (data exclusions identified and justified)	4 (data exclusion explained and justified)
Geographical coverage	4 (extensive coverage and distribution areas provided in a map)	3 (limited to south western Atlantic. Good distribution of effort maps provided)	4 (extensive coverage and distribution areas provided in a map)	4	3
Catch fraction	2	1	2	5	4
Length of time series relative to the history of exploitation	5 (series runs from 1959)	3 (series runs from 1983)	3 (1978-2012)	4 (1967-2015)	3 (2003-2014, but there is an older one 1985-1998)
Are other indices available for the same time period?	5	3	3	4	4
Does the index standardization account for known factors that influence catchability/selectivity?	4 (gear, area, hooks and other factors that may influence catchability and selectivity are included, as are interaction terms)	4 (analysis includes many factors that could affect fishing efficiency/selectivity. Multiple interactions included)	3 (time, area, and fishing strategy are considered, but the latter is not very clear)	4 (year, quarter, area, other species)	4 (year, month, position, vessel power, vessel type, target)

Is the interannual variability within plausible bounds (e.g. Walter and Cass-Calay, 2013)	4	4	3	4	4
Are biologically implausible interannual deviations severe? (e.g. Walter and Cass-Calay, 2013)	5	5	4	5	5
Assessment of data quality and adequacy of data for standardization purpose (e.g. sampling design, sample size, factors considered)	2 (previously the WG considered the sampling design was relatively good, as well as the sample size and factors considered. However, subsequent analyses indicate that there are not enough observations to properly standardize for all factors believed to be affected)	4 (information includes length frequencies of catches in recent years. Multiple factors and interactions included. Sample design takes into account effort distribution although proportion of effort cover01ed is not explicitly discussed)	3 (heterogeneous dataset but relatively good residuals)	3 (nº observations per each variable factor category not shown)	3 (nº observations per variable factor category not shown)
Is this CPUE time series continuous?	5	5	5	5	5

Table 10. Standardized annual CPUEs for North Atlantic albacore.

	Japan LL Early	Japan LL Transition	Japan LL By-catch	Japan LL core Early	Japan LL core Transition	Japan LL core By-catch	Chinese Taipei LL 1st period	Chinese Taipei LL 2nd period	Chinese Taipei LL 3rd period	Irish MWT Q3	US LL	Spanish Troll	France TR	Spanish BB	Venezuela LL
Age Range	3-8+	3-8+	3-8+	3-8+	3-8+	3-8+	2-8+	2-8+	2-8+	2-3	3-8	2-3	2-3	1-4	5-8+
Catch Units	Number	Number	Number	Number	Number	Number	Weight	Weight	Weight	Weight	Number	Number	Number	Number	Number
Effort Units	1000 hooks	1000 hooks	1000 hooks	1000 hooks	1000 hooks	1000 hooks	1000 hooks	1000 hooks	1000 hooks	Days at sea	1000 hooks	Fishing days	1000 hooks	Fishing days	1000 hooks
Model	Neg. binomial	Neg. binomial	Neg. binomial	Neg. binomial	Neg. binomial	Neg. Binomial	LogNormal	LogNormal	LogNormal	Delta log-normal	Delta log-normal	Log-Normal	Delta log-normal	Log-Normal	Delta log-normal
Used in assess.	No	No	Yes (1988-2012)	No	No	No	No	No	Yes	No	Yes	No	No	Yes	Yes
Year															
1959	27.459														
1960	23.329														
1961	19.188														
1962	28.380														
1963	14.992														
1964	14.918			33.83729											
1965	11.043			31.14848											
1966	10.358			36.91554											
1967	10.922			33.25215			294.6791								
1968	11.144			30.58286			509.5313								
1969	9.137	10.657		33.61161			409.4818								
1970		10.501		36.94203			389.2505								
1971		5.946		18.78532			317.8628								
1972		2.999		4.482254			311.4597								
1973		4.135		5.991785			305.3485								
1974		3.602		9.308208			317.9450								
1975		3.077	2.610		0.0000809		294.2251						1.36		

1976	2.203	0.0000889		291.7729						0.95		
1977	1.455	0.000077		287.0757						1.23		
1978	1.231	0.0000683		256.3453						1.46		
1979	1.489	0.0000612		295.9886						1.27		
1980	1.457	0.0000794		329.5752						1.46		
1981	1.471	0.0000536		383.6085					4.5086	1.55	120.3355	
1982	1.335	0.0000494		458.9732					4.2247	1.55	142.1404	
1983	1.213	0.0000339		432.0405					4.2092	0.86	211.781	
1984	1.036	0.0000425		366.9191					3.9418	0.47	105.5021	
1985	1.161	0.0000446		310.7035					4.1261	1.70	187.1337	
1986	0.670	0.00000684		274.2483					4.4814	0.37	143.0091	
1987	0.477	0.0000211		235.7245	283.9162			0.49	4.2205	0.62	207.4696	
1988	0.780	0.0000348			353.0965			0.56	4.2496		207.9697	
1989	0.739	0.0000338			342.1148			0.68	3.8423		166.3143	
1990	0.575	0.000015			301.7633			1.02	4.1443		234.0441	
1991	0.664	7.98E-10			285.1749			1.03	4.8585		182.3254	0.354
1992	0.518	0.000000001			226.0827			0.74	4.8065		139.7415	0.407
1993	0.510	0.0000212			424.6678			1.16	4.4924		179.4904	0.341
1994	0.693		5.46376		345.4850			1.30	4.0982		248.3461	0.667
1995	0.441		2.07878		398.5791			1.31	4.8424		179.4813	0.787
1996	0.387		3.6832		234.5771			0.84	4.4832		206.3494	0.795
1997	0.533		2.60247		312.8780			1.07	4.7074		209.1378	0.856
1998	0.868		0.54474		431.8790			1.03	4.3456		263.5269	1.082
1999	0.486		1.98103		245.1944	220.9084		1.26	4.3656		133.7631	1.054
2000	0.802		1.1334			175.4527		1.13	3.4317		132.3419	1.154
2001	1.098		1.6931			170.0116		1.31	3.4859		88.5964	0.672
2002	1.165		1.23169			158.9563		1.07	3.8258		90.6544	0.840
2003	0.839		1.30132			199.2920	495.48	0.86	3.8601		178.4587	1.040
2004	0.619		1.15949			281.6502	411.17	0.84	4.2377		184.171	1.089
2005	0.845		1.08905			281.8669	1151.74	0.87	4.5893		179.4839	1.150
2006	0.735		0.95077			404.8764	2948.40	0.72	4.6848		274.9101	1.177
2007	0.427					320.8192	683.32	0.75	4.1171		204.3802	1.958
2008	0.445					305.1050	2655.88	0.60	4.5269		155.6245	2.031
2009	0.670					375.2456	1419.13	0.80	4.2735		250.7806	1.085
2010	1.002					448.5055	248.99	1.01	3.4839		201.0325	0.910

2011	0.678	347.5100	3824.67	1.31	3.9809	423.3189	0.521
2012	0.790	456.7708		1.11	4.7090	340.1043	0.785
2013	9.233	706.7904		1.38	3.8416	329.9506	1.366
2014	0.012	1263.3011		1.75	3.4965	136.0997	1.881
2015		492.6446					

Table 11. Standardized annual CPUEs for South Atlantic albacore.

	Uruguay LL	Brazil LL	Taiwan LL	Japan LL_early	Japan LL_transition	Japan LL_by-catch	South Africa BB early	South Africa BB late
Age range	3-8+	3-8+	3-8+	3-8+	3-8+	3-8+	2-3	2-3
Catch units	Weight	Number	Number	Number	Number	Number	Weight	Weight
Effort units	1000 hooks	1000 hooks	1000 hooks	1000 hooks	1000 hooks	1000 hooks	Fishing days	Fishing days
Model	Delta log-normal	Delta log-normal	LogNormal	Neg. Binomial	Neg. Binomial	Neg. Binomial	LogNormal	LogNormal
Use in assess.	Yes	No	Yes	No	No	Yes (1975-2011)	No	No
Year								
1959				1.888				
1960				1.780				
1961				1.430				
1962				1.025				
1963				0.992				
1964				0.996				
1965				0.671				
1966				0.610				
1967			801.353	0.648				
1968			791.725	0.598				
1969			743.267	0.362	2.199			
1970			599.703		1.057			
1971			629.150		1.673			
1972			415.401		0.897			
1973			319.227		0.603			
1974			343.323		0.357			
1975			405.044		0.213			
1976			374.692			1.133		
1977			449.758			0.716		
1978		2.562	384.151			1.320		
1979		3.856	352.288			0.538		
1980		1.437	361.367			0.796		
1981		1.394	321.198			1.656		
1982		1.227	301.332			1.307		
1983	1.689	2.411	294.834			1.049		
1984	1.459	2.941	368.196			1.072		
1985	1.526	1.694	300.707			1.808	1.092	
1986	1.509	3.382	295.304			2.126	0.982	
1987	1.411	4.264	263.458			0.868	1.187	
1988	1.467	3.125	195.449			0.613	0.945	
1989	1.754	4.945	165.609			0.767	0.867	

1990	1.148	4.262	177.618			1.050	0.856	
1991	1.333	2.429	197.547			1.205	0.805	
1992	0.884	1.322	214.567			0.665	0.973	
1993	1.546	7.881	218.197			0.566	0.895	
1994	0.690	5.518	282.081			0.824	0.940	
1995	1.103	4.621	276.066			0.523	0.969	
1996	1.511	5.949	292.352			0.570	1.012	
1997	1.110	5.967	308.641			0.764	1.227	
1998	1.532	5.363	281.759			0.750	1.250	
1999	1.217	4.892	197.968			0.771		
2000	0.970	6.141	174.602			1.298		
2001	0.564	3.703	218.395			1.349		
2002	0.455	2.03	175.165			0.847		
2003	0.317	1.051	153.284			0.925		1320.9
2004	0.229	1.459	202.268			0.979		923.6
2005	0.145	1.019	253.888			0.717		1321.4
2006	0.561	1.201	202.059			0.392		1228.7
2007	0.706	0.605	239.128			0.300		1474.4
2008	0.531	0.978	248.354			0.624		1126.9
2009	0.671	0.895	262.413			0.767		1502.1
2010	0.589	0.628	286.470			0.951		1272.8
2011	0.371	2.268	240.716			0.828		1032.8
2012		3.572	250.9277			2.118		830.5
2013			270.3402			3.552		1241.4
2014			180.6426			0.477		1441.3

Table 12. Bootstrapped results of the *Biodyn* model for the North Atlantic albacore Base Case stock assessment. Maximum Sustainable Yield (MSY), Fishing mortality at MSY (F_{MSY}), Biomass at MSY (B_{MSY}), intrinsic growth rate (r) and carrying capacity (K).

	Median	*Mean*	*Standard Deviation*
MSY	37081.7632	38175.8805	3413.8010
F_{MSY}	0.0917	0.0970	0.0318
B_{MSY}	406885.5986	407566.6848	53470.5590
r	0.0918	0.0971	0.0318
K	1105477.2204	1107327.6799	145275.4414

Table 13. Fleet descriptions used in the ASPIC models for South Atlantic albacore.

Fleet	Fleet 1	Fleet 2 (1956-1969) Fleet 3 (1970-1975) Fleet 4 (1976-2014)	Fleet 5	Fleet 6 (1956 –1998) Fleet 7 (1999 –2014)	Fleet 8
CPUE	Chinese Taipei (LL)	Japan (LL) (1976-2011) None (1956-1969) None (1970-1975)	None	None	Uruguay (LL)
Catch	Chinese Taipei (LL) Korea (LL)	China LL EU.Spain (LL) EU.Portugal (LL) Japan (LL) Philippines (LL) St Vincent and Grenadier (LL) USA (LL) Vanuatu (LL) Honduras (LL) Nei (LL) Côte D'Ivoire (LL) EU.United Kingdom (LL) Seychelles (LL) UK.St Helena (LL) Angola (LL) Senegal (LL)	Brazil (LL, SU) Panama (LL) South Africa (LL, UN) Argentina (LL, TW, UN) Belize (LL) Cambodia (LL) Cuba (LL, UN) Namibia (LL)	Brazil (BB, GN, HL, PS, TW, UN) EU.Spain (PS) EU.France (BB, PS) EU.Portugal (BB, PS) Japan (BB, PS) Namibia (BB) Korea (BB) Maroc (PS) Panama (PS) South Africa (BB, HL, PS, RR, SP) USA (PS) USSR (SU) UK.St Helena (BB, RR) Chinese Taipei (GN) Nei (BB, PS) Argentina (PS) Belize (PS) Cabo Verde (PS) Curaçao (PS) Guatemala (PS) Côte D'Ivoire (PS) Ghana (BB, PS) Guinea Ecuatorial (UN, HL) Guinée Rep. (PS)	Uruguay (LL)

Table 14. Catches (t) for each fleet for ASPIC for south Atlantic albacore listed in **Table 13**.

Year	*Fleet 1*	*Fleet 2*	*Fleet 3*	*Fleet 4*	*Fleet 5*	*Fleet 6*	*Fleet 7*	*Fleet 8*	*Total*
1956		21							21
1957		725							725
1958		1,047							1,047
1959		3,015			1,700				4,715
1960		8,673			1,802				10,475
1961		8,893			1,872				10,765
1962		16,422			2,549				18,971
1963		15,104			2,281				17,385
1964	115	23,738			2,124	22			25,999
1965	346	28,309			1,190				29,845
1966	5,275	21,023			998				27,296
1967	7,412	7,719			752				15,883
1968	12,489	11,857			1,304	38			25,688
1969	21,732	6,331			430				28,493
1970	17,255		5,898		500				23,653
1971	21,323		3,218		344				24,885
1972	30,640		2,087		352	110			33,189
1973	25,888		277		1,969	100			28,234
1974	19,079		109		365	163			19,716
1975	16,614		306		536	151			17,607
1976	17,976			73	1,129	197			19,375
1977	19,858			105	1,162	330			21,455
1978	21,837			135	867	256			23,095
1979	21,218			105	666	651			22,640
1980	19,400			333	1,024	2,189			22,946
1981	18,869			558	996	3,594		23	24,040
1982	23,363			569	1,114	4,391		235	29,672
1983	10,101			162	1,360	2,922		373	14,918
1984	8,237			224	1,061	4,551		526	14,599
1985	20,154			623	517	8,272		1,531	31,097
1986	27,913			739	1,263	7,111		262	37,288
1987	29,173			357	1,733	9,189		178	40,630
1988	20,926			405	816	7,926		100	30,173
1989	18,440			450	788	7,450		83	27,212
1990	20,461			587	638	6,973		55	28,714
1991	19,914			804	1,333	3,930		34	26,016
1992	23,068			1,001	3,374	9,089		31	36,562
1993	19,420			748	3,753	8,863		28	32,813
1994	22,576			923	1,684	10,100		16	35,300
1995	18,354			695	941	7,513		49	27,552
1996	18,974			785	1,165	7,426		75	28,426
1997	18,169			673	769	8,354		56	28,022
1998	16,113			487	3,098	10,787		110	30,595
1999	17,391			1,560	1,651		6,965	90	27,656
2000	17,239			3,041	4,027		6,989	90	31,387
2001	15,834			5,235	6,834		10,757	135	38,796
2002	17,321			1,142	3,097		10,074	111	31,746
2003	17,356			534	2,641		7,364	108	28,002
2004	13,325			703	606		7,789	120	22,543
2005	10,772			1,446	727		5,905	32	18,882
2006	12,359			2,247	3,041		6,713	93	24,453
2007	13,202			1,313	538		5,195	34	20,283
2008	10,054			2,633	478		5,650	53	18,867
2009	9,052			2,470	493		10,152	97	22,265
2010	11,105			1,693	649		5,754	24	19,225
2011	13,103			1,888	1,417		7,684	37	24,129
2012	12,902			3,708	1,226		7,213	12	25,061
2013	8,553			4,136	966		5,399	209	19,263
2014	6,677			1,645	564		4,790		13,677

Table 15. Standardized CPUE series included in the ASPIC models for South Atlantic albacore.

Fleet represented	*Fleet 1*	*Fleet 2*	*Fleet 3*	*Fleet 4*	*Fleet 5*	*Fleet 6*	*Fleet 7*	*Fleet 8*
CPUE series flag	Chinese Taipei LL	Japan LL1*	Japan LL2*	Japan LL3	Brazil LL*	South Africa BB1*	South Africa BB2*	Uruguay LL
1959		1.888						
1960		1.780						
1961		1.430						
1962		1.025						
1963		0.992						
1964		0.996						
1965		0.671						
1966		0.610						
1967	2.517	0.648						
1968	2.487	0.598						
1969	2.335	0.362	2.199					
1970	1.884		1.057					
1971	1.976		1.673					
1972	1.305		0.897					
1973	1.003		0.603					
1974	1.078		0.357					
1975	1.272		0.213					
1976	1.177			1.133				
1977	1.413			0.716				
1978	1.207			1.320	0.838			
1979	1.107			0.538	1.261			
1980	1.135			0.796	0.470			
1981	1.009			1.656	0.456			
1982	0.946			1.307	0.401			
1983	0.926			1.049	0.789			1.689
1984	1.156			1.072	0.962			1.459
1985	0.945			1.808	0.554	1.092		1.526
1986	0.928			2.126	1.106	0.982		1.509
1987	0.828			0.868	1.395	1.187		1.411
1988	0.614			0.613	1.022	0.945		1.467
1989	0.520			0.767	1.618	0.867		1.754
1990	0.558			1.050	1.394	0.856		1.148
1991	0.620			1.205	0.795	0.805		1.333
1992	0.674			0.665	0.432	0.973		0.884
1993	0.685			0.566	2.578	0.895		1.546
1994	0.886			0.824	1.805	0.940		0.690
1995	0.867			0.523	1.512	0.969		1.103
1996	0.918			0.570	1.946	1.012		1.511
1997	0.969			0.764	1.952	1.227		1.110
1998	0.885			0.750	1.754	1.250		1.532
1999	0.622			0.771	1.600			1.217
2000	0.548			1.298	2.009			0.970
2001	0.686			1.349	1.211			0.564
2002	0.550			0.847	0.664			0.455
2003	0.481			0.925	0.344		1.077	0.317
2004	0.635			0.979	0.477		0.753	0.229
2005	0.797			0.717	0.333		1.077	0.145
2006	0.635			0.392	0.393		1.002	0.561
2007	0.751			0.300	0.198		1.202	0.706
2008	0.780			0.624	0.320		0.919	0.531
2009	0.824			0.767	0.293		1.225	0.671
2010	0.900			0.951	0.205		1.038	0.589
2011	0.756			0.828	0.742		0.842	0.371
2012	0.788			2.118*	1.168		0.677	
2013	0.849			3.552*			1.012	
2014	0.567			0.477*			1.175	

*Eliminated in the Base Case scenarios.

Table 16. Details of model runs in the ASPIC for South Atlantic albacore.

Run	*Weight*	B_1/K (fixed)	*Model*
2	Equal for all fleets	0.9	Logistic
6	Equal for all fleets	0.9	Fox
7	Weighted by catch	0.9	Logistic
8	Weighted by catch	0.9	Fox

Table 17. Results of the ASPIC and BSP model runs for South Atlantic albacore compared to those of the 2013 assessment.

ASPIC 2016 results

Model run	*MSY (t)*	F_{MSY}	B_{MSY} *(t)*	B_{2012}/B_{MSY}	F_{2011}/F_{MSY}	*K (t)*	*r*
Run2	26,920	0.212	127,100	0.937	0.573	254,300	0.42
Run6	25,200	0.172	146,200	1.001	0.564	397,300	0.17
Run7	26,210	0.145	180,300	1.097	0.491	360,600	0.29
Run8	25,080	0.138	182,000	1.147	0.489	494,800	0.14

ASPIC 2013 results

Model run	*MSY (t)*	F_{MSY}	B_{MSY} *(t)*	B_{2012}/B_{MSY}	F_{2011}/F_{MSY}	*K (t)*	*r*
Run2	28,060	0.301	93,330	0.813	1.076	254,300	0.60
Run6	25,660	0.199	128,800	0.861	1.098	397,300	0.20
Run7	22,620	0.070	323,000	0.816	1.301	360,600	0.14
Run8	24,250	0.127	191,300	0.950	1.047	494,800	0.13

BSP 2016 results

Model run	*MSY (t)*	B_{MSY} *(t)*	B_{CUR}/B_{MSY}	H_{CUR}/H_{MSY}	*K*	*r*
EQ SH	29,598	121,380	1.181	0.786	254,706	0.53
EQ FOX	23,037	88,887	1.972	0.316	243,656	0.58
CW SH	31,684	86,691	0.508	0.851	173,499	0.73
CW FOX	14,854	72,636	1.110	0.831	196,266	0.41

BSP 2013 results

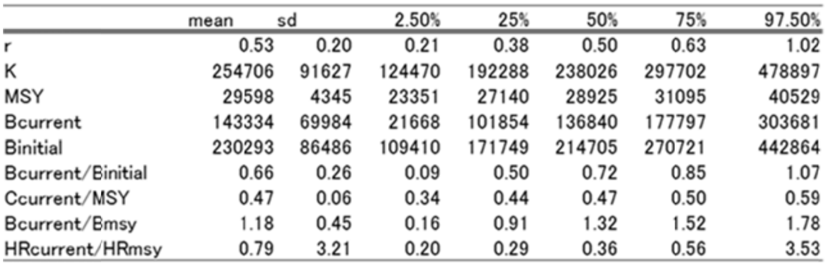
Model run	*MSY (t)*	B_{MSY} *(t)*	B_{CUR}/B_{MSY}	H_{CUR}/H_{MSY}	*K*	*r*
EQ SH	23,230	345,701	0.87	1.35	704,250	0.18
EQ FOX	23,580	303,850	1.13	1.14	843,490	0.23
CW SH	37,330	410,376	1.25	0.89	802,680	0.23
CW FOX	52,240	323,333	1.68	0.69	864,040	0.42

Table 18. Scenarios of sensitivity analyses for the ASPIC model runs for South Atlantic albacore.

Scenario	*Abbreviation in the graph*
B1/K fix at 0.8	B1/K 0.8
B1/K fix at 1.0	B1/K 1.0
Only with Taiwanese LL index	Only TWLL
Only with index of Japan LL3 (1975-2011)	Only JPLL3
Without Uruguay LL index	No URG LL
Additional South Africa BB index (early+late)	
Additional Brazil LL index	Add BZLL
Start year 1975	Start 1975

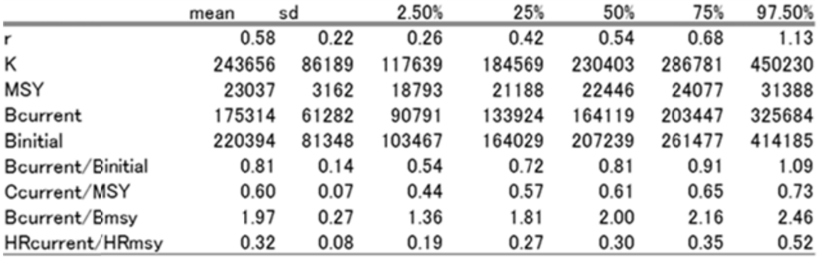
Table 19. BSP model parameter estimates.

a) Equal weighted logistic model BSP.



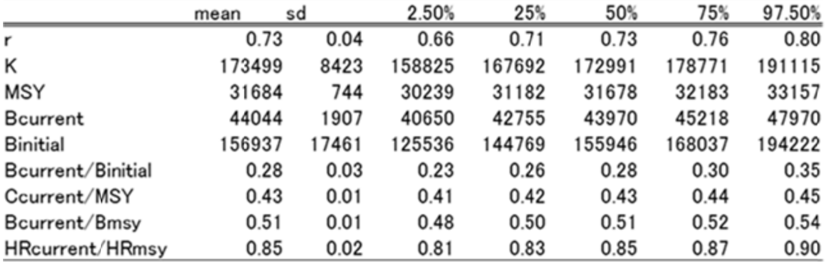
	mean	sd	2.50%	25%	50%	75%	97.50%
r	0.53	0.20	0.21	0.38	0.50	0.63	1.02
K	254706	91627	124470	192288	238026	297702	478897
MSY	29598	4345	23351	27140	28925	31095	40529
Bcurrent	143334	69984	21668	101854	136840	177797	303681
Binitial	230293	86486	109410	171749	214705	270721	442864
Bcurrent/Binitial	0.66	0.26	0.09	0.50	0.72	0.85	1.07
Ccurrent/MSY	0.47	0.06	0.34	0.44	0.47	0.50	0.59
Bcurrent/Bmsy	1.18	0.45	0.16	0.91	1.32	1.52	1.78
HRcurrent/HRmsy	0.79	3.21	0.20	0.29	0.36	0.56	3.53

b) Equal weighted FOX model BSP.



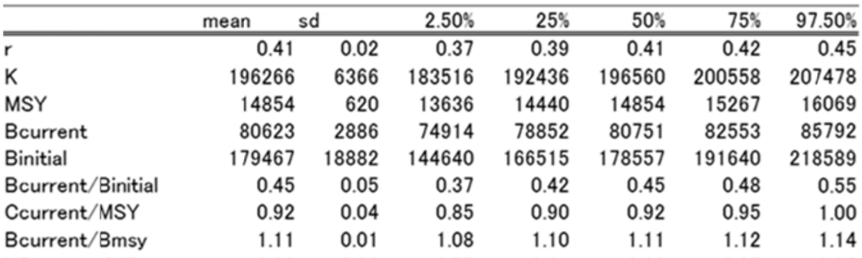
	mean	sd	2.50%	25%	50%	75%	97.50%
r	0.58	0.22	0.26	0.42	0.54	0.68	1.13
K	243656	86189	117639	184569	230403	286781	450230
MSY	23037	3162	18793	21188	22446	24077	31388
Bcurrent	175314	61282	90791	133924	164119	203447	325684
Binitial	220394	81348	103467	164029	207239	261477	414185
Bcurrent/Binitial	0.81	0.14	0.54	0.72	0.81	0.91	1.09
Ccurrent/MSY	0.60	0.07	0.44	0.57	0.61	0.65	0.73
Bcurrent/Bmsy	1.97	0.27	1.36	1.81	2.00	2.16	2.46
HRcurrent/HRmsy	0.32	0.08	0.19	0.27	0.30	0.35	0.52

c) Catch weighted logistic model.



	mean	sd	2.50%	25%	50%	75%	97.50%
r	0.73	0.04	0.66	0.71	0.73	0.76	0.80
K	173499	8423	158825	167692	172991	178771	191115
MSY	31684	744	30239	31182	31678	32183	33157
Bcurrent	44044	1907	40650	42755	43970	45218	47970
Binitial	156937	17461	125536	144769	155946	168037	194222
Bcurrent/Binitial	0.28	0.03	0.23	0.26	0.28	0.30	0.35
Ccurrent/MSY	0.43	0.01	0.41	0.42	0.43	0.44	0.45
Bcurrent/Bmsy	0.51	0.01	0.48	0.50	0.51	0.52	0.54
HRcurrent/HRmsy	0.85	0.02	0.81	0.83	0.85	0.87	0.90

d) Catch weighted FOX model.



	mean	sd	2.50%	25%	50%	75%	97.50%
r	0.41	0.02	0.37	0.39	0.41	0.42	0.45
K	196266	6366	183516	192436	196560	200558	207478
MSY	14854	620	13636	14440	14854	15267	16069
Bcurrent	80623	2886	74914	78852	80751	82553	85792
Binitial	179467	18882	144640	166515	178557	191640	218589
Bcurrent/Binitial	0.45	0.05	0.37	0.42	0.45	0.48	0.55
Ccurrent/MSY	0.92	0.04	0.85	0.90	0.92	0.95	1.00
Bcurrent/Bmsy	1.11	0.01	1.08	1.10	1.11	1.12	1.14
HRcurrent/HRmsy	0.83	0.03	0.77	0.81	0.83	0.85	0.90

Table 20. Kobe II strategy matrix. Probability of being green over time for North Atlantic albacore under constant TAC projections.

TAC	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
20000	96	97	99	99	100	100	100	100	100	100	100	100	100	100
22000	96	97	98	99	100	100	100	100	100	100	100	100	100	100
24000	96	96	97	99	99	100	100	100	100	100	100	100	100	100
26000	96	96	97	97	99	99	99	100	100	100	100	100	100	100
28000	96	96	96	97	97	98	99	99	99	100	100	100	100	100
30000	96	96	96	96	96	97	97	98	98	99	99	99	99	100
32000	96	96	96	96	96	96	96	96	96	97	97	97	98	98
34000	95	95	96	96	96	96	96	96	96	96	96	96	96	96
36000	94	94	93	93	93	92	92	92	92	92	91	91	91	91
38000	89	89	88	88	88	88	88	87	87	86	86	86	85	85
40000	86	85	85	84	84	83	83	82	81	80	80	79	79	77
42000	83	82	80	79	79	77	76	75	74	73	72	71	71	70
44000	79	77	75	74	73	71	71	69	67	66	64	63	61	60
46000	74	72	71	69	67	66	63	61	59	58	56	55	55	54
48000	71	67	66	63	60	58	57	55	54	53	51	50	49	48
50000	66	62	59	57	55	54	52	50	49	48	46	43	42	41
52000	60	57	55	54	52	49	48	46	43	41	40	38	37	36
54000	56	54	52	49	48	44	42	40	38	36	35	35	34	32
56000	53	50	48	46	42	39	38	36	35	34	32	30	28	25
58000	50	48	44	41	38	36	35	34	31	29	26	24	23	20
60000	48	44	40	38	35	35	32	29	26	24	21	19	16	15

Table 21. Kobe 2 Strategy matrix. Probability of being green over time for North Atlantic albacore using alternative HCRs, as combinations of B_{LIM} ($0.4B_{MSY}$), $B_{THRESHOLD}$ and F_{TARGET}.

																		Cumulative catch over			
Bthresh	Ftarget	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	Avge catch over 3y	5 y	10 y	15 y	20 y
.6	0.75	97	98	99	100	100	100	100	100	100	100	100	100	100	100	100	41759	205785	401061	591403	779155
0.6	0.8	97	98	99	99	100	100	100	100	100	100	100	100	100	100	100	44327	217559	420676	616784	809106
0.6	0.85	97	98	99	99	99	100	100	100	100	100	100	100	100	100	100	46870	229110	439550	640801	837030
0.6	0.9	97	98	99	99	99	99	100	100	100	100	100	100	100	100	100	49386	240440	457706	663512	863029
0.6	0.95	97	98	99	99	99	99	99	99	99	100	100	100	100	100	100	51877	251553	475165	684973	887200
0.6	1	97	93	94	95	96	96	95	95	93	94	94	92	94	92	92	54342	262453	491950	705238	909638
0.8	0.75	97	98	99	100	100	100	100	100	100	100	100	100	100	100	100	41759	205785	401061	591403	779155
0.8	0.8	97	98	99	99	100	100	100	100	100	100	100	100	100	100	100	44327	217559	420676	616784	809106
0.8	0.85	97	98	99	99	99	100	100	100	100	100	100	100	100	100	100	46870	229110	439550	640801	837030
0.8	0.9	97	98	99	99	99	99	100	100	100	100	100	100	100	100	100	49386	240440	457706	663512	863029
0.8	0.95	97	98	99	99	99	99	99	99	99	100	100	100	100	100	100	51877	251553	475165	684973	887200
0.8	1	97	93	94	95	96	96	95	95	93	94	94	92	94	92	92	54342	262453	491950	705238	909638
1	0.75	97	98	99	100	100	100	100	100	100	100	100	100	100	100	100	41695	205605	400927	591304	779079
1	0.8	97	98	99	100	100	100	100	100	100	100	100	100	100	100	100	44259	217368	420537	616684	809032
1	0.85	97	98	99	100	100	100	100	100	100	100	100	100	100	100	100	46798	228907	439406	640701	836958
1	0.9	97	98	99	99	100	100	100	100	100	100	100	100	100	100	100	49311	240226	457556	663412	862960
1	0.95	97	98	99	99	100	100	100	100	100	100	100	100	100	100	100	51798	251328	475010	684873	887134
1	1	97	94	95	96	97	97	96	96	95	96	96	93	96	94	93	54259	262215	491785	705134	909574

Table 22. Kobe II risk matrix for B-ratio and F-ratio (probability of not exceeding MSY level) based on ASPIC results for South Atlantic albacore.

Run02 Probability B>B_{MSY}

Catch (t)	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
12,000	73%	88%	95%	97%	97%	98%	98%	98%	98%	98%	98%	98%	98%	98%
14,000	73%	86%	95%	96%	97%	97%	97%	97%	97%	97%	97%	97%	97%	97%
16,000	73%	85%	92%	95%	96%	96%	96%	96%	96%	96%	96%	96%	96%	96%
18,000	73%	82%	89%	93%	95%	95%	95%	96%	96%	96%	96%	96%	96%	96%
20,000	73%	79%	86%	89%	92%	93%	94%	94%	94%	94%	94%	95%	95%	95%
22,000	73%	78%	81%	86%	87%	89%	90%	90%	91%	91%	91%	91%	91%	91%
24,000	73%	75%	77%	77%	79%	82%	83%	83%	84%	84%	84%	84%	84%	84%
26,000	73%	72%	72%	72%	72%	71%	70%	70%	68%	67%	66%	66%	65%	65%
28,000	73%	70%	68%	62%	58%	55%	50%	47%	43%	41%	36%	34%	30%	27%
30,000	73%	67%	59%	52%	43%	37%	32%	27%	20%	15%	10%	8%	6%	2%
32,000	73%	64%	52%	41%	32%	23%	17%	10%	7%	3%	1%	1%	1%	1%
34,000	73%	59%	44%	32%	21%	13%	7%	4%	2%	1%	1%	1%	0%	0%
F	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
0.75*FMSY	73%	76%	78%	79%	80%	82%	82%	82%	83%	83%	83%	83%	83%	83%
0.80*FMSY	73%	74%	75%	76%	77%	77%	77%	77%	77%	78%	78%	78%	78%	78%
0.85*FMSY	73%	73%	72%	73%	73%	73%	73%	73%	73%	73%	73%	73%	73%	73%
0.90*FMSY	73%	71%	70%	69%	69%	68%	67%	67%	67%	67%	67%	66%	66%	66%
0.95*FMSY	73%	69%	67%	64%	63%	62%	61%	59%	58%	57%	56%	56%	55%	55%
1.00*FMSY	73%	68%	63%	58%	55%	54%	51%	50%	50%	49%	48%	47%	47%	46%

Run02 Probability F<F_{MSY}

Catch (t)	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029			
12,000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%			
14,000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%			
16,000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%			
18,000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%			
20,000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%			
22,000	97%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%			
24,000	90%	91%	93%	94%	94%	94%	94%	94%	94%	93%	93%	93%	93%			
26,000	79%	78%	77%	76%	76%	76%	75%	74%	74%	73%	74%	74%	73%			
28,000	63%	58%	54%	50%	46%	42%	40%	35%	32%	31%	29%	26%	22%			
30,000	44%	38%	31%	26%	20%	16%	12%	9%	7%	4%	3%	1%	1%			
32,000	28%	22%	15%	11%	7%	5%	3%	2%	1%	1%	1%	1%	0%			
34,000	17%	12%	7%	5%	3%	2%	1%	1%	1%	1%	0%	0%	0%			
														Estimated average catch		
F	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2015–2017	2015–2019	2017–2019
0.75*FMSY	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	20,857	24,032	29,473
0.80*FMSY	84%	84%	84%	84%	84%	84%	84%	84%	84%	84%	84%	84%	84%	21,460	24,890	30,903
0.85*FMSY	79%	79%	79%	79%	79%	79%	79%	79%	79%	79%	79%	79%	79%	22,057	25,718	32,283
0.90*FMSY	72%	72%	72%	72%	72%	72%	72%	72%	72%	72%	72%	72%	72%	22,640	26,510	33,603
0.95*FMSY	62%	62%	62%	62%	62%	62%	62%	62%	62%	62%	62%	62%	62%	23,217	27,268	34,867
1.00*FMSY	51%	51%	51%	51%	51%	51%	51%	51%	51%	51%	51%	51%	51%	23,783	27,994	36,077

Table 22. (continued)

Run02 Probability of being green

Catch (t)	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
12,000	73%	88%	95%	97%	97%	98%	98%	98%	98%	98%	98%	98%	98%
14,000	73%	86%	95%	96%	97%	97%	97%	97%	97%	97%	97%	97%	97%
16,000	73%	85%	92%	95%	96%	96%	96%	96%	96%	96%	96%	96%	96%
18,000	73%	82%	89%	93%	95%	95%	95%	96%	96%	96%	96%	96%	96%
20,000	73%	79%	86%	89%	92%	93%	94%	94%	94%	94%	94%	95%	95%
22,000	73%	78%	81%	86%	87%	89%	90%	90%	91%	91%	91%	91%	91%
24,000	73%	75%	77%	77%	79%	82%	83%	83%	84%	84%	84%	84%	84%
26,000	73%	72%	72%	72%	72%	71%	70%	70%	68%	67%	66%	66%	65%
28,000	63%	58%	54%	50%	46%	42%	40%	35%	32%	31%	29%	26%	22%
30,000	44%	38%	31%	26%	20%	16%	12%	9%	7%	4%	3%	1%	1%
32,000	28%	22%	15%	11%	7%	5%	3%	2%	1%	1%	1%	1%	0%
34,000	17%	12%	7%	5%	3%	2%	1%	1%	1%	1%	0%	0%	0%

F	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
0.75*FMSY	73%	76%	78%	79%	80%	82%	82%	82%	83%	83%	83%	83%	83%
0.80*FMSY	73%	74%	75%	76%	77%	77%	77%	77%	77%	78%	78%	78%	78%
0.85*FMSY	73%	73%	72%	73%	73%	73%	73%	73%	73%	73%	73%	73%	73%
0.90*FMSY	71%	70%	69%	69%	68%	68%	67%	66%	66%	66%	66%	66%	66%
0.95*FMSY	62%	61%	60%	60%	59%	59%	58%	57%	56%	56%	55%	55%	55%
1.00*FMSY	51%	51%	51%	51%	50%	49%	48%	48%	47%	47%	46%	45%	45%

Run06 Probability B>B_{MSY}

Catch (t)	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
12,000	76%	89%	96%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%
14,000	76%	87%	94%	97%	99%	99%	99%	99%	100%	100%	100%	100%	100%	100%
16,000	76%	84%	91%	95%	97%	99%	99%	99%	99%	99%	99%	99%	99%	99%
18,000	76%	83%	87%	92%	94%	96%	97%	98%	98%	98%	98%	98%	99%	99%
20,000	76%	79%	83%	86%	88%	91%	92%	94%	94%	95%	96%	96%	96%	96%
22,000	76%	77%	78%	79%	81%	82%	83%	83%	85%	85%	85%	86%	86%	86%
24,000	76%	75%	74%	72%	70%	68%	65%	63%	62%	60%	58%	56%	54%	51%
26,000	76%	72%	66%	62%	58%	53%	48%	43%	40%	35%	29%	25%	21%	19%
28,000	76%	69%	61%	54%	46%	40%	33%	27%	22%	18%	15%	10%	8%	6%
30,000	76%	64%	55%	45%	37%	28%	22%	17%	12%	9%	6%	4%	3%	3%
32,000	76%	62%	50%	39%	28%	20%	15%	10%	7%	4%	3%	3%	2%	1%
34,000	76%	60%	45%	32%	22%	15%	10%	6%	4%	3%	2%	1%	1%	0%

F	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
0.75*FMSY	76%	79%	82%	84%	86%	87%	88%	88%	88%	89%	89%	89%	89%	89%
0.80*FMSY	76%	77%	79%	80%	81%	82%	82%	83%	83%	83%	83%	83%	83%	83%
0.85*FMSY	76%	76%	76%	76%	76%	77%	77%	77%	76%	76%	76%	76%	76%	76%
0.90*FMSY	76%	75%	74%	73%	72%	71%	70%	69%	69%	69%	69%	68%	68%	68%
0.95*FMSY	76%	73%	70%	68%	65%	63%	63%	62%	62%	61%	60%	60%	60%	59%
1.00*FMSY	76%	71%	66%	63%	61%	58%	57%	55%	54%	53%	53%	52%	51%	51%

Table 22. (continued)

Run06 Probability F<F_{MSY}

Catch (t)	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029			
12,000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%			
14,000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%			
16,000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%			
18,000	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%			
20,000	95%	97%	98%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%			
22,000	86%	86%	87%	88%	88%	89%	90%	90%	90%	91%	91%	91%	91%			
24,000	69%	66%	64%	62%	61%	60%	58%	56%	54%	51%	49%	47%	44%			
26,000	50%	46%	42%	38%	35%	30%	26%	23%	21%	17%	15%	13%	10%			
28,000	35%	31%	26%	22%	18%	14%	12%	10%	8%	5%	4%	3%	3%			
30,000	25%	21%	16%	12%	10%	7%	5%	4%	3%	3%	2%	2%	1%			
32,000	17%	13%	11%	8%	5%	4%	3%	2%	2%	1%	1%	0%	0%			
34,000	13%	10%	7%	5%	3%	2%	2%	1%	1%	1%	0%	0%	0%			
														Estimated average catch		
F	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2015-2017	2015-2019	2017-2019
0.75*FMSY	92%	92%	92%	92%	92%	92%	92%	92%	92%	92%	92%	92%	92%	20,003	22,986	27,730
0.80*FMSY	87%	87%	87%	87%	87%	87%	87%	87%	87%	87%	87%	87%	87%	20,570	23,824	29,127
0.85*FMSY	78%	78%	78%	78%	78%	78%	78%	78%	78%	78%	78%	78%	78%	21,130	24,636	30,480
0.90*FMSY	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	21,683	25,420	31,787
0.95*FMSY	59%	59%	59%	59%	59%	59%	59%	59%	59%	59%	59%	59%	59%	22,230	26,178	33,050
1.00*FMSY	52%	52%	52%	52%	52%	52%	52%	52%	52%	52%	52%	52%	52%	22,770	26,908	34,267

Run06 Probability of being green

Catch (t)	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
12,000	76%	89%	96%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%
14,000	76%	87%	94%	97%	99%	99%	99%	99%	100%	100%	100%	100%	100%
16,000	76%	84%	91%	95%	97%	99%	99%	99%	99%	99%	99%	99%	99%
18,000	76%	83%	87%	92%	94%	96%	97%	98%	98%	98%	98%	98%	99%
20,000	76%	79%	83%	86%	88%	91%	92%	94%	94%	95%	96%	96%	96%
22,000	76%	77%	78%	79%	81%	82%	83%	83%	85%	85%	85%	86%	86%
24,000	69%	66%	64%	62%	61%	60%	58%	56%	54%	51%	49%	47%	44%
26,000	50%	46%	42%	38%	35%	30%	26%	23%	21%	17%	15%	13%	10%
28,000	35%	31%	26%	22%	18%	14%	12%	10%	8%	5%	4%	3%	3%
30,000	25%	21%	16%	12%	10%	7%	5%	4%	3%	3%	2%	2%	1%
32,000	17%	13%	11%	8%	5%	4%	3%	2%	2%	1%	1%	0%	0%
34,000	13%	10%	7%	5%	3%	2%	2%	1%	1%	1%	0%	0%	0%
F	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
0.75*FMSY	76%	79%	82%	84%	86%	87%	88%	88%	88%	89%	89%	89%	89%
0.80*FMSY	76%	77%	79%	80%	81%	82%	82%	83%	83%	83%	83%	83%	83%
0.85*FMSY	76%	76%	76%	76%	76%	76%	76%	76%	76%	76%	76%	76%	76%
0.90*FMSY	68%	68%	68%	68%	68%	68%	67%	67%	67%	67%	66%	66%	66%
0.95*FMSY	59%	59%	59%	59%	59%	59%	59%	59%	58%	58%	58%	57%	57%
1.00*FMSY	52%	52%	51%	51%	51%	51%	51%	51%	51%	50%	50%	49%	49%

Table 22. (continued)

Run07 Probability B>B$_{MSY}$

Catch (t)	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
12,000	93%	97%	98%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%
14,000	93%	97%	98%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%
16,000	93%	95%	97%	98%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%
18,000	93%	95%	96%	97%	98%	98%	98%	99%	99%	99%	99%	99%	99%	99%
20,000	93%	94%	95%	95%	95%	96%	96%	97%	97%	97%	97%	97%	97%	98%
22,000	93%	93%	94%	94%	94%	95%	95%	95%	95%	95%	95%	95%	95%	95%
24,000	93%	92%	92%	92%	91%	90%	89%	89%	87%	87%	86%	86%	85%	85%
26,000	93%	91%	89%	86%	85%	83%	82%	79%	77%	75%	72%	69%	66%	62%
28,000	93%	89%	85%	82%	78%	74%	68%	62%	57%	49%	42%	34%	28%	24%
30,000	93%	87%	83%	77%	69%	60%	52%	40%	31%	24%	19%	15%	11%	8%
32,000	93%	86%	80%	69%	58%	44%	32%	23%	17%	13%	9%	5%	4%	3%
34,000	93%	85%	76%	61%	44%	30%	22%	14%	9%	6%	4%	3%	2%	2%
F	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
0.75*FMSY	93%	93%	93%	93%	93%	93%	94%	94%	94%	94%	94%	94%	94%	94%
0.80*FMSY	93%	92%	92%	92%	92%	91%	91%	91%	90%	90%	90%	90%	90%	90%
0.85*FMSY	93%	92%	90%	89%	88%	86%	86%	85%	85%	85%	85%	85%	85%	85%
0.90*FMSY	93%	90%	87%	85%	85%	84%	83%	83%	82%	82%	81%	80%	80%	79%
0.95*FMSY	93%	89%	85%	84%	83%	80%	78%	77%	76%	74%	73%	72%	71%	70%
1.00*FMSY	93%	88%	84%	82%	77%	75%	71%	69%	66%	64%	62%	61%	59%	58%

Run07 Probability F<F$_{MSY}$

Catch (t)	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029			
12,000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%			
14,000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%			
16,000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%			
18,000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%			
20,000	99%	100%	100%	100%	99%	100%	100%	100%	100%	100%	100%	100%	100%			
22,000	98%	98%	98%	98%	98%	98%	98%	98%	98%	99%	99%	99%	99%			
24,000	93%	93%	92%	92%	92%	91%	90%	90%	89%	89%	88%	87%	87%			
26,000	83%	80%	77%	74%	71%	67%	64%	61%	57%	55%	52%	47%	43%			
28,000	64%	57%	50%	43%	36%	31%	27%	23%	19%	16%	14%	12%	9%			
30,000	41%	32%	26%	22%	17%	14%	11%	9%	6%	5%	4%	3%	3%			
32,000	25%	19%	15%	10%	9%	6%	5%	3%	2%	2%	2%	2%	1%			
34,000	16%	11%	9%	6%	5%	3%	2%	2%	2%	1%	1%	1%	0%			
														Estimated average catch		
F	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2015-2017	2015-2019	2017-2019
0.75*FMSY	97%	97%	97%	97%	97%	97%	97%	97%	97%	97%	97%	97%	97%	19,057	21,560	25,353
0.80*FMSY	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	19,587	22,410	26,770
0.85*FMSY	87%	87%	87%	87%	87%	87%	87%	87%	87%	87%	87%	87%	87%	20,113	23,244	28,160
0.90*FMSY	79%	79%	79%	79%	79%	79%	79%	79%	79%	79%	79%	79%	79%	20,633	24,056	29,513
0.95*FMSY	66%	66%	66%	66%	66%	66%	66%	66%	66%	66%	66%	66%	66%	21,153	24,854	30,843
1.00*FMSY	51%	51%	51%	51%	51%	51%	51%	51%	51%	51%	51%	51%	51%	21,667	25,632	32,140

Table 22. (continued)

Run07 Probability of being green

Catch (t)	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
12,000	93%	97%	98%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%
14,000	93%	97%	98%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%
16,000	93%	95%	97%	98%	99%	99%	99%	99%	99%	99%	99%	99%	99%
18,000	93%	95%	96%	97%	98%	98%	98%	99%	99%	99%	99%	99%	99%
20,000	93%	94%	95%	95%	95%	96%	96%	97%	97%	97%	97%	97%	97%
22,000	93%	93%	94%	94%	94%	95%	95%	95%	95%	95%	95%	95%	95%
24,000	93%	92%	92%	92%	91%	90%	89%	89%	87%	87%	86%	86%	85%
26,000	83%	80%	77%	74%	71%	67%	64%	61%	57%	55%	52%	47%	43%
28,000	64%	57%	50%	43%	36%	31%	27%	23%	19%	16%	14%	12%	9%
30,000	41%	32%	26%	22%	17%	14%	11%	9%	6%	5%	4%	3%	3%
32,000	25%	19%	15%	10%	9%	6%	5%	3%	2%	2%	2%	2%	1%
34,000	16%	11%	9%	6%	5%	3%	2%	2%	2%	1%	1%	1%	0%
F	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
0.75*FMSY	93%	93%	93%	93%	93%	93%	94%	94%	94%	94%	94%	94%	94%
0.80*FMSY	93%	92%	92%	92%	92%	91%	91%	91%	90%	90%	90%	90%	90%
0.85*FMSY	87%	87%	87%	87%	86%	86%	86%	85%	85%	85%	85%	85%	85%
0.90*FMSY	79%	79%	79%	79%	79%	79%	79%	79%	79%	78%	78%	78%	78%
0.95*FMSY	66%	66%	66%	66%	66%	66%	66%	66%	66%	66%	66%	66%	66%
1.00*FMSY	51%	51%	51%	51%	51%	51%	51%	51%	51%	51%	51%	51%	51%

Run08 Probability B>B$_{MSY}$

Catch (t)	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
12,000	90%	95%	97%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
14,000	90%	94%	96%	98%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%
16,000	90%	94%	95%	97%	98%	99%	99%	100%	100%	100%	100%	100%	100%	100%
18,000	90%	93%	95%	95%	96%	97%	98%	98%	98%	99%	99%	99%	99%	100%
20,000	90%	91%	94%	94%	95%	95%	96%	96%	97%	97%	97%	97%	97%	98%
22,000	90%	90%	91%	91%	91%	92%	92%	93%	93%	93%	93%	93%	93%	94%
24,000	90%	89%	88%	87%	86%	85%	84%	84%	81%	81%	80%	80%	79%	77%
26,000	90%	88%	85%	82%	80%	77%	75%	72%	69%	67%	62%	60%	56%	53%
28,000	90%	86%	82%	77%	73%	69%	63%	58%	53%	48%	41%	36%	32%	29%
30,000	90%	84%	79%	72%	67%	59%	52%	44%	36%	31%	27%	24%	20%	17%
32,000	90%	83%	75%	68%	58%	50%	39%	32%	27%	23%	19%	14%	11%	10%
34,000	90%	82%	71%	62%	51%	38%	30%	25%	20%	16%	12%	10%	7%	5%
F	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
0.75*FMSY	90%	90%	90%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%
0.80*FMSY	90%	90%	89%	88%	88%	87%	87%	87%	87%	86%	86%	86%	86%	86%
0.85*FMSY	90%	89%	87%	85%	84%	83%	82%	82%	81%	81%	81%	80%	80%	80%
0.90*FMSY	90%	87%	84%	82%	81%	79%	78%	77%	76%	75%	75%	74%	74%	73%
0.95*FMSY	90%	86%	82%	79%	77%	75%	73%	71%	71%	69%	69%	68%	67%	66%
1.00*FMSY	90%	84%	80%	76%	73%	71%	69%	67%	64%	63%	62%	60%	58%	57%

Table 22. (continued)

Run08 Probability F<F_{MSY}

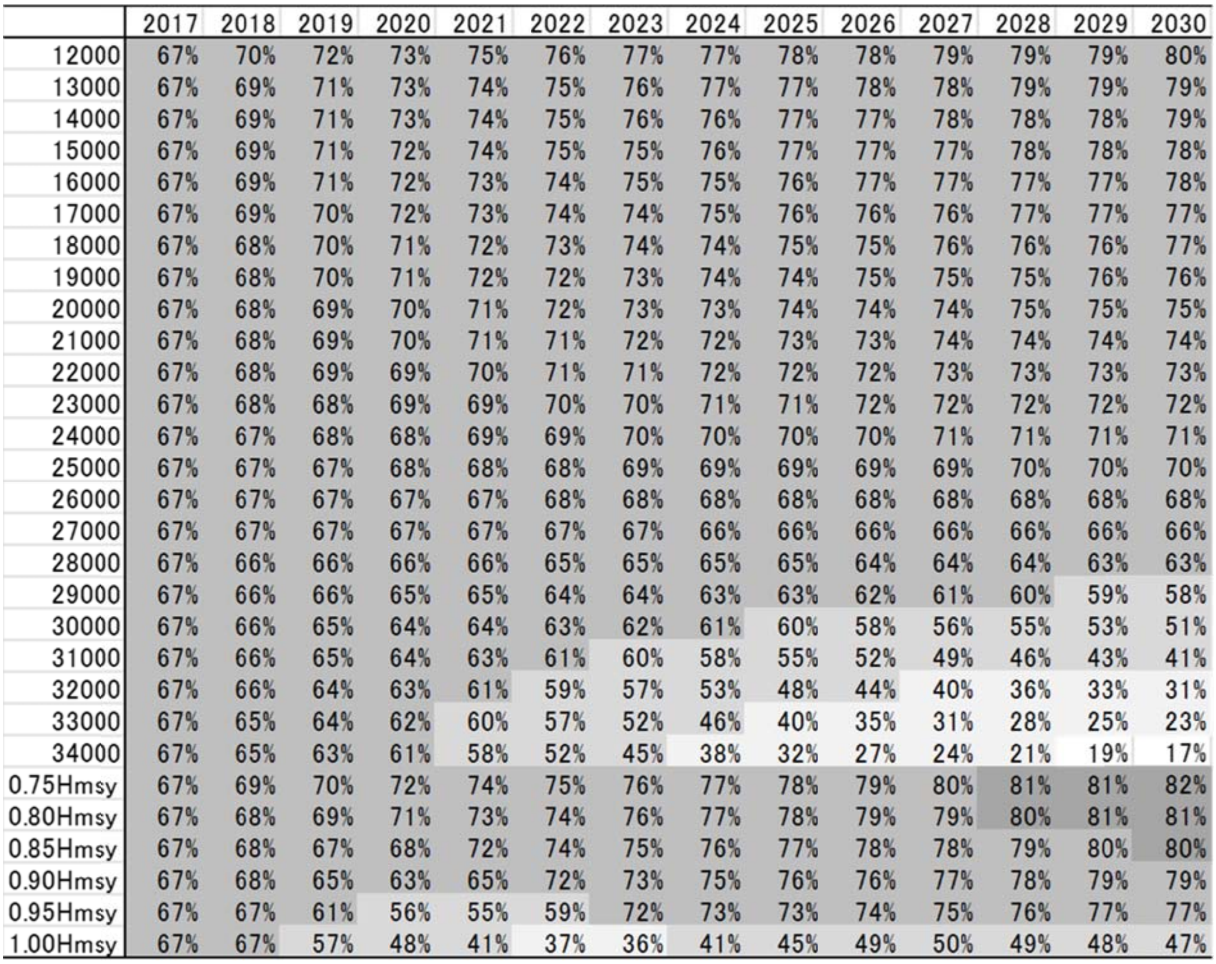
Catch (t)	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029			
12,000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%			
14,000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%			
16,000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%			
18,000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%			
20,000	98%	98%	99%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%			
22,000	94%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%	96%	96%			
24,000	84%	83%	82%	81%	80%	79%	77%	76%	76%	75%	74%	73%	71%			
26,000	71%	69%	65%	63%	59%	55%	52%	50%	44%	40%	37%	35%	32%			
28,000	56%	52%	46%	40%	34%	31%	29%	27%	23%	22%	19%	17%	14%			
30,000	42%	34%	30%	27%	24%	21%	18%	15%	12%	11%	10%	8%	7%			
32,000	30%	26%	23%	19%	15%	12%	10%	9%	7%	5%	4%	4%	4%			
34,000	24%	20%	16%	12%	10%	9%	7%	5%	4%	4%	4%	3%	2%			
														Estimated average catch		
F	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2015-2017	2015-2019	2017-2019
0.75*FMSY	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	19,340	22,002	26,090
0.80*FMSY	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%	19,883	22,858	27,517
0.85*FMSY	78%	78%	78%	78%	78%	78%	78%	78%	78%	78%	78%	78%	78%	20,423	23,694	28,910
0.90*FMSY	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	20,960	24,510	30,270
0.95*FMSY	62%	62%	62%	62%	62%	62%	62%	62%	62%	62%	62%	62%	62%	21,490	25,304	31,593
1.00*FMSY	52%	52%	52%	52%	52%	52%	52%	52%	52%	52%	52%	52%	52%	22,017	26,082	32,890

Run08 Probability of being green

Catch (t)	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
12,000	90%	95%	97%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%
14,000	90%	94%	96%	98%	99%	100%	100%	100%	100%	100%	100%	100%	100%
16,000	90%	94%	95%	97%	98%	99%	99%	100%	100%	100%	100%	100%	100%
18,000	90%	93%	95%	95%	96%	97%	98%	98%	98%	99%	99%	99%	99%
20,000	90%	91%	94%	94%	95%	95%	96%	96%	97%	97%	97%	97%	97%
22,000	90%	90%	91%	91%	91%	92%	92%	93%	93%	93%	93%	93%	93%
24,000	84%	83%	82%	81%	80%	79%	77%	76%	76%	75%	74%	73%	71%
26,000	71%	69%	65%	63%	59%	55%	52%	50%	44%	40%	37%	35%	32%
28,000	56%	52%	46%	40%	34%	31%	29%	27%	23%	22%	19%	17%	14%
30,000	42%	34%	30%	27%	24%	21%	18%	15%	12%	11%	10%	8%	7%
32,000	30%	26%	23%	19%	15%	12%	10%	9%	7%	5%	4%	4%	4%
34,000	24%	20%	16%	12%	10%	9%	7%	5%	4%	4%	4%	3%	2%
F	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
0.75*FMSY	90%	90%	90%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%
0.80*FMSY	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%
0.85*FMSY	78%	78%	78%	78%	78%	78%	78%	78%	78%	78%	78%	78%	78%
0.90*FMSY	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%	70%
0.95*FMSY	62%	62%	62%	62%	62%	62%	62%	62%	62%	62%	61%	61%	61%
1.00*FMSY	52%	52%	52%	52%	52%	52%	52%	52%	52%	52%	52%	52%	52%

Table 23. Kobe II strategy matrices for each BSP model run.

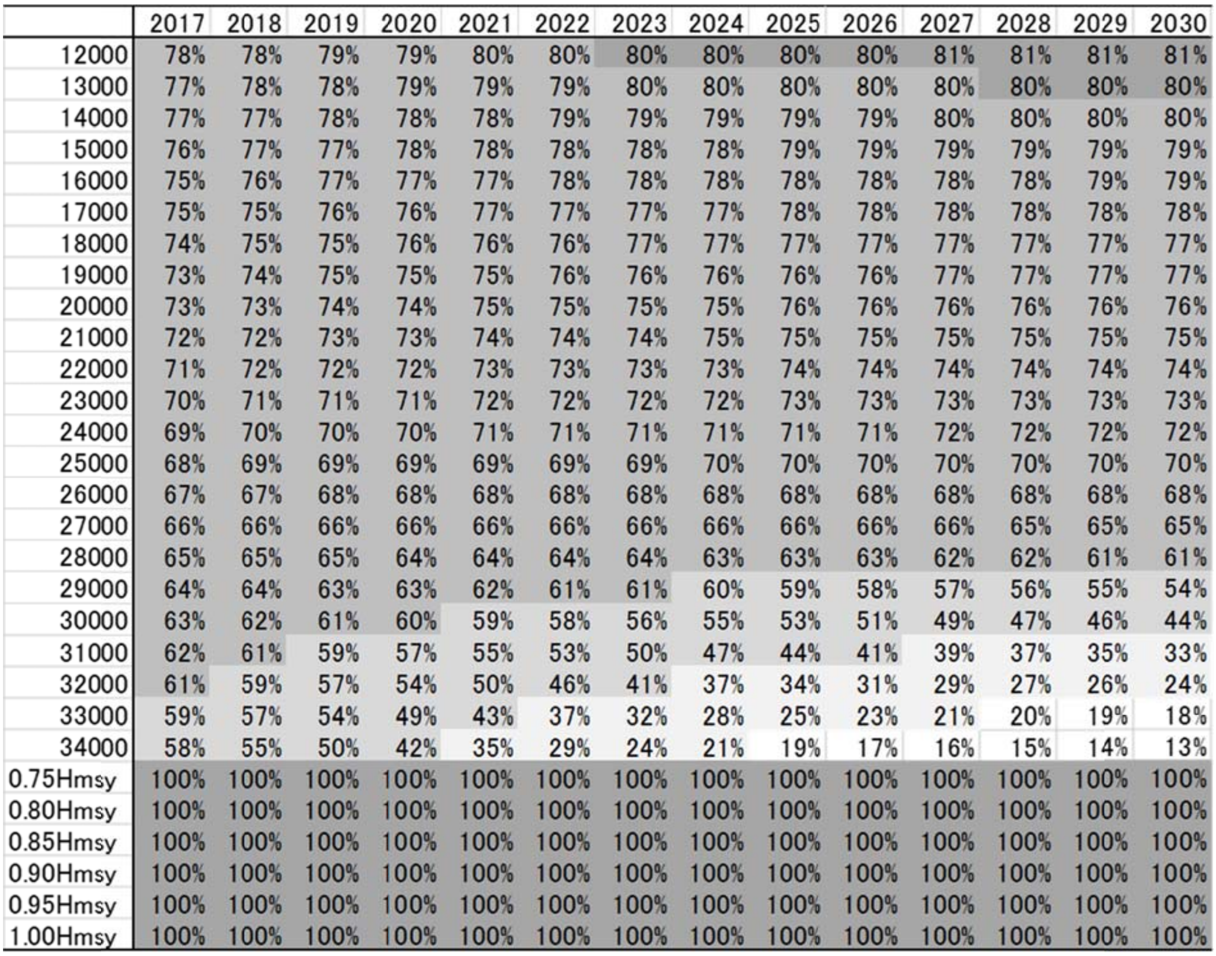
Run02 Probability B>B_{MSY}



	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
12000	67%	70%	72%	73%	75%	76%	77%	77%	78%	78%	79%	79%	79%	80%
13000	67%	69%	71%	73%	74%	75%	76%	77%	77%	78%	78%	79%	79%	79%
14000	67%	69%	71%	73%	74%	75%	76%	76%	77%	77%	78%	78%	78%	79%
15000	67%	69%	71%	72%	74%	75%	75%	76%	77%	77%	77%	78%	78%	78%
16000	67%	69%	71%	72%	73%	74%	75%	75%	76%	77%	77%	77%	77%	78%
17000	67%	69%	70%	72%	73%	74%	74%	75%	76%	76%	76%	77%	77%	77%
18000	67%	68%	70%	71%	72%	73%	74%	74%	75%	75%	76%	76%	76%	77%
19000	67%	68%	70%	71%	72%	72%	73%	74%	74%	75%	75%	75%	76%	76%
20000	67%	68%	69%	70%	71%	72%	73%	73%	74%	74%	74%	75%	75%	75%
21000	67%	68%	69%	70%	71%	71%	72%	72%	73%	73%	74%	74%	74%	74%
22000	67%	68%	69%	69%	70%	71%	71%	72%	72%	72%	73%	73%	73%	73%
23000	67%	68%	68%	69%	69%	70%	70%	71%	71%	72%	72%	72%	72%	72%
24000	67%	67%	68%	68%	69%	69%	70%	70%	70%	70%	71%	71%	71%	71%
25000	67%	67%	67%	68%	68%	68%	69%	69%	69%	69%	69%	70%	70%	70%
26000	67%	67%	67%	67%	67%	68%	68%	68%	68%	68%	68%	68%	68%	68%
27000	67%	67%	67%	67%	67%	67%	67%	66%	66%	66%	66%	66%	66%	66%
28000	67%	66%	66%	66%	66%	65%	65%	65%	65%	64%	64%	64%	63%	63%
29000	67%	66%	66%	65%	65%	64%	64%	63%	63%	62%	61%	60%	59%	58%
30000	67%	66%	65%	64%	64%	63%	62%	61%	60%	58%	56%	55%	53%	51%
31000	67%	66%	65%	64%	63%	61%	60%	58%	55%	52%	49%	46%	43%	41%
32000	67%	66%	64%	63%	61%	59%	57%	53%	48%	44%	40%	36%	33%	31%
33000	67%	65%	64%	62%	60%	57%	52%	46%	40%	35%	31%	28%	25%	23%
34000	67%	65%	63%	61%	58%	52%	45%	38%	32%	27%	24%	21%	19%	17%
0.75Hmsy	67%	69%	70%	72%	74%	75%	76%	77%	78%	79%	80%	81%	81%	82%
0.80Hmsy	67%	68%	69%	71%	73%	74%	76%	77%	78%	79%	79%	80%	81%	81%
0.85Hmsy	67%	68%	67%	68%	72%	74%	75%	76%	77%	78%	78%	79%	80%	80%
0.90Hmsy	67%	68%	65%	63%	65%	72%	73%	75%	76%	76%	77%	78%	79%	79%
0.95Hmsy	67%	67%	61%	56%	55%	59%	72%	73%	73%	74%	75%	76%	77%	77%
1.00Hmsy	67%	67%	57%	48%	41%	37%	36%	41%	45%	49%	50%	49%	48%	47%

Table 23. (continued)

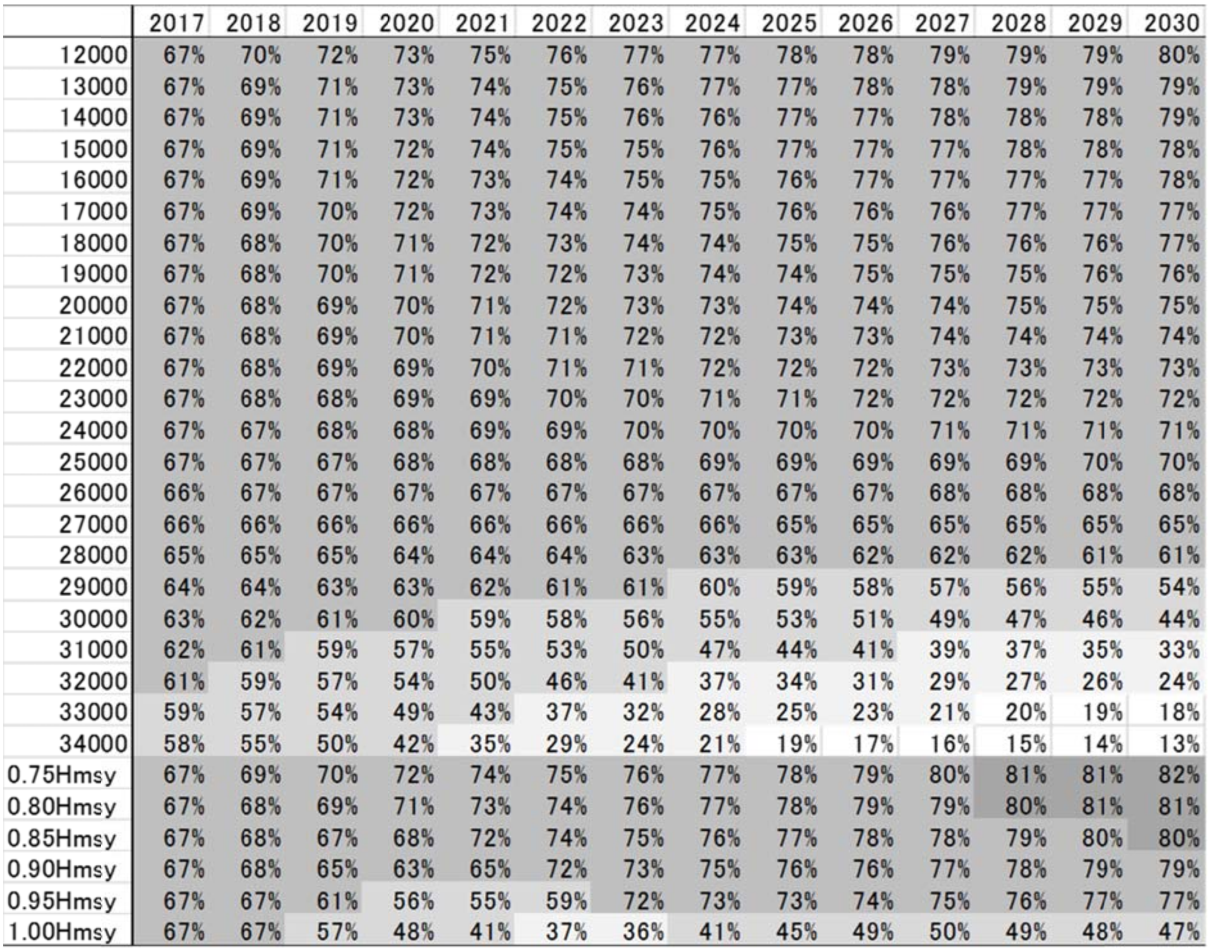
Run02 Probability H<H_{MSY}



	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
12000	78%	78%	79%	79%	80%	80%	80%	80%	80%	80%	81%	81%	81%	81%
13000	77%	78%	78%	79%	79%	79%	80%	80%	80%	80%	80%	80%	80%	80%
14000	77%	77%	78%	78%	78%	79%	79%	79%	79%	79%	80%	80%	80%	80%
15000	76%	77%	77%	78%	78%	78%	78%	78%	79%	79%	79%	79%	79%	79%
16000	75%	76%	77%	77%	77%	78%	78%	78%	78%	78%	78%	78%	79%	79%
17000	75%	75%	76%	76%	77%	77%	77%	77%	78%	78%	78%	78%	78%	78%
18000	74%	75%	75%	76%	76%	76%	77%	77%	77%	77%	77%	77%	77%	77%
19000	73%	74%	75%	75%	75%	76%	76%	76%	76%	76%	77%	77%	77%	77%
20000	73%	73%	74%	74%	75%	75%	75%	75%	76%	76%	76%	76%	76%	76%
21000	72%	72%	73%	73%	74%	74%	74%	75%	75%	75%	75%	75%	75%	75%
22000	71%	72%	72%	72%	73%	73%	73%	73%	74%	74%	74%	74%	74%	74%
23000	70%	71%	71%	71%	72%	72%	72%	72%	73%	73%	73%	73%	73%	73%
24000	69%	70%	70%	70%	71%	71%	71%	71%	71%	71%	72%	72%	72%	72%
25000	68%	69%	69%	69%	69%	69%	69%	70%	70%	70%	70%	70%	70%	70%
26000	67%	67%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%	68%
27000	66%	66%	66%	66%	66%	66%	66%	66%	66%	66%	66%	65%	65%	65%
28000	65%	65%	65%	64%	64%	64%	64%	63%	63%	63%	62%	62%	61%	61%
29000	64%	64%	63%	63%	62%	61%	61%	60%	59%	58%	57%	56%	55%	54%
30000	63%	62%	61%	60%	59%	58%	56%	55%	53%	51%	49%	47%	46%	44%
31000	62%	61%	59%	57%	55%	53%	50%	47%	44%	41%	39%	37%	35%	33%
32000	61%	59%	57%	54%	50%	46%	41%	37%	34%	31%	29%	27%	26%	24%
33000	59%	57%	54%	49%	43%	37%	32%	28%	25%	23%	21%	20%	19%	18%
34000	58%	55%	50%	42%	35%	29%	24%	21%	19%	17%	16%	15%	14%	13%
0.75Hmsy	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
0.80Hmsy	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
0.85Hmsy	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
0.90Hmsy	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
0.95Hmsy	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
1.00Hmsy	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Table 23. (continued)

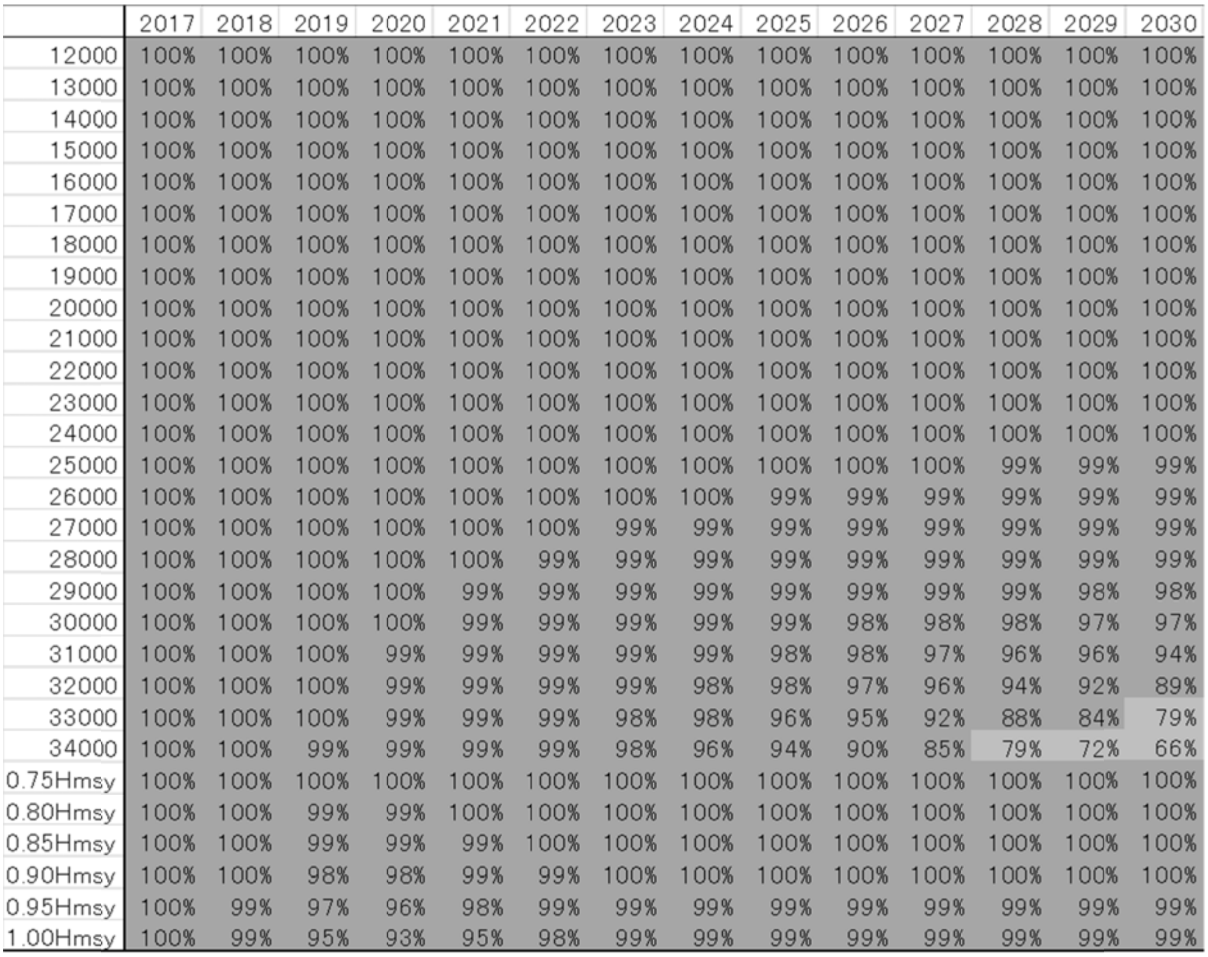
Run02 Probability of being green



	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
12000	67%	70%	72%	73%	75%	76%	77%	77%	78%	78%	79%	79%	79%	80%
13000	67%	69%	71%	73%	74%	75%	76%	77%	77%	78%	78%	79%	79%	79%
14000	67%	69%	71%	73%	74%	75%	76%	76%	77%	77%	78%	78%	78%	79%
15000	67%	69%	71%	72%	74%	75%	75%	76%	77%	77%	77%	78%	78%	78%
16000	67%	69%	71%	72%	73%	74%	75%	75%	76%	77%	77%	77%	77%	78%
17000	67%	69%	70%	72%	73%	74%	74%	75%	76%	76%	76%	77%	77%	77%
18000	67%	68%	70%	71%	72%	73%	74%	74%	75%	75%	76%	76%	76%	77%
19000	67%	68%	70%	71%	72%	72%	73%	74%	74%	75%	75%	75%	76%	76%
20000	67%	68%	69%	70%	71%	72%	73%	73%	74%	74%	74%	75%	75%	75%
21000	67%	68%	69%	70%	71%	71%	72%	72%	73%	73%	74%	74%	74%	74%
22000	67%	68%	69%	69%	70%	71%	71%	72%	72%	72%	73%	73%	73%	73%
23000	67%	68%	68%	69%	69%	70%	70%	71%	71%	72%	72%	72%	72%	72%
24000	67%	67%	68%	68%	69%	69%	70%	70%	70%	70%	71%	71%	71%	71%
25000	67%	67%	67%	68%	68%	68%	68%	69%	69%	69%	69%	69%	70%	70%
26000	66%	67%	67%	67%	67%	67%	67%	67%	67%	67%	68%	68%	68%	68%
27000	66%	66%	66%	66%	66%	66%	66%	66%	65%	65%	65%	65%	65%	65%
28000	65%	65%	65%	64%	64%	64%	63%	63%	63%	62%	62%	62%	61%	61%
29000	64%	64%	63%	63%	62%	61%	61%	60%	59%	58%	57%	56%	55%	54%
30000	63%	62%	61%	60%	59%	58%	56%	55%	53%	51%	49%	47%	46%	44%
31000	62%	61%	59%	57%	55%	53%	50%	47%	44%	41%	39%	37%	35%	33%
32000	61%	59%	57%	54%	50%	46%	41%	37%	34%	31%	29%	27%	26%	24%
33000	59%	57%	54%	49%	43%	37%	32%	28%	25%	23%	21%	20%	19%	18%
34000	58%	55%	50%	42%	35%	29%	24%	21%	19%	17%	16%	15%	14%	13%
0.75Hmsy	67%	69%	70%	72%	74%	75%	76%	77%	78%	79%	80%	81%	81%	82%
0.80Hmsy	67%	68%	69%	71%	73%	74%	76%	77%	78%	79%	79%	80%	81%	81%
0.85Hmsy	67%	68%	67%	68%	72%	74%	75%	76%	77%	78%	78%	79%	80%	80%
0.90Hmsy	67%	68%	65%	63%	65%	72%	73%	75%	76%	76%	77%	78%	79%	79%
0.95Hmsy	67%	67%	61%	56%	55%	59%	72%	73%	73%	74%	75%	76%	77%	77%
1.00Hmsy	67%	67%	57%	48%	41%	37%	36%	41%	45%	49%	50%	49%	48%	47%

Table 23. (continued)

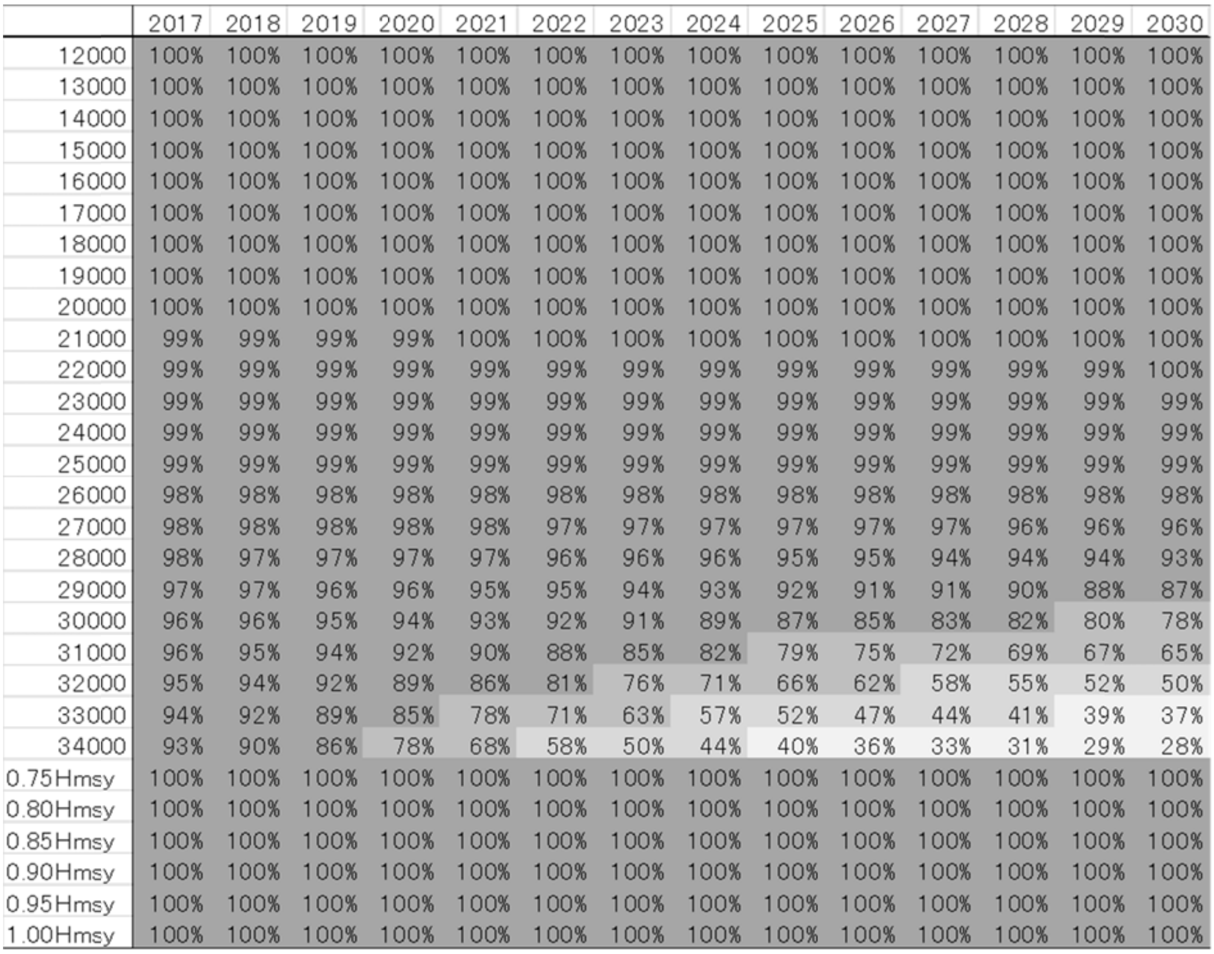
Run06 Probability B>B_{MSY}



	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
12000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
13000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
14000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
15000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
16000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
17000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
18000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
19000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
20000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
21000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
22000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
23000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
24000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
25000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	99%	99%
26000	100%	100%	100%	100%	100%	100%	100%	100%	99%	99%	99%	99%	99%	99%
27000	100%	100%	100%	100%	100%	100%	99%	99%	99%	99%	99%	99%	99%	99%
28000	100%	100%	100%	100%	100%	99%	99%	99%	99%	99%	99%	99%	99%	99%
29000	100%	100%	100%	100%	99%	99%	99%	99%	99%	99%	99%	99%	98%	98%
30000	100%	100%	100%	100%	99%	99%	99%	99%	99%	98%	98%	98%	97%	97%
31000	100%	100%	100%	99%	99%	99%	99%	99%	98%	98%	97%	96%	96%	94%
32000	100%	100%	100%	99%	99%	99%	99%	98%	98%	97%	96%	94%	92%	89%
33000	100%	100%	100%	99%	99%	99%	98%	98%	96%	95%	92%	88%	84%	79%
34000	100%	100%	99%	99%	99%	99%	98%	96%	94%	90%	85%	79%	72%	66%
0.75Hmsy	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
0.80Hmsy	100%	100%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
0.85Hmsy	100%	100%	99%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%
0.90Hmsy	100%	100%	98%	98%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%
0.95Hmsy	100%	99%	97%	96%	98%	99%	99%	99%	99%	99%	99%	99%	99%	99%
1.00Hmsy	100%	99%	95%	93%	95%	98%	99%	99%	99%	99%	99%	99%	99%	99%

Table 23. (continued)

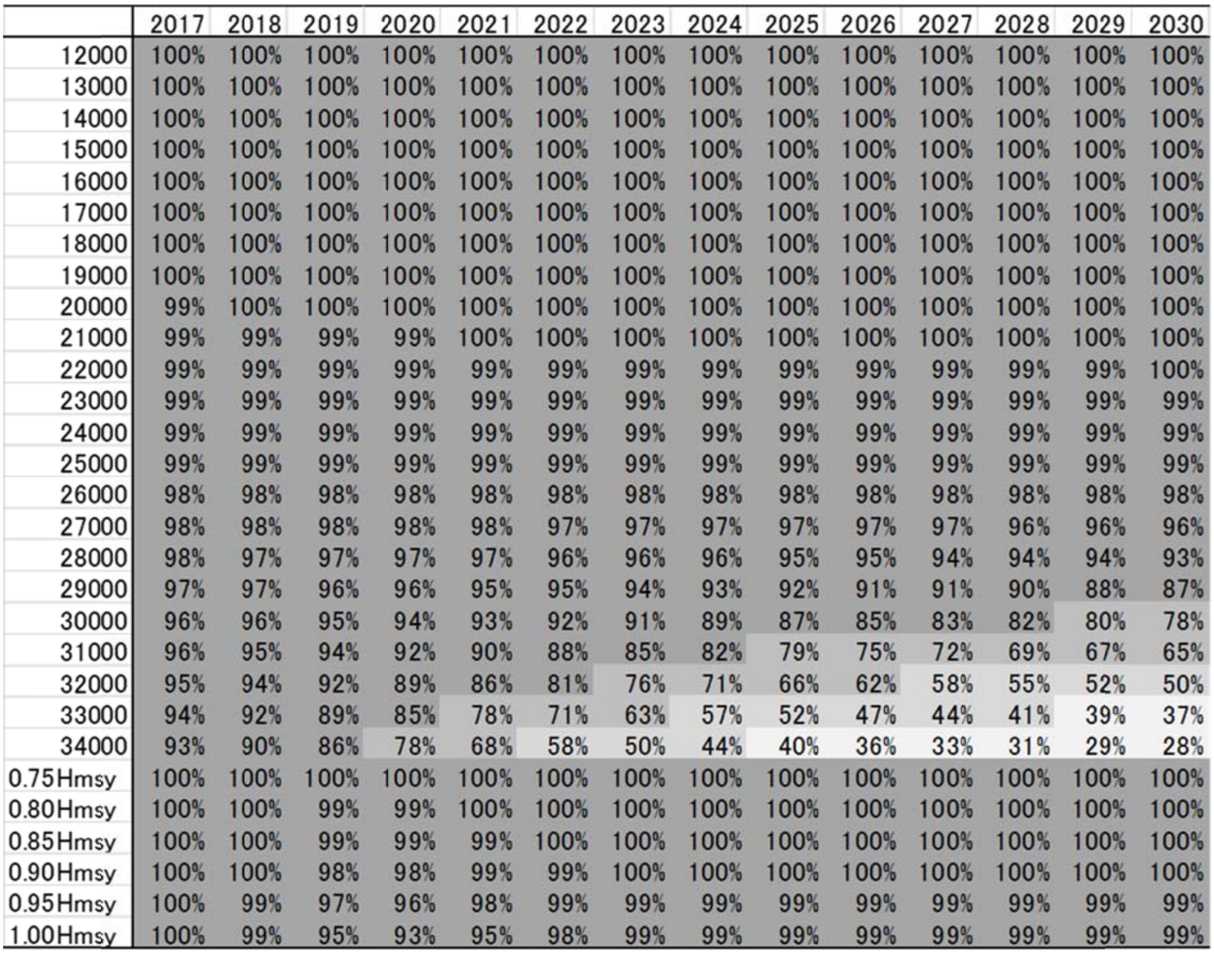
Run06 Probability H<H_{MSY}



	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
12000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
13000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
14000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
15000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
16000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
17000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
18000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
19000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
20000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
21000	99%	99%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
22000	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	100%
23000	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%
24000	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%
25000	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%
26000	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%
27000	98%	98%	98%	98%	98%	97%	97%	97%	97%	97%	97%	96%	96%	96%
28000	98%	97%	97%	97%	97%	96%	96%	96%	95%	95%	94%	94%	94%	93%
29000	97%	97%	96%	96%	95%	95%	94%	93%	92%	91%	91%	90%	88%	87%
30000	96%	96%	95%	94%	93%	92%	91%	89%	87%	85%	83%	82%	80%	78%
31000	96%	95%	94%	92%	90%	88%	85%	82%	79%	75%	72%	69%	67%	65%
32000	95%	94%	92%	89%	86%	81%	76%	71%	66%	62%	58%	55%	52%	50%
33000	94%	92%	89%	85%	78%	71%	63%	57%	52%	47%	44%	41%	39%	37%
34000	93%	90%	86%	78%	68%	58%	50%	44%	40%	36%	33%	31%	29%	28%
0.75Hmsy	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
0.80Hmsy	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
0.85Hmsy	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
0.90Hmsy	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
0.95Hmsy	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
1.00Hmsy	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Table 23. (continued)

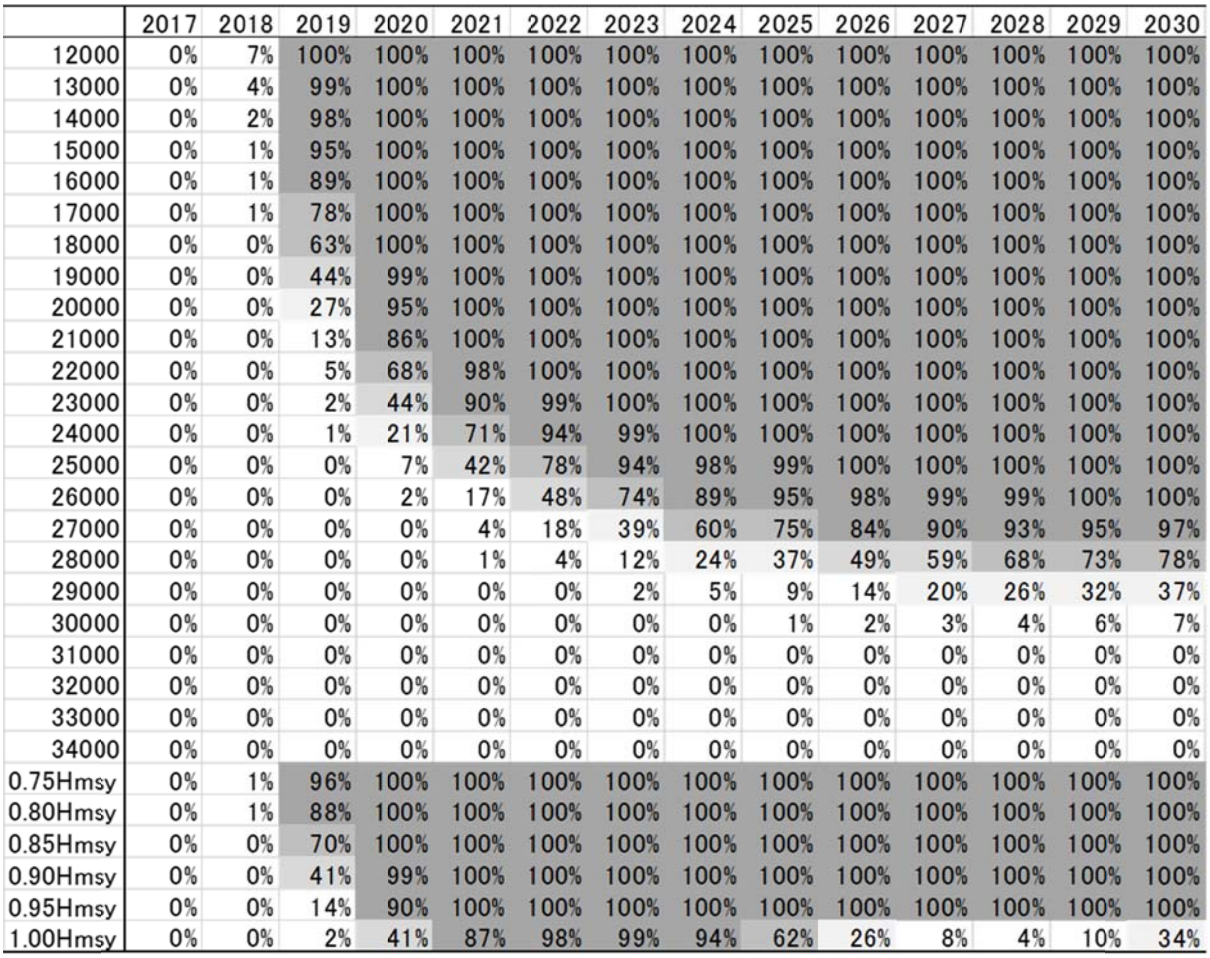
Run06 Probability of being green



	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
12000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
13000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
14000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
15000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
16000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
17000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
18000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
19000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
20000	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
21000	99%	99%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
22000	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	100%
23000	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%
24000	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%
25000	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%
26000	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%
27000	98%	98%	98%	98%	98%	97%	97%	97%	97%	97%	97%	96%	96%	96%
28000	98%	97%	97%	97%	97%	96%	96%	96%	95%	95%	94%	94%	94%	93%
29000	97%	97%	96%	96%	95%	95%	94%	93%	92%	91%	91%	90%	88%	87%
30000	96%	96%	95%	94%	93%	92%	91%	89%	87%	85%	83%	82%	80%	78%
31000	96%	95%	94%	92%	90%	88%	85%	82%	79%	75%	72%	69%	67%	65%
32000	95%	94%	92%	89%	86%	81%	76%	71%	66%	62%	58%	55%	52%	50%
33000	94%	92%	89%	85%	78%	71%	63%	57%	52%	47%	44%	41%	39%	37%
34000	93%	90%	86%	78%	68%	58%	50%	44%	40%	36%	33%	31%	29%	28%
0.75Hmsy	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
0.80Hmsy	100%	100%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
0.85Hmsy	100%	100%	99%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%
0.90Hmsy	100%	100%	98%	98%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%
0.95Hmsy	100%	99%	97%	96%	98%	99%	99%	99%	99%	99%	99%	99%	99%	99%
1.00Hmsy	100%	99%	95%	93%	95%	98%	99%	99%	99%	99%	99%	99%	99%	99%

Table 23. (continued)

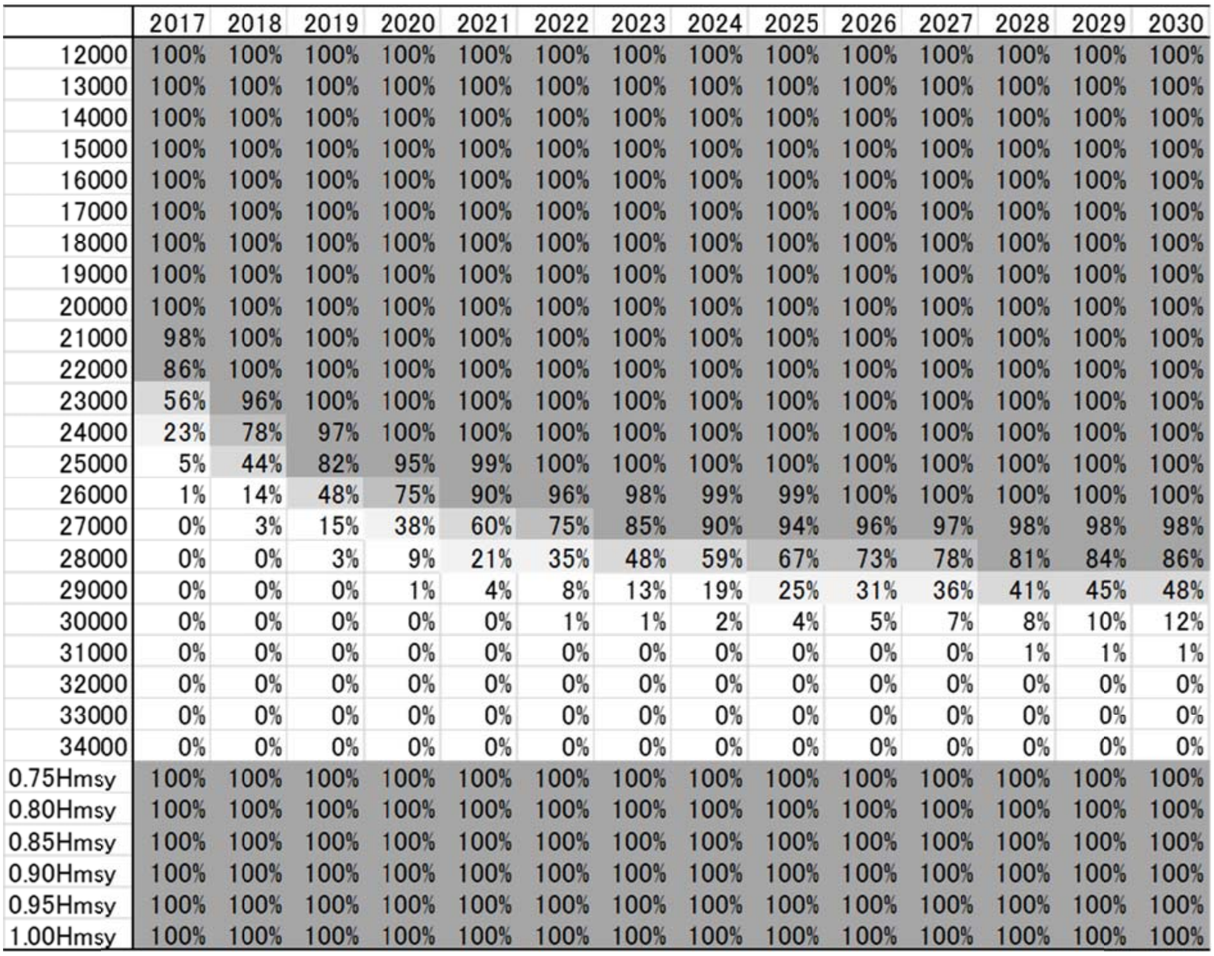
Run07 Probability B>B_{MSY}



	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
12000	0%	7%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
13000	0%	4%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
14000	0%	2%	98%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
15000	0%	1%	95%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
16000	0%	1%	89%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
17000	0%	1%	78%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
18000	0%	0%	63%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
19000	0%	0%	44%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
20000	0%	0%	27%	95%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
21000	0%	0%	13%	86%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
22000	0%	0%	5%	68%	98%	100%	100%	100%	100%	100%	100%	100%	100%	100%
23000	0%	0%	2%	44%	90%	99%	100%	100%	100%	100%	100%	100%	100%	100%
24000	0%	0%	1%	21%	71%	94%	99%	100%	100%	100%	100%	100%	100%	100%
25000	0%	0%	0%	7%	42%	78%	94%	98%	99%	100%	100%	100%	100%	100%
26000	0%	0%	0%	2%	17%	48%	74%	89%	95%	98%	99%	99%	100%	100%
27000	0%	0%	0%	0%	4%	18%	39%	60%	75%	84%	90%	93%	95%	97%
28000	0%	0%	0%	0%	1%	4%	12%	24%	37%	49%	59%	68%	73%	78%
29000	0%	0%	0%	0%	0%	0%	2%	5%	9%	14%	20%	26%	32%	37%
30000	0%	0%	0%	0%	0%	0%	0%	0%	1%	2%	3%	4%	6%	7%
31000	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
32000	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
33000	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
34000	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
0.75Hmsy	0%	1%	96%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
0.80Hmsy	0%	1%	88%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
0.85Hmsy	0%	0%	70%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
0.90Hmsy	0%	0%	41%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
0.95Hmsy	0%	0%	14%	90%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
1.00Hmsy	0%	0%	2%	41%	87%	98%	99%	94%	62%	26%	8%	4%	10%	34%

Table 23. (continued)

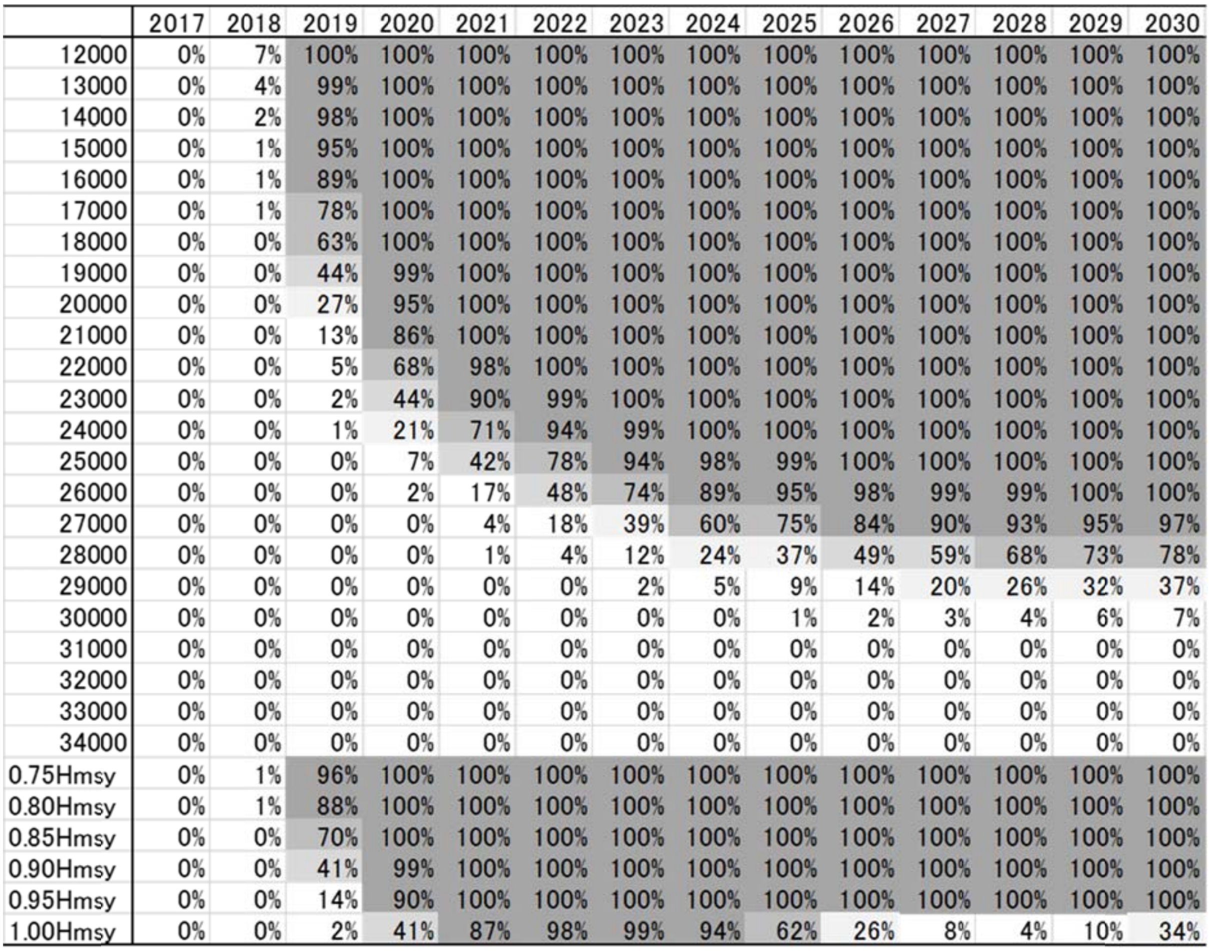
Run07 Probability H<H_{MSY}



	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
12000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
13000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
14000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
15000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
16000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
17000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
18000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
19000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
20000	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
21000	98%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
22000	86%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
23000	56%	96%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
24000	23%	78%	97%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
25000	5%	44%	82%	95%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%
26000	1%	14%	48%	75%	90%	96%	98%	99%	99%	100%	100%	100%	100%	100%
27000	0%	3%	15%	38%	60%	75%	85%	90%	94%	96%	97%	98%	98%	98%
28000	0%	0%	3%	9%	21%	35%	48%	59%	67%	73%	78%	81%	84%	86%
29000	0%	0%	0%	1%	4%	8%	13%	19%	25%	31%	36%	41%	45%	48%
30000	0%	0%	0%	0%	0%	1%	1%	2%	4%	5%	7%	8%	10%	12%
31000	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	1%	1%
32000	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
33000	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
34000	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
0.75Hmsy	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
0.80Hmsy	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
0.85Hmsy	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
0.90Hmsy	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
0.95Hmsy	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
1.00Hmsy	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Table 23. (continued)

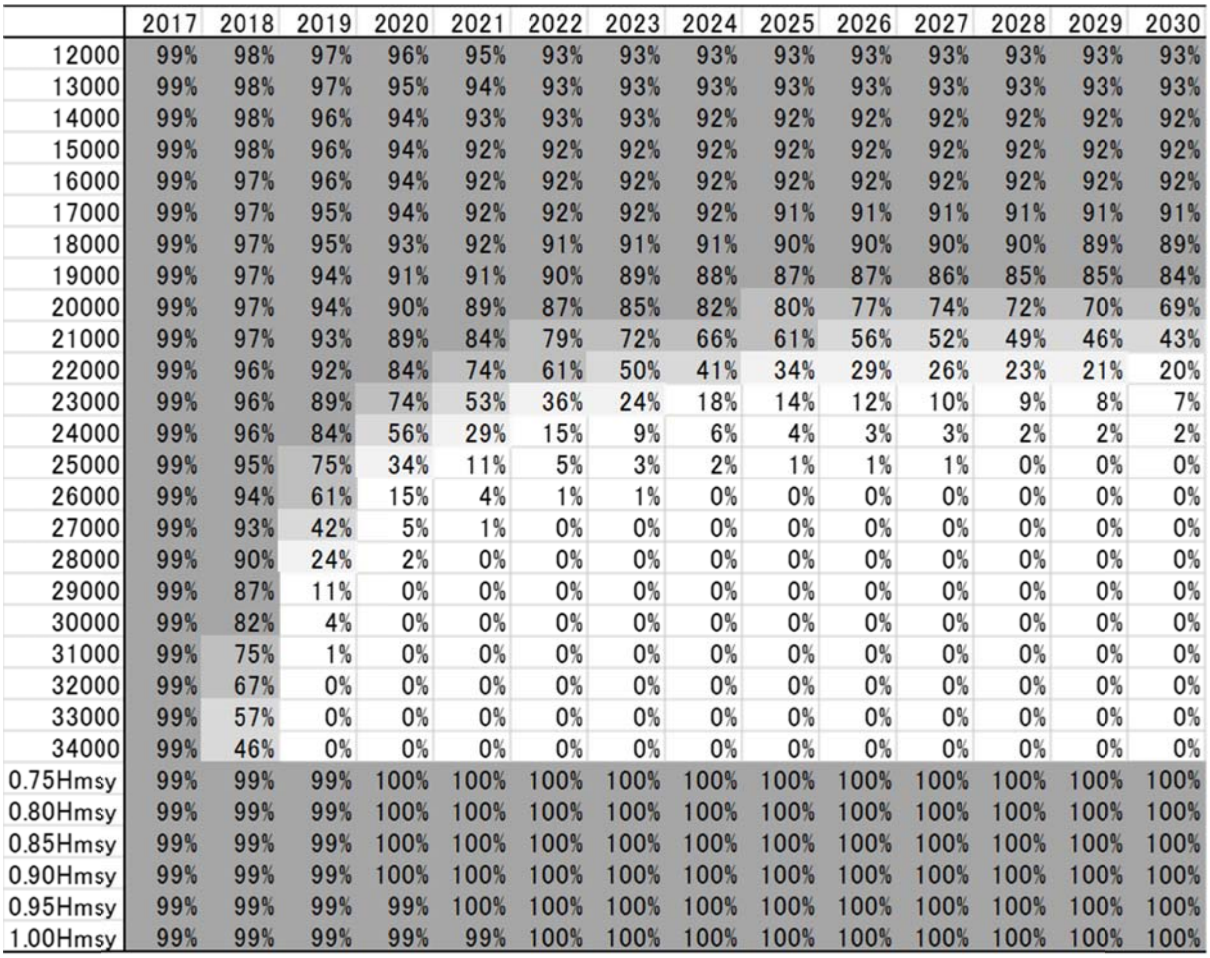
Run07 Probability of being green



	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
12000	0%	7%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
13000	0%	4%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
14000	0%	2%	98%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
15000	0%	1%	95%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
16000	0%	1%	89%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
17000	0%	1%	78%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
18000	0%	0%	63%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
19000	0%	0%	44%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
20000	0%	0%	27%	95%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
21000	0%	0%	13%	86%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
22000	0%	0%	5%	68%	98%	100%	100%	100%	100%	100%	100%	100%	100%	100%
23000	0%	0%	2%	44%	90%	99%	100%	100%	100%	100%	100%	100%	100%	100%
24000	0%	0%	1%	21%	71%	94%	99%	100%	100%	100%	100%	100%	100%	100%
25000	0%	0%	0%	7%	42%	78%	94%	98%	99%	100%	100%	100%	100%	100%
26000	0%	0%	0%	2%	17%	48%	74%	89%	95%	98%	99%	99%	100%	100%
27000	0%	0%	0%	0%	4%	18%	39%	60%	75%	84%	90%	93%	95%	97%
28000	0%	0%	0%	0%	1%	4%	12%	24%	37%	49%	59%	68%	73%	78%
29000	0%	0%	0%	0%	0%	0%	2%	5%	9%	14%	20%	26%	32%	37%
30000	0%	0%	0%	0%	0%	0%	0%	0%	1%	2%	3%	4%	6%	7%
31000	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
32000	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
33000	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
34000	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
0.75Hmsy	0%	1%	96%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
0.80Hmsy	0%	1%	88%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
0.85Hmsy	0%	0%	70%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
0.90Hmsy	0%	0%	41%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
0.95Hmsy	0%	0%	14%	90%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
1.00Hmsy	0%	0%	2%	41%	87%	98%	99%	94%	62%	26%	8%	4%	10%	34%

Table 23. (continued)

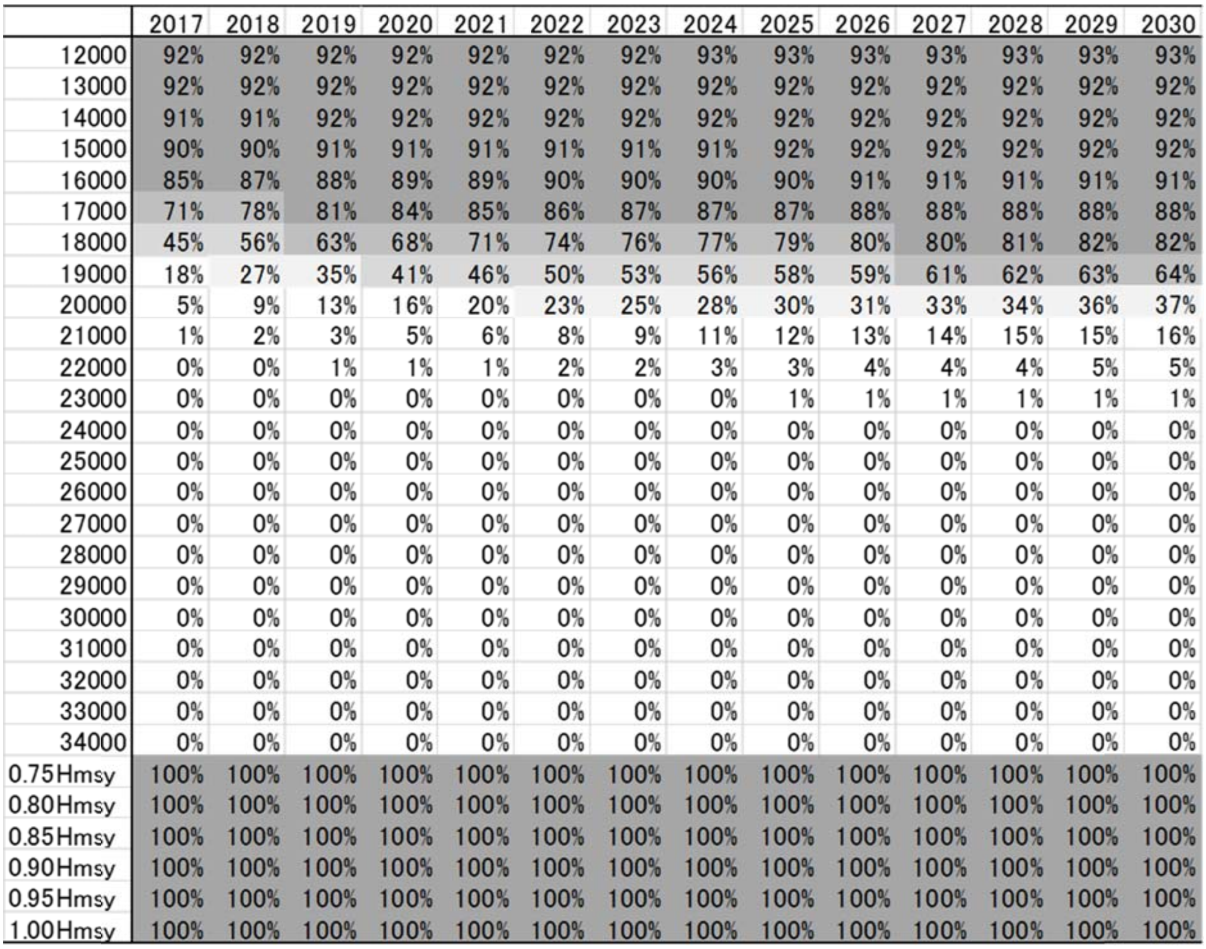
Run08 Probability B>B$_{MSY}$



	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
12000	99%	98%	97%	96%	95%	93%	93%	93%	93%	93%	93%	93%	93%	93%
13000	99%	98%	97%	95%	94%	93%	93%	93%	93%	93%	93%	93%	93%	93%
14000	99%	98%	96%	94%	93%	93%	93%	92%	92%	92%	92%	92%	92%	92%
15000	99%	98%	96%	94%	92%	92%	92%	92%	92%	92%	92%	92%	92%	92%
16000	99%	97%	96%	94%	92%	92%	92%	92%	92%	92%	92%	92%	92%	92%
17000	99%	97%	95%	94%	92%	92%	92%	92%	91%	91%	91%	91%	91%	91%
18000	99%	97%	95%	93%	92%	91%	91%	91%	90%	90%	90%	90%	89%	89%
19000	99%	97%	94%	91%	91%	90%	89%	88%	87%	87%	86%	85%	85%	84%
20000	99%	97%	94%	90%	89%	87%	85%	82%	80%	77%	74%	72%	70%	69%
21000	99%	97%	93%	89%	84%	79%	72%	66%	61%	56%	52%	49%	46%	43%
22000	99%	96%	92%	84%	74%	61%	50%	41%	34%	29%	26%	23%	21%	20%
23000	99%	96%	89%	74%	53%	36%	24%	18%	14%	12%	10%	9%	8%	7%
24000	99%	96%	84%	56%	29%	15%	9%	6%	4%	3%	3%	2%	2%	2%
25000	99%	95%	75%	34%	11%	5%	3%	2%	1%	1%	1%	0%	0%	0%
26000	99%	94%	61%	15%	4%	1%	1%	0%	0%	0%	0%	0%	0%	0%
27000	99%	93%	42%	5%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%
28000	99%	90%	24%	2%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
29000	99%	87%	11%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
30000	99%	82%	4%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
31000	99%	75%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
32000	99%	67%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
33000	99%	57%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
34000	99%	46%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
0.75Hmsy	99%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
0.80Hmsy	99%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
0.85Hmsy	99%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
0.90Hmsy	99%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
0.95Hmsy	99%	99%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
1.00Hmsy	99%	99%	99%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Table 23. (continued)

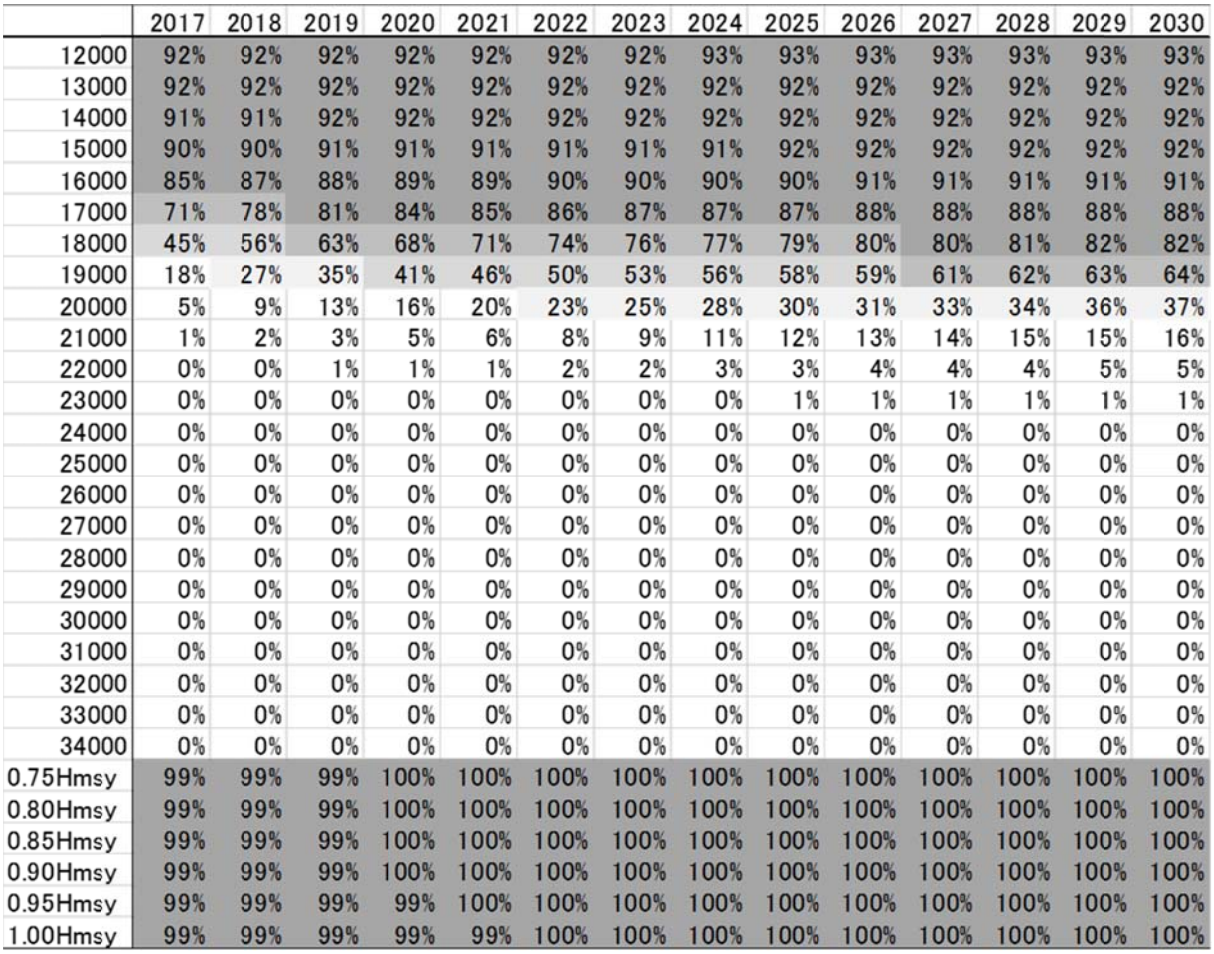
Run08 Probability $H<H_{MSY}$



	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
12000	92%	92%	92%	92%	92%	92%	92%	93%	93%	93%	93%	93%	93%	93%
13000	92%	92%	92%	92%	92%	92%	92%	92%	92%	92%	92%	92%	92%	92%
14000	91%	91%	92%	92%	92%	92%	92%	92%	92%	92%	92%	92%	92%	92%
15000	90%	90%	91%	91%	91%	91%	91%	91%	92%	92%	92%	92%	92%	92%
16000	85%	87%	88%	89%	89%	90%	90%	90%	90%	91%	91%	91%	91%	91%
17000	71%	78%	81%	84%	85%	86%	87%	87%	87%	88%	88%	88%	88%	88%
18000	45%	56%	63%	68%	71%	74%	76%	77%	79%	80%	80%	81%	82%	82%
19000	18%	27%	35%	41%	46%	50%	53%	56%	58%	59%	61%	62%	63%	64%
20000	5%	9%	13%	16%	20%	23%	25%	28%	30%	31%	33%	34%	36%	37%
21000	1%	2%	3%	5%	6%	8%	9%	11%	12%	13%	14%	15%	15%	16%
22000	0%	0%	1%	1%	1%	2%	2%	3%	3%	4%	4%	4%	5%	5%
23000	0%	0%	0%	0%	0%	0%	0%	0%	1%	1%	1%	1%	1%	1%
24000	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
25000	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
26000	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
27000	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
28000	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
29000	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
30000	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
31000	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
32000	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
33000	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
34000	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
0.75Hmsy	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
0.80Hmsy	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
0.85Hmsy	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
0.90Hmsy	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
0.95Hmsy	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
1.00Hmsy	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Table 23. (continued)

Run08 Probability of being green



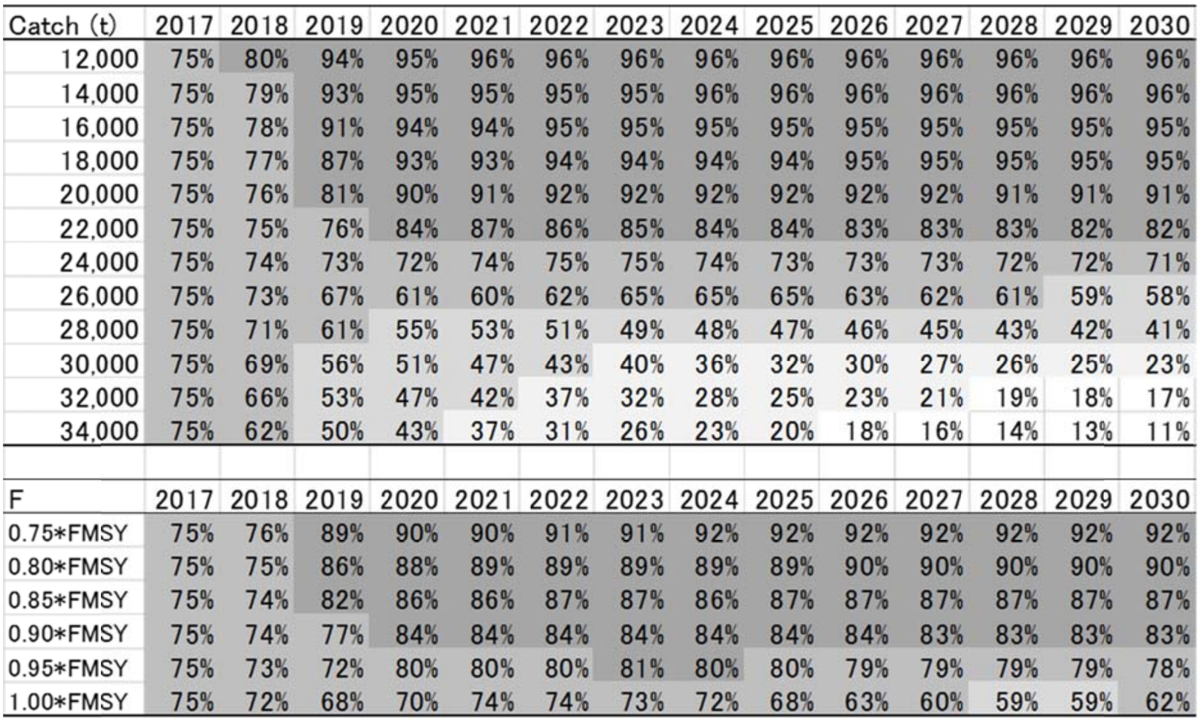
	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
12000	92%	92%	92%	92%	92%	92%	92%	93%	93%	93%	93%	93%	93%	93%
13000	92%	92%	92%	92%	92%	92%	92%	92%	92%	92%	92%	92%	92%	92%
14000	91%	91%	92%	92%	92%	92%	92%	92%	92%	92%	92%	92%	92%	92%
15000	90%	90%	91%	91%	91%	91%	91%	91%	92%	92%	92%	92%	92%	92%
16000	85%	87%	88%	89%	89%	90%	90%	90%	90%	91%	91%	91%	91%	91%
17000	71%	78%	81%	84%	85%	86%	87%	87%	87%	88%	88%	88%	88%	88%
18000	45%	56%	63%	68%	71%	74%	76%	77%	79%	80%	80%	81%	82%	82%
19000	18%	27%	35%	41%	46%	50%	53%	56%	58%	59%	61%	62%	63%	64%
20000	5%	9%	13%	16%	20%	23%	25%	28%	30%	31%	33%	34%	36%	37%
21000	1%	2%	3%	5%	6%	8%	9%	11%	12%	13%	14%	15%	15%	16%
22000	0%	0%	1%	1%	1%	2%	2%	3%	3%	4%	4%	4%	5%	5%
23000	0%	0%	0%	0%	0%	0%	0%	0%	1%	1%	1%	1%	1%	1%
24000	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
25000	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
26000	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
27000	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
28000	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
29000	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
30000	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
31000	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
32000	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
33000	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
34000	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
0.75Hmsy	99%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
0.80Hmsy	99%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
0.85Hmsy	99%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
0.90Hmsy	99%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
0.95Hmsy	99%	99%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
1.00Hmsy	99%	99%	99%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Table 24. Maximum catch which enables Kobe green zone in 2020 with a probability higher than or equal to 60%, for each ASPIC and BSP run.

Model	Run	Catch
ASPIC	Run2	26,000
	Run6	24,000
	Run7	26,000
	Run8	26,000
BSPM	EQ SH	30,000
	EQ FOX	34,000
	CW SH	22,000
	CW FOX	18,000
Average		25,750
Median		26,000

Table 25. Kobe II matrices for the 8 ASPIC and BSP scenarios combined in the South Atlantic.

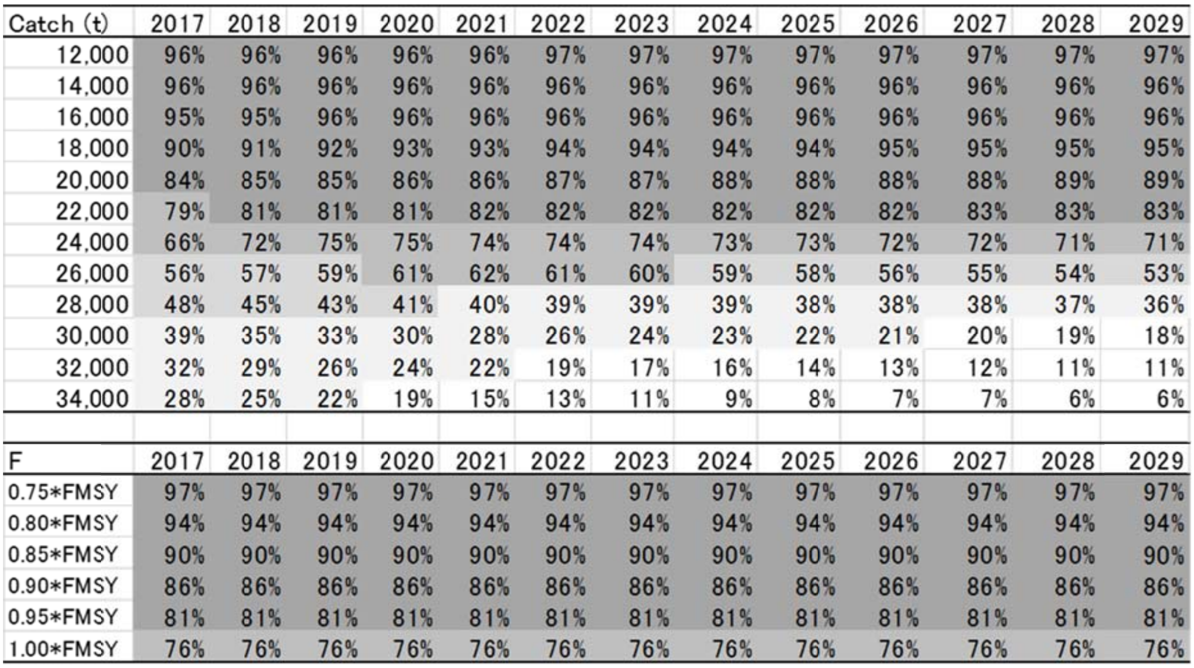
Probability B>B_{MSY}



Catch (t)	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
12,000	75%	80%	94%	95%	96%	96%	96%	96%	96%	96%	96%	96%	96%	96%
14,000	75%	79%	93%	95%	95%	95%	95%	96%	96%	96%	96%	96%	96%	96%
16,000	75%	78%	91%	94%	94%	95%	95%	95%	95%	95%	95%	95%	95%	95%
18,000	75%	77%	87%	93%	93%	94%	94%	94%	94%	95%	95%	95%	95%	95%
20,000	75%	76%	81%	90%	91%	92%	92%	92%	92%	92%	92%	91%	91%	91%
22,000	75%	75%	76%	84%	87%	86%	85%	84%	84%	83%	83%	83%	82%	82%
24,000	75%	74%	73%	72%	74%	75%	75%	74%	73%	73%	73%	72%	72%	71%
26,000	75%	73%	67%	61%	60%	62%	65%	65%	65%	63%	62%	61%	59%	58%
28,000	75%	71%	61%	55%	53%	51%	49%	48%	47%	46%	45%	43%	42%	41%
30,000	75%	69%	56%	51%	47%	43%	40%	36%	32%	30%	27%	26%	25%	23%
32,000	75%	66%	53%	47%	42%	37%	32%	28%	25%	23%	21%	19%	18%	17%
34,000	75%	62%	50%	43%	37%	31%	26%	23%	20%	18%	16%	14%	13%	11%

F	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
0.75*FMSY	75%	76%	89%	90%	90%	91%	91%	92%	92%	92%	92%	92%	92%	92%
0.80*FMSY	75%	75%	86%	88%	89%	89%	89%	89%	89%	90%	90%	90%	90%	90%
0.85*FMSY	75%	74%	82%	86%	86%	87%	87%	86%	87%	87%	87%	87%	87%	87%
0.90*FMSY	75%	74%	77%	84%	84%	84%	84%	84%	84%	84%	83%	83%	83%	83%
0.95*FMSY	75%	73%	72%	80%	80%	80%	81%	80%	80%	79%	79%	79%	79%	78%
1.00*FMSY	75%	72%	68%	70%	74%	74%	73%	72%	68%	63%	60%	59%	59%	62%

Probability F<F_{MSY}/H<H_{MSY}

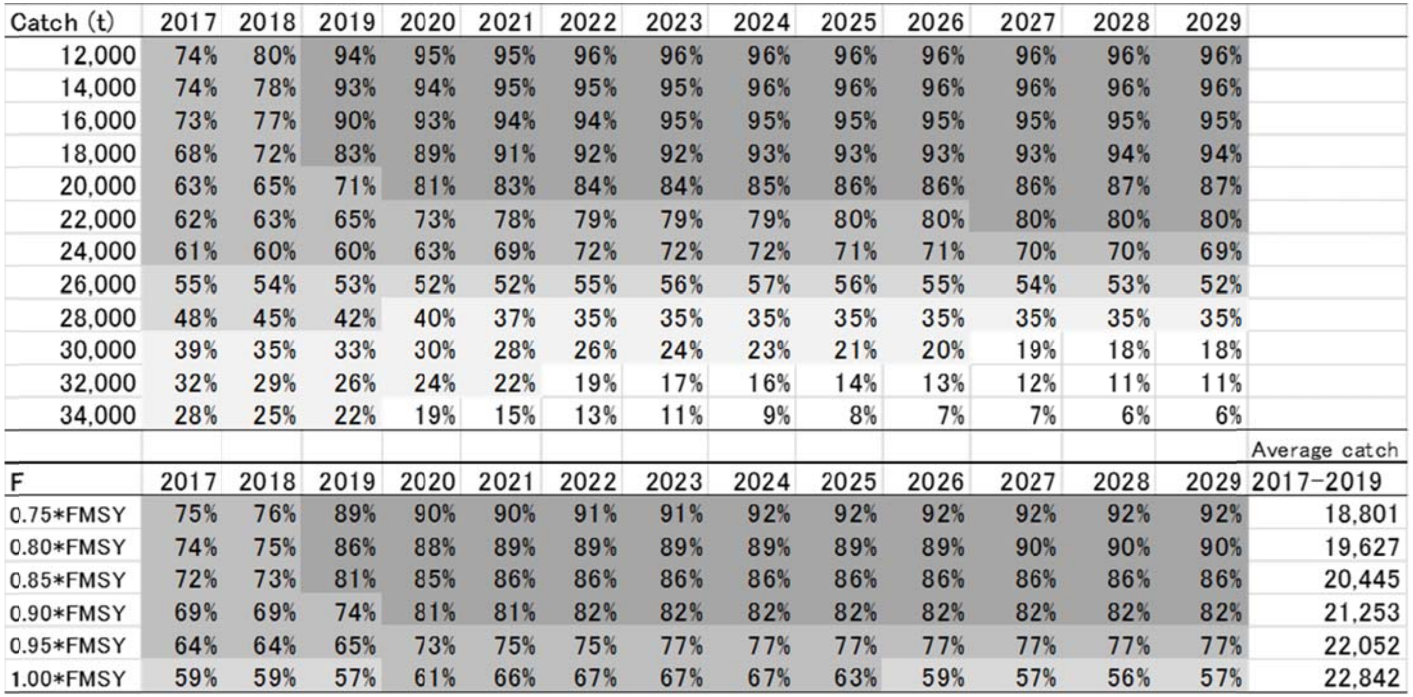


Catch (t)	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
12,000	96%	96%	96%	96%	96%	97%	97%	97%	97%	97%	97%	97%	97%
14,000	96%	96%	96%	96%	96%	96%	96%	96%	96%	96%	96%	96%	96%
16,000	95%	95%	96%	96%	96%	96%	96%	96%	96%	96%	96%	96%	96%
18,000	90%	91%	92%	93%	93%	94%	94%	94%	94%	95%	95%	95%	95%
20,000	84%	85%	85%	86%	86%	87%	87%	88%	88%	88%	88%	89%	89%
22,000	79%	81%	81%	81%	82%	82%	82%	82%	82%	82%	83%	83%	83%
24,000	66%	72%	75%	75%	74%	74%	74%	73%	73%	72%	72%	71%	71%
26,000	56%	57%	59%	61%	62%	61%	60%	59%	58%	56%	55%	54%	53%
28,000	48%	45%	43%	41%	40%	39%	39%	39%	38%	38%	38%	37%	36%
30,000	39%	35%	33%	30%	28%	26%	24%	23%	22%	21%	20%	19%	18%
32,000	32%	29%	26%	24%	22%	19%	17%	16%	14%	13%	12%	11%	11%
34,000	28%	25%	22%	19%	15%	13%	11%	9%	8%	7%	7%	6%	6%

F	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
0.75*FMSY	97%	97%	97%	97%	97%	97%	97%	97%	97%	97%	97%	97%	97%
0.80*FMSY	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%
0.85*FMSY	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%
0.90*FMSY	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%	86%
0.95*FMSY	81%	81%	81%	81%	81%	81%	81%	81%	81%	81%	81%	81%	81%
1.00*FMSY	76%	76%	76%	76%	76%	76%	76%	76%	76%	76%	76%	76%	76%

Table 25. (continued)

Probability of being green



Catch (t)	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	
12,000	74%	80%	94%	95%	95%	96%	96%	96%	96%	96%	96%	96%	96%	
14,000	74%	78%	93%	94%	95%	95%	95%	96%	96%	96%	96%	96%	96%	
16,000	73%	77%	90%	93%	94%	94%	95%	95%	95%	95%	95%	95%	95%	
18,000	68%	72%	83%	89%	91%	92%	92%	93%	93%	93%	93%	94%	94%	
20,000	63%	65%	71%	81%	83%	84%	84%	85%	86%	86%	86%	87%	87%	
22,000	62%	63%	65%	73%	78%	79%	79%	79%	80%	80%	80%	80%	80%	
24,000	61%	60%	60%	63%	69%	72%	72%	72%	71%	71%	70%	70%	69%	
26,000	55%	54%	53%	52%	52%	55%	56%	57%	56%	55%	54%	53%	52%	
28,000	48%	45%	42%	40%	37%	35%	35%	35%	35%	35%	35%	35%	35%	
30,000	39%	35%	33%	30%	28%	26%	24%	23%	21%	20%	19%	18%	18%	
32,000	32%	29%	26%	24%	22%	19%	17%	16%	14%	13%	12%	11%	11%	
34,000	28%	25%	22%	19%	15%	13%	11%	9%	8%	7%	7%	6%	6%	

F	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	Average catch 2017-2019
0.75*FMSY	75%	76%	89%	90%	90%	91%	91%	92%	92%	92%	92%	92%	92%	18,801
0.80*FMSY	74%	75%	86%	88%	89%	89%	89%	89%	89%	89%	90%	90%	90%	19,627
0.85*FMSY	72%	73%	81%	85%	86%	86%	86%	86%	86%	86%	86%	86%	86%	20,445
0.90*FMSY	69%	69%	74%	81%	81%	82%	82%	82%	82%	82%	82%	82%	82%	21,253
0.95*FMSY	64%	64%	65%	73%	75%	75%	77%	77%	77%	77%	77%	77%	77%	22,052
1.00*FMSY	59%	59%	57%	61%	66%	67%	67%	67%	63%	59%	57%	56%	57%	22,842

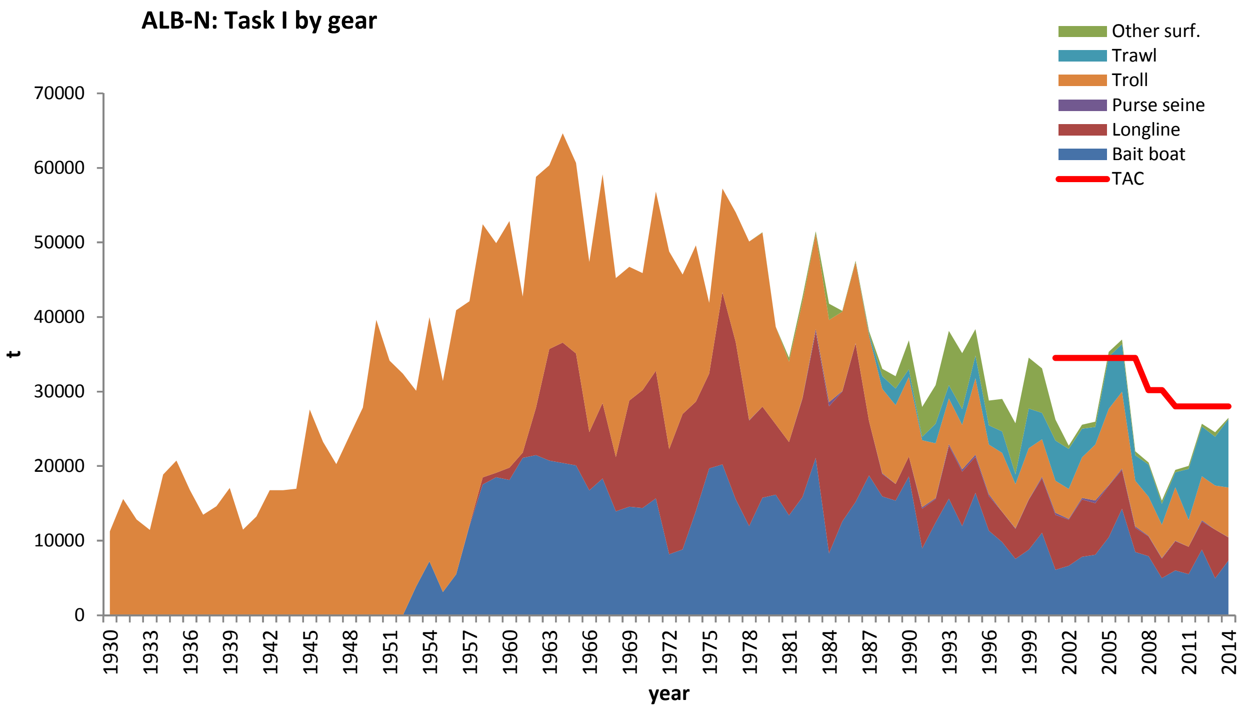


Figure 1. ALB-N accumulated catches by major gear for the entire period (1950-2014).

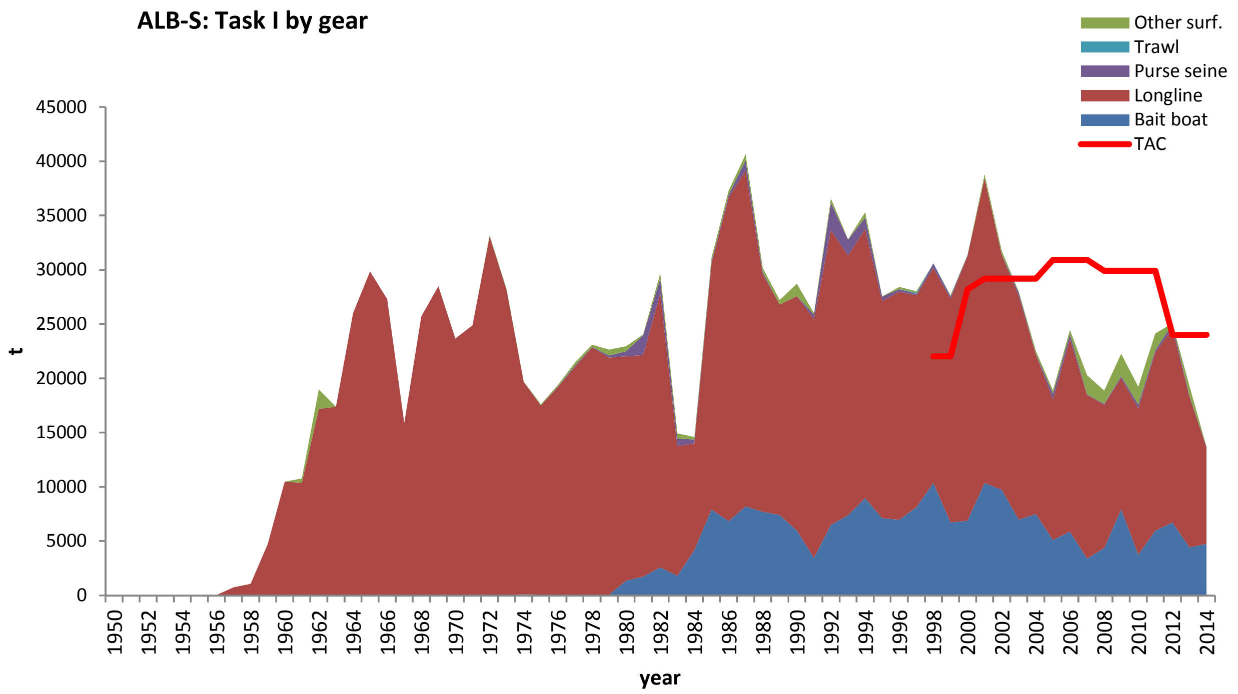
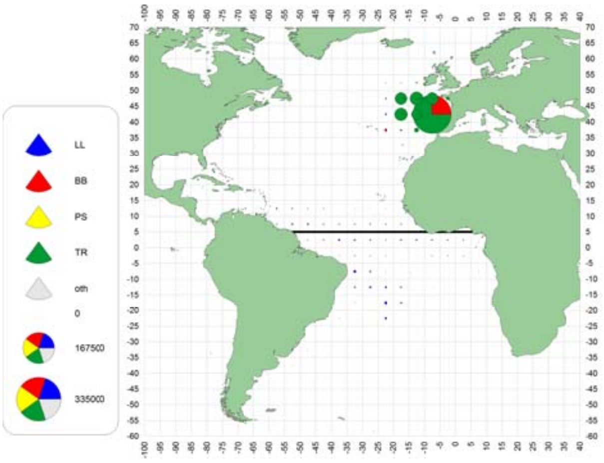
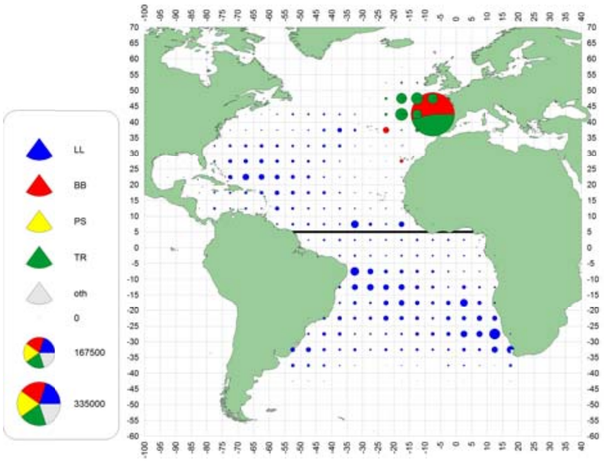


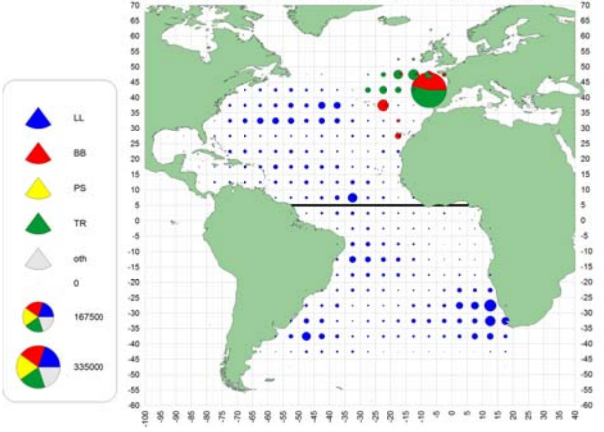
Figure 2. ALB-S accumulated catches by major gear for the entire period (1950-2014).



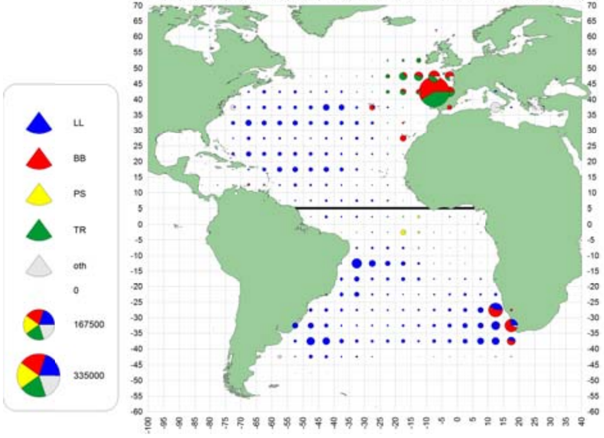
a. ALB(1950-59)



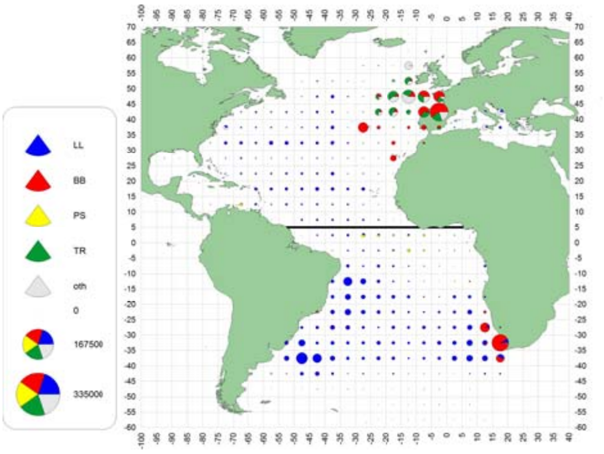
b. ALB(1960-69)



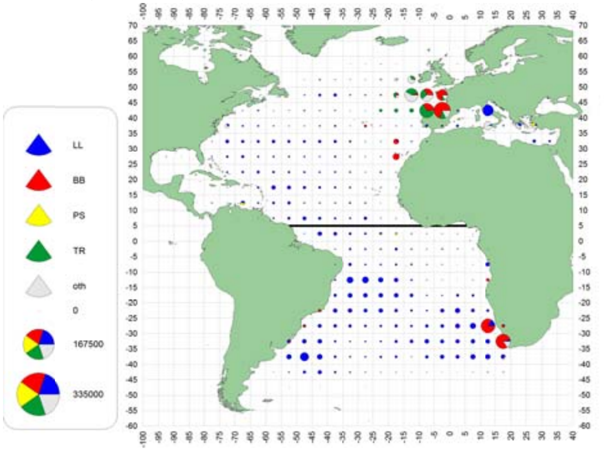
c. ALB(1970-79)



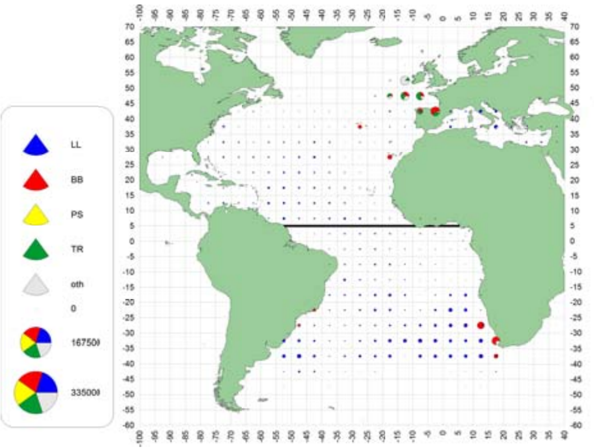
d. ALB(1980-89)



e. ALB(1990-99)



f. ALB(2000-09)



g. ALB(2010-13)

Figure 3. Geographical distribution of cumulative albacore catches by main gears and decade (Source: CATDIS). For relative comparisons, map “f (2010-13)” was differently scaled (1/3 of 10 years scale) because it only contains three years in the decade.

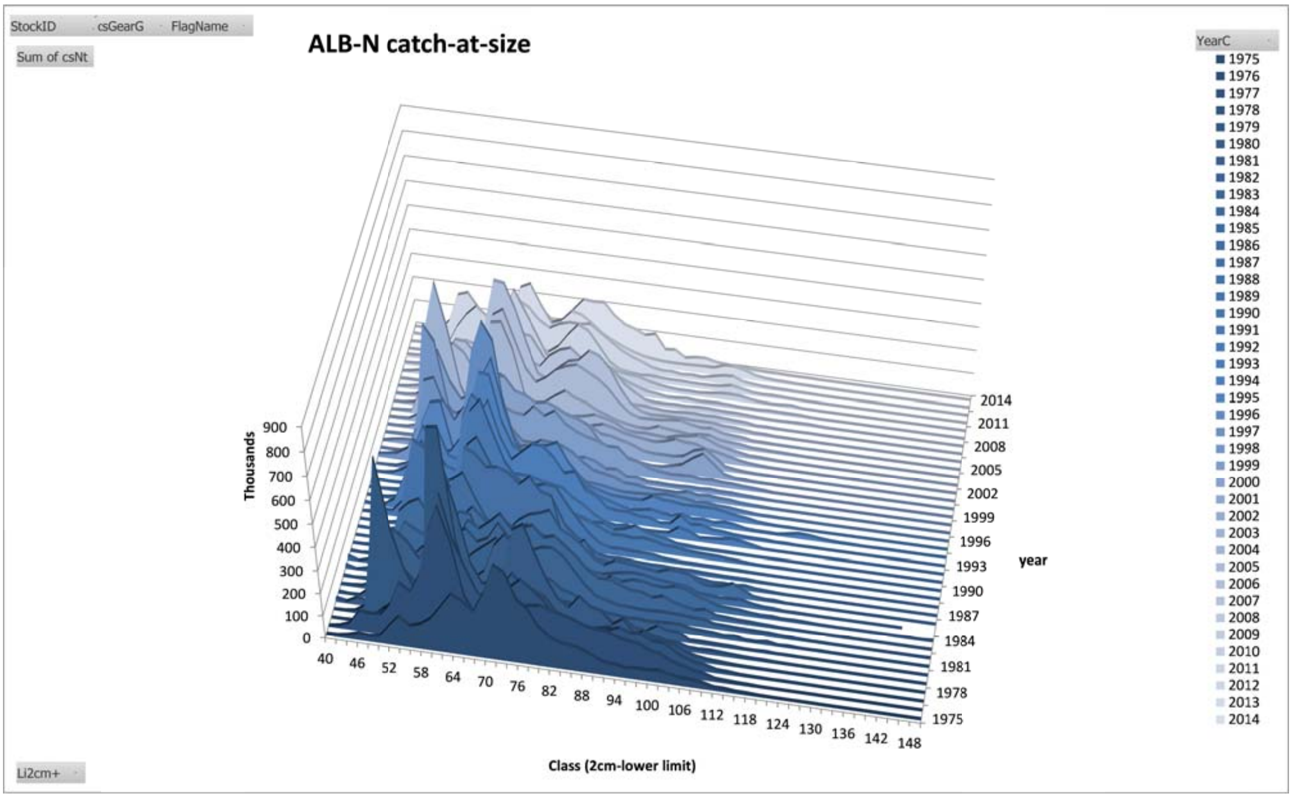


Figure 4. Histograms of northern albacore catch-at-size by year (1975-2014).

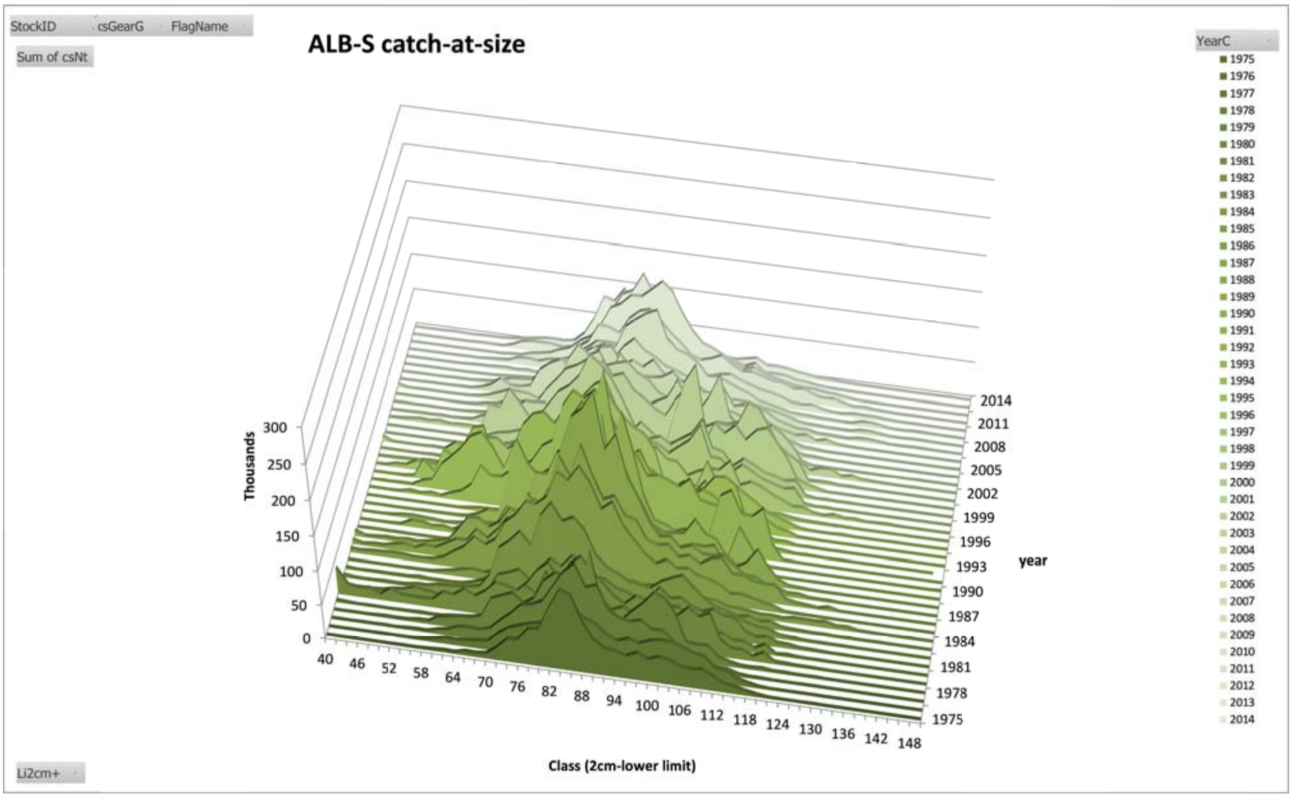


Figure 5. Histograms of southern albacore catch at size by year (1975-2014).

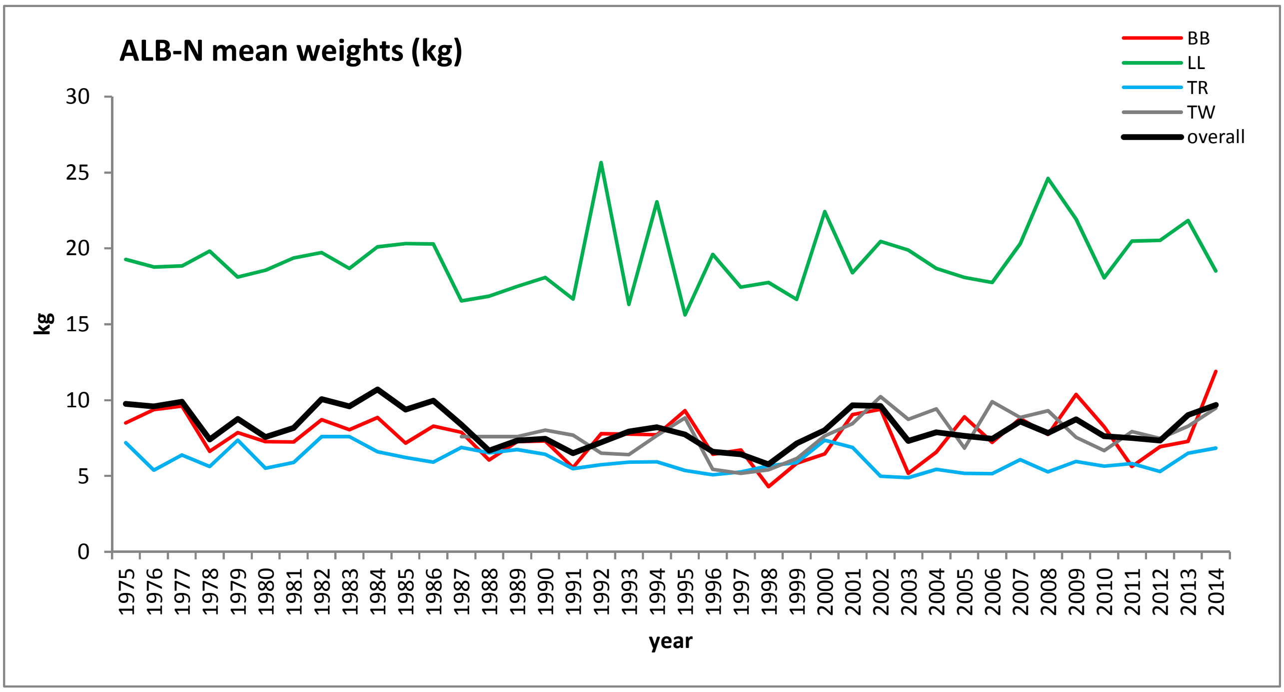


Figure 6. Means weights (kg) of northern albacore (overall stock, and by major gear) obtained from the CAS estimations.

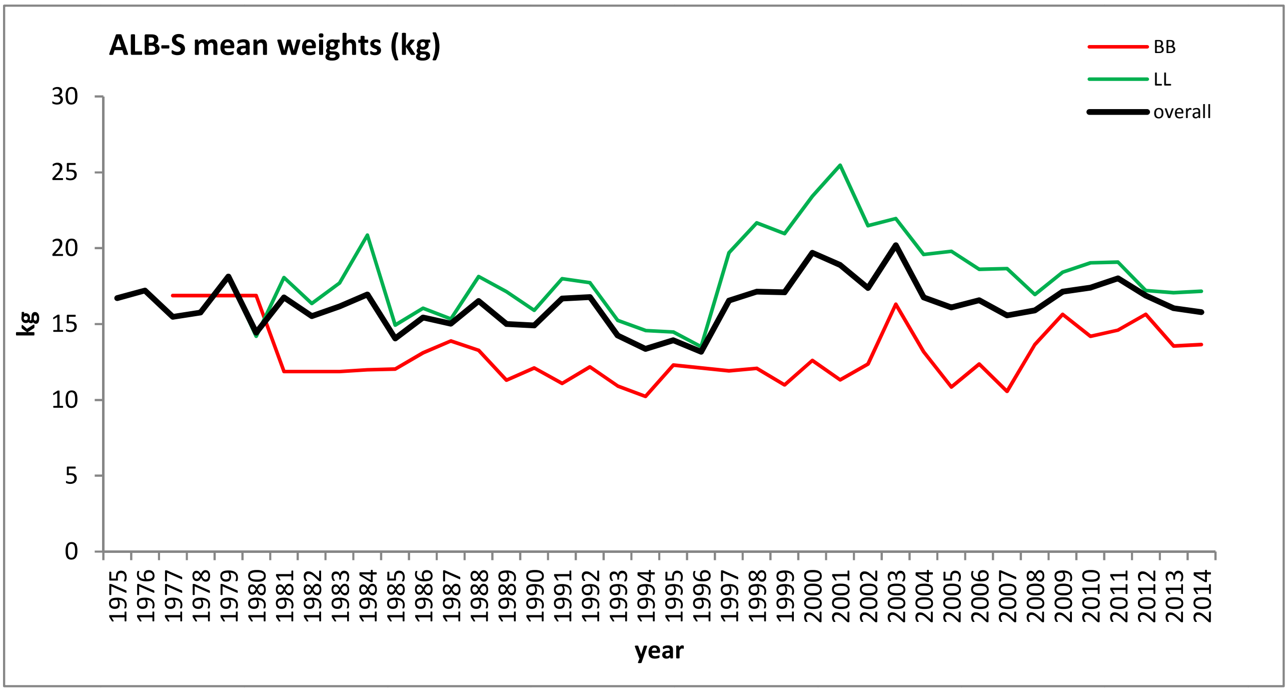


Figure 7. Means weights (kg) of southern albacore (overall stock, and by major gear) obtained from the CAS estimations.

Figure 8. Available North Atlantic CPUE series.

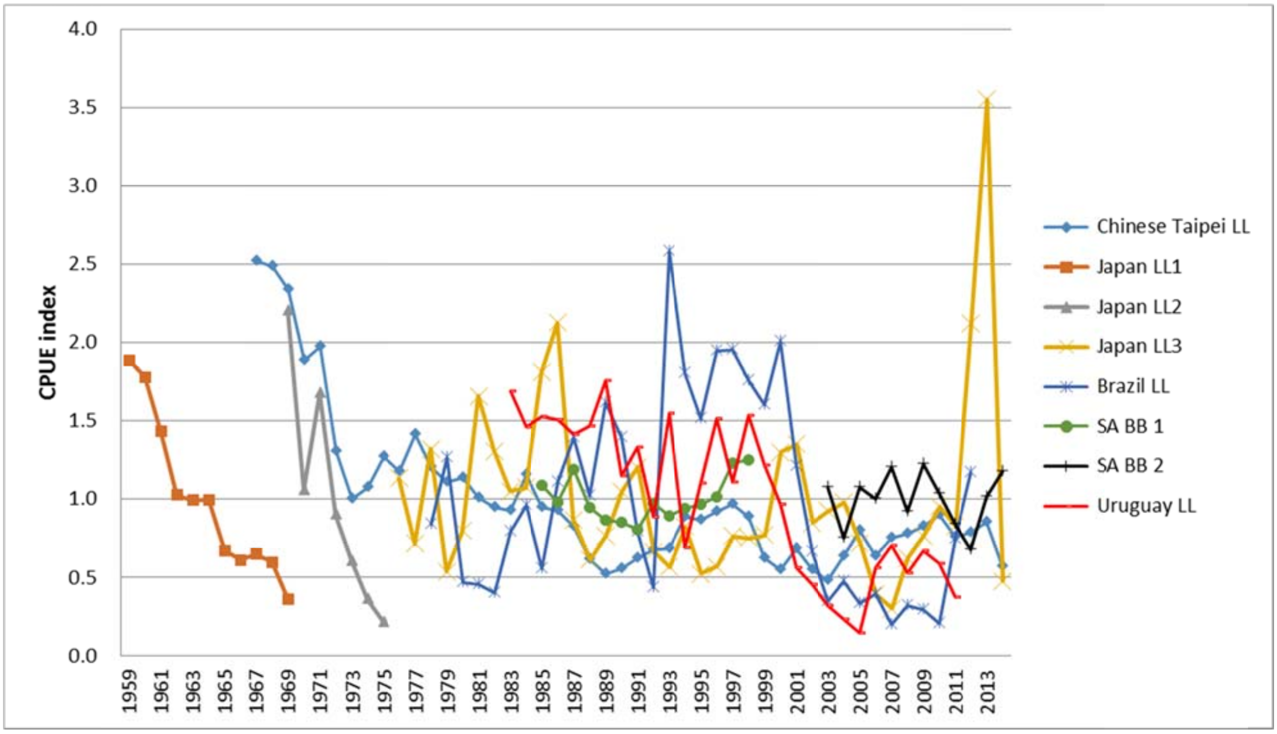


Figure 9. Available South Atlantic CPUE series.

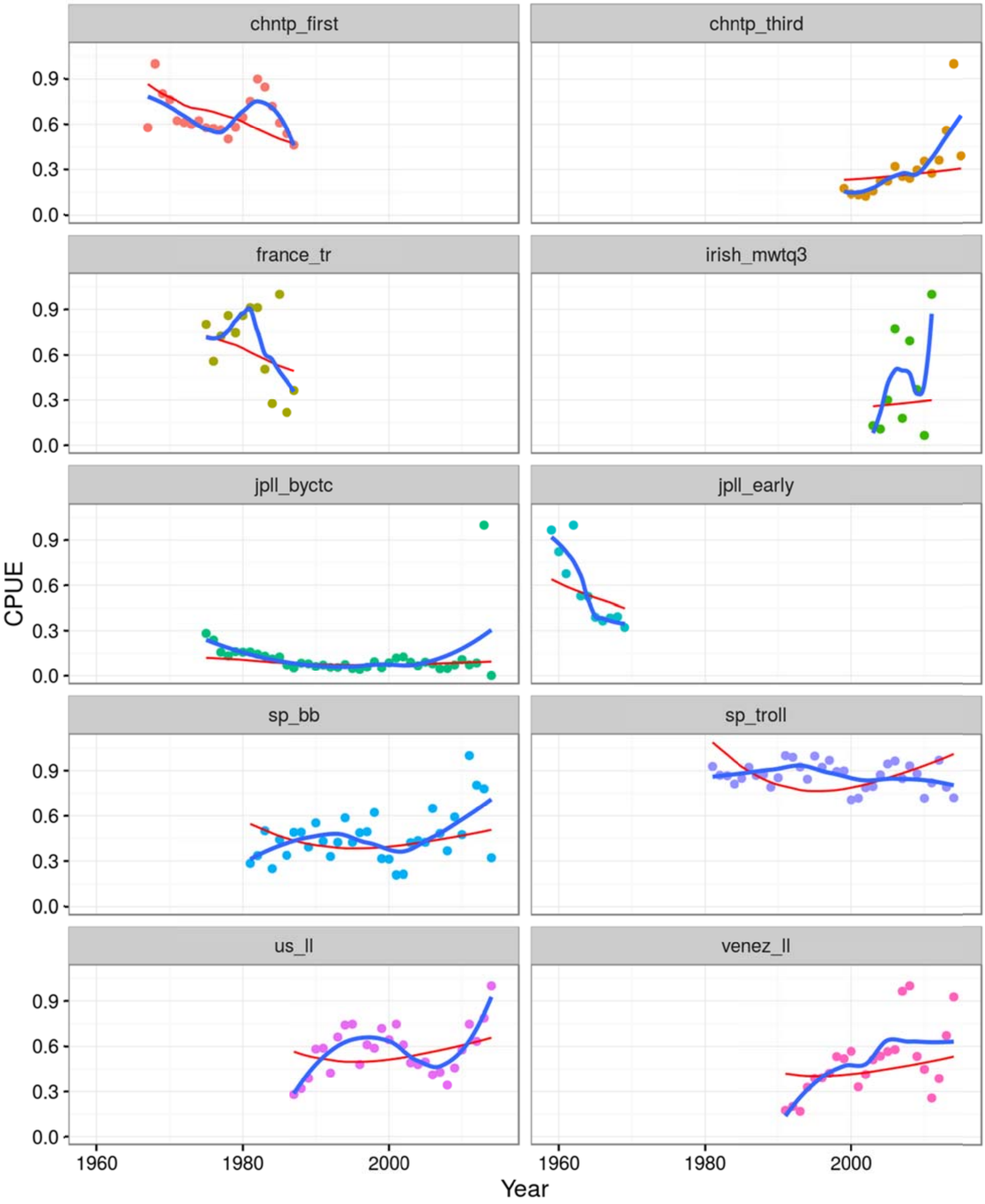


Figure 10a. North Atlantic CPUE series used as potential proxies for stock abundance. Points are the standardized values; lines, the prediction from a GAM fitted either to all the indices with 'year' as a smooth term and 'index' as a factor (red), and by index individually (blue).

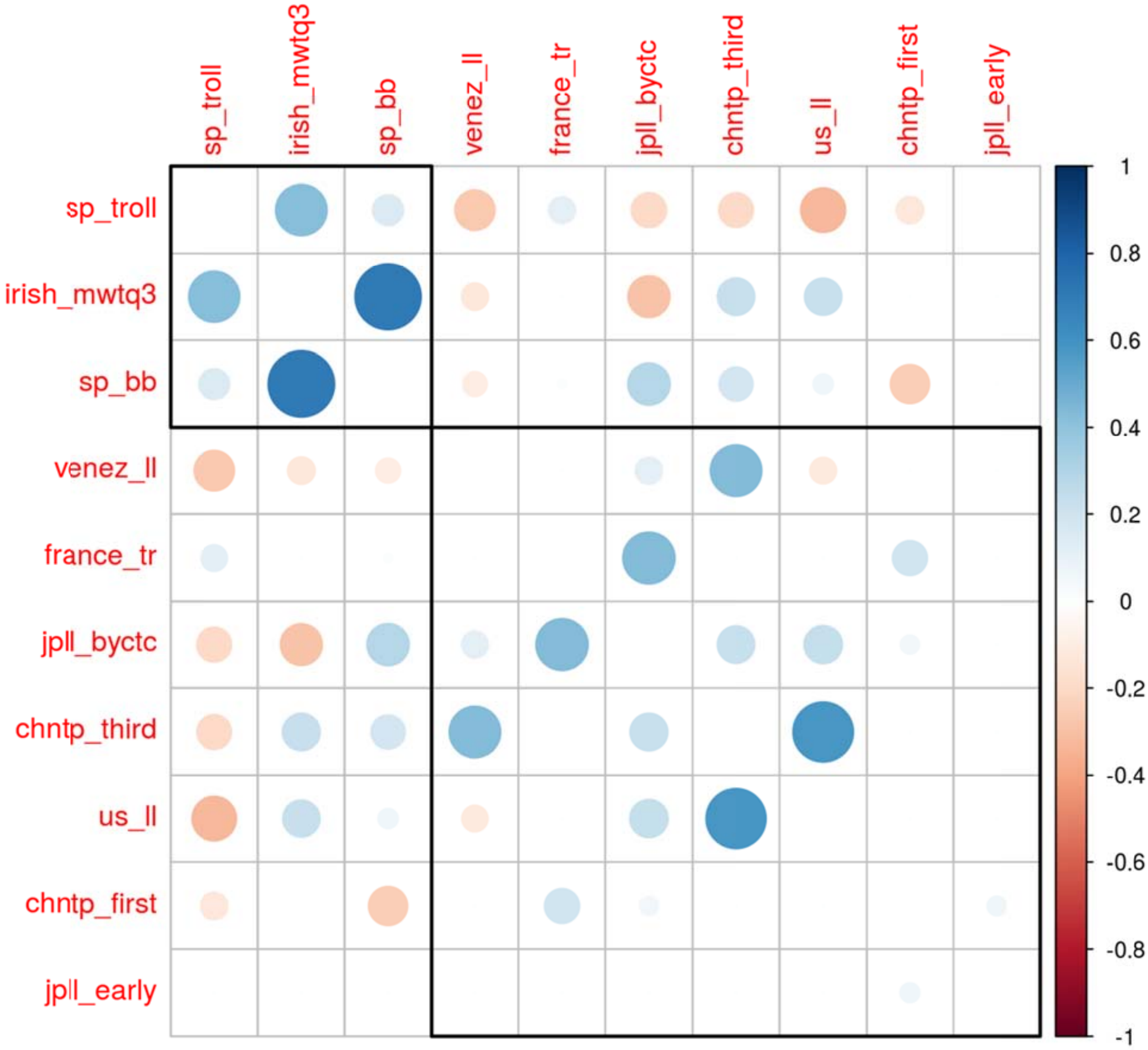


Figure 10b. North Atlantic correlation matrix for the 2016 index. Blue indicates positive correlations and red, negative correlations. The order of the index and the rectangular boxes are chosen based on a hierarchical cluster analysis using a set of dissimilarities.

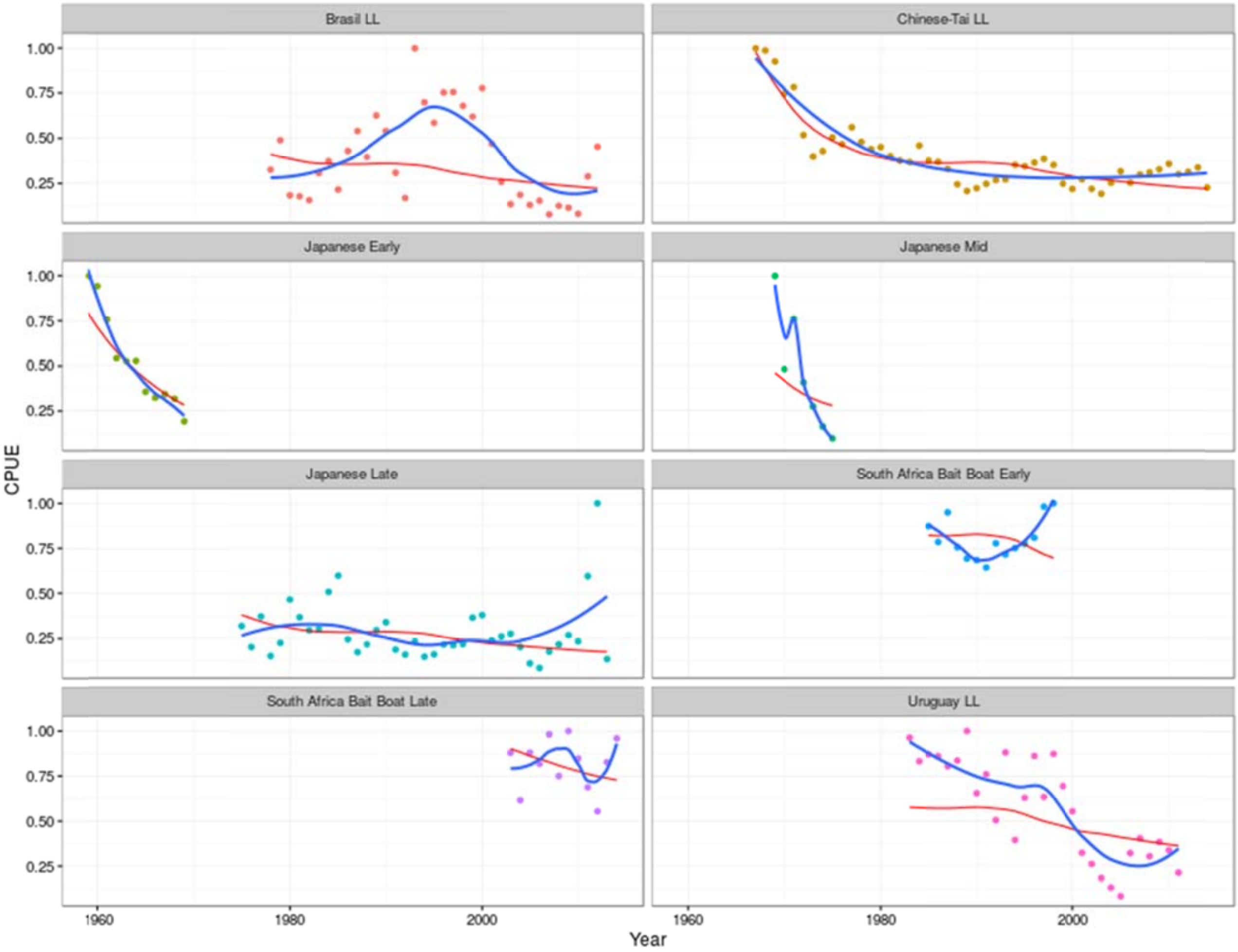


Figure 11a. South Atlantic CPUE series used as potential proxies for stock abundance. Points are the standardized values; lines, the prediction from a GAM fitted either to all the indices with 'year' as a smooth term and 'index' as a factor (red), and by index individually (blue).

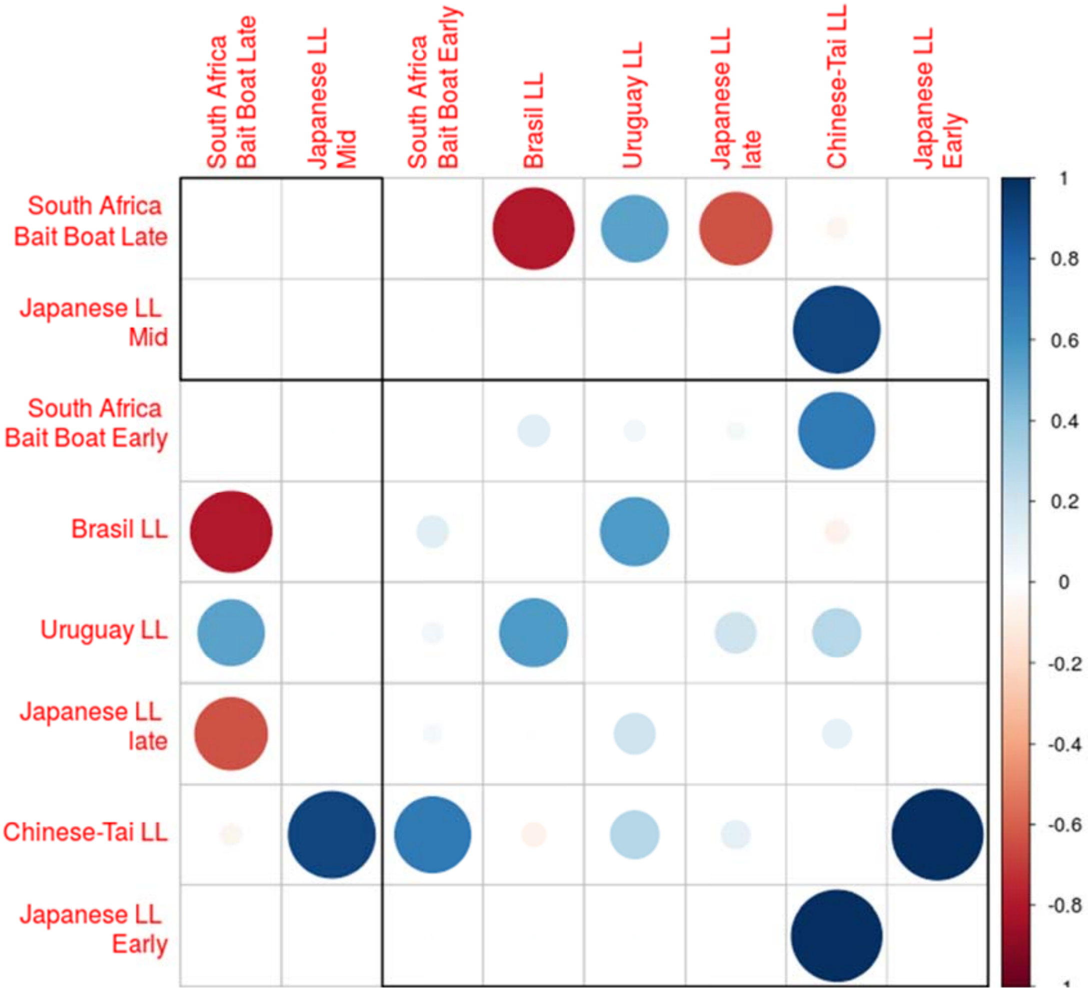


Figure 11b. South Atlantic correlation matrix for the 2016 indices. Blue indicates positive correlations and red, negative correlations. The order of the index and the rectangular boxes are chosen based on a hierarchical cluster analysis using a set of dissimilarities.

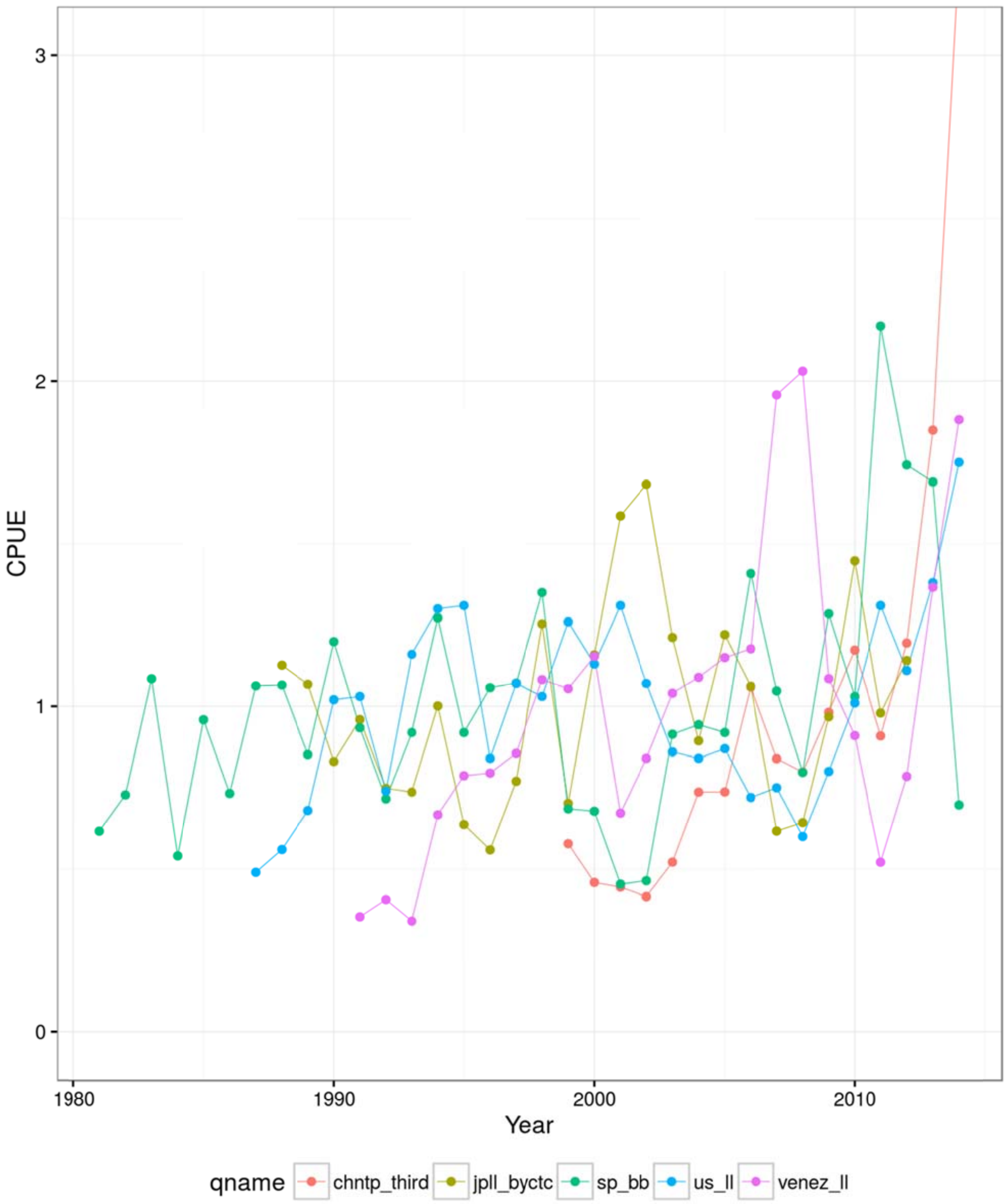


Figure 12a. North Atlantic CPUE series used in the 2016 assessment as potential proxies for stock abundance.

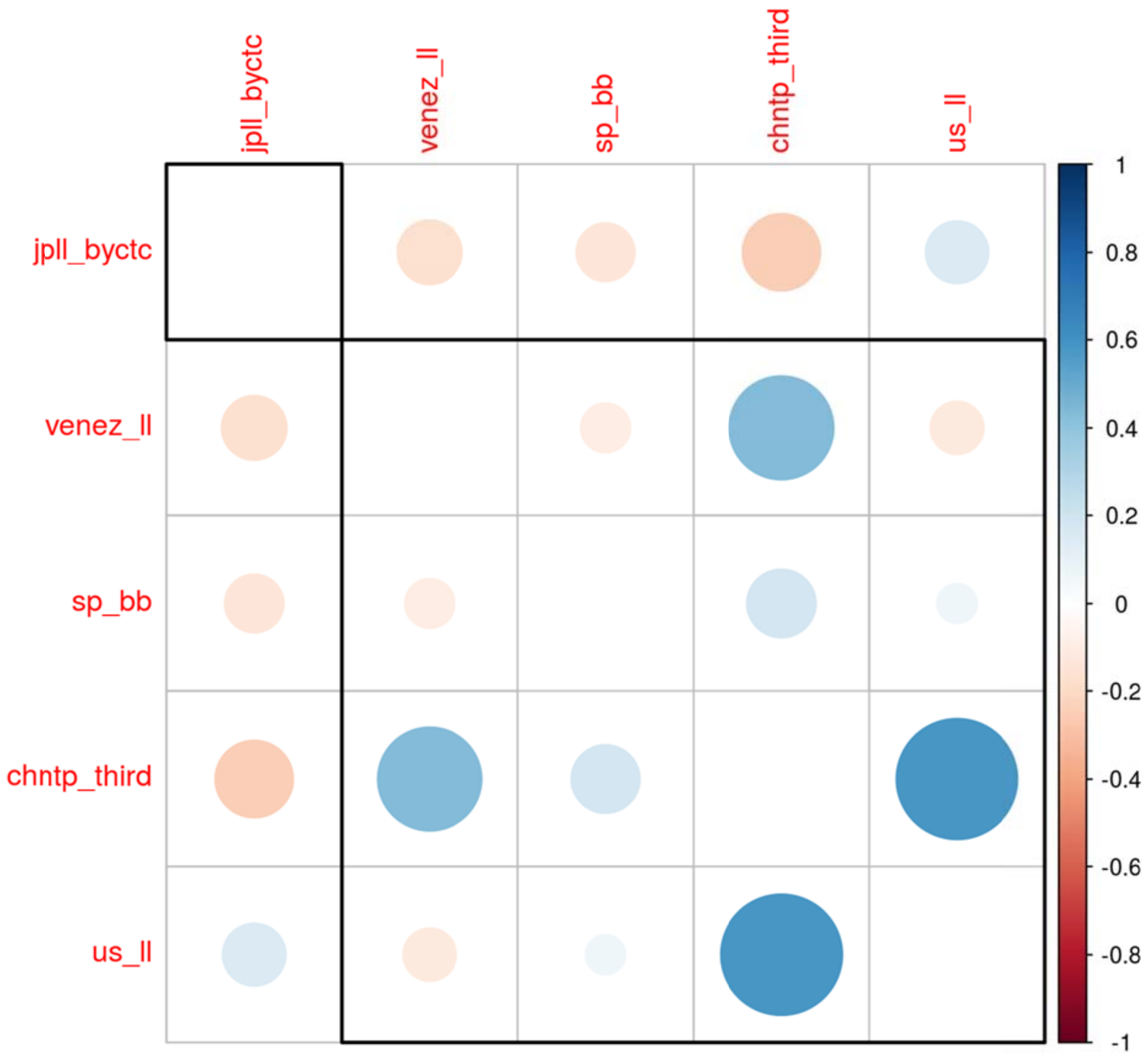


Figure 12b. North Atlantic correlation matrix for the 2016 indices used in the assessment. Blue indicates positive correlations and red, negative correlations. The order of the index and the rectangular boxes are chosen based on a hierarchical cluster analysis using a set of dissimilarities.

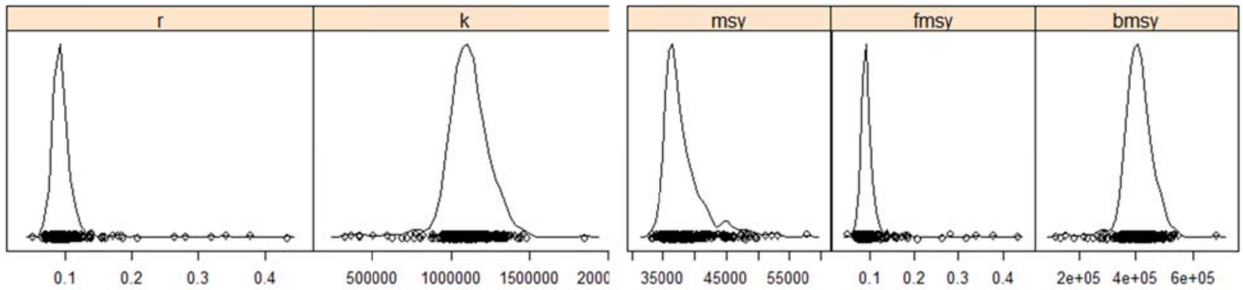


Figure 13. Density distributions of bootstrapped parameters and reference points estimated for the Base Case scenario of the North Atlantic albacore stock assessment with the *Biodyn* model.

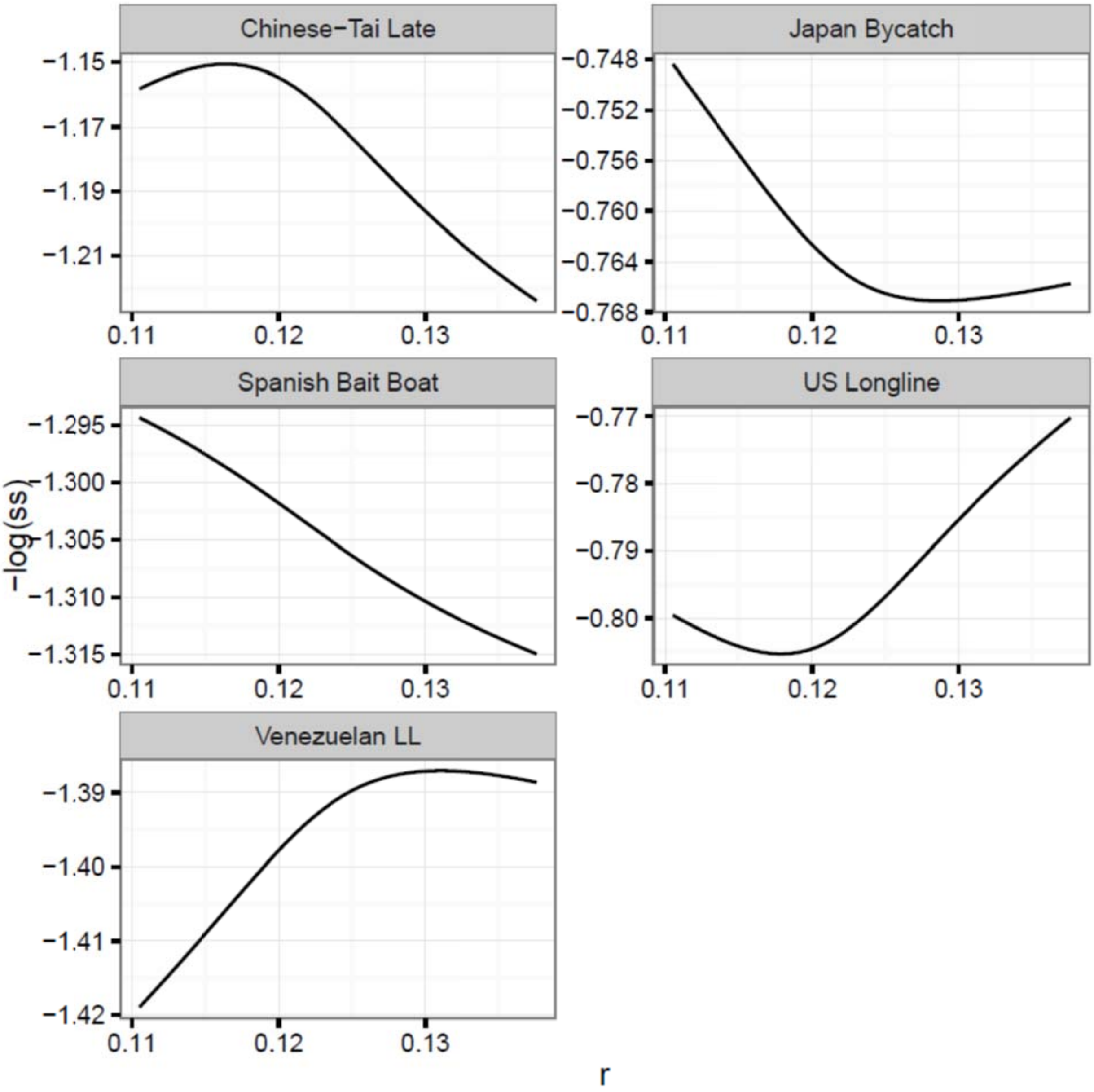


Figure 14. Partial likelihood profiles for the 5 CPUE indices considered in the biomass dynamic model for the Northern Atlantic albacore stock.

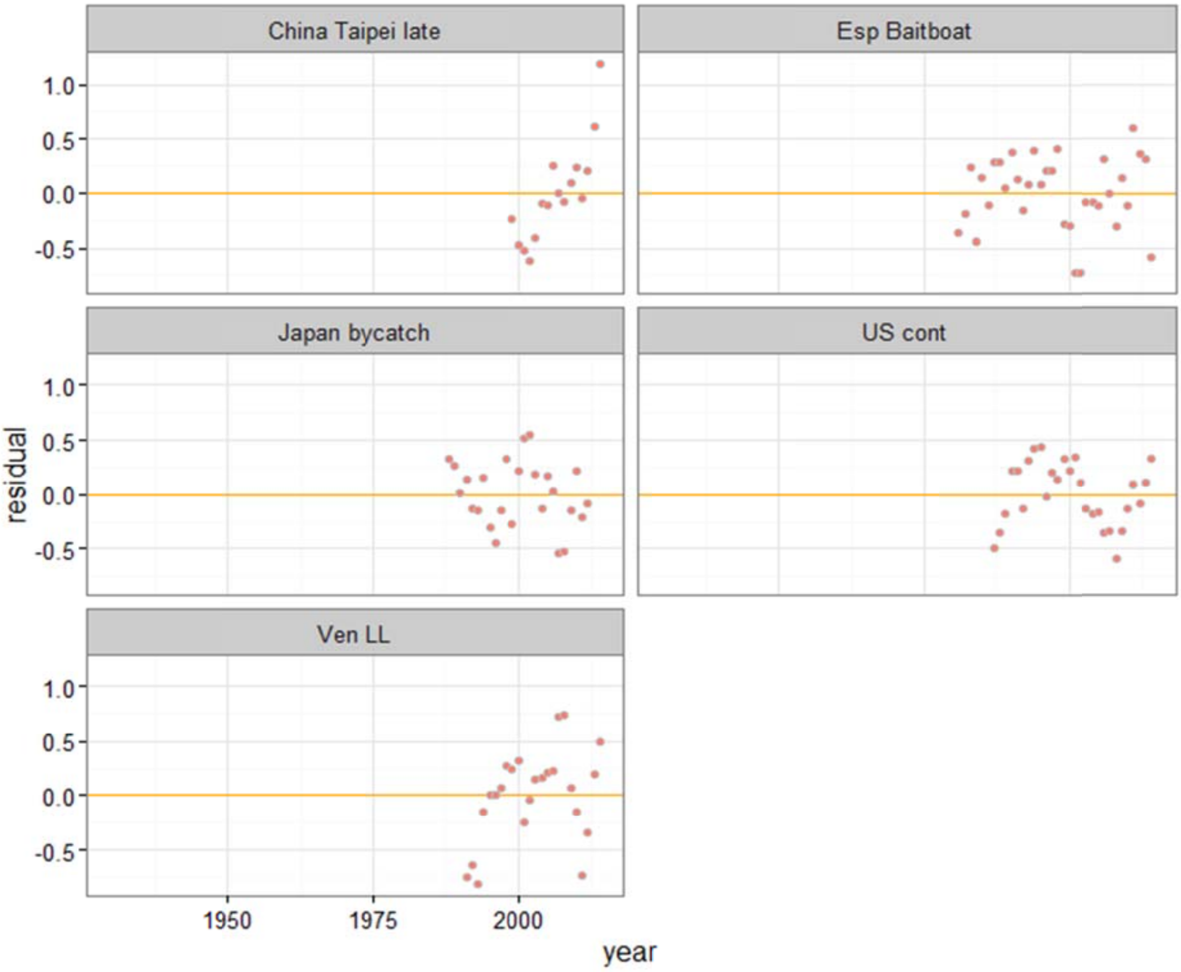


Figure 15. Estimated residuals for the Base Case stock assessment fit to the available CPUE series.

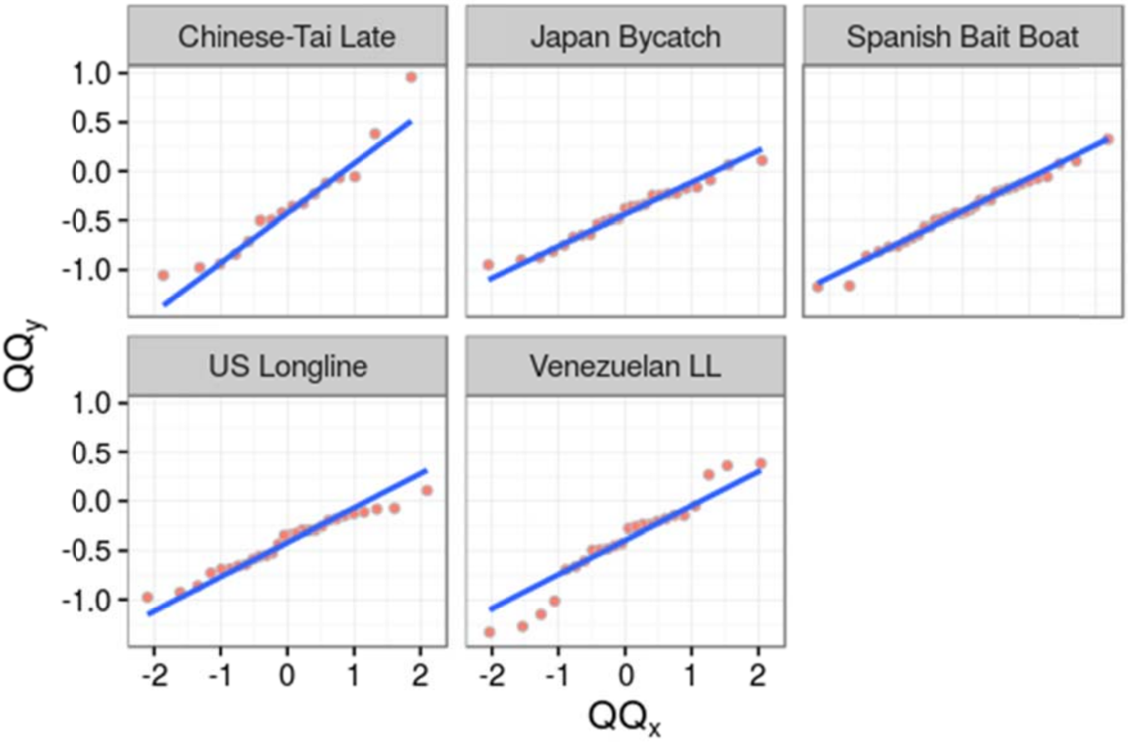


Figure 16. Quantile-quantile plots to compare CPUE residual distributions with the normal distribution.

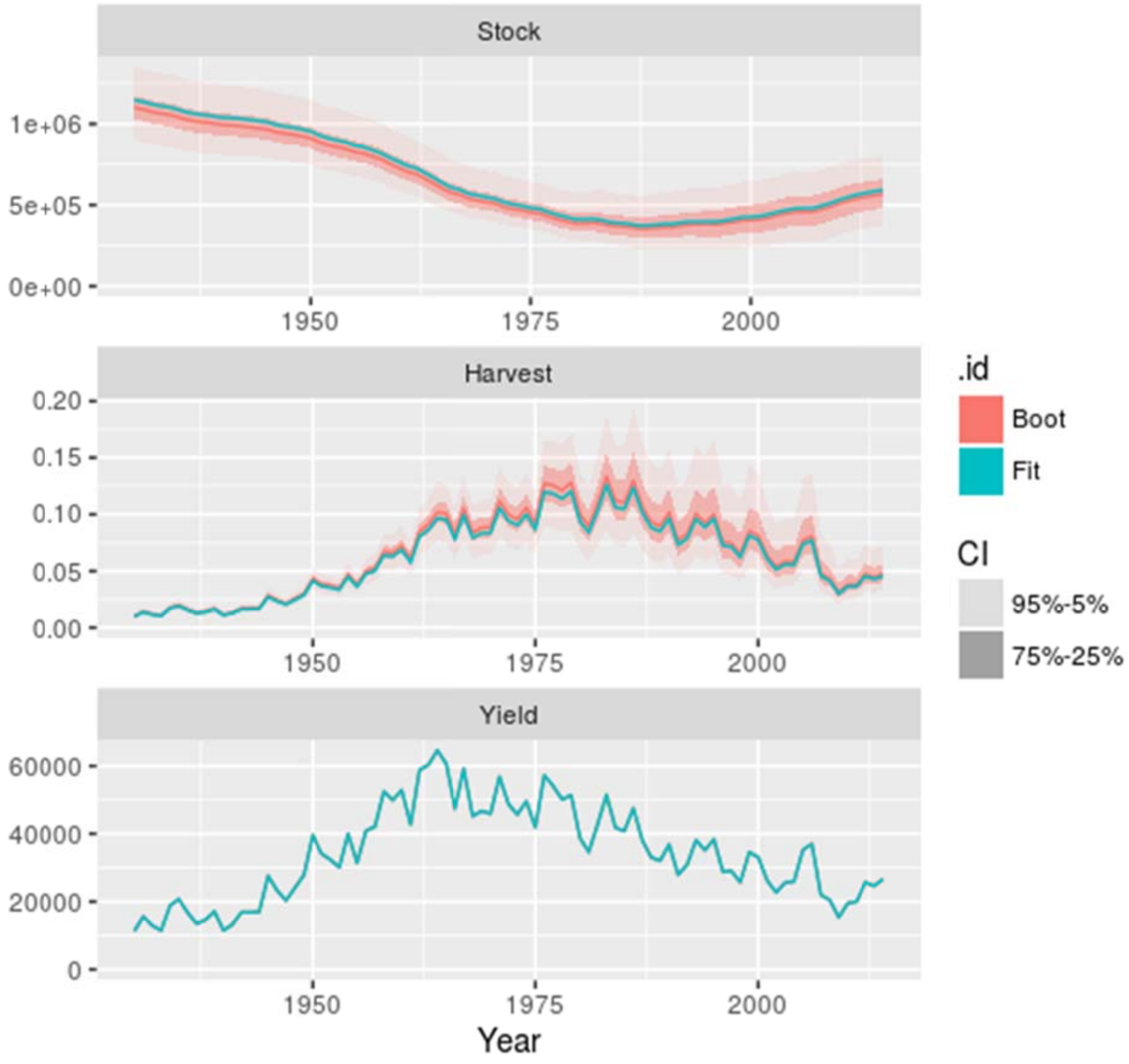


Figure 17. North Atlantic biomass dynamic Base Case stock assessment results with confidence intervals.

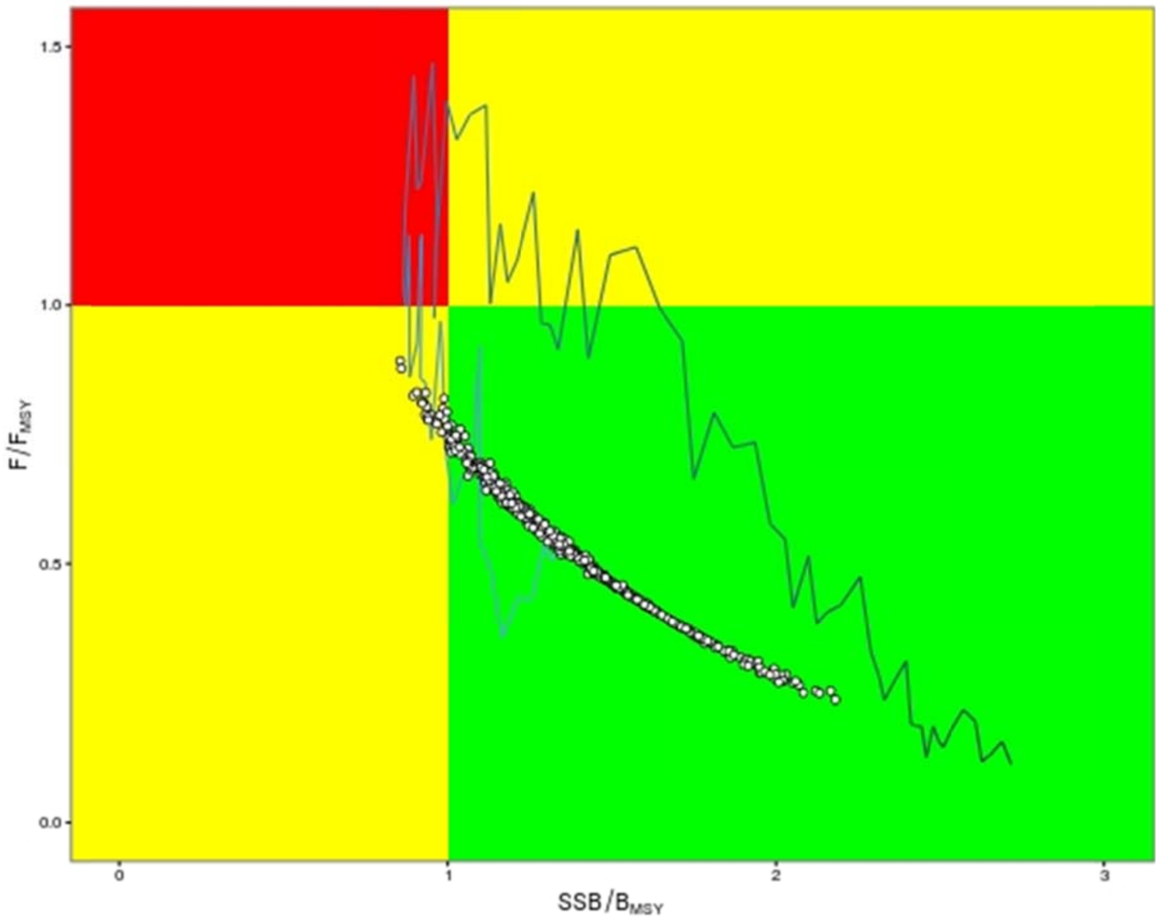


Figure 18. Estimated trends in B/B_{MSY} and F/F_{MSY} with the Base Case scenario of the North Atlantic albacore stock assessment with the *Biodyn* model. Dots: Bootstrapped 2014 B/B_{MSY} and F/F_{MSY} coordinates.

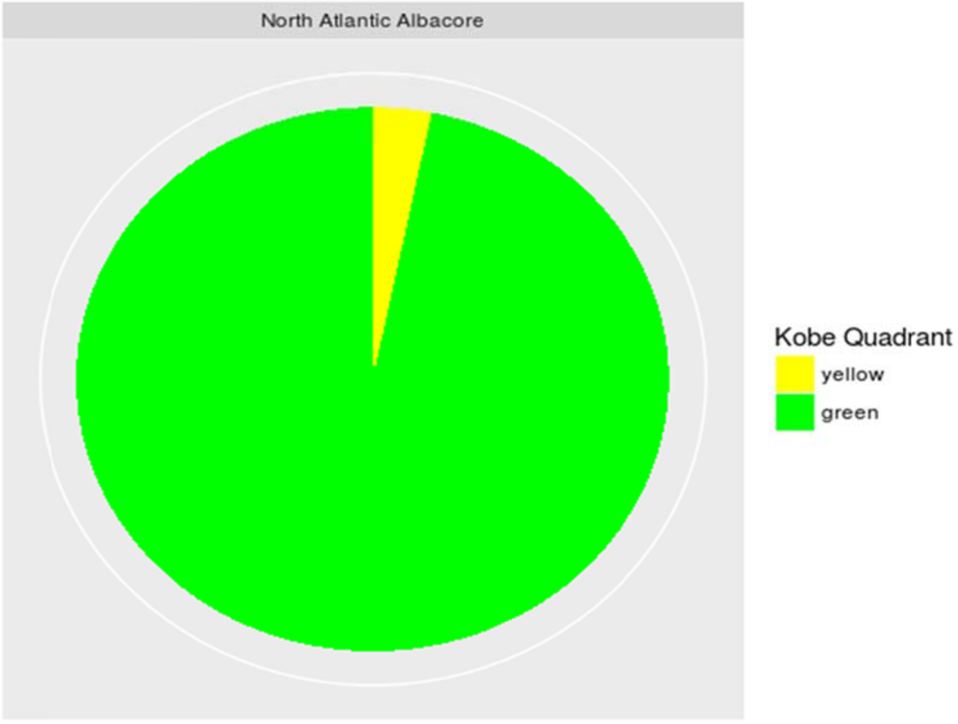


Figure 19. Kobe pie plot for the Base Case North Atlantic assessment.

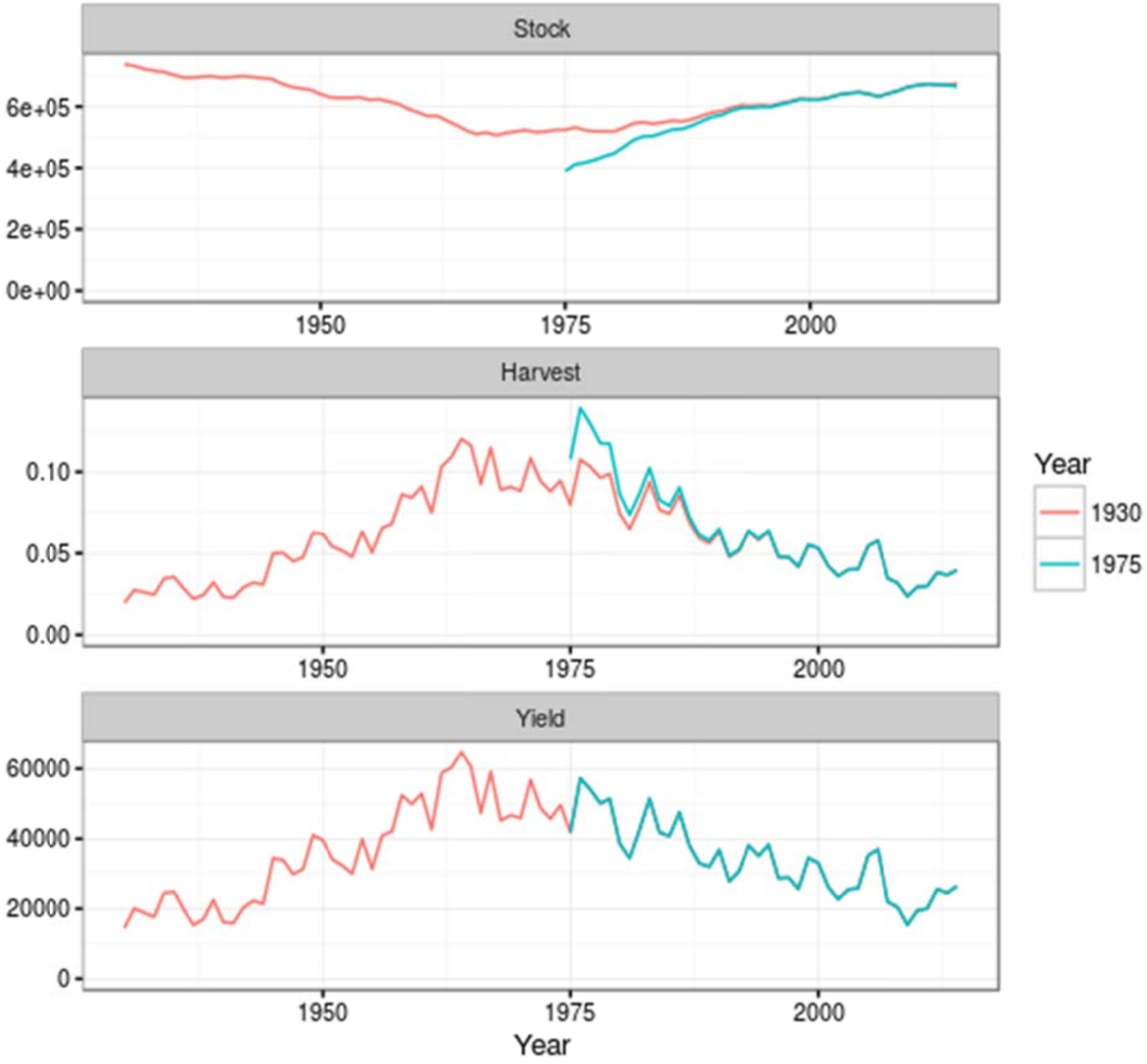


Figure 20. North Atlantic albacore *Biodyn* model fit to the catch series starting in 1930 and in 1975. Initial conditions in the truncated run were assuming B_{RATIO} of 0.5*K.

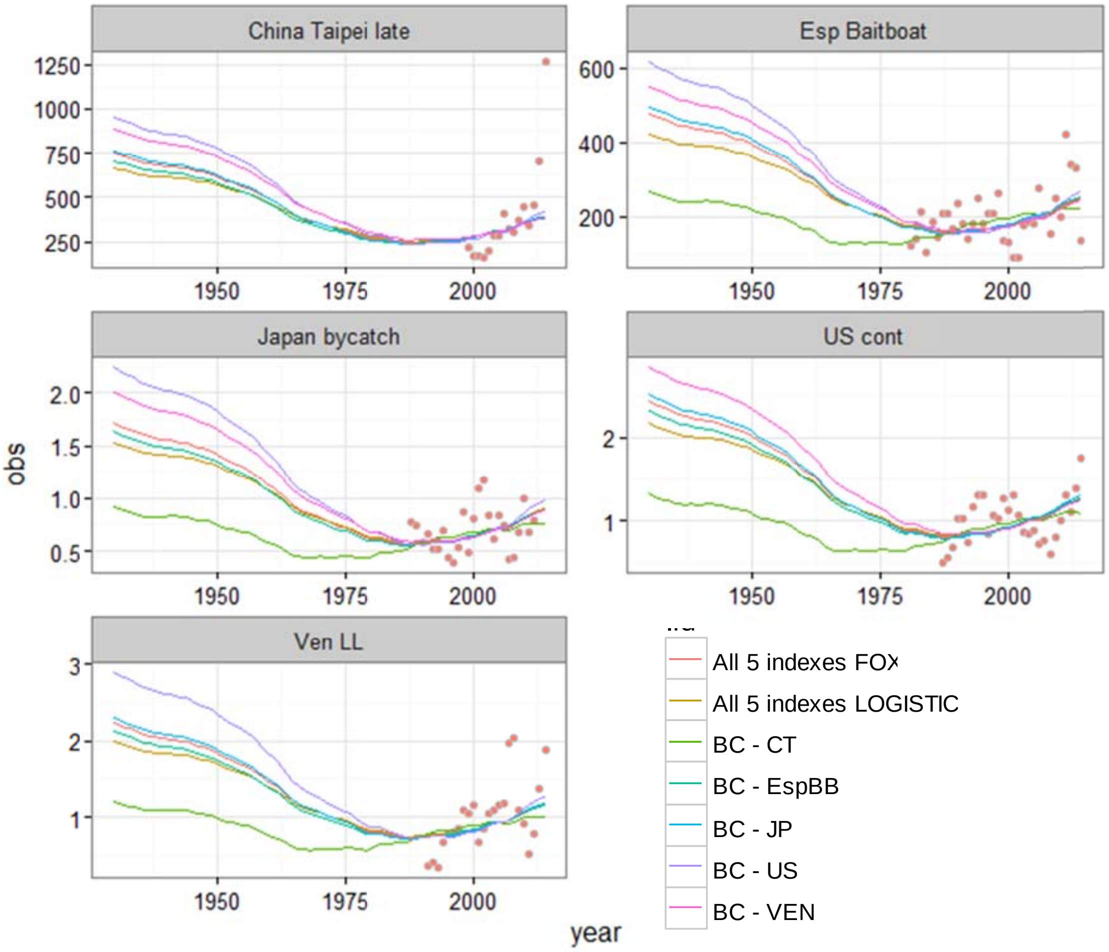


Figure 21. Estimated historical stock trends for the Base Case (BC, red) and sensitivity runs (Base Case with logistic production model and sensitivities removing one single fleet each time). The observed fleets' CPUE series (dots, in different panels) for the Base Case North Atlantic albacore stock assessment are also shown.

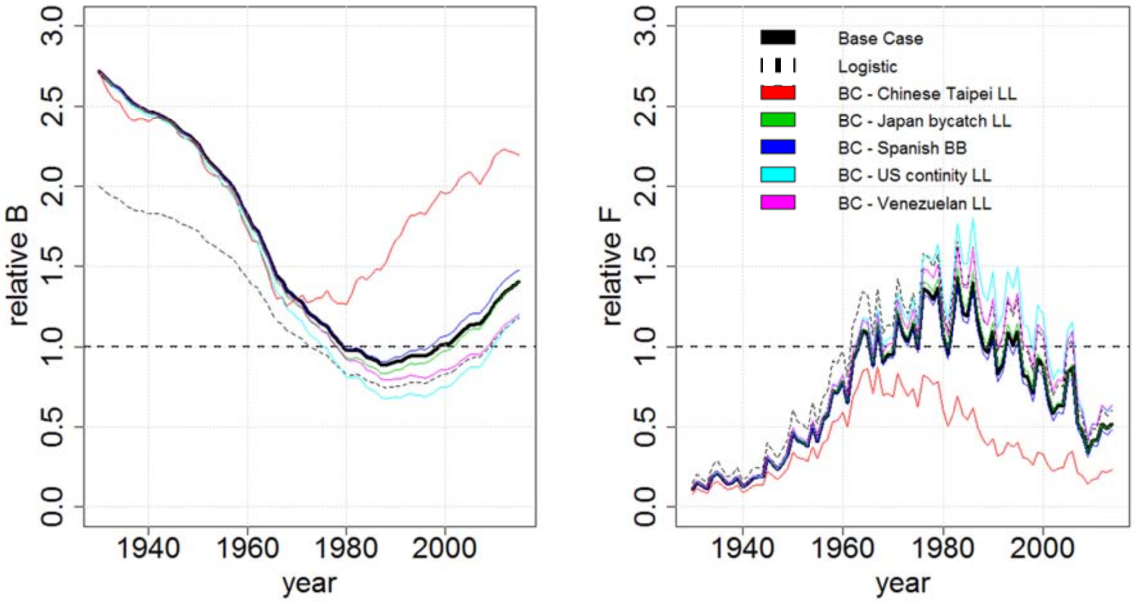


Figure 22. Estimated relative biomass (B/B$_{MSY}$, left) and fishing mortality (F/F$_{MSY}$, right) for the Base Case scenario (black line) and sensitivity runs (Base Case with logistic production function and sensitivities removing one single index each time).

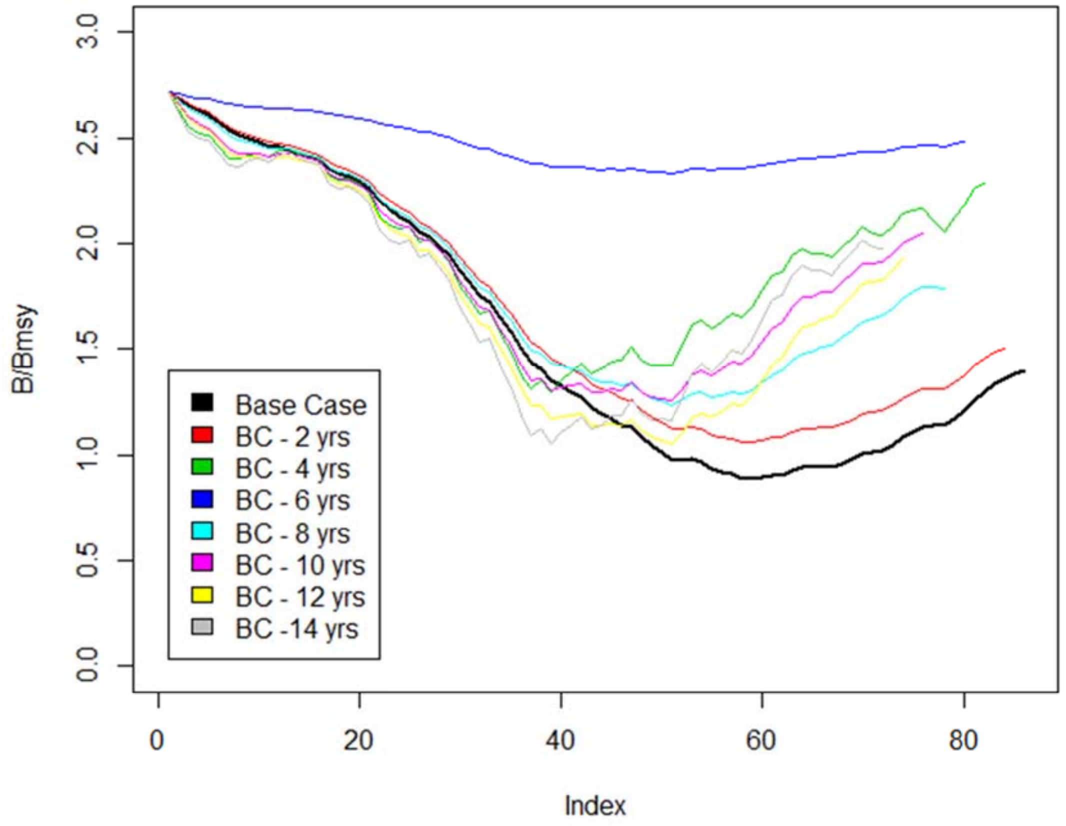


Figure 23. Retrospective analysis for B/B_{MSY}. Base Case results (black), and results when dropping 2 to 14 years (in 2 year steps) data in the time series.

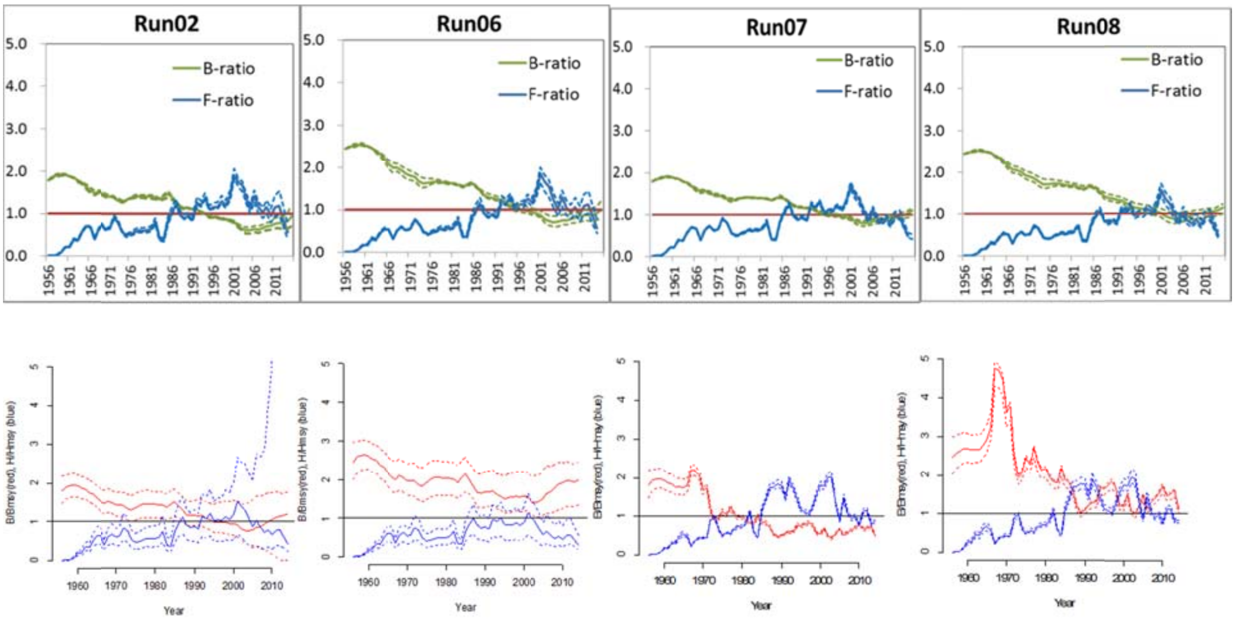


Figure 24. Biomas and fishing mortality/harvest rate trajectories for South Atlantic albacore based on ASPIC (upper panels) and BSP (lower panels).

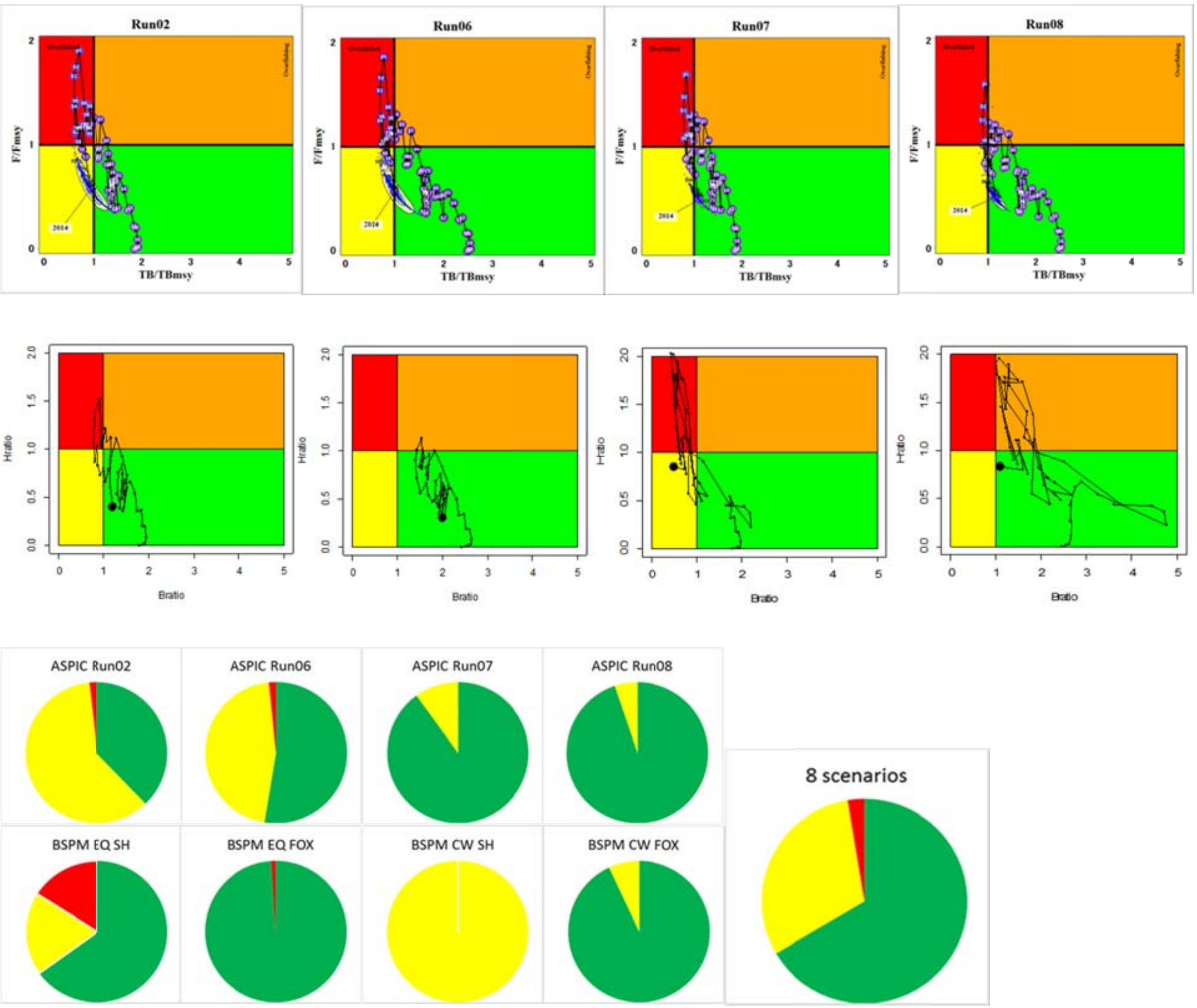


Figure 25. Kobe phase plots and pie charts for South Atlantic albacore based on ASPIC (upper) and BSP (lower). End year is 2014.

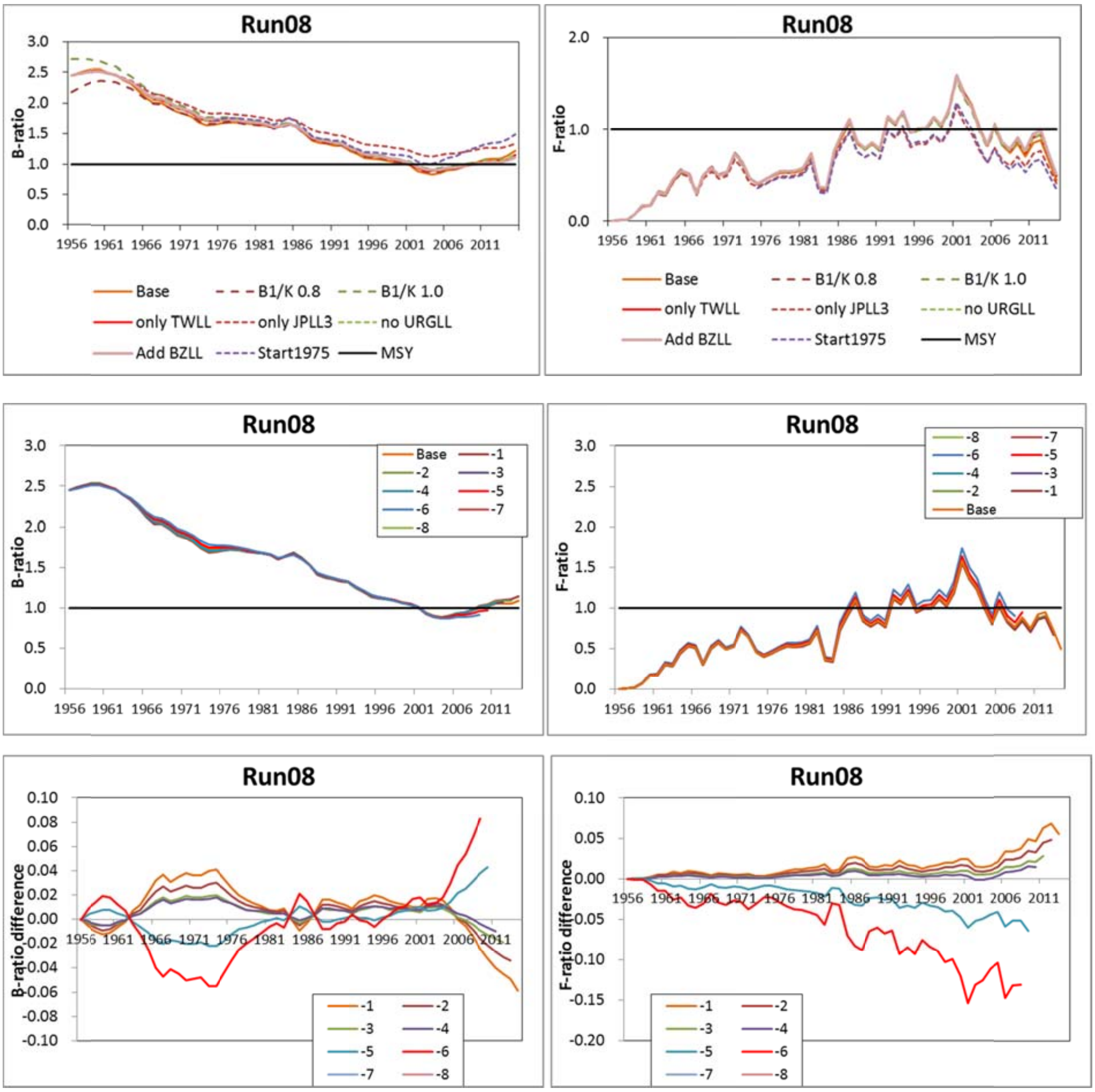


Figure 26. Results of sensitivity (top) and retrospective (middle) analyses for ASPIC Run08 for South Atlantic albacore. Bottom graphs show the difference between base case and retrospective analysis.

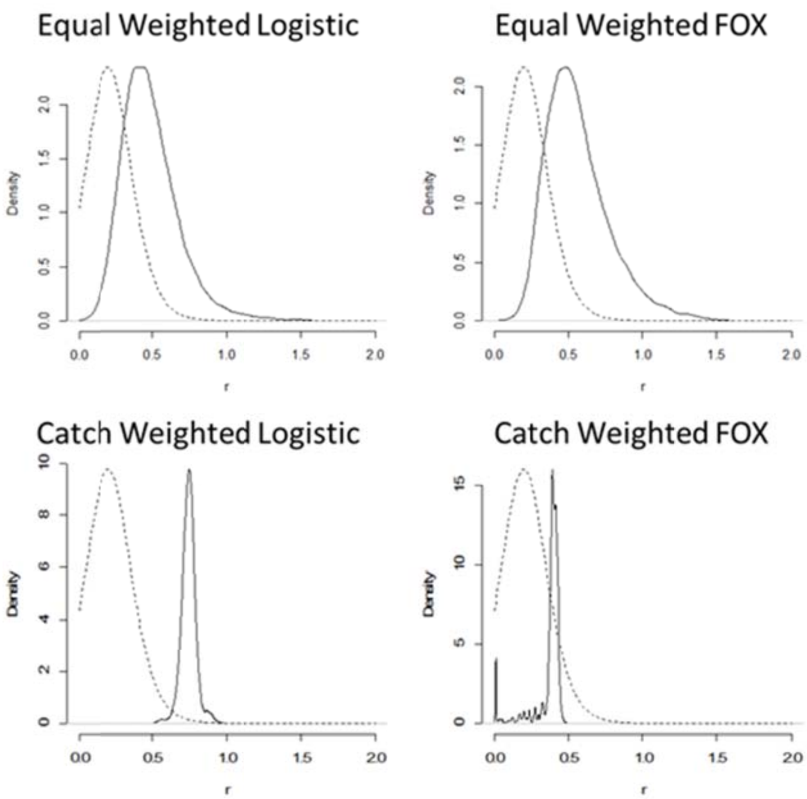


Figure 27. Estimated prior and posterior distributions for r by BSP. Dashed lines show prior and solid lines show posterior distributions.

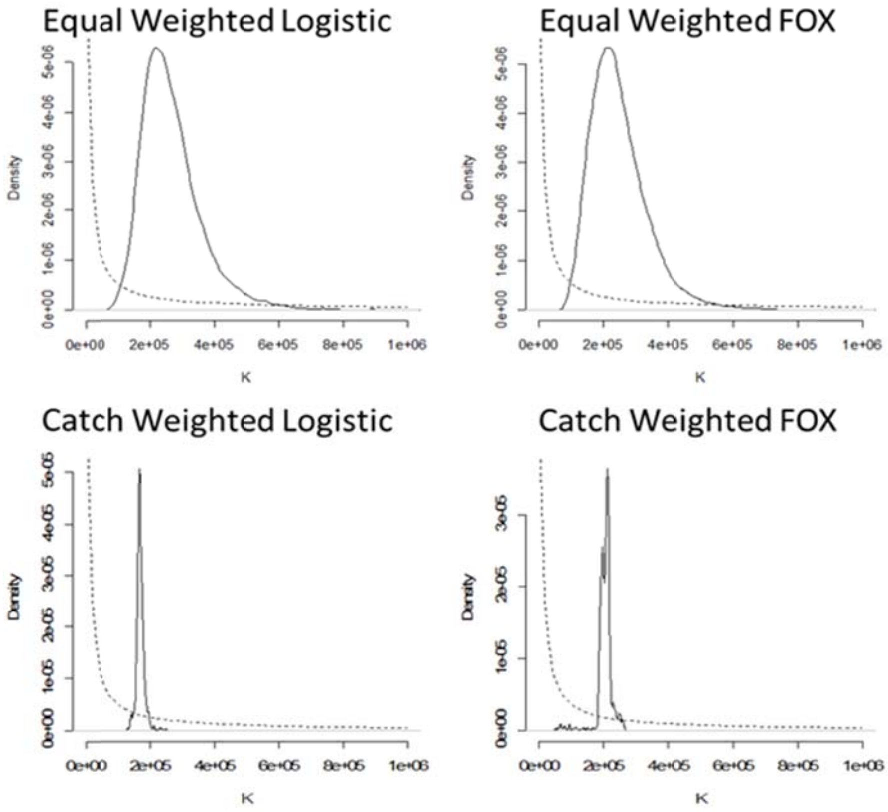


Figure 28. Estimated prior and posterior distributions for K by BSP. Dashed lines show prior and solid lines show posterior distributions.

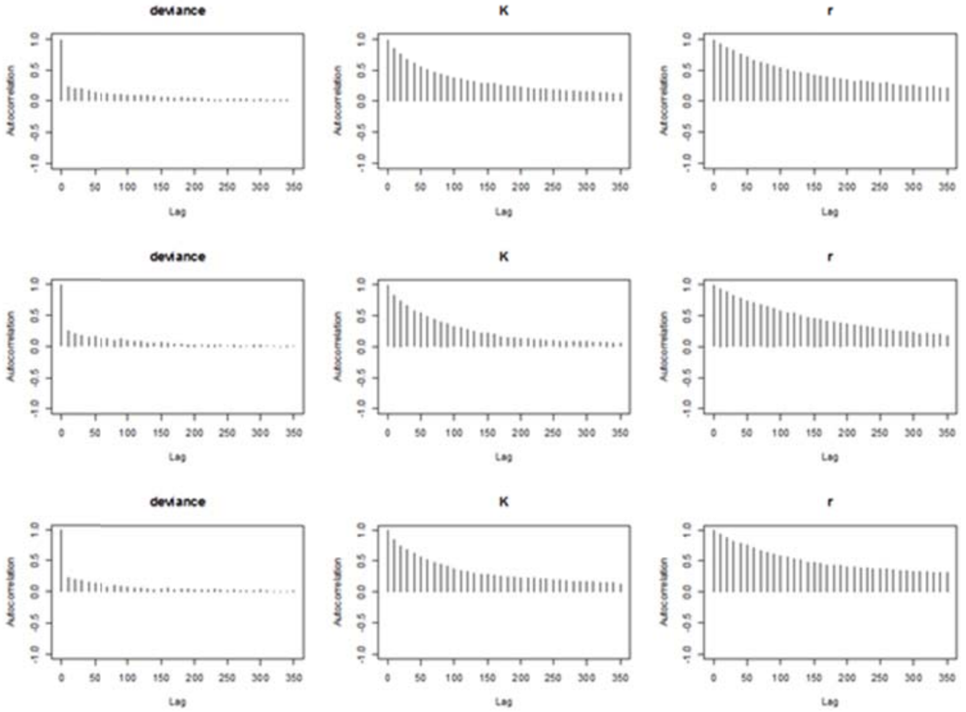


Figure 29a. South Atlantic albacore BSP model diagnostics. Correlation for "equal weighted and logistic" scenario.

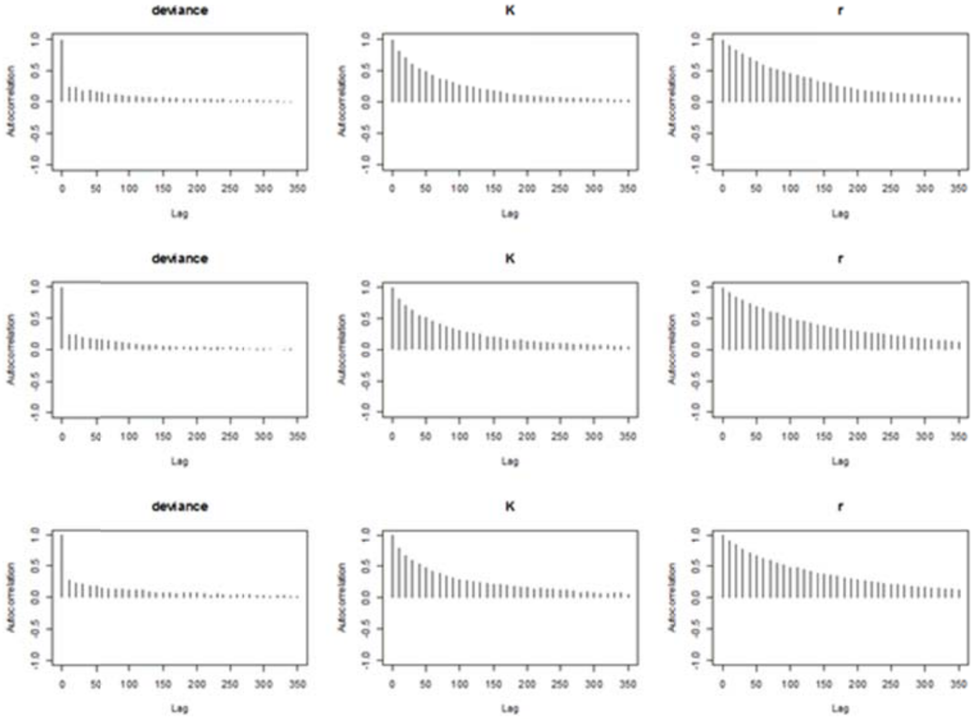


Figure 29b. South Atlantic albacore BSP model diagnostics. Correlation for "equal weighted and FOX" scenario.

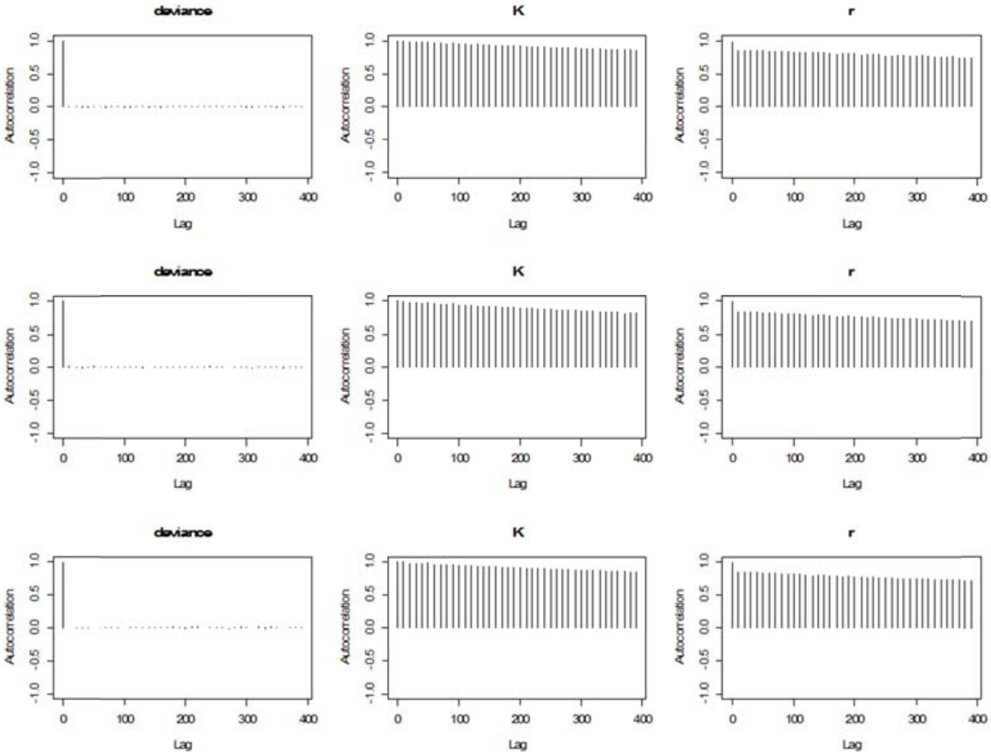


Figure 29c. South Atlantic albacore BSP model diagnostics. Correlation for "catch weighted and logistic" scenario.

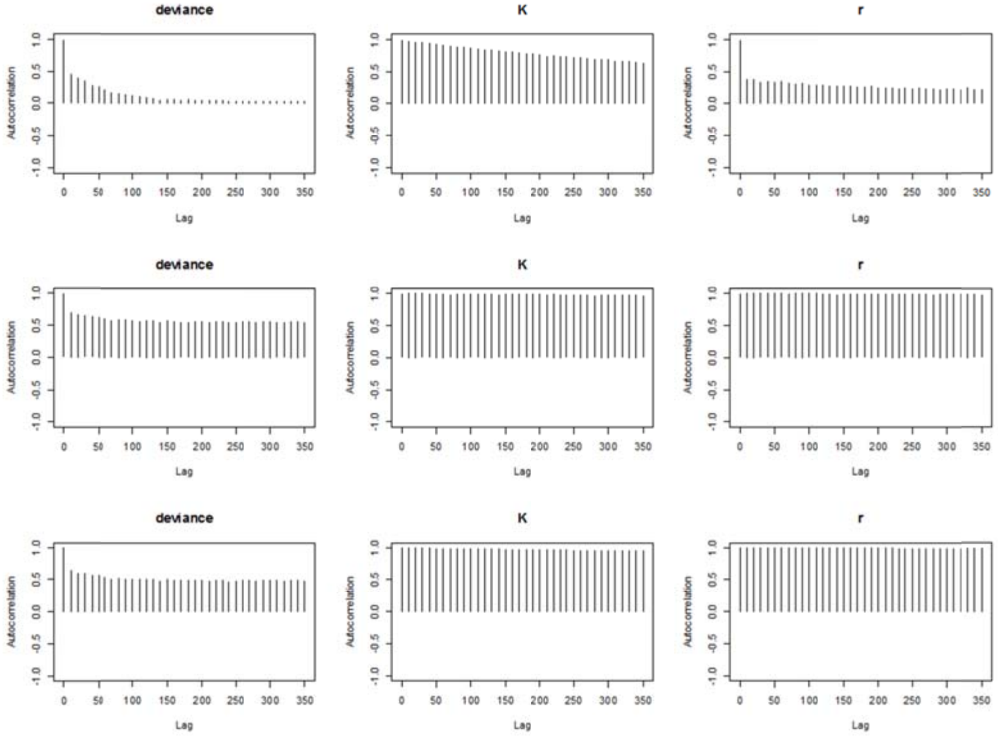


Figure 29d. South Atlantic albacore BSP model diagnostics. Correlation for "catch weighted and FOX" scenario.

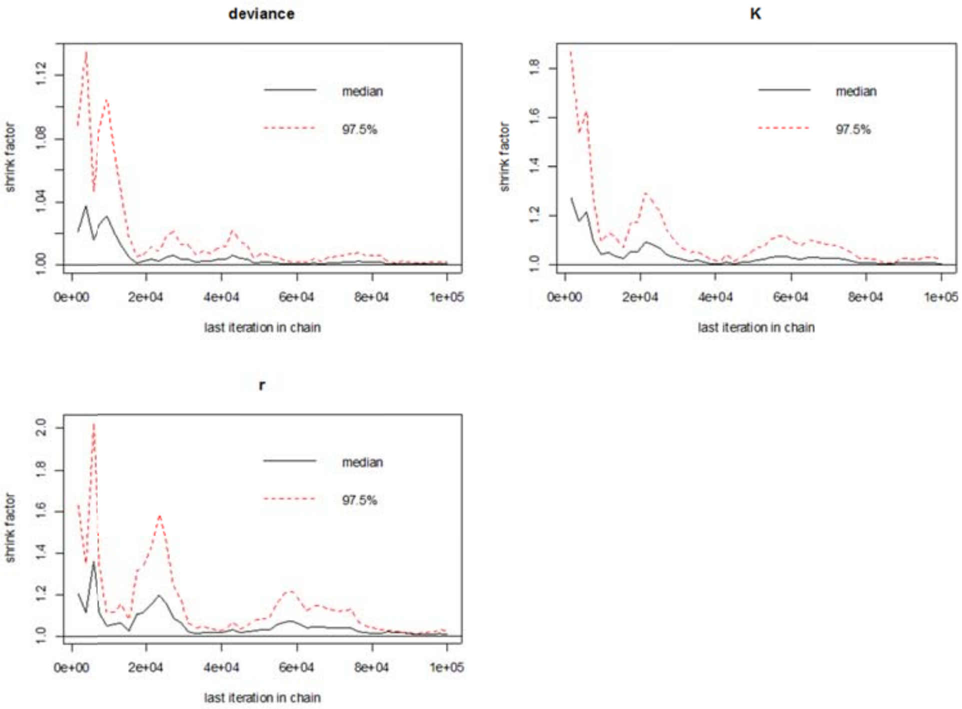


Figure 30a. South Atlantic albacore BSP model diagnostics. Gelman plots for "equal weighted and logistic" scenario.

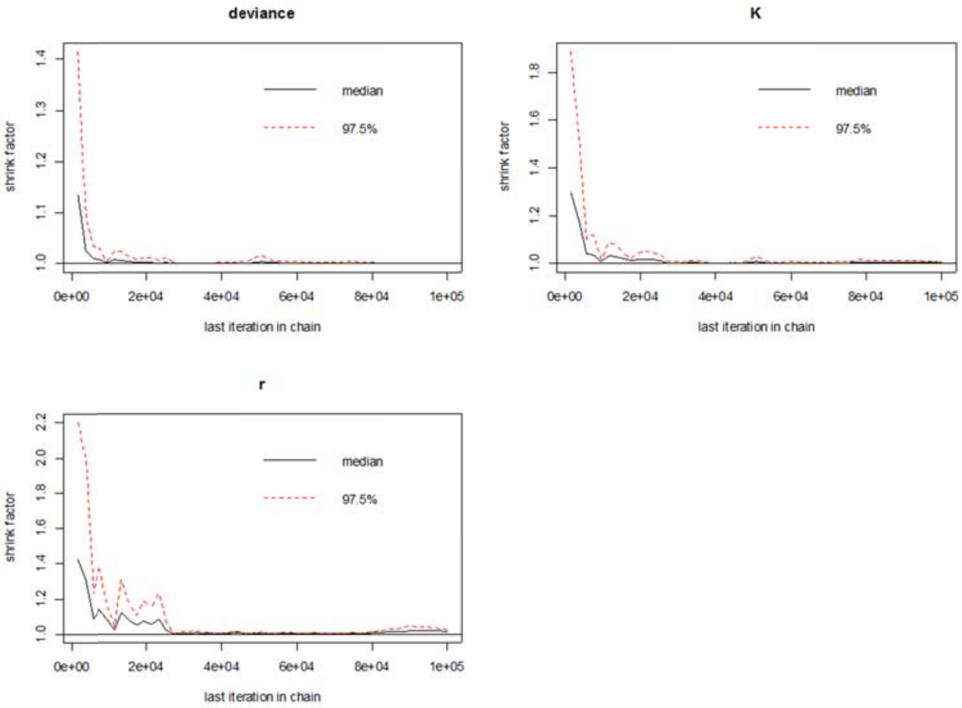


Figure 30b. South Atlantic albacore BSP model diagnostics. Gelman plots for "equal weighted and FOX" scenario.

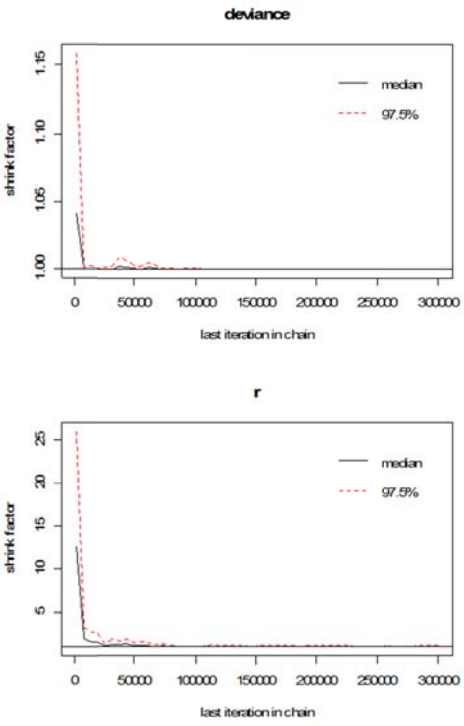


Figure 30c. South Atlantic albacore BSP model diagnostics. Gelman plots for "catch weighted and logistic" scenario.

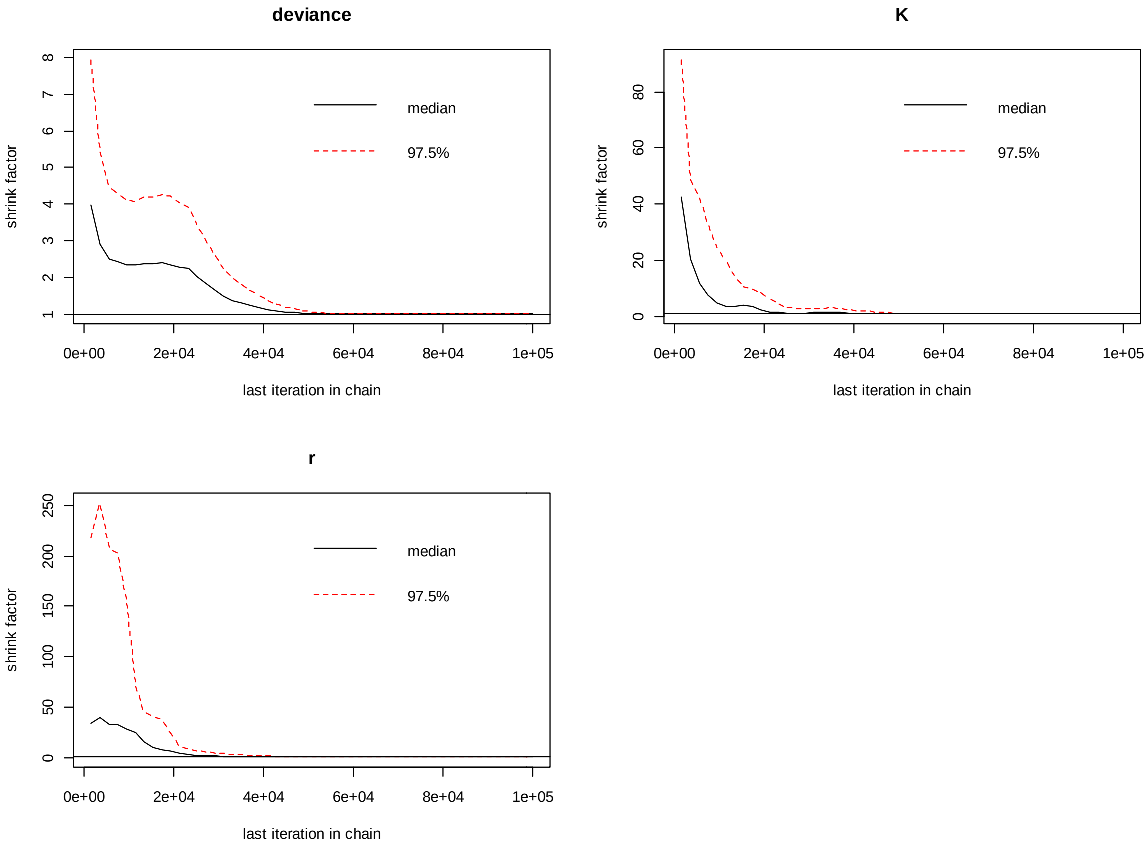


Figure 30d. South Atlantic albacore BSP model diagnostics. Gelman plots for "catch weighted and FOX" scenario.

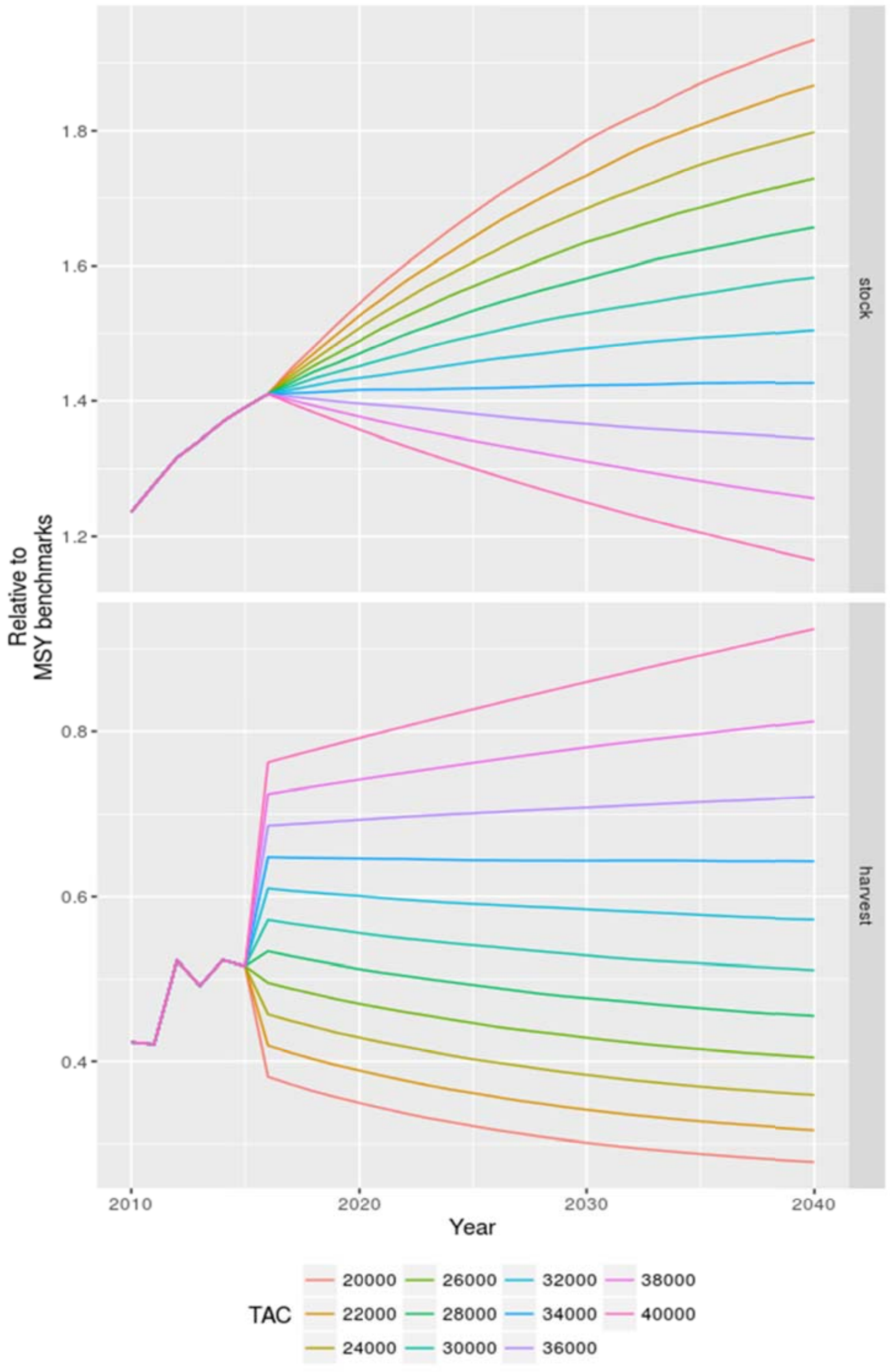
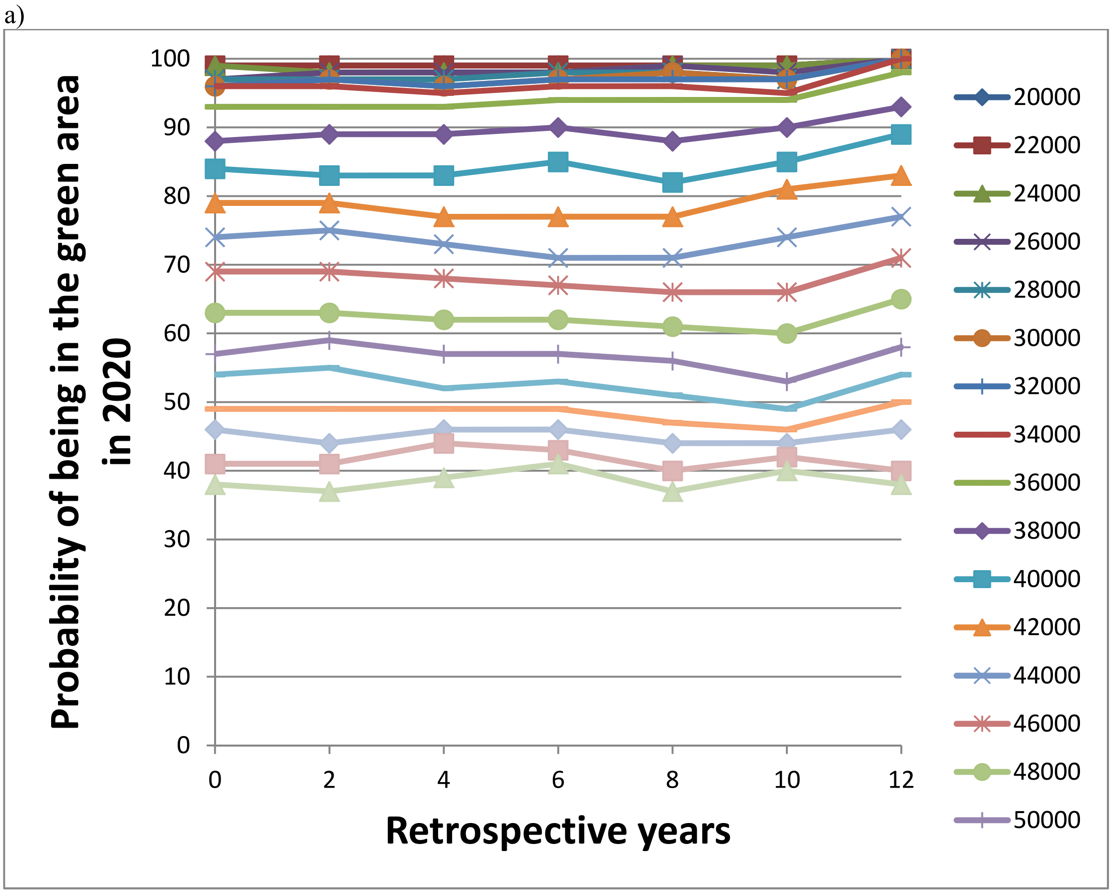


Figure 31. Projections of B/B_{MSY} (upper panel) and F/FMSY (lower panel) at constant TAC for the North Atlantic albacore Base Case scenario.

a)



b)

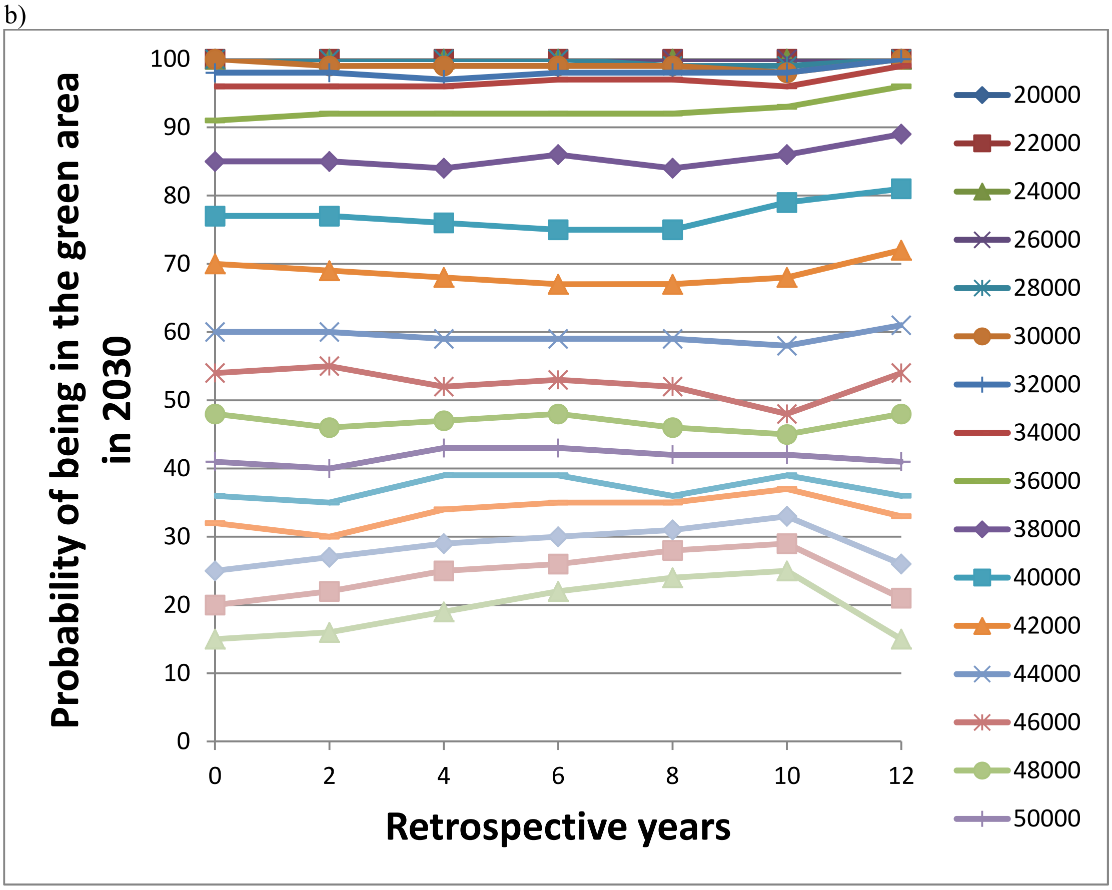


Figure 32. Probability of being in the green area in 2020 (a) and 2030 (b) under alternative retrospective scenarios (dropping 2 years of data in each successive scenario, X axis).

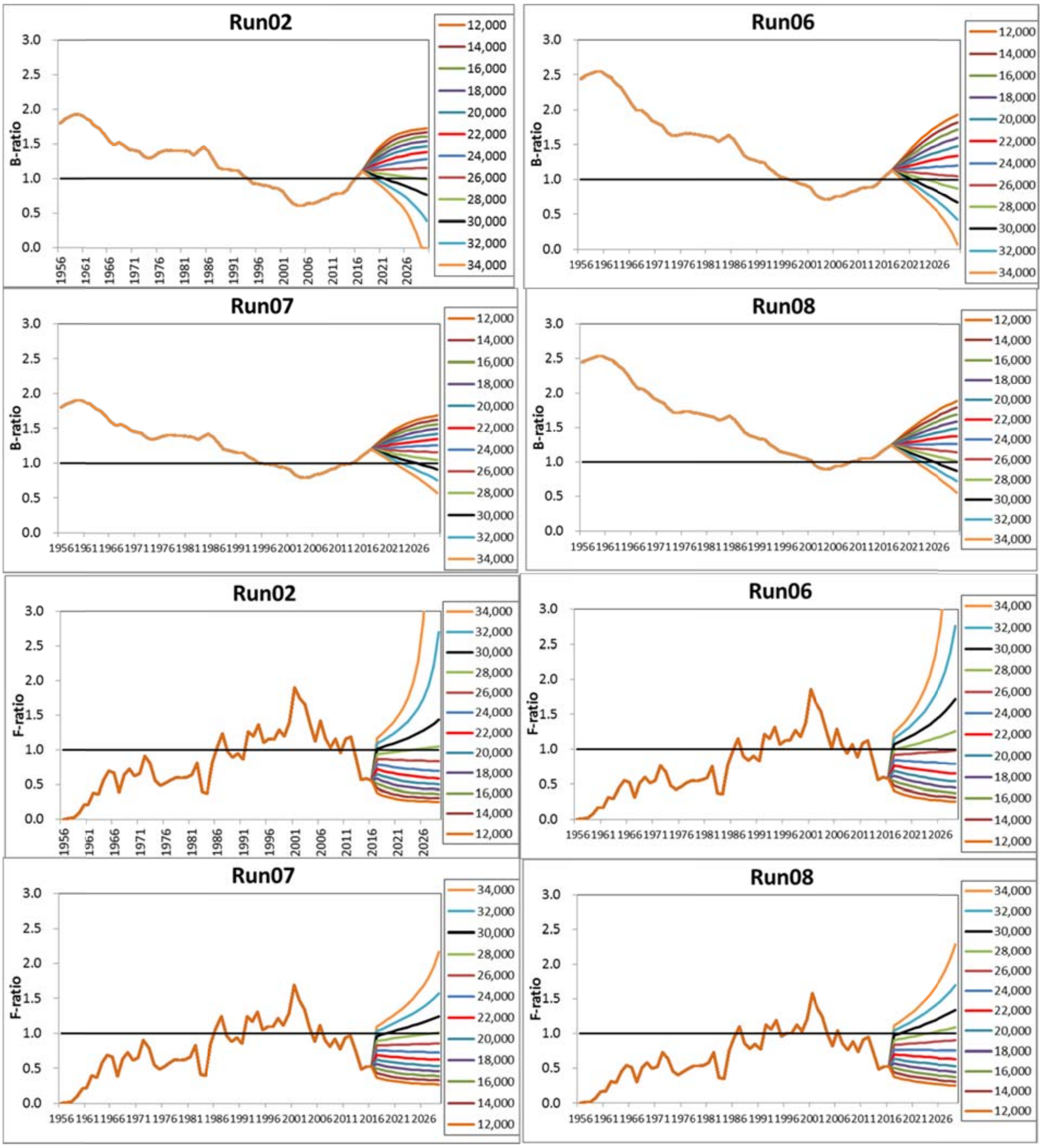


Figure 33. Future projection (16 years) of B-ratio (B/B_{MSY}) and F-ratio (F/F_{MSY}) for 4 ASPIC runs for South Atlantic albacore under constant catch.

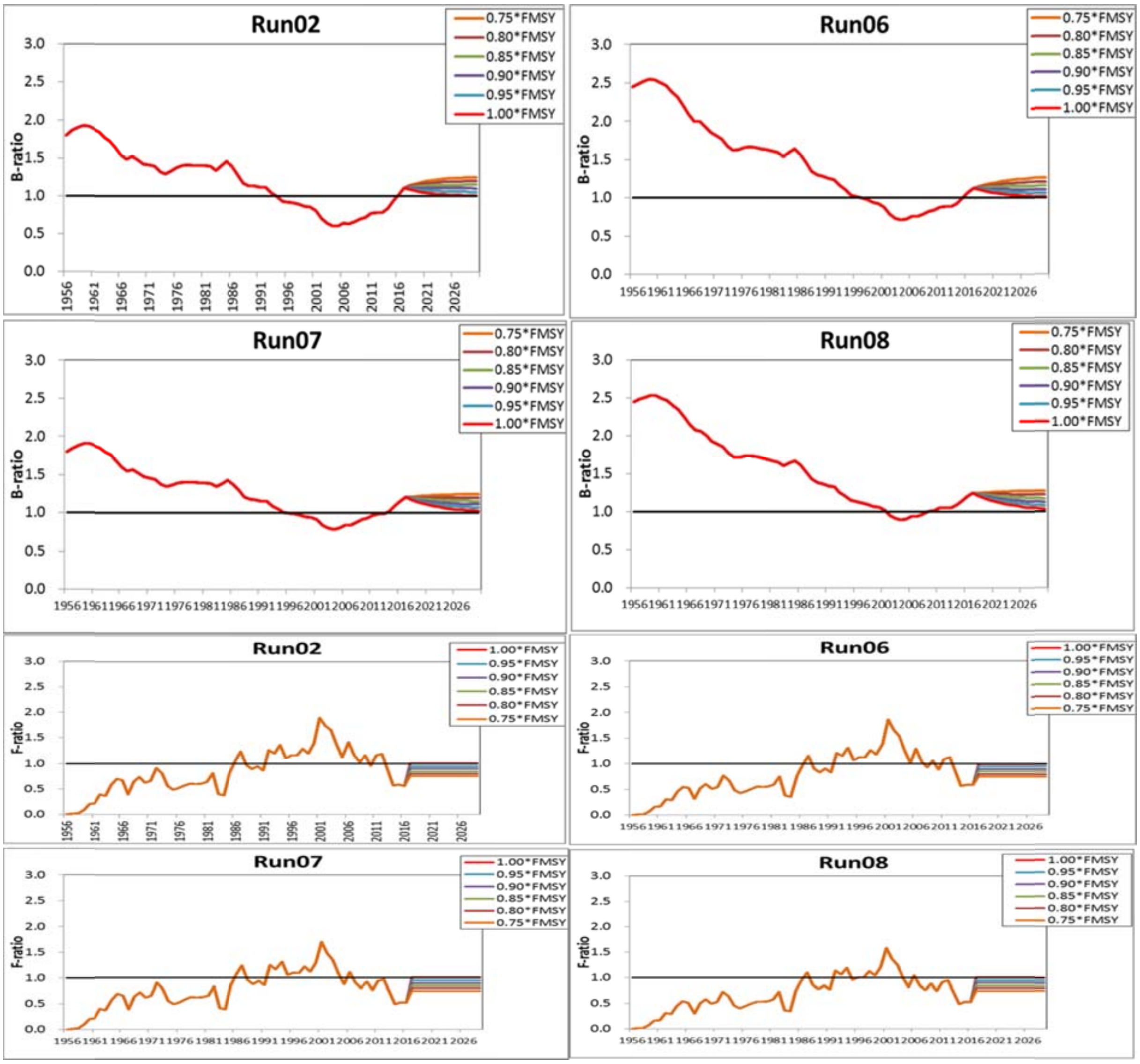


Figure 34. Future projection (16 years) of B-ratio (B/B_{MSY}) and F-ratio (F/F_{MSY}) for 4 ASPIC runs for South Atlantic albacore under constant F.

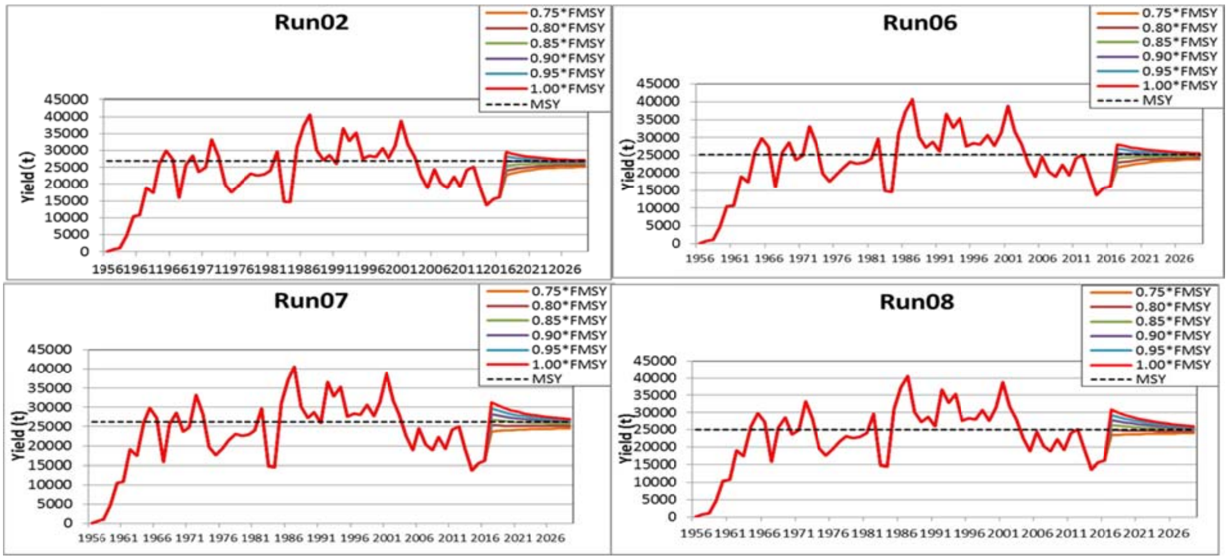
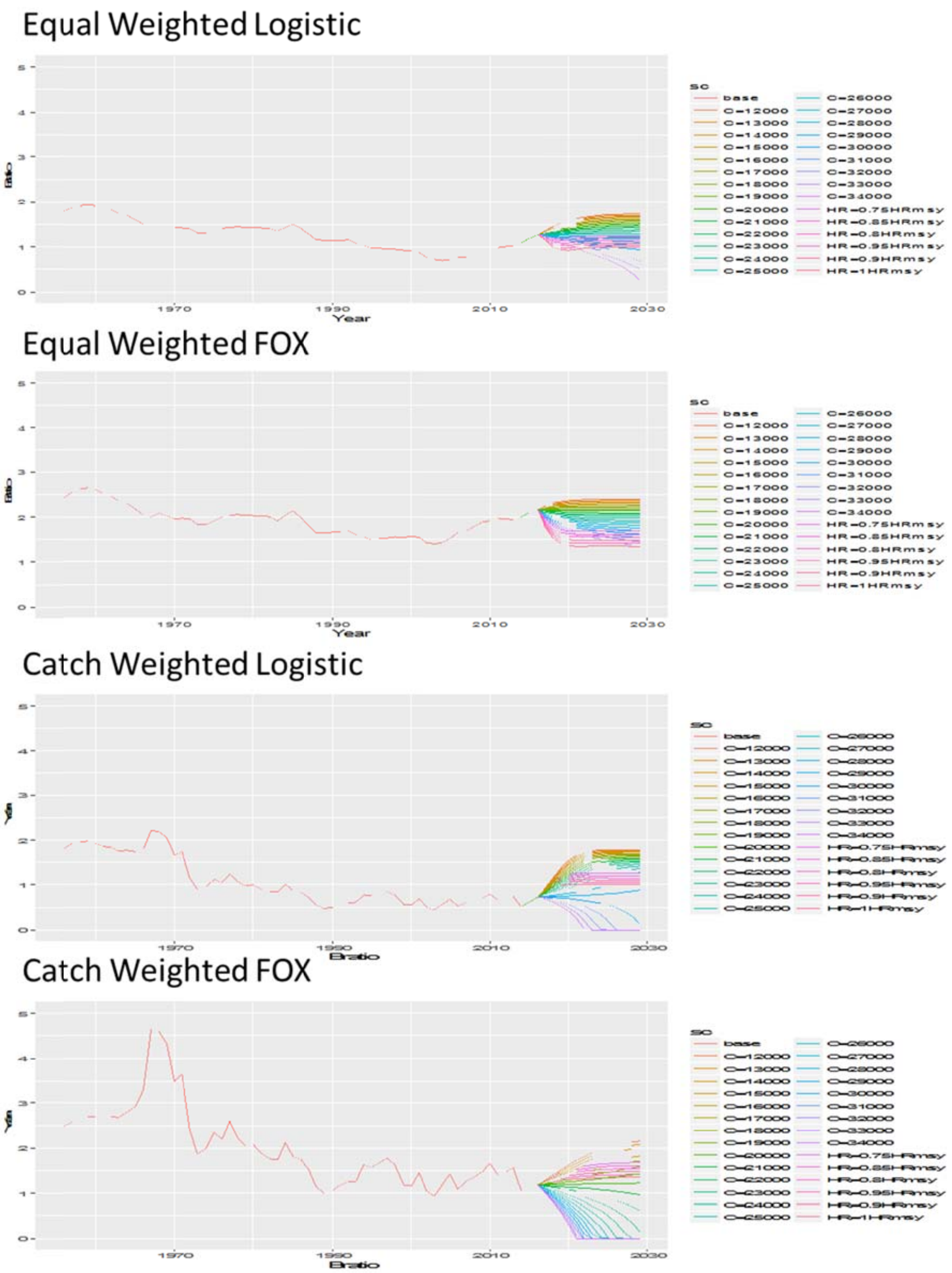


Figure 35. Predicted yield for future projection (16 years) for 4 ASPIC runs for South Atlantic albacore under constant F.



Equal Weighted Logistic

Equal Weighted FOX

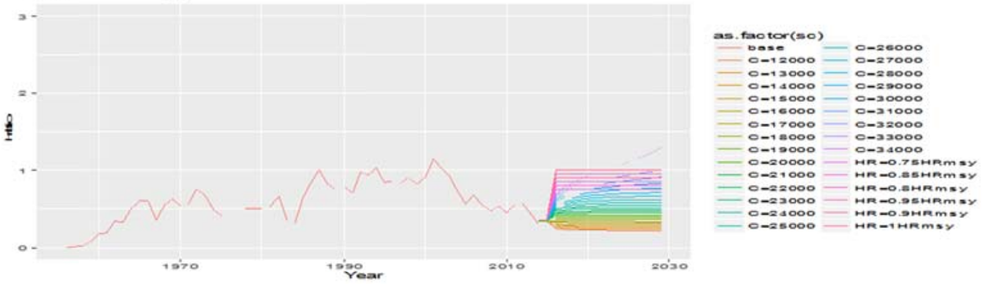
Catch Weighted Logistic

Catch Weighted FOX

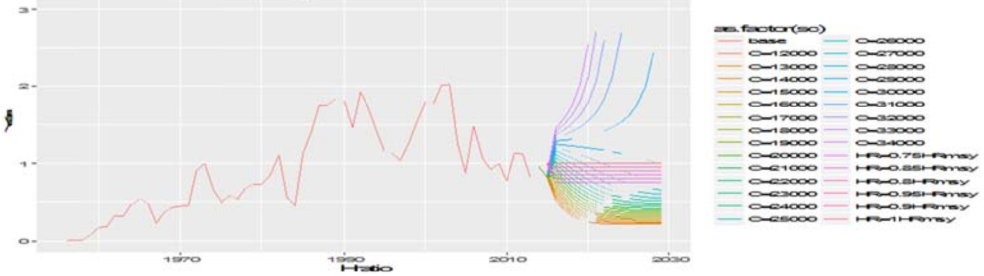
Figure 36. Projections for B_{RATIO} by each BSP scenario.

Equal Weighted Logistic

Equal Weighted FOX



Catch Weighted Logistic



Catch Weighted FOX

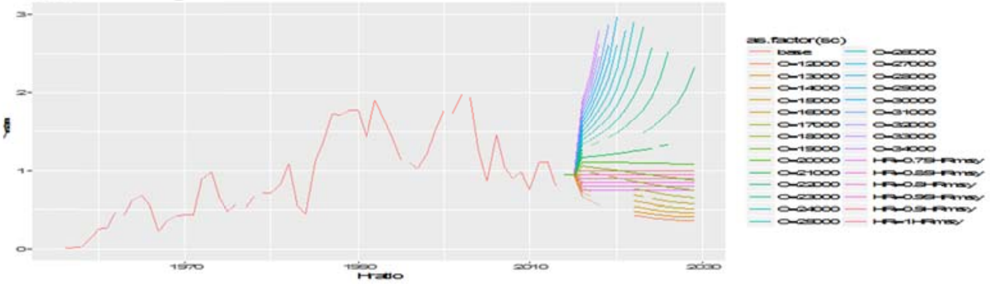


Figure 37. Projections for H_{RATIO} by each BSP scenario.

Appendix 1

Agenda

1. Opening, adoption of the Agenda and meeting arrangements
2. Summary of available data for assessment
    - 2.1 Biology
    - 2.2 Catch, effort and size
    - 2.3 Relative abundance indices
3. Reference Points, Harvest Control Rules and Management Strategy Evaluation
    - 3.1 Update of the progress of the North Atlantic Albacore MSE
    - 3.2 Implications for current assessment
    - 3.3 Input to the upcoming Commission Panel 2 meeting in Sapporo
    - 3.4 Assessing risks of errors in management decisions
4. Stock status relative to target and limit reference points
    - 4.1 North Atlantic albacore stock
    - 4.2 South Atlantic albacore stock
5. Projections
    - 5.1 North Atlantic albacore stock
    - 5.2 South Atlantic albacore stock
6. Management recommendations
    - 6.1 North Atlantic albacore stock (including harvest control rules)
    - 6.2 South Atlantic albacore stock
7. Recommendations on research and statistics
8. Adoption of the Report and closure

Appendix 2

List of participants

CONTRACTING PARTIES

ANGOLA
André António, Miguel
Chef de Département auprès de la Direction Nationale des Pêches et de l'Aquaculture, Ministère de la Pêche, Direction Nationale des Pêches, Avenida 4 de Fevereiro, 26 - Edificio Atlântico, Luanda
Tel: +244 923 797608, Fax: +244 912 208970, E-Mail: amiguelandre@yahoo.com.br

do A.M. Barreto, Tânia Célia
Ministério das Pescas, Avenida 4 de Fevereiro, 30, Edifício Atlántico, Caixa Postal 83 Luanda
Tel: +244 912 202 100, Fax: +244 222 310 759, E-Mail: tania.mandinga@gmail.como

BRAZIL
Hazin, Fabio H. V.
Universidade Federal Rural de Pernambuco - UFRPE / Departamento de Pesca e Aqüicultura - DEPAq, Rua Desembargador Célio de Castro Montenegro, 32 - Apto 1702, Monteiro Recife Pernambuco
Tel: +55 81 3320 6500, Fax: +55 81 3320 6512, E-Mail: fabio.hazin@depaq.ufrpe.br; fhvhazin@terra.com.br

CÔTE D'IVOIRE
Amandè, Monin Justin
Chercheur Halieute, Centre de Recherches Océanologiques de Côte d'Ivoire, Département Ressources Aquatiques Vivantes - DRAV29 Rue des Pêcheurs, BP V 18, Abidjan 01
Tel: +225 05 927 927, Fax: +225 21 351 155, E-Mail: monin.amande@yahoo.fr; monin.amande@cro-ci.org

EUROPEAN UNION
Alves, Adriana
Estrada da Potinha, 9004-562 Funchal, Madeira, Portugal
Tel: +351 291 203 200, E-Mail: adrianaalves@gov-madeira.pt

Amorim, Antonieta
DSIDP, Estrada da Potinha, 9004-562 Funchal, Madeira, Portugal
Tel: +351 291 203200, E-Mail: antonietaamorim@gov-madeira.pt

Arrizabalaga, Haritz
AZTI - Tecnalia /Itsas Ikerketa Saila, Herrera Kaia Portualde z/g, 20110 Pasaia Gipuzkoa, Spain
Tel: +34 94 657 40 00, Fax: +34 94 300 48 01, E-Mail: harri@azti.es

Duncan, Roxanne
Galway - Mayo Institute of Technology, Dublin Road, Galway, Ireland
Tel: +353 91 753161, Fax: +35391 751 107, E-Mail: roxanne.duncan@gmit.ie

Ferreira de Gouveia, Lidia
Direcçao Regional das Pescas, Estrada da Pontinha, Edificio da Sociedade Metropolitana de Câmara de Lobos - Praça da Autonomia 9300-138 Câmara de Lobos, 9000 Funchal Madeira, Portugal
Tel: +351 291 203251, Fax: +351 291 229691, E-Mail: lidiagouveia@gov-madeira.pt

Hermida, Margarida
CIIMAR - Madeira, Edificio Madeira Tecnopolo, piso Q, Caminho da Penteada, 9020-105 Funchal, Madeira, Portugal
Tel: +351 291 721 216, E-Mail: margaridahermida@gmail.com

Keatinge, Michael
BIM (The Irish Sea fisheries Board), Crofton Road, Dun Laoghaire, Dublin, Ireland
Tel: +353 1 214 4230, Fax: +353 1 230 0564, E-Mail: keatinge@bim.ie

Merino, Gorka
AZTI - Tecnalia /Itsas Ikerketa Saila, Herrera Kaia Portualde z/g, 20110 Pasaia - Gipuzkoa, Spain
Tel: +34 94 657 4000; +34 664 793 401, Fax: +34 94 300 4801, E-Mail: gmerino@azti.es

Minto, Cóilin
Stock Assessment Scientist, Galway-Mayo Institute of Technology, Dublin Road, Galway, Ireland, Ireland
Tel: +353 91 742514, E-Mail: coilin.minto@gmit.ie

Ortiz de Urbina, José María
Ministerio de Economía y Competitividad, Instituto Español de Oceanografía, C.O. de Málaga, Puerto Pesquero s/n, 29640 Fuengirola Málaga, Spain
Tel: +34 952 197 124, Fax: +34 952 463 808, E-Mail: urbina@ma.ieo.es

Ortiz de Zárate Vidal, Victoria
Ministerio de Economía y Competitividad, Instituto Español de Oceanografía, C.O. de Santander, Promontorio de San Martín s/n, 39012 Santander Cantabria, Spain
Tel: +34 942 291 716, Fax: +34 942 27 50 72, E-Mail: victoria.zarate@st.ieo.es

Santiago Burrutxaga, Josu
Head of Tuna Research Area, AZTI-Tecnalia, Txatxarramendi z/g, 48395 Sukarrieta (Bizkaia) País Vasco, Spain
Tel: +34 94 6574000 (Ext. 497); 664303631, Fax: +34 94 6572555, E-Mail: jsantiago@azti.es; flarrauri@azti.es

JAPAN
Kanaiwa, Minoru
Tokyo University of Agriculture, 196 Yasaka, Abashiri, Hokkaido
Tel: +81 152 483 906, Fax: +81 152 482 940, E-Mail: minoru.kanaiwa@gmail.com

Matsumoto, Takayuki
Senior Researcher, Tuna and Skipjack Resources Division, National Research Institute of Far Seas Fisheries, Fisheries Research Agency, 5-7-1 Orido, Shizuoka Shimizu 424-8633
Tel: +81 54 336 6000, Fax: +81 54 335 9642, E-Mail: matumot@affrc.go.jp

Uozumi, Yuji
Visiting Scientist, National Research Institute of Far Seas Fisheries, Fisheries Research Agency, 5-7-1 Orido, Shizuoka Shimizu 424-8633
Tel: +81 54 336 6000, E-Mail: uozumi@japantuna.or.jp; uozumi@affrc.go.jp

Yokawa, Kotaro
Research Coordinator, National Research Institute of Far Seas Fisheries, Fisheries Research Agency, 5-7-1 Orido, Shimizu-ku, Shizuoka 424-8633
Tel: + 81 54 336 5834, Fax: +81 543 359642, E-Mail: yokawa@affrc.go.jp

UNITED STATES
Díaz, Guillermo
NOAA-Fisheries, Southeast Fisheries Science Center, 75 Virginia Beach Drive, Miami Florida 33139
Tel: +1 305 361 4277, Fax: E-Mail: guillermo.diaz@noaa.gov

Sharma, Rishi
NOAA, 75 Virginia Key Dr., Miami, Florida 33149
Tel: +1 305 361 4487, Fax: +1 305 361 4219, E-Mail: rishi.sharma@noaa.gov

URUGUAY
Domingo, Andrés
Dirección Nacional de Recursos Acuáticos - DINARA, Laboratorio de Recursos Pelágicos, Constituyente 1497, 11200 Montevideo
Tel: +5982 400 46 89, Fax: +5982 401 32 16, E-Mail: adomingo@dinara.gub.uy; dimanchester@gmail.com

VENEZUELA
Arocha, Freddy
Instituto Oceanográfico de Venezuela Universidad de Oriente, A.P. 204, 6101 Cumaná Estado Sucre
Tel: +58-293-400-2111 - Mobile: 58 416 693 0389, E-Mail: farocha@udo.edu.ve; farochap@gmail.com

OBSERVERS FROM COOPERATING NON-CONTRACTING PARTIES, ENTITIES, FISHING ENTITIES

CHINESE TAIPEI
Chang, Feng-Chen
Overseas Fisheries Development Council, 3F, No.14, Wenzhou St. Da'an Dist. 106, 106 Taipei City, Chinese Taipei
Tel: +886 2 2368 0889, Fax: +886 2 2368 1530, E-Mail: fengchen@ofdc.org.tw; d93241008@ntu.edu.tw

OBSERVERS FROM NON-GOVERNMENTAL ORGANIZATIONS

INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION – ISSF
Scott, Gerald P.
11699 SW 50th Ct, Cooper City, Florida 33330, United States
Tel: +1 954 465 5589, E-Mail: gpscott_fish@hotmail.com

SCRS CHAIRMAN
Die, David
SCRS Chairman, Cooperative Institute of Marine and Atmospheric Studies, University of Miami, 4600 Rickenbacker Causeway, Miami Florida 33149, United States
Tel: +1 305 421 4607, Fax: +1 305 421 4221, E-Mail: ddie@rsmas.miami.edu

******

ICCAT Secretariat
C/ Corazón de María 8 – 6th floor, 28002 Madrid – Spain
Tel: +34 91 416 56 00; Fax: +34 91 415 26 12; E-mail: info@iccat.int

De Bruyn, Paul
Kell, Laurence
Palma, Carlos

Appendix 3

List of documents and presentations

SCRS/2016/015	Evaluation of Harvest Control Rules for North Atlantic albacore through Management Strategy Evaluation	Merino G., Arrizabalaga H., Murua H., Santiago J., Ortiz de Urbina J., Scott G.P., Kell L.T.
SCRS/2016/023	Conditioning an operating model for North Atlantic albacore	Kell L.T., Arrizabalaga H., Merino G. and de Bruyn P.
SCRS/2016/024	An observation error model for North Atlantic albacore	Kell L.T., Arrizabalaga H., Merino G., and De Bruyn P.
SCRS/2016/025	The implicit North Atlantic albacore management procedure	Kell L.T., Arrizabalaga H., Merino G. and de Bruyn P.
SCRS/2016/026	Cross testing of Biodyn an R package to implement management procedures based on biomass dynamic models	Kell L.T., Arrizabalaga H., Merino G., and De Bruyn P.
SCRS/2016/027	Validation of Biodyn an R package to implement management procedures based on biomass dynamic models	Kell L.T., Arrizabalaga H., Merino G. and de Bruyn P.
SCRS/2016/028	A preliminary stock assessment for North Atlantic albacore using a biomass dynamic model	Kell L.T., Arrizabalaga H., Merino G. and de Bruyn P.
SCRS/2016/032	Standardized catch rates for northern albacore (*Thunnus alalunga*) from the Venezuelan pelagic longline fishery off the Caribbean Sea and adjacent areas of the Western Central Atlantic	Arocha F., Ortiz M., Marcano J. H.
SCRS/2016/033	Spatial and temporal size/age distribution patterns of northern albacore (*Thunnus alalunga*) in the Caribbean Sea and adjacent waters of the Western Central Atlantic from observer data of the Venezuelan fisheries	Arocha F., Ortiz M., Evaristo E., Gutiérrez X., Marcano J. H.
SCRS/2016/067	Review of operation and albacore catch by Japanese longline fishery including recent status in the Atlantic	Matsumoto *et al.*
SCRS/2016/068	Updating of standardized CPUE for North and South Atlantic albacore by the Japanese longline fishery	Matsumoto *et al.*
SCRS/2016/069	Stock assessment for South Atlantic albacore using a non-equilibrium production model	Matsumoto *et al.*
SCRS/2016/073	Standardized North Atlantic albacore (*Thunnus alalunga*) CPUEs from the Spanish baitboat fleet, period: 1981-2014	Ortiz de Zárate V., Ortiz M. and Pérez B.
SCRS/2016/074	Standardized North Atlantic albacore (*Thunnus alalunga*) CPUEs from the Spanish troll fleet, period: 1981-2014	Ortiz de Zárate V., Ortiz M. and Pérez B.
SCRS/2016/077	Standardization of the Catch Per Unit Effort For albacore (*Thunnus alalunga*) for the South African tuna pole-line (baitboat) fleet for the time series 2003-2015	Winker H., Kerwath S.E. and West W.M.
SCRS/2016/078	CPUE standardization on northern Atlantic albacore caught by Taiwanese longliners, 1967 to 2015	Chang F.-C.
SCRS/2016/079	CPUE standardization on southern Atlantic albacore caught by Taiwanese longliners, 1967 to 2015	Chang F.-C.
SCRS/2016/080	Updated standardized indices of albacore tuna, *Thunnus alalunga*, from the United States pelagic longline fishery	Lauretta M.V.
SCRS/2016/082	Updated fishery statistics for bigeye, skipjack and albacore tunas from Madeira archipelago	Gouveia L., Amorim A., Alves A. and Hermida M.

SCRS/2016/085	Catch and effort analysis of the Atlantic albacore caught by Japanese longliners in the period between 1960 and 1975	Yokawa K., Shiozaki K., Kanaiwa M. and Matsumoto T.
SCRS/2016/086	Catch and effort analysis of the northern Atlantic albacore caught by Japanese longliners in the period between 1975 and 1993	Yokawa K., Shiozaki K., Kanaiwa M. and Matsumoto T.
SCRS/2016/087	Standardized CPUE of the north Atlantic albacore caught by Japanese longliners in the proposed core area	Kanaiwa M., Yokawa K., Matsumoto T. and Kimoto A.
SCRS/2016/089	Standardized catch rates of albacore (*Thunnus alalunga*) caught by the Brazilian fleet (1978-2012) using Generalized Linear Mixed Models (GLMM) – Delta Log approach	Sant'Ana R., Hazin H.G., Hazin F.H.V, Mourato B., Andrade H.A. and Travassos P.
SCRS/P/2016/021	Defining risk and evaluating limit reference points using a simple simulation model	Sharma R.