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OBSERVED MIGRATION OF ALBACORE (*Thunnus alalunga*) BASED ON RESULTS OF SPANISH TAGGING CRUISES IN NORTH EAST ATLANTIC (Bay of Biscay, 1988-1993).

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ABSTRACT

Within the research framework of the Special Program of Albacore (PSG) sponsored by ICCAT the activities included intensive tagging campaigns carried out by Spain (1989-1991). Among the aims was the study of migration pattern and movements. From a total of 12,127 immature albacore tagged and released in the third quarter of the year in the Bay of Biscay (Cantabrian sea) 381 individuals were recovered along the north eastern Atlantic and Cantabrian sea for this purpose. The study shows that the migration patterns for immature albacore confirm previous summer established migration routes towards the southern coast of Ireland and inner area of Bay of Biscay where the shoals concentrate at the end of summer season, although variations between years exist.

RESUME

Parmi les activités prévues dans le cadre du Programme Spécial de Recherche sur le Germon financé par l'ICCAT, une campagne de marquage intensif a été réalisée par l'Espagne (1989-1991). L'un des objectifs de cette campagne était l'étude des migrations et des déplacements. Sur un total de 12.127 germons marqués au cours du troisième trimestre de l'année dans le Golfe de Gascogne (Mer Cantabrique), 381 individus ont été récupérés dans l'Atlantique Nord-Ouest et dans la Mer Cantabrique. L'étude démontre que les itinéraires de migration estivale des jeunes germons sont les mêmes que ceux qui avaient été établis dans le cadre de travaux antérieurs (l'un vers le Sud de l'Irlande et l'autre vers le Golfe de Gascogne), même si l'on peut observer quelques variations d'une année sur l'autre.

RESUMEN

En el marco del Programa de Investigación Especial de Atún Blanco patrocinado por ICCAT dentro de las actividades se incluyó la realización de campañas de marcado que realizó España. Entre los objetivos se encontraba el estudio de las migraciones y desplazamientos. Un total de 12.127 ejemplares de atún blanco fueron marcados y liberados durante el tercer trimestre del año en el Golfo de Vizcaya, de los cuales se recapturaron 381 para este estudio. Este trabajo muestra que las rutas de migración estivales seguidas por los atunes blancos juveniles concuerdan con las establecidas en trabajos previos, una hacia el sur de Irlanda y otra via hacia el golfo de Vizcaya, aunque se observa una variación entre años.

1. INTRODUCTION

One of the purposes, among others, of tagging experiments is to know the movement patterns of the population. Aloncle et Delaporte (1977) defined two migration paths for immature albacore in the north Atlantic, known as the "Classical or Cantabrian" route and the "Azorian" route, derived from tagging data.

A description of summer and winter albacore migrations is found in Hue (1980), who analyzed 6.206 tagged and released albacore in the North Atlantic from 1968 to 1977.

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During 1976, tagging studies were initiated by the IEO (Instituto Español de Oceanografía) in the Bay of Biscay, in the east of the Cantabrian Sea. Although the target species was not albacore (Cort and Mejuto, 1990), 1,009 thousand albacore were released up to 1987.

Between 1988 and 1991, annual tagging campaigns were carried out in this area directed at immature albacore (Cort *et al*, 1992; Ortiz de Zárate *et al.*, 1991, 1993). The main purpose of these tagging activities was to achieve a better knowledge of the biology, ecology and population dynamics of this species in the Atlantic Ocean within the research framework of the Special Program of Albacore (PSG) sponsored by ICCAT (ICCAT 1990, 1991). In particular, the use of marking studies to determine patterns in the migration behaviour and interaction between surface fleets were identified as research areas.

The first attempt to analyze the spatial/temporal distribution of recaptures obtained from Spanish tagging campaigns by size group individuals was done by Cort *et al*, 1992.

In this study the results from the last albacore tagging cruises in the Atlantic (1988-1993) are summarized, giving an overall qualitative description of the migration pattern.

2. MATERIALS AND METHODS

During the 1988 to 1991 period, when the directed albacore tagging campaigns were carried out by Spain, a total amount of 12,127 tagged juvenile albacores (1-2 age group) were released. Figure 1 shows the fork length of released individuals.

All the tagging cruises took place during the summer season, August and September, in the inner area of the Bay of Biscay (Cort and Mejuto, 1989; Ortiz de Zárate *et al.*,1991; Ortiz de Zárate and Parrack, 1994)

Information recorded for every tag/returned fish was: date, location (latitude and longitude) and gear. Total number of recaptures was 381, which represents 3,14% of the recapture rate reported by the surface fisheries fleets. These were baitboat, trollers, mid-water trawlers and driftnetters targeting albacore in the north east Atlantic Ocean and Bay of Biscay in the period 1988-1993. Table 1 includes all the recoveries.

However, the description of migration comprised only the recoveries from tagged individuals being at liberty more than 9 months, which means recaptured in the next fishing season or years following years the date of release. As the surface fishery operates from the beginning of June to the end of November, only this period is covered.

A partition between Atlantic waters and Bay of Biscay was chosen to analyze the percentage recovered by area, year and fleet. The meridian 10°W was chosen to classify the area into: area east (E) from 0°W to 9°59' W and area west (W) from 10°W to 30°W.

We have used the term "migration" as defined by Harden Jones (1984) in the sense of coming and going with the seasons on a regular basis. Therefore we have studied the trophic migration during summer and fall seasons.

3. RESULTS

The number of recovered fish eligible was 260, which accounts for 68.2% of total returns and 2.1% with respect to the total released number. For each given year those recoveries classified by area and fleet are included in Table 2.

In Figure 2, the recoveries for the 1989 fishing season are represented. Despite the low number of recoveries in this year, due to a small number of tagged albacore having been released prior to this year, the two migratory routes followed by albacore when moving for feeding purposes are evident.

In Figure 3, after an increase in the number of releases in 1989, a large amount of recoveries are present for 1990. Also, the established directions followed during summer movements to productive areas are clear.

In Figure 4, the recoveries for the 1991 fishing season are represented. As well, a second massive albacore release took place in 1990. The dispersion of recoveries fit the migratory routes for immature albacore.

In Figure 5, the recoveries for the 1992 fishing season are represented. The defined migratory routes are observed as well as three recoveries located in the most southern area of the Atlantic corresponding to sub-adult albacore recaptured in November.

In Figure 6, the recoveries for the 1993 fishing season are represented. Again the scattered recoveries fit the known migratory routes, while the recovery located in the most southern area in the Atlantic corresponds to a sub-adult albacore caught in November as well.

4. DISCUSSION AND CONCLUSION

The information on migration is in accordance with previous results from other tagging cruises (Alocle et Delaporte, 1977, Cort *et al.*, 1992). There is a direction followed at the beginning of the season in the outermost area described in this study as area west, corresponding to the adjacent waters of the Atlantic Ocean towards the eastern area (Cort *et al.*, 1992)

As the season progresses the shoals approach the Cantabrian sea where they concentrate, until the end of the season, in the area defined as east, corresponding to the Bay of Biscay. Although the recoveries are not analyzed on a monthly basis, the trajectory of fleets during the summer fishing period is sufficiently explicit to understand the movements of albacore through their activities. As for driftnetters and trollers, their operations begin in May and June respectively. Bait boats begin the fishing season in July and mid-water trawlers, quite opportunist, may begin their activity in August or September.

The recent recoveries along the Portuguese platform are obtained by the bait boats and trollers that moved to the Mediterranean in the autumn season. A growth in the number of recoveries is noticed at the beginning of the season coming from catch by driftnets from 1990 onwards.

Further studies might incorporate quantitative treatment to these observations by means of statistical analysis.

5. ACKNOWLEDGEMENTS

Thanks are extended to the fishermen and skippers from surface fisheries that promptly reported recoveries of tagged fish. We should also like to express our appreciation of the collaboration of IFREMER (Center in Brest), AZTI-SIO (Center in Sukarrieta) and collaborators from IEO at fishing ports, for collecting the data used in this study.

Table 1. **Number of recoveries analyzed for the period 1988 - 1993, reported by different surface gears.**

YEAR	NUMBER OF TOTAL RELEASES	No. RECOVERIES BY YEAR 1988	1989	1990	1991	1992	1993
1988	486	[22]	8	7		1	
1989	2969		[19]	58	9	6	1
1990	4481			[28]	23	36	2
1991	4191				[52]	92	17
TOTAL		22	27	93	84	135	20

[ ] - represent number of recoveries of tagged fish being at liberty less than 3 months not included.

Table 2. **Recoveries of albacore being at liberty more than 9 months by area and type of surface fleet.**

	WEST (10°W - 30°W)				EAST (0° W - 10°W)				
YEAR	BB	TROL	GILL	MWTD	BB	TROL	GILL	MWTD	TOTAL
1989	3	--	1	1	3	--	--	--	8
1990	2	4	3	1	46	7	--	2	65
1991	3	1	5	--	20	2	--	1	32
1992	3	6	9	--	98	9	--	10	135
1993	--	--	4	--	9	4	--	3	20

BB = Bait boat TROL = Troll
GILL = Gillnet MWTD = Mid-water trawl

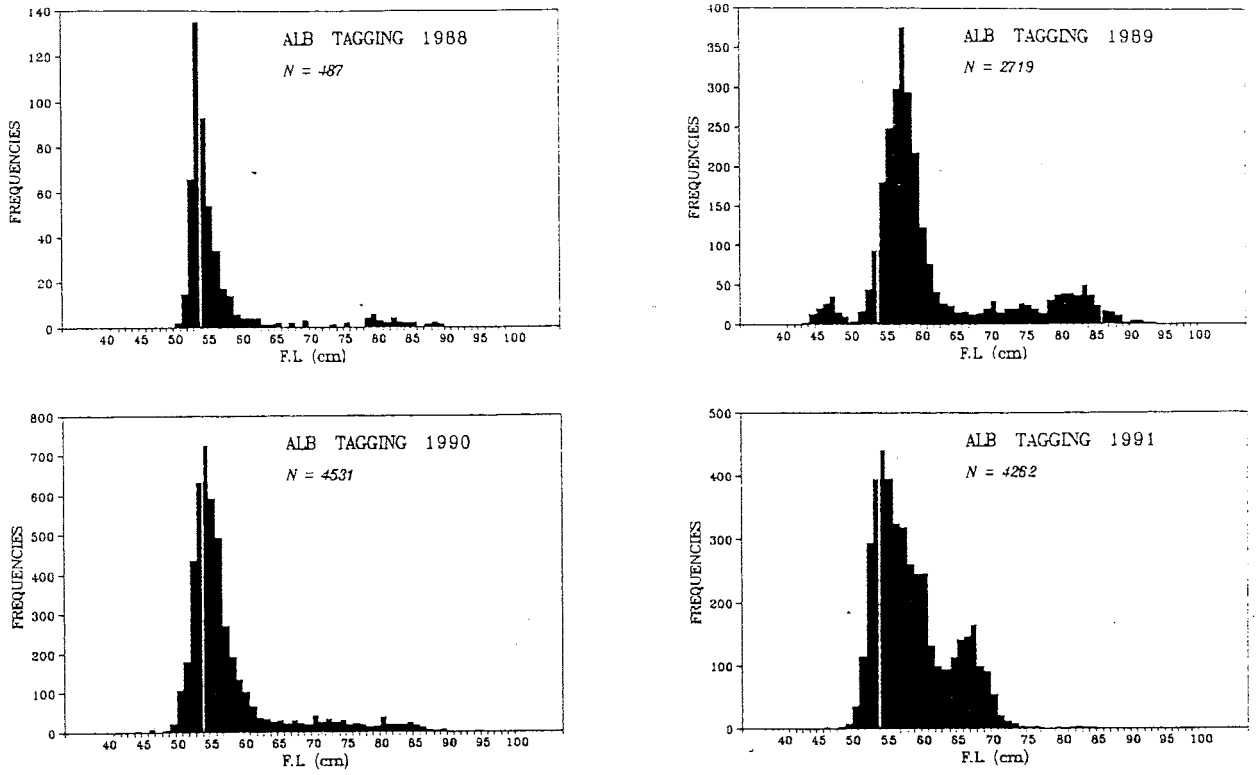

Fig. 1. Length frequency distribution of tagged and released albacore from 1988 to 1991.

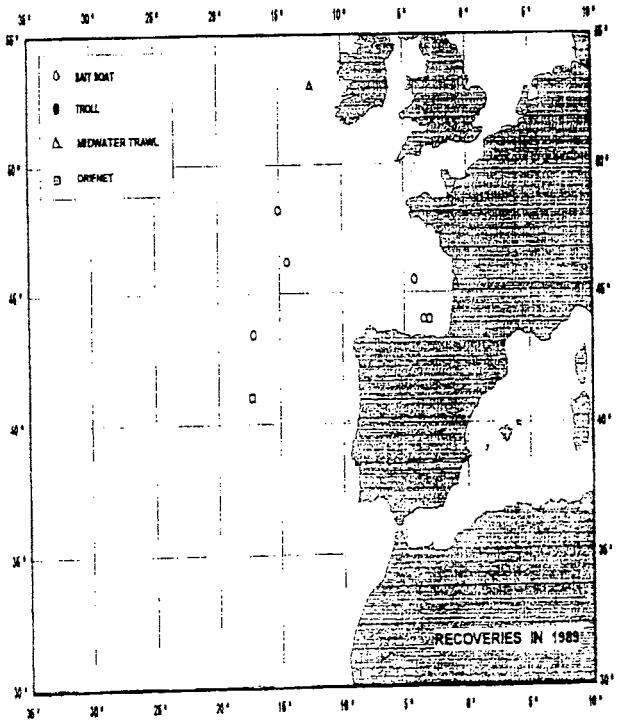

Fig. 2. Distribution of the recoveries for tagged albacore in the 1989 fishing season being at liberty more than 9 months.

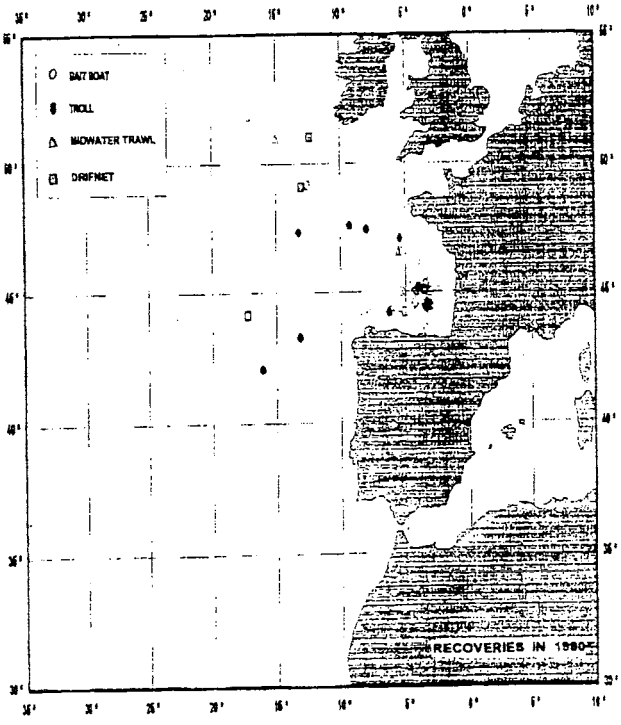

Fig. 3. Distribution of the recoveries for tagged albacore in the 1990 fishing season being at liberty more than 9 months.

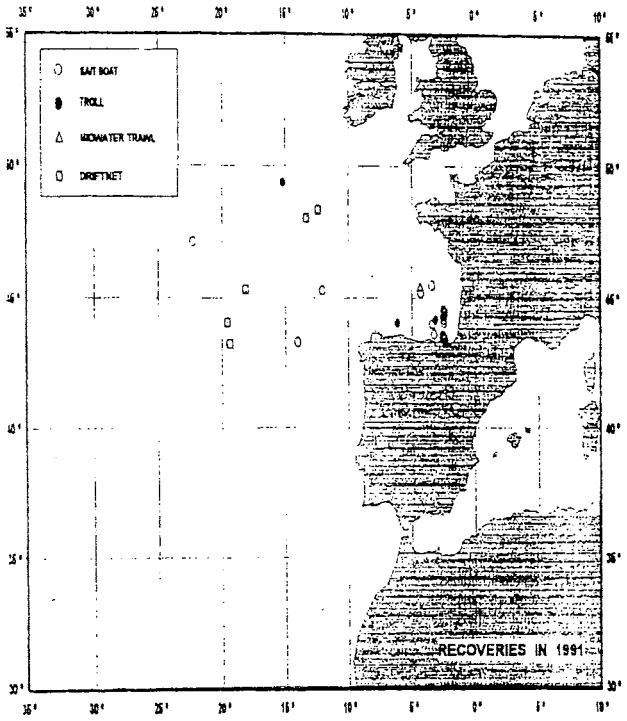

Fig. 4. Distribution of the recoveries for tagged albacore in the 1991 fishing season being at liberty more than 9 months.

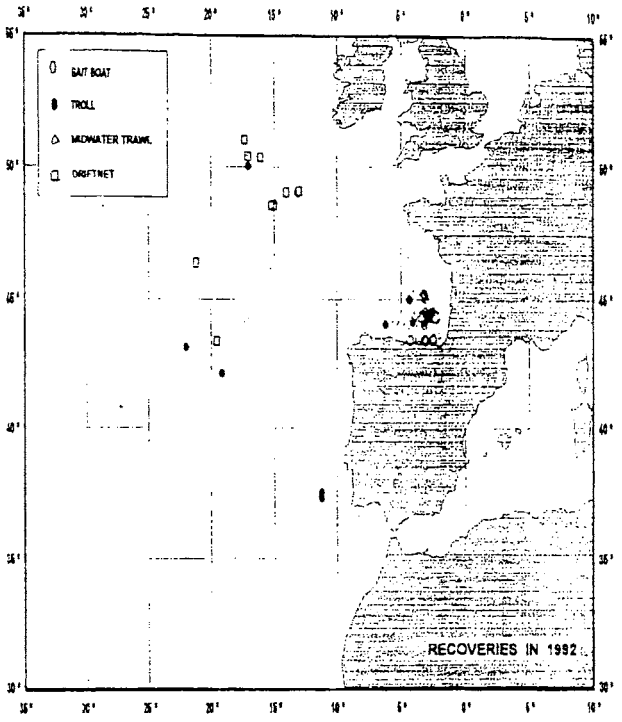

Fig. 5. Distribution of the recoveries for tagged albacore in the 1992 fishing season being at liberty more than 9 months.

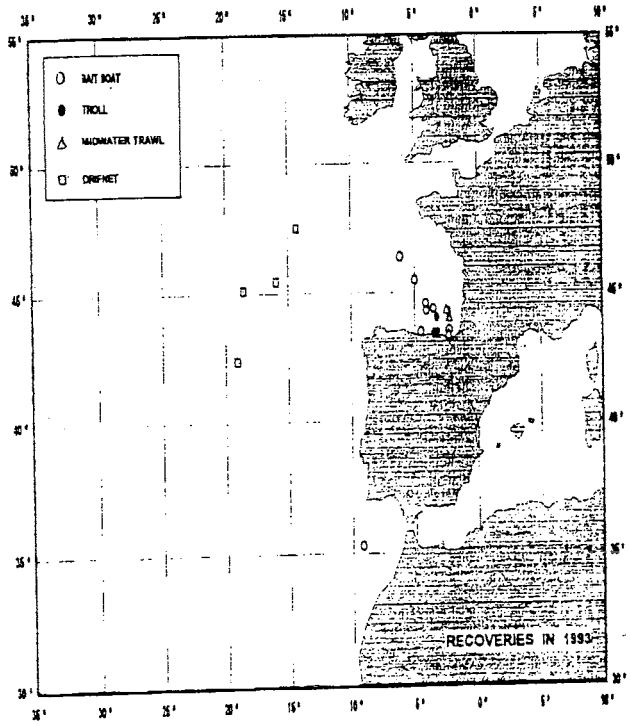

Fig. 6. Distribution of the recoveries for tagged albacore in the 1993 fishing season being at liberty more than 9 months.