

## RESULTS OF TAGGING EXPERIMENTS ON ALBACORE (*THUNNUS ALALUNGA*) IN THE NORTHERN IONIAN AND SOUTHERN ADRIATIC SEAS FROM 1990 TO 1995

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### SUMMARY

In the years 1990 to 1995, tagging operations were carried out in the Ionian and Adriatic Seas in order to study albacore migrations and growth rates. In addition, oxytetracycline was injected into their dorsal muscles as a chemical marker for age validation. The results shows that the average annual length increased to about 2.85 cm and only on discontinuity for each year of life at liberty was observed to form in the hard parts. No information was obtained on migrations.

### RÉSUMÉ

Au cours des années 1990-95, des opérations de marquage ont été menées à bien dans les mers Ionienne et Adriatique afin d'étudier les migrations et les taux de croissance du germon.

De plus, de l'oxytétracycline a été injectée dans leur muscles dorsaux en tant que marqueur chimique pour la validation de l'âge.

Les résultats montrent que l'accroissement annuel moyen de la longueur est d'environ 2,85 cm et on a observé la formation dans les pièces dures d'une seule discontinuité pour chaque année de vie en liberté.

Aucune information n'a été obtenue au sujet des migrations.

### RESUMEN

En los años 1990 a 1995, se llevaron a cabo operaciones de marcado en los mares Jónico y Adriático, con el fin de estudiar las migraciones y tasas de crecimiento del atún blanco.

Además, se inyectó oxitetraciclina en sus músculos dorsales como marcador químico para validación de la edad.

Los resultados mostraron que la media de incremento de talla anual está en torno a 2.85 cm, y se observó que formaba las partes duras una sola discontinuidad para cada año de vida en libertad.

No se obtuvo información acerca de las migraciones.

**Key-words:** albacore, age validation, oxytetracycline, Mediterranean

### INTRODUCTION

In 1990, three cruises were planned in the Mediterranean and another one in the Eastern Atlantic in order to study the stock structure and growth rates of albacore (*Thunnus alalunga* Bonn.).

Noting this, the GFGM-ICCAT Expert Consultation on evaluation of stocks of Large Pelagic Fish in the Mediterranean Sea, on the occasion of the meeting held in Bari during the 21-27 June 1990 period, being convinced that the Mediterranean fishery offered an unique opportunity to validate age reading on hard parts, since size frequency and hard parts could be collected from the same sample, recommended that scientists initiate or continue investigations on this subject with an international cooperation.

In addition, the Consultation, aware of the necessity of age validation (Beamish and Mc Farlane, 1987; Casselman 1983), also suggest the use of tetracycline injection to verify aging, and of different coloured tags to distinguish the fish injected with tetracycline, so that fishermen could return the fish together with the tags (FAO, 1991).

The cruises began in 1990 with a joint project founded by ECC and by some national institutions: the Ministry for the Navy in Italy, the Instituto Español de Oceanografía in Spain and the Ministry of Agriculture in Greece, but during the following years each country continued the tagging.

In this paper, we report the results obtained from the cruises carried out in Italy during the six year period 1990 - 1995.

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## MATERIALS AND METHODS

In the years 1990 to 1995, 897 albacores were marked, 661 of which in the Ionian Sea (Gulf of Taranto) and 236 in the Southern Adriatic Sea (Figure 1); 765 of them - 590 in the Ionian Sea, 175 in the Southern Adriatic - were injected with oxytetracycline and marked with spaghetti-like red tags and then released.

Table 1 shows the tagging scheme (R = red tag; Y = yellow tag) used in 1990 to 1995.

Table 1 - Summary of the albacore taggings carried out in the Italian Southern seas in the years 1990 to 1995.

	IONIAN		ADRIATIC	
	R	Y	R	Y
1990	44	10	-	-
1991	140	35	53	24
1992	4	-	-	-
1993	86	-	-	-
1994	206	26	14	-
1995	110	-	108	37
Total	590	71	175	61
Total (R)	765			
Total (R+Y)	897			

Oxytetracycline (trade name IZOMICINA 100) was injected in the dorsal muscle, on the side of the dorsal fin, in the dose of 70mg/kg of evaluated weight (Mc Farlane and Beamish, 1987), employing a SOCOREX automatic syringe.

The date and place of release were marked for each animal, and the fork length (FL) in cm was measured.

Data on capture and information on the place of recovery were noted for the two recaptured animals whose tags only had been returned, whereas data on length, date and place of recovery were given for the animals whose body had been returned. The first ray of the dorsal fin and the last caudal vertebrae were removed from the latter animals.

Using a low-speed saw (ISOMET) in the lab, three serial, 0.6mm-thick sections were obtained from the first ray of the dorsal fin, near the condyle, whereas two sagittal, 0.6mm-thick sections were obtained from a caudal vertebra.

All sections obtained were mounted with synthetic resin (EUKIT) (Gonzales-Garces and Fariña-Perez, 1983) and observed with a LEITZ DIAPLAN microscope equipped with a Leitz Phoemopak ultraviolet light (3 lambda) with a D-type filter for tetracycline.

The trace left by tetracycline was pinpointed and, by adding white light to the ultraviolet light, the discontinuities formed after the trace of tetracycline were counted.

The same LEITZ DIAPLAN microscope was used for pictures, equipped with a Wild Photomat MPS 45/51 system and a FLUOTAR 10/0.03 lens.

## RESULTS

Only seven albacores, corresponding to 0.91% of all the animals injected with tetracycline, have been recovered so far. All the recovered animals had been tagged in the Northern Ionian at approximately the same area of recovering. No recovery has been as yet reported of the animals tagged in the Adriatic Sea.

The first two specimen were recovered in 1991, almost exactly one year after the tagging, and their tag only was returned, as well as some verbal indication as to the date and place of recovering. The third specimen was recovered in 1994, after three years of life at liberty. Of the last four specimen, one was recovered after two years, and three after ten months of life at liberty. Both the tag and the body were returned of the last four specimen, as well as some information on the date and place of recovering. The data regarding the dates and place of releasing and recovering of the 7 specimen are reported in Table 2.

Table 2 - Tag number code - Date and coordinates of releasing and recovering, and fork length of the recovered albacores in the Ionian Sea from 1990 to 1994.

TAG CODE	RELEASES			RECOVERIES		
	DATE	FL(cm)	COORDINATES	DATE	FL (cm)	COORDINATES
N.5364	11.11.90	76	40°10'N/17°15'E	10.11.91	unknown	same area
N.5336	20.11.90	75	40°08'N/17°20'E	29.10.91	unknown	same area
N.5262	07.10.91	71	40°05'N/17°16'E	07.12.94	77	39°50'N/17°28'E
N.00220	17.10.93	66	40°41'N/17°14'E	27.10.95	70.5	39°41'N/17°24'E
N.00330	22.11.94	70	40°05'N/17°22'E	04.10.95	72.5	40°02'N/17°24'E
N.00377	24.11.94	67	39°51'N/17°21'E	30.09.95	70.5	39°49'N/17°20'E
N.05158	06.12.94	71	39°55'N/17°13'E	07.10.95	73.5	39°38'N/17°23'E

Figure 2 shows the place of release and recovery of the 5 albacores recaptured after oxytetracycline injection. As it can be seen, all albacores, independently of the period spent at liberty, were recovered in the same area of release, some miles off the place where they were tagged. The measurement of the fork length (FL), carried out both at the moment of release and of recovery, permitted to obtain the growth rates reported in Table 3.

Table 3 - Tag number code, dates of release and recovery, time spent at liberty, total, monthly and annual increase of the 5 albacores whose body was returned.

Tag Code	Release date	Recovery date	Months at liberty	FL (cm) at Release	FL (cm) at Recovery	Tot. increase (cm)	Month. mean increase (cm)	Annual mean increase (cm)
5262	07.10.91	07.12.94	38	71	77.0	6	0.158	1.90
00220	17.10.93	27.10.95	24	66	70.5	4.5	0.188	2.25
00330	22.11.94	04.10.95	10	70	72.5	2.5	0.250	3.00
00377	24.11.94	30.09.95	10	67	70.5	3.5	0.350	4.20
05158	06.12.94	07.10.95	10	71	73.5	2.5	0.250	3.00

These data suggest that the average annual growth varied from 1.9 to 4.2 cm and that it was included between 2 and 3 cm in most albacores.

The microscope examination of the hard parts, carried out on the cross sections of the first spiniform ray of the first dorsal fin and on the sagittal sections of the vertebrae, showed that it was easier to carry out observations on the vertebral sections of the albacores examined than on the spine cross sections, as the former showed much clearer discontinuities. Furthermore, the ratios between the tetracycline trace and the bone structure formed after its injection in the spine were not as clear as they were in the vertebrae.

In both the hard parts, however, a prolonged exposure to UV was observed to remarkably weaken the fluorescent trace, particularly when it was not too marked.

Adding white light to UV helped a lot in defining the connections between the fluorescent trace and the bone structures formed afterwards.

The results of the observation carried out on the vertebrae and shown in Figures 3-6, indicate that only one discontinuity formed in the hard parts for each year of life at liberty, in four albacores of the five studied.

In fact the Figure 3 shows the oxytetracycline trace 10 months after the injection: no discontinuity were formed after.

The Figure 4, that shows the image obtained from the vertebra sagittal section of the albacore tagged in 1991 and recovered in 1994, indicates that the tetracycline deposit began immediately after the beginning of the formation of the 1991 autumn increase, and that three more translucent bands were formed soon after the fluorescent trace, probably corresponding to the autumn of 1992, 1993 and 1994 respectively.

Figures 5 and 6 show the situation observed in an albacore tagged in October 1993 and recovered in October 1995, after two years at liberty. It seems that the situation is not clear both in figure 5 in UV and in figure 6 in UV added with white light. The pictures obtained are not too clear. It seems, however, that the fluorescent trace covers the limits of the translucent band formed in the 1993 autumn, and it is also possible to observe two more translucent bands that were presumably formed in 1994 and 1995 respectively.

#### CONCLUSIONS

The percentage of tags recovered from albacores tagged and injected with oxytetracycline was very low (0.91%), particularly when compared to the recovery percentages (4.7%) obtained by Ortiz de Zarate *et al* (1994) during the experiment carried out in the Bay of Biscay.

More than to mortality, this was certainly due to the poor willingness of the local fishermen to cooperate in returning the tags. They would rather keep the tags as a memento than returning them.

Even though it is impossible to draw any indication on the migrations of the species from the albacore recoverings, since the few recoveries were all made in the same area of the release, it seems legitimate anyway to draw some preliminary conclusions on both growth rates and age validation.

The data obtained so far seem to indicate that the Mediterranean albacore average annual length increase corresponds to about 2.85cm and it shows that its growth pattern differs from that of the Atlantic albacore, for which Ortiz De Zarate *et al.* (1994) report an average increase of about 10 cm per year.

Although the number of albacores recovered and studied was not high, it is legitimate to draw some indication about the validity of the method to evaluate the albacore age also by reading vertebrae, mainly in the Mediterranean, where it seems that the pattern of the fin ray bone structure is different from the one of the Atlantic.

The results obtained so far seem to indicate that only one discontinuity in the bone tissue is formed in one year in the Mediterranean albacore, but the number of specimen examined up to now is too limited to assert this. On the other hand, Ortiz De Zarate *et al.* (1994) described the annual formation of a discontinuity number as varying from 1 to 3 in the Atlantic albacore.

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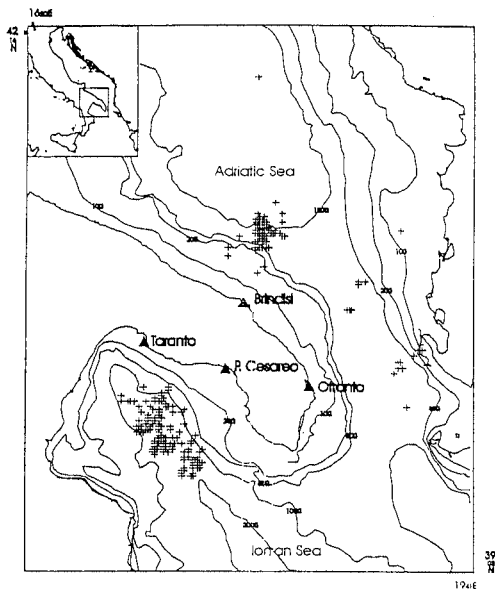


Fig.1 - Areas of the Northern Ionian and the Southern Adriatic where albacore taggings were carried out in the six-year period between 1990 and 1995.

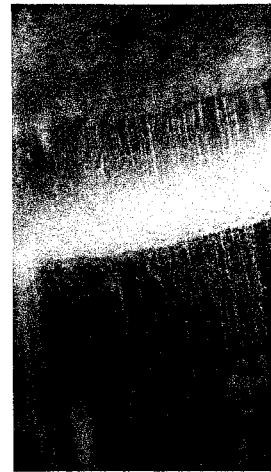


Figure 3

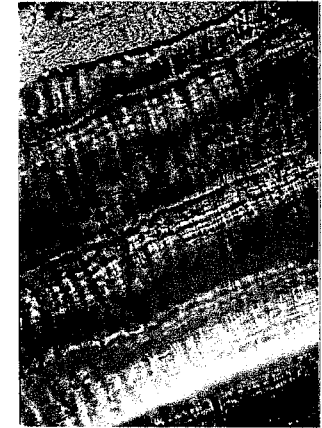


Figure 4

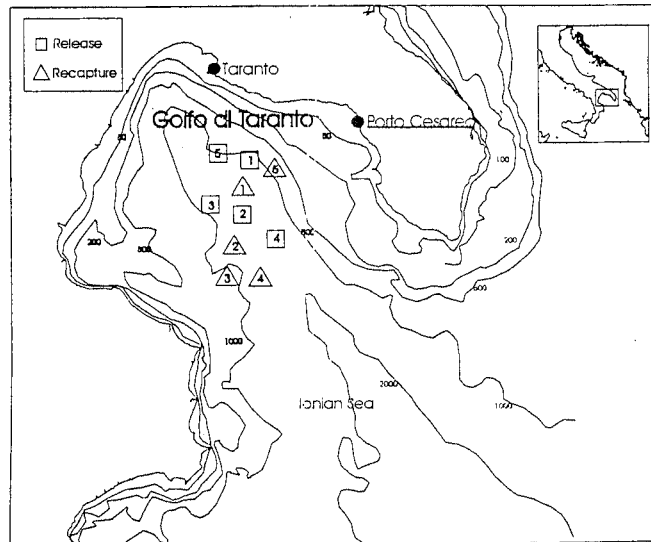


Fig.2 - Place of release and recovery of the five albacore recovered after oxytetracycline injection.



Figure 5

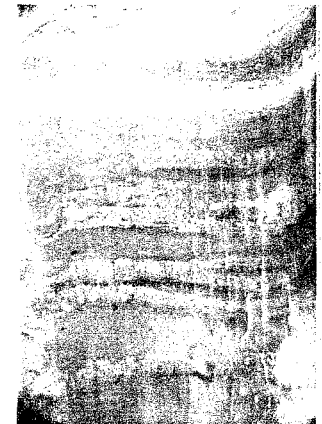


Figure 6