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Distribution of Juvenile and Adult American plaice on the Grand Bank, NAFO Division 3LNO

by

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Introduction

The greatest abundance of American plaice in the Northwest Atlantic occurs on the Grand Bank off Newfoundland, NAFO Div. 3LNO. The fishery which has yielded an average 40,000 t during the last 2 years, occurs mainly on the northern part of the Bank (Div. 3L) in depths of 75 to 185 m, along the eastern edge (Div. 3N) in depths of 70-275 m to a lesser extent on the southwestern part of the Bank (Div. 3Ø) in depths of 70-185 m (Pitt, 1975; Walsh, 1982) (Fig. 1).

Walsh (1982) proposed that both juvenile and adult plaice, in catches from spring groundfish surveys, were concentrated in the same areas of the Grand Bank. Since 1985 directed juvenile flatfish surveys on the shallow plateau of the Grand Banks inside of the 91 m (50 fath.) depth contour have identified a proposed nursery area for the southern Grand Bank population on the "Tail" of the Bank, NAFO Div. 3N (Walsh and Brodie, 1988; Walsh, 1989). In 1989 the fall juvenile flatfish survey was extended into the slope waters to a depth of 183 m (100 fath.) to investigate the range of distribution of juvenile plaice in the southern area and to look for other possible nursery areas not sampled.

This paper will report on the findings of this survey and contrast distribution of juveniles with distribution of catches and discards of plaice from the commercial fleet.

Materials and Methods

A stratified-random survey was conducted aboard the Canadian research vessel W. TEMPLEMAN in August/September of 1989 in NAFO Divisions 3NO. The fishing gear used was the standard juvenile flatfish trawl: a Yankee 41 shrimp trawl with 38.1 mm mesh size throughout and a 12-mm stretched mesh codend liner. All fishing hauls were adjusted to 30-minute duration at a towing speed of 2.5 knots and a towing distance of 1.25 miles. A total of 215 fishing hauls were made in depths up to 183 m (100 fath.)

Results

Table 1 shows the average catch (numbers and weights) of American plaice, all sizes, from the 1985 to 1989 surveys. In the southern area of the Bank, stratum 360 in Div. 3N has consistently shown the largest catches for all surveys, however, stratum 376, the southern portion of the Southeast Shoals, which has in the 1986-88 surveys shown to be a heavily concentrated area was low in abundance in the 1989 survey. Stratum 359 in Div. 3N and stratum 339 (Whale Deep) in Div. 3Ø also contained high abundance estimates (Fig. 1). In Div. 3L strata on the northern slope in depths of 92 to 183 m, for the first time surveyed in 1989, showed large catches, most notably strata 341, 348, and 349 on the northwest slope (Fig. 1).

Table 2 shows the average catch per tow of juvenile plaice ages 1, 2, 3, and 4 years during surveys from 1985 to 1988. On the shallow plateau, inside 91 m (50 fath.) depth zone, the largest catches of these age groups have been located in the southern area of the Grand Bank in strata 360 and 376 of Div. 3N and stratum 353 in Div. 3Ø. However, in 1989, estimates of juveniles in stratum 376 were low in comparison to the years 1986-88. A comparison of abundance and biomass estimates for the southern region in the area known as the "Tail of the Bank" showed a noticeable decrease in estimates for stratum 376 and stratum 353 and a large

increase in stratum 360. Low numbers in stratum 376 may be due to emigration out of the area into stratum 360 to the south. Increased survey coverage into depths of 183 m (100 fath.) on the southern part of the Bank showed that juveniles were concentrated in stratum 359 on the "Tail of the Bank" in Div. 3N and stratum 339 in Whale Deep, Div. 3Ø. All depth strata on the southeast and the southwest slopes had catches which contained small amounts of juveniles. On the north and northeast slopes of Div. 3L in the depth range of 91-183 (50-100 fath.), juveniles were more abundant than what is usually found in the shallow areas of Div. 3L with the exception of strata 328, 341, 342, and 343 close to the inside flow of the Labrador Current through the Avalon Channel (Table 3).

Table 4 shows the abundance estimates at age for the nursery area on the "Tail of the Bank", the monitoring station - stratum 360. The 1989 survey catches in this region were dominated by (ages 3 and 4) the 1986 and 1985 year-classes which were the strongest in 1988 survey (Table 4, Fig. 2). Estimates of 1 to 4 year olds, while being fairly stable in 1986-1988 surveys, doubled in 1989 over the 1988 estimate due to the strength of the 1985 and 1986 year-classes. These two year-classes also dominated catches in Whale Deep (stratum 339) in Div. 3Ø and on the north and northeast slope of Div. 3L (Table 3).

Table 5 shows the abundance and biomass of plaice in the southern area of the Bank from surveys in 1986-89. The biomass increased 33% from 1988 to 1989, in agreement with the increase seen for Div. 3N in the 1989 spring survey (Brodie and Bowering, 1989). As can be seen from Table 5, 84% of this biomass was found in stratum 360 in 1989. Generally this has been the pattern seen in other years of the juvenile surveys with stratum 376 (Div. 3N) and stratum 353 (Div. 3Ø) making up the bulk of the rest of the biomass. It is interesting to note that in 1989 abundance estimates for stratum 376 were the lowest in the time series. One possible explanation for this is that the temperature regimes in this stratum and in stratum 353 differed between 1988 and 1989, the latter year having the highest temperatures in the time series for both strata. This may have prompted movement of plaice into the cooler waters found in stratum 360. Another explanation of the increase in abundance and biomass in stratum 360 is that 80% increase in the abundance estimates in this stratum of 7+ yellowtail from 1988 to 1989. (Table 4).

Figures 3 and 6 show the distribution of catches in numbers of ages 1, 4, and 5+ plaice on the Grand Bank from the 1989 survey which covered for the first time strata in depths to 183 m (100 fath.). The length frequency of catches inside the 200 mile limit show higher catches of small fish in Div. 3L than in the other two divisions and relatively low catch rates were seen in comparison to strata 353, 376 and 360, which are located mainly outside the 200 mile limit catches of small plaice up to 32 cm are extremely high (Fig. 3). In figures 4 and 6 we can see that the 'Tail of the Bank', the north and northeast slopes in Div. 3L and to a lesser extent Whale Deep (stratum 339) are areas of concentration of juveniles of ages 1 and 4 years and age 5+ plaice. Although not illustrated, these three areas also contain dense concentration of 2 and 3 year old plaice as seen in Table 2. This general pattern of distribution of 1 to 4 year old plaice in Div. 3NØ have been seen in the time series (Table 2) (Walsh, 1989).

Table 6 shows distribution of catches (percent by weight) of plaice by the Canadian offshore fleet for the combined years 1986-88. Largest catches were taken on the northern slope in depths up to 183 m (100 fath.) in Unit areas 328 and 329 and as well deeper to 270 m in Unit area 330 of Div. 3L (Fig. 7). Catches were also high in Unit area 315, north of the Southeast Shoals in Div. 3N (Table 6, Fig. 7). Discards of small plaice by the Canadian fleet are highest in areas of the northern slope of Div. 3L and the western edge around Whale Bank in Div. 3Ø in the 1988 estimates (Fig. 8).

Table 7 shows catch at age and average weights at age for plaice in NAFO Div. 3LNO by Canada, Spain and the USA. Spanish catches in the Div. 3NØ in 1989 showed that average lengths and weight at age consisted more of smaller plaice. 75% of the Spanish catch in Div. 3N consisted of ages 4, 5 and 6 year olds (5% 1 and 2 year olds) compared to less than 2% by Canada and the USA, both generally took older fish (Brodie and Bowering, 1990).

Discussion

The available information shows that there may be three areas of concentrated abundance of juvenile American plaice. The largest catches were located on the "Tail of the Bank", Div. 3N; the north and northeast slopes of Div. 3L and Whale Deep in Div. 3Ø. It is believed that these areas are the only possible nursery areas on the Grand Banks with the two southern areas recruiting mostly to the southern Grand Bank plaice population, Div. 3NØ. The northern areas recruit mostly to the population located in the slope waters. These nursery areas also contain dense concentrations of adult plaice and the two main areas, the Tail and the northern slopes, are heavily fished by the commercial fleets of foreign and Canadian designation, respectively.

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Table 1. Average numbers and weights of American plaice caught during juvenile surveys 1985-1989.

Div.	Stratum	Category	1985 ^a	1986	1987 ^a	1988	1989
30	330	No. of sets	-	-	-	2	7
		Av. no./set				24.48	355.06
		Av. wt./set				40.47	80.35
30	331	No. of sets	-	-	-	2	2
		Av. no./set				6.99	305.00
		Av. wt./set				2.50	113.75
30	338	No. of sets	-	3	-	6	6
		Av. no./set		33.00		89.60	289.00
		Av. wt./set		15.50		14.49	36.87
30	340	No. of sets	-	-	-	3	6
		Av. no./set				19.79	60.17
		Av. wt./set				6.09	36.87
3L	350	No. of sets	5	6	-	5	8
		Av. no./set	43.60	106.67		273.99	71.63
		Av. wt./set	39.80	93.92		69.25	51.44
30	351	No. of sets	3	9	-	7	8
		Av. no./set	66.00	81.33		48.11	334.25
		Av. wt./set	35.00	36.28		39.47	54.54
30	352	No. of sets	-	13	-	11	14
		Av. no./set		88.62		120.09	150.14
		Av. wt./set		37.30		28.22	39.06
30	353	No. of sets	-	5	-	4	3
		Av. no./set		794.00		700.71	770.33
		Av. wt./set		51.33		145.90	108.07
3N	360	No. of sets	3	14	19	20	19
		Av. no./set	189.67	1823.93	1043.14	1271.32	3015.54
		Av. wt./set	29.00	86.67	47.28	83.37	165.56
3N	361	No. of sets	6	8	8	6	9
		Av. no./set	31.50	29.88	59.08	64.12	53.78
		Av. wt./set	24.17	19.69	41.80	24.90	188.50
3N	362	No. of sets	9	7	2	6	8
		Av. no./set	63.78	62.57	201.84	135.76	177.50
		Av. wt./set	37.72	34.71	84.19	45.55	38.44

^aIncomplete survey

Table 1. Average numbers and weights of American plaice caught during juvenile surveys 1985-1989.

Div.	Stratum	Category	1985 ^a	1986	1987 ^a	1988	1989
3L	363	No. of sets	5	5	-	6	7
		Av. no./set	161.00	119.40		53.79	315.43
		Av. wt./set	56.30	42.61		27.65	88.70
3L	371	No. of sets	4	-	-	5	4
		Av. no./set	252.00			74.34	67.00
		Av. wt./set	102.13			41.45	33.50
3L	372	No. of sets	9	8	-	8	8
		Av. no./set	98.28	108.50		97.80	97.88
		Av. wt./set	72.09	90.38		55.02	38.43
3N	373	No. of sets	10	7	-	8	8
		Av. no./set	399.80	182.93		51.59	95.25
		Av. wt./set	313.34	139.68		35.93	54.13
3N	374	No. of sets	4	4	-	4	3
		Av. no./set	147.25	408.50		166.12	173.33
		Av. wt./set	62.63	218.25		53.98	37.00
3N	375	No. of sets	7	5	7	9	8
		Av. no./set	57.71	24.38	48.96	23.54	21.63
		Av. wt./set	67.43	31.98	69.54	17.45	17.06
3N	376	No. of sets	2	4	10	12	9
		Av. no./set	60.00	221.75	347.63	674.98	71.89
		Av. wt./set	45.50	284.31	18.75	52.81	18.89
3N	383	No. of sets	4	-	-	4	3
		Av. no./set	236.00			106.42	268.33
		Av. wt./set	75.63			42.59	52.50
3L	384	No. of sets	4	-	-	5	4
		Av. no./set	282.25			191.45	372.25
		Av. wt./set	105.45			88.33	72.41
3L	328	No. of sets					3
		Av. no./set					159.85
		Av. wt./set					15.00
3Ø	329	No. of sets					4
		Av. no./set					803.63
		Av. wt./set					132.21
3Ø	332	No. of sets					4
		Av. no./set					592.25
		Av. wt./set					80.53
3Ø	337	No. of sets					2
		Av. no./set					357.00
		Av. wt./set					45.38
3Ø	339	No. of sets					2
		Av. no./set					2960.50
		Av. wt./set					449.60
3L	341	No. of sets					4
		Av. no./set					1194.50
		Av. wt./set					220.88
3L	342	No. of sets					2
		Av. no./set					223.00
		Av. wt./set					51.25
3L	343	No. of sets					2
		Av. no./set					59.00
		Av. wt./set					7.50

^aIncomplete survey

Table 1. (Cont'd.)

Div.	Stratum	Category	1985 ^a	1986	1987 ^a	1988	1989
3L	348	No. of sets					7
		Av. no./set					1562.50
		Av. wt./set					146.84
3L	349	No. of sets					5
		Av. no./set					1341.40
		Av. wt./set					199.62
3Ø	354	No. of sets					2
		Av. no./set					472.50
		Av. wt./set					80.53
3N	359	No. of sets					2
		Av. no./set					2395.50
		Av. wt./set					99.55
3L	364	No. of sets					11
		Av. no./set					1406.53
		Av. wt./set					113.02
3L	365	No. of sets					4
		Av. no./set					1854.75
		Av. wt./set					95.08
3L	370	No. of sets					6
		Av. no./set					1703.83
		Av. wt./set					87.53
3N	382	No. of sets					2
		Av. no./set					48.00
		Av. wt./set					5.25
3L	385	No. of sets					5
		Av. no./set					1085.80
		Av. wt./set					69.33
3L	390	No. of sets					4
		Av. no./set					284.00
		Av. wt./set					50.91

^aIncomplete survey

Table 2. Average catch per tow of juvenile and adult American plaice on the Grand Banks, NAFO Div. 3LNO in juvenile surveys 1985-89.

Stratum	Category	1985	1986	1987	1988	1989
Div. 3Ø 330	No. of sets	-	-	-	2	7
	Age 1				0.00	12.06
	Age 2				0.04	41.66
	Age 3				0.36	71.71
	Age 4				0.09	67.41
Div. 3Ø 331	No. of sets	-	-	-	2	2
	Age 1				0.08	3.85
	Age 2				2.11	32.44
	Age 3				2.17	66.19
	Age 4				0.48	64.53
Div. 3Ø 338	No. of sets	-	3	-	6	6
	Age 1		1.35		0.67	23.12
	Age 2		5.73		25.84	44.06
	Age 3		4.55		33.32	69.55
	Age 4		1.17		9.60	62.39

Table 2. (Cont'd)

Stratum	Category	1985	1986	1987	1988	1989
Div. 3Ø 340	No. of sets	-	1	-	3	6
	Age 1				0.85	0.48
	Age 2				8.04	2.59
	Age 3				4.19	5.89
	Age 4				1.31	6.49
Div. 3L 350	No. of sets	5	6	-	5	8
	Age 1	0.09	0.71		27.17	1.54
	Age 2	0.21	0.27		88.67	3.89
	Age 3	0.24	0.17		53.24	6.71
	Age 4	0.32	0.57		17.14	3.72
Div. 3Ø 351	No. of sets	3	9	-	7	8
	Age 1	4.09	10.93		0.88	14.70
	Age 2	4.20	9.04		5.86	51.40
	Age 3	3.39	6.94		4.26	93.73
	Age 4	2.32	5.08		1.37	76.38
Div. 3Ø 352	No. of sets	1	13	1	11	14
	Age 1		11.00		2.37	7.96
	Age 2		10.28		24.20	11.22
	Age 3		12.00		34.83	24.03
	Age 4		7.21		14.33	29.08
Div. 3Ø 353	No. of sets	-	5	1	4	3
	Age 1		280.19		5.90	14.00
	Age 2		191.35		124.76	31.64
	Age 3		132.70		240.18	133.86
	Age 4		54.65		105.48	188.11
Div. 3N 360	No. of sets	3	14	19	20	19
	Age 1	24.79	483.81	309.58	28.69	122.61
	Age 2	66.08	486.80	448.80	300.14	413.46
	Age 3	32.64	396.98	175.49	507.20	871.23
	Age 4	11.07	173.58	68.55	220.37	837.81
Div. 3N 361	No. of sets	6	8	8	6	9
	Age 1	0.76	3.44	3.21	4.54	0.80
	Age 2	2.57	1.93	4.78	15.28	4.29
	Age 3	2.25	2.92	4.41	14.08	8.94
	Age 4	0.91	2.02	3.55	3.20	10.87
Div. 3N 362	No. of sets	9	7	2	6	8
	Age 1	1.28	0.83	41.76	14.01	4.34
	Age 2	3.84	3.41	29.94	38.32	22.67
	Age 3	3.19	4.39	28.82	22.05	44.73
	Age 4	2.54	4.49	17.36	6.56	39.43
Div. 3L 363	No. of sets	5	5	-	6	7
	Age 1	2.53	5.34		0.60	9.94
	Age 2	8.44	5.05		3.86	27.10
	Age 3	5.13	5.19		5.04	44.41
	Age 4	3.85	6.42		2.95	39.63
Div. 3L 371	No. of sets	4	-	-	5	4
	Age 1	5.13			1.84	0.00
	Age 2	9.49			4.08	0.39
	Age 3	5.33			2.86	0.90
	Age 4	4.84			2.05	1.37
Div. 3L 372	No. of sets	9	8	-	8	8
	Age 1	0.37	2.46		2.68	2.23
	Age 2	0.51	1.82		4.82	7.51
	Age 3	0.42	1.49		5.69	15.16
	Age 4	0.74	1.82		3.82	13.94
Div. 3N 373	No. of sets	10	7	-	8	8
	Age 1	3.43	1.83		0.49	0.72
	Age 2	12.23	2.57		2.74	4.81
	Age 3	9.87	3.76		2.37	11.39
	Age 4	7.23	4.88		1.12	12.73

Table 2. (Cont'd)

Stratum	Category	1985	1986	1987	1988	1989
Div. 3N 374	No. of sets	4	4	1	4	3
	Age 1	10.45	8.29		4.10	4.47
	Age 2	23.82	57.09		43.29	26.02
	Age 3	12.67	57.61		45.40	45.55
	Age 4	6.84	37.88		12.30	38.42
Div. 3N 375	No. of sets	7	5	7	9	8
	Age 1	0.0	0.28	0.78	0.17	0.36
	Age 2	0.05	0.33	1.07	4.93	0.66
	Age 3	0.11	0.17	0.52	5.22	1.16
	Age 4	0.07	0.14	0.40	1.35	1.43
Div. 3N 376	No. of sets	2	4	10	12	9
	Age 1	2.05	7.62	127.02	31.50	1.91
	Age 2	2.02	17.64	143.50	148.58	4.16
	Age 3	0.63	20.00	25.64	244.47	8.61
	Age 4	0.28	10.24	6.51	118.32	11.97
Div. 3N 383	No. of sets	4	-	-	4	3
	Age 1	10.78			6.60	4.59
	Age 2	26.03			19.40	21.56
	Age 3	17.71			14.76	39.79
	Age 4	11.26			6.48	49.93
Div. 3L 384	No. of sets	4	-	-	5	4
	Age 1	20.81			10.19	32.44
	Age 2	50.49			16.73	55.37
	Age 3	22.71			10.25	82.72
	Age 4	8.47			5.38	50.95
Div. 3L 328	No. of sets					3
	Age 1					4.02
	Age 2					15.04
	Age 3					33.29
	Age 4					38.58
Div. 3Ø 329	No. of sets					4
	Age 1					29.24
	Age 2					88.31
	Age 3					156.19
	Age 4					138.81
Div. 3Ø 332	No. of sets					4
	Age 1					22.79
	Age 2					56.39
	Age 3					113.84
	Age 4					134.46
Div. 3Ø 337	No. of sets					2
	Age 1					10.43
	Age 2					15.80
	Age 3					65.48
	Age 4					86.13
Div. 3Ø 339	No. of sets					2
	Age 1					321.92
	Age 2					443.01
	Age 3					594.07
	Age 4					356.90
Div. 3L 341	No. of sets					4
	Age 1					3.52
	Age 2					33.96
	Age 3					107.76
	Age 4					221.49
Div. 3L 342	No. of sets					2
	Age 1					0.47
	Age 2					3.55
	Age 3					11.45
	Age 4					23.48

Table 2. (Cont'd)

Stratum	Category	1985	1986	1987	1988	1989
Div. 3L 343	No. of sets					2
	Age 1					0.45
	Age 2					1.79
	Age 3					5.46
	Age 4					13.11
Div. 3L 348	No. of sets					7
	Age 1					48.98
	Age 2					144.95
	Age 3					327.33
	Age 4					355.72
Div. 3L 349	No. of sets					5
	Age 1					23.56
	Age 2					84.74
	Age 3					174.54
	Age 4					234.13
Div. 3Ø 354	No. of sets					2
	Age 1					4.16
	Age 2					16.49
	Age 3					81.27
	Age 4					124.95
Div. 3N 359	No. of sets					2
	Age 1					20.76
	Age 2					268.62
	Age 3					761.92
	Age 4					730.60
Div. 3L 364	No. of sets					11
	Age 1					63.40
	Age 2					219.15
	Age 3					405.28
	Age 4					296.16
Div. 3L 365	No. of sets					4
	Age 1					139.38
	Age 2					311.16
	Age 3					568.70
	Age 4					399.40
Div. 3L 370	No. of sets					6
	Age 1					119.26
	Age 2					347.19
	Age 3					579.91
	Age 4					368.62
Div. 3N 382	No. of sets					2
	Age 1					0.11
	Age 2					0.88
	Age 3					5.19
	Age 4					14.94
Div. 3L 385	No. of sets					5
	Age 1					87.14
	Age 2					199.38
	Age 3					234.19
	Age 4					217.20
Div. 3L 390	No. of sets					4
	Age 1					7.41
	Age 2					32.66
	Age 3					64.24
	Age 4					62.46

Table 3. Average catch at age of plaice from strata on the north and northeast slope of Div. 3L in a depth range of 91-183 m from 1989 survey.

Age	Stratum 348	Stratum 349	Stratum 364	Stratum 365	Stratum 370	Stratum 385	Overall average
1	0.91	0.63	1.16	1.14	3.45	8.02	2.65
2	42.24	17.17	47.48	129.33	103.49	77.02	60.53
3	238.93	137.83	363.84	530.95	562.94	337.01	332.48
4	281.46	180.87	390.90	485.98	565.65	283.23	339.91
5	186.71	86.60	134.35	196.01	154.65	93.61	134.78
6	228.59	144.75	121.98	191.92	110.71	95.05	144.81
7	228.98	199.88	98.63	142.58	65.81	69.23	134.62
8	201.77	297.91	113.93	103.55	52.82	51.23	142.48
9	107.40	218.52	92.28	49.31	50.67	41.07	98.96
10	25.65	40.66	29.92	13.96	22.10	19.40	26.69
11	7.65	9.70	8.96	7.99	9.16	6.89	8.38
12	3.24	5.29	2.88	1.71	2.92	3.08	3.32
13	0.98	1.65	0.23	-	0.98	0.72	0.78
14	-	-	0.09	0.15	0.19	0.19	0.14

Table 4. Comparison of abundance estimates (nos x 10⁻³) at age for Stratum 360 in 1986, 1987, 1988 and 1989.^a

Age	1986 Numbers at age	1987 Numbers at age	1988 Numbers at age	1989 Numbers at age
1	153,870	98,459	9,123	38,994
2	154,823	143,736	95,458	131,496
3	126,257	55,812	161,311	277,087
4	55,206	21,803	70,086	266,457
5	20,014	4,977	37,292	106,768
6	22,692	3,611	13,667	74,686
7	11,994	1,505	5,783	50,131
8	4,882	700	4,676	22,123
9	2,209	422	2,426	6,156
10	1,142	223	1,479	1,807
11	774	212	952	1,161
12	639	157	548	525
13	513	150	377	436
14	255	139	209	292
15	232	65	78	118
16	106	21	24	50
17	15	0	14	0
18	23	0	0	0
19	6	0	0	0
Unknown	0	714.92	0	0
Total				
1+	555,651	331,707	403,517	978,294
4+	120,701	33,985	137,625	530,717
7+	22,790	3,594	16,580	82,779
1 to 4	490,156	318,810	335,978	714,034

^aPoor coverage in 1985.

Table 5. Comparison of abundance and biomass of American plaice in selected stratas of Division 3N0 ($\times 10^{-6}$).

Strat.	1985		1986		1987		1988		1989	
	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass	Abund	Biomass
360 (3N)	60.3	9.2	580.0	27.5	332.0	15.0	404.6	26.5	978.3	52.6
376 (3N)	9.5	7.1	35.5	45.3	55.4	3.0	107.6	8.4	11.5	3.0
375 (3N)	9.7	11.4	4.1	5.4	8.3	11.8	4.0	3.0	3.7	2.9
361 (3N)	6.2	4.8	5.9	3.9	11.7	8.2	12.7	4.9	10.6	4.1
352 (3Ø)	N.S.	-	24.3	10.2	N.S.	N.S.	33.0	7.7	41.2	10.7
353 (3Ø)	N.S.	-	108.2	7.0	N.S.	N.S.	95.6	19.9	105.0	14.7
Total biomass in Div. 3N	85.2	32.5	625.5	82.1	407.4	38.0	528.9	42.0	1150.8	62.6

N.S: no survey.

Table 6. Percent composition of catches of American plaice by the Canadian commercial fleet for the combined years 1986-88.

Unit Area	Catch (mt)	% Catch
337	10.7	0.01
331	1457.7	1.8
330	8540.9	10.6
325	61.7	0.1
336	74.4	0.9
332	1817.0	2.3
329	11890.6	14.8
326	4515.6	5.6
335	170.2	1.21
334	490.0	0.6
328	15165.8	18.9
333	4775.3	5.6
327	2951.7	3.6
315	8501.5	10.6
320	2363.0	2.9
316	4020.2	5.0
319	2455.0	3.1
317	2.0	0
318	0.8	0
310	3198.8	4.0
314	2401.5	3.0
311	1300.5	1.6
313	2853.0	3.6
312	1203.7	1.5
Total	80221.5	

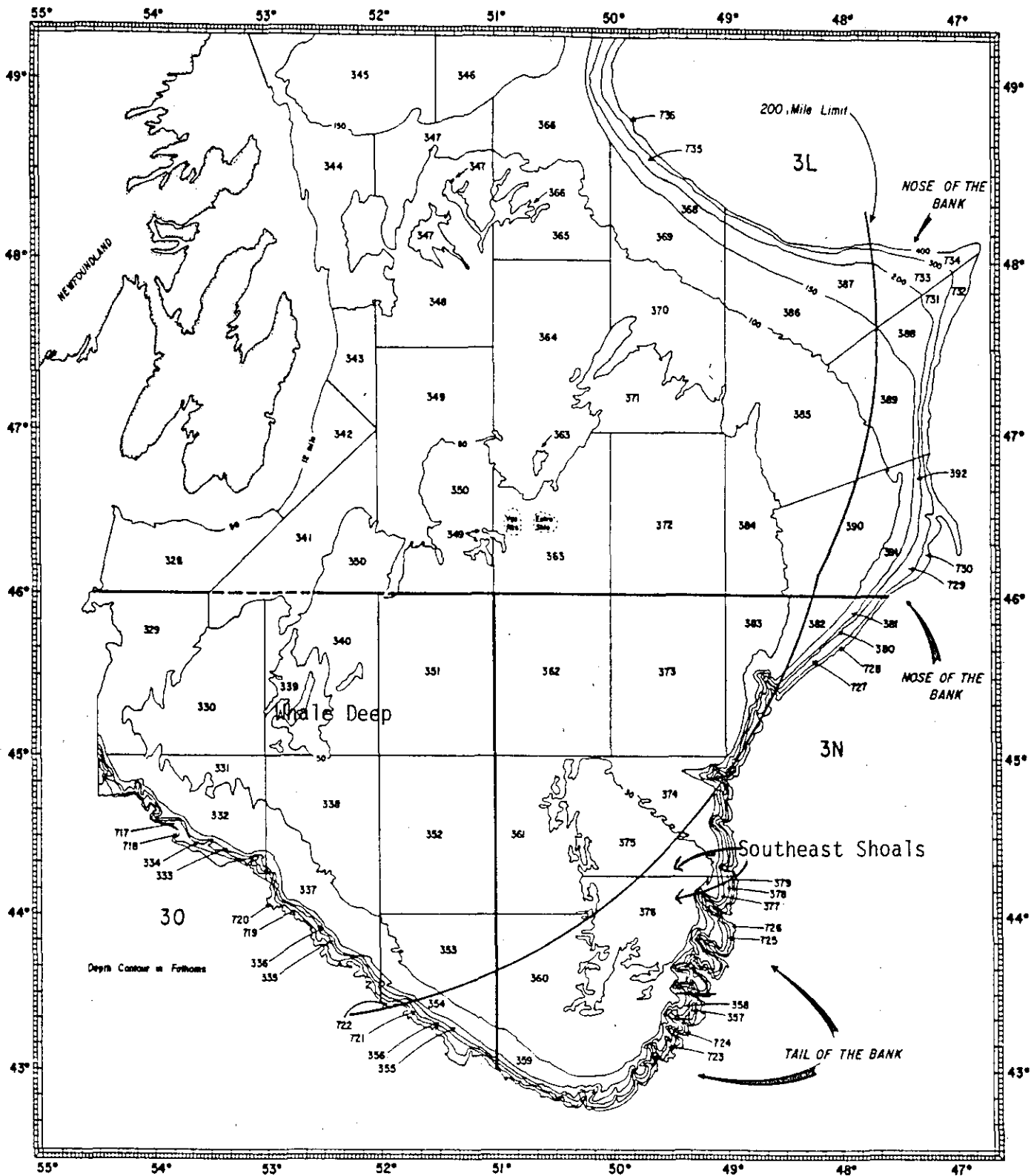


Fig. I. Depth stratification chart of the Grand Bank, NAFO Div. 3LNO

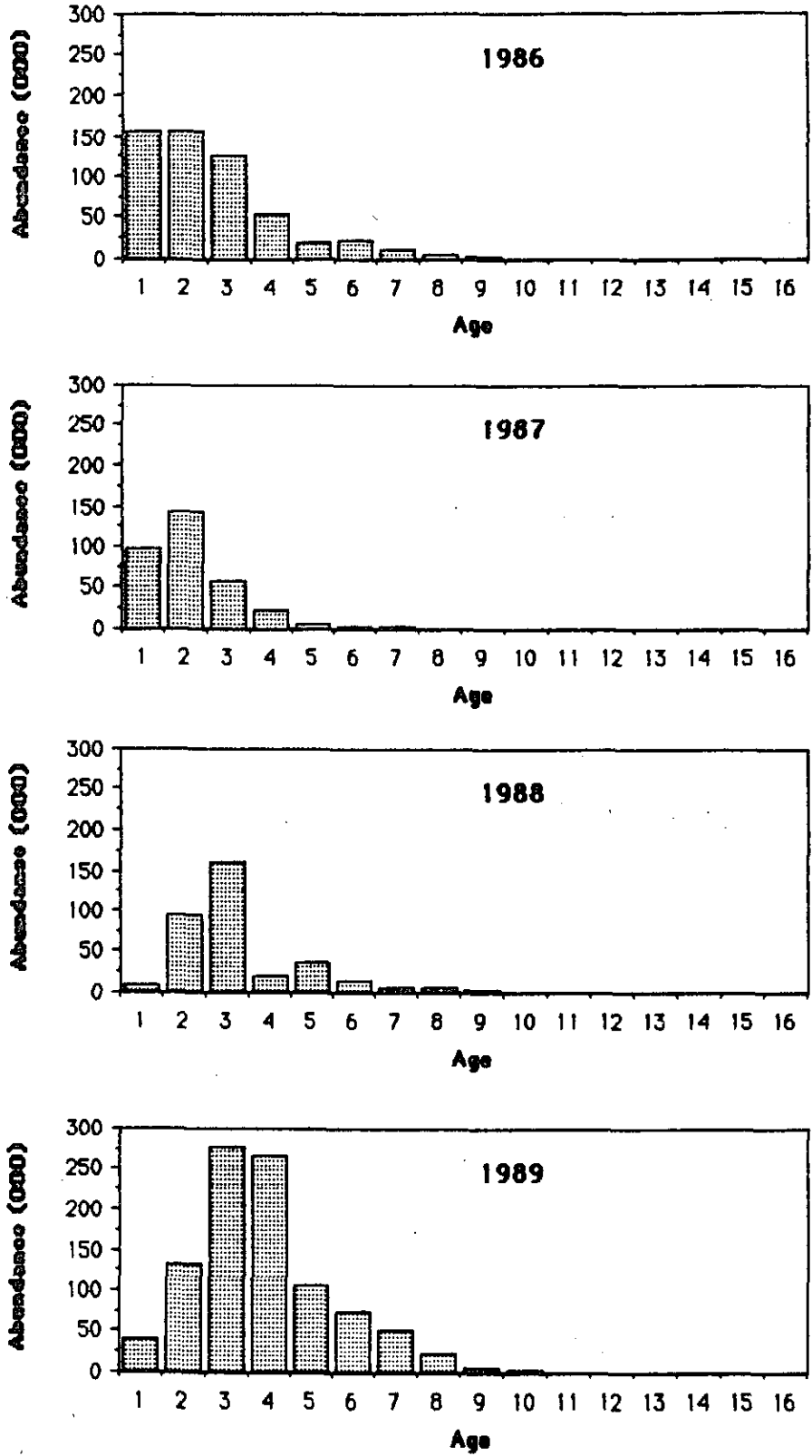
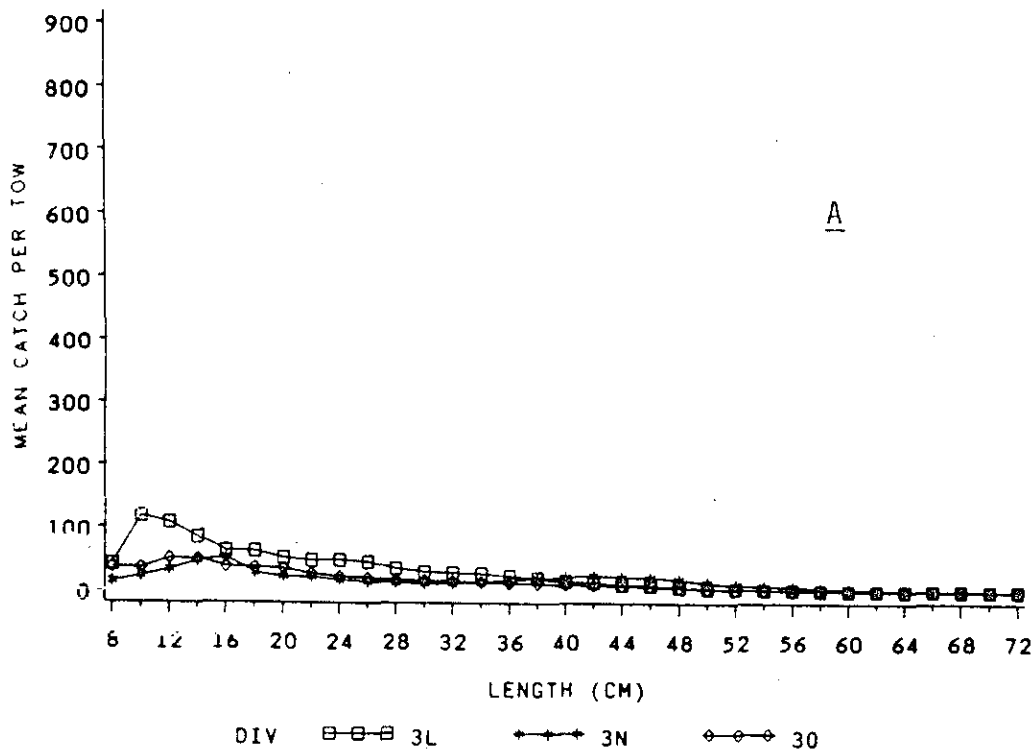


Fig.2 Abundance of American plaice on the Grand Banks from juvenile surveys in stratum 360 from 1986-89



AMERICAN PLAICE: 1989 JUVENILE SURVEY

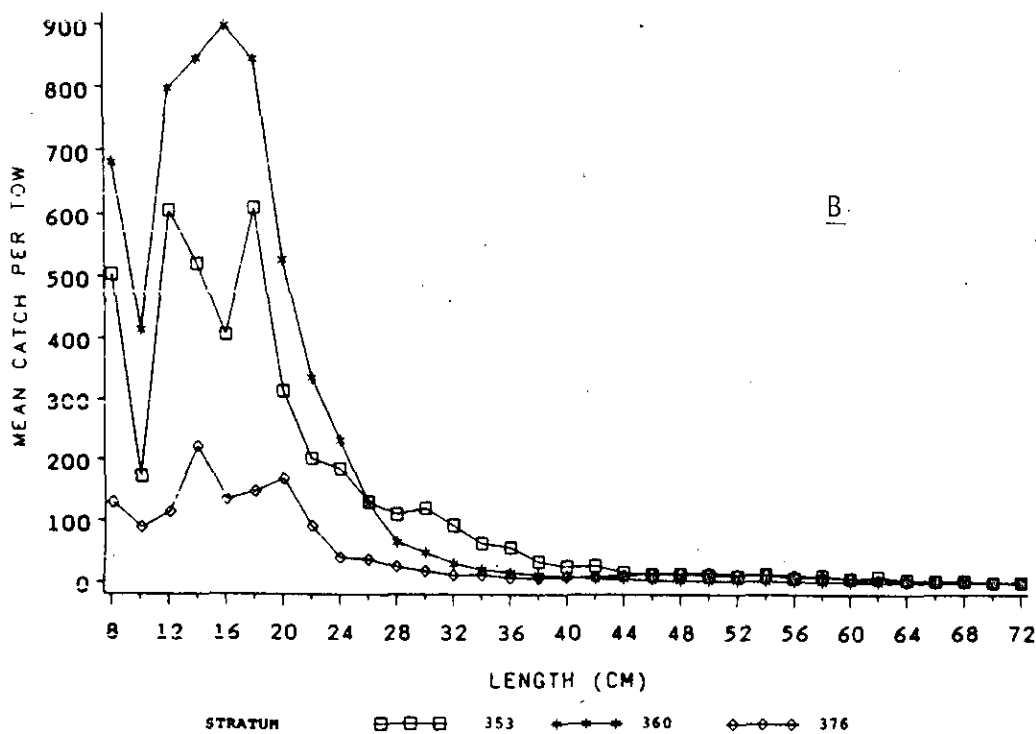


Fig.3A. Length frequency distribution of plaice in Div. 3L, 3N, 30' strata 353,360 and 376 are not included.

Fig.3B. Length frequency distribution of plaice in Strat 353,360 and 376

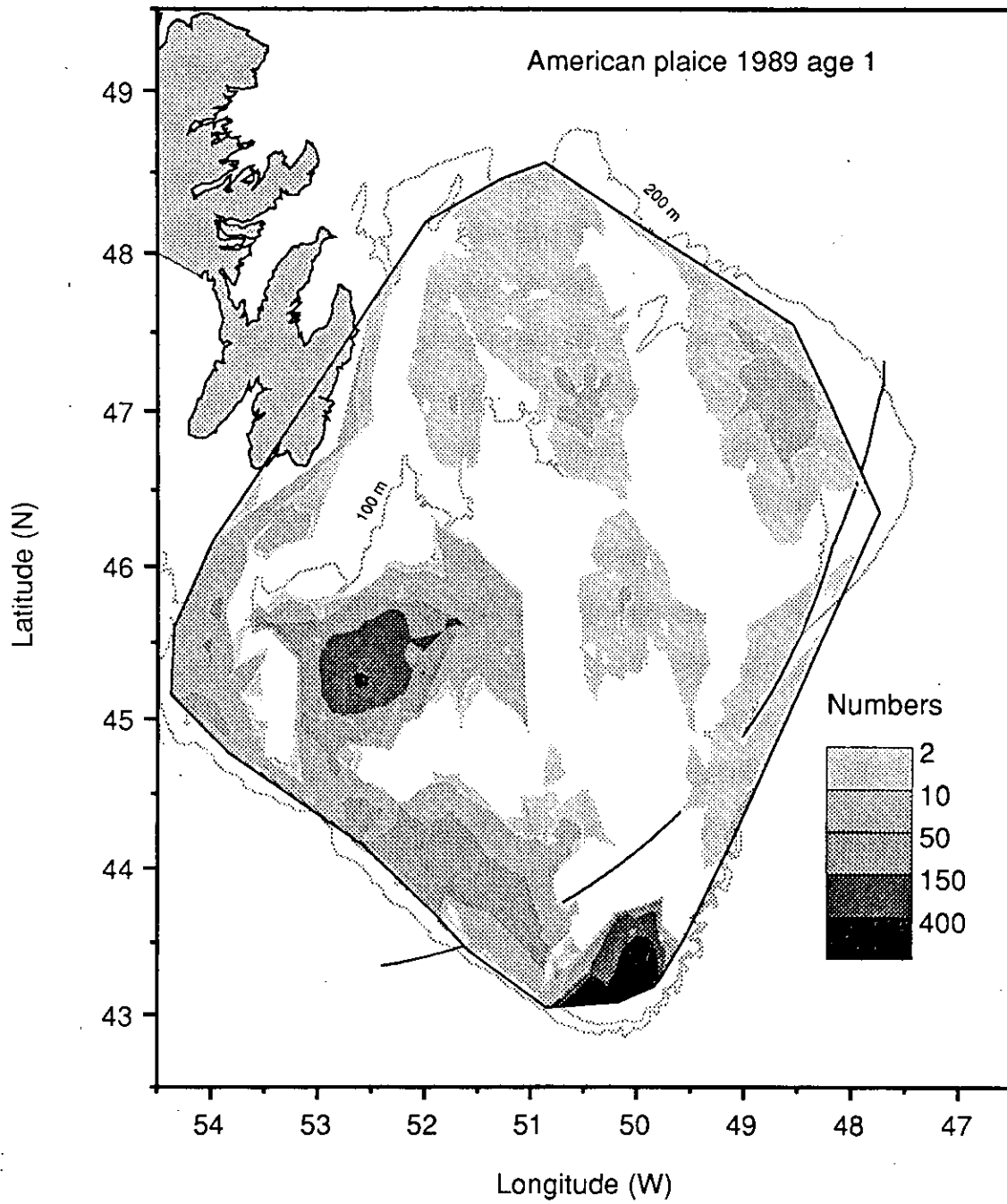


Fig. 4 Distribution of 1 year old American plaice on the Grand Banks from the 1989 juvenile survey.

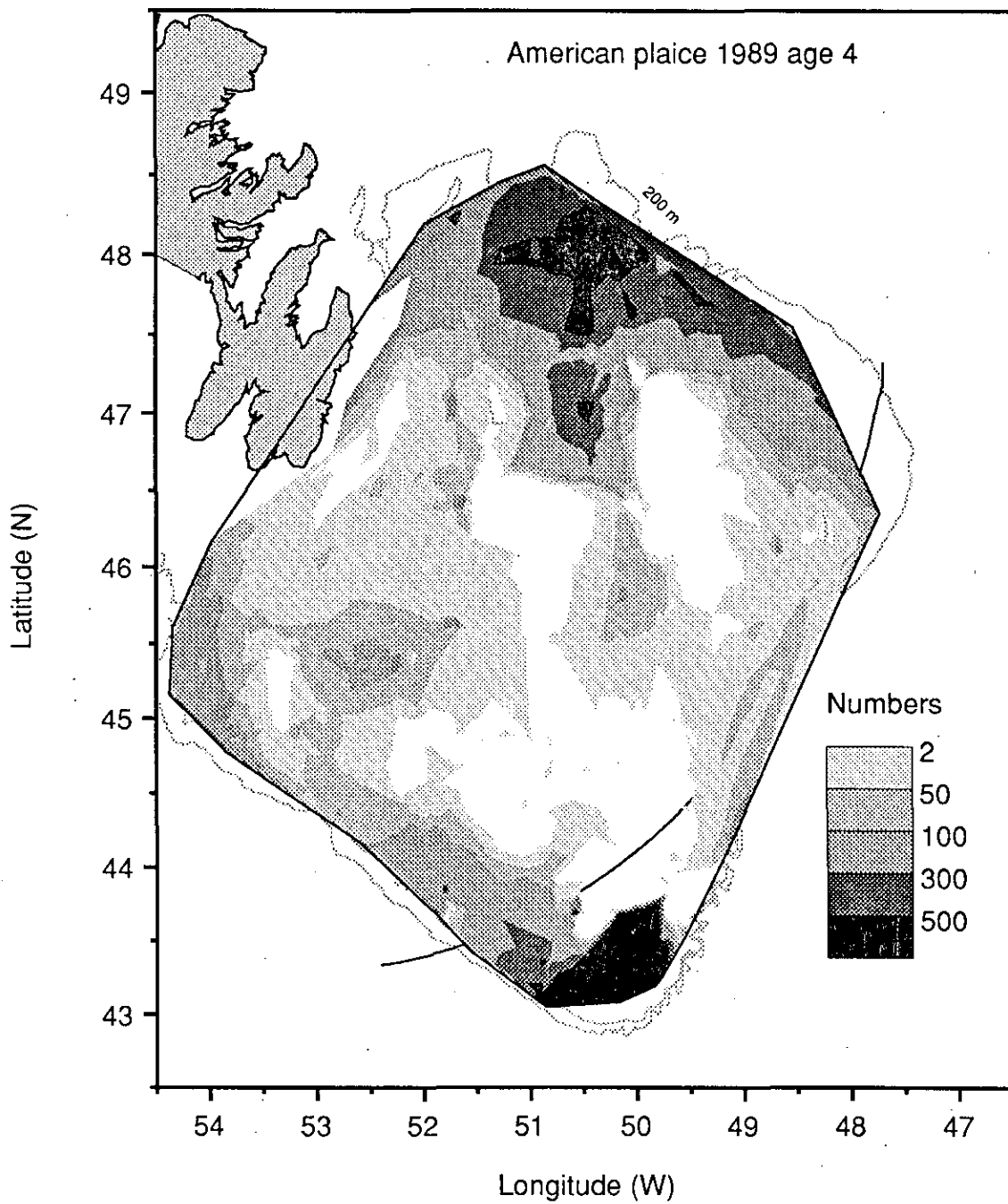


Fig.5 Distribution of 4 year old American plaice on the Grand Banks from the 1989 juvenile survey.

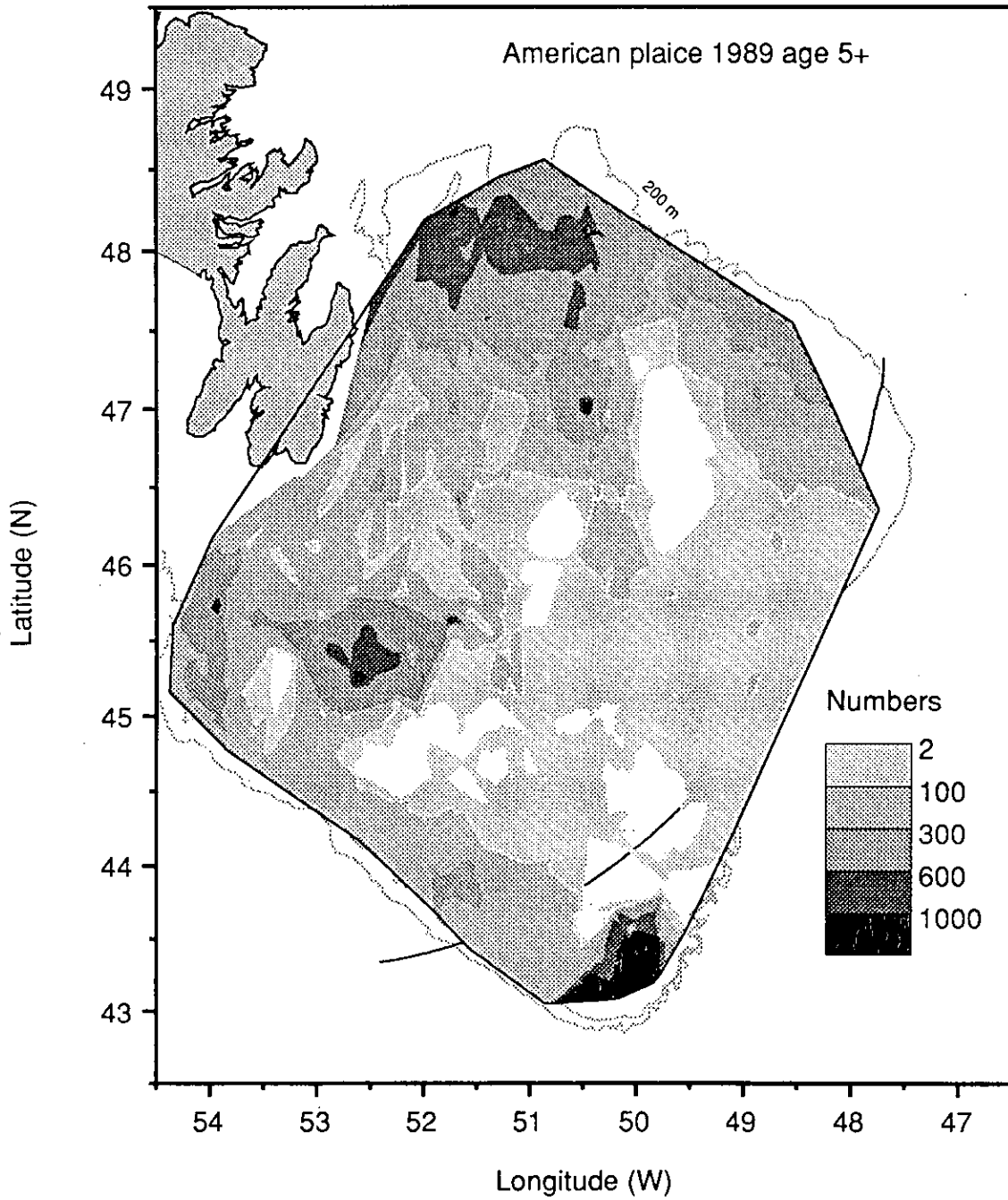


Fig.6 Distribution of 5+ year old American plaice on the Grand Banks from the 1989 juvenile survey.

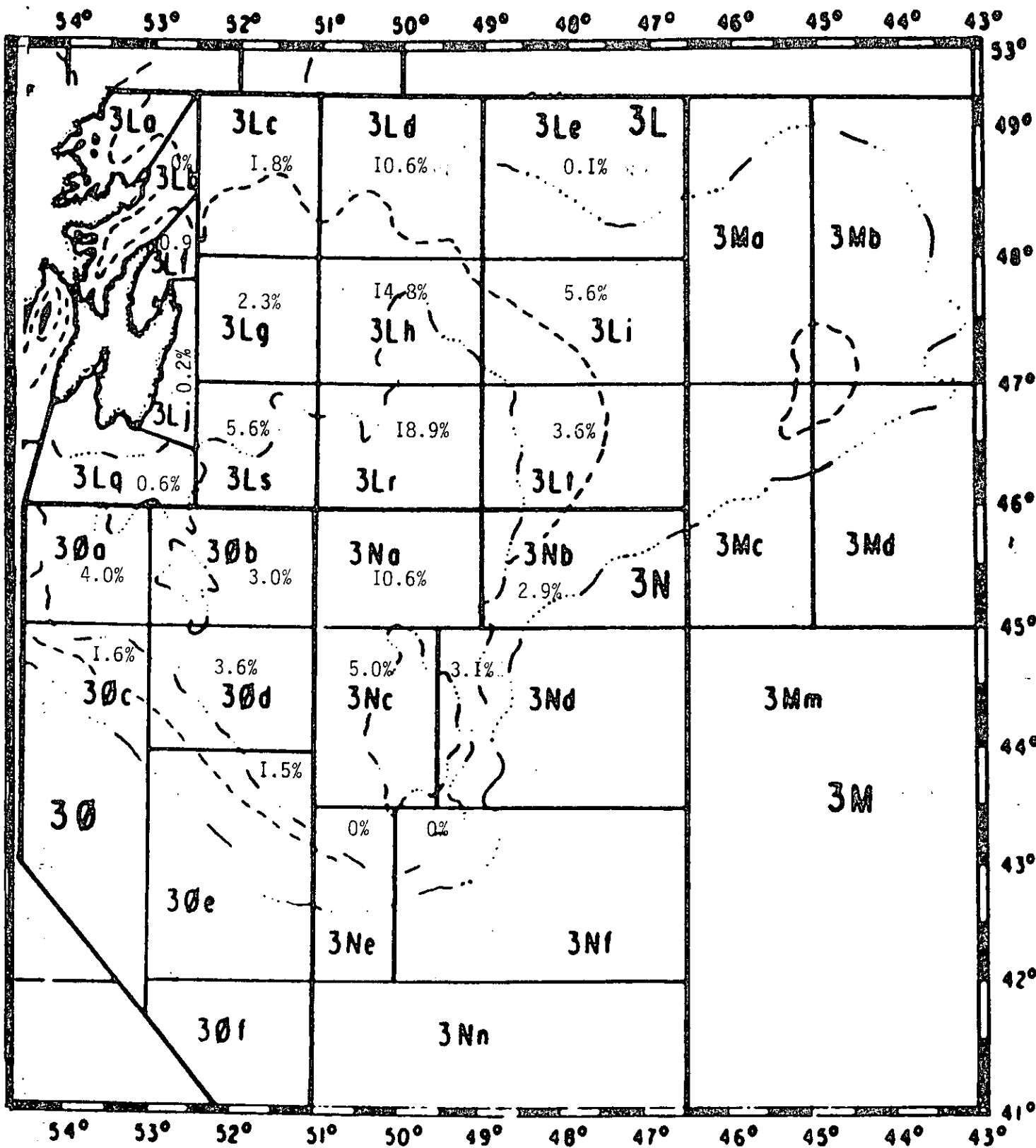


Fig. 7 Distribution of percent catch of American plaice by the Canadian commercial fleet for the combined years 1986-88

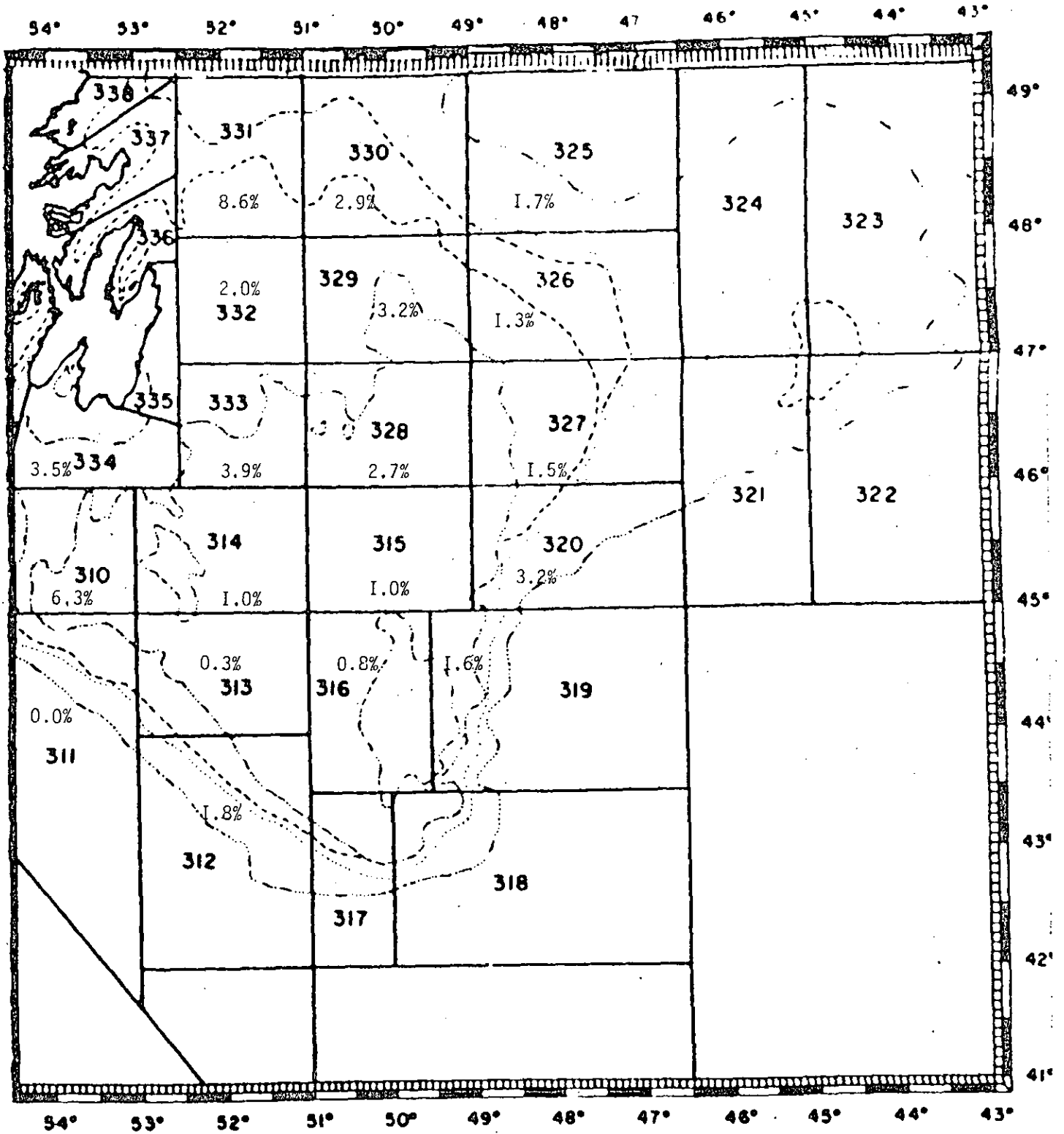


Fig. 2 Distribution of discards (percentage) of under-sized American plaice by the Canadian fleet in Divs. 3LNO in 1988.