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Determination of the Growth Curve Parameters of the American Plaice (*Hippoglossoides platessoides*) in the NAFO Subdivision 3Ps

by

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1. Introduction

The American plaice stock of the NAFO Subdivision 3Ps has regained some interest over the past few years since even if the level of french catches of that species is still low, it has been increasing steadily from 1978 to 1989 (respectively 47 to 766 m. tons).

One of the basic information required prior to any structural population dynamic study is the age-length relation. In this paper are presented the age-length key constructed from an otolith sample taken during a research survey in the late winter of 1990 and a few observations on the readings. The Von Bertalanffy (1938) growth equation parameters for male and female are estimated.

2. Material and methods

A total of 540 (235 male and 305 female) otholiths were taken in 1990 during the french annual groundfish survey which took place from the 26th of february to the 28th of march. From these, 80 otoliths were discarded for being too confusing to be read. The otoliths were stored dry and immersed whole in ethanol prior to reading which was made with transmitted light.

The parameters of the Von Bertalanffy growth equation were determined using the arithmetical mean of the observed length as the central value for each age and by the classic least square method of fitting (Tomlinson *et al.*, 1961) optimised by Gros *et al.* (1987). The weighting for each age-length couple used in the regression is the ratio number of individuals to the mean length variance.

Estimated parameters are compared to other values in litterature and to some unpublished results obtained from 1978 readings.

3. Results and discussion

The age-length keys are given in table 1. Figures 1 and 2 show the histograms of relative length frequencies (in percents) for age 4 to 9 respectively for males and females. Important dispersion of the length values for each age is noted.

In table 2, the values used in the calculation of the Von Bertalanffy parameters are presented. Ages 2 and 3 were not used in the regression because of the bias in the mean length caused by the selectivity of the trawl. Ages greater than 15 for the males and 19 for the females were not taken into account due to the low number of readings. Table 3 gives the estimated values of the parameters and their related variances. The figure 3 shows the plot of the Von Bertalanffy curve and its fitting to the observed values. As commonly observed in flatfishes, males and females have differents growth rates.

From comparison with differents values of the growth parameters estimated by distincts authors in different years (Table 4), the 1990 values are closer to the 1978 ones from the same author. The values given in this table and the figure 4 and 5 which gives the corresponding plotted curves point out the high variations in the estimation of the parameters.

Such variations could be due to biological evolution of the population over that period of time (24 years). But the importance of the difference between the time wise closely related 1974 and 1975 values shows that this hypothesis could not account in much for an explanation.

However, a few observations were made from the readings themselves. The first one is that, in general, the otoliths are from hard to very hard to read. Opacity, double rings are common and the interpretation of the readings are highly dependant on the reader himself. The second one is that taking only the clear otoliths (90% confidence or more), the histograms of the lengths at age are as widely spread as if different growth rates were effective in the studied area. These differents growth rates could be related to the areas where the samples were collected.

Zamarro *et al.* (1990) have pointed out after an otolith exchange between Canada and Spain that differences in interpretation can lead to a low agreement on readings of the same otoliths by different readers. The disagreements lied mainly in the interpretation of the nucleus and on the double rings.

In order to improve the accuracy of the American plaice age-length key, any effort toward a standardization of interpretation of the otolith rings should be of interest. A more intensive otolith sampling that would aim to differenciate the major distribution areas of the species in the 3Ps should help to clarify the problem of growth rate.

4. References

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Males

Lt (cm)	Age (years) 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	TOTAL
6	1																1
8	1																1
10			1														1
12	1	7	3		1												12
14		4	4	3													11
16		1	5	5													11
18			2	6		1	1										10
20			1	5	3	1											10
22		1	2	4	3						1						11
24			1	3	4							1					9
26				1	4	2	1	1	1								10
28				2	2		4				1	1					10
30					2	3	1		2	1				1			10
32				2		1	3	3									9
34							2	2	3		2	1					10
36							2	5	2		1						10
38						1		2	2	2	2		1				10
40								3		1	1						5
42							1			1	3	3			1		9
44								1	1	1	3	1	2	1	1		11
46										3	3	2	1	1			10
48									1	2	2	1	1	1			8
50										1	2	1	3	1			8
52									1			1	1	2	1	1	7
54												2		2			4
56												1					1
TOTAL	3	13	19	31	19	9	15	17	13	12	21	15	9	9	3	1	209

Females

Lt (cm)	Age (years) 2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20+	TOTAL
6	1																			1
8																				
10		3																		3
12		6	2																	8
14		3	5	1	1															10
16			8	2																10
18			7	2	1															10
20			1	6	3															10
22				4	4	1	1													10
24				3	3	1	2													9
26			1		5	1	2													9
28				1	2	4	2			1										10
30					4	2	2		1		1									10
32					2	1	2	2		2										9
34					1	2	1	3			1				1					9
36						1	2	1	2		1			1						8
38				1			2	1	1	2			1		1					9
40						1	1			2			1	2						7
42								2	1	2		1	1	1						8
44									3		4		1				1	1		10
46								2	1	1		3	1							8
48									2		1			1	1	1				6
50									1	1	2	1	1	1	1					8
52										1	3	1	2		1	1	1			10
54									1		1	1	1		1	1	1		1	8
56													1	1	2	2		2	1	9
58													1	1	1		1		1	5
60														1	2	2		1	1	7
62														3	1	1	3		2	10
64														1	3		2			6
66														1			1	1	1	4
68																		2		2
70																	1	2	1	4
72																1	1			2
74																			2	2
TOTAL	1	12	24	20	26	14	17	11	13	12	14	7	11	14	15	9	12	9	10	251

Table 1 - Age-length keys for American plaice in Subdivision 3Ps from otolith readings (samples taken in february-march 1990).

Age	Males			Females		
	Number	Mean length	Weight	Number	Mean length	Weight
4	19	17.08	1.31	24	17.46	2.67
5	31	21.47	1.26	20	22.40	0.74
6	19	24.92	1.15	26	26.15	1.15
7	9	28.50	0.25	14	31.14	0.59
8	15	32.10	0.52	17	31.74	0.56
9	17	37.03	0.95	11	38.86	0.42
10	13	37.80	0.25	13	43.96	0.30
11	12	43.83	0.36	12	41.08	0.24
12	21	42.02	0.42	14	46.57	0.26
13	15	45.30	0.16	7	48.93	0.49
14	9	47.83	0.46	11	49.23	0.24
15	9	48.72	0.17	14	54.36	0.13
16				15	55.70	0.18
17				9	58.72	0.20
18				12	61.42	0.20
19				9	62.83	0.11

Table 2 - Observed values and their weigth (ratio number of observation / variance) per age class used in the regression model to fit the Von Bertallanfy growth equation (American plaice of Subdivision 3Ps).

	Males	Females
L inf.	66.29	90.38
Variance	*0.65*	*0.73*
K	0.098	0.063
Variance	0.12×10^{-5}	0.3×10^{-6}
T_0	1.01	0.58
Variance	0.36×10^{-2}	0.37×10^{-2}
Residual variance	2854.03	2312.97

Table 3 - Estimated values of the Von Bertalanffy growth equation parameters for American plaice of Subdivision 3Ps.

	Pitt (1967)	Minet (1974)	Pitt (1975)	Mahé (1978)[1]	Mahé *et al.* (1991)
	Males				
L inf.	60.0	65.6	73.5	68.44	66.29
K	0.09	0.08	0.093	0.078	0.098
T_0	0.78	-1.21	0.75	-0.17	1.01
	Females				
L inf.	64.9	80.7	96.5	87.21	90.38
K	0.09	0.06	0.071	0.058	0.063
T_0	0.65	-1.45	1.45	-0.28	0.58

Table 4 - Comparison of the different values of the Von Bertalanffy growth equation parameters taken from different authors and different years for American plaice of Subdivision 3Ps.

[1] Unpublished.

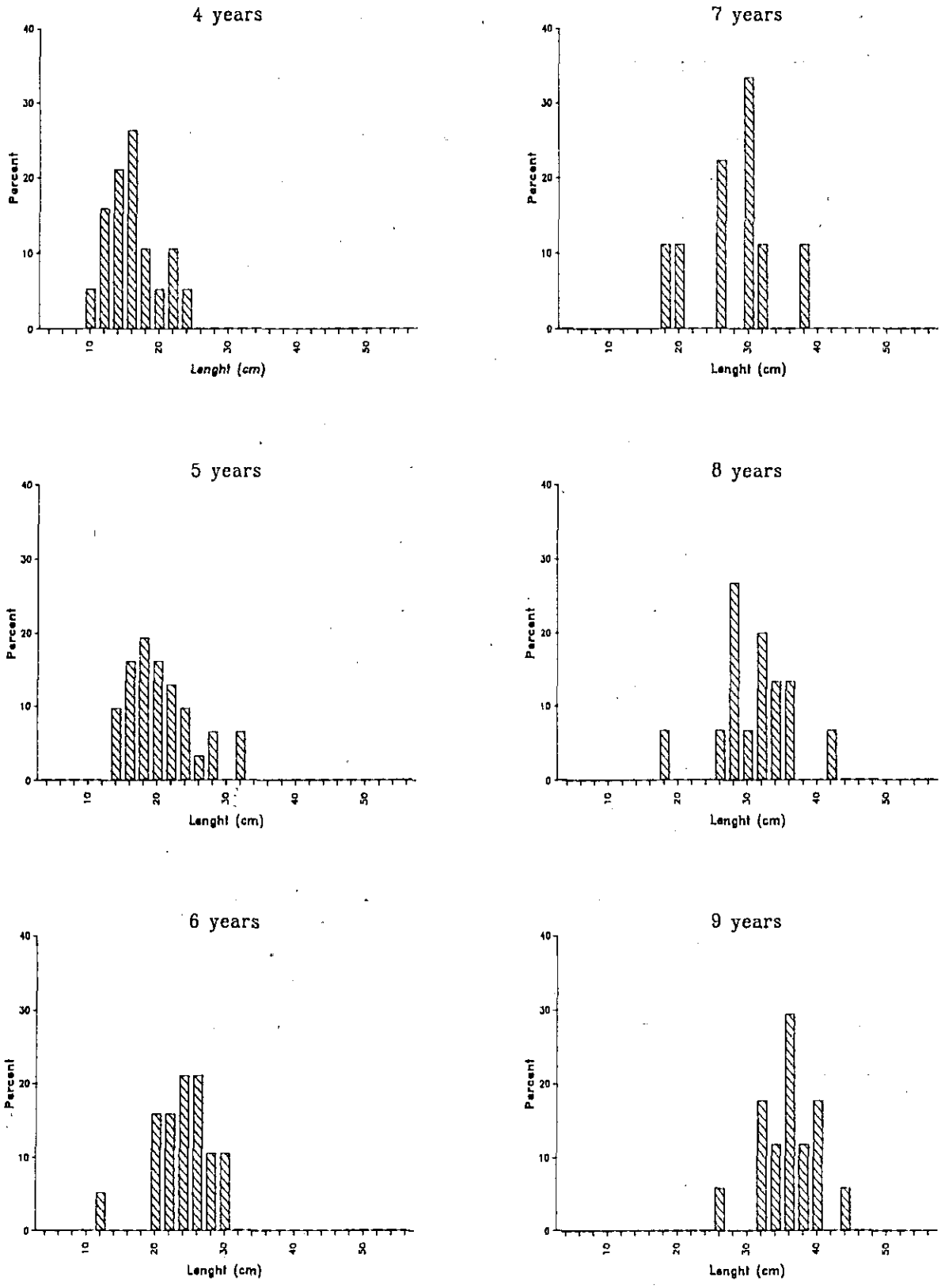


Figure 1. Histograms of the length composition of the age classes 4 to 9 of male American plaice from the age-length key.

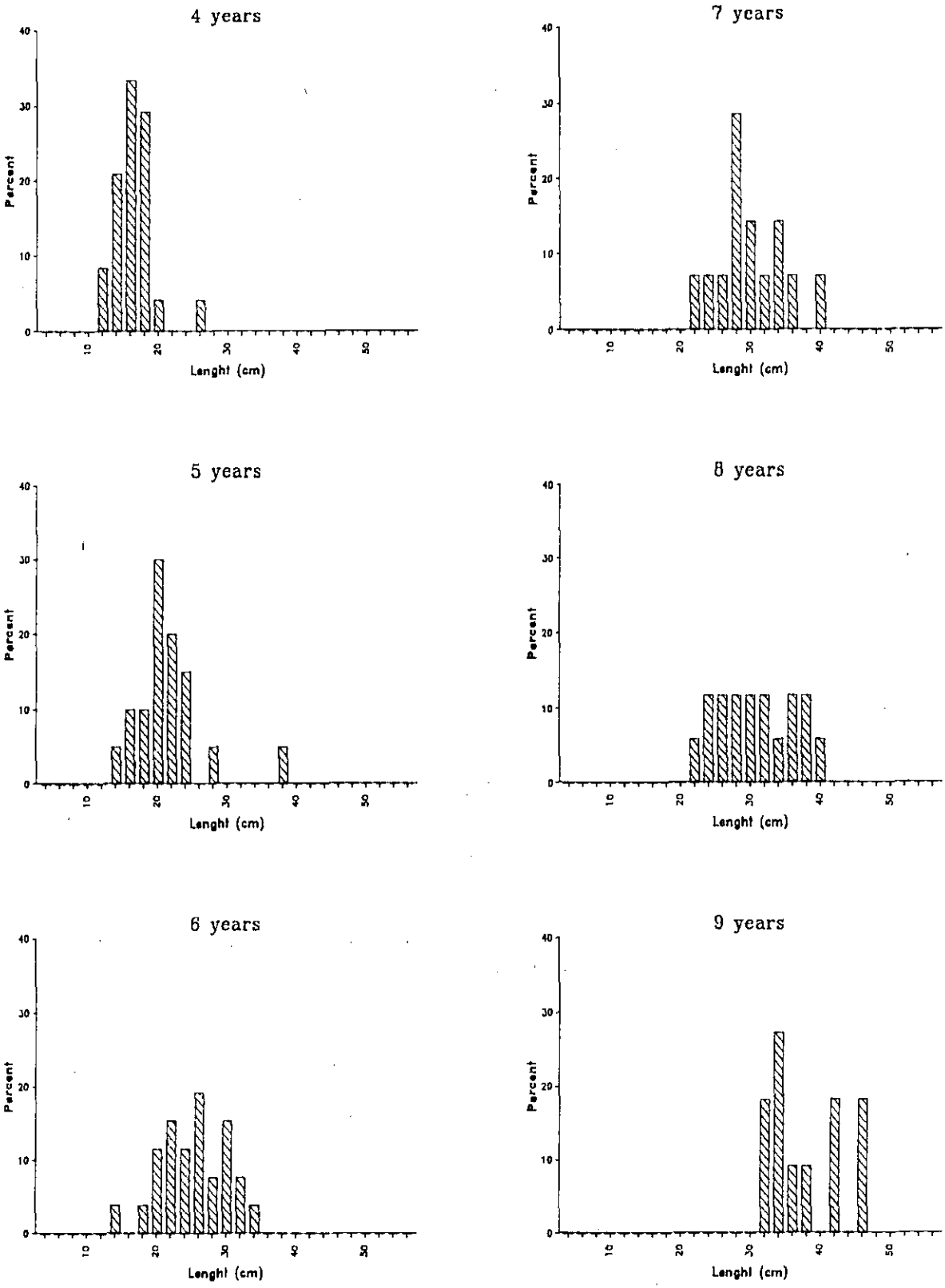


Figure 2. Histograms of the length composition of the age classes 4 to 9 of female American plaice from the age-length key.

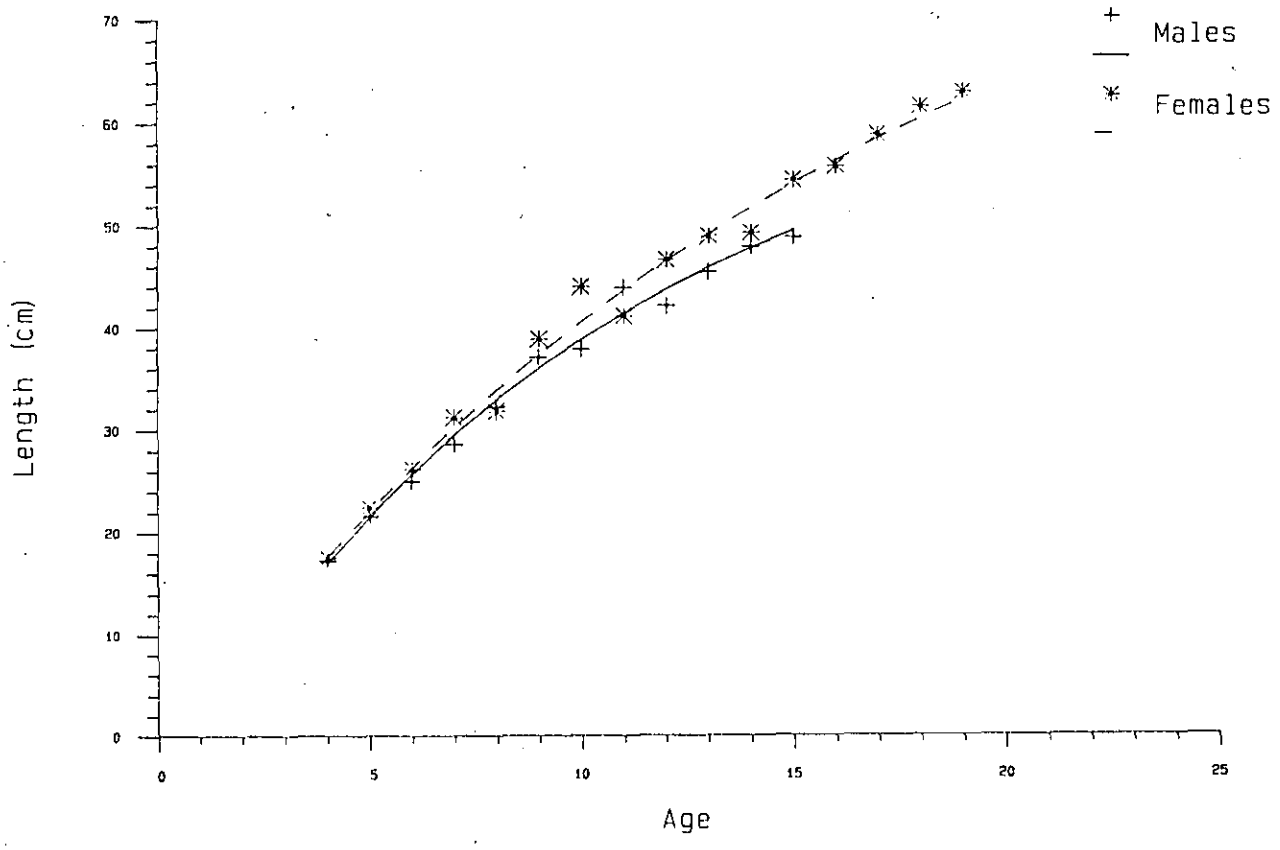
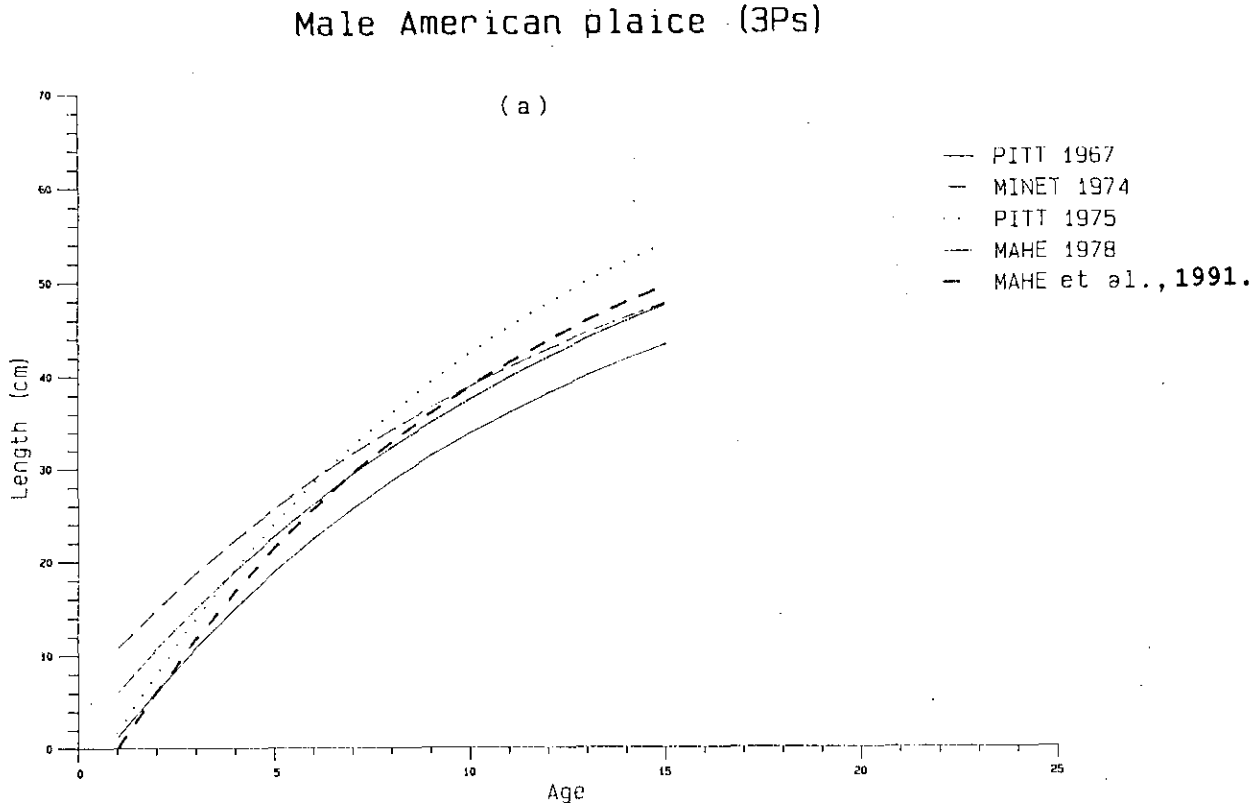


Figure 3. Growth curves for male and female American plaice of NAFO Subdivision 3Ps from the 1990 otolith sample.



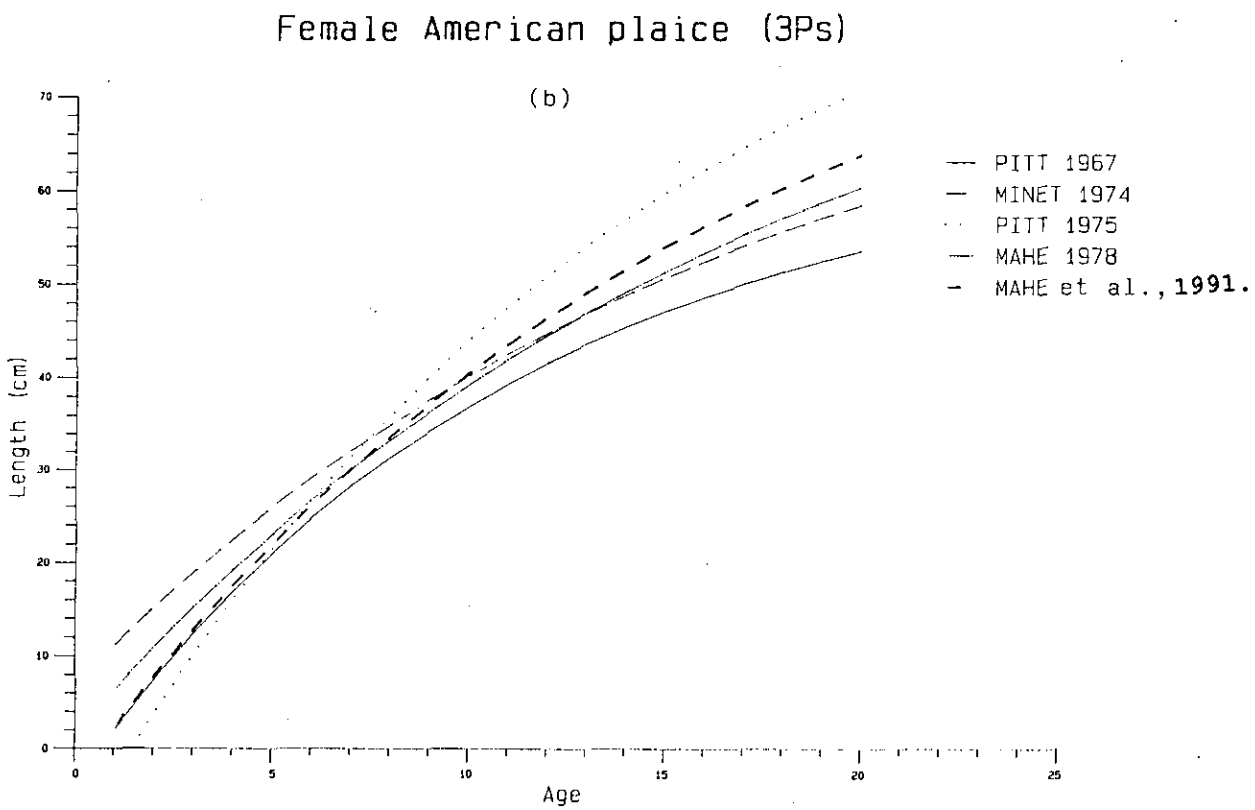


Figure 4 (a & b). Comparison of male and female American plaice growth curves from differents authors and years for the NAFO Subdivision 3Ps.