Northwest Atlantic Fisheries Organization

Serial No. N1944 NAFO SCR Doc. 91/60

SCIENTIFIC COUNCIL MEETING - JUNE 1991

Results for American plaice from USSR surveys in Divisions 3KLMNO

by

W. B. Brodie[1], A. K. Chumakov[2], J. W. Baird[1], and W. R. Bowering[1]

[1]Science Branch, Department of Fisheries and Oceans
P. O. Box 5667, St. John's, Newfoundland A1C 5X1

[2]Polar Research Institute of Marine Fisheries and
Oceanography (PINRO), 6 Knipovich Street
Murmansk, 183763 USSR

Introduction

This paper presents the results of USSR spring--summer surveys in Div. 3K, 3L, 3M, 3N, and 3Ø. Bowering and Chumakov (1990) presented the data for American plaice from these surveys for the period 1972-89; and this paper adds the data from the 1990 survey, as well as age compositions of A. plaice for Div. 3LNO for some years. In recent years, there have been problems with catch statistics and lack of sampling data from some non-member countries fishing for A. plaice in the NAFO Regulatory Area. This has led to increased emphasis being placed on the results of research-vessel surveys in determining stock status. The purpose of this paper is to provide additional survey data for consideration in the assessments of some A. plaice stocks in Subarea 3.

Materials and Methods

The USSR has conducted groundfish surveys in NAFO Div. 3KLMNO in the spring--summer period of each year since 1972. Details of how these surveys are conducted are found in Bulatova and Chumakov (1986) and have been recently reviewed by a working group of NAFO (Anon, 1990). The method outlined in Bowering and Chumakov (1990) was followed for the analyses, adding the 1990 data to the time series. As was the case in the previous analyses, no data for 1983 was available for any of the NAFO divisions. Multiplicative models, using year and stratum effects, were employed to determine estimates of abundance and biomass for strata not fished in a year. Ten analyses were conducted, one each for abundance and biomass in each of Div. 3K, 3L, 3M, 3N, and 3Ø.

To determine age compositions of the surveyed A. plaice population in Div. 3LNO, length frequencies collected on the USSR surveys were examined. Age-length keys from Canadian surveys conducted about the same time as the USSR surveys each year were used to derive values of abundance at age from the length frequency data and the total abundance from the multiplicative models. Length frequency data for A. plaice were available for the years 1984-90.

Results and Discussion

In Div. 3K, strata down to 1000 m were chosen for the analyses (Fig. 1). In most of the earlier years, many strata deeper than 500 m were not surveyed and were thus estimated by the model, usually with a relatively small value. From 1986 to 1990, all strata to 1000 m were surveyed in each year. The abundance and biomass in Div. 3K were highest in the mid-1970s, dropped sharply in 1978, and have since declined - with 1989 and 1990 being the lowest values in the series (Fig. 2 and 3). The low estimates in recent years correspond with the results from Canadian surveys.

In Div. 3L, strata 328, 342, and 343 were not surveyed at all in the time series; and strata 341 and 344 were surveyed on only a few occasions (Fig. 4). Strata deeper than 200 fath (366 m) were not surveyed regularly prior to 1983. From 1984 to 1990, survey coverage was consistent; and with the exceptions noted above, no other strata were omitted from the surveys. Both abundance and biomass were at relatively high levels from 1977 to 1984, declined sharply in 1985, and have continued to decline up to 1990 (Fig. 5 and 6). This is identical to the pattern observed in Canadian surveys in this area (Brodie et al., 1990).

Coverage in Div. 3M was generally complete, with strata 518 and 519 (Fig. 7) being surveyed on the fewest number of occasions (9 and 8 respectively). From 1984 to 1990, all strata were covered by each survey. Abundance and biomass show identical trends (Fig. 8, and 9), increasing from a relatively low level in 1979 until 1986, then declining in each year up to 1990 - which is the lowest point in both time series.

In Div. 3N (Fig. 4), the strata deeper than 200 fath (366 m) were not surveyed regularly in the early years of the surveys. From 1984 to 1990, no strata were left out of the survey coverage. The trends in abundance (Fig. 10) and biomass (Fig. 11) are similar but sometimes differ in magnitude - e.g., the declines in each series from 1985 to 1988. The abundance in 1987-90 is at a relatively low level, although not unlike the estimates for 1972, 1978, and 1982. On the other hand, the biomass estimates in 1987-90 are well below historic levels. Canadian r.v. surveys also show the stock size in recent years to be at a very low level.

For Div. 3Ø (Fig. 4), coverage was generally complete, with the exception of the deeper strata (> 200 fath or 366 m). Both indices showed considerable variability but both indicate a decline in stock size from the early 1980s to 1990, which is the lowest point in both series (Fig. 12 and 13). Again, this is similar to the results of Canadian surveys.

Figures 14 and 15 show the indices of abundance and biomass for Div. 3L, 3N, and 3Ø combined. These resemble the trends for Div. 3L alone, given that about two-thirds of the surveyed population on the Grand Bank is usually found in that division. Both indices show the sharp decline in 1985 noted previously and the continued decrease to the lowest levels in the series in recent years.

Tables 1-4 show the age composition of the surveyed population of A. plaice for the period 1984-90 (for Div. 3L, 3N, 3Ø, and 3LNO respectively). Figure 16 compares the age compositions of the three divisions separately and combined (from the 1990 survey). The age compositions in Div. 3N and 3Ø are virtually identical to those calculated for the Canadian survey in 1990, showing the dominance of the 1985 year-class. In Div. 3L, ages 6-8 dominated the USSR survey catches, compared to ages 7-9 in the Canadian survey. Neither survey in Div. 3L in 1990 showed the 1985 year-class to be dominant, although it was the largest value in the time series at ages 3 and 4 in the USSR surveys (Table 1).

References

Anon, 1990. Final report of the STACREC working group on survey design and procedures. NAFO SCS Doc. 90/20, Ser. No. N1816, 81 p.

Bowering, W. R., and A. K. Chumakov. 1990. Trends in biomass and abundance estimates of yellowtail flounder (Limanda ferruginea) from USSR surveys in Div. 3LNO. NAFO SCR Doc. 90/70, Ser. No. N1792, 11 p.

Brodie, W. B., W. R. Bowering, and J. W. Baird. 1990. An assessment of the A. plaice stock in Divisions 3LNO. NAFO SCR Doc. 90/80, Ser. No. N1802, 32 p.

Bulatova, A. Yu., and A. K. Chumakov. 1986. USSR trawl surveys in NAFO Subareas 0, 2, 3. NAFO SCR Doc. 86/66, Ser. No. N1183, 13 p.

Table 1. Abundance (millions) of A.plaice, by age group, from USSR surveys conducted in NAFO Div. 3L.

AGE	1984	1985	1986	1987	1988	1989	1990
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.4	0.8	0.8	0.7	0.0
3	0.0	0.4	1.6	2.2	7.2	6.5	0.3
4	9.5	1.5	4.6	14.0	10.2	22.5	12.5
5	21.9	10.8	23.2	37.9	22.2	38.6	23.9
6	129.0	37.2	71.8	70.8	42.2	91.9	39.1
7	285.7	89.5	118.6	102.4	51.3	96.2	57.3
8	270.7	92.9	101.2	94.0	44.6	82.7	46.2
9	217.9	57.5	76.7	47.8	36.6	56.5	34.0
10	97.4	35.3	35.0	23.6	11.6	21.5	22.2
11	44.0	19.5	15.4	8.3	5.4	11.0	7.9
12	27.2	9.2	10.1	8.5	3.7	6.1	4.7
13	10.5	5.6	5.1	3.6	2.0	3.2	3.1
14	5.9	2.8	2.1	1.5	1.5	2.0	1.1
15	2.9	1.6	1.2	0.7	0.8	1.3	0.6
16	1.7	0.9	0.6	0.2	0.6	0.5	0.4
17	1.0	0.2	0.2	0.1	0.2	0.2	0.3
18	0.4	0.0	0.1	0.0	0.0	0.0	0.0
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1+	1125.9	364.7	467.8	416.4	241.0	441.5	253.5
2+	1125.9	364.7	467.8	416.4	241.0	441.5	253.5
3+	1125.9	364.7	467.4	415.6	240.2	440.8	253.5
4+	1125.9	364.3	465.8	413.4	232.9	434.2	253.2
5+	1116.4	362.8	461.3	399.4	222.8	411.8	240.6
6+	1094.4	352.0	438.1	361.5	200.6	373.2	216.8
7+	965.4	314.9	366.3	290.7	158.4	281.3	177.7
8+	679.7	225.4	247.8	188.3	107.1	185.1	120.4
9+	408.9	132.5	146.6	94.3	62.4	102.4	74.2
10+	191.0	75.0	69.9	46.5	25.8	45.9	40.3
11+	93.6	39.7	34.9	22.9	14.2	24.4	18.0
12+	49.6	20.2	19.5	14.7	8.8	13.4	10.2
13+	22.3	11.1	9.3	6.2	5.2	7.2	5.5
14+	11.8	5.5	4.2	2.6	3.2	4.1	2.4
15+	6.0	2.7	2.2	1.0	1.6	2.0	1.3

Table 2. Abundance (millions) of A.plaice, by age group, from USSR surveys conducted in NAFO Div. 3N.

AGE	1984	1985	1986	1987	1988	1989	1990
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.8	0.8	0.7	0.9	4.1	0.0
3	1.8	16.9	3.3	11.8	28.7	18.3	0.4
4	3.5	44.9	13.9	17.3	21.4	58.8	4.2
5	10.8	30.7	33.0	15.0	14.2	21.7	15.0
6	20.5	34.1	39.3	16.3	9.6	13.0	4.6
7	23.4	27.6	32.3	11.4	7.7	8.4	3.4
8	19.7	29.3	19.6	6.9	6.6	8.9	3.5
9	17.5	26.3	16.1	6.4	5.4	8.4	4.0
10	15.2	26.7	12.9	4.6	2.7	4.2	2.0
11	6.7	22.4	6.9	2.5	1.5	2.5	1.4
12	4.3	16.8	4.6	1.9	1.7	1.9	0.9
13	2.3	7.6	2.8	1.3	1.5	1.7	0.7
14	1.4	4.1	1.3	1.0	0.8	1.0	0.4
15	1.3	3.1	1.3	0.8	0.9	0.9	0.4
16	1.2	0.9	0.7	0.5	0.4	0.4	0.2
17	0.6	0.5	0.7	0.2	0.1	0.3	0.1
18	0.3	0.0	0.2	0.1	0.1	0.1	0.0
19	0.1	0.0	0.0	0.0	0.0	0.0	0.0
1+	130.7	292.7	189.9	98.8	104.3	154.6	41.3
2+	130.7	292.7	189.9	98.8	104.3	154.6	41.3
3+	130.7	291.9	189.1	98.1	103.4	150.5	41.3
4+	128.9	275.0	185.8	86.3	74.7	132.3	40.9
5+	125.4	230.1	171.8	69.0	53.3	73.5	36.7
6+	114.6	199.4	138.8	54.0	39.0	51.7	21.8
7+	94.1	165.3	99.5	37.7	29.4	38.8	17.2
8+	70.7	137.7	67.2	26.3	21.7	30.3	13.8
9+	51.0	108.4	47.6	19.4	15.2	21.4	10.2
10+	33.5	82.1	31.5	13.0	9.8	13.0	6.2
11+	18.3	55.4	18.6	8.4	7.1	8.8	4.2
12+	11.6	33.0	11.7	5.9	5.6	6.3	2.7
13+	7.2	16.2	7.1	4.0	3.8	4.5	1.8
14+	4.9	8.6	4.2	2.6	2.3	2.8	1.1
15+	3.5	4.5	2.9	1.6	1.5	1.8	0.7

Table 3. Abundance (millions) of A.plaice, by age group, from USSR surveys conducted in NAFO Div. 3O.

AGE	1984	1985	1986	1987	1988	1989	1990
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.3	0.6	0.0	0.0	0.0
3	0.0	1.6	6.8	2.3	3.2	5.0	0.1
4	1.2	3.3	13.8	5.3	8.5	6.1	2.5
5	7.3	8.7	12.4	9.4	11.4	6.2	5.6
6	15.6	7.9	17.8	11.2	19.1	14.7	4.7
7	20.4	13.4	26.0	13.8	18.5	18.3	7.4
8	37.8	16.5	21.1	11.3	17.0	13.8	6.7
9	26.2	12.9	17.2	8.6	10.1	11.4	6.3
10	18.0	11.6	14.4	5.3	4.2	6.2	4.4
11	7.2	6.2	8.1	2.8	2.2	2.9	2.5
12	3.9	3.8	7.2	1.8	2.0	2.9	2.1
13	2.2	2.0	3.9	1.5	1.1	1.6	1.2
14	1.5	1.5	1.2	0.6	0.8	0.9	1.0
15	2.3	0.9	1.2	0.5	0.6	0.9	0.6
16	1.4	0.3	0.5	0.4	0.4	0.7	0.4
17	0.7	0.0	0.3	0.1	0.1	0.3	0.3
18	0.2	0.0	0.1	0.1	0.1	0.1	0.1
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1+	146.0	90.8	152.2	75.8	99.3	92.2	46.1
2+	146.0	90.8	152.2	75.8	99.3	92.2	46.1
3+	146.0	90.8	151.9	75.2	99.3	92.2	46.1
4+	146.0	89.2	145.1	72.9	96.1	87.2	46.0
5+	144.8	85.9	131.3	67.6	87.6	81.1	43.5
6+	137.5	77.2	118.9	58.2	76.2	74.8	37.9
7+	121.9	69.3	101.1	46.9	57.1	60.1	33.1
8+	101.5	55.8	75.1	33.1	38.6	41.8	25.7
9+	63.7	39.3	54.0	21.8	21.6	28.0	19.0
10+	37.5	26.4	36.8	13.1	11.5	16.6	12.7
11+	19.5	14.7	22.4	7.8	7.3	10.3	8.2
12+	12.3	8.5	14.3	5.0	5.1	7.4	5.7
13+	8.4	4.7	7.2	3.2	3.1	4.5	3.6
14+	6.2	2.7	3.3	1.7	2.0	2.9	2.4
15+	4.6	1.2	2.1	1.1	1.2	2.0	1.4

Table 4. Abundance (millions) of A.plaice, by age group, from USSR surveys conducted in NAFO Div. 3LNO.

AGE	1984	1985	1986	1987	1988	1989	1990
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.8	1.5	2.1	1.7	4.8	0.0
3	1.8	18.9	11.6	16.3	39.1	29.8	0.8
4	14.3	49.7	32.3	36.6	40.1	87.4	19.2
5	40.0	50.2	68.7	62.2	47.8	66.5	44.5
6	165.1	79.2	128.8	98.3	70.9	119.6	48.3
7	329.6	130.5	176.9	127.7	77.5	122.9	68.2
8	328.2	138.8	141.8	112.2	68.2	105.5	56.5
9	261.6	96.7	110.0	62.8	52.1	76.3	44.3
10	130.6	73.6	62.3	33.5	18.5	31.9	28.7
11	57.9	48.1	30.3	13.6	9.1	16.4	11.8
12	35.5	29.8	22.0	12.2	7.4	10.9	7.7
13	15.1	15.2	11.8	6.4	4.6	6.4	5.0
14	8.8	8.4	4.6	3.2	3.1	4.0	2.5
15	6.5	5.6	3.7	2.0	2.3	3.2	1.6
16	4.3	2.1	1.8	1.1	1.4	1.6	1.0
17	2.3	0.7	1.2	0.4	0.4	0.8	0.7
18	0.9	0.0	0.4	0.2	0.2	0.2	0.1
19	0.1	0.0	0.0	0.0	0.0	0.0	0.0
1+	1402.6	748.2	809.9	591.0	444.6	688.3	340.9
2+	1402.6	748.2	809.9	591.0	444.6	688.3	340.9
3+	1402.6	747.4	808.4	588.8	442.8	683.5	340.9
4+	1400.8	728.5	796.7	572.6	403.7	653.7	340.1
5+	1386.5	678.8	764.4	535.9	363.6	566.3	320.9
6+	1346.5	628.6	695.8	473.7	315.8	499.8	276.4
7+	1181.4	549.4	566.9	375.4	244.9	380.1	228.1
8+	851.9	419.0	390.0	247.7	167.4	257.3	159.9
9+	523.6	280.2	248.2	135.5	99.2	151.8	103.4
10+	262.0	183.5	138.2	72.7	47.1	75.5	59.1
11+	131.4	109.9	75.8	39.2	28.6	43.6	30.4
12+	73.4	61.7	45.5	25.6	19.5	27.1	18.7
13+	37.9	32.0	23.5	13.4	12.1	16.2	10.9
14+	22.9	16.8	11.8	6.9	7.5	9.8	6.0
15+	14.1	8.4	7.2	3.8	4.3	5.8	3.4

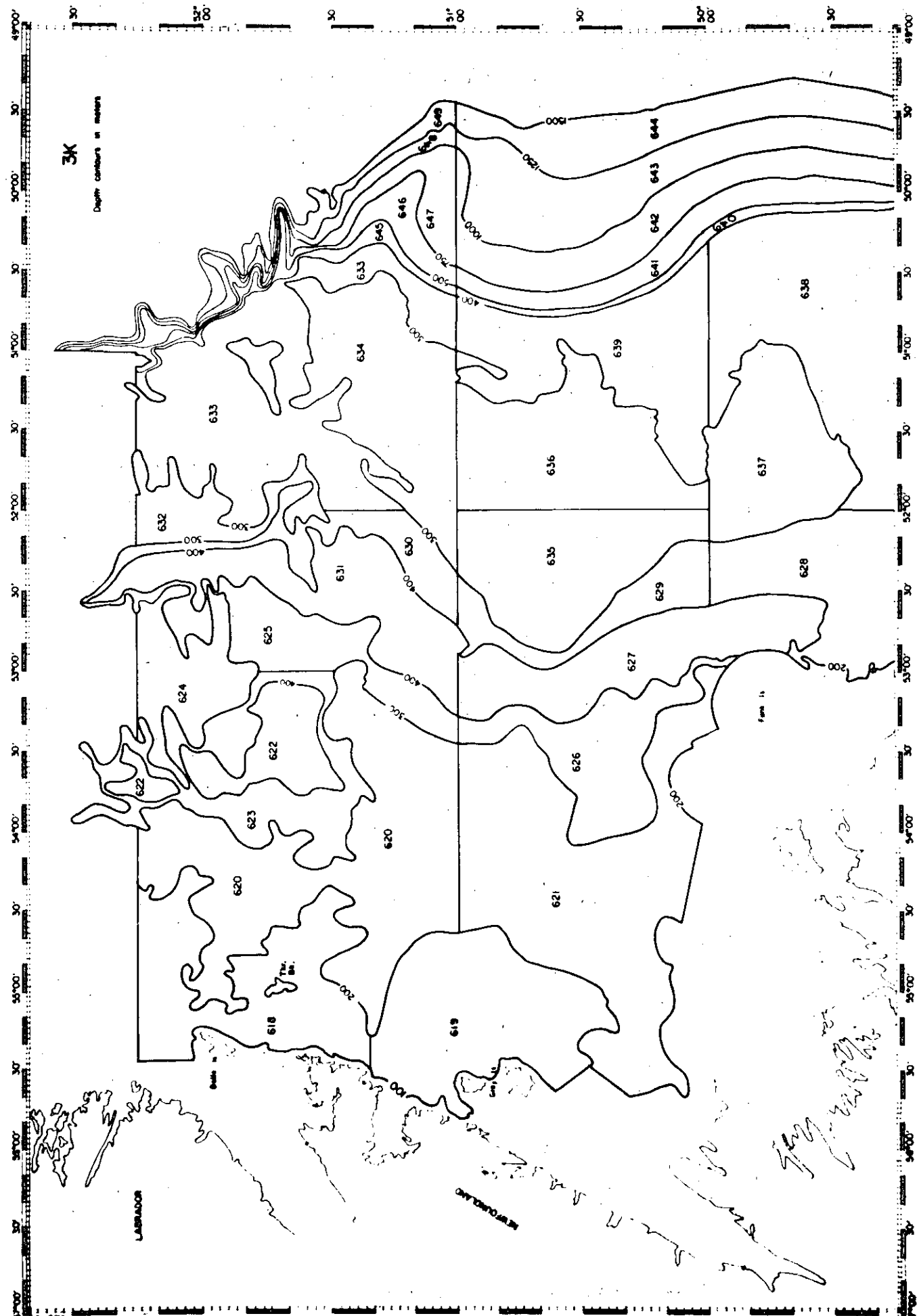

Fig. 1. Stratification scheme used in stratified random surveys of Div. 3K.

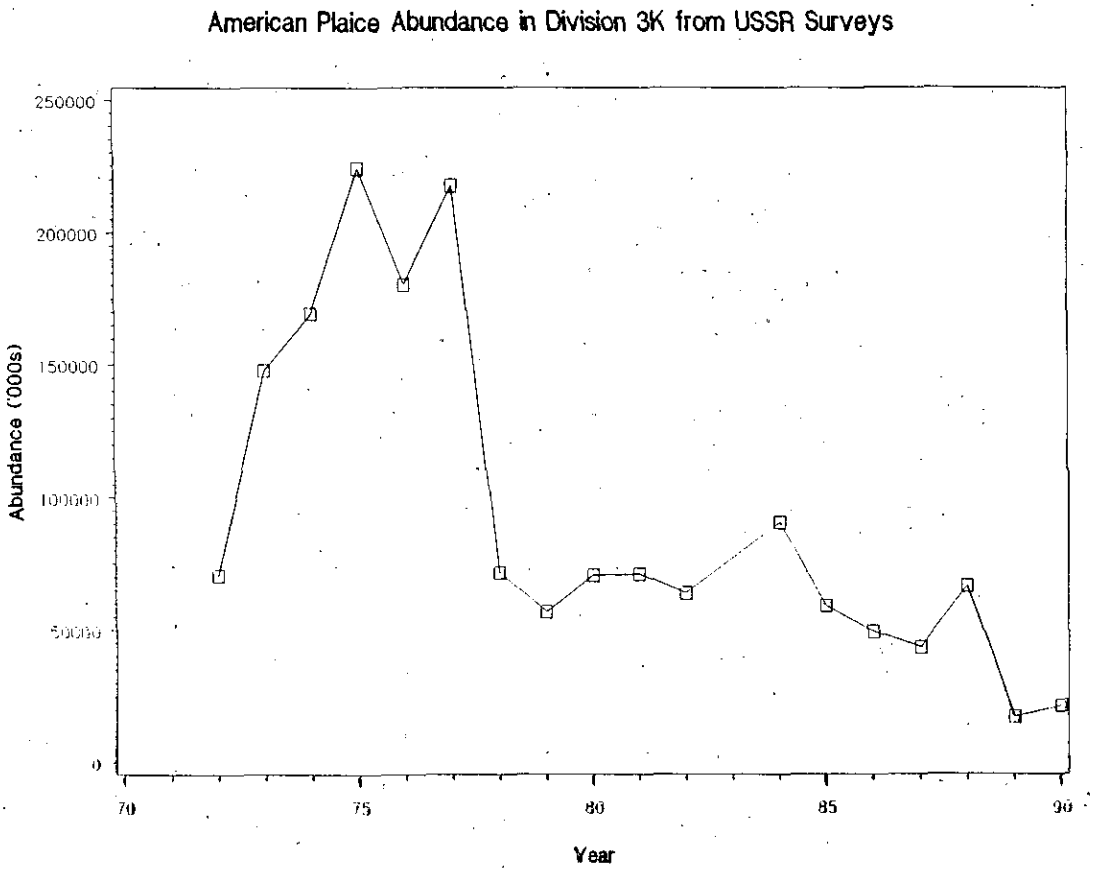

Fig. 2. Abundance of A.plaice in Div. 3K, from USSR surveys.

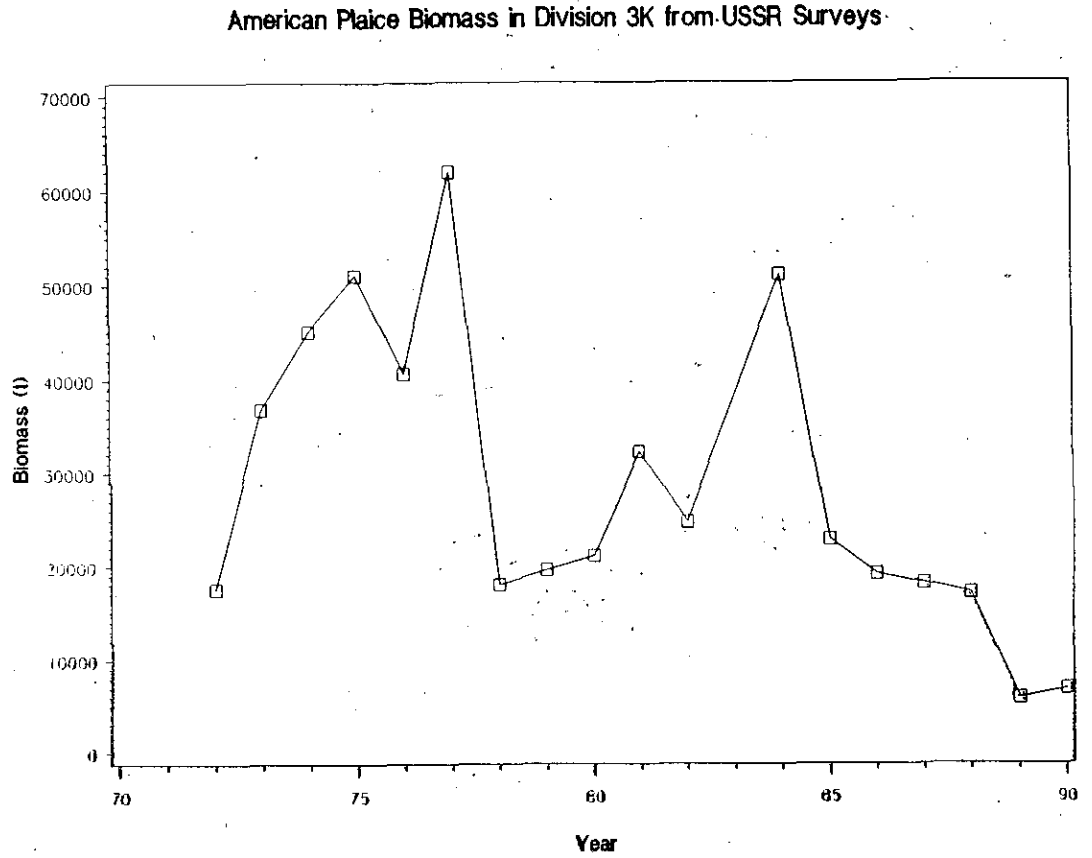

Fig. 3. Biomass of A.plaice in Div. 3K, from USSR surveys.

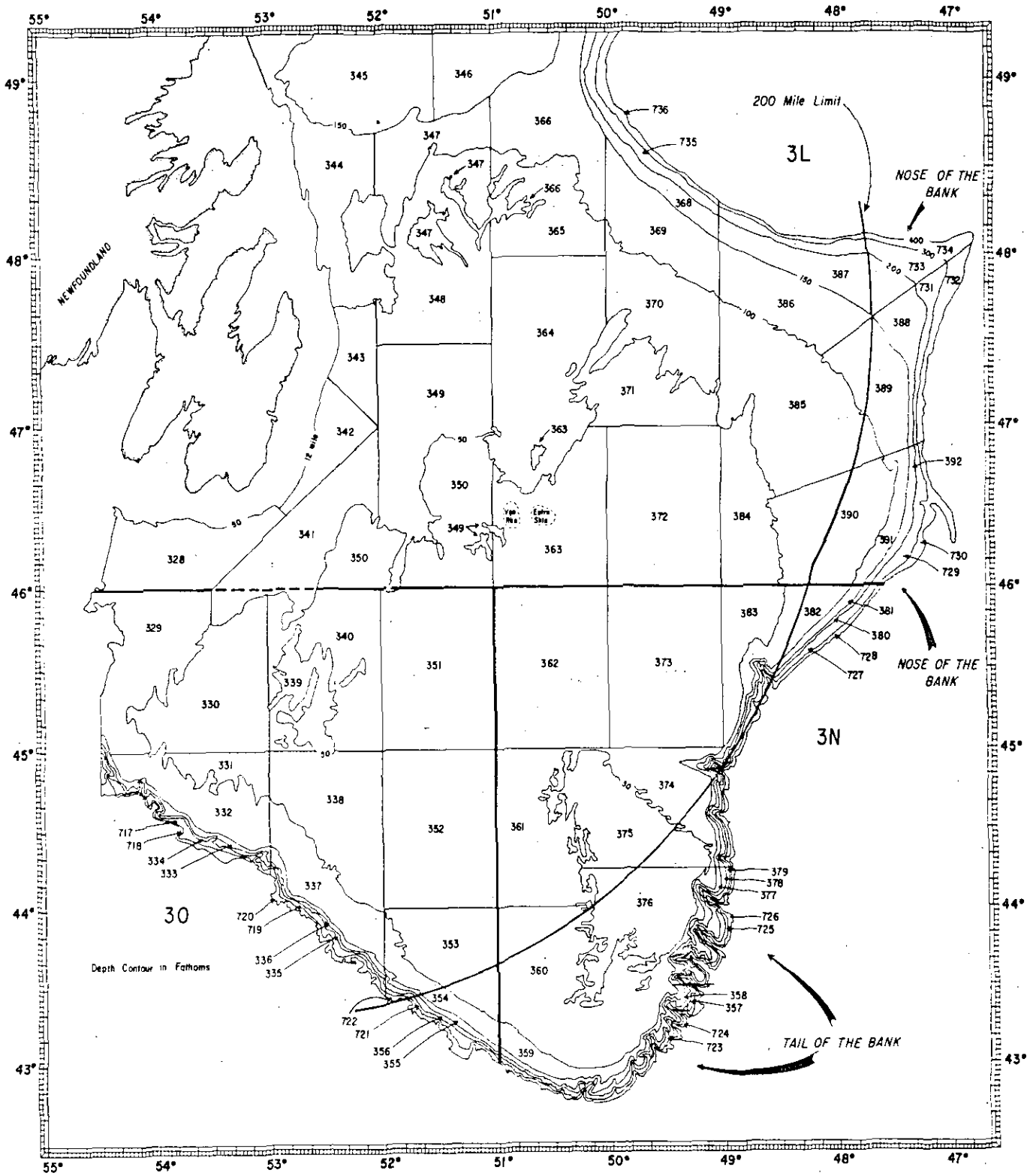

Fig. 4. Stratification scheme used in stratified random surveys of Div. 3LNO.

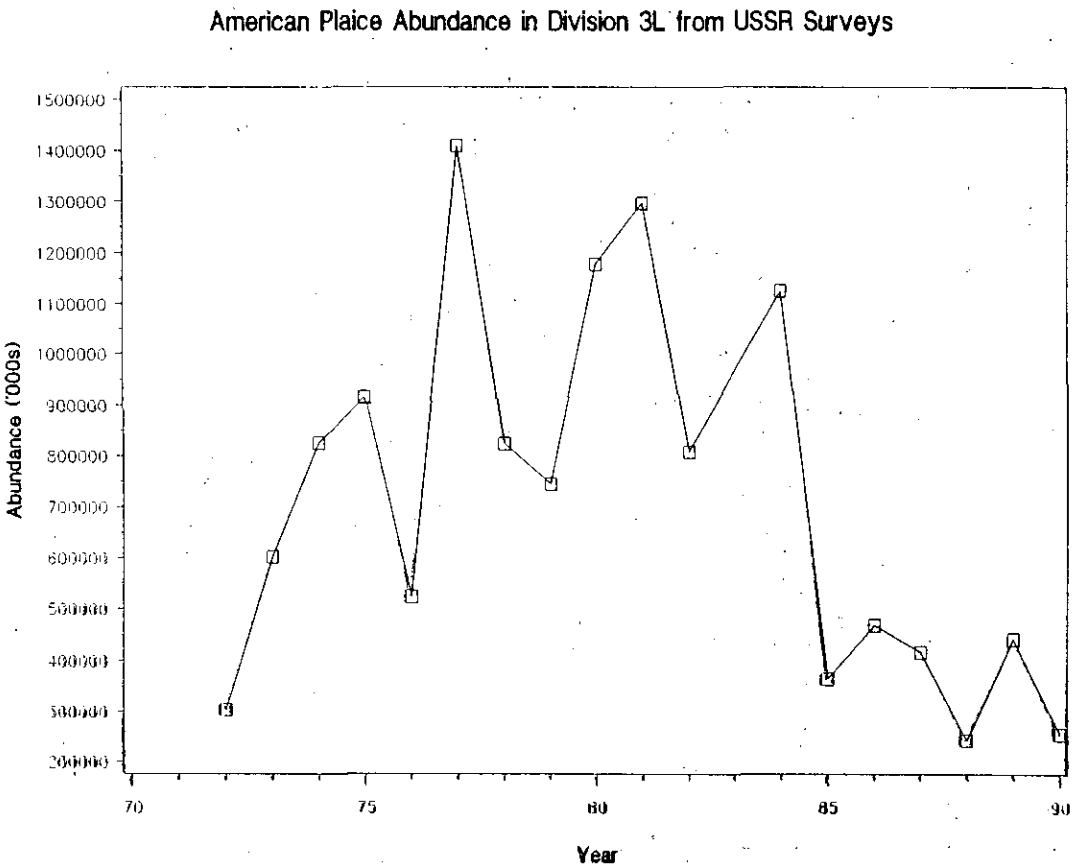

Fig. 5. Abundance of A.plaice in Div. 3L, from USSR surveys.

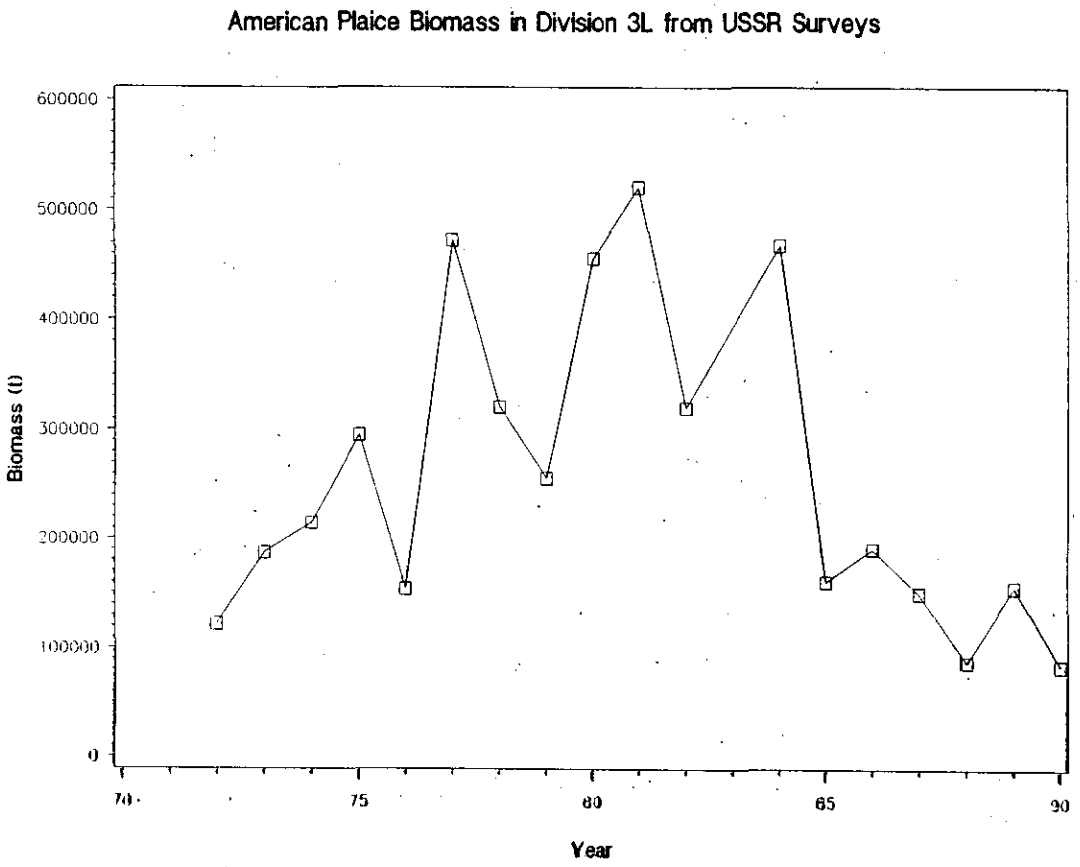

Fig. 6. Biomass of A.plaice in Div. 3L, from USSR surveys.

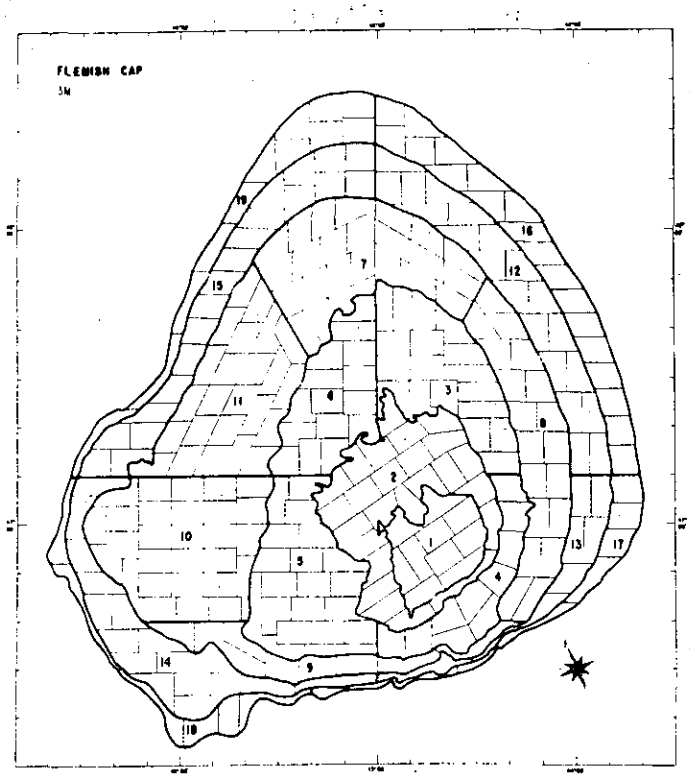

Fig. 7. Stratification scheme used in stratified random surveys of Div. 3M.

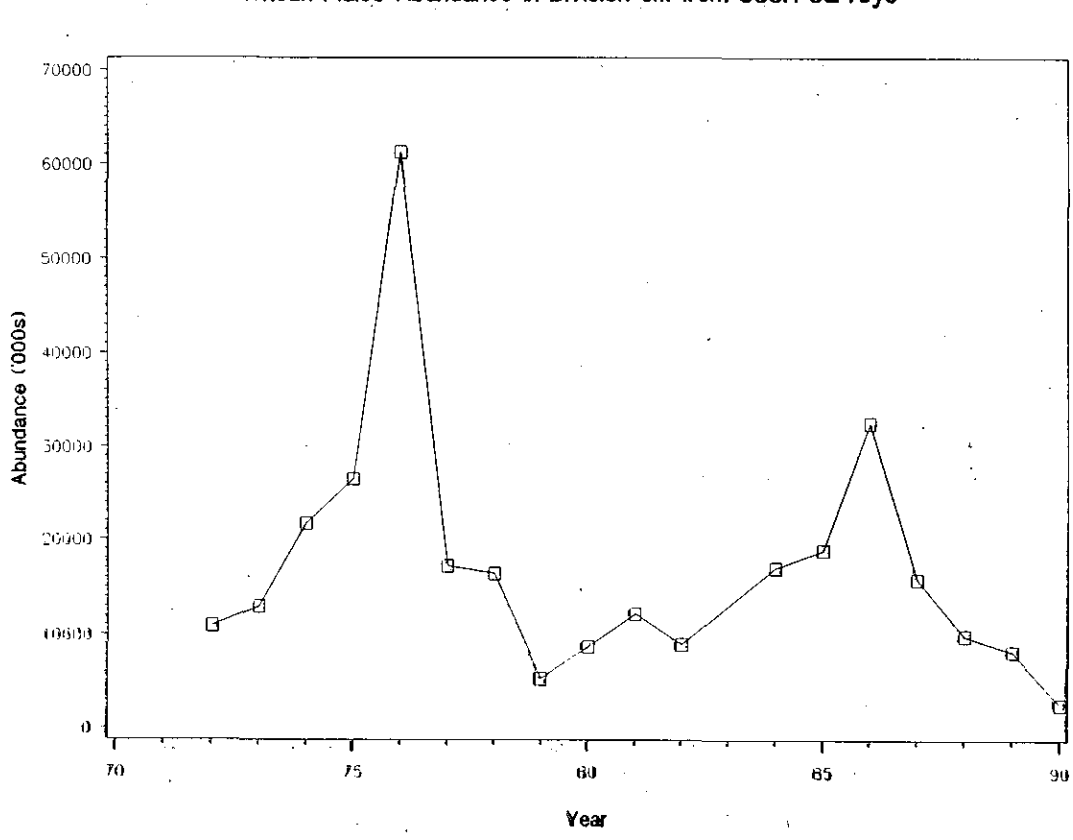

Fig. 8. Abundance of A.plaice in Div. 3M, from USSR surveys.

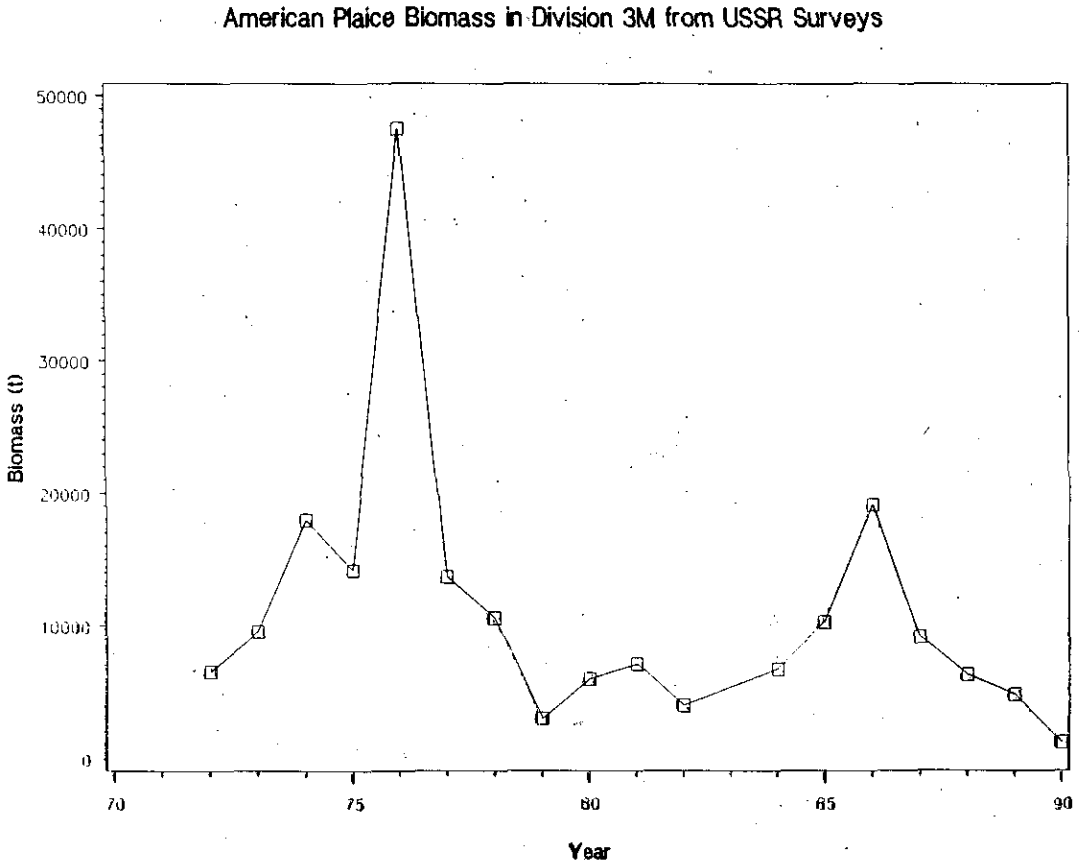

Fig. 9. Biomass of A.plaice in Div. 3M, from USSR surveys.

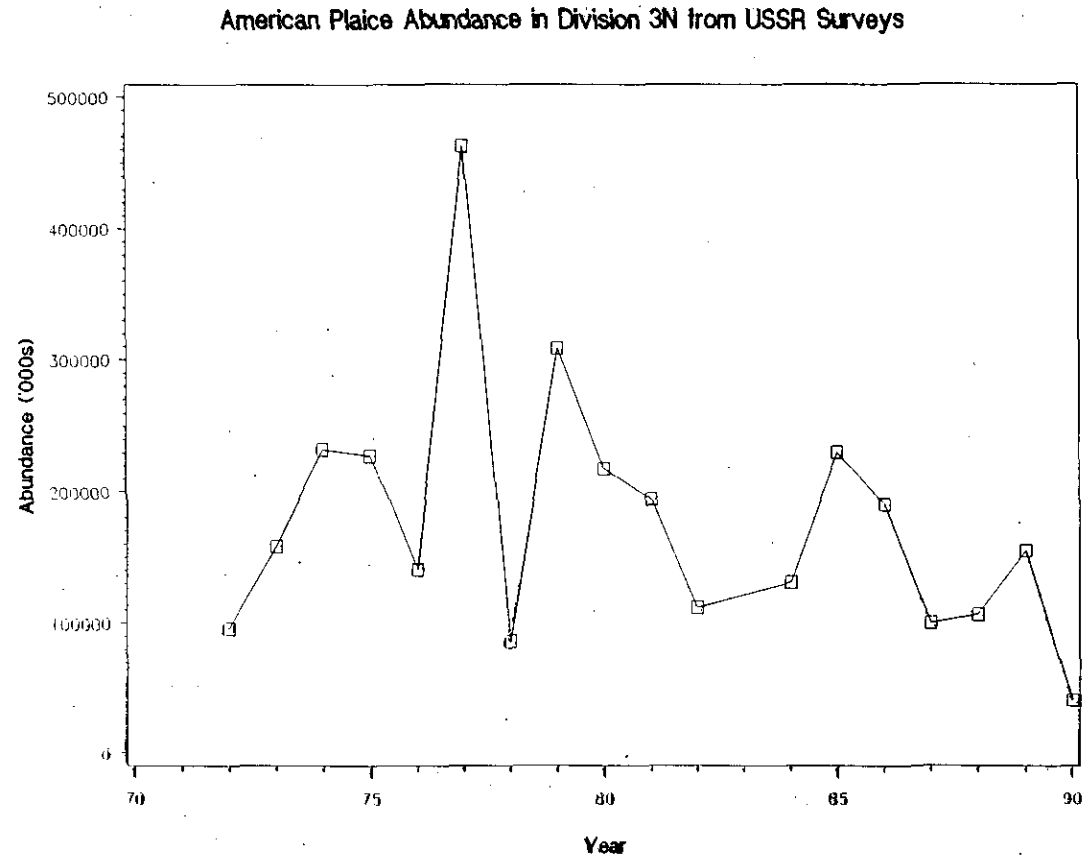

Fig.10. Abundance of A.plaice in Div. 3N, from USSR surveys.

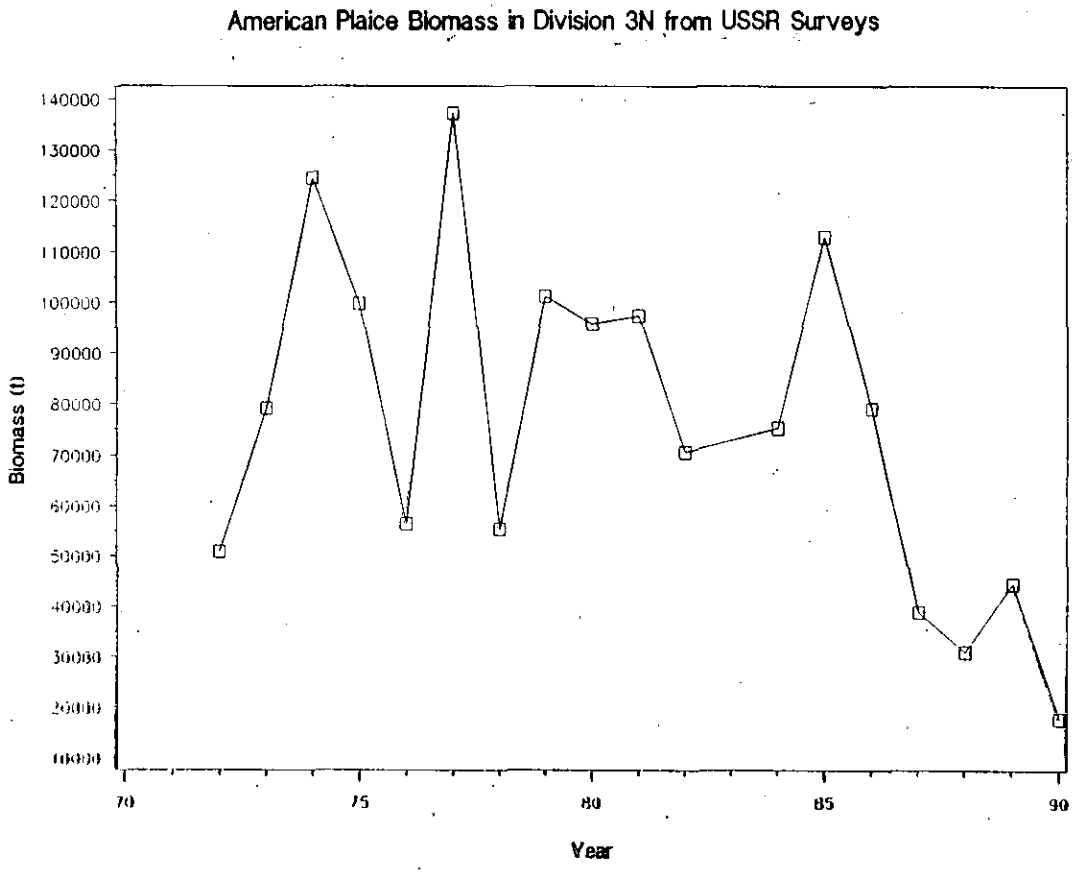

Fig.11. Biomass of A.plaice in Div. 3N, from USSR surveys.

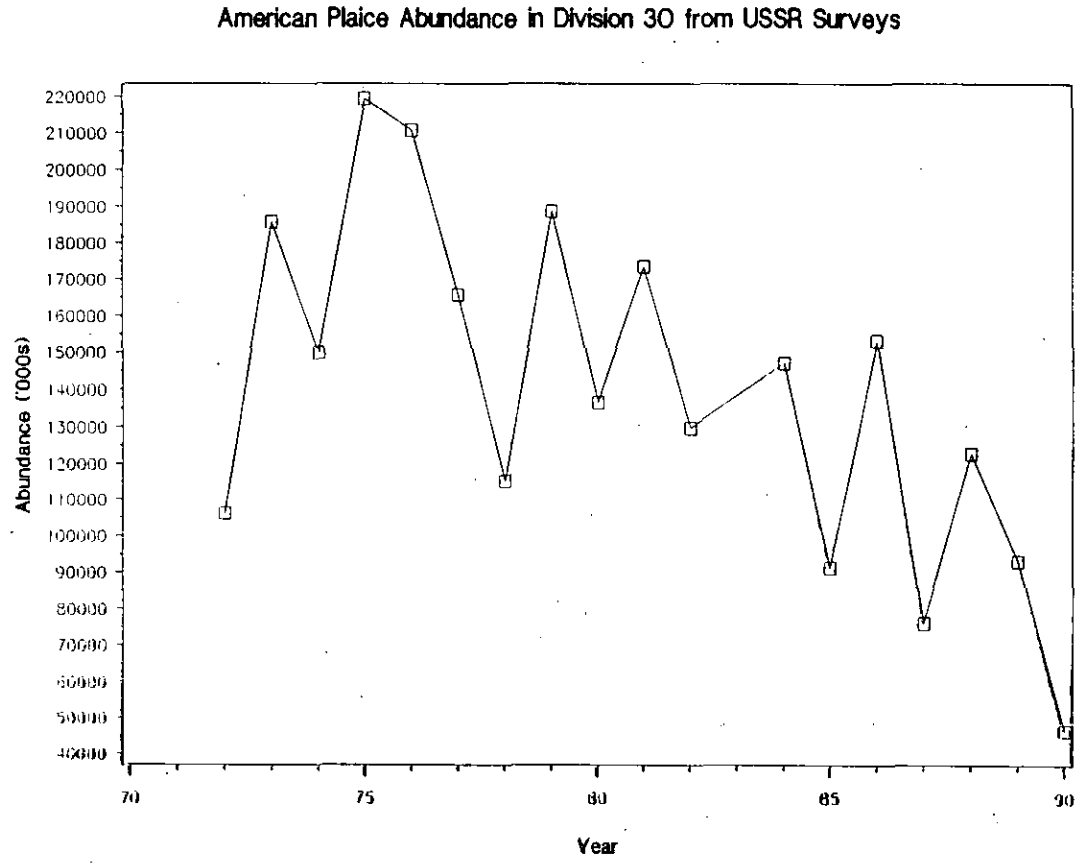

Fig.12. Abundance of A.plaice in Div. 3O, from USSR surveys.

American Plaice Biomass in Division 3O from USSR Surveys

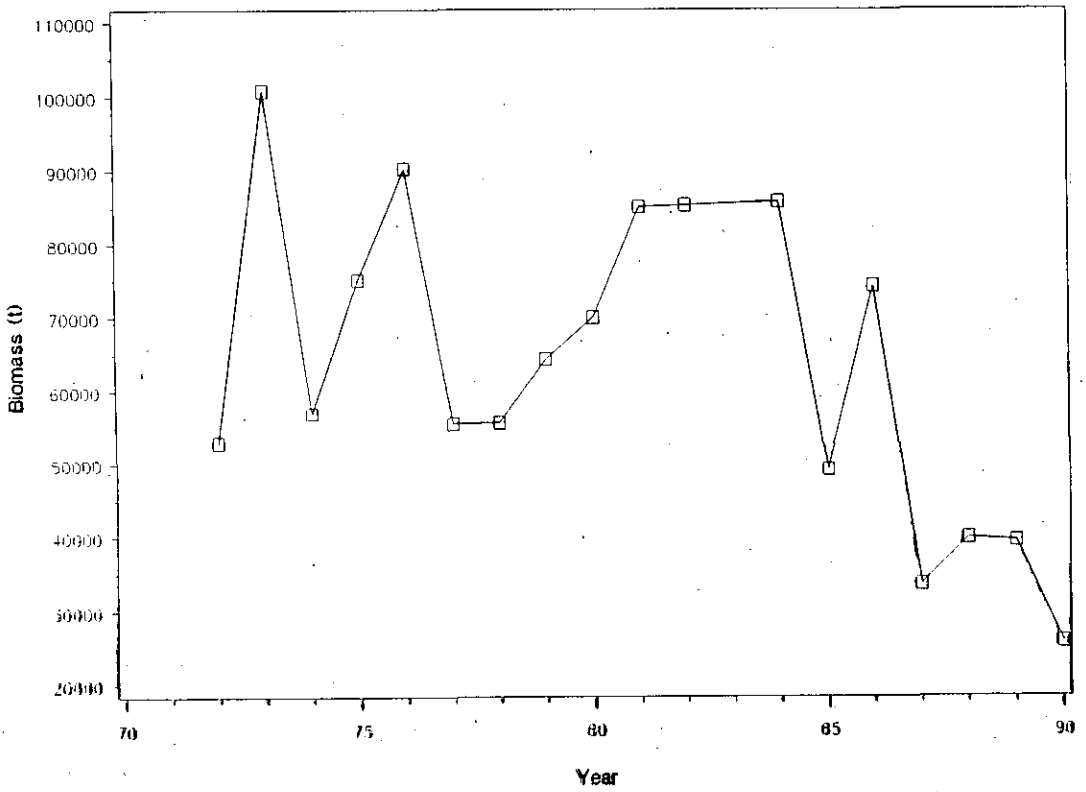

Fig.13. Biomass of A.plaice in Div. 3O, from USSR surveys.

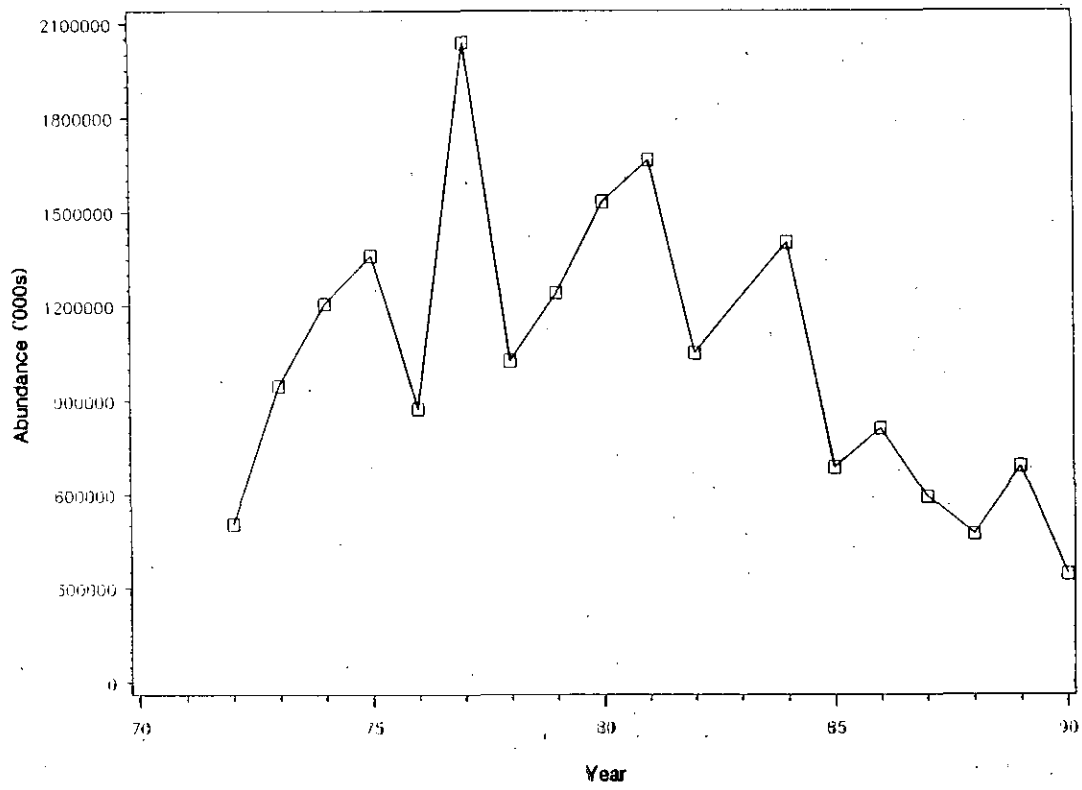

Figure 14 American Plaice Abundance in Division 3LNO from USSR Surveys

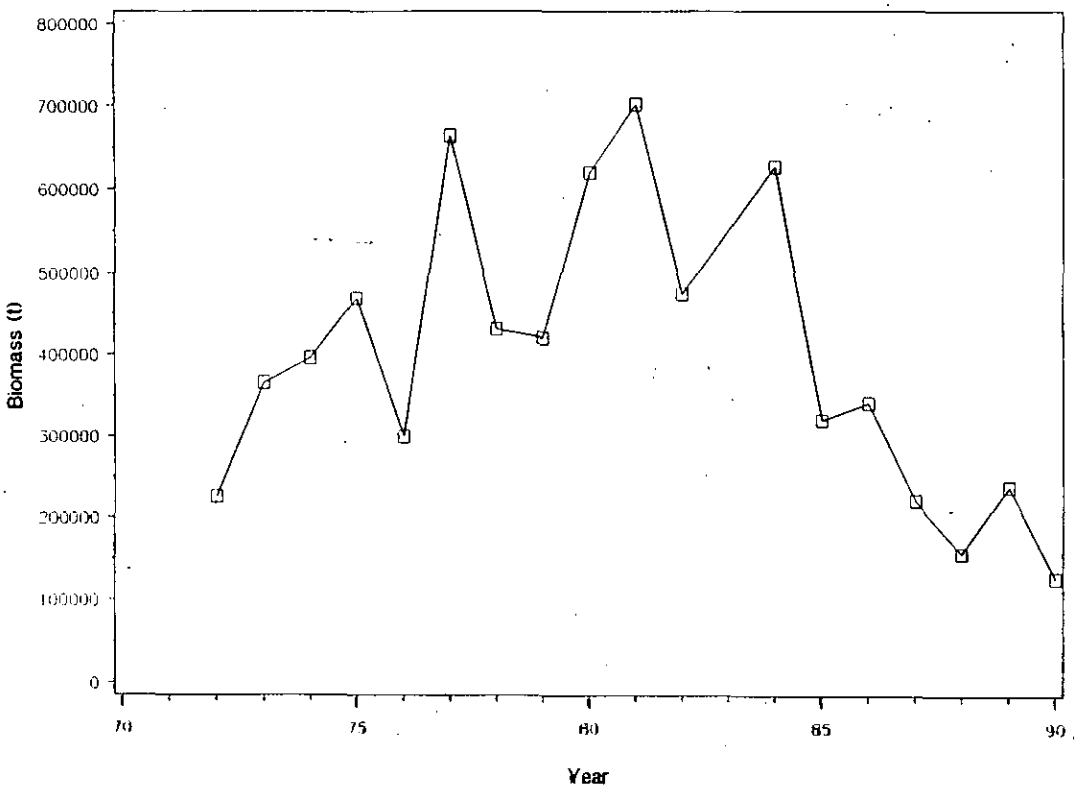

Figure 15 American Plaice Biomass in Division 3LNO from USSR Surveys

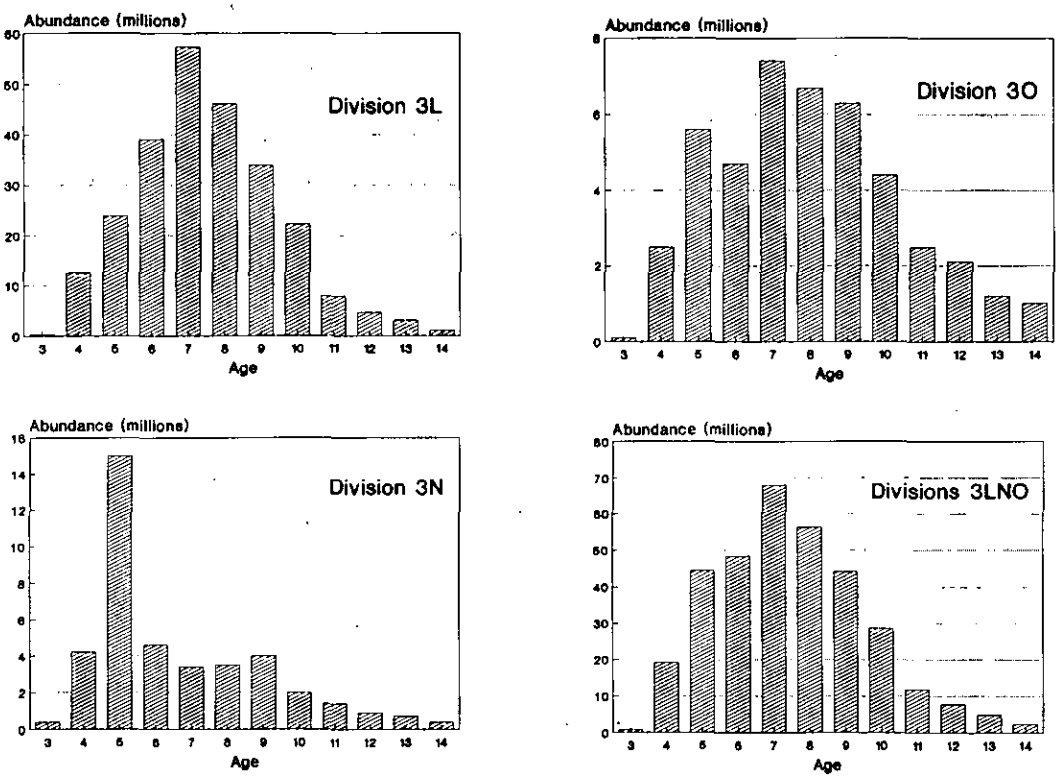

Figure 16 Abundance of American Plaice derived from USSR surveys in Divisions 3LNO during 1990.