TAGGING OF THE NORTHERN BLUEFIN TUNA (*THUNNUS THYNNUS*) IN THE EAST ATLANTIC AND MEDITERRANEAN SEA IN 2005

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SUMMARY

*This paper represents a review of different tagging activities carried out on bluefin tuna (*Thunnus thynnus*) in the eastern Atlantic and Mediterranean Sea. Except in Croatia where tagging has been done on captive specimens, all other tagging campaigns, performed within framework of joint European Tuna Tagging Programme, have been done on bluefin tuna released in the open sea. Besides the tagging programmes based on the deployment of large numbers of conventional "spaghetti" tags on small specimens and electronic tagging campaigns (using pop-up archival tags) performed on large specimens, a first attempt in bluefin tuna tagging was made with sonic tags. In some cases the availability of fish was the main obstacle in tagging campaigns, and it has been noticed that fish from bluefin tuna farms captured for fattening purposes could also be used for tagging purposes.*

RÉSUMÉ

Le présent document fournit un examen des différentes activités de marquage réalisées sur le thon rouge (Thunnus thynnus) *dans l'Atlantique Est et la mer Méditerranée. A l'exception de la Croatie où le marquage s'est effectué sur des spécimens captifs, toutes les autres campagnes de marquage, réalisées dans le cadre du Programme européen conjoint de marquage des thonidés, ont porté sur le thon rouge remis à l'eau en haute mer. Outre les programmes de marquage basés sur le déploiement d'un grand nombre de marques conventionnelles « spaghetti » sur de petits spécimens et les campagnes de marquage électronique (utilisant les marques archives « pop-up ») effectuées sur de gros spécimens, on a tenté pour la première fois de marquer des thons rouges à l'aide de marques soniques. Dans certains cas, la disponibilité des poissons a constitué le principal obstacle dans les campagnes de marquage, et il a été observé que des poissons originaires d'établissements d'engraissement de thons rouges capturés à des fins d'engraissement pouvaient également être employés à des fins de marquage.*

RESUMEN

*Este documento supone una revisión de las diferentes actividades de marcado que se han llevado a cabo en relación con el atún rojo (*Thunnus thynnus*) en el Atlántico este y Mediterráneo. Excepto en Croacia, donde se marcaron ejemplares en cautividad, todas las demás campañas de marcado, que se llevaron a cabo en el marco de un Programa conjunto europeo de marcado de túnidos, se han realizado en atunes rojos liberados en mar abierto. Además de los programas de marcado basados en el despliegue de un gran número de marcas convencionales, marcas "espagueti" en ejemplares pequeños y campañas de marcado electrónico (con marcas archivo pop-up) en ejemplares grandes, se ha realizado un primer intento de marcado de atún rojo con marcas acústicas. En algunos casos la disponibilidad de peces fue el principal obstáculo para las campañas de marcado, y se ha constatado que los ejemplares de las granjas de atún rojo capturados para fines de engorde pueden utilizarse también en los estudios de marcado.*

KEYWORDS

Bluefin tuna (Thunnus thynnus), tagging

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1. Introduction

As it is well known, bluefin tuna is a highly migratory species with a very extensive distribution range. This fact makes it difficult to conduct direct stock assessments. Currently, stock assessment of bluefin tuna stocks relies on fisheries data, mostly within a VPA framework calibrated with different CPUE series. Three CPUE series were used in the last assessment of the eastern Atlantic bluefin tuna for calibrating the VPA. These are as follows:

- Spanish traps (ages 6+) – located in the strait of Gibraltar area;
- Spanish baitboat (ages 2-3) – operating in the surface water layer of the Gulf of Biscay;
- Japanese longline (ages 8+) – operating at a given depth range, mostly in the North Atlantic.

However, there is concern that CPUE series are affected by inter-annual variability of the stock availability to the different gears and do not accurately reflect stock abundance. This means that if VPA is tuned with biased CPUE indices, eventually it will lead to increased bias in stock abundance estimates. This fact may represent significant source of uncertainty in current bluefin tuna stock assessment. Furthermore, other uncertainties in stock assessment of bluefin tuna include:

- Spatio-temporal variability in growth patterns;
- Estimates of mortality parameters, both natural and fishing;
- Rate of mixing between east and western Atlantic stocks.

Therefore, the principal aim of tagging surveys is the reduction of these uncertainties in the bluefin tuna stock assessment. Tagging based research might include migration and behavioural studies that are closely related to stock mixing and stock delimitation issues, as well as calibration of CPUE series currently used for analytical stock assessment purposes. However, due to the fact that several research institutions from different countries are involved in conducting bluefin tuna tagging within the framework of a joint European Tuna Tagging Programme, their tagging activities have to be coordinated so that there will be no duplication of research effort.

In addition to tagging surveys, experimental tagging on small bluefin tuna in captivity, at tuna farms in the Adriatic Sea, has been done with the aim of addressing issues such as fish weight change due to farming, as well as describing post-tagging mortality in relation to different fish handling procedures, and shedding rates of conventional “spaghetti” single barb anchored tags.

2. Material and methods

Specimens of bluefin tuna used in tagging campaigns in 2005 were very different in size. The small bluefin tuna specimens have been used for tagging in captivity, as well as in tagging campaigns carried out with conventional “spaghetti” tags and sonic tags in the Western Mediterranean Sea and the Bay of Biscay. In tagging campaigns with pop-up satellite tags large bluefin tuna specimens were used.

Different fishing gears have been used to capture bluefin tuna for tagging purposes such as trolling, sport fishing and traps. Some fish were captured by purse seines, put in the farming cages and eventually used for tagging purposes.

Beside the tagging campaigns carried out by scientific institutions, some opportunistic tagging (based on recreational fishery) with conventional “spaghetti” tags has also been carried out in the East Atlantic.

3. Review of tagging activities in 2005

3.1 Croatia

Experimental tagging was carried out on 20 bluefin tuna specimens in captivity in tuna farms in the Adriatic Sea. Conventional, single-barb “spaghetti” tags have been used but in some cases experiments were also carried out with double tagging using caudal peduncle tags. Tagged fish were harvested in January 2006.

Expected outcome

Results of this experimental tagging are likely to address issues such as fish weight changes due to farming and/or tagging related stress, as well as to describe post-tagging mortality in relation to fish handling procedures used. Such experiments may improve knowledge about shedding rates and/or suitability of different types of tags (anchors) currently used in tagging campaigns.

3.2 Greece

Greek tagging surveys in 2005 focused on swordfish only, but in this occasion two bluefin tuna specimens were tagged with conventional "spaghetti" tags provided by ICCAT.

3.3 Italy-Cyprus-Malta

The joint Italian-Cypriot and -Maltese bluefin tuna tagging programme in 2005 had a target to tag 50 bluefin tuna with pop-up satellite tags. However, a total of 24 bluefin tuna were tagged in 2005, with 5 of these tagged in Sicily, 9 in Malta and 10 in Cyprus. All these BFT originated from farming facilities. Low catches in the traps in the agreed tagging period in 2005 resulted in reduced tagging opportunities and a shortfall in the target set.

Expected outcome

Mid-May 2006 is the expected pop-up date for these tags. Bluefin tuna tagged under this joint programme will help to refine the CPUE series for Spanish trap, and longline CPUE series for Japan, Italy and Spain, the first two of which are used to tune the VPA based assessment of the stock. Furthermore, it will provide additional information on spawning site fidelity, mixing rates and stock delimitation issues.

3.4 Portugal

Portugal purchased five tags and made the necessary arrangements to purchase bluefin tuna from trap owners in August with the aim of tagging five fish between 100 and 150 kg. However no fish were trapped during the agreed period and therefore no tags were deployed. Therefore, tags will be used during the 2006 tagging surveys.

Expected outcome

Portuguese electronic tagging of bluefin tuna contribute to the overall pop-up tagging effort with the aim of obtaining data for refining the Spanish trap CPUE series currently used to tune the VPA based bluefin tuna assessment. Furthermore, the knowledge on spawning site fidelity, mixing rates and stock delimitation issues is expected to improve.

3.5 Ireland

Ireland purchased five electronic tags in 2005 and made necessary arrangements with charter boat operators to obtain fish and deploy tags. However, fish were not available in the Irish coastal waters until late September. At that time bad weather and tidal regimes prevented the sport fishery. Therefore, no tags were deployed and tags were returned to storage for use in 2006.

Expected outcome

Irish tagging of bluefin tuna contributes to the overall tagging effort. The presence of bluefin in the Irish coastal waters and the existence of a sport catch-and-release fishery offer a unique opportunity to tag large bluefin in an area of the north east Atlantic far removed from other tagging sites, as well as from the known bluefin spawning areas. Therefore, it is expected that Irish tagging data could be used for refining Japanese longline CPUE series and to improve knowledge on stock delimitation and mixing rates in the North Atlantic.

3.6 Spain

3.6.1 Electronic tagging campaign

Due to the difficulties of the administrative procedures required for purchasing the electronic tags, it was impossible to deploy pop-up tags during 2005. Eventually, 20 pop-up archival tags (PAT tags) have been purchased and they are re-scheduled to be used during the 2006 tagging surveys.

3.6.2 Sonic tagging campaign

During the period of July-August 2005, a total of 18 bluefin tuna were caught by trolling line in the Bay of Biscay, but most of them were rejected as unsuitable for tagging purpose as they were too small. Taking into account the size of the tags, bluefin tuna specimens of at least age two were needed. Three bluefin tuna were

tagged and tracked for 4, 5 and 5 hours respectively providing information on temperature and depth. The main problems encountered were the low catch rates of fish using trolling lines and the fact the majority of the fish caught were smaller than the targeted size. In the future, it is planned to use smaller tags suitable for smaller fish (age 1) also. In addition to sonic tags, internal archival tags purchased by AZTI will be used.

Expected outcome

This was the first attempt of tagging small bluefin tuna with sonic tags. Therefore, as expected, new experience in field work has been gained. In general, it might be expected that sonic tagging data collected in the future could help resolve uncertainties in the assessment of juvenile stock components of bluefin tuna through calibration of the Spanish bait boat CPUE series used in a Habitat based model (HBM) approach.

3.6.3 Conventional tagging campaign

Conventional tagging targeting small bluefin tuna was done in the Bay of Biscay during 2005. A total of 1696 small bluefin tuna were tagged in 27 tagging operations, ranging between 54 cm and 105 cm in FL, between July 19 and the August 2, 2005. The estimated age-composition of tagged specimens, based on the growth curve by Cort (1991), was: 1270 specimens of age one, 423 specimens of age two and just one specimen of age three. Fifty-one tagged fish have been recaptured up to March 2006. In this occasion, two different tag anchor types were used, and preliminary results indicate a better performance of the steel attachment method.
Due to the low occurrence of juveniles in the western Mediterranean, conventional tagging in the Balearics has been postponed for 2006.

Expected outcome

Conventional tagging of bluefin tuna juveniles in the Bay of Biscay was proposed with the aim of studying horizontal distribution and the influence of temporal changes in their availability to the baitboat fishery in the area. It is expected that the results will refine baitboat CPUE series used in the calibration of the model applied to the eastern and Mediterranean bluefin tuna stock assessment. Furthermore, the results of these surveys will serve to study bluefin tuna feeding migrations to the Bay of Biscay, quantify transfer movements between different areas and estimate fidelity to birthplace in the Mediterranean. Also, it is expected that the results could be used to estimate growth and natural mortality of small bluefin tuna.

3.6.4 Opportunistic tagging

During the 2005, 316 bluefin tuna were tagged with conventional spaghetti tags by collaborating skippers onboard recreational vessels. During the same year, 24 tags were recovered. The information has been sent to the ICCAT database.

Expected outcome

It is expected that information obtained in opportunistic tagging will contribute to the analyses carried out with other conventional tagging information.

4. Discussion and suggestions

Tagging surveys carried out with conventional spaghetti tags could be useful tool to refine baitboat relative abundance index (CPUE) series, and to test if juveniles in the Bay of Biscay are representative of juveniles in the whole population, and allow the estimation of the proportion of fish born in the Mediterranean. If the similar tagging campaign is done in parallel in the Western Mediterranean, the exchange rate of fish between Biscay and the Mediterranean Sea could be estimated. It was not a case in 2005, but in the future efforts should be made to ensure that parallel conventional tagging surveys are conducted in both areas from 2006 onwards. However, because of minimum size regulation, there could be a concern on the underreporting of recaptured fish of age one.

In the case of sonic tagging the low rate of tagging and short periods of time of fish tracking put a concern on this tagging activity. In this first attempt, valuable field experience was gained. Results obtained in this research may represent valuable source of information about behaviour of juvenile bluefin tuna in the wild. It can be suggested to continue with such tagging campaigns. However, it is also suggested to make necessary

improvements to enable researches to be in contact with fish for more extended time periods, and to deploy sufficient numbers of tags that will be useful for Habitat Based Models assessment approach also.

Electronic tagging can provide information on both the horizontal and vertical distribution of the stock that could be used to refine the annual CPUE values. The objective should be to conduct a joint electronic tagging program in the East Atlantic and Mediterranean Sea that will track the variations in annual availability of bluefin to the different gears. Together with the results from electronic United States tagging experiments it will help to improve our knowledge on spatial dynamics of bluefin tuna stocks, mixing rates between East and West Atlantic, spawning site fidelity, and stock delimitation issues. Such work can be best done through electronic tagging campaigns. It was noticed that bluefin tuna farms are the best source of fish for electronic tagging, and good relationships with tuna farm owners could be of vital importance for successful electronic tagging in the future.