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Growth of American Plaice, Hippoglossoides platessoides (Fabricius), in ICNAF Subarea 5

by

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Abstract

American plaice from off New England (ICNAF Subarea 5) grow faster than in the Gulf of St. Lawrence. Bertalanffy growth equations were $L_t = 450 \left[1 - e^{-0.27(t-0.41)}\right]$ for males and $L_t = 675 \left[1 - e^{-0.15(t-0.10)}\right]$ for females.

Introduction

The fishery for American plaice in waters off New England is a comparatively small one: landings at New England ports in 1960-67 averaged 2,600 metric tons per year. About 95 percent of this catch came from ICNAF Subarea 5, particularly from the western Georges Bank, Stellwagen Bank, and Great South Channel areas. Much of it was incidental to fishing effort for other species of trawl fishes.

Methods and Materials

Age and growth studies of plaice have been summarized by Powles (1965) who studied this species in the Gulf of St. Lawrence (ICNAF Subarea 4T) and demonstrated that the number of hyaline rings on otoliths accurately indicates age in years.

Age and growth information presented here for fish of age group 1 and over is based on age determinations of otoliths from 825 plaice. Most of the fish were caught in monthly otter trawl sampling from March 1958 through January 1959 in 55-110 m of water just to the north of the tip of Cape Cod (approximately 42°10'N, 70°04'W). In addition, a sample of 1-group fish in this area collected in August 1960 otter trawl sampling was included to supplement growth information for this age group.

Total length in millimeters and sex were recorded for each fish and otoliths were excised and stored in a 50 percent solution of glycerin. The latter were examined under a low power microscope in the manner described by Powles (1965), and the number of hyaline rings was counted.

Observations on spawning condition in these samples indicated that spawning began in late March, peaked in April, and was completed by late May. This agrees closely with information from other studies summarized by Bigelow and Schroeder (1953), and I therefore used 1 April as the birthday.

Results

No 0-group plaice were caught in the trawl samples, and growth during the first year therefore was estimated from lengths of pelagic stage fish. Plaice are about 5.5 mm long at hatching, in late March to early May (Marak and Colton, 1961). Mean lengths of 84 pelagic plaice in late July and of 13 in early September were 26 mm and 34 mm, respectively (Figure 1).[1/]

Length at age by sex of age 1 and older fish (Table 1, Figure 1) shows that the females grow faster than males, as was shown by Powles (1965) for plaice from the Gulf of St. Lawrence.

Bertalanffy growth equations of the form $L_t = L_\infty \left[1 - e^{-K(t - t_o)}\right]$ in which L is length in millimeters, L_∞ is the maximum attained length, t is age in years, and K is a constant were fitted, by the method of Ricker (1958), to the growth data of Table 1 (Figure 1). The equations $L_t = 450\left[1 - e^{-0.27(t - 0.41)}\right]$ (male), $L_t = 675\left[1 - e^{-0.15(t - 0.10)}\right]$ (female), provide estimates of the growth rates for fish beyond age 2.

The values of L_∞ for the equations were estimated from plots of length at age t against length at age t + 1 (Walford, 1946). I know, however, from limited sampling of commercial catches, that female plaice from Subarea 5 attain a length of at least 700 mm. This is slightly greater than the 675 mm given in the equation. The equations given here therefore may be slightly in error because of the paucity of large fish in the age samples and the wide variability in length at these ages. I attribute the rather poor fit of the equation to the female length at age data for older fish also to the small numbers of fish represented in these groups.

The plaice in Subarea 5 grew faster than was shown by Powles (1965) for this species in Subarea 4T (Table 2). Despite slower growth in 4T, maximum attained lengths were similar in the two subareas. In Subarea 4T the males approach L_∞ of 455 mm at a theoretical age 30, and females, L_∞ of 706 mm at age 50, as computed from growth equations given by Powles (1965). In Subarea 5 the males approach L_∞ of 450 mm at a theoretical age 17, and females, L_∞ of 675 mm at age 30.

Table 2. --Lengths (centimeters) of American plaice in Subarea 4T and 5.[2/]

Subarea	Age group 1	2	3	4	5	6	7	8	9	10
					Male					
4T	--	11	14	19	22	26	28	31	34	35
5	10	19	26	30	--	--	--	--	--	--
					Females					
4T	--	12	15	20	24	28	31	36	38	41
5	10	20	27	32	38	--	--	--	--	--

2/ Data for 4T are from Powles (1965), Fig. 5, for August-October collections. For Subarea 5 they are from the July-September collections given in Table 5 of this document.

1/ Unpublished data from pelagic collections by G. F. Kelly in the Gulf of Maine in 1957.

Slower growth in Subarea 4T is likely related to lower water temperature there. Powles (1965) reported that plaice were most abundant at bottom temperatures of -1.0 to 0.0°C in June, 0.1 to 2.0°C in October, 2.1 to 5.0°C in January, and 0.0 to 5.0°C in April. In the Subarea 5 study area the water temperature at 77 m (based on monthly bathythermograms) in March 1958 - January 1959, in °C, was as follows:

Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.
3.5	3.3	3.3	3.3	3.6	4.2	5.6	6.9	8.1	7.2	5.0

These temperatures were measured about 30 m above the bottom; however, they closely reflected bottom temperature in the few cases where comparative observations were made. 3/ A comparison of the above sets of data indicates that plaice in Subarea 5 were in warmer water in most seasons.

Literature Cited

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3/ The temperatures also fell within the temperature ranges at the 75m level for the period 1940-59 in the same vicinity (Colton and Stoddard, In press).

Table 1. --Number of fish (n) and mean length in centimeters at age ($\bar{x}$) for American plaice, by calendar quarter, from trawl catches in 1958-60.

Age	Apr. - June		July - Sept.		Oct. - Dec.		Jan. - Mar.	
group	n	$\bar{x}$	n	$\bar{x}$	n	$\bar{x}$	n	$\bar{x}$
			Male and female					
1			41	10.2	1	11.9	13	14.4
			Male					
2	20	17.9	41	18.8	36	20.6	25	22.0
3	23	23.9	42	25.6	35	26.5	26	28.2
4	10	29.4	11	29.5	5	30.0	2	30.0
5	1	35.0	1	33.0	1	28.0	1	33.0
6	1	33.0	--	----	--	----	4	38.8
			Female					
2	32	18.1	38	20.5	45	20.9	47	22.1
3	49	24.5	46	26.9	60	28.1	36	28.4
4	24	30.8	18	32.0	22	32.9	15	34.4
5	7	37.4	5	38.4	4	37.0	13	39.8
6	9	40.1	1	35.0	3	36.0	3	43.3
7	2	43.5	--	----	--	----	1	47.2
8	1	41.7	--	----	--	----	1	46.0
9	1	49.9	--	----	--	----	1	49.9
10	--	----	1	45.9	--	----	--	----

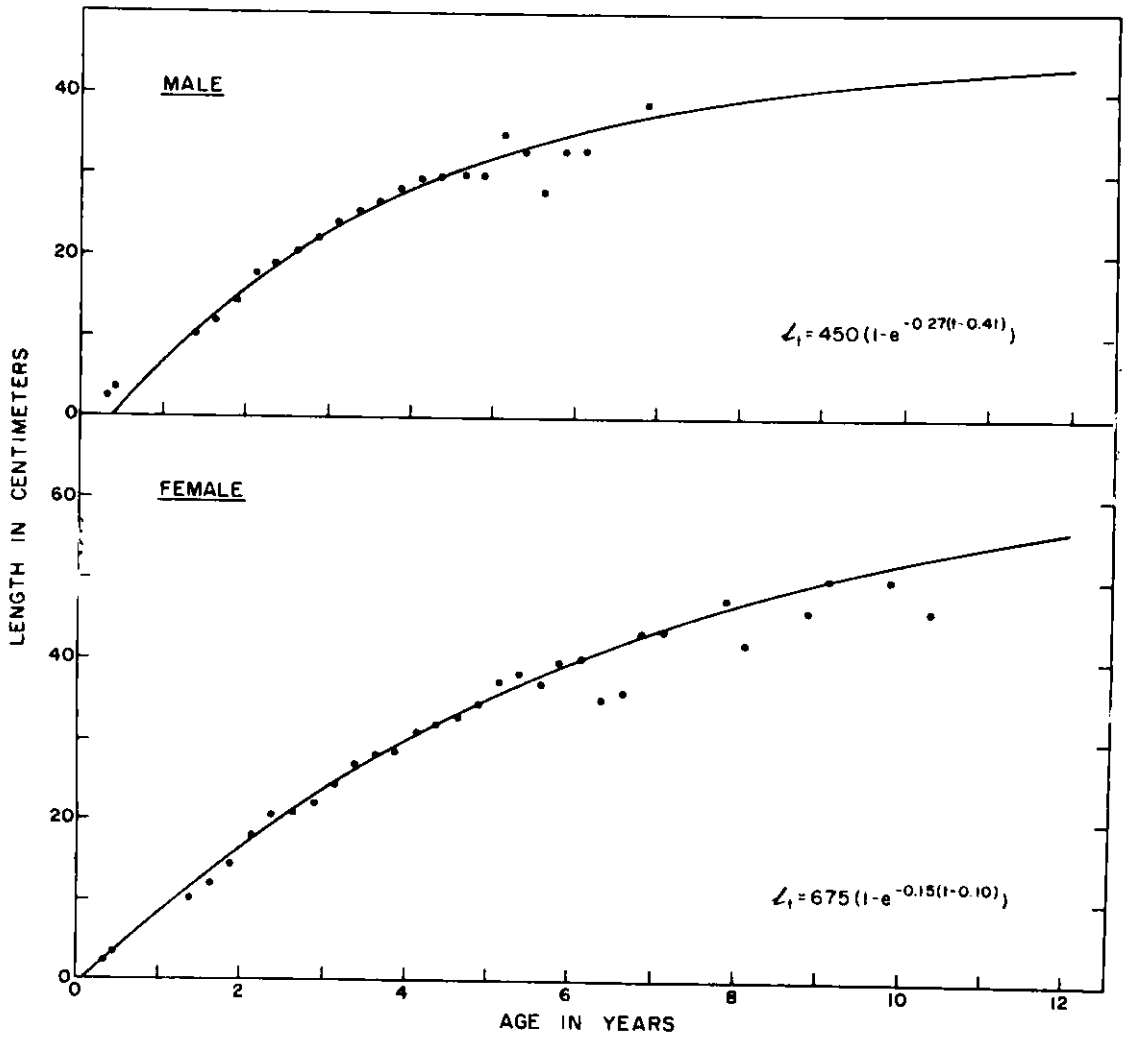

Fig. 1. Length at age of male and female American plaice, based on mean lengths of Table 1, and the computed Bertalanffy growth equations.