5.1 ALB – ATLANTIC ALBACORE

The status of the North and South Atlantic albacore stocks is based on the analyses conducted in July 2020 by means of using the available data up to 2018. Complete information on the assessment can be found in the Report of the 2020 ICCAT North and South Atlantic Albacore Stock Assessment Meeting (Anon. 2020a).

The status of the Mediterranean albacore stock is based on the 2017 assessment using available data up to 2015. Complete information is found in the Report of the 2017 ICCAT Albacore Species Group Intersessional Meeting (including assessment of Mediterranean albacore) (Anon. 2017).

ALB-1. Biology

Albacore is a temperate tuna widely distributed throughout the Atlantic Ocean and Mediterranean Sea. On the basis of the biological information available for assessment purposes, the existence of three stocks is assumed: northern and southern Atlantic stocks (separated at 5°N) and a Mediterranean stock (**ALB-Figure 1**). However, some studies support the hypothesis that various sub populations of albacore exist in the North Atlantic and Mediterranean. Likewise, there is likely intermingling of Indian Ocean and South Atlantic immature albacore which needs further research.

Scientific studies on albacore stocks, in the North Atlantic, North Pacific and the Mediterranean, suggest that environmental variability may have a serious potential impact on albacore stocks, affecting fisheries by changing the fishing grounds, as well as productivity levels and potential MSY of the stocks. Those yet sufficiently unexplored aspects might explain recently observed changes in fisheries, such as the lack of availability of the resource in the Bay of Biscay in some years, or the apparent decline in the estimated recruitment which are demanding focussed research.

The expected life-span for albacore is around 15 years. While albacore is a temperate species, spawning in the Atlantic occurs in tropical waters. Present available knowledge on habitat, distribution, spawning areas and maturity of Atlantic albacore is based on limited studies, mostly from past decades. In the Mediterranean, there is a need to integrate different available studies so as to better characterize growth of Mediterranean albacore. Besides some additional recent studies on maturity, in general, there is poor knowledge about Mediterranean albacore biology and ecology in some areas.

More information on albacore biology and ecology is published in the *ICCAT Manual*.

ALB-2. Description of fisheries or fishery indicators

North Atlantic

The northern stock is exploited by surface fisheries targeting mainly immature and sub-adult fish (50 cm to 90 cm FL) and longline fisheries targeting immature and adult albacore (60 cm to 130 cm FL). The main surface fisheries are carried out by EU fleets (Ireland, France, Portugal and Spain) in the Bay of Biscay, in the adjacent waters of the Northeast Atlantic, including the Azores Islands in summer and autumn, and in the vicinity of the Canary Islands year around. The main longline fleet is the Chinese Taipei fleet which operates in the central and western North Atlantic year around. However, Chinese Taipei fishing effort decreased in the late 1980s due to a shift towards targeting tropical tunas, and then continued at this lower level to the present. Over time, the relative contribution of different fleets to the total catch of North Atlantic albacore has changed, which resulted in differential effects on the age structure of the stock. Since the 1980s, a reduction of the area fished for albacore was observed for both longline and surface fisheries.

Total reported landings, steadily increased since 1930 to peak above 60,000 t in the early 1960s, declining afterwards, largely due to a reduction of fishing effort by the traditional surface (troll and baitboat) and longline fisheries (**ALB-Table 1**; **ALB-Figure 2**). Some stabilization was observed in the 1990s and early 2000s, mainly due to increased effort and catch by new surface fisheries (driftnet and mid-water pair pelagic trawl). The lowest catch level of the whole time series was observed in 2009 with 15,375 t, but catches have substantially increased since then, and have fluctuated around the TAC in the last few years.

The preliminary total reported catch in 2019 was 34,772 t (above the TAC of 33,600 t), and the catch in the last five years has remained around 30,000 t. During the last years, the surface fisheries contributed to approximately 80% of the total catch (**ALB-Table 1**). The reported catch for 2019, when compared with the average of the last five years, was higher for EU-Spain, EU-Ireland and EU-France.

Longline catch contributed to approximately 15% of the total catch during the last five years. During the last decades, both Chinese Taipei and Japan have reduced their fishing effort directed to albacore. In the case of Japan, albacore was taken mainly as by-catch. The catch reported in 2019 for Japan and for Chinese Taipei was above the last 5-year average.

South Atlantic

During the last decades, the total annual South Atlantic albacore landings were largely attributed to five fisheries, namely the surface baitboat fleets of South Africa and Namibia, and the longline fleets of Chinese Taipei, Brazil and Japan (**ALB-Table 1**; **ALB-Figure 2**). The surface fleets are albacore directed and mainly catch sub-adult fish (70 cm to 90 cm FL). These surface fisheries operate seasonally, from October to May, when albacore is available in coastal waters. The longline Chinese Taipei fleet operates over a larger area and throughout the year, consisting of vessels that target albacore and vessels that take albacore as by-catch, in bigeye directed fishing operations. On average, the longline vessels catch larger albacore (60 cm to 120 cm FL) than the surface fleets.

Albacore landings increased sharply since the mid-1950s to reach values oscillating around 25,000 t between the mid-1960s and the 1980s, 35,000 t until the last decade when they oscillated around 20,000 t. However, total reported albacore landings for 2017 decreased to 13,825 t, which is among the lowest values in the time series. The preliminary total reported catch in 2019 was 15,640 t. The Chinese Taipei catch in the last years has decreased compared to historical catches, mainly due to a decrease in fishing effort targeting albacore.

In 2019, the estimated South African and Namibian catch (mainly baitboats) was below the average of the last five years. During the last decades, Japan took albacore as bycatch using longline gear, but recently Japan is again targeting albacore and increased the fishing effort in waters off South Africa and Namibia (20˚-40˚S). Thus, catches during the last decade have substantially increased compared to those in the last few decades.

Mediterranean

During the last assessment, the catch series was revisited, and after revision, some series were included in the ICCAT database. In 2019, the reported landings were 2,402 t, below those in the last decade (**ALB-Table 1** and **ALB-Figure 2**). The majority of the catch came from longline fisheries. EU-Italy is the main producer of Mediterranean albacore, with around 50% of the catch during the last 10 years. In 2019 the Italian catch remained similar to the last five years average. 2015 was an unusual year in that the fishing pattern was very different as compared to previous years, possibly related to the anticipation of management measures directed to Mediterranean swordfish that modified the fishing strategy in 2015. Therefore, the relative abundance estimates for 2015 CPUE indices were not used in the assessment.

ALB-3. State of stocks

North Atlantic

In the 2013 benchmark stock assessment, several model formulations (Multifan-CL, Stock Synthesis, VPA and ASPIC) with varying degrees of complexity were used. This allowed the modeling of different scenarios that represented different hypotheses, and the characterization of 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, and no model indicated that the stock was undergoing overfishing. The analyses conducted in 2013 involved a large amount of data preparation and scrutiny, and the Committee suggested that future assessment updates could be conducted using simpler models (e.g. production models).

Thus, in 2016 a production model was used to assess the stock status. A thorough revision of North Atlantic Task 1 data was conducted and catch rate analyses were improved and updated with new information for the northern albacore fisheries up to and including data to 2014. Decisions on the final specifications of the base case model were guided by first principles (e.g. knowledge of the fisheries) and data exploration (e.g. correlation between indices). The management procedure (MP) tested within the Management Strategy Evaluation (MSE) was similar to the process followed during the 2016 assessment. Thus, in 2020, the same assessment approach was replicated in order to provide advice according to the MP. The results of these efforts are reflected in the following summaries of stock status that analyzed data through 2018.

The same five CPUE indices (four longline and one baitboat) were used in a production model framework, using the same model configuration as the 2016 assessment (**ALB-Figure 3**). Despite their variable pattern, these indices showed an overall increasing trend during the last decade.

The biomass dynamic model results suggest a biomass drop between 1930 and the 1990s and a recovery since then, while fishing mortality decreases. Relative to MSY benchmarks, the base case scenario estimates that the stock remained slightly overfished with B below B_{MSY} between the late 1970s and the 2000s, but has now recovered to levels well above B_{MSY} (**ALB-Figure 4**). Peak relative fishing mortality levels in the order of 1.66 were observed in the early 1980s but overfishing stopped in the early 2000s, with the current F_{2018}/F_{MSY} ratio being 0.62. The uncertainty around the current stock status has a clear shape determined by the strong correlation between parameters 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 98.4% while the probability of being in the yellow area (overfished, $B<B_{MSY}$) is 1.66%. The probability of being in the red area (overfished and undergoing overfishing, $F>F_{MSY}$ and $B<B_{MSY}$) is 0% (**ALB-Figure 4**).

Sensitivity analyses revealed that recent stock status indicators are not very sensitive to removing some individual CPUE data points and that the B/B_{MSY} trajectory showed minimal changes when removing up to 3 years of data at the end of the series, whereas removing 4 years yielded a similar result to the last assessment.

Historical trends of biomass levels are lower than the estimates from the 2016 stock assessment. This is not unexpected and the MSE accounts for this type of behavior. None the less, biomass is still estimated to have been increasing since the 1990s. The stock is estimated to be in the green area of the Kobe plot with very high probability.

South Atlantic

In 2020, a stock assessment of South Atlantic albacore was conducted including catch and effort data up until 2018, and considering similar methods as in the previous assessment.

For the South Atlantic stock, the standardized CPUE indices are mainly based on longline fisheries, which catch mostly adult albacore. The same three longline CPUEs that were used in 2016 were also selected to update the 2020 stock assessment results. The longest time series of Chinese Taipei showed a strong declining trend in the early part of the time series followed by a less steep decline over the next three decades (similar to the Japanese longline index), and an increasing trend since the early 2000s. The Uruguayan longline CPUE series showed a decrease since the 1980s (**ALB-Figure 5**). The Chinese Taipei CPUE was the only index that informed stock trends in recent years. In addition, standardized CPUE series from the Brazilian longline (2002-2018) and the South African baitboat fishery were made available, which were used for sensitivity analyses.

In the 2020 assessment the Committee selected a base case to best represent the population dynamics of albacore and uncertainty around stock status as well as impact of alternative fishing scenarios. Base case model results suggest that biomass increased since fishing mortality started to decrease in the early 2000s, and currently there is a 99.4% probability that the South Atlantic albacore stock is neither overfished nor subject to overfishing, with only 0.6% probability for the stock to be overfished. The median MSY value was 27,264 t (ranging between 23,734 t and 31,567 t), the median estimate of current B_{2018}/B_{MSY} was 1.58 (ranging between 1.14 and 2.05) and the median estimate of current F_{2018}/F_{MSY} was 0.40 (ranging between 0.28 and 0.59). The wide confidence intervals reflect the large uncertainty around the estimates of stock status (**ALB-Figure 6**).

Mediterranean

In 2017, the stock assessment for Mediterranean albacore was conducted using catch data up until 2015 and CPUE data up until 2014. The methods used were coherent with the "limited data" category of this stock. The methods applied included a length-based catch curve analysis and a Bayesian state space surplus production model (JABBA).

Two standardized CPUE series for EU-Spain and EU-Italy longline fisheries were used during this last assessment (**ALB-Figure 7**). In addition, a larval index independent of the fishery, providing information on the trends of the spawning biomass, was used. These indices showed a general decreasing trend for the period 2010-2014.

The results of the 2017 assessment, based on the limited information available, show that the status of the stock is highly uncertain with respect to both fishing mortality and biomass. Despite the high uncertainty, the results would seem to indicate that recent albacore median biomass levels are at about $B_{MSY,}$ and median fishing mortality levels are below F_{MSY} (**ALB-Figure 8A**). The probability of being in the red, yellow, orange and green parts of the Kobe plot is 35.7%, 14.1%, 1.7% and 48.5%, respectively (**ALB-Figure 8B**).

However, the Committee noted the lack of CPUE estimates in 2015. Given the recent downward trends of the available series, it is very important to corroborate, in the coming years, whether this trend continues or not. However, the Committee reiterates that the ability to monitor stock trends is limited, and that the currently used fishery dependent indices might be affected by the ban imposed as part of the swordfish recovery plan.

During 2018-2020, two of the three indices used in the last evaluation (the larval index and the Spanish longline index), as well as a new one from the Spanish recreational fishery have been updated. The larval index showed a general decreasing trend in the last years (2012-2016). Both the Spanish longline and the Spanish recreational indices showed a relatively stable trend for the most recent period (2014-2018).

ALB-4. Outlook

North Atlantic

In 2017, the Commission adopted a Harvest Control Rule (HCR) for North Atlantic albacore and used it to set a 3-year (2018-2020) TAC (Rec 17-04). Using MSE, this HCR was tested as part of an MP prior to and since adoption. The MP uses the results of a production model with parameters and indices similar to those used in the 2016 assessment. The MSE results suggest that managing the stock according to the tested MP would meet the management objectives for this stock (Rec 16-06), i.e. to be in the green quadrant of the Kobe plot with a probability higher than 60%. As with every MSE process, MP and MSE testing can be further improved and expanded in the future (see workplan). In addition, the adopted HCR could be converted into a full MP as detailed in **ALB-Table 3**.

Since 2018, the HCR adopted in Rec. 17-04 was tested together with variants accounting for i) the carry over, ii) the effect of setting a lower TAC limit of 15,000 t, iii) the effect of applying the 20% stability clause when $B_{CUR}>B_{LIM}$, iv) the effect of 20% maximum TAC reduction and 25% maximum TAC increase when $B_{LIM}<B_{CUR}<B_{THR}$, v) the effect of 20% maximum TAC reduction and 25% maximum TAC increase when $B_{CUR}>B_{LIM,}$ and vi) the absences of one or more indices for the stock assessment. Results indicate that the HCR adopted in Rec. 17-04 and all the above tested variants achieve ICCAT's management objective of maintaining stocks in the green quadrant of the Kobe plot with at least 60% probability. Compared to a perfect implementation of the TAC, the carry over scenario (i) produced lower yield and stability, but better stock condition and safety. Historically, catch has remained below TAC in most of the years and has only occasionally been slightly above the TAC (see **ALB-Figure 2**). The carry over effect was tested assuming that these historical differences between catch and TAC would remain in the future, and the Committee notes that the results of the analyses might differ under other assumptions. The other variants tested (ii, iii, iv, v) led to more stability together with comparable yield and while meeting the objective of being in green area of the Kobe plot with more than 60% probability (**ALB-Figure 10**).

It should be noted that there are some differences between the 2020 stock assessment process and the MP tested within the MSE. Examples of differences include 1) the use of five indices rather than four, 2) the availability of catch and indices only until two years prior, rather than one year prior, and 3) an index evaluation process that resulted in some index values for some years being excluded based on the judgement that they were not reflective of abundance trends. However, the Committee considered that these differences were not sufficient to preclude the use of the 2020 stock assessment results to set the TAC for the next 3 years by applying the interim HCR. As discussed in the Workplan, the Committee intends to develop a new MSE that will further address these issues.

The harvest control rule applied to the current biomass (B_{2019} in the Summary Table below) estimated in the 2020 stock assessment results in a TAC of 37,801 t for 2021-2023. This represents a 12.5% increase with respect to the previous one and is in line with the positive stock status estimated in the 2020 assessment. If the Commission would select any of the variants mentioned in the paragraph above, the resulting TAC would be the same. It is noted that this TAC for 2021-2023 is above the MSY estimate for this stock (36,816 t); this is because the current biomass is well above BMSY (B_{2019}/B_{MSY} = 1.32), and therefore this level of catch can be sustained in the near term.

South Atlantic

The Kobe matrix indicates that catches around the MSY level of 27,000 tons will maintain biomass levels above B_{MSY} and fishing mortality below F_{MSY} with a high probability of 90% over the projection horizon through 2033 (**ALB-Table 2**). In fact, due to the current high stock biomass, catches of up to 30,000 tons are expected to maintain stock levels above B_{MSY} until 2033 with a probability higher than 60%. However, it is important to note that these catch levels would exceed MSY and it would require a reduction in TAC after 2033 to prevent overfishing (**ALB-Table 2**).

Mediterranean

Due to the limited quantitative information available to the SCRS, the sensitivity of the stock assessment to different sources of information, and the limited prediction skill of the assessment model, the projections for this stock were not conducted. As a result, future stock status in response to constant catch levels could not be quantified.

ALB-5. Effect of current regulations

North Atlantic

In 2017, the Commission adopted the interim HCR described in **ALB-Figure 9**, with a maximum TAC of 50,000 t and a maximum change of 20% when $B_{CUR}>B_{THR}$. Its application established a TAC of 33,600 t for 2018-2020 (Rec. 17-04) and the possibility to carry over some unused portions of the quotas to be caught later in time (Rec. 16-06) remained. The Committee noted that, since the establishment of the TAC in the year 2001, catch remained substantially below the TAC in all but four years (**ALB-Figure 2**), which might have accelerated rebuilding over the last decade. The bulk of the catch is caught by traditional surface fisheries operating in the Bay of Biscay and surrounding waters. Thus, it is likely that the fluctuations in catches reflect the fluctuations in the availability of the resource to those local regional fisheries, and the carry over allows to compensate the fleets for the years when the stock was less available.

Furthermore, Rec. 98-08 that limits fishing capacity to the average of 1993-1995, remains in force. The effect of this recommendation has not been evaluated but a general decrease of fishing mortality has been observed since its implementation.

South Atlantic

In 2016 the Commission established a new TAC of 24,000 t for 2017-2020 (Rec. 16-07). The Committee noted that, since 2004, reported catches remained below 24,000 t, except in 2006, 2011 and 2012, where reported catches were slightly above this value (**ALB-Table 1**). The Committee did not test for the effect of perfect implementation of the TAC since 2004.

Mediterranean

In 2017 the Commission adopted Rec. 17-05, according to which, no increase in catch and fishing effort is allowed until more accurate scientific advice can be provided by the SCRS. Moreover, a time closure of two months (1 October - 30 November), originally aimed at protecting Mediterranean swordfish juveniles, applies to the longline fleet targeting albacore in the Mediterranean from 2017 onwards. Furthermore, the number of vessels for each CPC is limited to the number of vessels that were authorized to target Mediterranean albacore in 2017 under Rec. 16-05.

ALB-6. Management recommendations

North Atlantic

Recommendation 16-06 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 as soon as possible, while maximizing average catch and minimizing inter-annual fluctuations in TAC levels.

In the 2020 assessment, the Committee noted that the relative abundance of North Atlantic albacore has continued to increase over the last decade and is estimated to be in the green area of the Kobe plot with 98% probability. In 2018, an external peer review was conducted confirming that, overall, the MSE framework appears to be scientifically sound and robust to uncertainty. Thus, the interim HCR adopted by the Commission in 2017 had a robust scientific basis. On this basis, and considering that no exceptional circumstances have been detected using the proposed indicators, the Committee recommends to apply the HCR to the current biomass (B_{2019} in the Summary Table below) estimates to set next TAC for the 2021-2023 period. The recommended TAC obtained by applying the HCR is 37,801 t, which represents a 12.5% increase with respect to the previous one.

Likewise, the additional analyses conducted by the species group in 2018 and 2019 are based on the same MSE framework and suggest that the Commission could adopt alternative harvest control rules to provide additional stability to the fisheries while meeting management objectives. These alternatives include applying the restriction of 20% maximum TAC change when B is estimated to be higher than B_{LIM}, and applying the restriction of 20% maximum TAC reduction and 25% maximum TAC increase when B is estimated to be higher than B_{LIM}. On the other hand, the Committee noted that imposing the minimum TAC of 15,000 t would also meet management objectives, but would override the application of paragraph 7.c of Rec. 17-04 (with current estimates of B_{MSY}, F_{MSY} and MSY) and would no longer follow the graphic form of the HCR (**ALB-Figure 9**). Results also showed that this scenario scored lowest in stock status indicators.

In view of adopting a long-term management procedure (paragraph 17 of Rec 17-04), the Commission would need to select one HCR (either the interim one or one of the variants tested by the SCRS), plus the specifications of the stock assessment procedure. As for the latter, and while additional management procedures are tested in the future, the Committee recommends specifying the elements of the current stock assessment approach, as specified in **ALB-Table 3**. Should the Commission consider adopting an Exceptional Circumstances protocol, the Committee recommends using the indicators provided in the detailed report of the 2020 intersessional meeting (Anon. 2020a).

South Atlantic

Results indicate that, most probably, the South Atlantic albacore stock is not overfished and that overfishing is not occurring. Projections at a level consistent with the MSY (27,264 t) showed that probabilities of being in the green quadrant of the Kobe plot would remain very high (90%) by 2033. In fact, due to the current high stock biomass, catches of up to 30,000 tons are expected to maintain stock levels above B_{MSY} until 2033 with a probability higher than 60%. However, it is important to note that these catch levels exceed MSY and it would require a reduction in TAC after 2033 to prevent overfishing (**ALB-Table 2**).

Mediterranean

Unfortunately, limited quantitative information is available to the SCRS for use in conducting a robust quantitative characterization on biomass status relative to Convention objectives. Recent fishing mortality levels appear to be below F_{MSY}, and current biomass is approximately at B_{MSY} level. However, there is considerable uncertainty about current stock status. For this reason, the Commission should maintain management measures designed to avoid increases in catch and effort directed at Mediterranean albacore. The analyses suggest that catch levels as high as those in the years 2006-2007 (beyond 5,900 t) proved to be clearly unsustainable. Moreover, recent average catches for this stock are close to the estimated MSY.

Considering the high uncertainty regarding the most recent abundance trends, the Committee recommends maintaining catches below MSY at least until these abundance trends are further updated. The precise level of catch would depend on the level of risk the Commission is willing to take.

ATLANTIC AND MEDITERRANEAN ALBACORE SUMMARY			
	North Atlantic	**South Atlantic**	**Mediterranean**
Maximum Sustainable Yield	36,816 t (35,761 - 38,039)[1]	27,264 t (23,734 - 31,567)[2]	3,419 t (2,187 - 7,842)[2]
Current (2019) Yield	34,772 t	15,640 t	2,402 t
Yield in last year of assessment (2018)	29,691 t	17,098 t	
Yield in last year of assessment (2015)			2,774 t
B_{MSY}	392,556 t (349,403 - 405,097)[1]	124,453 t (79,611-223,424) [2]	29,168 t (17,939-65,861)[2]
F_{MSY}	0.093 (0.091-0.108)[1]	0.219 (0.116-0.356) [2]	0.119 (0.072-0.192)[2]
B_{2019}[3]	508,074 t (425,273 - 602,157)[1]		
$B_{current}/B_{MSY}$	1.32 (1.13 - 1.51)[4]	1.58 (1.14 - 2.05)[5]	1.002 (0.456 - 1.760)[6]
B_{2019}/B_{LIM}[7]	3.30 (2.83 - 3.78)[1]		
$F_{current}/F_{MSY}$	0.62 (0.52 - 0.74)[8]	0.40 (0.28 - 0.59)[9]	0.830 (0.223-2.194)[10]
Stock Status	Overfished: NO Overfishing: NO	Overfished: NO Overfishing: NO	Overfished: NOT LIKELY Overfishing: NOT LIKELY
Management measures in effect:	Rec. 98-08: Limit number of vessels to 1993-1995 average. Rec. 17-04: TAC of 33,600 t for 2018-2020, according to interim HCR. Management objective is to keep the stock in (or rebuild it to) the green area of the Kobe plot with 60% probability, while maximizing catch and reducing variability of TAC.	Rec. 16-07: TAC of 24,000 t for 2017-2020	Rec. 17-05: Time closure of two months (1 October- 30 November) for longlines, aimed at protecting the Mediterranean swordfish juveniles. A list of vessels authorized to target Mediterranean albacore implemented in 2017. No increase of catch and effort until more accurate advice is delivered.
Recommended TAC for the period 2021-2023 as estimated following the HCR adopted in Rec. 17-04	37,801 t		

[1] Median and 80% CI for the base case.

[2] Median and 95% CI for the base case.

[3] The assessment model estimates the biomass at the beginning of the year following the last year of data, this is $B_{current}$ as referred in Rec. [17-04].

[4] B_{2019}/B_{MSY} Median and 80% CI for the base case.

[5] B_{2018}/ B_{MSY} Median and 95% CI for the base case.

[6] B_{2015}/ B_{MSY} Median and 95% CI for the base case.

[7] The interim B_{LIM} is $0.4*B_{MSY}$.

[8] F_{2018}/F_{MSY} Median and 80% CI for the base case

[9] F_{2018}/F_{MSY} Median and 95% CI for the base case

[10] F_{2014}/F_{MSY} Median and 95% CI for the base case

ALB-Table 1. Estimated catches (t) of albacore (*Thunnus alalunga*) by area, gear and flag.

				1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
TOTAL				67491	56326	69615	73086	71812	67517	60379	59585	59039	67063	70088	69919	60095	61470	53379	57763	67407	48794	42320	41663	40764	48743	53000	45814	42757	44304	48995	45006	49223	52813
	ATN			36881	27931	30851	38135	35163	38377	28803	29023	25746	34551	33124	26253	22741	25567	25960	35318	36989	21991	20483	15375	19416	19985	25672	24854	26655	25551	30340	28401	29691	34772
	ATS			28714	26016	36562	32813	35300	27552	28426	28022	30595	27656	31387	38796	31746	28005	22545	18916	24453	20283	18867	22265	19225	24129	25282	19457	13702	15199	14336	13825	17098	15640
	MED			1896	2379	2202	2138	1349	1587	3150	2541	2698	4856	5577	4870	5608	7898	4874	3529	5965	6520	2970	4024	2124	4628	2047	1503	2400	3554	4319	2780	2434	2402
Landings	ATN	Bait boat		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	9265	14455	12196	11330	14024
		Longline		2683	5315	3152	7093	7309	4859	4641	4051	4035	6710	7321	7372	6235	7826	7037	6911	5223	3237	2647	2619	3913	3666	3759	6514	3093	4458	5394	4951	4473	4630
		Other surf.		3865	3999	5173	7279	7506	3555	3337	4378	6846	6817	5971	2828	365	470	577	624	625	525	274	427	231	359	344	816	163	136	95	138	62	156
		Purse seine		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	115	45	38	39	65
		Trawl		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	5771	6299	6611	8820	10816
		Troll		10675	8959	7348	6109	5959	10226	6652	7870	5894	6845	5023	4312	4009	5373	7501	10224	10296	6105	5239	4440	7146	3578	5909	5891	6660	5597	3753	4165	4807	4930
	ATS	Bait boat		5982	3459	6518	7379	9339	7091	6960	8110	10353	6709	6873	10355	9712	6976	7477	5119	5938	3421	4443	8007	3750	6058	6933	5213	4765	4965	2949	1846	3228	2852
		Longline		21590	22025	27167	23950	24806	20040	21000	19547	19799	20640	24398	28039	21671	20626	14735	12977	17740	15087	13218	12113	13471	16445	17846	13888	8888	10104	11243	11674	13767	12612
		Other surf.		1138	115	360	36	91	10	209	127	0	73	58	377	323	82	299	288	333	1716	1125	1985	1648	1418	64	264	7	0	108	114	84	134
		Purse seine		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	129	36	190	19	3
		Trawl		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	0	0	0	0	
	MED	Bait boat		83	499	171	231	81	163	205	0	33	96	88	77	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Longline		624	524	442	410	350	87	391	348	194	416	2796	2597	3704	4248	2335	1997	3026	4101	2694	2160	1719	2327	1959	1392	2343	3235	4258	2706	2378	2365
		Other surf.		1098	1198	1533	879	766	1031	2435	1991	2426	4271	2693	2196	1757	46	87	169	134	182	246	634	404	1408	8	18	27	58	29	46	40	13
		Purse seine		91	110	6	559	23	0	0	0	0	0	0	0	1	3557	2452	1362	2803	2237	24	1230	0	869	68	86	14	247	7	26	14	18
		Trawl		0	0	0	0	0	0	0	0	0	0	0	0	0	48	0	0	0	0	5	0	0	0	0	0	5	4	9	0	2	1
		Troll		0	48	50	59	129	306	119	202	45	73	0	0	117	0	0	0	1	0	1	0	1	0	6	0	3	0	0	2	1	6
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	93	179	209	300	302	160	151	
	ATS	Longline		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	0	39
		Purse seine		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	MED	Longline		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	6	7	8	10	16	0	0	
Landings	ATN CP	Barbados		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	16	38	32	15	7
		Belize		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	1	399	448	385	216
		Brazil		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	0	0	0	0	
		Canada		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	32	20	17	26	31
		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	5	0	0	0	
		China PR		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	21	103	124	124	129
		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	0	12	
		Côte d'Ivoire		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	0	151	549	0	76
		EU.España		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	14126	17077	13964	15691	16536
		EU.France		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	3441	4224	4191	5824	7881
		EU.Ireland		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	2337	2492	3102	3213
		EU.Netherlands		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	0	0	0	0	
		EU.Portugal		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	929	1111	2527	498	2493
		EU.United Kingdom		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	0	0	0	0
		FR.St Pierre et Miquelon		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	0	0	0	0	
		Grenada		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	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	3	0	0	0	0	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	
		Japan		737	691	466	485	505	386	466	414	446	425	688	1126	711	680	893	1336	781	288	402	288	525	336	400	1745	267	276	297	366	196	350
		Korea Rep.		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	5	13	8	27	48
		Liberia		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	90	3	
		Maroc		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	0	20	20	20	25
		Mexico		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	1	2	0	7	0
		Panama		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	103	200	0	196	198
		Philippines		0	0	0	0	0	0	0	0	151	4	0	0	0	0	0	0	9	0	8	19	54	0	0	83	0	0	0	0	0	
		Senegal		0	0	0	0	0	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
		Sierra Leone		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	0	0	0	0	
		St. Vincent and Grenadines		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	305	291	297	173	180
		Trinidad and Tobago		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	95	71	48	33	19
		U.S.A.		357	479	438	509	741	545	472	577	829	315	406	322	480	444	646	488	400	532	257	189	221	369	409	819	458	354	250	238	103	221
		U.S.S.R.		0	0	0	0	0	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	1	0	2	2	2	0	0	1	1	0	0	0	0	0	1	0	0	1	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	2	0	0	0	0	
		Vanuatu		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	0	0	0	0	
		Venezuela		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	351	287	301	165	221
	NCC	Chinese Taipei		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	3134	2385	2926	2770
		Guyana		0	0	0	0	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	
		Suriname		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	0	0	0	0	
	NCO	Cuba		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	0	0	0	0	
		Dominica		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	1	1	0	0	
		Dominican Republic		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	0	0	0	0	
		NEI (Flag related)		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	0	0	0	0	
		Saint Kitts and Nevis		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		Sta. Lucia		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	0	2	1	0	

				1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
TOTAL				67491	56326	69615	73086	71812	67517	60379	59585	59039	67063	70088	69919	60095	61470	53379	57763	67407	48794	42320	41663	40764	48743	53000	45814	42757	44304	48995	45006	49223	52813
	ATS	CP	Angola	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	0	0	0	0	
			Belize	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	0	123	219	311	158
			Brazil	514	1113	2710	3613	1227	923	819	652	3418	1872	4411	6862	3228	2647	522	556	361	535	487	202	271	1269	2077	2016	462	490	658	497	396	1003
			Cape Verde	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	0	0	0	0	
			China PR	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	120	94	185	116	132
			Curaçao	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	1	14	10	0	
			Côte d'Ivoire	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	0	0	0	6	19
			EU.España	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	418	195	347	303	186
			EU.France	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	53	17	78	16	3
			EU.Portugal	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	1	9	9	11	3
			EU.United Kingdom	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	0	0	0	0	
			Ghana	0	0	0	0	0	0	0	0	0	0	0	0	0	53	0	0	0	5	10	14	25	0	0	0	0	0	0	0	0	
			Guatemala	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	1	3	1	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	6	0	0	0	0	1	
			Guinée Rep.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	7	74	0	0	0	0	0	0	0	
			Honduras	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	0	0	0	0	
			Japan	587	654	583	467	651	389	435	424	418	601	554	341	231	322	509	312	316	238	1370	921	973	1194	2903	3106	1131	1752	1096	1189	2985	1527
			Korea Rep.	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	4	48	86	167	170
			Maroc	0	8	92	68	24	24	0	5	4	0	0	0	14	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Namibia	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	1062	994	214	888	260
			Panama	4	240	482	318	458	228	380	53	60	14	0	0	0	0	0	17	0	87	5	6	1	0	12	3	0	6	5	13	1	
			Philippines	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	0	0	0	0	
			Senegal	0	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	24
			South Africa	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	4030	2065	1785	2572	2455
			St. Vincent and Grenadines	0	0	2	0	29	30	41	0	23	0	2116	4303	44	0	0	0	65	160	71	51	31	94	92	97	110	100	107	101	98	31
			Trinidad and Tobago	0	0	0	0	0	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
			U.S.A.	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	0	0	0	0	
			U.S.S.R.	0	0	0	0	0	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	1	5	28	38	5	82	47	18	1	1	58	12	2	3	1	35	62	46	94	81	3	120	2	2	0	0	0	0	0	
			Uruguay	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	0	0	0	0	
			Vanuatu	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	0	0	0	0	
	NCC		Chinese Taipei	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	8907	9090	9227	9626
	NCO		Argentina	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	0	0	0	0	
			Cambodia	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	0	0	0	0	
			Cuba	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	0	0	0	0	
			NEI (ETRO)	0	0	28	0	1	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			NEI (Flag related)	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	0	0	0	0	
			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	
	MED	CP	EU.Croatia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	7	12	20	30	11	7	2	2	1
			EU.Cyprus	0	0	0	0	0	0	0	0	0	0	6	0	12	30	255	425	507	712	209	223	206	222	315	350	377	495	542	568	624	652
			EU.España	84	548	227	298	218	475	429	380	126	284	152	200	209	1	138	189	382	516	238	204	277	343	389	244	283	53	51	206	71	68
			EU.France	121	140	11	64	23	3	0	5	5	0	0	0	1	0	0	0	0	2	1	0	1	2	0	0	1	1	0	0	0	15
			EU.Greece	500	500	500	1	1	0	952	741	1152	2005	1786	1840	1352	950	773	623	402	448	191	116	125	126	126	165	287	541	1332	608	522	297
			EU.Italy	1191	1191	1464	1275	1107	1109	1769	1414	1414	2561	3630	2826	4032	6913	3671	2248	4584	3970	2104	2727	1109	2501	1117	615	1353	1602	1490	1348	1044	1287
			EU.Malta	0	0	0	0	0	0	0	1	1	6	4	4	2	5	10	15	18	1	5	1	2	5	19	29	62	37	56	4	104	77
			EU.Portugal	0	0	0	0	0	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Korea Rep.	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	0	0	0	0	
			Libya	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	750	800	0	30	
			Maroc	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	120	0	0	0	0	0	0	0	0	0	
			Syria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	14	0	0	1	1	0	0	0	0	0	
			Turkey	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27	30	73	852	208	631	402	1396	62	71	0	53	25	44	38	4
	NCO		NEI (MED)	0	0	0	500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
			Yugoslavia Fed.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Discards	ATN	CP	Canada	0	0	0	0	0	0	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	
			Venezuela	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	209	300	302	160	151
	NCC		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	
	ATS	CP	EU.France	0	0	0	0	0	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	0	0	0	0	0	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
			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	
			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	
	NCC		Chinese Taipei	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	0	
	MED	CP	EU.Cyprus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	6	7	8	10	16	0	0	
			EU.España	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

ALB-Table 2. South Atlantic albacore estimated probabilities (in %) based on Bayesian surplus production model that the stock fishing mortality is below F_{MSY} (a), biomass is above B_{MSY} (b) and both (c). Projections for constant catch levels (16000 t to 34000 t) are shown.

(a) Probability $F<F_{MSY}$

TAC | Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
16000	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
20000	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
22000	100	100	100	100	100	100	100	100	100	100	99	99	99
23000	100	100	100	100	100	100	99	99	99	99	99	99	99
24000	100	100	100	99	99	99	99	99	99	99	99	98	98
25000	100	100	99	99	99	99	98	98	98	98	98	97	97
26000	99	99	99	99	98	98	98	97	97	96	95	95	94
27000	99	99	98	98	97	97	96	95	94	93	92	91	90
28000	99	98	98	97	96	95	93	92	91	89	87	86	84
29000	99	98	97	96	94	93	90	88	85	82	80	77	74
30000	98	97	96	94	91	89	85	81	78	73	70	65	62
32000	97	95	92	88	82	76	69	62	56	49	44	39	35
34000	95	91	85	77	67	57	48	40	32	27	22	19	16

(b) Probability $B>B_{MSY}$

TAC | Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
16000	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
20000	100	100	100	100	100	100	100	100	100	100	100	100	100
21000	100	100	100	99	99	99	99	99	99	99	99	99	99
22000	100	100	100	99	99	99	99	99	99	99	99	99	99
23000	100	100	100	99	99	99	99	99	99	99	99	99	98
24000	100	99	99	99	99	99	99	99	98	98	98	98	98
25000	100	100	99	99	99	99	98	98	98	98	97	97	97
26000	100	99	99	99	99	99	98	98	97	97	96	95	95
27000	100	99	99	99	98	98	97	97	96	95	94	93	92
28000	100	99	99	99	98	97	96	95	94	93	91	90	88
29000	100	99	99	98	98	97	96	94	92	90	88	85	83
30000	100	99	99	98	97	96	94	92	89	86	83	79	76
32000	100	99	99	98	96	93	89	85	80	74	68	62	56
34000	100	99	98	96	93	89	82	75	66	58	49	42	36

(c) Probability of green status ($B>B_{MSY}$ and $F<F_{MSY}$).

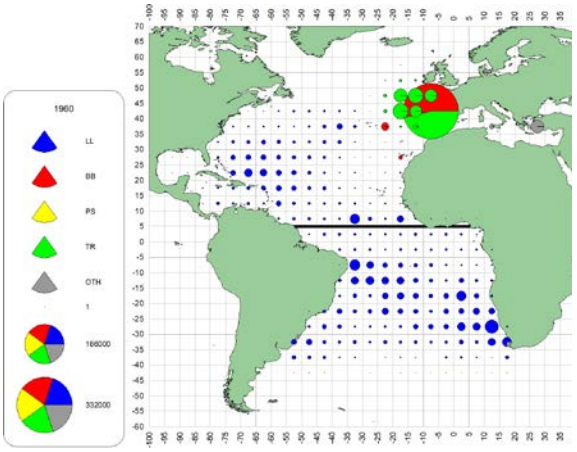
TAC | Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
16000	100	100	100	100	100	100	100	100	100	100	100	100	100
18000	100	100	100	100	100	100	100	100	100	100	100	100	100
20000	100	100	100	100	100	100	100	100	100	100	100	100	100
21000	100	100	100	99	99	99	99	99	99	99	99	99	99
22000	100	100	100	99	99	99	99	99	99	99	99	99	99
23000	100	100	99	99	99	99	99	99	99	99	99	98	98
24000	100	99	99	99	99	99	99	98	98	98	98	98	98
25000	100	99	99	99	99	98	98	98	98	97	97	97	96
26000	99	99	99	98	98	98	97	97	96	96	95	94	94
27000	99	99	98	98	97	97	96	95	94	93	92	91	90
28000	99	98	98	97	96	95	93	92	90	89	87	85	83
29000	99	98	97	96	94	93	90	88	85	82	79	77	74
30000	98	97	96	94	91	89	85	81	78	73	69	65	61
32000	97	95	92	88	82	76	69	62	56	49	44	39	35
34000	95	91	85	77	67	57	48	40	32	27	22	19	16

ALB-Table 3. North Atlantic albacore specifications for the management procedure (MP).

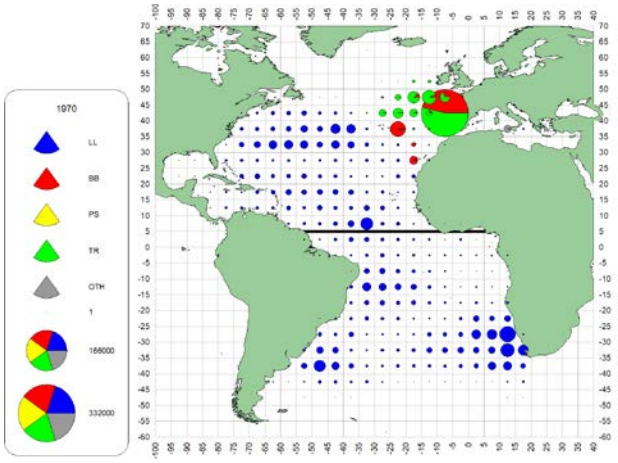
- Indices**:**

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

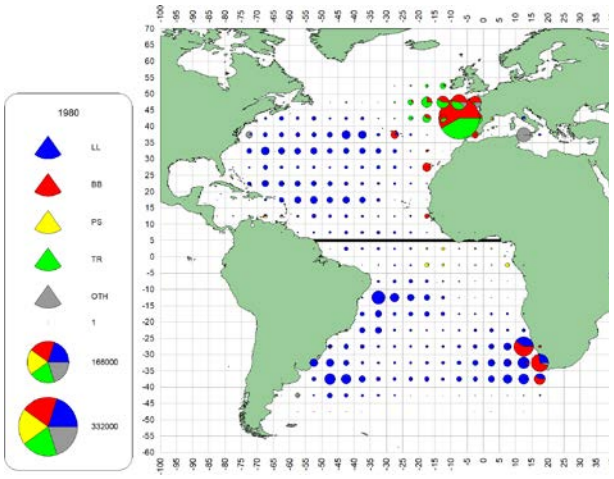
- Software: *mpb*
- Model: Fox (biomass dynamic), with the following specifications:
- Catch time series start year: 1930
- Catch and CPUE time series final year: t-1 preferably (t-2 otherwise) where *t* is the year of the MP iteration (when the TAC is set for year *t*+1, *t*+2 and *t*+3).
- Biomass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



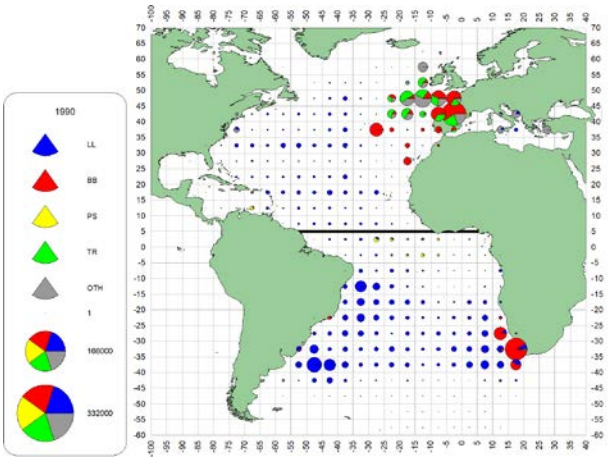
a. ALB (1960-69)



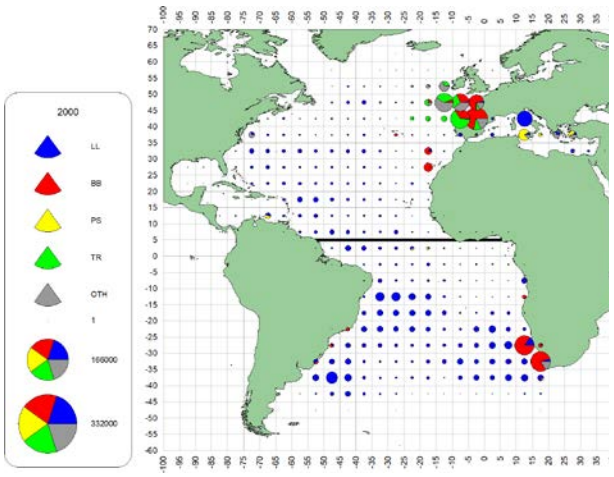
b. ALB (1970-79)



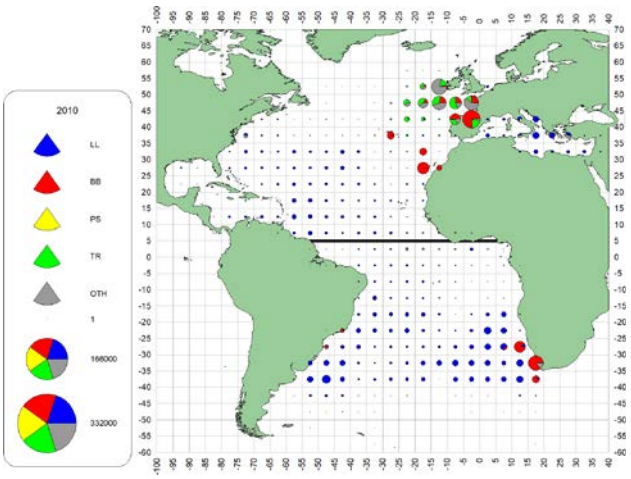
c. ALB (1980-89)



d. ALB (1990-99)

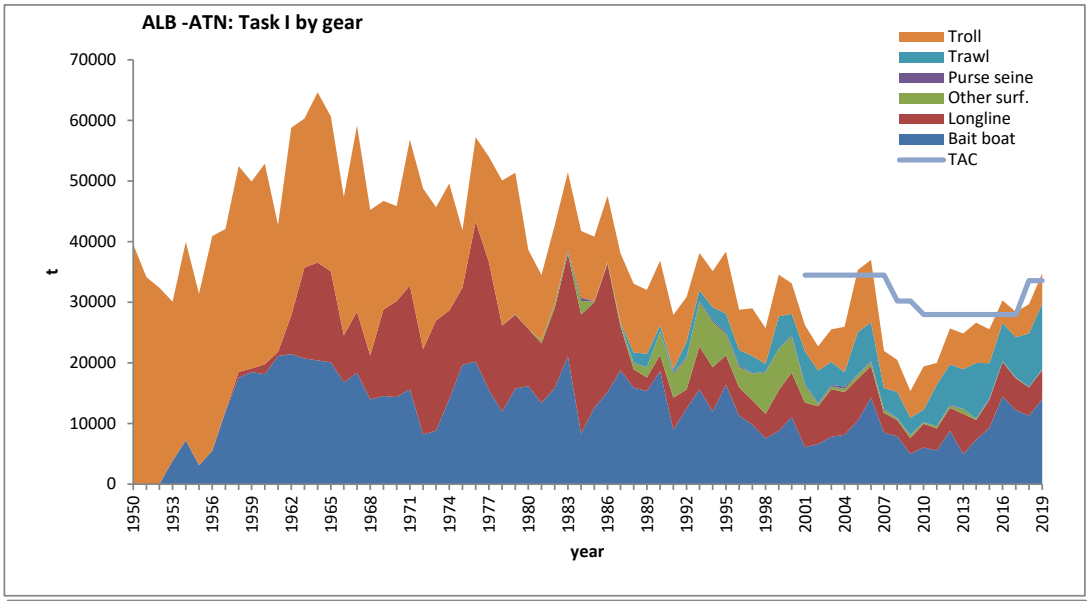


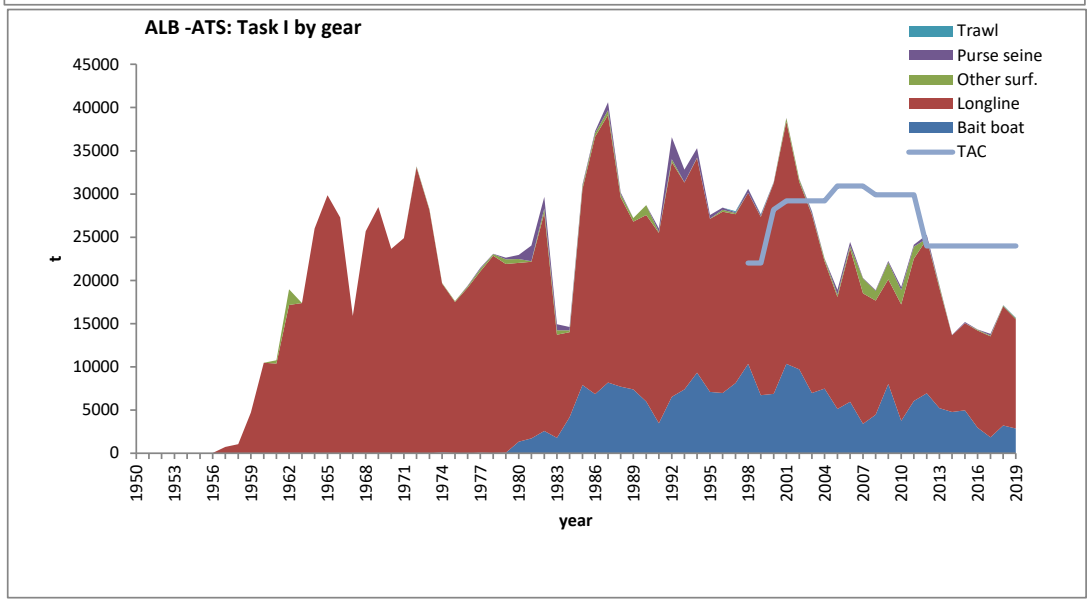
e. ALB (2000-09)

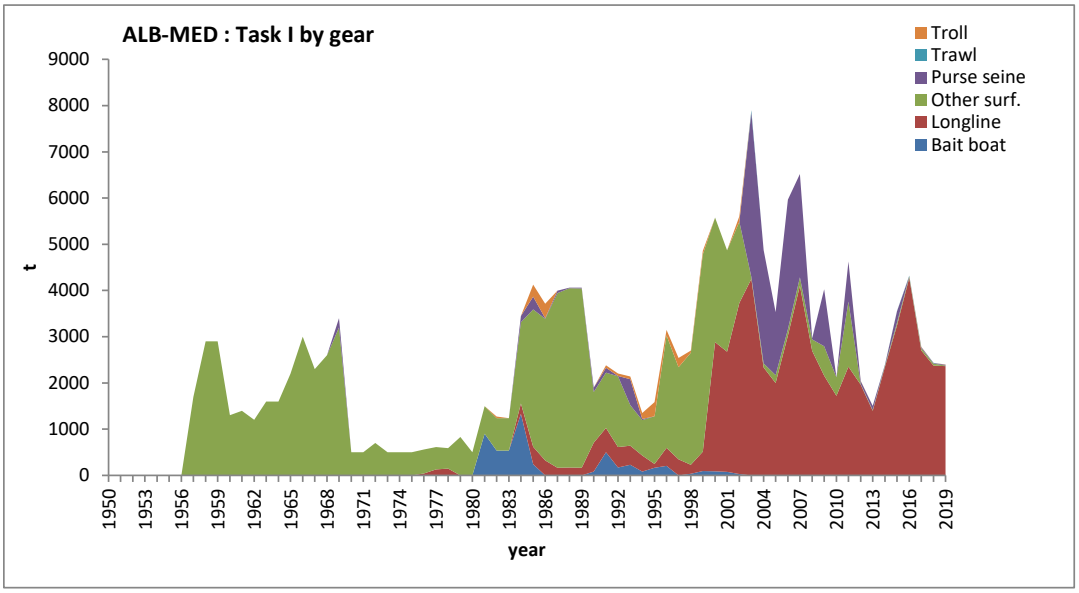


f. ALB (2010-17)

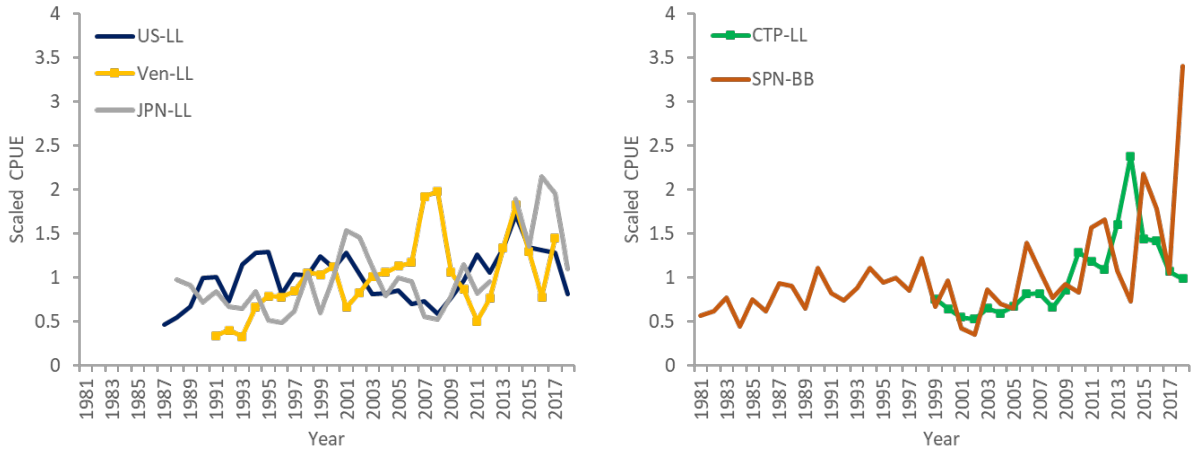
ALB-Figure 1. Geographic distribution of albacore accumulated catch by major gears and decade (1960-2018). Baitboat and troll catches prior to the 1990s, these catches were assigned to only one 5ºx5º stratum in the Bay of Biscay. Plots are scaled to the maximum catch observed from 1960 to 2017 (last decade only covers 8 years).



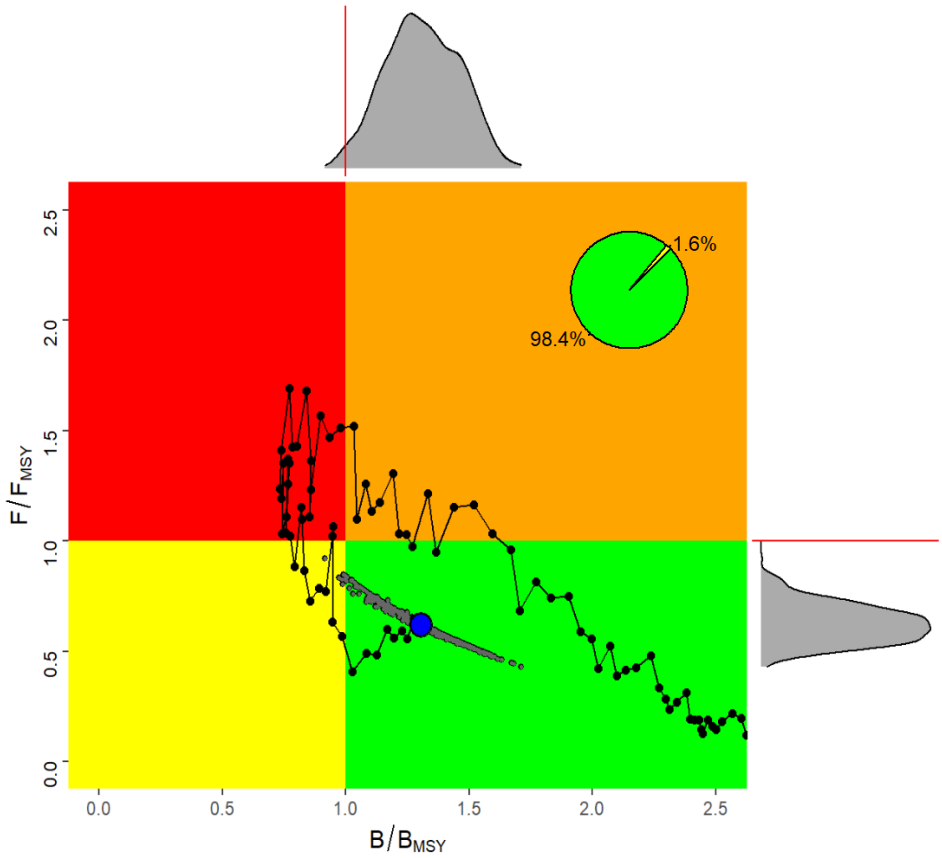




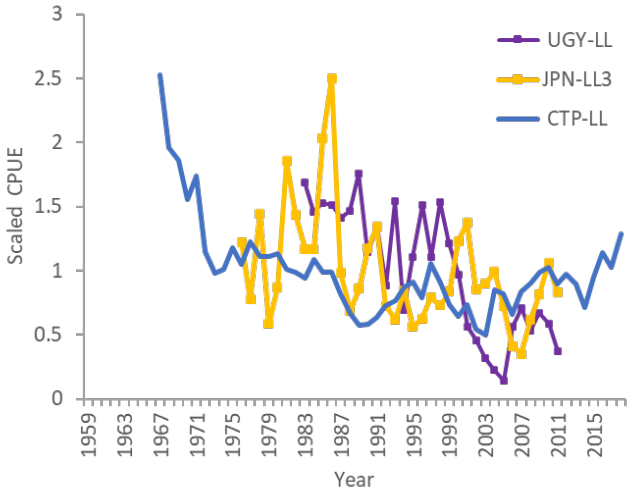
ALB-Figure 2. Total albacore catches reported to ICCAT (Task I) by gear for the northern (top), southern (middle) Atlantic stocks including TAC, and the Mediterranean (bottom) stock.



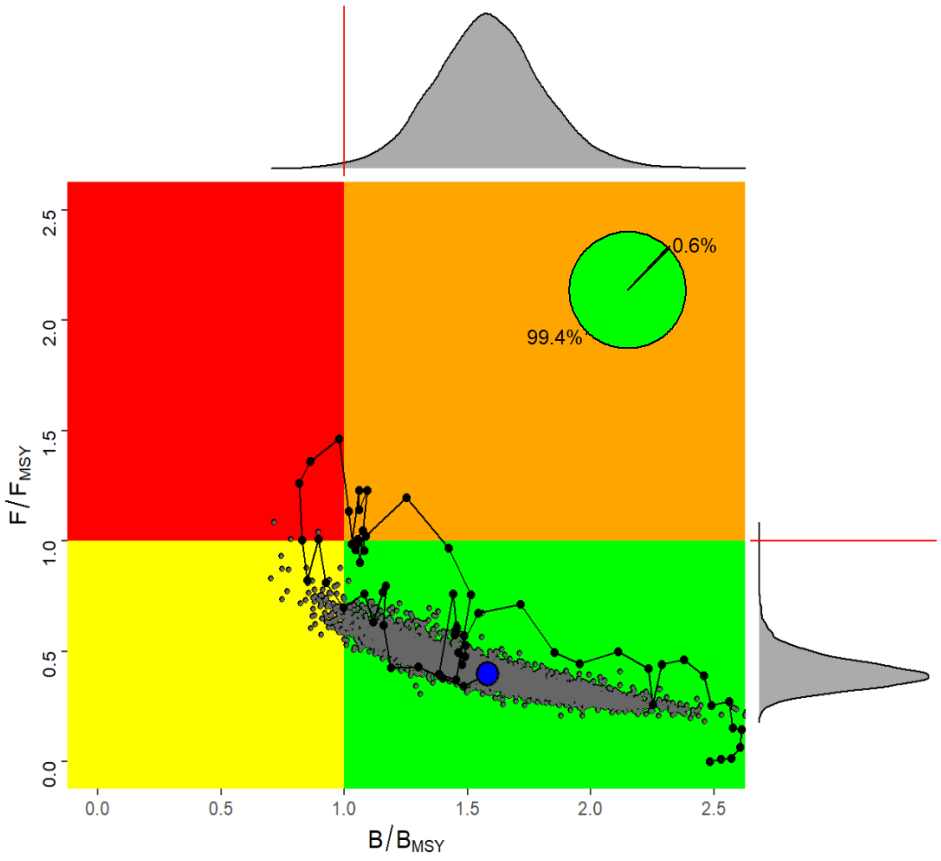
ALB-Figure 3. North Atlantic albacore. Standardized catch rate indices used in the 2020 stock assessment from the surface fishery (baitboat) which take mostly juvenile fish, and from the longline fisheries which take mostly adult fish.



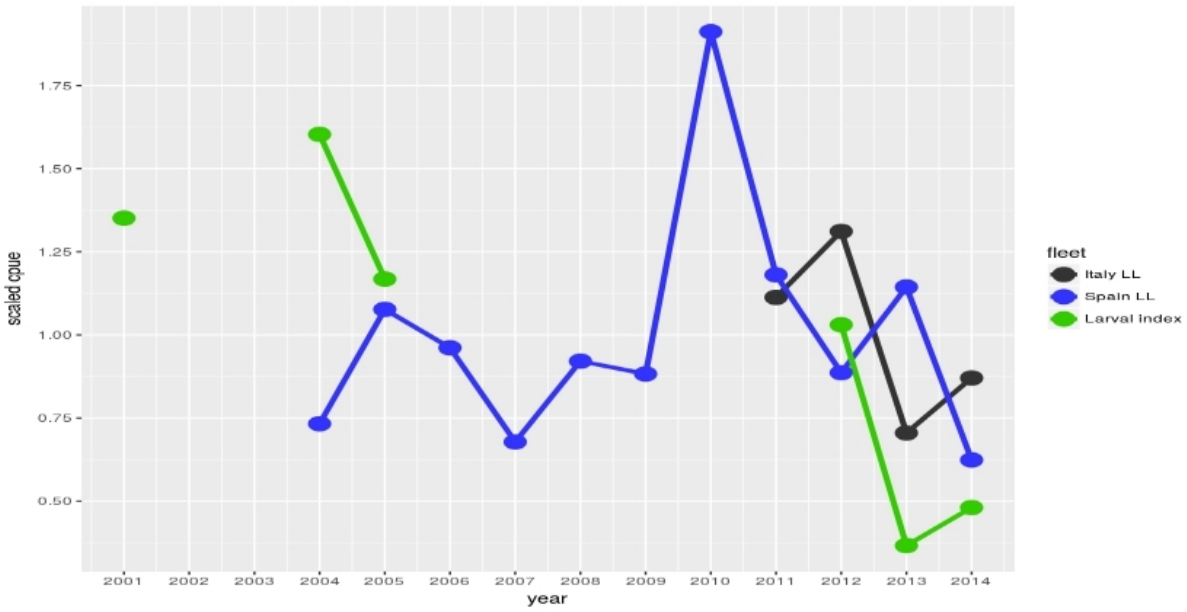
ALB-Figure 4. North Atlantic albacore (Kobe plot). Stock status trajectories of B/B_{MSY} and F/F_{MSY} over time (1930-2018), as well as uncertainty (grey dots) around the current (F_{2018}/F_{MSY}, B_{2018}/B_{MSY}) estimate (blue point) based on Surplus production model with probability of being overfished and overfishing (red, 0%), of being neither overfished nor overfishing (green, 98.4%), and of being overfished (yellow, 1.6%).



ALB-Figure 5. South Atlantic albacore. Standardized catch rates used for the base case of the 2020 stock assessment.

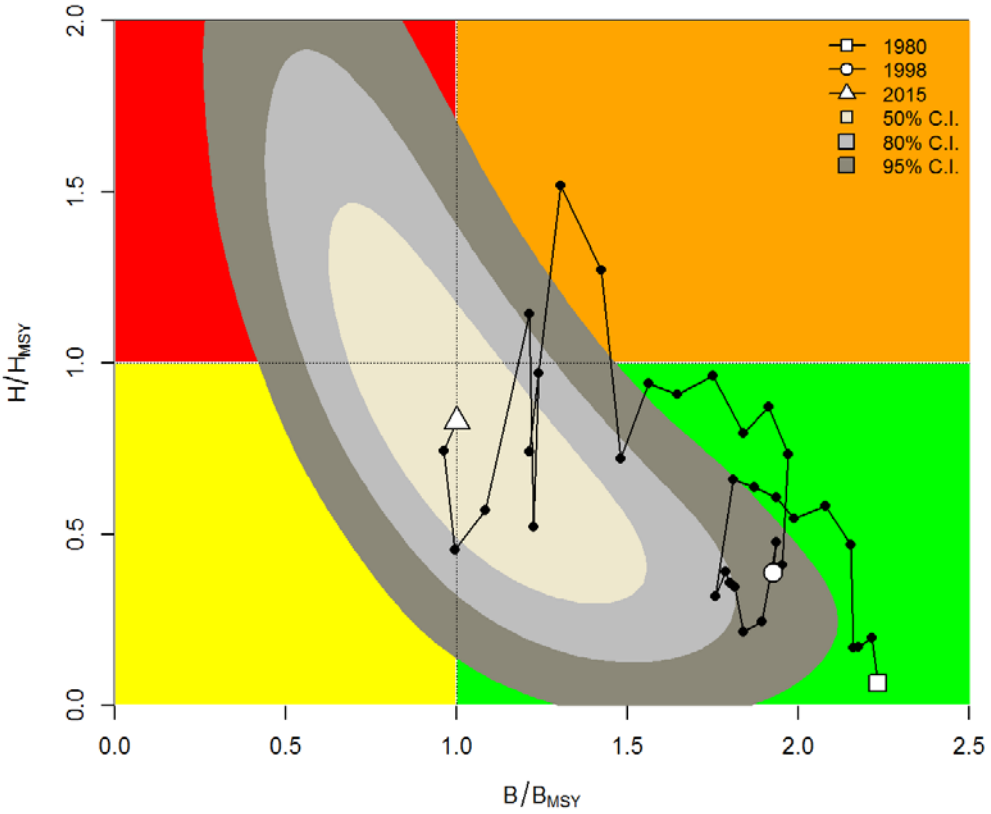


ALB-Figure 6. South Atlantic albacore (Kobe plot). Stock status trajectories of B/B_{MSY} and F/F_{MSY} over time (1956-2018), as well as uncertainty (grey dots) around the current (2018) estimate (blue point) based on Bayesian surplus production model with probability of being overfished and overfishing (red, 0%), of being neither overfished nor overfishing (green, 99.4%), and of being overfished (yellow, 0.6%).



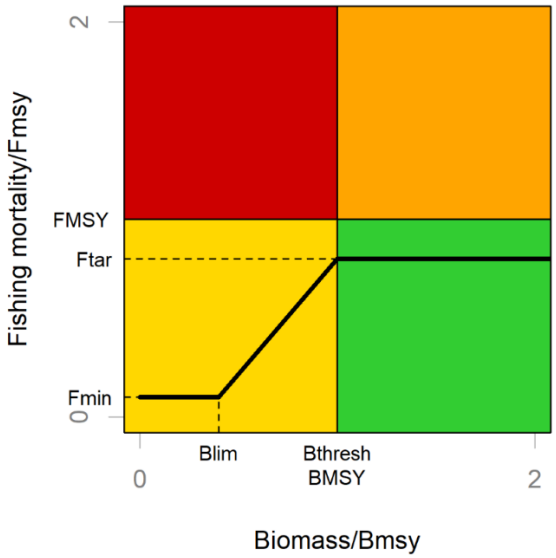
ALB-Figure 7. Mediterranean albacore. Set of abundance indices used in the 2017 assessment of the Mediterranean albacore stock.

a)

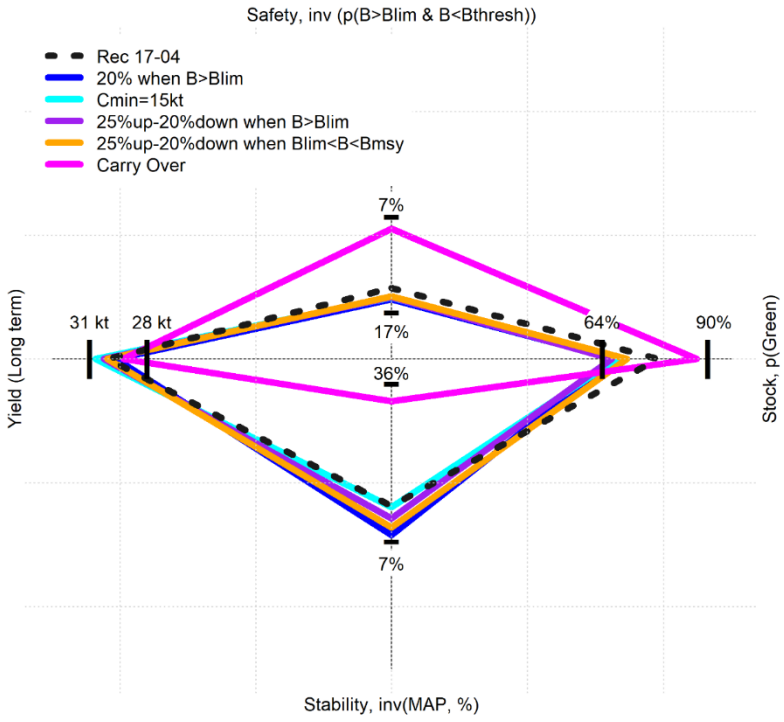


b)

ALB-Figure 8. Mediterranean albacore. a) Stock status trajectories of B/B_{MSY} and F/F_{MSY} over time (1980-2015), as well as uncertainty around the current estimate (Kobe plots) for Bayesian surplus production model. (b) Probability of being overfished and overfishing (red, 35.7%), of being neither overfished nor overfishing (green (48.5%), of being overfished but not overfishing (yellow, 14.1%) and of overfishing but not overfished (orange, 1.7%).



ALB-Figure 9. Graphic form of the HCR adopted in Rec 17-04. B_{LIM} (set at 0.4BMSY) is the limit biomass reference point, B_{THRESH} (set at B_{MSY}) is the point below which fishing mortality decreases linearly, F_{TAR} (set at $0.8F_{MSY}$) is the target fishing mortality rate to be applied to achieve the management objectives, and F_{MIN} (set at $0.1F_{MSY}$) is the fishing mortality to be applied when $B<B_{LIM}$.



ALB-Figure 10. Spider plots representing the relative performance of the HCR adopted in Rec. 17-04, as well as different variants, namely the effect of the carry over as allowed in Rec (17.04) (pink), the effect of setting a lower TAC limit of 15000 t (light blue), the effect of applying the 20% stability clause when $B_{CUR}>B_{LIM}$ (dark blue), and the effect of 20% maximum TAC reduction and 25% maximum TAC increase when $B_{THR}>B_{CUR}>B_{LIM}$ (orange) and when $B_{CUR}>B_{LIM}$ (purple).