

**JUVENILE BLUEFIN TUNA (*THUNNUS THYNNUS*) TAGGING
IN THE WESTERN MEDITERRANEAN DURING THE PERIOD 1990-1995 :
RELIABILITY AND UTILITY OF THE RESULTS (REVISED)**

de la Serna, J.M., E. Alot, J.M. Ortíz de Urbina, M.P. Rioja¹

SUMMARY

This paper analyses the tagging-recovery operations carried out on juvenile bluefin tuna in the western Mediterranean during the period 1990-1995. The reliability and the viability of the results are discussed.

RÉSUMÉ

Ce document présente une analyse des activités de marquage-recapture des thons rouges juvéniles dans la Méditerranée occidentale entre 1990 et 1995. La fiabilité et l'applicabilité des résultats sont également débattues.

RESUMEN

En el presente documento se hace un análisis de la actividad de marcado-recaptura de atún rojo juvenil en el Mediterráneo occidental durante el período 1990-1995 y se reflexiona sobre la fiabilidad y aplicabilidad de los resultados.

FOREWORD

The Standing Committee on Research and Statistics (SCRS) of ICCAT has strongly recommended juvenile bluefin tuna tagging campaigns as a way of improving knowledge about the stock structure of this species and to validate the studies on growth and estimation procedures of relative abundance.

During the bluefin tuna year programme (BYP) several questions were addressed concerning the main aspects of the tagging activity, such as the likely mortality of very young fishes and the negative effect of this practice on juvenile growth.

MATERIAL AND METHODS

Two sources of data were used to develop the main aims of this work: mark-recapture data from tagging campaigns in the Gulf of Vera (Almería) and the Gulf of Valencia (Western Mediterranean) during 1990-1995 and histological analyses of 12 recaptured fishes. Furthermore, it is carried out an examination of the used methodology during tagging campaigns and the reliability and applicability of the results.

RESULTS

1. ABUNDANCE INDICES

Table 1 shows juvenile bluefin tuna tagged during the period 1990-1995 in the Western Mediterranean. It must be remarked the variability on the number of recaptured fishes.

For recruitment abundance estimation, using the data base on mark-recapture for 0 age class, it seems necessary to have some previous knowledge about the mortality due to the tagging activity. Furthermore, it is necessary to evaluate the number (or percentage) of recaptured fishes, keeping in mind that we are speaking about notified recaptured fishes.

1.1 Mortality

Juvenile bluefin tuna mortality due to tagging activity is a function of several factors such as:

1.1.1. Fishing gear used during the tagging activity. For example, troll could produce traumatism in the fish gill. This problem is actually solved with elastic dampers.

1.1.2. Tagging technique could have some incidence on juvenile mortality; the depth of the mark and its trajectory are very important factors.

1.1.3. The size of the tags is disproportionate to the length of the tagged fishes (*Figures 1, 2*).

1.1.4. The length of the tagged bluefin tuna in the Western Mediterranean is always small; these fishes go off the fishery when they get 2 kg weight. Very few fishes, which were smaller than 30 cm when tagged, have been recaptured. (*Figure 3*).

1.1.5. Because of the tagging technique and the marks, it is necessary some evaluation of the inflicted wound which, added to likely infections, constitute the main cause of tagged juvenile mortality.

¹ Instituto Español de Oceanografía, C.O. de Málaga, Apartado 285, Puerto Pesquero s/n, 29640 Fuengirola-Málaga, España.

These wounds have been observed for 12 recaptured fishes (Table 2) which were recaptured after a period of 19- 53 days at freedom. When tagging wounds were observed, it could be seen that two individuals presented internal anomalies, likely related to haemorrhage or inflammation processes. External appearance, albeit the lack of bacteriological analyses, showed correctly healing except for 3 individuals. The use of antibiotics when tagging activity is being developed seems necessary.

Lastly, it must be remarked that the recapture of bluefin tuna - tagged several hours or few days ago - was not an uncommon event; which would indicate low incidence of tagging activity on juvenile mortality.

1.2 Recaptures

The number of recaptured fishes is a function of three main factors: the number of tagged fishes, the abundance of the resource and the fishing effort done; but there are some other factors such as:

Mark - recapture campaigns publicity; when information on tagging campaigns is given to the fishing sector, the percentage of notified recaptured fishes is higher.

The fishing area is also an important factor, depending on the presence of a fishing fleet. Also the fishing gear is an important factor; it must be noted that the percentage of recaptured fishes is smaller when it is used troll than when it is used hand line. This could be related to a fall in the swimming power of the tagged tuna and, consequently, a fall in feeding competitiveness of the fishes.

Lastly, the tagging season also have some influence on the number of recaptured fishes. The probability of being recaptured is higher for fishes that are tagged at the beginning of the fishing season.

The environmental factors during and after the tagging season determinate higher or lower fishing effort which will have some incidence on the number of recaptured fishes. Furthermore, the tagging season with its associated environmental and oceanographic characteristics will influence the juvenile migratory behaviour, which is related to the search of feeding areas.

2. STOCK STRUCTURE

Choosing an area in the Western Mediterranean for bluefin tuna tagging campaigns will have some influence on the results. In Figures 4 and 5 it must be noted that the results for recaptured fishes tagged in the Gulf of Vera are slightly different from those tagged in the Gulf of Valencia. Probably, the above mentioned areas get their recruits from different spawning areas with different subpopulations of adult spawners. These subpopulations would exhibit genetic differences which would influence migratory behaviour. Now, further work on genetic characterization of recaptured juvenile is being developed.

3. BIOLOGICAL PARAMETERS

1.2 Growth

Bluefin tuna tagging activity will cause a period of stress that will influence fish feeding behaviour and growth patterns. It must be noted that several fishes which had the population modal length when tagged, maintained, when recaptured, the population modal length of fishes captured in the same area.

Table 2 shows daily growth coefficients, which present some variability, but it is not difficult to discern a trend: bluefin tuna growth becomes slower as the winter time approaches, due to the fall in sea temperature.

It must be remarked that for bluefin tuna tagged at the same date and presenting comparable number of days at freedom, those which showed external or internal anomalies had smaller growth coefficient.

Figure 6 summarizes the length- weight relationship for juvenile bluefin tuna captured in the Gulf of Valencia during 1994. It also includes the values for the 12 recaptured fishes.

Further growth studies, based on microstructures (otoliths) and modal progression analysis of recaptured fishes, would improve the knowledge about tagging effects in growth patterns of juvenile bluefin tuna

YEAR	NUMBER	RECAPTURED	%
83	331	41	12.4
90	538	11	2.0
91	1211	7	0.6
92	476	3	0.6
93	310	7	2.3
94	1139	99	8.7
95	177	4	2.3
	4182	172	4.1

Table 1.- Bluefin tuna tagged in the Western Mediterranean during 1990- 1995.

N° ORDER	TAGGING DATE	TAGGING LENGTH (LH)	RECAPTURED DATE	RECAPTURED LENGTH (LH)	DAYS AT FREEDOM	DAILY COEFF.	EXTERNAL APPEARANCE	INTERNAL APPEARANCE
4	24/09/94	390	20/10/94	427	26	1.42	N	N
8	24/09/94	330	04/11/94	405	41	1.82	N	N
10	24/09/94	340	16/11/94	421	53	1.52	*	N
11	24/09/94	330	14/11/94	372	51	0.82	N	*
12	24/09/94	310	15/11/94	364	52	1.03	N	N
2	15/10/94	380	01/12/94	445	47	1.38	N	N
5	15/10/94	330	30/11/94	346	46	0.34	*	*
9	22/10/94	390	01/12/94	404	40	0.35	N	N
6	29/10/94	380	17/11/94	384	19	0.21	N	*

Table 2.- Mark- recaptured data. Juvenile Bluefin tuna. (N: normal ; * : anomalous).

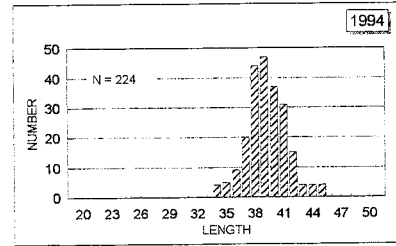
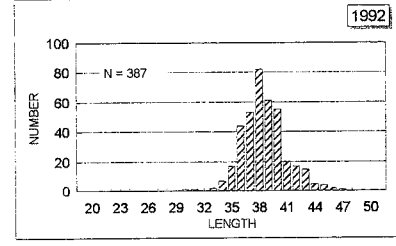
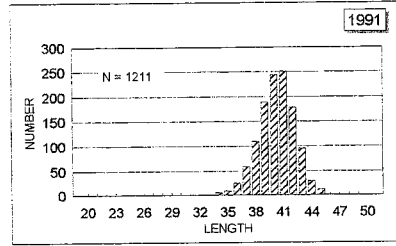
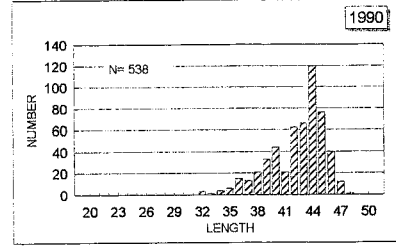
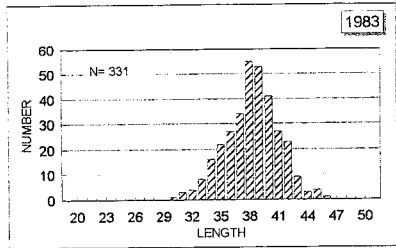


Figure 1.- Length distributions for age 0 class Bluefin tuna tagged in the Gulf of Almeria.

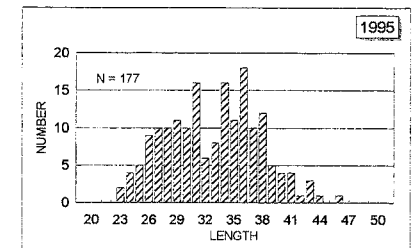
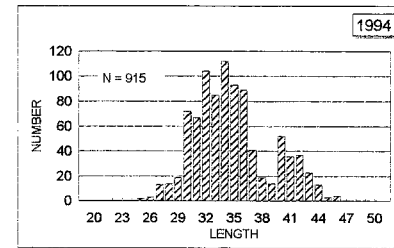
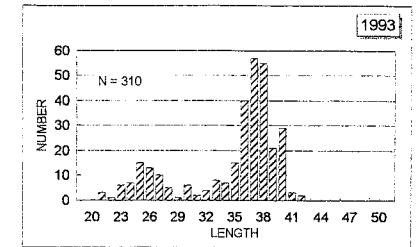
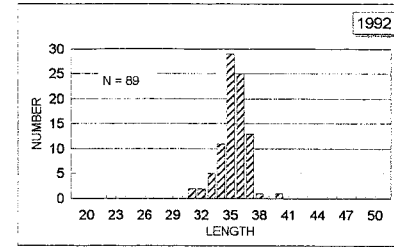


Figure 2.- Length distributions for age 0 class Bluefin tuna tagged in the Gulf of Valencia.

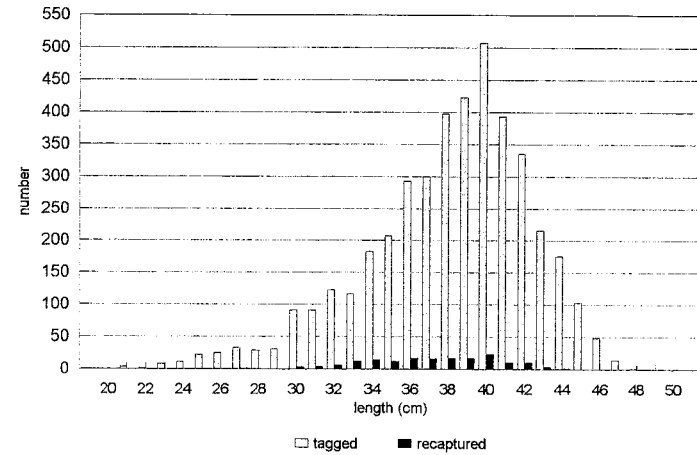


Figure 3.- Length distribution, when tagged, of recaptured Bluefin tuna in the Western Mediterranean.

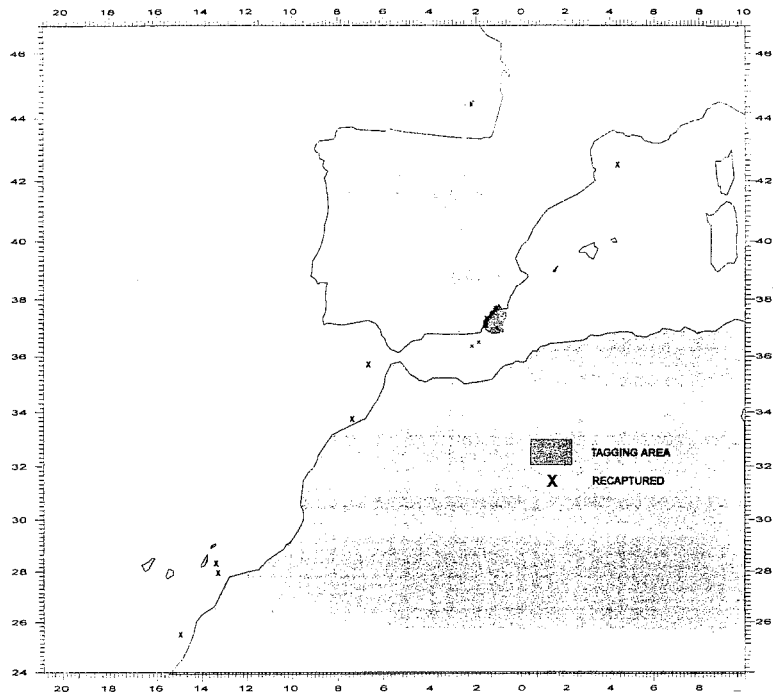


Figure 4.- Tagging area and recaptured tags. Gulf of Almeria.

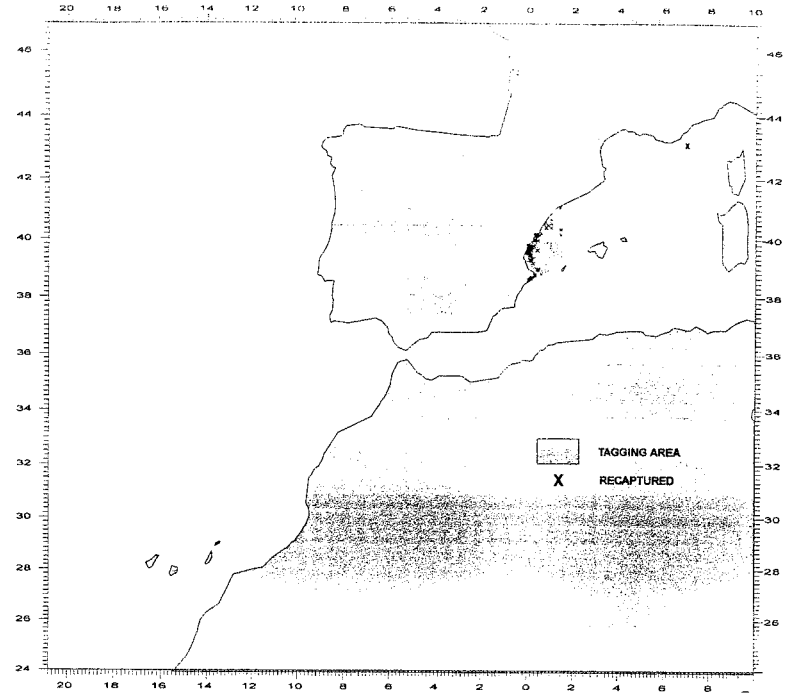


Figure 5.- Tagging area and recaptured fishes. Gulf of Valencia

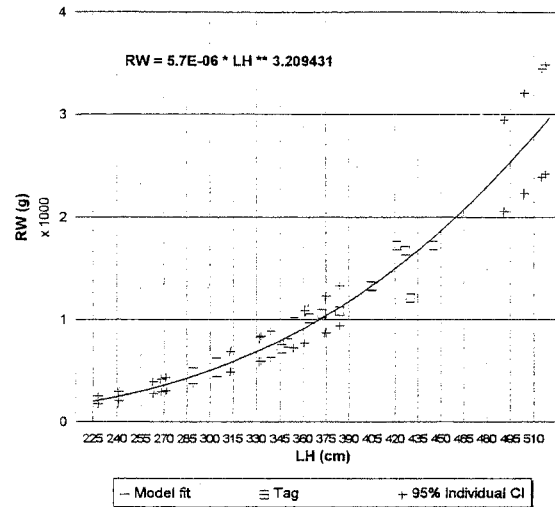


Figure 6.- Length- round weight relationship for juvenile Bluefin tuna. Gulf of Valencia, 1994.