Atlantic Albacore tuna Year Programme (ALBYP)

The Albacore Species Group proposes to pursue a coordinated, comprehensive multi-year research programme on Atlantic albacore to advance knowledge of the North and South stocks and be able to provide more accurate scientific advice to the Commission.

North Atlantic stock

This plan is based on the plan initially presented in 2010, which was based on a document by Ortiz de Zárate (published in 2011) that has been revised according to new knowledge, reconsidering the new priorities and reducing the total cost.

Biology and ecology

The estimation of comprehensive biological parameters is considered a priority as part of the process of evaluating North Atlantic albacore stock capacity for rebounding from limit reference points. Additional biological knowledge would help to establish priors for the intrinsic rate of increase of the population, as well as the steepness of the stock recruitment relationship, which would facilitate the assessment. Among the key biological parameters are those related to the reproductive capacity of the North Atlantic albacore stock, which include sex-specific maturity schedules (L50) and egg production (size/age related fecundity). In order to estimate comprehensive biological parameters related to the reproductive capacity of the North Atlantic albacore stock, an enhanced collection of sex-specific gonad samples needs to be implemented throughout the fishing area where known and potential spawning areas have been generally identified. The collection of samples needs to be pursued by national scientists from those fleets known to fish in the identified areas and willing to collaborate in the collection of samples for the analysis. Potential CPCs that could collaborate with the sampling programme may include (but not limited to): Chinese Taipei, Japan, USA and Venezuela. Expected results will include a comprehensive definition of sex-specific maturity development for albacore, spatial and temporal spawning grounds for northern albacore, estimate of L50 and size/age related fecundity.

The Committee also recommended further studies on the effect of environmental variables on CPUE trends of surface fisheries. The understanding of the relationship between albacore horizontal and vertical distribution with the environment will help disentangle abundance signals from anomalies in the availability of albacore to surface fleets in the Northeast Atlantic.

It is also proposed to conduct an electronic tagging experiment to investigate the spatial and vertical distribution of albacore throughout the year. Given the typically high cost of these experiments, and the difficulties tagging albacore with electronic tags, it is proposed to deploy 50 small size pop-up tags in different parts of the Atlantic where albacore are available to surface fisheries (to guarantee good condition and improve survival), namely the Sargasso Sea and off Guianas, off USA/Canada, Azores-Madeira-Canary Islands, and the Northeast Atlantic. Internal archival tags will also be considered for multiyear tracks.

Finally, the existence of potential subpopulations in the North Atlantic has been largely discussed in the literature. While recent genetic studies suggest genetic homogeneity (Laconcha *et al.* 2015), otolith chemistry analyses (Fraile *et al.,* 2016) suggested the potential existence of different contingents, which could also have important management implications. Thus, in order to clarify the existence of potential contingents, the Committee proposes expanding the area studied in Fraile *et al.,* 2016 to the entire North Atlantic, as well as to address inter-annual variability through multiyear sampling and analysis of otolith chemistry.

Monitoring of stock status

The Committee recommended that the joint analysis of operational catch and effort data from multiple fleets be undertaken, following the example of other SCRS Species Groups. This would provide a more consistent view of population trends, compared to partial views offered by different fleets operating in different areas. The analysis is suggested for both longline fleets operating in the central and western Atlantic, and surface fleets operating in the Northeast Atlantic. However, this task has lower priority since the iteration of the Management Procedure requests using individual indices.

Finally, given the limitations of the available fishery dependent indicators, the Committee mentioned the need to investigate fishery independent abundance indices. Although the Committee is aware that, in the case of albacore, there are not many options to develop such fishery independent indices of abundance, it is proposed to conduct a feasibility test using acoustics during baitboat fishery operations to improve the currently available indices. A fine scale analysis for surface fisheries catch of albacore recruits (Age 1) is suggested to analyze the feasibility of designing some transect-based approach for a recruitment index.

Management Strategy Evaluation

The Committee recommends that further elaboration of the MSE framework be developed for albacore, considering the recommendations by the 2018 external review, the Working Group on Stock Assessment Methods and the Albacore Species Groups, as well as the guidance of the Commission and the Joint t-RFMO MSE Group initiative. Now that an HCR is in place and advice for adopting a long-term MP has been provided, the Committee realizes that the OMs were conditioned with data up until 2011, so it is time to start working towards reconditioning them using more recent data. The Committee decided to start working towards a Stock Synthesis based reference case and use this as a basis to reconditioning the OMs after reconsidering the axes of uncertainty. The process to adopt a new grid of OMs and reference tests will take several years. Once this is achieved, it is important to improve observation error models (e.g. by considering the statistical properties of CPUE residuals in future projections) and to test alternative management procedures (e.g. empirical harvest control rules, alternative stock assessment models such as Jabba or Delay Difference models).

The total requested funds to develop this research programme was estimated to be €942,000, with €600,000 to cover priority 1 tasks. The research programme will be an opportunity to join efforts from an international multidisciplinary group of scientists currently involved in specific topics and fisheries.

Budget

Research aim	***Priority***	*Approximate 4-year cost (€)*
Biology and Ecology		
Reproductive biology (spawning area, season, maturity, fecundity)	1	100,000
Environmental influence on NE Atlantic surface CPUE	2	20,000
Distribution throughout the Atlantic (e-tags)	1	350,000
Population structure: contingents	3	100,000
Monitoring stock status		
Joint Atlantic longline CPUE	3	30,000
Joint NE Atlantic surface CPUE	3	12,000
Feasibility of fisheries independent survey	3	180,000
Management Strategy Evaluation		
Development of MSE framework	1	150,000
	Total	**942,000**

Timeline

Research aim	*2021*	*2022*	*2023*	*2024*
Biology and Ecology				
Reproductive biology (spawning area, season, maturity, fecundity)	x	x	x	
Environmental influence on NE Atlantic surface CPUE	x	x		
Distribution throughout the Atlantic (e-tags)	x	x	x	x
Population structure: contingents	x	x	x	x
Monitoring stock status				
Joint Atlantic longline CPUE	x	x		
Joint NE Atlantic surface CPUE	x	x		
Feasibility of fisheries independent survey		x	x	x
Management Strategy Evaluation				
Operating models:				
- Stock Synthesis based reference case	x	x	x	
- New OM reference grid and robustness tests		x	x	x
Observation error:				
- Project CPUEs with error structures			x	
Management Procedures:				
- JABBA, Delay difference, empirical			x	x
Communication:				
- Determine additional minimum standards for performance metrics (currently only prob(Green)>0.6)	x	x	x	x

South Atlantic stock

Background information

Despite South Atlantic albacore being an important resource to fleets from several countries, it is perhaps one of the tuna stocks within ICCAT that has the least information available on its bio-ecology parameters and more data deficiencies for monitoring stock status, even if this information is essential for management measures. Thus, this proposal's main objective is to improve the current knowledge on the bio-ecology and fisheries for South Atlantic albacore, providing important information and more accurate scientific advice to the Commission.

The project proposal follows that already underway for the North Atlantic stock, so as to avoid discrepancies in scientific information between the South and North Atlantic. The research plan will be focused on two main research areas: biology and ecology, and monitoring stock status, during a four-year period (2021-2024).

Biology/ecology and stock structure

Important gaps in basic biological parameters such as size at first maturity, fecundity, age-growth, and others still persist for this stock, bringing considerable uncertainty to stock assessments as well as to the implementation of fisheries management and species conservation measures. Therefore, to estimate these different biological parameters a broad biological sampling programme should be implemented in different areas of the South Atlantic (east and west sides and high and low latitudes), taking into account the knowledge of potential breeding and feeding areas.

Sampling would be carried out by national scientists from the countries that actively fish the species in the South Atlantic in the different areas. Potential CPCs that could collaborate in this sampling effort would be (but not limited to): Brazil, Japan, Namibia, South Africa, Uruguay and Chinese Taipei.

Similar knowledge gaps exist with regards to the ecology of the species, particularly the effects of oceanographic conditions on the space-time distribution, migration, definition of areas and periods of reproduction and feeding, as well as the vertical habitat of albacore. This is also relevant information to better understand the availability of the species for surface (baitboat) and sub-surface (longline) fisheries and the trends in the abundance indexes.

In this case, information from fisheries (gear, catch and effort) and the environment (temperature, chlorophyll, currents, climate indices and others) would be used in the analyses to assess possible effects of climate variability on the distribution and fishing conditions of albacore in the southern Atlantic Ocean.

It is intended to implement electronic tagging experiments (pop-up archival tag/miniPAT) to evaluate and better understand the migration processes undertaken by the species between breeding (West) and feeding (East) areas (**Figure 1**) and also to determine the vertical movements, behaviour, and habitat use in the light of environmental conditions. Due to the difficulty of tagging albacore tuna and the costs of such study, miniPAT tags will be used (n=50) in two areas where baitboat fisheries can ensure the catch of fish in good conditions for tagging. One in Brazil (Rio de Janeiro), where the target species of this fishery is skipjack (W-SKJ), but it also catches a fair amount of albacore, and another in South Africa, where historically the species is caught by this fishing method.

As a complement to these tagging experiments, a preliminary investigation into the West-East connectivity of the South Atlantic albacore stock will be implemented based on analysis of parasitic communities and parasite genetics from fish sampled offshore Brazil and South Africa. Fish that undertake lengthy migrations within their life, such as tuna species, expose themselves to areas with various parasites which ultimately increases their chances of parasite transmission (Lester and MacKenzie, 2009). Parasites can be used as biological tags. The idea is that fish can only become infected with a particular parasite if the fish moves into the endemic area of that parasite (Lester and MacKenzie, 2009). Thus, to the extent that there are behavioral differences between stocks with respect to distribution and migration, parasites can be used to assign stock as they are evidence of migration history. Parasites have been considered as biotags for bigeye tuna (*Thunnus obesus*) and yellowfin tuna (*T. albacares*) in Indonesian waters (Lestari *et al.,* 2017).

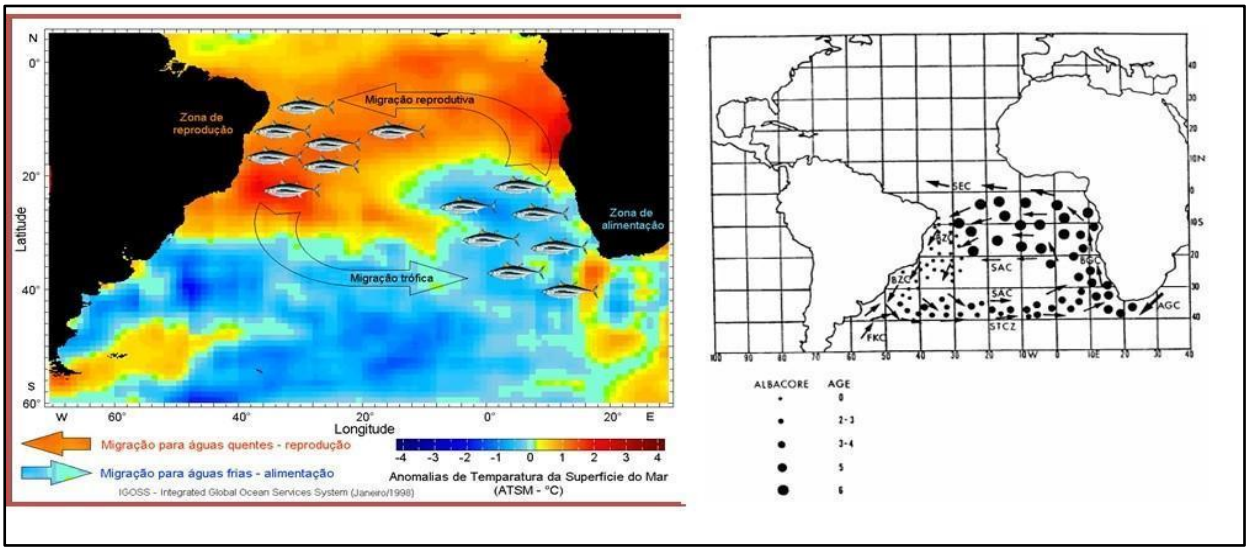

Figure 1. Representative scheme of albacore West-East connectivity in the southern Atlantic Ocean through migratory processes (Travassos, 1999a, 1999b) and the spatial distribution of catches by age (Coimbra, 1999).

Monitoring of stock status

To improve methods of evaluating status of the South Atlantic albacore stock, the Committee intends to perform a joint analysis of catch and effort of different fleets, generating joint standardized series of abundance indexes following work already accomplished by other Species Groups. This analysis should be considered both for longline fleets operating in different regions in the South Atlantic (e.g., Brazil, Japan, Uruguay and Chinese Taipei) and for surface fleets (baitboat) operating in the Southeast Atlantic (e.g. Namibia, South Africa).

Budget

The total requested funds to develop this research plan are €605,000, with €450,000 to cover priority 1 tasks. The research programme will be an opportunity for international collaboration between CPC scientists with multidisciplinary expertise and experience in specific topics and fisheries.

Research aim	***Priority Tasks***	***Approximate 4-year cost (€)***
Biology / ecology and stock structure		
Reproductive biology (spawning area, season, maturity, fecundity)	1	100,000
Age-growth	3	50,000
Environmental influence on CPUE	4	30,000
Migration / vertical movements (e-tags)	1	350,000
Analysis of parasitic communities (biotag) and parasite genetics	3	30,000
Monitoring stock status		
Joint South Atlantic longline CPUE	2	30,000
Joint South Atlantic surface CPUE	2	15,000
	Total	**605,000**

Timeline

Research aim	***2021***	***2022***	***2023***	***2024***
Biology / ecology and stock structure				
Reproductive biology (spawning area, season, maturity, fecundity)	X	X	X	
Age-growth	X	X		
Environmental influence on CPUE	X	X		
Migration / vertical movements (e-tags)	X	X	X	
Analysis of parasitic communities (biotag) and parasite genetics	X	X	X	
Monitoring stock status				
Joint South Atlantic longline CPUE	X	X		
Joint South Atlantic surface CPUE	X	X		
Availability of information and results			**X**	**X**