

Report of the Albacore Year Programme (ALBYP)

Background and programme objectives

Since 2010, the Albacore Species Group (ALB SG) has designed a research programme to address key uncertainties that would allow to improve the scientific advice for management of the species. The research programme is now developed for both the northern and the southern stocks of Atlantic albacore and has been revised on several occasions according to new knowledge, priorities and cost estimates. The research plan is focused on three main research areas: biology and ecology, monitoring stock status and management strategy evaluation (in the case of northern albacore). Funds for this research programme became available in 2021 which were used to develop some of the key research topics as described below.

2022 activities

Since 2021, the Albacore Species Group has prioritized the following research topics: a reproductive biology study to improve knowledge on maturity and fecundity, an electronic tagging study to better understand the life cycle and habitat use, and Management Strategy Evaluation to follow the MSE schedule agreed by the Commission. The first two research items are pursued for both the North and the South Atlantic stocks, while the third one is, for now, specific for the northern stock. The following are the cumulative ALBYP activities conducted up to 2022.

Reproductive biology of North Atlantic albacore

ICCAT funds were used to issue a contract to a consortium to address this project in order to improve knowledge on: (a) the reproduction and maturity for the northern Atlantic albacore stock, (b) sex-specific maturity ogives, (c) spatial and temporal spawning grounds and (d) L_{50} and size/age related fecundity.

The project consortium is led by Dr Alex Hanke and Dr Dheeraj Busawon (Department of Fisheries and Oceans, DFO, Canada), assisted on coordination activities by Dr Victoria Ortiz de Zárate (EU-Spain, IEO-CSIC). Other scientists involved include: Dr Freddy Arocha (Instituto Oceanográfico de Venezuela (IOV), Universidad de Oriente (UDO), Venezuela), Dr Nan-Jay Su (National Taiwan Ocean University, Chinese Taipei), Dr David Macías (EU-Spain, IEO-CSIC) and Dr Kadra Benhalima (DFO, Canada).

During December 2020 and 2021 the sampling plan was focused on pelagic longline fisheries either targeting albacore (Chinese Taipei fleet) or bycatching it (Venezuela and Canada fleets). The female and male fish gonads sampled, and a subsample of dorsal fin ray were analysed to completion in the first semester of 2022.

All the male and female albacore collected were analysed to determine maturity stage. A total number of 284 gonads were collected, of which 272 were processed (199 from Venezuela and 73 from Chinese Taipei). First dorsal fin rays collected by Venezuela (n=111) were processed and read applying the methodology described in Ortiz de Zárate and Babcock (2016). Two readers made independent estimations of age of the total number of samples and final age was determined by agreement.

According to their different developmental stages, oocytes were classified into one of 6 classes using similar terminology of Brown-Peterson *et al.* (2011). To determine the maturity stage of each female and its ovarian phase, a microscopic maturity scale was applied to identify: Most Advanced Group of Oocytes (MAGO) in the ovary, the Post Ovulatory Follicles (POF) and Vitellogenic Oocytes development (Farley *et al.*, 2013 and 2016; and Schaefer, 2001). To estimate fecundity parameters two approaches were used, fecundity estimates described by Weibel method (Weibel and Gómez, 1962; Weibel, *et al.*, 1966; Weibel, 1969) and a new dissector method (Sterio, 1984). Fecundity parameters were estimated on a reduced number of gonads (n=20) collected in May and June of 2021 in the Central North Atlantic area by Chinese Taipei longline vessels.

All the female albacore collected in the tropical area by Venezuela longliners were mature but had no sign of spawning in 2021. These female albacores were classified in resting stage, therefore were not eligible to estimate fecundity parameters.

The new findings on the reproductive biology of North Atlantic albacore obtained from 2020-2021 samples analysis were presented at the Albacore Species Group that met in September 2022. Collection of albacore gonads continues in 2022 in the Central area of North Atlantic. New results will be compiled with previous ones and a comprehensive summary with all the available data from the Reproductive albacore biology study in North Atlantic (2020-2022) will be presented in 2023 to the ALB SG.

Reproductive biology of South Atlantic albacore

Dr Paulo Travassos, a national scientist from Brazil, is the project leader for this short-term contract, with research activities being conducted with the participation and support of scientists from Brazil (Dr Mariana Rego, Dr Maria Lúcia Araújo and Dr Luis Gustavo Cardoso), Uruguay (Dr Andrés Domingo and Dr Rodrigo Forselledo), South Africa (Dr Denham Parker) and Chinese Taipei (Dr Nan-Jay Su).

Regarding this topic, there is still an important gap in scientific knowledge for the albacore in the South Atlantic Ocean that needs to be filled. Thus, the objective of this research is to determine the spawning areas and season, as well as estimate the age-size at maturity and fecundity of the species, using samples/measurements provided by participating CPCs. Therefore, with the development of this work, it is expected to generate important and necessary information for the conservation of the species and the management of fisheries in the South Atlantic.

To achieve these objectives, biological sampling is being carried out in the three main areas of abundance/fishing in the South Atlantic (oceanic areas off Brazil, Uruguay and South Africa). However, only samples collected by the Brazilian tuna fleet (104 gonads) have been analyzed so far. These samples were obtained from two areas: one to the North (around 8°S; fleet based in Recife), with samples collected in Sep-Oct-Nov/2021 and February 2022, and the other to the South (around 32°S; fleet based in Rio Grande), with samples collected in February and July 2021. In addition, information obtained from samples collected years ago as part of independent studies on the reproduction of the species by Brazil (2005-2010), Uruguay (2013-2016), and South Africa (2012-2018), have also been analyzed. For fish caught by the longline Recife fleet, the range of fork length was 97.0 to 115.0 cm. The size of the fish caught by the longline Rio Grande fleet ranged from 81.0 to 111.0 cm fork length.

The histological criteria used to assess the maturity status indicate that female and male reproductive activity occurred in 56% of the samples of the mature individuals analyzed, and 44% of the adult individuals were in regressing phase. Most mature individuals were caught by the Recife based fleet, and the following maturation stages were present in the samples: immature 4.2%, developing 25%, spawning capable 2.0%, active 37.5%, and regressing 31.3%. Notwithstanding, the maturation stages of individuals caught by the Rio Grande fleet were: immature 36%, developing 57%, and regressing 7%. The data support the hypothesis that the reproduction site of this species is up to 20°S along the Brazilian coast. The maturation stages identified in samples from the Rio Grande fleet are similar to preterit data of individuals sampled in South Africa (immature 42.9, developing 51.2%, spawning capable 5.0%, active 0.7 %, and regressing 0.3%). The sampling limitation is expected to be corrected with material which will be sent for analysis soon from the partner from Chinese Taipei.

The spines of the first dorsal fin have been collected and are being processed for analysis, with no results yet to present.

Movements and habitat use of North Atlantic albacore

This project is led by Dr Haritz Arrizabalaga (AZTI, EU-Spain), in collaboration with scientists mainly from EU-Spain (AZTI and IEO), and the support from scientists from different CPCs involved in communication of tagging recoveries and rewarding (EU-France, EU-Ireland, EU-Portugal, Chinese Taipei and Japan).

ICCAT funds are used mainly to purchase tags and to cover some of the deployment and satellite transmission costs, while other costs (additional tags, personnel, travel, etc.) are provided by participating institutions involved in tagging and analyses.

Since 2019, several tagging surveys have been conducted off the Canary Islands and the Bay of Biscay. The surveys off the Canary Islands were conducted onboard baitboats and charter vessels targeting large individuals during winter-spring. So far 29 MiniPATs have been implanted (5 in 2019, 10 in 2020 and 14 in

2022). In the Bay of Biscay surveys were conducted onboard baitboats used for the bluefin tuna acoustic survey, as well as recreational and charter vessels using trolling gear, targeting small to medium size individuals during summer and autumn. So far, 82 internal archival tags (Lotek LAT 2810L) and 2 PSATS have been implanted in 2020-2022.

In order to increase the chances of recovering internal archival tags, posters announcing €1,000 rewards were produced in Spanish, French, English, Portuguese, Japanese and Mandarin Chinese and distributed through collaborating ALB SG participants from different CPCs. To date we have collected data from 25 of the PSATs deployed, which account for an accumulated 1448 tracking days. As for the internal archival tags, 4 tags were recovered after 10, 17, 37 and 439 days at liberty. Unfortunately, the first one was recovered with the antenna broken, but the third recovery is, to our best knowledge, the longest recovery for an albacore tuna in the Atlantic Ocean. This track covers, for the first time, more than a year in the life of a juvenile albacore that visited shallow waters of the Bay of Biscay in subsequent summers, while inhabiting deeper waters in the central and western Atlantic during the winter. An update of the results obtained so far was presented to the Albacore Species Group during the 2022 Species Group meetings held in September (Cabello de los Cobos, 2022). In the near future we will continue deploying purchased tags that remain to be deployed.

Movements and habitat use of South Atlantic albacore

The project leaders for this study are Dr Paulo Travassos and Dr Andrés Domingo, national scientists from Brazil and Uruguay, respectively. The main purpose of this study is to provide information about movement patterns and habitat use of albacore in the South Atlantic Ocean, to contribute to the assessment and management the southern stock of the species.

To achieve this goal, a total of 6 miniPAT (Wild-Life Computers) tags have been made available so far by ICCAT as of the end of 2021. These tags arrived in Brazil in February 2022 and since then attempts have been made to tag some specimens of the species off the Northeast coast of Brazil. Taking the opportunity of an expedition to tag yellowfin tuna around the Fernando de Noronha archipelago (Protuna Project, national research supported by the Brazilian government; CNPq Process No. 445810/2015-7), an attempt to tag albacore in this area was conducted from 23-27 May 2022. However, no albacore was caught during this cruise and thus no fish was tagged. This region of the Fernando de Noronha archipelago does not have a high abundance of albacore and, furthermore, the time of year was not the most suitable for the presence of the species on the Northeast coast of Brazil. The greatest abundance occurs during the austral spring-summer periods, when the species seeks the warm tropical waters for its reproductive activity.

Management strategy evaluation of North Atlantic albacore

ICCAT funds are used for a short-term contract to AZTI, coordinated by Dr Gorka Merino and Dr Agurtzane Urtizbera, to accomplish the technical tasks required to follow the MSE schedule adopted by the Commission in 2021. According to this schedule, after adoption of the first ICCAT Management Procedure (MP) in 2021 (following adoption of a harvest control rule in 2017), the existence of exceptional circumstances is needed to be checked on a yearly basis (indicators depending on the year). In addition, in 2023 a new benchmark stock assessment using SS3 is scheduled, which should serve as a basis for conditioning new operating models for the second round of the MSE framework, expected to be delivered in 2026, to allow the Commission to revise the MP if they wish to do so. Moreover, the [Recommendation by ICCAT on conservation and management measures, including a management procedure and Exceptional Circumstances Protocol, for North Atlantic albacore \(Rec. 21-04\)](#) requires testing alternatives to the MP adopted.

Following up a webinar held in 2021 to decide on basic SS3 model structure, in 2022 interested members of the ALB SG worked with the ICCAT Secretariat on the definition of the fleet structure and the production of input catch, CPUE and size data for the SS3 model (Kimoto *et al.*, 2022b). The contractors made initial SS3 runs with the agreed model and fleet structure and presented results to the September 2022 ALB SG meeting (Urtizbera and Merino, 2022). They also evaluated the performance of MP variants requested in Rec. 21-04, namely with varying levels of target fishing mortality and biomass thresholds, as well as the effect of using only some of the CPUE series on MP performance. They also performed initial tests with varying levels of underreporting and updated the analyses regarding the effect of the carry over provision, implementation error, and alternative stability clauses. Finally, they produced the necessary plots for the

ALB SG to discuss the detection of exceptional circumstances, as requested by the Exceptional Circumstances protocol contained in Rec. 21-04.

Expenditures in 2022

The total budget within ALBYP in 2018, 2019 and 2020 amounted to €94,375, €85,000 and €130,000, respectively. The effective expenditures for that period were of €41,832, €42,788 and €163,644, respectively.

In 2021 and 2022 to implement the main activities planned in the framework of ALBYP, the total budget of provided by ICCAT amounted to €142,500 and €110,000, respectively. The total amount of the expenditures as of 16 September 2022 are shown in the Table below.

The detailed fund available for ALBYP during 2021 and 2022 and respective expenditures as off 16 September 2022 are detailed in the table below.

<i>Component</i>	<i>2021</i>		<i>2022</i>	
	<i>Budget (€)</i>	<i>Expenditure (€)</i>	<i>Budget (€)</i>	<i>Expenditure (€)</i>
Tagging	46,500	19,487	40,000	1,394
Biological studies	27,000	16,764	35,000	-
Age and growth	-	-	10,000	-
Sample collection and shipping	31,000	21,347	5,000	-
MSE	38,000	24,000	-	-
TOTAL	142,500	81,598	90,000	1,394

2023 Plan and activities

Reproductive biology of North Atlantic albacore

In view of the inherent difficulties to collect mature albacore fish and the need for additional gonads samples to better cover the spatio/temporal strata of maturity and fecundity estimates in the North Atlantic sampling, additional sampling is planned to continue until the end of the Summer 2022 onboard Chinese Taipei and Canada longliners. The sampling that was re-scheduled for spring and summer seasons of 2022 to continue collecting gonads and the first dorsal fin rays on board Chinese Taipei longline vessels catching albacore in Central North Atlantic. When new samples are provided to the laboratories involved the analyses will be done with same methods to estimate maturity stage and fecundity. In 2023, it is expected to continue sampling gonads and spines of albacore onboard longliners from Chinese Taipei, to allow drawing conclusions from a larger collection of samples.

Reproduction of albacore in the South Atlantic Ocean

Given that so far only samples collected by Brazilian have been analyzed, priority will be given to collecting and especially shipping samples from the other partner countries to Brazil. Once that task is accomplished, it will be possible to obtain information from the samples collected in the different space and time strata, as outlined in the research plan. This sampling effort should continue until the end of this year and early 2023.

Movements and habitat use of North Atlantic albacore

During the rest of 2022 and 2023 we plan to continue deploying tags that have remained to be deployed on albacore using different tagging opportunities (commercial, research, charter and recreational vessels). Following the experience in recent years, deployments are planned by AZTI scientists in the Bay of Biscay and the Canary Islands, but open to other areas if opportunities arise.

Movements and habitat use of albacore in the South Atlantic Ocean

Tagging activities will continue in the second semester of 2022 and throughout 2023, including other areas off the Southeast and South coasts of Brazil, depending on the opportunities. In this case, it is intended to tag fish caught by baitboats that target skipjack tuna. Even in small proportion, albacore is caught in this fishery, with the advantage of tagging fish in good condition by the characteristics of this fishing method. Thus, it is expected to successfully accomplish this task. New attempts to tag the species will also be made in the Northeast region of Brazil from September to October, when the spawning season begins, promoting an increase in abundance, especially of adult fish.

Management strategy evaluation of North Atlantic albacore

In 2023 a benchmark stock assessment for North Atlantic will take place. For this stock assessment, SS3 model will need to be prepared, aiming to identify a base case and a set of main sensitivity runs, which will be used as a basis to condition future Operating Models. In 2023 the Management Procedure will also be iterated to set the TAC for 2024-2026. Accordingly, the mpb model will need to be run according to the specifications set in Rec. 21-04, and the exceptional circumstances assessed according to the Exceptional Circumstances protocol contained in Rec. 21-04.