

AGE OF BLUEFIN TUNA (THUNNUS THYNNUS, L.) IN CANADIAN WATERS

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SUMMARY

Aging of bluefin tuna based on thin otolith sections has been carried out since 1975. The growth assessed from annuli on otoliths shows a high degree of variability for the older ages. The relationships are:

$$\text{Males: } A = 4.89 \times 10^{-4} \times \text{FL}^{1.90}; n = 953; r^2 = 0.83;$$

$$\text{Females: } A = 1.26 \times 10^{-4} \times \text{FL}^{2.17}; n = 463; r^2 = 0.85;$$

where A is age in years and FL is fork length in cm.

The catch-at-age matrix derived from this aging covers ages 15 to 33 years and indicates a slight increasing trend in mean age since 1979. A comparison between this catch matrix and one created from growth equations showed little difference.

RESUME

La détermination de l'âge du thon rouge à partir de coupes fines d'otolithes est effectuée depuis 1975. La croissance déterminée par les anneaux sur les otolithes montre un fort degré de variabilité pour les groupes les plus âgés. Ci-après les rapports:

$$\text{Mâles } A = 4.89 \times 10^{-4} \times \text{FL}^{1.90}; n = 953; r^2 = 0.83$$

$$\text{Femelles } A = 1.26 \times 10^{-4} \times \text{FL}^{2.17}; n = 463; r^2 = 0.85$$

où A est l'âge en années et FL la longueur fourche en cm.

La matrice de capture à un âge donné qui découle de cette détermination de l'âge couvre les groupes de 15 à 33 ans et signale une légère tendance ascendante de l'âge moyen depuis 1979. Une comparaison entre cette matrice et une matrice créée à partir des équations de croissance montre peu de différences.

RESUMEN

Desde 1985 se han realizado estudios de determinación de la edad del atún rojo por medio de secciones en otolitos. El crecimiento estudiado en base a los anillos en otolitos muestra una gran variabilidad en las edades mas avanzadas. Las relaciones son:

$$\text{Machos: } A = 4.89 \times 10^{-4} \times \text{FL}^{1.90}; n = 953; r^2 = 0.83$$

$$\text{Hembras: } A = 1.26 \times 10^{-4} \times \text{FL}^{2.17}; n = 463; r^2 = 0.85$$

La matriz de captura a la edad derivada de esto cubre las edades entre 15 y 33 años e indica una ligera tendencia ascendente en la media de edad desde 1979. Una comparación entre esta matriz de captura y otra creada en base a ecuaciones de crecimiento, mostraba escasas diferencias.

INTRODUCTION

Biological sampling of bluefin tuna from Canadian waters for age determination has taken place since 1975. A time series of the following statistics has been accumulated: caliper fork length, tape flank length, girth measurements, round weight, sex and otolith age.

The techniques used to collect, section, and read the ages from the otoliths were those described by Caddy et al. (1976).

AGE AND GROWTH

This dataset contains 1416 age estimates (953 males and 463 females), ranging from ages 1 to 33 years. Otolith samples collected in 1982 have not been aged to date. Individuals are included from all the age classes encountered in the fishery, these data reflect the bias of the local exploited population in favour of giant, male bluefin (ie. greater than 120 kg.)

Individual length-at-age data were regressed separately for both sexes (Figs 1 and 2). The regression equations for these relationships are:

$$\begin{array}{l} \text{Males: } A = 4.89 \times 10^{-4} x L^2 \quad ; n = 953 ; r = 0.83; \\ \text{Females: } A = 1.26 \times 10^{-4} x L^2 \quad ; n = 463 ; r = 0.85; \end{array}$$

where A is age in years and L is fork length in cm.

The individual length-at-age scatter-grams (Figs 1 and 2) suggest a high degree of variability in length-at-age for the two sexes. Although this may be due to discrepancies in age assignment, it is more likely that this represents real variability in the growth for this species.

The length-at-age for the younger age classes (up to 20+) estimated from this study is quite similar to that obtained by analysing tag and recapture data (Parrack and Phares, 1979; Hurley and Iles, 1981; and Rey and Cort, 1984).

CATCH-AT-AGE MATRIX

The catch-at-age matrices were calculated from this aging data (Table 1). In recent years the Canadian fishery for bluefin tuna has been exploiting fish ranging in age from 15 to 33 years. Since 1979 there appears to be a trend toward increasing mean age for both sexes, this increase ranges from approximately 21 to 25 years for males and 21 to 28 years for females. This may indicate that the Canadian fishery for bluefin is still exploiting a "relict stock", receiving little or no recruitment from younger year classes, as hypothesized by Hurley and Iles (1981).

A comparison of the catch matrix produced above with one constructed with the use of Von Bertalanffy growth curves (Parrack, pers.com.) showed a high degree of similarity (Fig. 3). Further work on age and growth studies from hard parts will be carried out over the next year.

ACKNOWLEDGEMENTS

Data from aging and sampling programs conducted by the Maritimes Region, Department of Fisheries and Oceans (DFO), Canada have been made available for our analysis.

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Table 1. Catch at age matrix for male Atlantic bluefin tuna from Canadian waters (excluding the Canadian purse seine fishery off New England). The asterix indicate the mean age of the population.

	1975	1976	1977	1978	1979	1980	1981	1983
<=10								
11	6		7	4		5	2	
12				4	8	6	10	
13	6		7			6	5	
14	6	10	7	4	16	6		
15	17	20	15	4	8	6	15	
16	51	47	22	12		36	5	10
17	62	91	52	20			10	
18	17	111	104	43	23	6	10	19
19	90	124	215	106	70	30	10	10
20	73	77	201*	78	39	42	5	10
21	107*	104	141	78*	31*	36	15	10
22	129	161*	112	90	16	77*	25*	19
23	90	138	119	63		65	25	49
24	39	54	156	67	16	12	15	39
25	11	40	60	31	8	36	40	97
26	17	23	30	12		36		165*
27			7	4	8	42	10	136
28		3				18		58
29						6	5	19
30	6					6	5	78
30+								19
								29

Table 2. Catch at age matrix for female Atlantic bluefin tuna from Canadian waters (excluding the Canadian purse seine fishery off New England). The asterix indicate the mean age of the population.

	1975	1976	1977	1978	1979	1980	1981	1983
<=10		7	7			9	18	
11					8		5	
12					8			
13					8		5	
14		3		4				
15	6	3				6	5	
16	6	3		8			5	
17	34	27	22	12	16			10
18	11	34	22	12	47	6		
19	17	37	60	47	31	6		
20	34*	34	22	27	62	18	10	
21	67	20*	22	71	8*	42	10	
22	51	40	67*	71	31	36	25	
23	11	37	74	39*	16	12*	15	10
24	11	30	67	59	39	30	15	10
25	11	34	37	16	39	12	30*	10
26		13	22	35	16	12	20	39
27		7	15	4		24	20	19
28				4		12	10	39*
29			7				20	10
30							20	29
30+				4		12	15	68

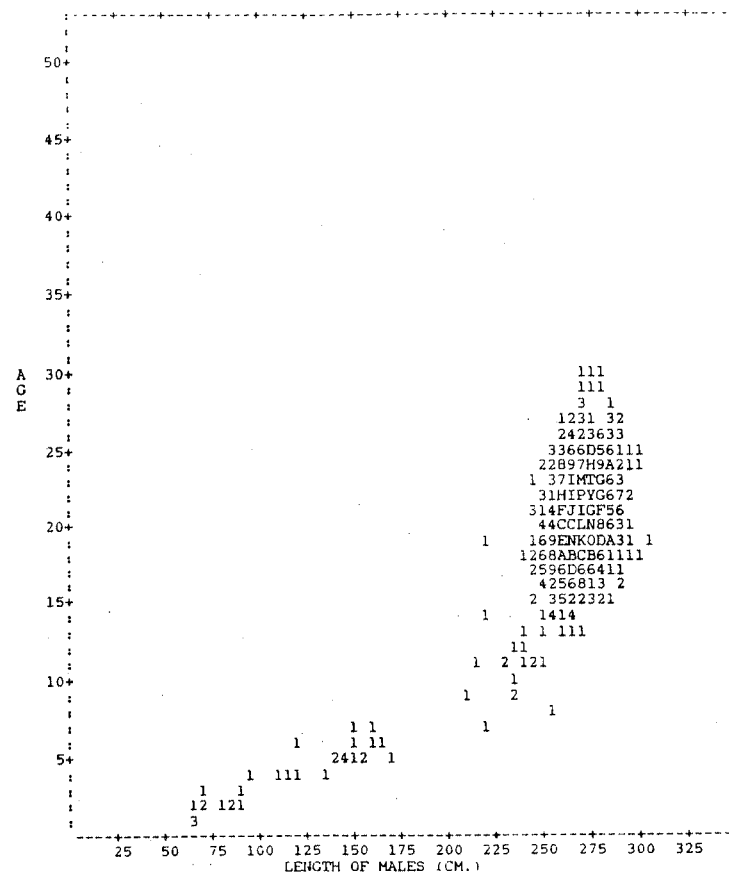


Figure 1. Length at age relationship for male (n = 953) bluefin tuna caught between 1975 and 1983. (Each numeral in these scatter-grams represents the number of observations occurring at that point. Each letter represents 9+ the numerical value of the letter at that point (ie. the letter C, the third letter, represents 9+3 = 12 observations)).

