ICCAT NORTH ATLANTIC ALBACORE RESEARCH PROGRAM

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SUMMARY

A summary of the main objectives and research aims included in the proposed research plan for North Atlantic albacore is presented. At this stage, it is an on-going project open to further examination and refinement by the SCRS. The development of the research plan requires provision of funds. The required funds for a research program period of 4 years are also estimated.

RÉSUMÉ

Ce document présente un résumé des principaux objectifs de recherche inclus dans le programme de recherche proposé s'appliquant au germon de l'Atlantique Nord. À ce stade, il s'agit d'un projet en cours de développement ouvert à un nouvel examen et à une amélioration future par le SCRS. Le financement de fonds est nécessaire pour mettre en place le programme de recherche. Les fonds nécessaires pour un programme de recherche d'une durée de quatre ans sont également envisagés.

RESUMEN

Se presenta un resumen de los principales objetivos y temas de investigación contemplados en la propuesta del plan de investigación para el stock de atún blanco del Atlántico norte. Se encuentra todavía en fase de desarrollo para ser examinado por el SCRS. El desarrollo de este plan de investigación lleva parejo la aportación de fondos. Esta financiación necesaria para el periodo contemplado de cuatro años también se ha estimado.

KEYWORDS

Thunnus alalunga, *albacore, research program, North Atlantic stock*

1. Introduction

Albacore (*Thunnus alalunga,* Bonaterre, 1788) is a temperate tuna widely distributed throughout the Pacific, Indian and Atlantic Oceans and the Mediterranean Sea. In the Atlantic Ocean three stocks are assumed for assessment purposes based on biological knowledge; i.e. North and South Atlantic (separated at 5ºN) and Mediterranean Sea.

The North Atlantic stock albacore supports an important fishery, the peak catch was seen 36,199 t in 2006 although the catch in 2008, at 20,359 t, was the lowest recorded during the past decades. Albacore distribution is strongly influenced by environmental conditions such as temperature, and dissolved oxygen and migration coincides with the position of the 17-19° C isotherm in northeast Atlantic fishing area. Albacore is an active predator and its migration to the fishing ground of Bay of Biscay is timed to feed on plankton crustacean, squid, and meso pelagic and pelagic fish in the summer months when European surface fleet target the immature and post spawning albacore.

The European surface fishery accounted for the bulk of the total catch from 72 to 86% in the last 6 years period from 2003 to 2008 in North Atlantic. These 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 and in the vicinity of the Canary and Azores Islands in summer and autumn. The other main fishery is that of Chinese Taipei longline

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fleet which operates in the central and western North Atlantic all year round. A by-catch catch is taken by longliners from the USA and Japan.

The stock is managed by under a management strategy based on maximum sustainable yield (MSY). Results from the last assessment (Anon. 2010a) showed that spawning stock biomass (SSB) has declined and in 2007 was about one third of the peak levels estimated for the late 1940s. Estimates of recruitment to the fishery, although variable, have shown generally higher levels in the 1960s and earlier periods with a declining trend thereafter until 2007, while the most recent recruitment is estimated to be the lowest in the series The stock is thought to be overfished and subject to overfishing since SSB has remained below B_{MSY} since the late 1960 and fishing mortality is above F_{MSY}. Several sources of uncertainties were highlighted when analysing the stock, i.e. estimates of selectivity and catchability of fleets, age structure of catch, length composition of catch, fishing effort that need further research. Moreover, the existence of at least 2 sub-populations in the North east Atlantic ocean exploited by the albacore surface fisheries was postulated by Aloncle and Delaporte (1973). If proven, that population structure can play a major role in the apparent change in productivity seen in the albacore stock and in the estimation of MSY based reference points (Anon. 2010a).

According to the assessment results obtain in 2009 and the research and statistics recommendation by the Albacore Species Group, it was presented to the Commission the SCRS general albacore recommendations (Anon., 2010b) to begin a coordinated, comprehensive research program to advance knowledge of this stock and therefore provide more accurate scientific advice to the Commission. Allocation of funds should be planned to better describe the status of the stock and consequently improve management recommendations. The cost of this research program has been estimated and it will be presented to the SCRS.

2. Objectives of the project

The main objective of the Albacore Research Plan Program sought during a four-year time period is to reduce uncertainty on the status of the stock. This would be achieved by focussing on:

- Improved knowledge of the population dynamics of albacore in the North Atlantic.
- Improved understanding on the interactions between the biological and ecological processes of the albacore stock and the fisheries.
- Reduced uncertainty in stock assessment, e.g. growth modelling and modelling of indices of abundance that take into account migrations based upon variable environmental conditions and targeting.
- The provision of robust management strategies for the sustainable exploitation of the stock at MSY that take into account social and economic objectives.

3. Research aims

The research program is structured into three main topics, i.e. Biology and Ecology, Fisheries and Management Advice is to be developed during three years and one more year to present the findings to the Albacore Species Group to evaluate the state of the stock after the celebration of a Workshop devoted to the presentation of achieved results and conclusions.

3.1 Biology and ecology

− *Reproductive biology*

Current knowledge: The only known spawning area is located in the western tropical waters of the North Atlantic Ocean, in the Sargasso Sea. Season is believed to be long, from March to September. Albacore are 50 % mature at around 85-90 cm fork length. Knowledge based on information from the 1960s not contrasted further.

Consequences for current scientific advice: A key uncertainty when providing management advice is the shape of the stock recruitment relationship.

Hypothesis, Workplan: Collect samples from mature albacore from longline fleets on the western Atlantic fishing grounds. New estimates on first age at maturity and the corresponding vector of maturity for this

stock. As well estimates of batch fecundity and a global knowledge on the reproductive biology of males and females albacore.

Benefits for assessment and management advice: Improving its knowledge will have a direct effect on diminishing the uncertainty of biological references points used to assess the status of the albacore North stock.

− *Growth*

Current knowledge: Growth albacore model describing the North Atlantic stock population is based on hard part (spines) study information form the 80´s. Validation study not carried out on time marks used to age albacore.

Consequences for current scientific advice: Growth rate is an essential input parameter into stock assessment models of fish populations with a significant impact on the outcome of the analysis: recruitment estimates, fishing mortality, population abundance, as well as knowledge on the life span of the species by sex. It is need to estimate catch-at-age, maturity-at-age, weight-at-age.

Hypothesis, Workplan: Sampling hard parts and large sample of adult albacore by sex should be conducted by sex for adult albacore. Validation of annual time mark to determine age by OTC tagging experiments. Studies on ageing techniques and growth model. Organized collaborative network to implement the growth studies.

Benefits for assessment and management advice: All parameters derived from the diverse assessment model applied, the exploitation rate and ultimately improve accuracy on management advice. The growth model estimates by sex will improve estimates of selectivity on the older ages and provide better time series of SSB and recruitment.

− *Natural mortality*

Current knowledge: Current parameter estimate based on tagging data from the 60´s. Need for conducting actual studies and update natural mortality vector estimates.

Consequences for current scientific advice: Natural mortality rate is an essential input parameter into stock assessment models of fish populations with a significant impact on the outcome of the analysis: recruitment estimates, fishing mortality, population abundance, as well as knowledge on the life history of the species by age.

Hypothesis, Workplan: Conduct conventional tagging campaigns using genetag method.

Benefits for assessment and management advice: Increase accuracy on fishing mortality estimates by reducing uncertainty on this parameter. Assessing stock status and doing projections for future evolution of stock.

− *Stock structure*

Current knowledge: Northern Atlantic stocks (separated at 5ºN) considered a separated stock for assessment purposes.

Consequences for current scientific advice: There is evidence (Aloncle and Delaporte, 1974) that there are at least 2 sub-populations. Differential exploitation of these sub populations may mean that current advice may decrease the sustainability of the stock particularly in the presence of environmental forcing (Kell et al, 2009, Kerr et al, 2010).

Hypothesis, Workplan: The stock is a meta-population and fisheries differentially exploit individuals from more than one stock on the fishing grounds. Elucidate levels of genetic differentiation between spatial and temporal aggregations of albacore tuna from the North-east Atlantic Ocean in their summer migration to Bay of Biscay by means of genetic sampling. Archival tags on smaller albacore, also suitable for testing hypothesis of sub populations in NE Atlantic.

Benefits for assessment and management advice: Improve management based on MSY based on a more accurate description of sub-population structure. This will be important both for the stock and also provide a better understanding of the management of meta-populations.

− *Habitat and migration*

Current knowledge: Limited by only few independent observations. Most of the studies based on fishery dependent data.

Consequences for current scientific advice: Lack of knowledge of real vertical distribution, movements and migration that might affect behaviour of fleets and availability to gears.

Hypothesis, Workplan: The migration paths, vertical and circadian behaviour, habitat use and habitat constrains by physical variables. Deployment of electronic tags (archival and pop-up) by network of partners and organized Workshop to present results.

Benefits for assessment and management advice: Improve modelling of North Atlantic stock by means of FCL method by testing different hypothesis.

− *Feeding ecology*

Current knowledge: Very scarce, only very limited and small scale studies.

Consequences for current scientific advice: Behaviour of immature albacore in the feeding area where surface fleets operate upon migration in the summer season. Impact on catchability of fleets thus on cpue´s abundance indicators.

Hypothesis, Workplan: Sampling stomachs and isotopes analyses. What role play the forage preys and albacore trophic ecosystem in the area, interactions and distribution of albacore in the fishing area.

*Benefits for assessment and management advice***:** Understand the availability to passive gears and catch rates of surface fleets.

3.2 Fishery data

−*Recovery of catch, effort, size data*

Current knowledge: Some fleets nor being reported or scarcely, specially the longline fishery. Low sampling coverage and bias length distribution of catch due to low sampling rate.

Consequences for current scientific advice: Improve catch-at-size data for all major fleets exploiting this stock, with emphasis on longline fleet.

Hypothesis, Workplan: Recovered existing logbooks and fishery records kept on fishermen association. Create data bases. Intensify the sampling effort on longline fleet.

Benefits for assessment and management advice: Increase coverage of basic information: catch, effort and size distribution by fleet by spatial and temporal strata. Increase accuracy on the catch-at-size and size samples required as input to the assessment model used. Reduce assumptions about treatment of basic data.

− *Conversion of CAS into CAA*

Current knowledge: At present, results obtained for the catch-at-age induced the decrease of the age-plus group producing unrealistic results in some of the modelling done with the ADAPT-VPA method.

Consequences for current scientific advice: Large uncertainty in the assessment analyses results.

Hypothesis, Workplan: Investigate performance models by improving sampling data coverage for all fleets on proper spatial temporal strata.

Benefits for assessment and management advice: Improve performance of management advice based on more sound assessment analyses.

− *Develop Abundance indices-CPUEs*

Current knowledge: Commercial fleets catch rates partially available and analysed.

Consequences for current scientific advice: The standardized catch rates from the fleets by age group are considered indicators of the relative abundance of the albacore stock in the North Atlantic. The accuracy of current status of the stock based on the last assessment (ICCAT, 2009) is largely influenced by the standardized CPUE´S obtained from fisheries statistics.

Hypothesis, Workplan: Use of more stratified catch and effort by age group and incorporate in the modelling oceanographic and climatic variables that may assist to study the relationship between albacore and its habitat and the observed trends from commercial fleets.

Benefits for assessment and management advice: The oceanographic and climatic variables may assist to study the relationship between albacore and its habitat and better assess abundance of stock.

− *Efficiency of fleets*

Current knowledge: Scarce information of evolution of fishing power by gear affecting the effective fishing effort.

Consequences for current scientific advice: Effects on catchability, thus fishing effort measures by fleet required for the assessment model used (MFCL).

Hypothesis, Workplan: Recovery information by means of enquires on electronic equipment.

Benefits on assessment and management advice: Increase accuracy on fishing mortality trends and derived trajectories of the biological references points based on F values.

− *Environmental influence*

Current knowledge: Limited, although oceanographic variables play an important role in the distribution of the immature and mature albacore in the North Atlantic.

Consequences for current scientific advice: Understand the impact of environment in the abundance trend of the stock (recruitment), likewise movements and vertical distribution that affect the perception of the stock obtained from analyses of fishery data.

Hypothesis, Workplan: Initiate tagging electronic experiments of North Atlantic albacore stock as the only possible mean to obtain this sort of information and independent data in order to understand the dynamics of this stock.

Benefits for assessment and management advice: Modelling of the population based on different environmental scenarios that influence the production of the stock.

3.3 Management advice

− *Evaluate uncertainties of hypothesis and models used*

Current knowledge: Several uncertainties in the assessment model fit and results.

Consequences for current scientific advice: Under a scenario of low recruitment and negative environmental forcing actual modelling tools are not able to evaluate the impact of those factors in the results of the status of the stock.

Hypothesis, Workplan: Investigate the uncertainties found when using the Multifan-CL method to assess the stock by modeling the stock under different hypothesis on the dynamics of albacore population by testing

new data. Continue to explore the two-sex model with Stock Synthesis for Northern Atlantic stock. Incorporate oceanography data into the assessment process.

Benefits for assessment and management advice: Improve accuracy in the estimate of MSY, consequently enunciate better management recommendation on TAC in line to the precautionary approach.

− *Evaluate robustness of alternative management strategies*

4. Dissemination of results

Through the four years period, as soon as results from different research activities will be accomplished the data and findings will be made available to Albacore Species Group by creating a common data base in ICCAT for the North Atlantic albacore purposes. Results will be submitted by means of publication of results and providing the data set to ICCAT. Several workshops will be organized to collate all findings from the Research Plan and the new North Atlantic albacore stock assessment.

5. Conclusion

This summary document has been an on going collaboration with the AZTI scientists, Haritz Arrizabalaga and Josu Santiago, with Ronan Cosgrove from BIM, and Laurie Kell from ICCAT, after a meeting held in AZTI (Pasaia, Guipuzcoa) in July 2010, to be presented at the Albacore Species Group and the SCRS for examination. Thanks are extended to Alain Fonteneau for encouraging albacore research in the North Atlantic. The Research Plan for the North Atlantic stock is a framework of collaboration between western and eastern Atlantic scientists working on diverse expertises to contribute to albacore research. Appreciation is extended to Victor Restrepo from ISSF for his interest and willingness to provide funds for research purposes, and also to the Chinese Taipei administration that showed a willingness to provide funds for the research activities. The required budget will be presented to the SCRS.

References

Aloncle, H. et Delaporte, F. 1973, Populations, croissance et migrations du germon (*Thunnus alalunga*) dans le nord-est Atlantique essai de synthèse. *Rev. Trav. Inst. Pêches marit*., 37(1): 97-115.

Anon. 2010a, Report of the 2009 ICCAT Albacore Stock Assessment Session *(Madrid, Spain - July 13 to 18, 2009)*. Collect. Vol. Sci. Pap. ICCAT, 65(4): 1113-1253.

Anon. 2010b, Report for Biennial Period, 2008-09 Part II (2009) - Vol. 2 English version, SCRS, Madrid 2010.

Annex To
North Atlantic Albacore ICCAT Research Program

The Albacore Species Group reiterates last year´s proposal to initiate a coordinated, comprehensive research program on North Atlantic albacore to advance knowledge of this stock and provide more accurate scientific advice to the Commission.

The research plan will be focussed on three main research areas: biology and ecology, fisheries data and management advice during the four-year period. Each of these main topics includes more detailed research aims as presented in the text of this document. The requested funds to develop this research plan have been estimated at a cost of 4.3 million Euros. The research program will be an opportunity for joint efforts from European scientists from research institutes involved in the albacore fisheries as well as CPCs' scientists involved in the research on the longline fisheries of North Atlantic albacore.

Research aim	*Feasibility*	*Priority*
1. Biology and ecology	1 to 4	1 to 3
	2	1
Reproductive biology (maturity, spawning area and season, and sex-ratio)		
Growth (validation, growth modelling by sex)	1	1
Stock structure, genetics	1	1
Natural mortality, conventional tagging (*)	4	3
Habitat and migration (wintering and feeding areas; horizontal and vertical distribution),electronic tags (*)	2	1
Feeding ecology (isotopes)	1	3
2. Fishery data		
	1	1
Recovery of catch, effort and size from logbooks and increase the number of size samples for longline and surface fleets		
Efficiency of fleets	1	1
3. Modelling		
	2	1
Environmental influence on the population dynamics		
Improve relative abundance indices by means of CPUE´s analyses	2	1
Improve conversion of Catch-at-Size into Catch-at-Age	2	1
Evaluate uncertainties under alternative hypothesis and models used	1	1
Evaluate robustness of alternative management strategies, uncertainties	1	1

Cost estimates in Euros (*) all tagging activities: conventional and electronic

Biology and ecology: estimated budget of	3.790.000 Euros
Fishery data: estimated budget of:	250.000 Euros
Modelling: estimated budget of	300.000 Euros
Total estimated cost for the 4 year program	**4.340.000 Euros**