

## SEASONAL GROWTH IN YOUNG BLUEFIN TUNA OF THE LIGURIAN SEA

*Orsi Relini, L., G. Palandri, F. Garibaldi, M. Relini, C. Cima, G. Torchia<sup>1</sup>*

### SUMMARY

A von Bertalanffy seasonal growth curve for bluefin tuna (age 0-4) was derived from length measurements obtained by different fishing activities. Growth rates observed in five tagged recaptured specimens are compared with the model.

### RÉSUMÉ

La courbe de croissance saisonnière de von Bertalanffy pour les thons rouges d'âges 0 à 4 a été dérivée à partir des données de longueur obtenues au cours de différentes activités de pêche. Les taux de croissance observés sur cinq spécimens marqués et recapturés ont été comparés au modèle.

### RESUMEN

Partiendo de las mediciones de talla obtenidas en diversas actividades de pesca, se derivó una curva de crecimiento estacional de von Bertalanffy para el atún rojo de edades 0-4. Las tasas de crecimiento observadas en cinco ejemplares marcados y recapturados se comparan con el modelo.

Bluefin tuna catches in the NW Mediterranean are mainly made up by young individuals, belonging to 1 - 4 age groups (Farruggio 1981, Liorzou and Bigot, 1991). During the period 1992-96 we studied the demographic structure of the catches of the Ligurian Sea within the framework of both the national programme on the evaluation of the large pelagics (Ministero delle Risorse Agricole, Alimentari e Forestali, 1990-95) and the EC project (1993-95) "Characterization of large pelagic stocks in the Mediterranean".

During our studies fishery was successful in alternate years, that is, in 1992, 1994; in the last year, 1996, young tuna were obtained only as a by-catch of swordfish fishery.

Moreover in 1994, 0-group fishes were found in coastal waters; these were sampled during tagging operations (Relini et al., 1995) and as a by catch of artisanal coastal fishery.

#### a) Length/frequency distributions

In total 2235 individuals caught by different gears were measured. Length/frequency distributions, obtained from professional offshore fishery (purse seine and longline) (Fig. 1) and from the catches for tagging purposes and with light purse seine, allowed us to arrive at mean lengths at age (Petersen method); the supposed birth date of the bluefin tuna was taken as 1<sup>st</sup> of June. The size structure of 0-group (Fig.2) is interesting. Its polymodal pattern corresponds to those registered near the Sicilian spawning grounds (Piccinetti and Piccinetti Manfrin, 1970). With 0-group fishes, hooks seem to select smaller fishes than nets; in fact, the length/frequency distributions are generally cut off on the

<sup>1</sup> Laboratori di Biologia Marina ed Ecologia Animale, Istituto di Zoologia, Università di Genova, Via Balbi 5, Genova, Italia.

right (Fig.2, above). The length/frequency distribution data obtained from tagging operations were consequently not included in the group shown in Fig. 3.

#### b) Mean lengths at age of different cohorts

Accepted mean lengths at age involve seven cohorts (Fig. 3). It is possible to observe that the 1990, 1991, 1992 and 1993 cohort present a very homogeneous growth. On the contrary, the 1994 cohort, the only one that was present in the Ligurian Sea with the 0-group and therefore probably very abundant, shows both groups with growth in alignment with the other cohorts, and groups with lower growth. In this last group, the observed gap from the previous cohorts is about 4 - 8 cm for the age 1+, and 5 - 10 cm for the age 2+.

#### c) Seasonalized growth function

The retained average length at age gives the growth function (FiSAT package, Gayanilo et al. 1994) shown in Fig. 4. The parameters obviously don't take in account maximum observed size in bluefin (more than 400 cm, according to Bigelow and Shroeder, 1953), but simply describe the initial segment of life. The possible use of the proposed function is to describe in details size and age in the limits of the following table:

**Table 1.** Size at age of the juvenile bluefin tuna in the Ligurian Sea

AGE	1	2	3	4
FL (cm)	56.0	82.0	102.2	117.1

#### d) Tagging and recovering

In autumn 1994, 543 bluefin were tagged with ICCAT yellow spaghetti. Of eleven recovered tags, five give useful growth data (Table 2). Daily growth rate ( $\Delta FL/\Delta T$ ) was 0.71 - 2 mm per day in autumn. Two specimens recovered at the beginning of the following summer had a growth rate of about 0.7 mm per day from the tagging date to age 1.

**Table 2 -** Daily growth rate of tagged and recovered *T. thynnus*.

Tagged on	Recovered on	Day free	$\Delta FL$ mm	$\Delta FL/\Delta T$ (mm/day)
28/09/94	23/11/94	56	360-320	0.71
05/10/94	24/11/94	50	400-300	2
12/10/94	02/11/94	21	370-340	1.43
12/10/94	20/06/95	251	530-360	0.68
05/10/94	08/07/95	269	560-330	0.86

#### e) Comparison of tagging data with the growth function

We have already noted that 0 group fish caught with hooks are smaller than those obtained by nets. However, taking in account the two specimens recovered at about age 1, their overall growth rate is very similar to that indicated by the function (Fig. 5).

#### Conclusion

A comparison among three set of length at age data of young bluefin (those of Furnestin et al., 1962, from the Atlantic Morocco; those of Cort, 1990, from the Cantabrian Sea and the present set), shows that at the age 0 the fishes are very similar; from age 1,5 to 2,3 (upper limit of the Morocco measurements) the Ligurian bluefins slightly overgrow those of Morocco; Ligurian and Cantabrian fishes are very close. These growth data suggest that, in spite of the supposed Mediterranean oligotrophy or its still discussed mesotrophy (Jacques, 1990, 1993; Barale, 1994), young bluefins find their food in the Mediterranean at least in the same quantities as in the Atlantic.

#### References

- BARALE V. 1994 - Mediterranean colours. *La lettre de la CIESM*. **Septembre 1994**. F. Briand ed.
- BIGELOW H.B. and SHROEDER W.C., 1953 - Fishes of the Gulf of Maine. *Fish. Bull. Fish and Wildl. Serv.*, **53** (74):577 pp.
- CORT J.L., 1990 - Biología y pesca del atun rojo, *Thunnus thynnus* (L.), del Mar Cantabrico. *Publ. Espec.Inst. Esp. Oceanogr.*, N° 4: 272 pp. Madrid 1990.
- FURNESTIN J. and DARDIGNAC J., 1962 - Le thon rouge du Maroc Atlantique (*Thunnus thynnus* Linné). *Rev. Trav. Inst. Pêches marit.*, **26**(4): 381-398
- FARRUGIO H., 1981 - Exploitation et dynamique des populations de Thon Rouge *Thunnus thynnus* (Linné, 1751) Atlanto Méditerranéennes. These de Docteur d'Etat. Academie de Montpellier, Université des Sciences et Techniques du Languedoc. 266 pp.
- GAYANILO F.C., SPARRE P., PAULY P., 1994 - The FAO-ICLARM Stock Assessment Tools (FiSAT) User's Guide. *FAO Computerized Information Series (Fisheries)*. N. 6, Rome, FAO, 186 pp.
- JACQUES G. 1990 - L'oligotrophie du milieu pelagique de Mediterranee occidentale: un paradigme qui s'estompe? *Bull. Soc. Zool. Fr.*, **114**: 17-30
- JACQUES G. 1994 - Nouvelles vues sur le systeme pelagique de Mer Ligure. *Biol. Mar. Medit.*, **1**(1): 65-82.
- LIORZOU B. and J.L. BIGOT, 1991 - L'exploitation du Thon Rouge au large des cotes francaises de Mediterranee. *Bull. Soc. Zool. France*. **114** (4): 91-100.
- ORSI RELINI L., PALANDRI G., RELINI M., CIMA C., GARIBALDI F., TORCHIA G., 1996 - Accrescimento del tonno rosso giovanile in Mar Ligure. *Biol. Mar. Medit.* **3** (1): 310 - 316.
- PICCINETTI C. and PICCINETTI MANFRIN G., 1970 - Osservazioni sulla biologia dei primi stadi giovanili del tonno (*Thunnus thynnus* L.) *Boll. Pesca Piscic. Idrobiol.*, **25** (2): 223-247.
- RELINI M., PALANDRI G., TORCHIA G., 1995 - Tagging of *Thunnus thynnus* juveniles in the Ligurian Sea, autumn 1994. *ICCAT, Coll. Vol. Sci. Pap.* **44**(1): 378.

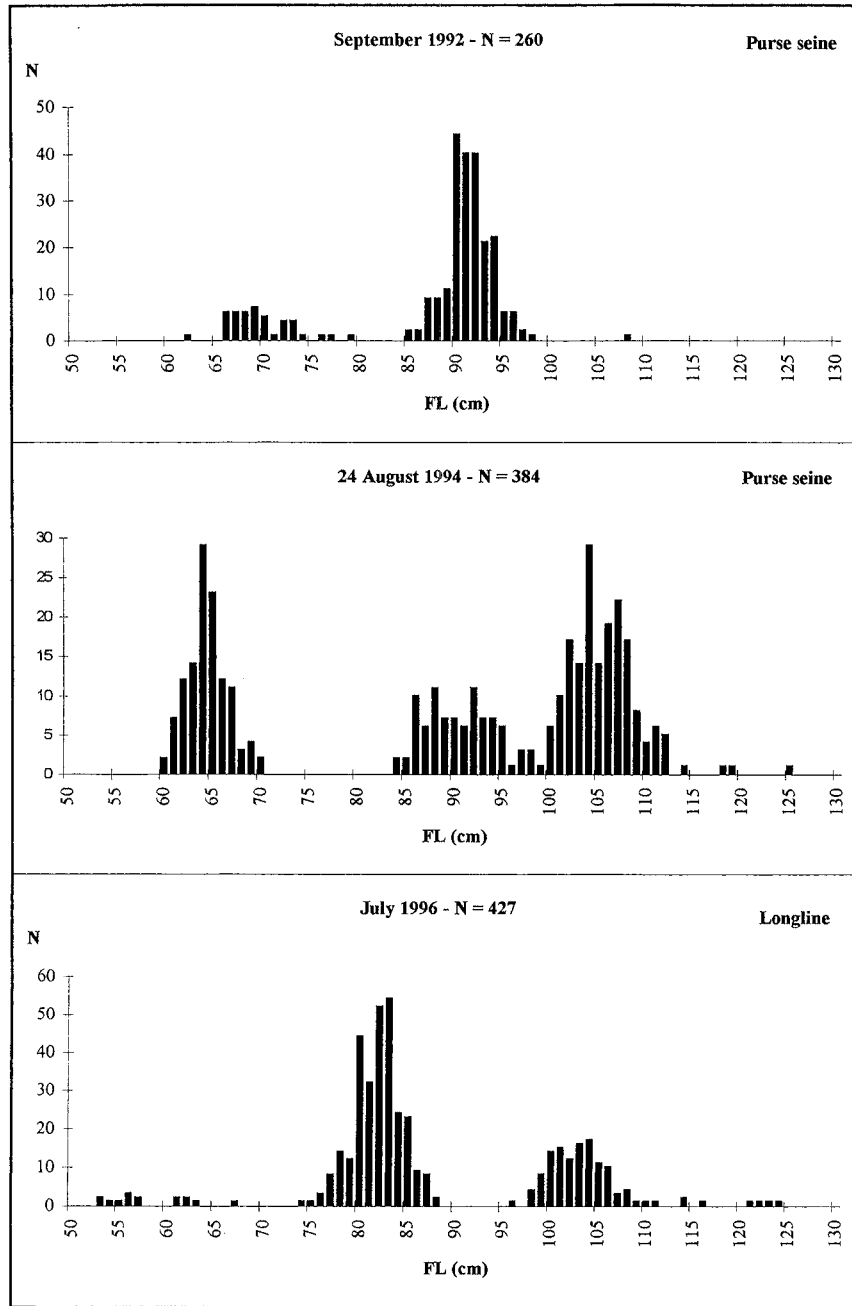


Fig. 1. Length/frequency distributions of bluefin from professional fisheries in the Ligurian Sea

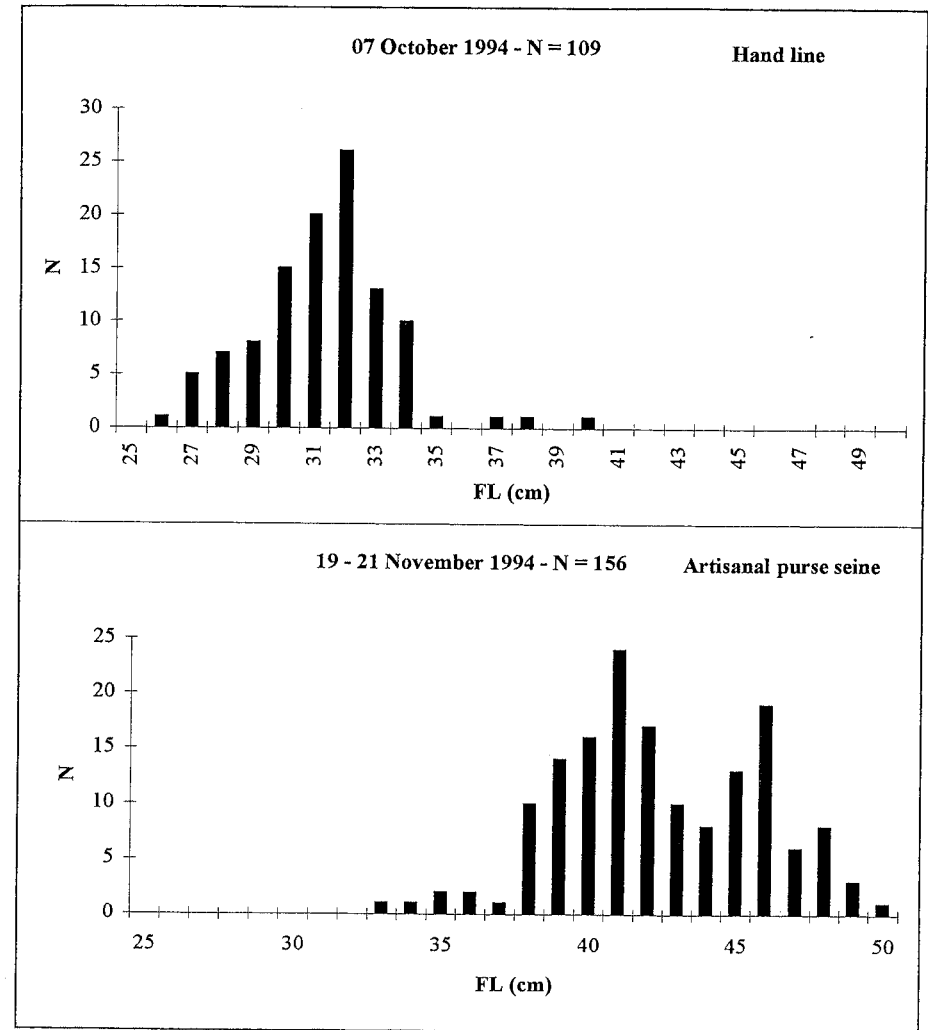


Fig. 2. L/F distribution of 0-group bluefin tuna caught by hooks and artisanal purse seine

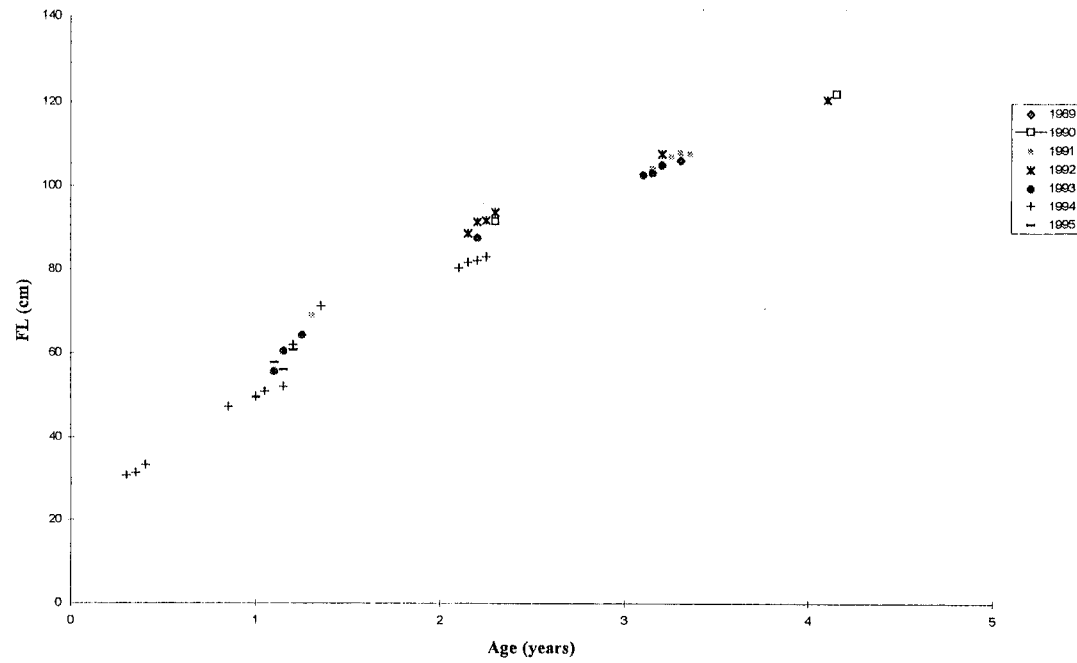


Fig. 3. Lengths at age of seven cohorts of bluefin recorded in the Ligurian Sea

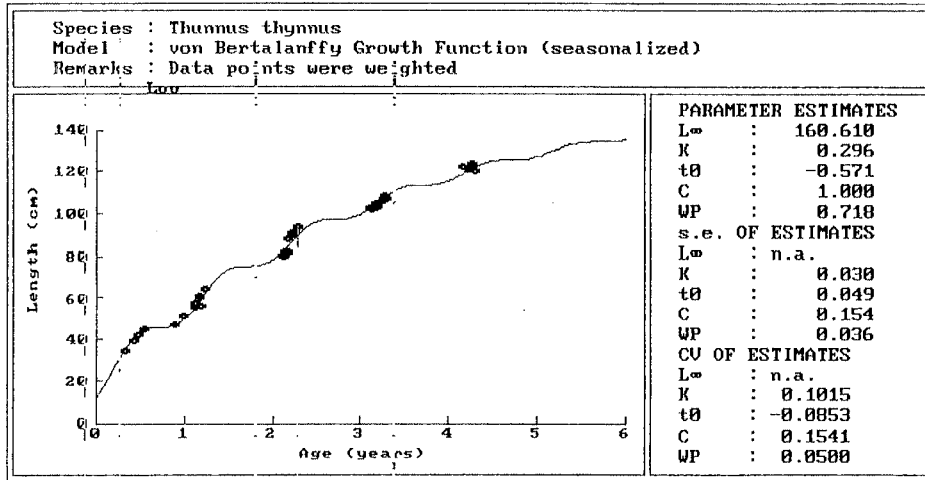


Fig.4. Seasonalized growth curve for young bluefin tuna.

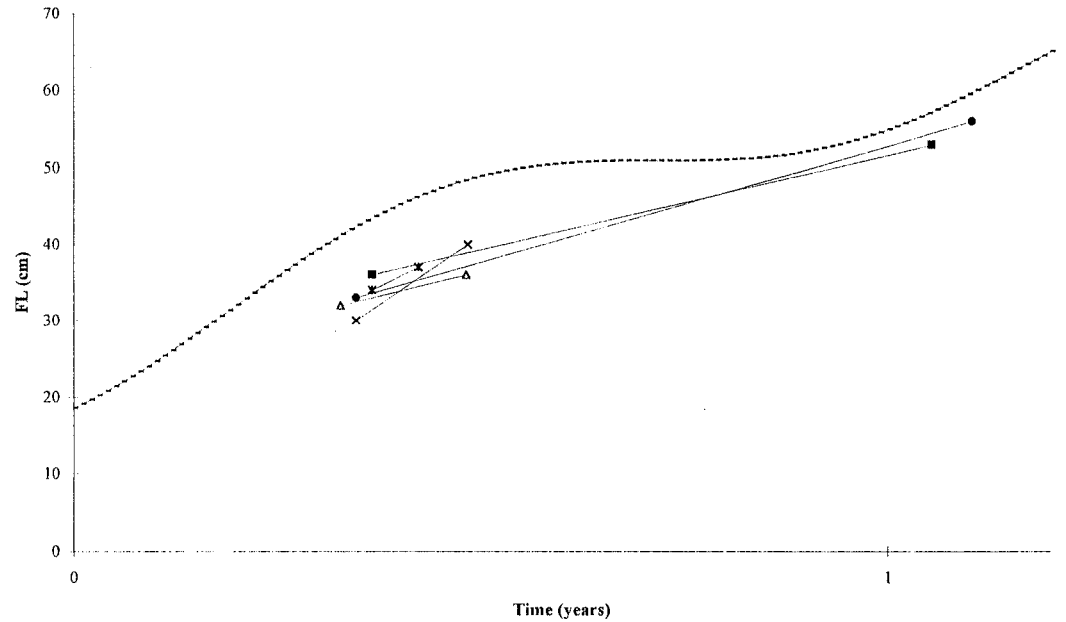


Fig.5. Growth of five tagged-recaptured specimens and seasonalized growth curve