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Status of the Northwestern Atlantic Butterfish Stock, July 1979

by

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Introduction

The NW Atlantic butterfish population was assessed by Murawski and Waring (1978). The assessment indicated good recruitment of the 1978 year-class based on preliminary findings from US-USSR juvenile hake surveys and US commercial catch statistics. Autumn 1977, and spring 1978 survey data indicated that total mortality estimates (Z) had declined from previous years and mean weights of the fish had increased. Preliminary findings did not indicate that the optimum yields (OY) of 11,000 MT should be adjusted.

This paper presents updated survey and commercial catch information reported in Murawski and Waring (1978) as well as new age/length data from US research vessels. The implications of this additional information is discussed.

Survey Abundance Indices

Autumn offshore (>27m) bottom trawl survey data between Cape Hatteras and Southern New England (Figure 1, Table 1) has been found to provide the most consistent and reliable information on the relative abundance of butterfish (Murawski and Waring, 1978). The linear catch per tow index (in numbers) from the autumn 1978 survey declined 15% from the previous year, and was 29.52% below the 11-year average of 114.32. This is the second consecutive decline (Table 1). Likewise linear weight per tow decreased 33.2% to 4.59 kg/tow. The autumn mean weights per fish was 61.0 g, a 16% decrease from the autumn 1977 mean (73.3 g, Figure 2).

The retransformed weight per tow index, however, increased 2.6% to 3.31 kg/tow in 1978 (Table 1, Figure 3).

The autumn 1978 catch per tow index in numbers was partitioned into age classes using research vessel age/length keys (Tables 6 & 7). The autumn estimate of age 0+ relative abundance (Table 2) was 48.73 fish/tow, 45% above the 1977 estimate but 43% below the 11-year average of 85.01 and 62% below the high 1976 year class index.

Spring linear catch per tow estimates have been used to assess total mortality of various year classes by regressing $\log_e$ catch/tow on age (Murawski and Waring, 1978). The 1979 data is given in Table 3. The decline in the value of Z since the 1976 year class recruited can be attributed to reduced exploitation under FCMA. The spring 1979 catch per tow indices in numbers indicates the abundance of all ages has increased.

Commercial Catch Data

The US commercial harvest of butterfish increased 146.0% from 1977 to 1978, and is the highest observed since 1965 (Table 4). Nominal distant water fleet (DWF) catches, however, declined 69.2% in 1978. The total landings in 1978 of 4,478 MT were the smallest since 1965, and 48.5% below the 16-year average nominal catch of 8,688 MT.

Total distant water fleet catches in 1978 were only 1324.1 MT, or 33.9% of the total allocation of 3,911 MT (Table 5). Restrictions on by-catch and time and area of fishing were probably at least in part responsible.

The age composition of the catch was determined by applying US and distant water fleet length frequency data to research vessel age/length keys (Tables 5 and 6). In the US food fishery the harvesting was primarily on age 2 (1976 year class) fish. The US industrial fishery took mostly age 0 (1978 year class) fish. This is not surprising since the industrial fishery uses a small mesh, 66 mm versus 114 mm mesh, in the food fishery. The DWF's catch consisted mainly of age 1 fish followed by age 2 fish 1977 and 1976 year classes, respectively.

DISCUSSION

The 1978 autumn and 1979 spring survey data do not indicate any trend in butterfish abundance. The current abundance is still within the range of values used earlier to calculate maximum average yield (16,000 tons). The total mortality rate of the population has been drastically reduced. As a result of the decline in fishing mortality in recent years the numbers of age 2+ and 3+ fish have increased (Table 3). The sharp decline in total catches in 1977 and 1978 combined with increasing numbers of older fish should maintain or increase spawning potential.

Table 1. Autumn USA survey butterfish catch per tow, Strata 1-12, 61-76, 1968-1977.

Year	Catch per tow in Numbers			Catch per tow in Weight (kg)		
	linear	$\log_e$	retransformed	linear	$\log_e$	retransformed
1968	121.09	1.99	47.28	10.44	0.66	2.91
1969	76.93	2.16	57.25	5.32	0.66	2.72
1970	48.29	1.13	10.74	3.07	0.34	1.06
1971	242.17	2.19	112.00	5.45	0.58	2.29
1972	86.67	1.36	20.11	3.21	0.36	1.16
1973	178.03	2.35	124.08	8.39	0.75	3.70
1974	116.32	1.95	77.52	5.12	0.66	2.66
1975	52.47	1.69	36.19	2.94	0.58	1.80
1976	160.31	2.32	156.60	6.71	0.86	4.15
1977	94.69	1.99	69.33	6.87	0.70	3.24
1978	80.57	2.16	94.33	4.59	0.76	3.31

Table 2. Estimates of relative juvenile (age 0+) abundance from NMFS autumn offshore bottom trawl surveys, and total 0+ stock size for year classes 1968-1977.

Year class	Autumn Catch per Tow Index ($\bar{x}$ N/tow Age 0+)	Estimate of 0+ Population Size from VPA ($x10^6$)
1968	46.19	1684.2
1969	44.61	823.3
1970	30.06	847.5
1971	231.58	1215.3
1972	79.59	1976.8
1973	135.02	1168.8
1974	92.02	1024.0
1975	29.95	368.1
1976	127.50	-
1977	33.60	-
1978	48.73	-

Table 3. Calculation of total instantaneous mortality (Z) utilizing number per tow by age for NMFS spring surveys, 1968-1978.

Year class	Stratified Number per Tow at Age				Regression coefficients for $\log_e$ No./Tow vs. coded Age[1]		
	0+	1+	2+	3+	r^2	a	b(= -Z)
1968	11.66	2.96	1.30	0.01[2]	0.980	3.462	-1.097
1969	10.04	2.36	1.24	0.31	0.981	3.322	-1.108
1970	26.36	4.22	8.00	0.33	0.768	4.546	-1.250
1971	313.31	40.17	3.78[2]	0.17[2]	1.000	7.801	-2.054
1972	44.09	9.05	1.89	0.18	0.989	5.745	-1.807
1973	22.12	6.88	1.82	0.02	0.972	4.918	-1.576
1974	162.24	5.12	0.62	0.01	0.981	7.650	-2.785
1975	36.40	5.32	0.20	0.17	0.913	5.310	-1.936
1976	3.80	2.07	1.85	--	0.861	1.617	-0.360
1977	4.25	4.27	--	--	--	--	--
1978	6.89	--	--	--	--	--	--

[1]Coded Ages A_i = 1, 2, 3,.....n for Ages 0+, 1+,2+....N+

[2]Not included in regression

Table 4. Nominal landings (MT, ICNAF SA 4-6) by country, and adjusted total catches[a], 1963-1978.

Year	USA	Japan	USSR	Poland	Bulgaria	GDR	Romania	Others	Nominal Total	Adjusted Catch
1963	4,513	--	2,285	--	--	--	--	--	6,798	6,798
1964	2,461	--	748	--	--	--	--	--	3,209	3,209
1965	3,340	--	749	--	--	--	--	--	4,089	4,089
1966	2,615	--	3,865	--	--	--	--	--	6,480	6,480
1967	2,452	146	2,170	--	--	--	--	--	4,768	4,768
1968	1,804	3,526	1,911	--	--	--	--	--	7,241	7,241
1969	2,438	3,930	11,107	--	36	--	--	--	17,511	17,816
1970	1,869	8,624	404	--	--	--	--	--	10,897	14,319
1971	1,570	5,771	486	--	26	--	--	--	7,853	10,483
1972	819	3,675	1,848	--	114	34	--	--	6,490	13,040
1973	1,557	12,172	2,334	2,804	239	196	152	--	19,454	33,236
1974	2,528	5,457	1,372	3,508	--	--	--	--	12,865	17,993
1975	2,088	3,624	789	3,754	298	1	--	612[b]	11,166	14,852
1976	1,528	7,884	420	1,518	4	3	62	--	11,419	15,837
1977	1,447	1,750	419	280	--	--	16	381[c]	4,293	4,293
1978	3,563	651	14	--	--	--	56	603[d]		

[a]Adjusted to account for discards of countries not reporting butterfish catches from the *Loligo* fishery.

[b]Ireland

[c]Spain = 105, Italy = 60, Cuba = 111, Canada = 105.

[d]Spain = 156, Italy = 354, Mexico = 93.

Table 5. Total reported landings (MT) of butterfish from US waters and allocations for 1978.

Country	Catch to date	1978 allocation	Percent taken
Bulgaria	0.0	0	0.0
France	0.0	2	0.0
FRG	0.0	105	0.0
GDR	0.0	185	0.0
Italy	354.0	501	70.7
Japan	651.2	672	96.9
Mexico	93.0	1,263	7.4
Poland	0.0	67	0.0
Romania	56.0	150	37.3
Spain	156.0	1,053	14.8
USSR	14.0	100	14.0
Σ	1,324.2	3,911	33.9
USA	3,563.3	-	-
	Σ 4,887.5		

TABLE 6.

1978 SPRING AGE/LENGTH KEY FOR
BUTTERFISH FROM R/V DATA COLLECTED IN
SOUTHERN NEW ENGLAND - MID-ATLANTIC SAMPLING STRATA
(1-12, 61-76)

Fork length (cm)	Ages 0+	1+	2+	3+	Σ
1	-	-	-	-	-
2	-	-	-	-	-
3	-	-	-	-	-
4	-	-	-	-	-
5	-	-	-	-	-
6	-	-	-	-	-
7	-	-	-	-	-
8	-	-	-	-	-
9	2	-	-	-	2
10	10	-	-	-	10
11	14	-	-	-	14
12	18	-	-	-	18
13	13	-	-	-	13
14	9	1	-	-	10
15	3	5	-	-	8
16	1	18	-	-	19
17	1	26	-	-	27
18	-	17	8	-	25
19	-	11	3	2	16
20	-	1	3	-	4
21	-	1	2	-	3
Σ	71	80	16	2	169
$\overline{X}$ Length	12.1	17.2	18.9	19.0	15.2

TABLE 7.

1978 AUTUMN AGE/LENGTH KEY FOR
BUTTERFISH FROM R/V DATA COLLECTED IN
SOUTHERN NEW ENGLAND - MID-ATLANTIC SAMPLING STRATA
(1-12, 61-76)

Fork length (cm)	Ages 0	1	2	3	4	Σ
1	-	-	-	-	-	-
2	-	-	-	-	-	-
3	1	-	-	-	-	1
4	12	-	-	-	-	12
5	12	-	-	-	-	12
6	23	-	-	-	-	23
7	22	-	-	-	-	22
8	26	-	-	-	-	26
9	21	-	-	-	-	21
10	55	-	-	-	-	55
11	41	1	-	-	-	42
12	34	12	-	-	-	46
13	19	21	-	-	-	40
14	9	35	2	-	-	46
15	2	57	5	-	-	64
16	-	58	25	-	-	83
17	-	30	65	-	-	95
18	-	24	84	1	-	109
19	-	9	52	2	-	63
20	-	-	23	1	-	24
21	-	-	6	1	-	7
22	-	-	2	-	-	2
Σ	277	247	264	5	-	793
$\overline{X}$ Length	9.4	15.4	18.0	19.4	-	14.2

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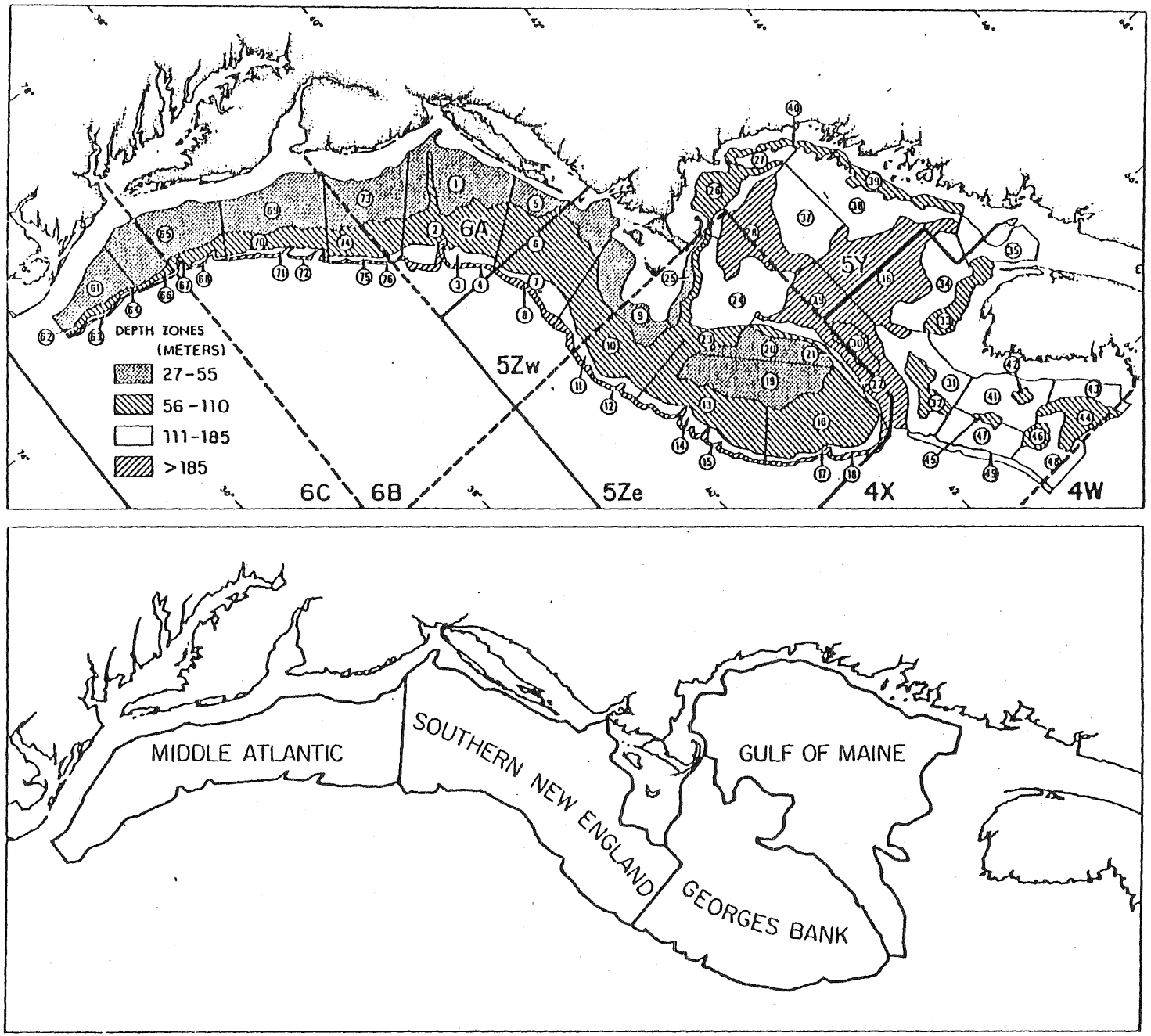
Figure 2. Mean weight of butterfish (g) taken from the Southern New England and Middle Atlantic areas during USA research vessel surveys, 1968-1977.

Figure 3. Retransformed catch per tow (kg) from the Southern New England and Middle Atlantic areas during autumn USA research vessel surveys 1968-1977.

A

B



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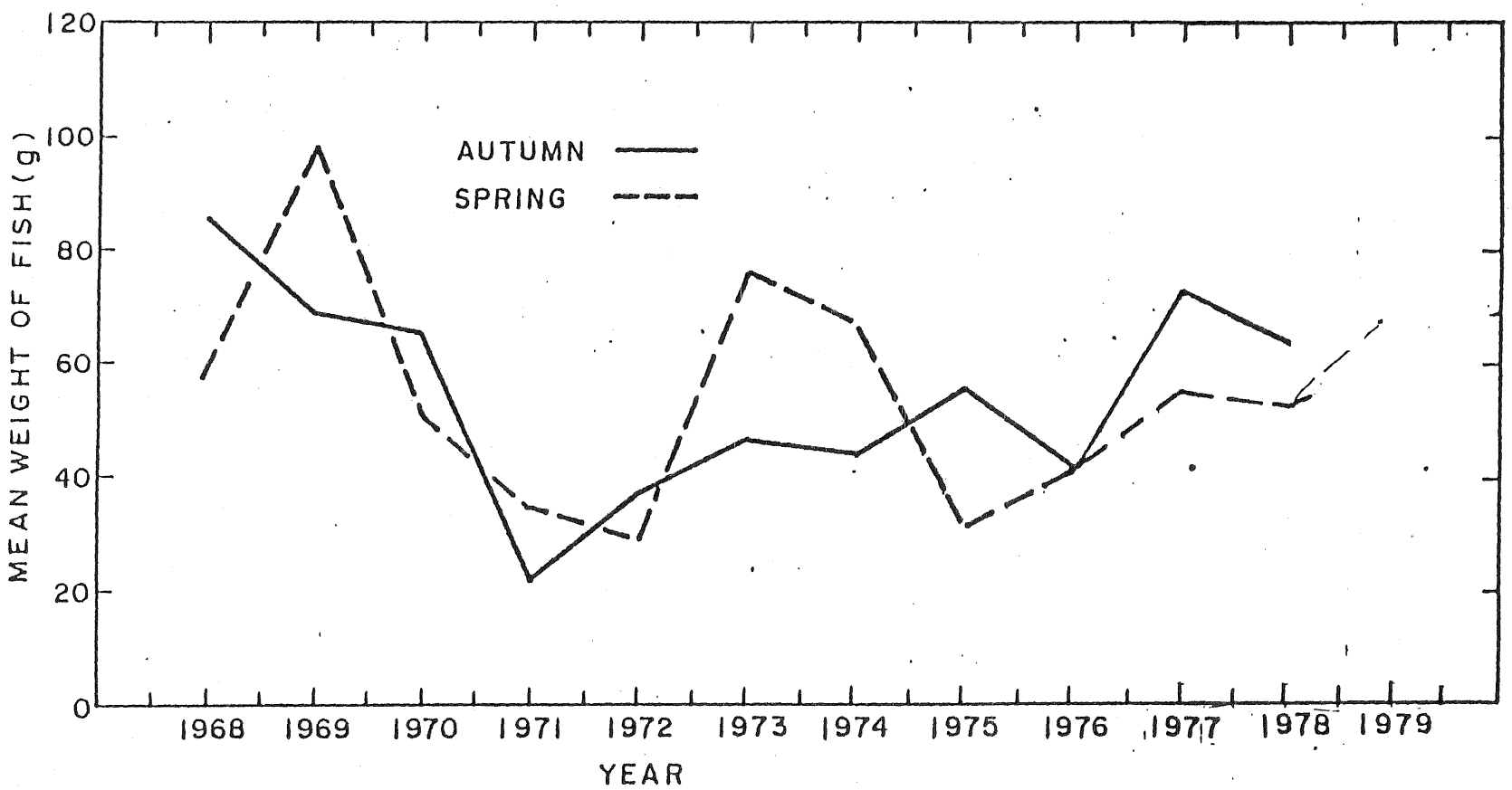

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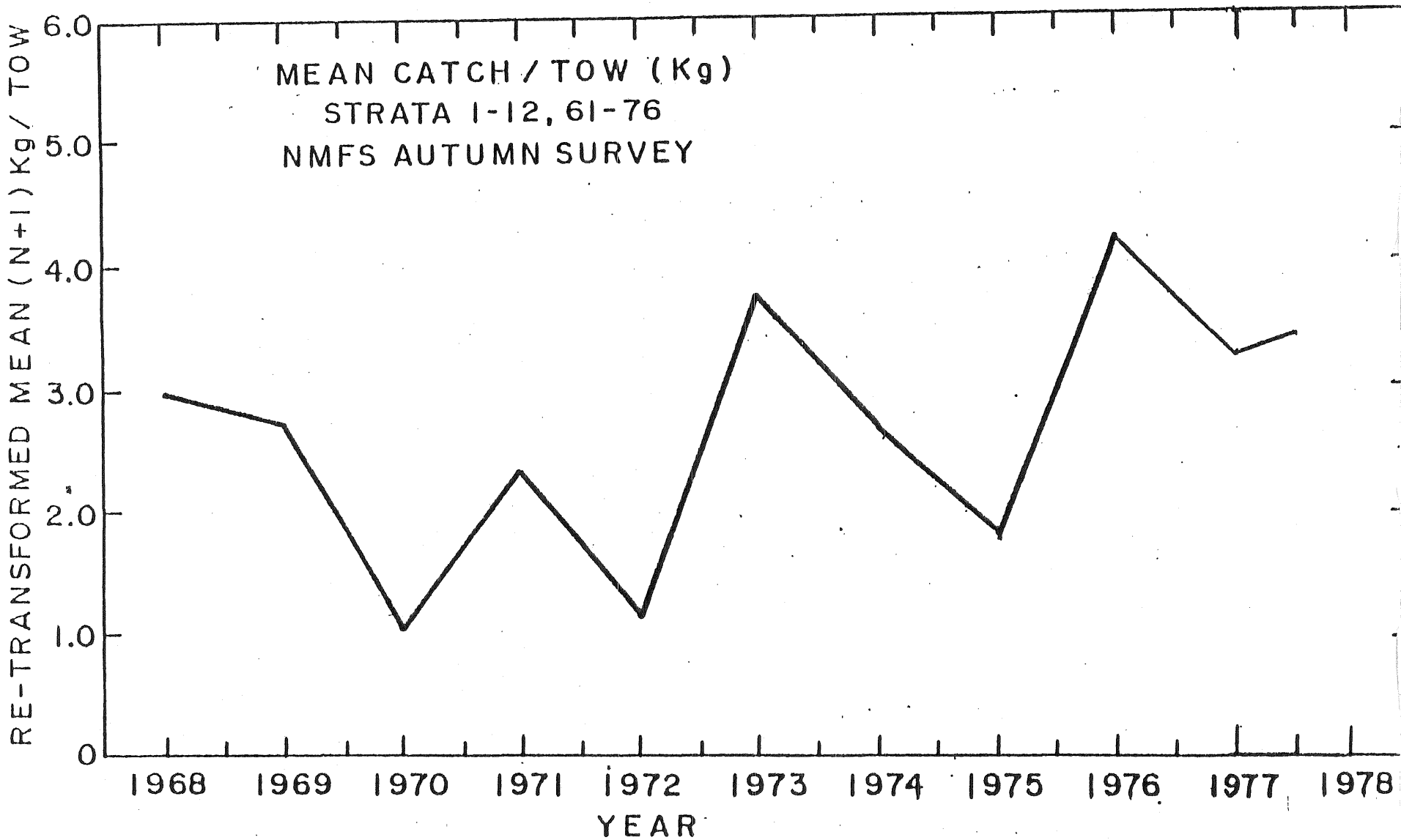

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