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Results of Surveys Directed at Yellowtail Flounder in NAFO Divisions 3NO, Conducted on a Canadian Commercial Trawler, 1996-1998.

by

W.B. Brodie, D. Maddock Parsons, C.McFadden, D.Orr, and S.J.Walsh

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

Introduction

The Department of Fisheries and Oceans (DFO) in St. John's, Newfoundland, and Fishery Products International Limited (FPI), a Canadian fishing company also based in St. John's, are continuing to conduct cooperative trawl surveys directed at yellowtail flounder on the Grand Bank, NAFO Divisions 3NO. Given the moratorium on fishing this stock of yellowtail in Divisions 3LNO, on a seasonal basis, which has existed since 1994, the primary objective of these surveys is to provide commercial indices of catch rate and distribution data on yellowtail flounder in this area. FPI provides the vessel, crew, fishing gear, operating expenses, and contributes toward the scientific and technical support necessary to conduct the surveys, which is the responsibility of DFO. The first cooperative survey was completed in July, 1996, with quarterly surveys being carried out in 1997 and thus far in 1998. Additional surveys are planned for the summer and autumn of 1998. This paper examines the results from the first six surveys in detail, documents preliminary results from the seventh survey (May-June 1998), and compares the information collected with results from research vessel surveys of the area done by DFO.

Methods and Materials

The surveys are designed to cover an area of approximately 9500 square nautical miles (Fig. 1), corresponding to the area where the yellowtail stock is mainly distributed, and where the FPI fishery operated in most years prior to the current NAFO-imposed moratorium on fishing. The survey area is divided into 100 equal-sized blocks, and the same pre-selected position is fished in each block in every survey. These positions were selected at the start of the first survey by FPI, based on their understanding of yellowtail abundance and distribution, and their knowledge of the fishing grounds. Some of the areas in the grid represent well-known fishing grounds for yellowtail, while other areas were not traditionally fished. All aspects of the fishing operation, including vessel, skipper, trawl gear, and tow speed and duration were kept standard within and between surveys, and aspects such as tow direction and time of day have been kept constant for a given tow between surveys where possible.

The vessel used is the Atlantic Lindsey, which is a commercial stern trawler, 44 m total length, 665 G.R.T., 1500 HP. The fishing gear used is an Engel 145 Hi-Lift otter trawl, with rockhopper footgear, and is reflective of trawls historically used by FPI in the yellowtail fishery. Brodie et al (1997) gives an in-depth comparison of this trawl used onboard the FPI trawler Atlantic Lindsey with the standard survey gears (Engel 145 Hi-Lift otter trawl, and Campelen 1800 shrimp trawl) as used by the DFO institute, Northwest Atlantic Fisheries Center (NAFC). There are major differences in the footgear, sweep/bridle lengths and mesh size. Unlike trawls used in research vessel (r.v.) surveys, no small mesh liner was used in the codend. All trawl components were measured prior to use, to ensure consistency within and between trips. Trawl performance was monitored with SCANMAR during each fishing set, which is one-hour in duration at a speed of 3.0 knots.

Catch numbers and weights of all yellowtail in the catch of each set were recorded. By-catch data on other species such as American plaice and cod were also collected, along with biological sampling (size and maturity) data for yellowtail. Temperature data were collected on about half of the tows on most surveys, using XBT's. To facilitate comparisons, as in the previous analysis (Brodie et al. 1997), the catch data were grouped into quadrants of 5 x 5 blocks, with Q1 corresponding to the northwest quadrant, Q2 the northeast, Q3 the southeast, and Q4 the southwest. Results from the first 6 surveys are compared with data from spring and fall stratified random surveys done by DFO (Walsh et al. 1998), and with the analyses of yellowtail CPUE data presented in Brodie et al. (1997).

Results and Discussion

Catches from first six surveys: Totals of sets from the first six surveys ranged from 50 to 85 (Table 1). Coverage in November, 1997 and March 1997 was reduced by bad weather. For all species examined, catch weights per tow in both March surveys were significantly lower than those in the other 4 surveys, as seen in Table 1.

Set by set catches for yellowtail flounder from the first six surveys are in Table 2. With the exception of all 4 quadrants in both March surveys, 13 of the remaining 16 quadrants (4 in each of 4 surveys) yielded a mean CPUE in excess of 550 kg. per hour (Fig.2a). Mean CPUE of yellowtail from the 4 non-winter surveys was higher in Div. 3N than Div. 3O, and in total ranged between 608 and 694 kg. per hour (Fig. 2b). Blocks in common to all surveys showed mean CPUE values similar to the total grid. With the exception of March 1998, maximum catches (per one hour tow) in each survey ranged from 2503 kg to 5931 kg.

Tables 4 and 5, and Figs. 3 and 4 show the same data for American plaice. For cod, the data are presented in Tables 6 and 7, along with Figs. 5 and 6. To further examine the ratio of A. plaice to yellowtail in the catches, some additional analyses were carried out. The 30 blocks fished in all six surveys were chosen, and Tables 8 and 9 show the catches of yellowtail and A. plaice, by block, ranked in descending order by the mean catch per block. Table 10 shows the catch of A. plaice divided by the catch of yellowtail (from the previous tables), ranked in ascending order of bycatch. Several sets produced by-catch ratios less than 5%, but only one block (F05) gave a total catch of A. plaice less than 5% of the total yellowtail catch over the 6 surveys. Seven other blocks had by-catches of A. plaice in the 5-10% range.

Table 11 also gives an indication of the catches of A. plaice compared to the catches of yellowtail. For the four levels of yellowtail catch indicated in the headings, each non-blank cell contains three numbers, with blank cells representing blocks not fished at all in the 6 surveys. The third numeral is the total number of sets in that block (this is the same in all 4 tables). The second numeral is the number of sets which fit the yellowtail catch criterion in the heading. The first numeral represents the number of sets where the catch of A. plaice was less than 5% of the yellowtail catch. Five percent was chosen as the cutoff as this is the bycatch limit to be imposed in the 1998 Canada fishery, scheduled to open in August. Examining the catches in these tables shows a high percentage of sets in the central portion of the grid (F05, F06,G04, G06) with large yellowtail catches and less than 5% bycatch of A. plaice. Most other areas had by-catches of A. plaice in excess of 5%.

Geographic distribution of yellowtail, American plaice, and cod: ACON plots (Black 1993) of yellowtail catch weights clearly show the difference in abundance and distribution of yellowtail flounder during the 6 surveys (Fig. 7). In March 1997, the only large catches of yellowtail were taken near the center of the grid, around blocks G04 and F04. This area also contained relatively large catches in the other surveys, with the exception of March 1998 when no concentrations of yellowtail were found. Several large catches have occurred in the northwest corner of the grid, which is somewhat surprising, as this area was not known as a prime location for yellowtail when the commercial fishery was operating, and DFO surveys of this area in spring and fall do not usually produce large catches of yellowtail. Catches in all surveys were lower in the southwest corner of the grid (Q4), as well in most tows in the eastern part (column J) of the grid.

To examine geographic distribution of yellowtail caught in the July surveys, by size groups, the numbers of fish <= 30 cm. and the number > 40 cm. were plotted on a set by set basis. The highest densities of small fish in both July surveys occurred in quadrant 3 (Figs. 8 and 9 (a)), in the nursery area for this species. There was a wider distribution of fish greater than 40 cm., with the largest catches occurring in the central portion of the grid (Figs 8 and 9 (b)). Similar patterns of distribution by size were seen in the other surveys as well.

For purpose of comparison, distribution plots of American plaice and cod from the first 6 surveys are shown in Figs. 10 and 11. In general, American plaice were most abundant in the south and west portions of the grid, and least abundant in the central portion. Cod were more abundant in the portion of the grid in Division 3O than in Division 3N. There were many more zero catches of cod in the surveys than for either of the flatfish species. Figs. 12 and 13 show the distribution of American plaice expressed as a percentage of the yellowtail catches.

Length and age composition of yellowtail: The overall length frequency of yellowtail caught during the first six surveys is shown in Fig. 14, and consists mainly of fish in the 30 to 45 cm. length range. For any single trip, less than 10% of catch numbers were below 30 cm., and less than 2% were under 26 cm. Between 21 and 32% of yellowtail measured 40 cm or greater. There was little difference in the length composition between surveys. The age compositions for the May 1997 and July 1996 and 1997 surveys were obtained by applying the yellowtail age-length key from the appropriate spring stratified random survey to the numbers at length in the grid survey. The age composition from the November 1997 survey was calculated in the same way, using the fall survey age-length key. Fig. 15 indicates that most fish caught were aged 6-8 years, which is typical of the Canadian commercial fishery in previous years (Brodie et al. 1993). The age compositions in Divs. 3N and 3O were similar, although there were more small fish in Div. 3N in all 4 surveys examined (Table 12), consistent with the location of some fishing sets in the nursery areas on the Tail of the Bank. Reports from the 1998 May survey indicate large numbers of small yellowtail in a few sets.

Comparison of results with commercial fishery data: No additional analyses of the historic CPUE data were conducted for this paper. In the previous analysis (Brodie et al. 1997), commercial CPUE data from the same class of vessel as the Atlantic Lindsey were examined for Div. 3N, for the years 1970-91. This comparison indicated that the July 1996 survey CPUE for yellowtail was similar to the maximum July CPUE, which occurred in the 1985 fishery. On the other hand, the March 1997 survey CPUE was much lower than any March CPUE value observed in the fishery. The catch rate index calculated previously (Brodie et al. 1993) shows that the March CPUE from the commercial fishery was intermediate between the low values in May-July, and the high values in September-October.

A summary of 16,000 fishing hauls from 15 FPI trawlers fishing for various species in Div. 3NO from 1985-91 was also presented in Brodie et al. (1997) . Most of the yellowtail catch from this fleet occurred in quadrants 2 and 3, with quadrant 3 usually showing the highest CPUE values. The blocks in the central parts of columns G and H had the highest overall catches of yellowtail. This analysis also indicated that the northwest corner of the grid, which produced several good catches in the grid surveys, was not a primary fishing area for yellowtail from 1985-91. Some other blocks which have yielded a few good catches in the grid survey, such as rows 2-8 of columns C and D, were also lightly fished historically. However, other areas which had some high CPUE values in the grid surveys, such as Blocks G05, F07, and I03, were heavily fished in the past.

It must be emphasized that the direct comparability of the catch rates in the grid surveys with those from the previous commercial fishery for yellowtail is not known. Tow duration during the commercial fishery was generally around three hours, compared to one hour in the grid surveys. Also, the catch rates in the commercial fishery were obtained by several vessels over longer periods of time. Nonetheless, results from all grid surveys, with the exception of the 2 March trips, suggest widespread distribution of yellowtail CPUE's which are quite high relative to historic CPUE in the fishery.

Comparison of results with research vessel data: The distribution of yellowtail from the 5 stratified random surveys conducted with the Campelen trawl in 1995-97 is shown in Fig. 16. The grid, which is not part of the design of the r.v. surveys, is superimposed on these plots, indicating that most of the yellowtail caught in the r.v. surveys is located within the boundaries of the grid. In fact, 87% of the yellowtail caught in spring 1996 were within the grid, compared with 89% in the autumn 1996 survey. In 1997, yellowtail were found to be more widely distributed, so that only 80% of the yellowtail (by number) in the spring and 64% in the fall survey were located inside the grid boundaries. Within the grid, r.v. survey catch rates of yellowtail were quite similar in all 4 surveys in 1996 and 1997, between 81 and 92 kg per 15 minute tow on average.

Observations on sexual maturity of yellowtail: In all surveys thus far, observations on sexual maturity of yellowtail have been collected. These are generally obtained at sea by sampling at least 2 sets per day, although the March 1998 data were collected from port samples. Fig. 17 indicates that about 30 % of the female yellowtail caught were immature, and that there was a slight declining trend in the 4 surveys in 1997. To allow comparisons

of the maturity data between surveys, data from females were grouped into 4 categories: 1 -immature, 2 - spent in the previous year and/or maturing for the current year, 3 - presence of clear eggs, and 4 - spawned in the current year and/or maturing for next year. Figure 18 shows a frequency distribution of these 4 categories for each of the 6 trips. Data from the 2 March surveys are almost identical, indicating all mature females to be in category 2. Most spawning had not occurred at the time of the May 1997 survey, and all spawning appeared to be completed by the time of the November 1997 trip. A closer look at the data from the 2 July surveys (Fig. 19) showed some differences between the 1996 and 1997 trips. In 1996, spawning had not been completed, as evidenced by the number of females with clear eggs (Mat B and Mat C stages), whereas in July 1997, most females were Spent (Sp.P) or spent and maturing for next year (Sp.P Mat AN). In both surveys, females which had spawned were the dominant category. Thus it appears that a decision to open the fishery no earlier than August 1 in 1998 will allow most fish to complete spawning; assuming a pattern similar to 1996 and 1997.

Preliminary results from the May-June 1998 survey: Table 13 contains results from the 1998 May-June grid survey. Catches of all 3 species are similar to the survey at the same time in 1997, and to the remainder of the surveys (except the 2 March trips).

Conclusions: Cooperative surveys in Divisions 3NO between DFO and FPI indicate drastic changes in catch rate and distribution of yellowtail and other species in March of 1997 and 1998 compared with surveys at other times of the year. The high CPUE observed in both July surveys, and the low CPUE observed in both March trips are both extreme when compared to historic CPUE data from the fishery. The similarity of CPUE from the remaining grid surveys suggest that the March surveys are not reflective of groundfish abundance in the grid area. No explanations for these differences can be offered at present. Comparison of all six surveys suggests further seasonal differences in distribution. There are no r.v. survey data from March in Div. 3NO in any year to compare with the March 1997 FPI survey, but r.v.surveys conducted in autumn 1995, spring 1996, autumn 1996, and spring 1997 show a picture of increasing yellowtail abundance and distribution (Walsh et al. 1998), with distribution appearing to be more extensive than in the surveys of the early 1990's.

References

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Table 1. Summary of results for selected species from the first six cooperative grid surveys in Div. 3NO.

Species	Survey	Mean	Std. Error	Median
Yellowtail	Jul-96	693.5	52.6	642.2
	Mar-97	124.0	73.4	25.6
	May/Jun-97	608.0	66.6	553.8
	Jul-97	666.4	51.9	566.7
	Nov-97	627.4	131.1	363.7
	Mar-98	68.7	9.7	36.4
A plaice	Jul-96	106.7	13.8	74.5
	Mar-97	20.4	5.4	4.5
	May/Jun-97	168.6	14.8	137.8
	Jul-97	180.9	28.8	96.0
	Nov-97	131.8	13.4	103.4
	Mar-98	19.8	4.6	5.0
Cod	Jul-96	105.6	31.1	41.0
	Mar-97	0.8	0.2	0.0
	May/Jun-97	43.8	7.3	21.0
	Jul-97	71.4	12.0	25.6
	Nov-97	72.1	14.6	22.4
	Mar-98	3.2	1.2	0.0

Trip 1=Jul-96, N=83
Trip 2=Mar-97, N=68
Trip 3=May/Jun-97, N=82
Trip 4=Jul-97, N=85
Trip 5=Nov-97, N=50
Trip 6=Mar-98, N=80

Table 2. Catches of yellowtail flounder (kg per 1-hr tow), by block, from grid surveys.

Block	Jul-96	Mar-97	May-97	Jul-97	Nov-97	Mar-98
Quad 1						
A01	1,315.9	7.0	234.9	997.6	436.8	26.8
A02	1,828.2		646.0	211.3	92.5	1.1
A03	1,086.8	23.7	204.0	690.8	300.8	6.0
A05	1,410.5	35.5	421.8	167.0	1,533.4	17.0
B01	1,075.2		1,014.6	1,112.0	366.5	7.3
B02	321.0	0.0	210.0	482.3	44.5	0.0
B03	683.7		587.3	720.5	489.1	5.0
B04	492.9	41.0	498.2	90.0	56.0	
C01	758.3	1.0	231.4	629.4	440.4	3.2
C02	352.5		389.8	371.3	195.0	1.4
C03	224.5	18.0	287.6	591.8	230.7	1.8
C04	324.0		702.0	462.6	758.4	13.0
C05	942.6	23.0	401.0	606.5		20.9
D01	720.9		1,524.6	2,500.6		0.9
D02	280.0	3.5	241.6	310.5		0.9
D03	234.0	4.5	245.0	248.5	78.4	
D04	668.1	35.0	400.0	567.4		37.7
D05	739.8		458.3	635.8	746.0	107.3
E01	713.9		4,607.0	3,369.1	627.1	1.4
E02	937.3	18.5	2,529.3	1,148.0	175.8	1.4
E03				491.3		
E04	2,503.5	27.5	582.4	409.5		
E05	1,340.8	60.0	633.0	371.3	1,205.7	22.9
Mean	**861.6**	**21.3**	**775.0**	**747.2**	**457.5**	**14.5**
Std Error	**120.7**	**4.7**	**214.5**	**157.3**	**100.8**	**5.7**
Median	**730.4**	**20.8**	**440.1**	**567.4**	**366.5**	**5.0**
Minimum	**224.5**	**0.0**	**204.0**	**90.0**	**44.5**	**0.0**
Maximum	**2503.5**	**60.0**	**4607.0**	**3369.1**	**1533.4**	**107.3**
Sum	**18954.4**	**298.2**	**17049.8**	**17185.1**	**7777.1**	**275.9**
Count	**22**	**14**	**22**	**23**	**17**	**19**

Block	Jul-97	Mar-97	May-97	Jul-97	Nov-97	Mar-98
Quad 2						
F01				478.5		
F02	1,037.0	52.0	1,145.0	653.3		9.1
F03	879.5	20.0	444.8		280.2	
F04	1,032.3	677.9	833.2	704.0	1,660.7	43.2
F05	1,818.1	498.3	935.6	1,396.9	5,931.0	66.4
G01	664.8	5.5	635.4	536.5		0.5
G03	344.7	81.0	322.0	518.5	87.0	47.7
G04	868.7	4,972.4	610.2	451.1	2,023.2	299.6
G05	502.5	67.5	469.3	528.5	610.3	237.2
H02	600.8	20.5	1,911.0	977.4		14.6
H03		40.5				
H04	357.6	205.0	457.0	684.7	377.1	141.4
H05	322.9	52.5	256.5	680.0	1,209.0	95.5
I01	278.5	0.0	949.5	483.2		3.6
I03	441.9	0.5	1,263.8	857.5		2.3
I05	440.2	7.0	404.1	635.3		25.9
J02	103.5	0.0	28.5	566.7		9.1
J04	34.0	0.0	32.0	481.3		3.6
	607.9	**394.2**	**668.6**	**664.7**	**1522.3**	**66.6**
	110.8	**289.9**	**122.7**	**60.8**	**675.5**	**23.7**
	472.2	**40.5**	**539.8**	**601.0**	**909.7**	**25.9**
	34.0	**0.0**	**28.5**	**451.1**	**87.0**	**0.5**
	1818.1	**4972.4**	**1911.0**	**1396.9**	**5931.0**	**299.6**
	9727.0	**6700.6**	**10697.9**	**10635.4**	**12178.5**	**999.5**
	16	**17**	**16**	**16**	**8**	**15**

Block	Jul-96	Mar-97	May-97	Jul-97	Nov-97	Mar-98
Quad 4						
A07	576.7		599.0	845.5	1,016.9	21.4
A08	326.0	67.5	585.0	637.3	103.5	60.0
A09	123.6	27.5	49.0	225.1	3.5	57.3
A10	114.5	7.0	32.5	41.0		20.0
B06	756.0	27.5	629.9	612.0	811.5	83.6
B07	106.5	65.5		556.9	276.0	37.3
B08	642.2		778.0	857.0	655.8	129.1
B09	254.2	36.0	142.0	582.3	9.0	59.1
B10	79.5	68.0	84.0	17.5		35.9
B10	67.0					
C07	526.8	40.5	778.0	1,240.5		48.6
C08	115.4		495.0	720.5	98.0	40.1
C09	471.9	21.5	638.0	489.4	360.9	181.3
C10	1,430.9	88.0	716.5	1,014.1	50.5	316.0
D06	1,560.3	47.0	976.6	1,382.5		32.3
D07	698.1	4.6	956.8	452.5		36.8
D08	471.9		525.2	481.5	452.2	55.4
D09	684.8	71.5	868.6	513.2		180.9
D10	445.7		687.0	478.3	122.0	223.1
E06		29.5	584.5	509.1		25.0
E07	890.6	14.5	336.0	699.9		28.6
E08	1,167.9	11.0	714.0	506.5	313.9	15.5
E09	609.6	5.0	640.0	500.8	298.2	8.3
E10	557.1		764.0	483.4	224.2	61.4
Mean	**551.2**	**37.2**	**571.8**	**602.0**	**319.7**	**76.4**
Std Error	**86.2**	**6.4**	**59.6**	**66.7**	**77.9**	**16.2**
Median	**526.8**	**29.5**	**634.0**	**513.2**	**276.0**	**48.6**
Minimum	**67.0**	**4.6**	**32.5**	**17.5**	**3.5**	**8.3**
Maximum	**1560.3**	**88.0**	**976.6**	**1382.5**	**1016.9**	**316.0**
Sum	**12677.2**	**632.1**	**12579.6**	**13846.8**	**4796.1**	**1756.8**
Count	**23**	**17**	**22**	**23**	**15**	**23**

Block	Jul-97	Mar-97	May-97	Jul-97	Nov-97	Mar-98
Quad 3						
F06	955.9	87.0	703.2	728.3	689.3	236.2
F07	1,921.1	126.5	751.5	881.0	171.5	225.7
F08	1,755.3	21.0	690.0	639.2		83.2
F09	836.8		587.0	354.3	306.9	40.9
F10	491.6		492.0	501.8	589.0	25.0
G06		31.0		1,114.5	2,519.0	211.2
G07	721.7	28.5	638.9	711.3	548.5	427.7
G08	873.1		690.5	1,669.0		122.7
G09	813.0	51.0	798.5	545.1	308.2	60.0
G10	658.5	148.0	272.4	351.3		67.3
H06	436.4	33.0	302.9	600.1	781.7	31.4
H07	443.0	67.5	850.0	1,349.3	288.4	264.8
H08	736.7	7.5	697.4	631.6	414.4	58.2
H09	485.1	7.5	154.5	269.7		101.4
H10	934.3	102.8	299.0	589.5		167.0
I07	1,084.2	19.0	378.0	1,321.8		117.7
I08	255.5	6.5	497.0	720.5		34.6
I09	806.7	15.5	200.3	433.3		37.3
I10	740.2	15.0	321.0	501.9		82.3
J06	82.0	2.0	24.5	289.8		24.3
J08	507.6	12.0	47.5	439.7		19.3
J09	127.5	2.5	46.0	139.0		7.7
J10	536.4	16.5	89.0	196.7		27.3
	736.5	**40.0**	**433.2**	**651.2**	**661.7**	**107.1**
	94.4	**9.7**	**57.9**	**81.2**	**215.4**	**21.6**
	729.2	**20.0**	**435.0**	**589.5**	**481.5**	**67.3**
	82.0	**2.0**	**24.5**	**139.0**	**171.5**	**7.7**
	1921.1	**148.0**	**850.0**	**1669.0**	**2519.0**	**427.7**
	16202.6	**800.3**	**9531.1**	**14978.7**	**6616.9**	**2463.2**
	22	**20**	**22**	**23**	**10**	**23**

Table 3. Catches of yellowtail flounder (kg per 1-hr tow) and associated statistics, for various areas, from grid surveys.

	Jul-96	Mar-97	May-97	Jul-97	Nov-97	Mar-98
Div. 3O (cols A-D)						
Mean	619.2	31.8	521.1	626.2	374.2	55.0
Standard Error	74.2	5.2	54.1	75.2	72.1	12.5
Median	526.8	27.5	498.2	574.9	288.4	34.1
Minimum	67.0	0.0	32.5	17.5	3.5	0.0
Maximum	1,828.2	88.0	1,524.6	2,500.6	1,533.4	316.0
Sum	22,910.9	764.3	18,239.2	22,543.0	9,728.3	1,868.3
Count	37	24	35	36	26	34
Div. 3N (cols E-J)						
Mean	753.3	174.2	672.7	696.0	901.7	78.8
Standard Error	73.2	113.2	108.6	71.5	252.7	14.0
Median	689.4	20.8	584.5	545.1	481.5	39.1
Minimum	34.0	0.0	24.5	139.0	87.0	0.5
Maximum	2,503.5	4,972.4	4,607.0	3,369.1	5,931.0	427.7
Sum	34,650.3	7,666.9	31,619.2	34,103.0	21,640.3	3,627.0
Count	46	44	47	49	24	46
Total (all blocks)						
Mean	693.5	124.0	608.0	666.4	627.4	68.7
Standard Error	52.6	73.4	66.6	51.9	131.1	9.7
Median	642.2	25.6	553.8	566.7	363.7	36.4
Minimum	34.0	0.0	24.5	17.5	3.5	0.0
Maximum	2,503.5	4,972.4	4,607.0	3,369.1	5,931.0	427.7
Sum	57,561.2	8,431.2	49,858.4	56,646.0	31,368.6	5,495.3
Count	83	68	82	85	50	80
Comparable blocks (July 96, July 97)						
Mean	698.9			667.3		
Standard Error	53.2			54.1		
Median	642.2			567.4		
Minimum	34.0			17.5		
Maximum	2503.5			3,369.1		
Sum	56614.7			54,051.8		
Count	81			81		
Comparable blocks (March 97, March 98)						
Mean		131.7				73.6
Standard Error		79.2				11.5
Median		23.7				36.8
Minimum		0.0				0.0
Maximum		4,972.4				427.7
Sum		8,297.7				4,639.2
Count		63				63
Comparable blocks (all 6 surveys)						
Mean	793.7	246.8	583.1	668.5	714.0	102.8
Standard Error	87.2	165.1	80.2	51.3	203.0	20.9
Median	746.4	35.8	620.1	620.7	369.0	58.6
Minimum	123.6	0.0	49.0	167.0	3.5	0.0
Maximum	1921.1	4972.4	2529.3	1396.9	5931.0	427.7
Sum	23809.8	7403.3	17492.6	20056.1	21419.4	3085.0
Count	30	30	30	30	30	30

Table 4. Catches of American plaice (kg per 1-hr tow), by block, from grid surveys.

Block	Jul-96	Mar-97	May-97	Jul-97	Nov-97	Mar-98
Quad 1						
A01	232.8	3.5	102.7	114.3	41.0	0.5
A02	180.0		200.0	45.5	90.0	0.0
A03	84.5	7.8	186.0	41.0	196.1	2.0
A05	110.0	3.5	162.2	35.0	492.9	2.0
B01	68.0		190.0	144.0	24.0	1.0
B02	45.0	0.0	81.0	158.7	51.0	0.0
B03	105.0		137.0	44.4	100.2	2.0
B04	111.5	5.5	120.4	15.5	51.9	
C01	7.5	1.5	95.4	42.4	57.2	1.4
C02	25.5		108.0	40.2	43.7	0.5
C03	19.5	0.0	56.2	43.4	31.8	0.5
C04	15.0		150.0	66.7	120.8	0.0
C05	47.0	3.5	152.6	86.6		0.9
D01	58.0		133.0	211.3		0.0
D02	17.5	0.5	54.0	27.5		0.2
D03	40.0	0.0	52.0	32.8	58.8	
D04	41.0	3.5	108.0	66.5		1.8
D05	10.0		94.2	149.0	254.4	1.8
E01	80.0		414.5	130.4	73.1	0.2
E02	85.6	6.0	171.2	70.0	23.3	0.0
E03				21.2		
E04	3.0	7.0	49.8	5.6		
E05	28.0	4.5	72.8	40.3	111.3	0.6
Mean	**64.3**	**3.3**	**131.4**	**71.1**	**107.2**	**0.8**
Std Error	**12.3**	**0.7**	**16.8**	**11.3**	**28.4**	**0.2**
Median	**46.0**	**3.5**	**114.2**	**44.4**	**58.8**	**0.5**
Minimum	**3.0**	**0.0**	**49.8**	**5.6**	**23.3**	**0.0**
Maximum	**232.8**	**7.8**	**414.5**	**211.3**	**492.9**	**2.0**
Sum	**1,414.4**	**46.8**	**2,890.9**	**1,634.2**	**1,821.6**	**15.3**
Count	**22**	**14**	**22**	**23**	**17**	**19**

Block	Jul-97	Mar-97	May-97	Jul-97	Nov-97	Mar-98
Quad 2						
F01				20.6		
F02	47.5	11.5	116.6	35.6		1.8
F03	11.0	10.0	79.2		117.7	
F04	8.0	76.3	68.5	38.1	222.6	9.6
F05	20.0	170.6	42.3	22.3	106.0	17.3
G01	42.0	1.5	95.4	49.9		0.9
G03	47.5	18.0	91.0	39.2	72.1	1.4
G04	39.0	212.4	83.3	30.6	169.6	15.5
G05	20.0	1.0	68.5	39.8	140.0	11.4
H02	67.0	9.5	171.0	92.8		0.9
H03		2.5				
H04	42.0	15.0	78.0	75.3	72.1	5.5
H05	31.0	3.8	72.0	122.1	181.3	4.6
I01	86.5	0.0	122.0	214.6		0.0
I03	81.0	1.0	149.8	274.4		0.0
I05	42.8	0.0	39.6	71.9		0.5
J02	127.5	0.5	67.0	321.6		0.0
J04	183.5	0.0	21.0	152.0		0.9
	56.0	**31.4**	**85.3**	**100.0**	**135.2**	**4.7**
	11.5	**15.4**	**9.8**	**23.5**	**18.9**	**1.5**
	42.4	**3.8**	**78.6**	**60.9**	**128.8**	**1.4**
	8.0	**0.0**	**21.0**	**20.6**	**72.1**	**0.0**
	183.5	**212.4**	**171.0**	**321.6**	**222.6**	**17.3**
	896.3	**533.6**	**1,365.2**	**1,600.6**	**1,081.3**	**70.0**
	16	**17**	**16**	**16**	**8**	**15**

Block	Jul-96	Mar-97	May-97	Jul-97	Nov-97	Mar-98
Quad 4						
A07	29.5		195.0	220.5	147.8	4.1
A08	220.5	65.0	468.0	111.1	76.3	32.3
A09	114.0	56.0	408.1	498.2	132.5	133.6
A10	62.5	15.0	759.8	299.0		52.7
B06	34.0	5.5	119.3	37.0	120.8	17.7
B07	45.0	23.0		78.0	100.7	35.9
B08	158.0		238.5	173.9	318.1	38.6
B09	420.2	45.0	519.4	326.9	176.1	246.7
B10	144.5	234.5	515.0	146.8		189.3
B10	125.5					
C07	151.0	11.0	165.4	231.2		28.9
C08	53.1		318.0	88.1	68.9	38.3
C09	144.0	42.0	564.0	264.8	296.8	138.3
C10	293.0	85.0	362.5	349.5	329.1	89.1
D06	69.0	12.0	104.3	214.3		7.3
D07	72.0	12.7	163.5	148.5		26.7
D08	124.0		185.3	96.0	111.3	37.6
D09	163.5	17.0	315.0	232.8		68.9
D10	163.0		277.0	402.0	262.5	63.9
E06		3.0	138.6	83.5		3.2
E07	51.5	1.5	207.8	38.5		7.3
E08	92.0	3.5	198.0	106.0	82.7	6.4
E09	86.0	2.0	176.6	241.2	111.3	3.4
E10	147.5		218.0	265.3	278.3	16.4
Mean	**128.8**	**37.3**	**300.8**	**202.3**	**174.2**	**55.9**
Std Error	**18.7**	**13.7**	**36.7**	**25.1**	**24.5**	**13.4**
Median	**124.0**	**15.0**	**228.3**	**214.3**	**132.5**	**35.9**
Minimum	**29.5**	**1.5**	**104.3**	**37.0**	**68.9**	**3.2**
Maximum	**420.2**	**234.5**	**759.8**	**498.2**	**329.1**	**246.7**
Sum	**2,963.3**	**633.7**	**6,617.0**	**4,653.0**	**2,613.3**	**1,286.7**
Count	**23**	**17**	**22**	**23**	**15**	**23**

Block	Jul-97	Mar-97	May-97	Jul-97	Nov-97	Mar-98
Quad 3						
F06	23.0	4.5	77.0	0.0	66.8	25.5
F07	92.5	23.0	192.6	100.8	83.7	7.7
F08	91.0	1.5	292.2	73.9		2.7
F09	67.5		112.0	85.1	132.0	12.7
F10	105.0		180.0	327.0	254.4	11.8
G06		4.5		35.0	60.4	13.2
G07	80.0	3.0	185.7	86.8	70.0	13.6
G08	108.0		139.1	100.9		17.3
G09	122.0	16.0	144.2	185.2	157.4	12.7
G10	251.7	35.5	196.0	1,440.1		13.6
H06	17.0	1.0	43.9	38.1	84.8	0.5
H07	36.0	8.5	288.9	40.2	80.6	2.7
H08	124.0	3.5	181.9	155.4	82.7	15.0
H09	74.5	1.5	122.4	280.4		6.8
H10	204.0	28.5	127.0	487.4		15.4
I07	98.0	4.0	53.0	32.8		13.2
I08	43.0	1.5	115.6	110.7		8.2
I09	370.0	13.0	154.0	822.3		3.6
I10	942.9	10.5	158.0	872.0		2.3
J06	46.0	2.5	3.5	41.0		2.9
J08	387.0	4.0	38.0	1,654.4		5.7
J09	63.5	1.0	37.0	104.7		1.8
J10	238.0	8.5	107.5	416.0		1.8
	162.9	**8.8**	**134.1**	**325.7**	**107.3**	**9.2**
	43.1	**2.2**	**16.1**	**94.7**	**19.0**	**1.3**
	95.3	**4.3**	**133.1**	**104.7**	**83.2**	**8.2**
	17.0	**1.0**	**3.5**	**0.0**	**60.4**	**0.5**
	942.9	**35.5**	**292.2**	**1,654.4**	**254.4**	**25.5**
	3,584.7	**176.0**	**2,949.4**	**7,490.0**	**1,072.7**	**210.8**
	22	**20**	**22**	**23**	**10**	**23**

Table 5. Catches of American plaice (kg per 1-hr tow) and associated statistics, for various areas, from grid surveys.

	Jul-96	Mar-97	May-97	Jul-97	Nov-97	Mar-98
Div. 3O (cols A-D)						
Mean	102.8	27.2	224.6	146.8	144.4	37.2
Standard Error	14.3	10.2	28.5	19.8	22.8	10.1
Median	72.0	9.4	163.5	112.7	106.0	5.7
Minimum	7.5	0.0	52.0	15.5	24.0	0.0
Maximum	420.2	234.5	759.8	498.2	492.9	246.7
Sum	3,804.1	653.0	7,860.7	5,285.3	3,755.0	1,264.6
Count	37	24	35	36	26	34
Div. 3N (cols E-J)						
Mean	109.9	16.8	126.8	206.0	118.1	6.9
Standard Error	22.2	6.2	11.5	47.7	13.0	0.9
Median	77.3	4.0	116.6	86.8	95.4	5.0
Minimum	3.0	0.0	3.5	0.0	23.3	0.0
Maximum	942.9	212.4	414.5	1,654.4	278.3	25.5
Sum	5,054.6	737.1	5,961.9	10,092.5	2,834.0	318.2
Count	46	44	47	49	24	46
Total (all blocks)						
Mean	106.7	20.4	168.6	180.9	131.8	19.8
Standard Error	13.8	5.4	14.8	28.8	13.4	4.6
Median	74.5	4.5	137.8	96.0	103.4	5.0
Minimum	3.0	0.0	3.5	0.0	23.3	0.0
Maximum	942.9	234.5	759.8	1,654.4	492.9	246.7
Sum	8,858.7	1,390.1	13,822.5	15,377.8	6,589.0	1,582.8
Count	83	68	82	85	50	80
Comparable blocks (July 96, July 97)						
Mean	107.7			187.9		
Standard Error	14.1			30.0		
Median	74.5			100.9		
Minimum	3.0			0.0		
Maximum	942.9			1,654.4		
Sum	8,722.2			15,217.5		
Count	81			81		
Comparable blocks (March 97, March 98)						
Mean		21.7				21.2
Standard Error		5.8				5.7
Median		4.5				5.5
Minimum		0.0				0.0
Maximum		234.5				246.7
Sum		1,365.1				1,336.5
Count		63				63.0
Comparable blocks (all 6 surveys)						
Mean	90.6	29.6	178.7	115.1	130.7	27.2
Standard Error	17.1	9.2	26.5	21.2	18.2	10.0
Median	63.8	5.8	131.7	72.6	95.4	7.0
Minimum	7.5	0.0	42.3	0.0	23.3	0.0
Maximum	420.2	212.4	564.0	498.2	492.9	246.7
Sum	2,718.6	887.4	5,361.0	3,453.4	3,919.8	817.2
Count	30	30	30	30	30	30

Table 6. Catches of cod (kg per 1-hr tow), by block, from grid surveys.

Block	Jul-96	Mar-97	May-97	Jul-97	Nov-97	Mar-98
Quad 1						
A01	506.0	0.0	51.0	101.3	0.0	0.0
A02	207.0		46.0	190.8	6.0	0.0
A03	274.0	0.0	175.2	280.6	4.8	0.0
A05	2,509.0	0.0	260.0	232.9	19.2	0.0
B01	36.0		0.0	64.0	0.0	0.0
B02	168.0	1.2	75.6	38.0	0.5	0.0
B03	6.0		64.8	380.0	0.0	0.0
B04	50.0	2.0	35.5	60.2	42.0	
C01	41.0	0.0	138.0	135.0	1.2	0.0
C02	130.5		21.6	21.3	15.0	0.0
C03	68.0	0.0	76.2	76.8	0.0	0.9
C04	174.0		308.0	81.0	37.2	1.9
C05	93.0	0.0	224.4	0.0		0.0
D01	78.0		39.6	163.6		0.0
D02	75.0	0.5	38.0	56.0		0.0
D03	62.0	1.0	22.8	61.5	16.0	
D04	49.0	0.0	20.4	7.5		0.0
D05	54.0		150.0	0.0	293.4	0.0
E01	10.0		27.6	26.1	0.0	0.0
E02	156.0	0.0	18.0	35.7	0.0	0.0
E03				66.1		
E04	47.0	5.5	43.2	148.2		
E05	193.0	2.0	25.8	368.6	43.2	0.0
Mean	**226.7**	**0.9**	**84.6**	**112.8**	**28.1**	**0.2**
Std Error	**111.2**	**0.4**	**18.4**	**23.1**	**17.0**	**0.1**
Median	**76.5**	**0.0**	**44.6**	**66.1**	**4.8**	**0.0**
Minimum	**6.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Maximum	**2509.0**	**5.5**	**308.0**	**380.0**	**293.4**	**1.9**
Sum	**4986.5**	**12.2**	**1861.7**	**2595.1**	**478.5**	**2.9**
Count	**22**	**14**	**22**	**23**	**17**	**19**

Block	Jul-97	Mar-97	May-97	Jul-97	Nov-97	Mar-98
Quad 2						
F01				37.3		
F02	48.5	1.5	36.0	39.9		0.0
F03	44.5	0.0	33.6		0.0	
F04	8.0	0.0	20.4	21.3	45.6	0.0
F05	4.0	0.0	1.8	5.3	0.0	0.0
G01	30.0	0.0	34.0	133.3		0.0
G03	2.5	0.0	11.0	24.0	0.5	0.0
G04	28.0	0.0	4.1	32.0	22.0	0.0
G05	0.0	0.3	4.2	0.0	0.0	0.0
H02	1.0	0.0	12.0	24.0		0.0
H03		0.0				
H04	26.0	0.0	10.8	24.5	44.4	0.0
H05	21.5	0.0	0.0	14.9	0.0	0.0
I01	2.0	0.0	9.6	11.1		0.0
I03	53.0	0.0	4.8	2.1		0.0
I05	21.0	0.0	0.0	24.0		0.0
J02	0.0	0.0	0.0	0.0		0.0
J04	6.0	0.0	0.0	6.4		0.0
	19.1	**0.1**	**10.8**	**25.0**	**14.1**	**0.0**
	4.7	**0.1**	**3.0**	**7.9**	**7.3**	**0.0**
	14.5	**0.0**	**7.2**	**22.7**	**0.3**	**0.0**
	0.0	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
	53.0	**1.5**	**36.0**	**133.3**	**45.6**	**0.0**
	305.0	**1.8**	**172.3**	**400.1**	**112.5**	**0.0**
	16	**17**	**16**	**16**	**8**	**15**

Block	Jul-96	Mar-97	May-97	Jul-97	Nov-97	Mar-98
Quad 4						
A07	131.0		30.0	230.3	43.8	0.0
A08	14.0	1.0	28.5	15.0	18.0	43.6
A09	78.0	0.0	34.8	25.0	0.0	0.0
A10	156.0	0.0	0.0	90.6		0.0
B06	260.0	1.5	145.8	49.0	167.5	0.5
B07	147.0	10.0		447.7	134.0	14.1
B08	314.0		139.8	644.0	15.0	10.9
B09	89.0	0.0	0.0	87.0	6.0	1.4
B10	242.0	0.0	27.0	29.9		0.0
B10	40.5					
C07	206.0	1.5	132.6	165.2		0.0
C08	184.6		75.6	88.5	81.6	0.0
C09	54.0	0.0	26.5	14.0	109.2	52.7
C10	33.0	0.0	0.0	16.0	20.4	55.0
D06	69.0	3.0	117.6	245.6		3.3
D07	55.0	0.0	70.1	22.9		0.2
D08	212.0		118.2	200.4	147.6	0.0
D09	24.0	0.0	24.0	103.4		0.0
D10	19.0		0.0	64.0	45.6	39.6
E06		0.0	57.0	0.0		0.5
E07	0.0	0.0	115.2	16.0		0.0
E08	145.2	0.0	252.0	65.0	66.0	1.8
E09	40.0	0.0	42.0	26.7	48.0	0.0
E10	32.0		0.0	0.0	411.5	1.4
Mean	**110.7**	**1.0**	**65.3**	**115.1**	**87.6**	**9.8**
Std Error	**18.9**	**0.6**	**13.9**	**32.7**	**26.9**	**3.8**
Median	**78.0**	**0.0**	**38.4**	**64.0**	**48.0**	**0.5**
Minimum	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Maximum	**314.0**	**10.0**	**252.0**	**644.0**	**411.5**	**55.0**
Sum	**2545.3**	**17.0**	**1436.7**	**2646.2**	**1314.2**	**224.9**
Count	**23**	**17**	**22**	**23**	**15**	**23**

Block	Jul-97	Mar-97	May-97	Jul-97	Nov-97	Mar-98
Quad 3						
F06	0.0	0.5	0.0	18.1	189.0	0.5
F07	30.0	0.0	19.8	14.4	78.6	0.9
F08	73.0	10.0	0.0	19.2		4.1
F09	295.0		0.0	0.0	181.2	1.4
F10	56.0		0.0	5.3	249.0	5.0
G06		0.8		9.6	22.8	1.8
G07	190.0	0.7	14.8	22.4	312.0	0.0
G08	41.0		51.0	25.6		0.0
G09	0.0	0.0	0.0	14.9	151.2	0.0
G10	0.0	1.0	0.0	12.3		0.0
H06	5.5	0.0	0.0	10.0	383.4	0.0
H07	190.8	0.0	34.8	148.2	122.4	0.9
H08	0.0	0.0	0.0	0.0	9.0	0.0
H09	0.0	0.0	0.0	6.9		0.0
H10	29.0	0.5	0.0	4.8		0.0
I07	0.0	1.5	0.0	3.7		0.0
I08	6.5	0.0	0.0	26.7		0.0
I09	0.0	0.0	0.0	5.3		0.0
I10	5.0	0.0	0.0	5.9		0.0
J06	4.0	0.0	0.5	28.0		0.0
J08	0.0	0.0	2.0	44.8		14.8
J09	5.0	0.0	0.0	0.0		2.3
J10	0.0	5.5	0.0	0.0		0.0
	42.3	**1.0**	**5.6**	**18.5**	**169.9**	**1.4**
	16.9	**0.5**	**2.8**	**6.3**	**38.2**	**0.7**
	5.0	**0.0**	**0.0**	**10.0**	**166.2**	**0.0**
	0.0	**0.0**	**0.0**	**0.0**	**9.0**	**0.0**
	295.0	**10.0**	**51.0**	**148.2**	**383.4**	**14.8**
	930.8	**20.5**	**122.9**	**426.0**	**1698.6**	**31.6**
	22	**20**	**22**	**23**	**10**	**23**

Table 7. Catches of cod (kg per 1-hr tow) and associated statistics, for various areas, from grid surveys.

	Jul-96	Mar-97	May-97	Jul-97	Nov-97	Mar-98
Div. 3O (cols A-D)						
Mean	186.7	0.9	77.6	124.7	47.1	6.6
Standard Error	66.7	0.4	13.0	23.2	13.8	2.7
Median	78.0	0.0	46.0	78.9	17.0	0.0
Minimum	6.0	0.0	0.0	0.0	0.0	0.0
Maximum	2,509.0	10.0	308.0	644.0	293.4	55.0
Sum	6,908.6	21.7	2,717.6	4,488.9	1,224.0	224.1
Count	37	24	35	36	26	34
Div. 3N (cols E-J)						
Mean	40.4	0.7	18.6	32.2	99.2	0.8
Standard Error	9.7	0.3	6.0	8.5	25.7	0.3
Median	9.0	0.0	2.0	16.0	45.0	0.0
Minimum	0.0	0.0	0.0	0.0	0.0	0.0
Maximum	295.0	10.0	252.0	368.6	411.5	14.8
Sum	1,859.0	29.8	875.9	1,578.5	2,379.8	35.2
Count	46	44	47	49	24	46
Total (all blocks)						
Mean	105.6	0.8	43.8	71.4	72.1	3.2
Standard Error	31.1	0.2	7.3	12.0	14.6	1.2
Median	41.0	0.0	21.0	25.6	22.4	0.0
Minimum	0.0	0.0	0.0	0.0	0.0	0.0
Maximum	2,509.0	10.0	308.0	644.0	411.5	55.0
Sum	8,767.6	51.5	3,593.5	6,067.4	3,603.8	259.3
Count	83	68	82	85	50	80
Comparable blocks (July 96, July 97)						
Mean	107.2			73.5		
Standard Error	31.8			12.5		
Median	41.0			25.6		
Minimum	0.0			0.0		
Maximum	2509.0			644.0		
Sum	8682.6			5954.4		
Count	81			81		
Comparable blocks (March 97, March 98)						
Mean		0.7				3.2
Standard Error		0.2				1.4
Median		0.0				0.0
Minimum		0.0				0.0
Maximum		10.0				55.0
Sum		43.0				199.2
Count		63				63
Comparable blocks (all 6 surveys)						
Mean	171.2	0.2	49.0	63.9	62.1	5.3
Standard Error	83.2	0.1	13.2	16.1	17.4	2.8
Median	40.5	0.0	20.1	24.8	19.8	0.0
Minimum	0.0	0.0	0.0	0.0	0.0	0.0
Maximum	2509.0	2.0	260.0	368.6	383.4	55.0
Sum	5134.5	7.2	1471.0	1916.6	1862.1	158.2
Count	30	30	30	30	30	30

Table 8. Catches of yellowtail flounder (kg per 1-hr tow), from blocks fished in all six surveys. Data are ranked in descending order of mean catch (last 2 columns).

Block	Jul-96	Mar-97	May-97	Jul-97	Nov-97	Mar-98	Mean	Rank
F05	1,818.1	498.3	935.6	1,396.9	5,931.0	66.4	1,774.4	30
G04	868.7	4,972.4	610.2	451.1	2,023.2	299.6	1,537.5	29
F04	1,032.3	677.9	833.2	704.0	1,660.7	43.2	825.2	28
E02	937.3	18.5	2,529.3	1,148.0	175.8	1.4	801.7	27
F07	1,921.1	126.5	751.5	881.0	171.5	225.7	679.6	26
E05	1,340.8	60.0	633.0	371.3	1,205.7	22.9	605.6	25
C10	1,430.9	88.0	716.5	1,014.1	50.5	316.0	602.7	24
A05	1,410.5	35.5	421.8	167.0	1,533.4	17.0	597.5	23
F06	955.9	87.0	703.2	728.3	689.3	236.2	566.7	22
H07	443.0	67.5	850.0	1,349.3	288.4	254.8	542.2	21
G07	721.7	28.5	638.9	711.3	548.5	427.7	512.8	20
A01	1,315.9	7.0	234.9	997.6	436.8	26.8	503.2	19
B06	756.0	27.5	629.9	612.0	811.5	83.6	486.8	18
E08	1,167.9	11.0	714.0	506.5	313.9	15.5	454.8	17
H05	322.9	52.5	256.5	680.0	1,209.0	95.5	436.1	16
G09	813.0	51.0	798.5	545.1	308.2	60.0	429.3	15
H08	736.7	7.5	697.4	631.6	414.4	58.2	424.3	14
G05	502.5	67.5	469.3	528.5	610.3	237.2	402.5	13
A03	1,086.8	23.7	204.0	690.8	300.8	6.0	385.4	12
H04	357.6	205.0	457.0	684.7	377.1	141.4	370.5	11
H06	436.4	33.0	302.9	600.1	781.7	31.4	364.2	10
C09	471.9	21.5	638.0	489.4	360.9	181.3	360.5	9
C01	758.3	1.0	231.4	629.4	440.4	3.2	343.9	8
E09	609.6	5.0	640.0	500.8	298.2	8.3	343.6	7
A08	326.0	67.5	585.0	637.3	103.5	60.0	296.6	6
G03	344.7	81.0	322.0	518.5	87.0	47.7	233.5	5
C03	224.5	18.0	287.6	591.8	230.7	1.8	225.7	4
B09	254.2	36.0	142.0	582.3	9.0	59.1	180.4	3
B02	321.0	0.1	210.0	482.3	44.5	0.1	176.3	2
A09	123.6	27.5	49.0	225.1	3.5	57.3	81.0	1

Table 9. Catches of American plaice (kg per 1-hr tow), from blocks fished in all six surveys. Data are ranked in descending order of mean catch (last 2 columns).

Block	Jul-96	Mar-97	May-97	Jul-97	Nov-97	Mar-98	Mean	Rank
B09	420.2	45.0	519.4	326.9	176.1	246.7	289.1	30
C10	293.0	85.0	362.5	349.5	329.1	89.1	251.4	29
C09	144.0	42.0	564.0	264.8	296.8	138.3	241.6	28
A09	114.0	56.0	408.1	498.2	132.5	133.6	223.7	27
A08	220.5	65.0	468.0	111.1	76.3	32.3	162.2	26
A05	110.0	3.5	162.2	35.0	492.9	2.0	134.3	25
G09	122.0	16.0	144.2	185.2	157.4	12.7	106.2	24
E09	86.0	2.0	176.6	241.2	111.3	3.4	103.4	23
H08	124.0	3.5	181.9	155.4	82.7	15.0	93.7	22
G04	39.0	212.4	83.3	30.6	169.6	15.5	91.7	21
A03	84.5	7.8	186.0	41.0	196.1	2.0	86.2	20
F07	92.5	23.0	192.6	100.8	83.7	7.7	83.4	19
A01	232.8	3.5	102.7	114.3	41.0	0.5	82.5	18
E08	92.0	3.5	198.0	106.0	82.7	6.4	81.4	17
H07	36.0	8.5	288.9	40.2	80.6	2.7	76.1	16
G07	80.0	3.0	185.7	86.8	70.0	13.6	73.2	15
F04	8.0	76.3	68.5	38.1	222.6	9.6	70.5	14
H05	31.0	3.8	72.0	122.1	181.3	4.6	69.1	13
F05	20.0	170.6	42.3	22.3	106.0	17.3	63.1	12
E02	85.6	6.0	171.2	70.0	23.3	0.0	59.3	11
B02	45.0	0.0	81.0	158.7	51.0	0.0	56.0	10
B06	34.0	5.5	119.3	37.0	120.8	17.7	55.7	9
H04	42.0	15.0	78.0	75.3	72.1	5.5	48.0	8
G05	20.0	1.0	68.5	39.8	140.0	11.4	46.8	7
G03	47.5	18.0	91.0	39.2	72.1	1.4	44.8	6
E05	28.0	4.5	72.8	40.3	111.3	0.6	42.9	5
C01	7.5	1.5	95.4	42.4	57.2	1.4	34.2	4
F06	23.0	4.5	77.0	0.0	66.8	25.5	32.8	3
H06	17.0	1.0	43.9	38.1	84.8	0.5	30.9	2
C03	19.5	0.0	56.2	43.4	31.8	0.5	25.2	1

Table 10. Ratio of American plaice catch to yellowtail catch, by block, from blocks fished in all six surveys. Mean is the mean of the ratios, and total ratio is the sum of A. plaice over the sum of yellowtail for each block. Data are ranked in ascending order of total ratio (last 2 columns).

Block	Jul-96	Mar-97	May-97	Jul-97	Nov-97	Mar-98	Mean	Total Ratio	Rank
F05	0.011	0.342	0.045	0.016	0.018	0.260	0.115	0.036	1
F06	0.024	0.052	0.109	0.000	0.097	0.108	0.065	0.058	2
G04	0.045	0.043	0.136	0.068	0.084	0.052	0.071	0.060	3
E05	0.021	0.075	0.115	0.108	0.092	0.027	0.073	0.071	4
E02	0.091	0.324	0.068	0.061	0.133	0.000	0.113	0.074	5
H06	0.039	0.030	0.145	0.063	0.108	0.014	0.067	0.085	6
F04	0.008	0.113	0.082	0.054	0.134	0.221	0.102	0.085	7
C01	0.010	1.500	0.412	0.067	0.130	0.428	0.425	0.100	8
C03	0.087	0.000	0.195	0.073	0.138	0.253	0.124	0.112	9
B06	0.045	0.200	0.189	0.061	0.149	0.212	0.143	0.114	10
G05	0.040	0.015	0.146	0.075	0.229	0.048	0.092	0.116	11
F07	0.048	0.182	0.256	0.114	0.488	0.034	0.187	0.123	12
H04	0.117	0.073	0.171	0.110	0.191	0.039	0.117	0.129	13
H07	0.081	0.126	0.340	0.030	0.279	0.011	0.144	0.140	14
G07	0.111	0.105	0.291	0.122	0.128	0.032	0.131	0.143	15
H05	0.096	0.071	0.281	0.180	0.150	0.048	0.138	0.159	16
A01	0.177	0.500	0.437	0.115	0.094	0.017	0.223	0.164	17
E08	0.079	0.318	0.277	0.209	0.263	0.412	0.260	0.179	18
G03	0.138	0.222	0.283	0.076	0.829	0.029	0.263	0.192	19
H08	0.168	0.467	0.261	0.246	0.200	0.258	0.267	0.221	20
A03	0.078	0.329	0.912	0.059	0.652	0.333	0.394	0.224	21
A05	0.078	0.099	0.384	0.210	0.321	0.118	0.202	0.225	22
G09	0.150	0.314	0.181	0.340	0.511	0.212	0.284	0.247	23
E09	0.141	0.400	0.276	0.482	0.373	0.411	0.347	0.301	24
B02	0.140	*	0.386	0.329	1.146	*	0.500	0.317	25
C10	0.205	0.966	0.506	0.345	6.517	0.282	1.470	0.417	26
A08	0.676	0.963	0.800	0.174	0.737	0.538	0.648	0.547	27
C09	0.305	1.953	0.884	0.541	0.822	0.763	0.878	0.670	28
B09	1.653	1.250	3.658	0.561	19.567	4.176	5.144	1.602	29
A09	0.922	2.036	8.329	2.213	37.857	2.334	8.949	2.762	30

Table 11. Categorization of ratio of A.plaice catch to yellowtail catch, for various levels of yellowtail catch. The third numeral in each cell is the total number of sets in that block (this is the same in all 4 tables). The second numeral is the number of sets which fit the yellowtail catch criterion in the heading. The first numeral represents the number of sets where the catch of A.plaice was less than 5% of the yellowtail catch. Blank cells were not fished in any of the 6 surveys.

Yellowtail Catch >100 Kg

	A	B	C	D	E	F	G	H	I	J
1	0, 4, 6	0, 4, 5	1, 4, 6	0, 3, 4	1, 4, 5	1, 1, 1	0, 3, 5		0, 3, 5	
2	0, 3, 5	0, 3, 6	0, 4, 5	0, 3, 5	0, 4, 6	1, 3, 5		0, 3, 5		0, 2, 5
3	0, 4, 6	0, 4, 5	0, 4, 6	0, 3, 5	1, 1, 1	1, 3, 4	0, 3, 6	0, 0, 1	0, 3, 5	
4		0, 2, 5	1, 4, 5	0, 3, 5	2, 3, 4	1, 5, 6	2, 6, 6	1, 6, 6		0, 1, 5
5	0, 4, 6		1, 3, 5	2, 5, 5	1, 4, 6	4, 5, 6	2, 5, 6	0, 4, 6	0, 3, 5	
6		1, 4, 6		1, 3, 5	0, 2, 4	2, 5, 6	2, 3, 4	1, 4, 6		0, 1, 5
7	0, 4, 5	0, 3, 5	0, 3, 5	0, 3, 5	0, 3, 5	2, 6, 6	1, 5, 6	2, 5, 6	1, 4, 5	
8	0, 4, 6	0, 5, 5	0, 3, 5	0, 4, 5	0, 4, 6	0, 3, 5	0, 4, 4	0, 4, 6	0, 3, 5	0, 2, 5
9	0, 2, 6	0, 3, 6	0, 5, 6	0, 4, 5	0, 4, 6	0, 4, 5	0, 4, 6	0, 4, 5	0, 3, 5	0, 2, 5
10	0, 1, 5	0, 0, 5	0, 4, 6	0, 5, 5	0, 4, 5	0, 4, 5	0, 4, 5	0, 5, 5	0, 3, 5	0, 2, 5

Yellowtail Catch >300 Kg

	A	B	C	D	E	F	G	H	I	J
1	0, 3, 6	0, 4, 5	1, 3, 6	0, 3, 4	1, 4, 5	1, 1, 1	0, 3, 5		0, 2, 5	
2	0, 2, 5	0, 2, 6	0, 3, 5	0, 1, 5	0, 3, 6	1, 3, 5		0, 3, 5		0, 1, 5
3	0, 3, 6	0, 4, 5	0, 1, 6	0, 0, 5	1, 1, 1	1, 2, 4	0, 3, 6	0, 0, 1	0, 3, 5	
4		0, 2, 5	1, 4, 5	0, 3, 5	2, 3, 4	1, 5, 6	2, 5, 6	0, 4, 6		0, 1, 5
5	0, 3, 6		1, 3, 5	1, 4, 5	1, 4, 6	4, 5, 6	1, 4, 6	0, 3, 6	0, 3, 5	
6		1, 4, 6		1, 3, 5	0, 2, 4	2, 4, 6	2, 2, 4	1, 4, 6		0, 0, 5
7	0, 4, 5	0, 1, 5	0, 3, 5	0, 3, 5	0, 3, 5	1, 3, 6	1, 5, 6	1, 3, 6	1, 3, 5	
8	0, 3, 6	0, 4, 5	0, 2, 5	0, 4, 5	0, 4, 6	0, 3, 5	0, 3, 4	0, 4, 6	0, 2, 5	0, 2, 5
9	0, 0, 6	0, 1, 6	0, 4, 6	0, 3, 5	0, 3, 6	0, 4, 5	0, 4, 6	0, 1, 5	0, 2, 5	0, 0, 5
10	0, 0, 5	0, 0, 5	0, 4, 6	0, 3, 5	0, 3, 5	0, 4, 5	0, 2, 5	0, 2, 5	0, 3, 5	0, 1, 5

Yellowtail Catch >500 Kg

	A	B	C	D	E	F	G	H	I	J
1	0, 2, 6	0, 3, 5	1, 2, 6	0, 3, 4	1, 4, 5	0, 0, 1	0, 3, 5		0, 1, 5	
2	0, 2, 5	0, 0, 6	0, 0, 5	0, 0, 5	0, 3, 6	1, 3, 5		0, 3, 5		0, 1, 5
3	0, 2, 6	0, 3, 5	0, 1, 6	0, 0, 5	0, 0, 1	1, 1, 4	0, 1, 6	0, 0, 1	0, 2, 5	
4		0, 0, 5	0, 2, 5	0, 2, 5	1, 2, 4	1, 5, 6	2, 4, 6	0, 1, 6		0, 0, 5
5	0, 2, 6		1, 2, 5	1, 3, 5	1, 3, 6	4, 4, 6	1, 3, 6	0, 2, 6	0, 1, 5	
6		1, 4, 6		1, 3, 5	0, 2, 4	2, 4, 6	2, 2, 4	0, 2, 6		0, 0, 5
7	0, 4, 5	0, 1, 5	0, 3, 5	0, 2, 5	0, 2, 5	1, 3, 6	0, 4, 6	1, 2, 6	1, 2, 5	
8	0, 2, 6	0, 4, 5	0, 1, 5	0, 1, 5	0, 3, 6	0, 3, 5	0, 3, 4	0, 3, 6	0, 1, 5	0, 1, 5
9	0, 0, 6	0, 1, 6	0, 1, 6	0, 3, 5	0, 3, 6	0, 2, 5	0, 3, 6	0, 0, 5	0, 1, 5	0, 0, 5
10	0, 0, 5	0, 0, 5	0, 3, 6	0, 1, 5	0, 2, 5	0, 2, 5	0, 1, 5	0, 2, 5	0, 2, 5	0, 1, 5

Yellowtail Catch >700 Kg

	A	B	C	D	E	F	G	H	I	J
1	0, 2, 6	0, 3, 5	1, 1, 6	0, 3, 4	1, 3, 5	0, 0, 1	0, 0, 5		0, 1, 5	
2	0, 1, 5	0, 0, 6	0, 0, 5	0, 0, 5	0, 3, 6	1, 2, 5		0, 2, 5		0, 0, 5
3	0, 1, 6	0, 1, 5	0, 0, 6	0, 0, 5	0, 0, 1	1, 1, 4	0, 0, 6	0, 0, 1	0, 2, 5	
4		0, 0, 5	0, 2, 5	0, 0, 5	1, 1, 4	1, 4, 6	2, 3, 6	0, 0, 6		0, 0, 5
5	0, 2, 6		1, 1, 5	1, 2, 5	1, 2, 6	4, 4, 6	0, 0, 6	0, 1, 6	0, 0, 5	
6		1, 2, 6		1, 3, 5	0, 0, 4	2, 3, 6	2, 2, 4	0, 1, 6		0, 0, 5
7	0, 2, 5	0, 0, 5	0, 2, 5	0, 1, 5	0, 1, 5	1, 3, 6	0, 2, 6	1, 2, 6	1, 2, 5	
8	0, 0, 6	0, 2, 5	0, 1, 5	0, 0, 5	0, 2, 6	0, 1, 5	0, 2, 4	0, 1, 6	0, 1, 5	0, 0, 5
9	0, 0, 6	0, 0, 6	0, 0, 6	0, 1, 5	0, 0, 6	0, 1, 5	0, 2, 6	0, 0, 5	0, 1, 5	0, 0, 5
10	0, 0, 5	0, 0, 5	0, 3, 6	0, 0, 5	0, 1, 5	0, 0, 5	0, 0, 5	0, 1, 5	0, 1, 5	0, 0, 5

Table 12. Age compositions of yellowtail from selected cooperative surveys. Data are mean numbers of fish per 1-hr tow.

	3N				3O			
Age	Jul-96	May-97	Jul-97	Nov-97	Jul-96	May-97	Jul-97	Nov-97
0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	3.29	0.619	0.758	0.115	0	0.096	0.084	0.007
4	32.06	14.783	18.254	2.883	0.84	0.771	1.432	0.653
5	115.08	116.59	176.99	66.43	10.04	9.522	19.976	13.079
6	443.98	450.2	559.3	451.1	209.93	211.32	275.99	143.11
7	638.02	535.4	538.2	726.9	588.58	485.7	566.4	317.2
8	356.79	344.35	326.86	497.3	361.29	306.48	374.1	211.65
9	11.07	9.478	9.693	24.768	6.71	6.519	9.508	11.522
unknown	0.78	0.882	0.715	0.229	0.15	0	0.247	0.212
total	1601.07	1472.302	1630.77	1769.725	1177.54	1020.408	1247.737	697.433

Table 13. Preliminary results from cooperative survey completed in May-June 1998. All catches in kg per 1-hr tow.

Stratum	Yellowtail	A. Plaice	Cod	Stratum	Yellowtail	A. Plaice	Cod
A01	759.00	285.70	5.40	F04	1087.23	120.84	0.00
A02	483.52	329.30	8.64	F05	2244.98	67.84	0.00
A03	603.47	269.60	28.80	F06	776.39	164.30	0.00
A07	458.70	182.32	14.40	F07	1103.30	195.00	0.00
A08	334.97	190.80	82.80	F08	535.90	241.68	346.20
A09	105.00	161.85	171.20	F09	530.04	169.60	0.00
A10	67.00	415.50	30.60	F10	540.98	92.20	22.20
B02	457.50	245.50	63.60	G01	312.45	70.49	27.60
B03	485.55	217.30	0.00	G03	908.72	178.08	0.00
B04	237.98	49.82	5.28	G04	592.55	103.88	0.00
B05	344.48	126.00	333.60	G05	818.64	175.43	0.00
B07	511.35	148.00	297.60	G06	1104.33	119.78	0.00
B08	452.57	136.74	268.80	G07	1734.08	367.29	0.00
B09	469.08	169.60	66.00	G08	834.03	206.00	400.00
B10	129.00	87.45	10.20	G09	289.95	169.60	0.00
C02	716.48	137.27	75.60	G10	585.74	284.46	0.00
C03	291.45	58.83	188.40	H02	1113.00	235.32	0.00
C04	226.35	74.00	264.00	H04	779.70	150.50	0.00
C05	310.44	82.15	185.40	H05	533.86	137.80	0.00
C07	651.88	228.96	9.60	H06	725.29	117.66	18.00
C08	363.78	313.76	166.20	H07	1227.90	785.46	4.80
C09	350.93	217.30	4.80	H08	695.69	460.92	0.00
C10	795.80	217.30	47.40	H09	568.21	241.44	0.00
D01	1271.96	103.35	12.00	H10	486.83	252.28	0.00
D04	130.08	39.22	15.60	I01	813.76	196.10	0.00
D05	328.70	80.56	46.20	I03	2398.70	221.54	0.00
D06	352.17	95.40	24.60	I07	512.46	65.72	0.00
D07	385.26	133.56	69.00	I08	437.73	114.48	0.00
D09	656.41	274.54	25.20	I09	500.96	302.10	0.00
E01	2877.01	72.34	22.20	I10	803.41	283.36	0.00
E02	1373.62	195.57	50.40	J02	246.05	69.00	0.00
E03	337.73	106.00	4.80	J06	348.98	33.92	0.00
E04	392.64	58.83	165.60				
E06	621.90	133.56	3.60	Mean	656.3	178.5	54.3
E07	400.86	130.38	0.00	St. Error	59.0	13.6	11.3
E08	594.06	100.17	201.00	Median	521.3	163.1	9.1
E09	356.02	173.84	7.20	Minimum	67.0	33.9	0.0
E10	605.30	216.24	34.80	Maximum	2,877.0	785.5	400.0
F02	443.00	120.84	16.50	Sum	47,256.2	12,854.1	3,911.8
F03	331.38	80.56	66.00	Count	72	72	72

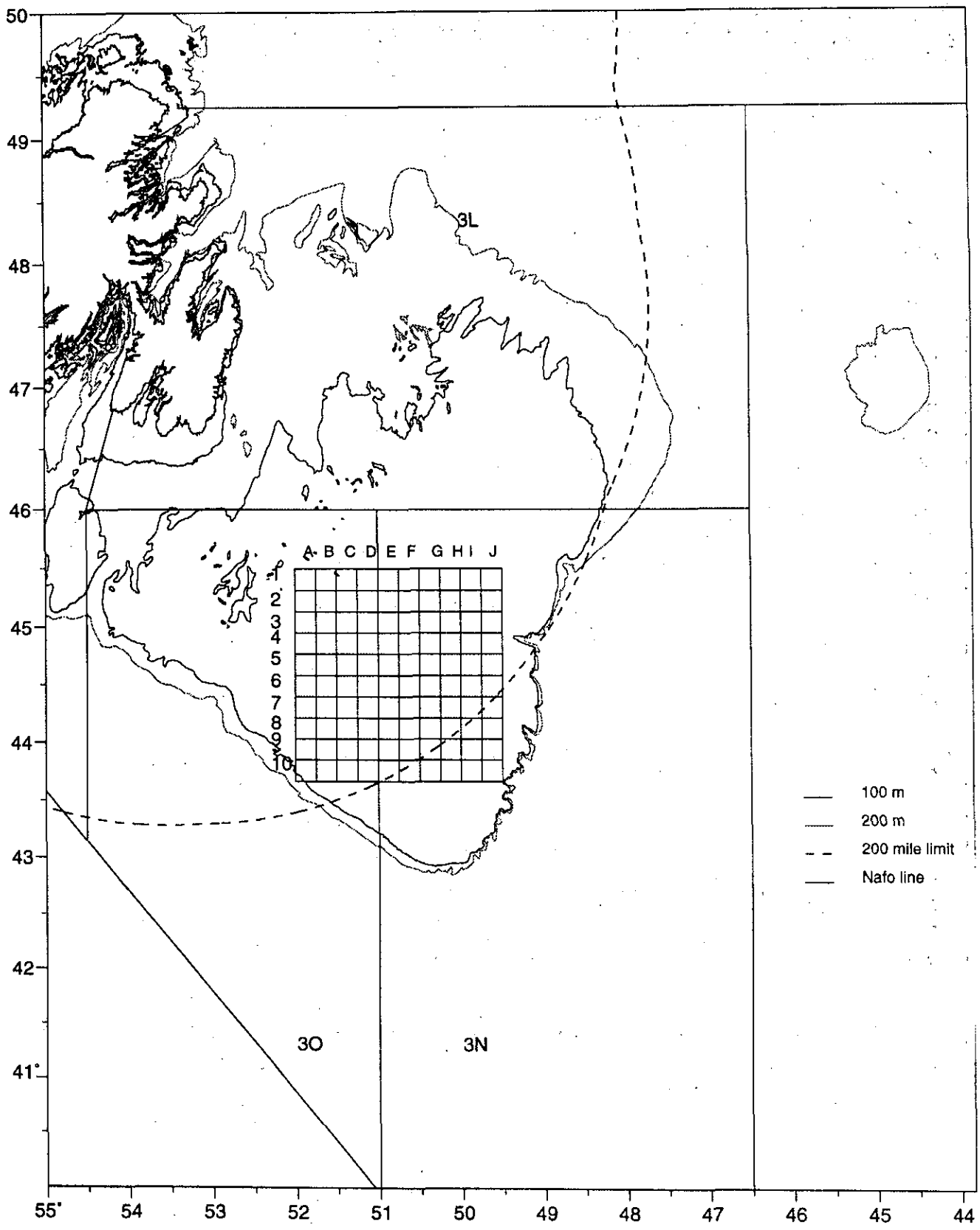


Fig. 1. Location of grid used in cooperative surveys directed at yellowtail flounder in NAFO Div. 3NO.

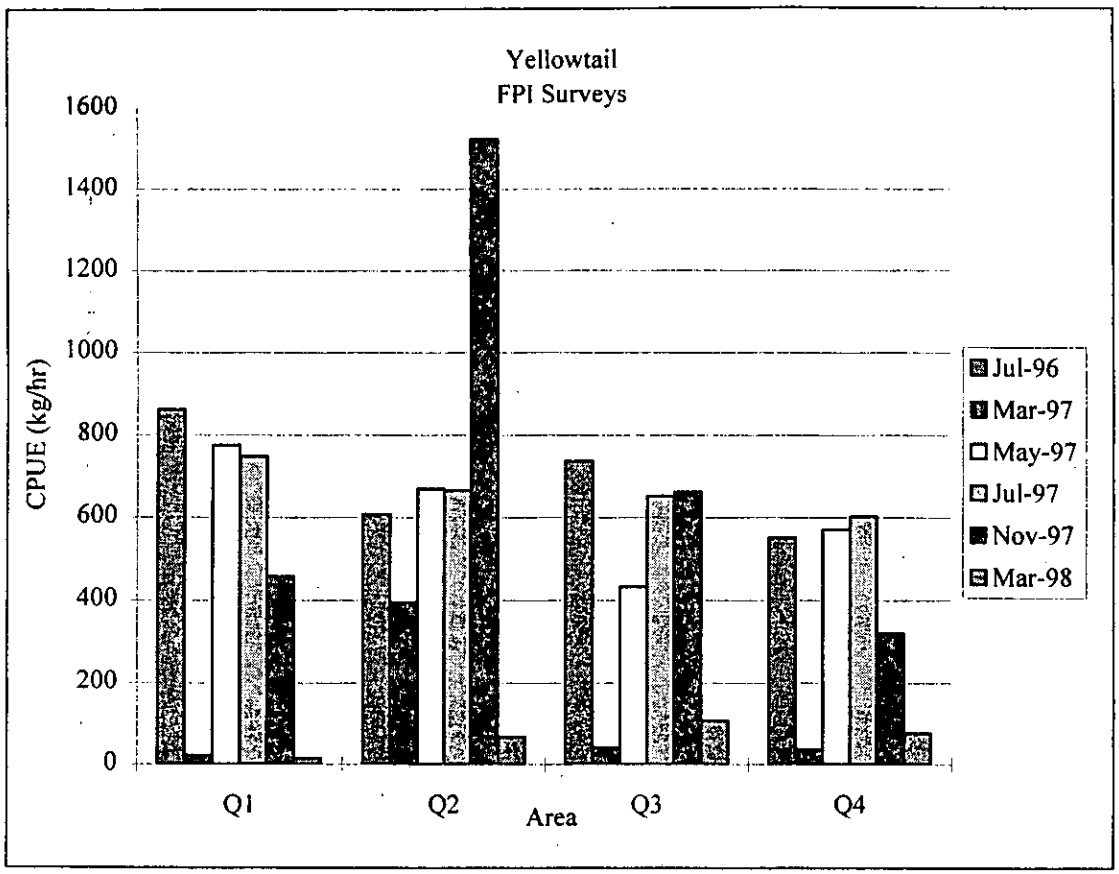


Fig. 2a. CPUE (kg/hr) of yellowtail, by quadrant, caught in cooperative surveys in 1996-1998.

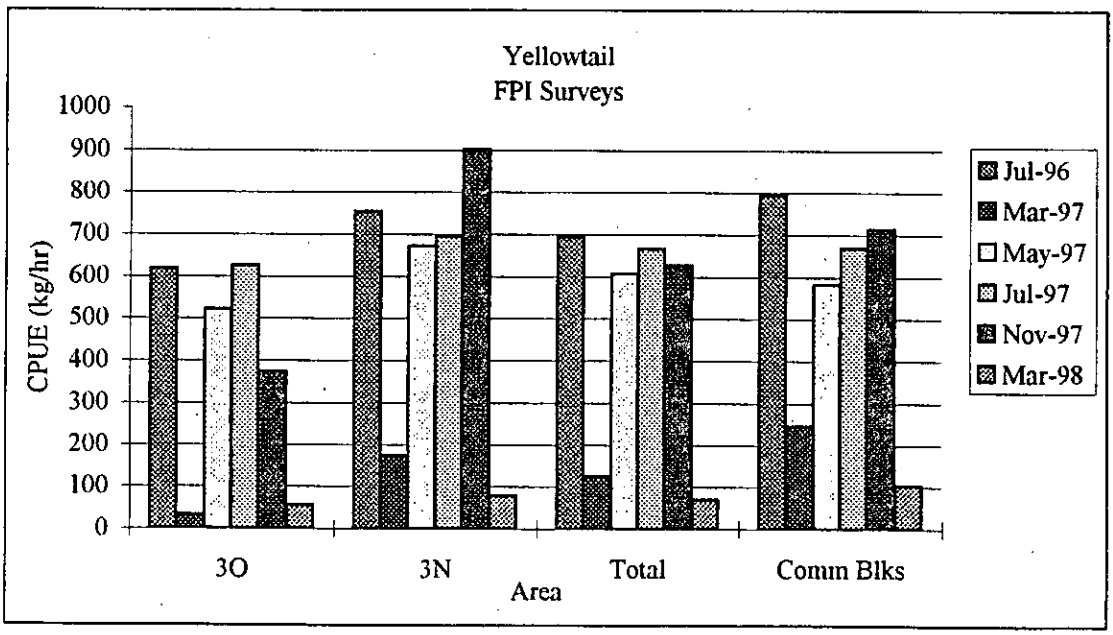


Fig. 2b. CPUE (kg/hr) of yellowtail, for various areas, caught in cooperative surveys in 1996-1998.

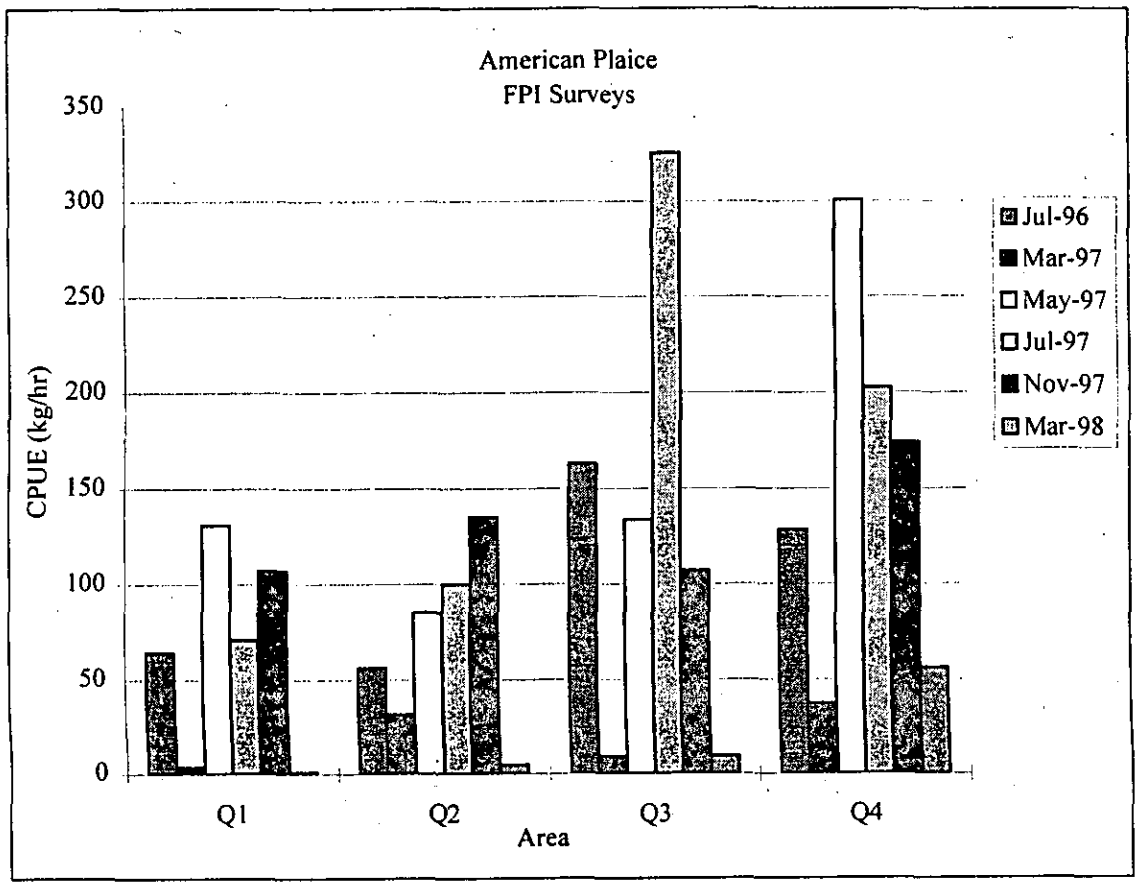


Fig. 3. CPUE (kg/hr) of American plaice, by quadrant, caught in cooperative surveys in 1996-1998.

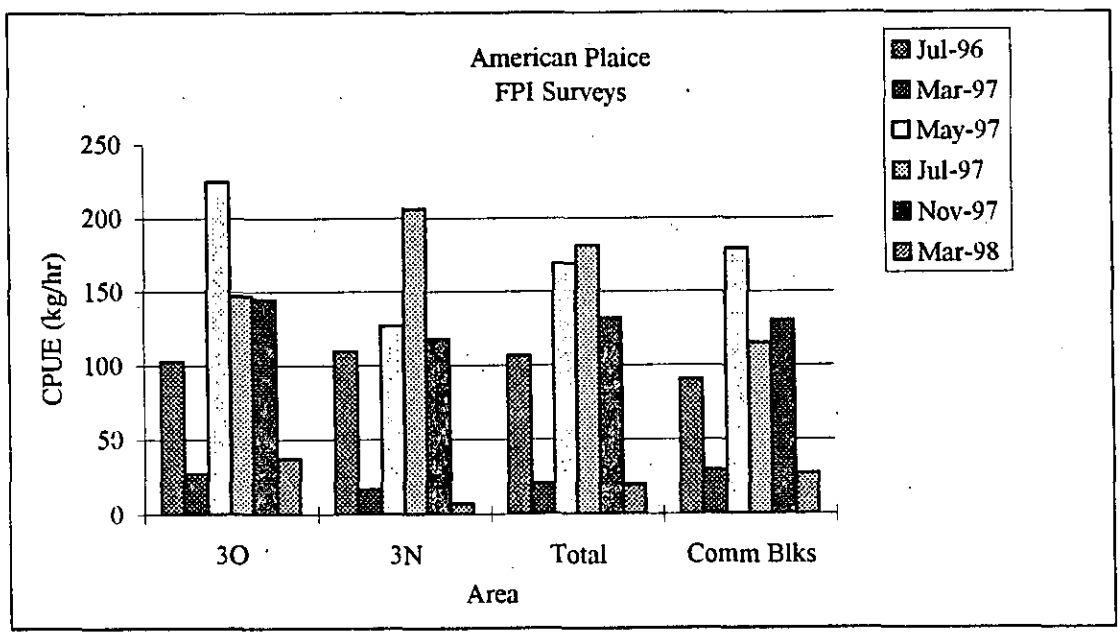


Fig. 4. CPUE (kg/hr) of American plaice, for various areas, caught in cooperative surveys in 1996-1998.

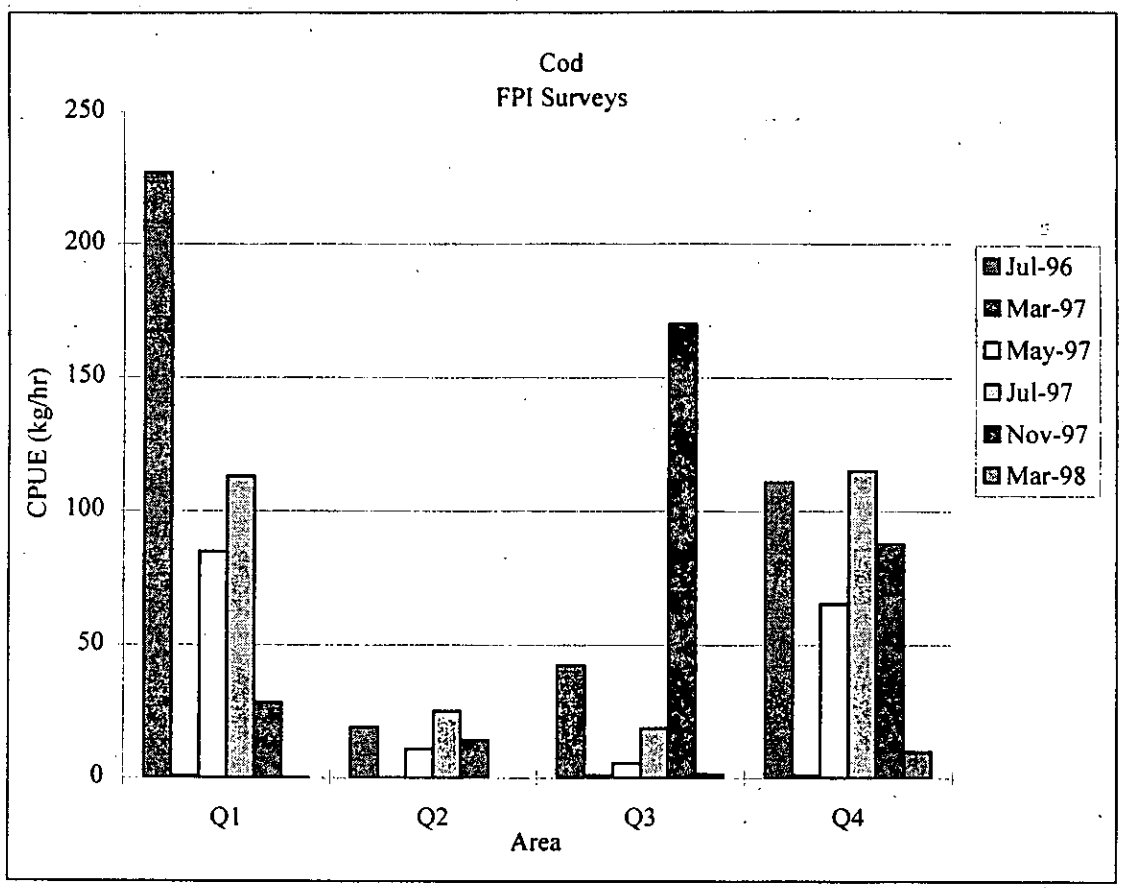


Fig. 5. CPUE (kg/hr) of cod, by quadrant, caught in cooperative surveys in 1996-1998.

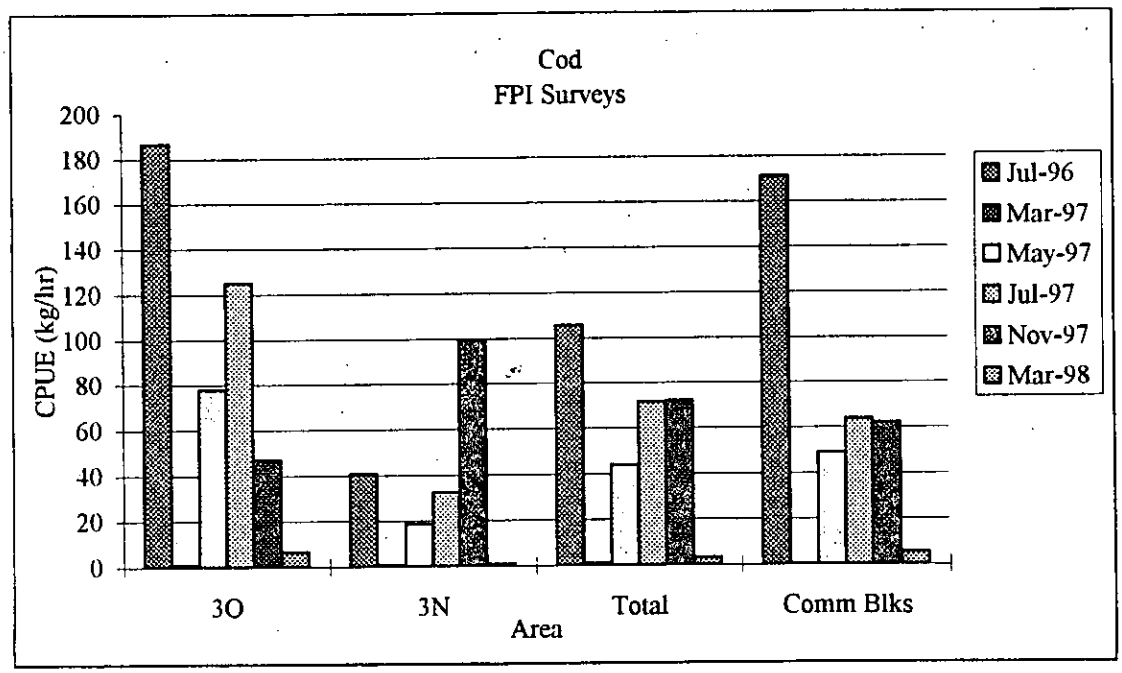


Fig. 6. CPUE (kg/hr) of cod, for various areas, caught in cooperative surveys in 1996-98.

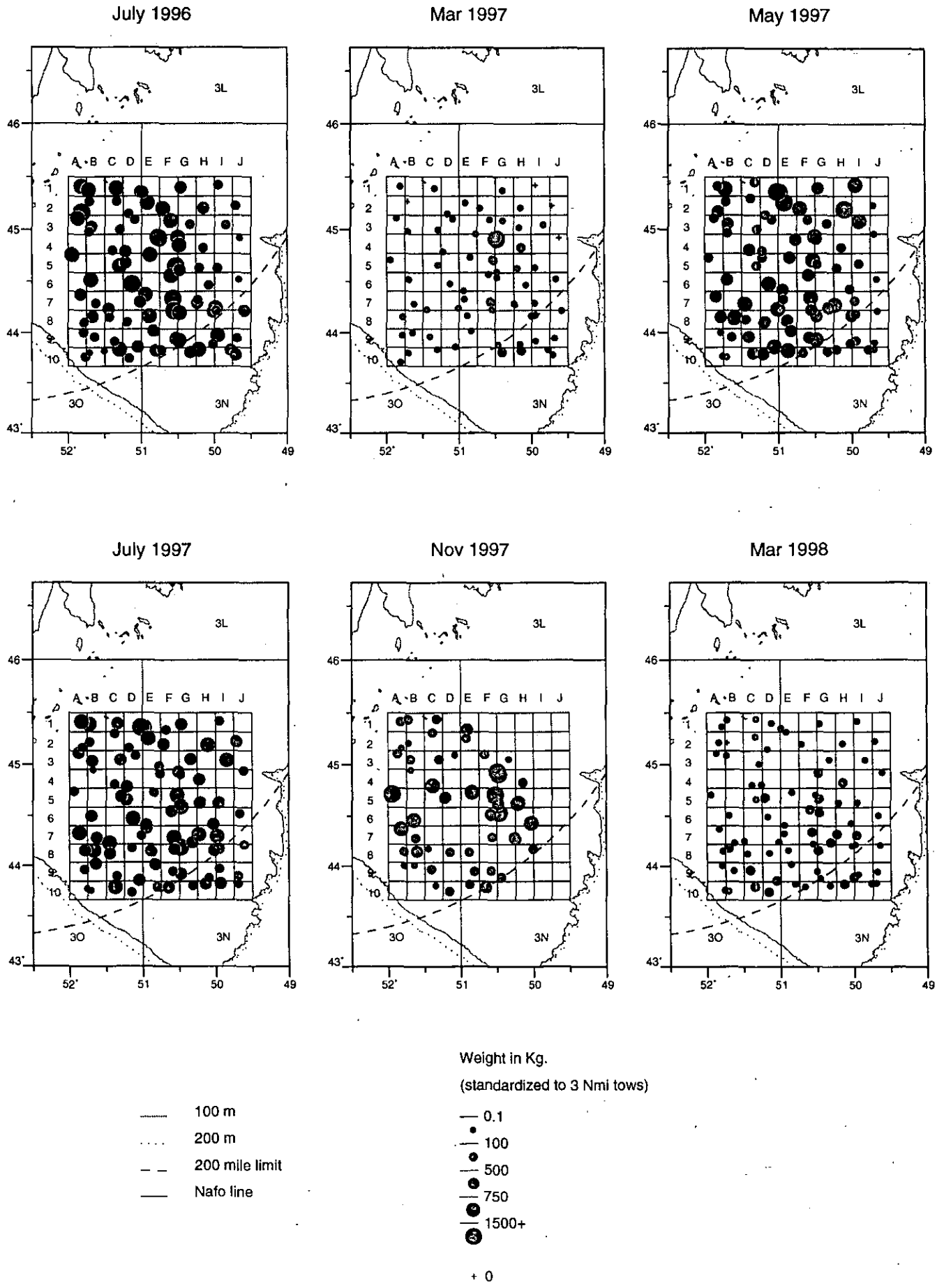


Fig. 7. Distribution of yellowtail flounder catches (weight in kgs.) from 1996,1997, and 1998 Atlantic Linsey Trips 1-6.

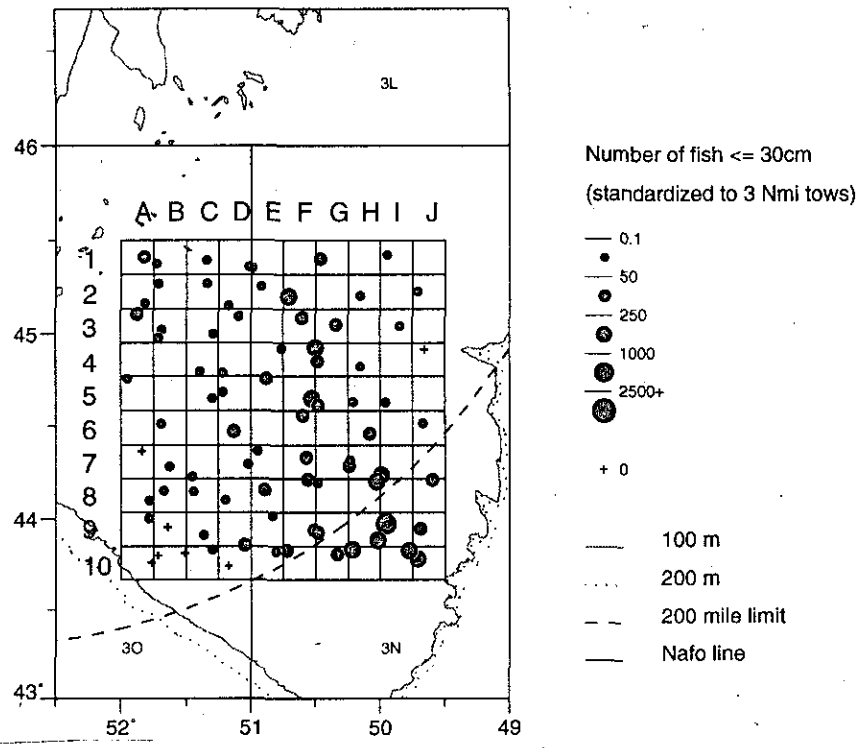


Fig. 8a. Distribution of yellowtail flounder catches (fish <= 30 cm) from July 1996, Atlantic Lindsey trip 1.

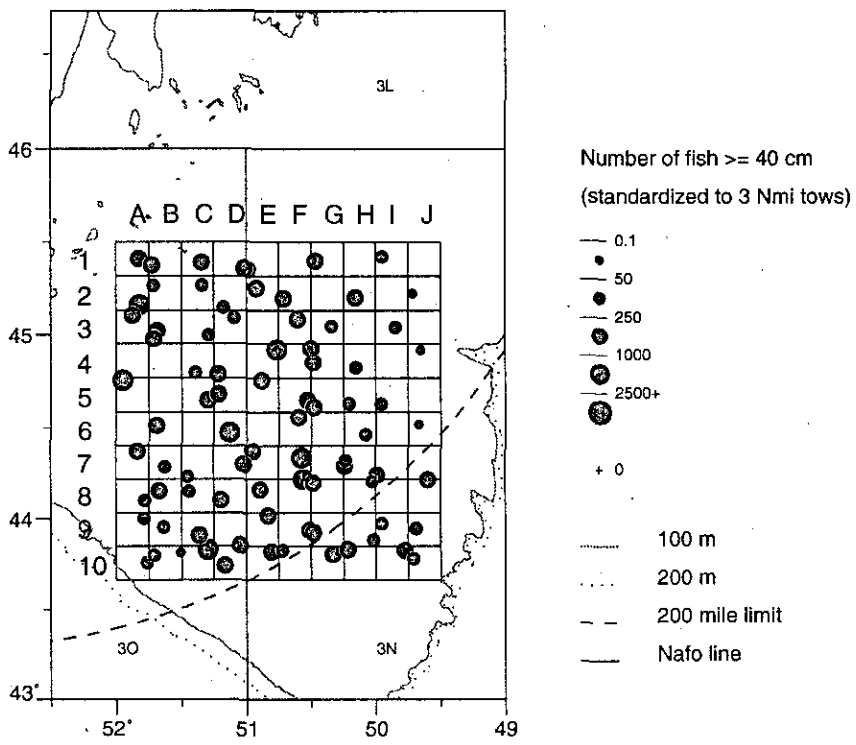


Fig. 8b. Distribution of yellowtail flounder catches (fish > 40 cm) from July 1996, Atlantic Lindsey trip 1.

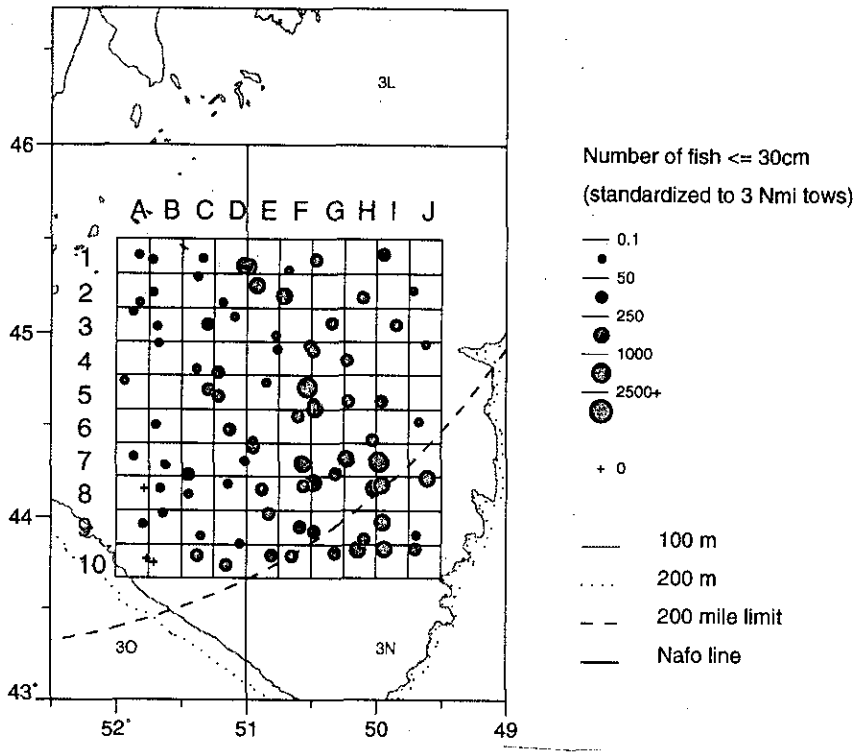


Fig. 9a. Distribution of yellowtail flounder catches (fish <= 30 cm) from July 1997, Atlantic Lindsey trip 4.

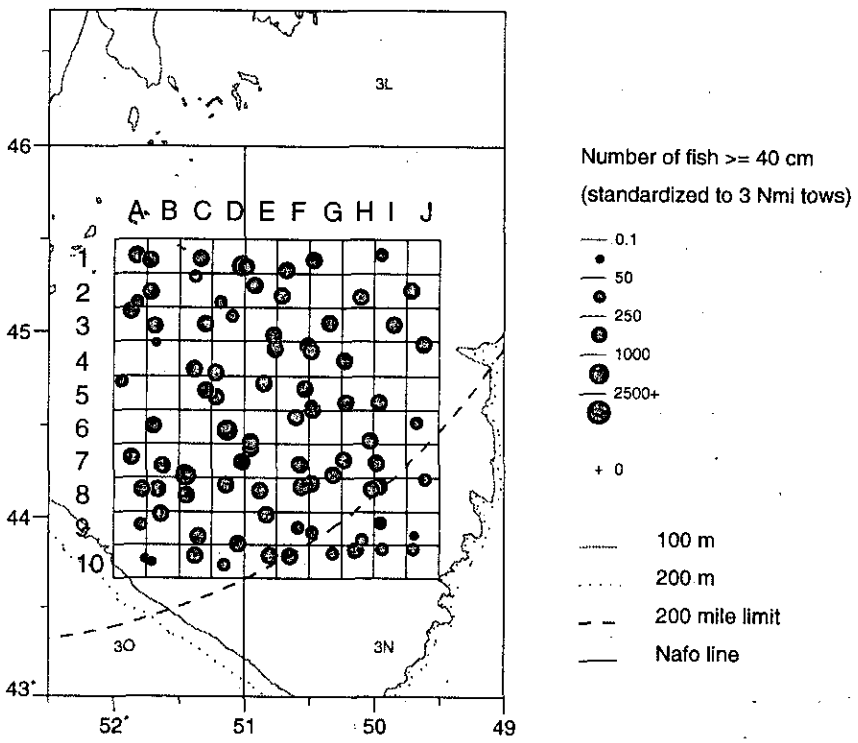


Fig. 9b. Distribution of yellowtail flounder catches (fish > 40 cm) from July 1996, Atlantic Lindsey trip 4.

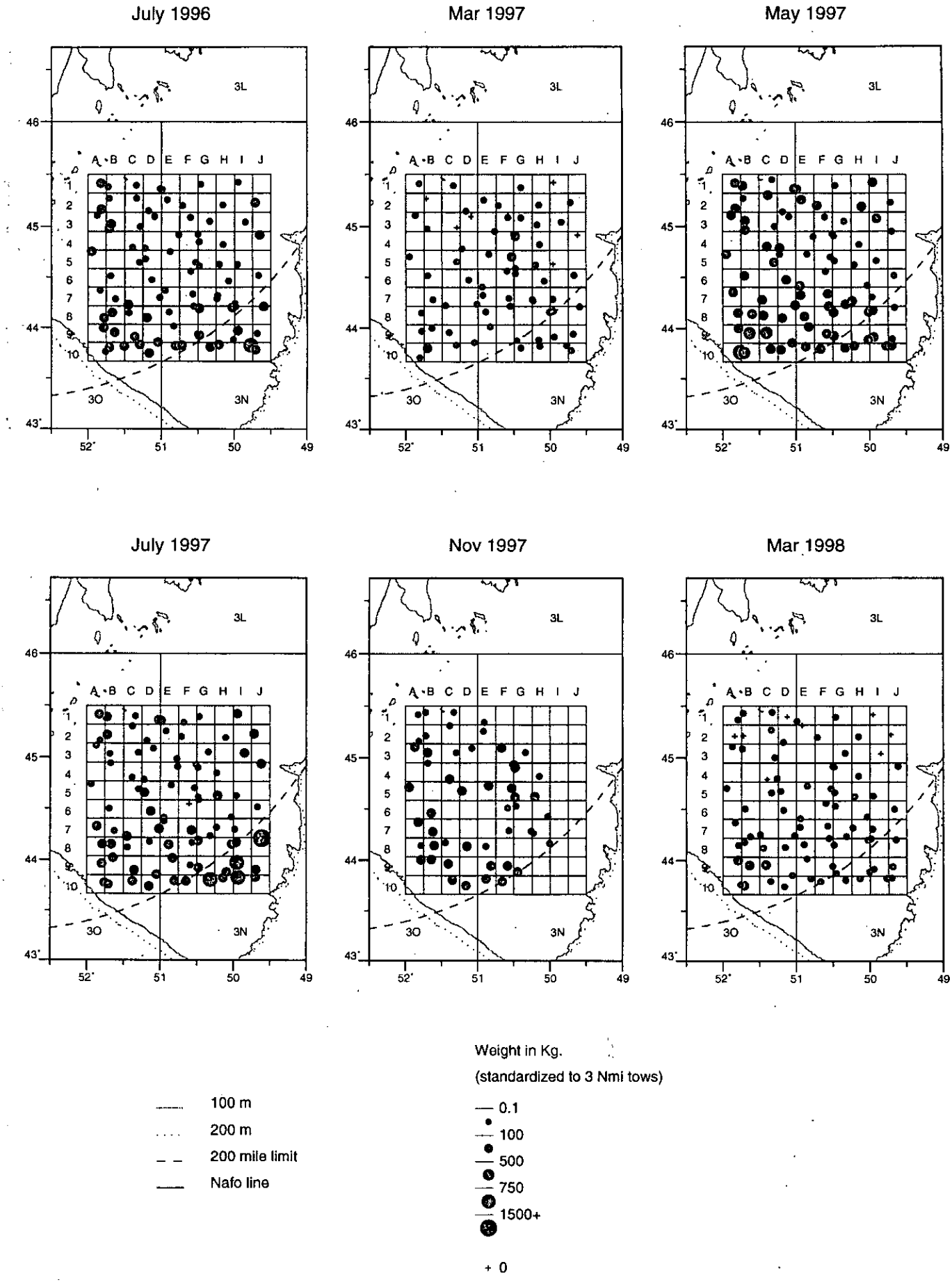


Fig. 10. Distribution of American Plaice catches (weight in kgs.) from 1996, 1997, and 1998 Atlantic Linsey Trips 1-6.

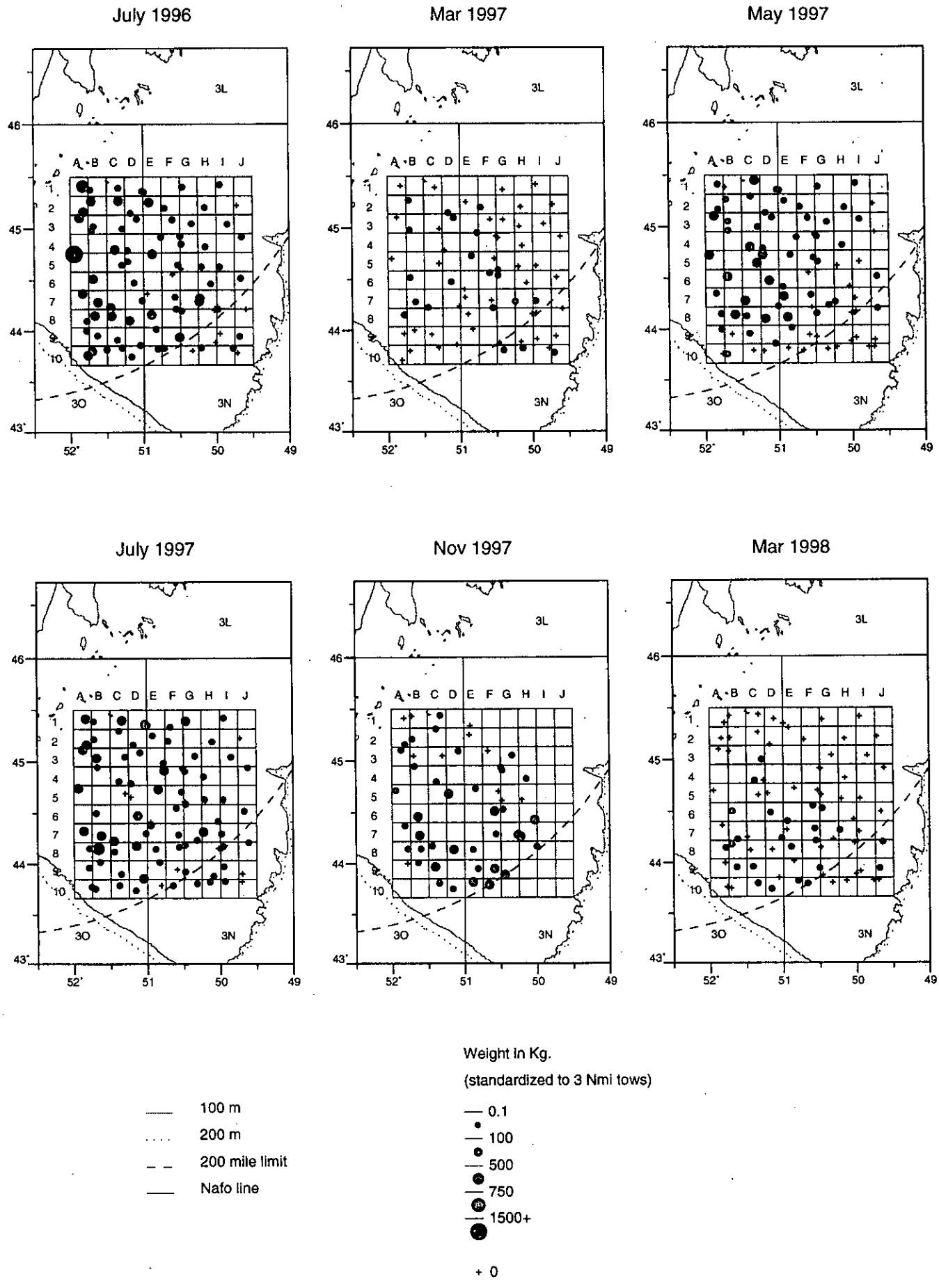


Fig. 11. Distribution of Cod catches (weight in kgs.) from 1996, 1997, and 1998 Atlantic Lipsey Trips 1-6

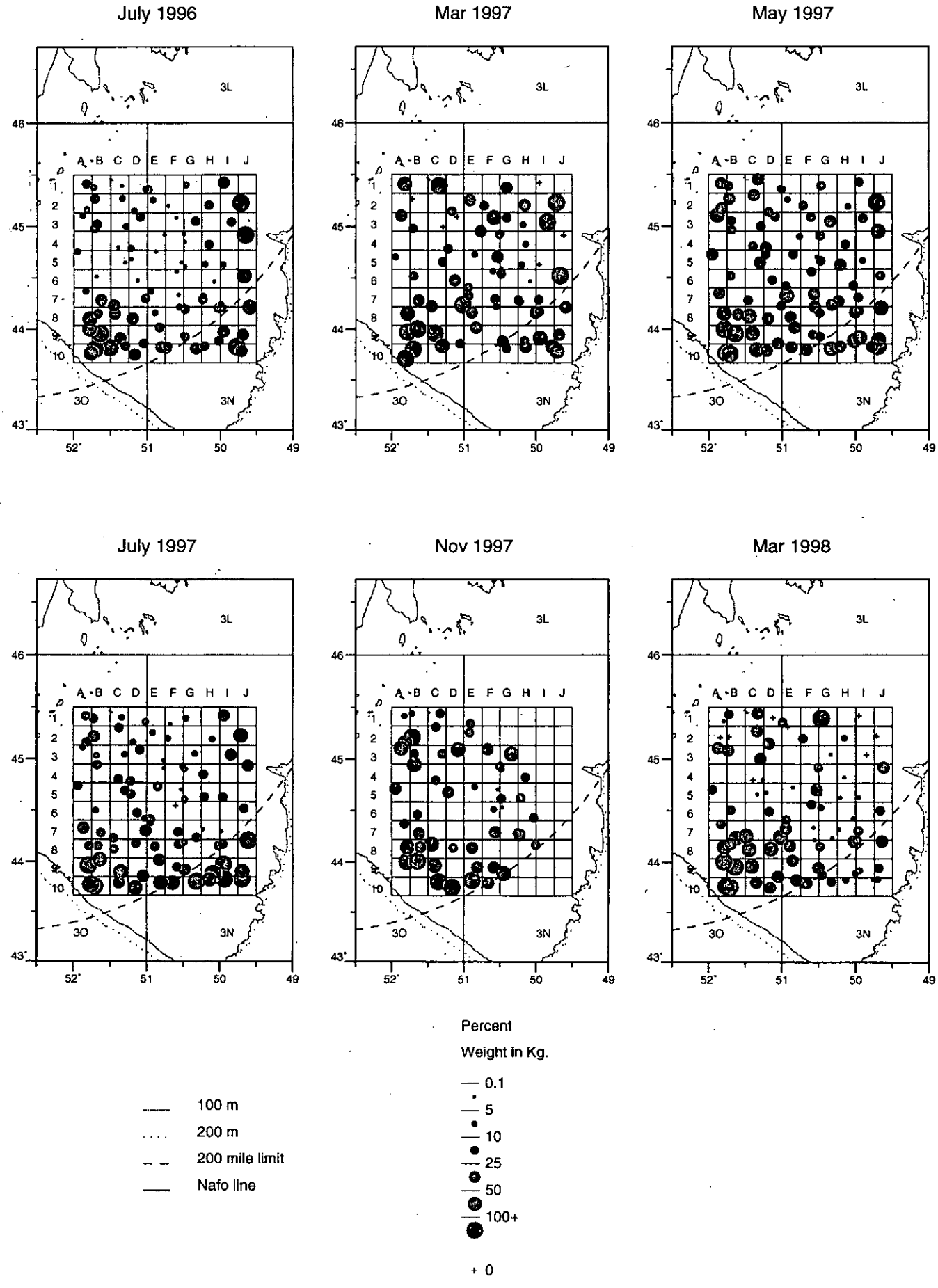


Fig. 12. Ratio of American plaice to yellowtail catches, Atlantic Lindsey trips 1-6.

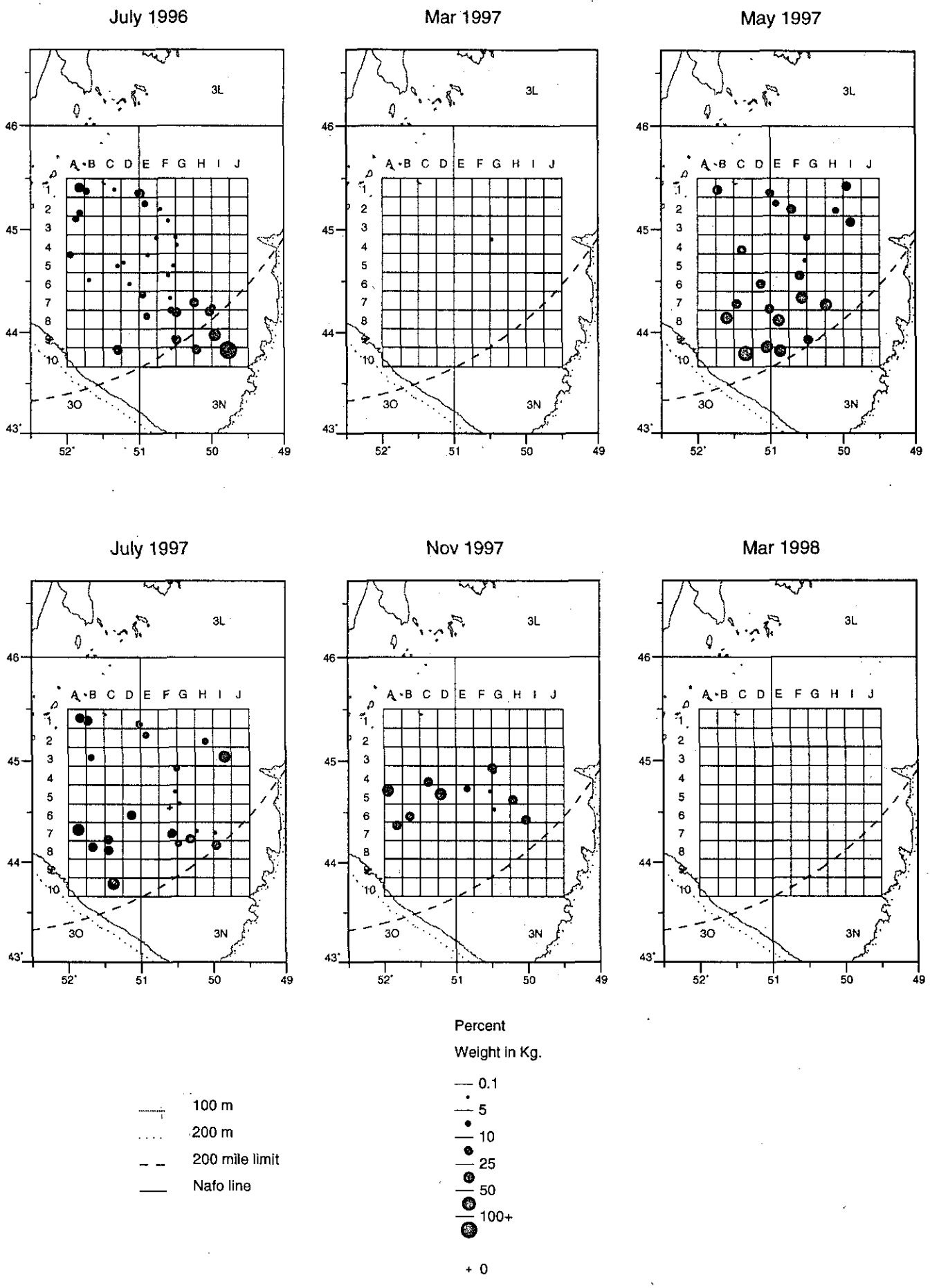
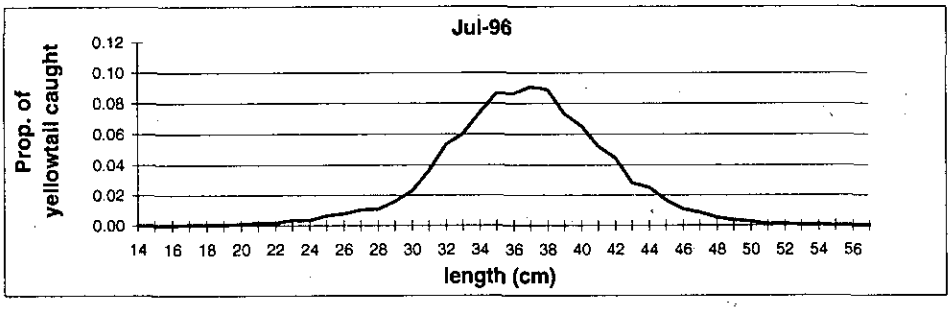
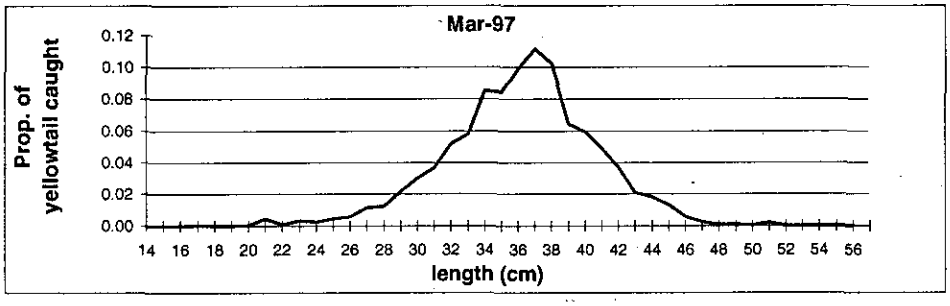


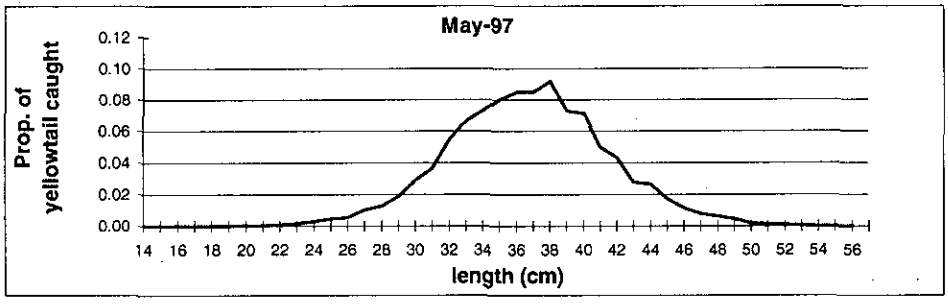
Fig. 13. Distribution of American plaice over yellowtail flounder catches (where yellowtail is greater than 700 kg.) from 1996, 1997, and 1998, Atlantic Linsey Trips 1-6.



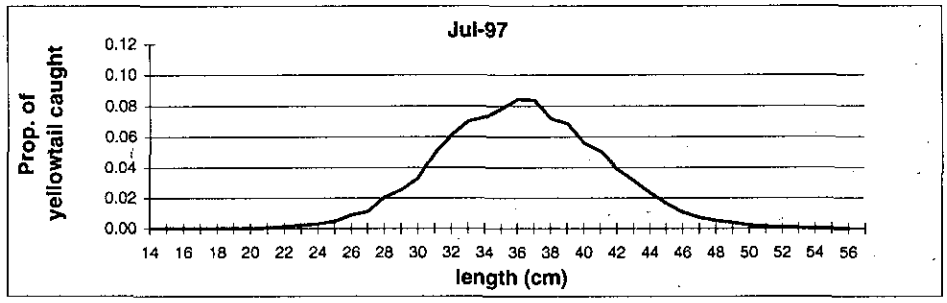
1.9% < 26 cm
6.3% < 30 cm
26.4% >= 40 cm



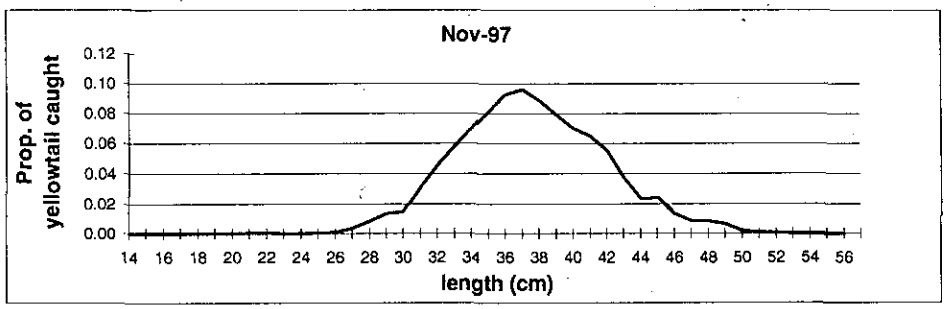
1.6% < 26 cm
6.7% < 30 cm
21.0% >= 40 cm



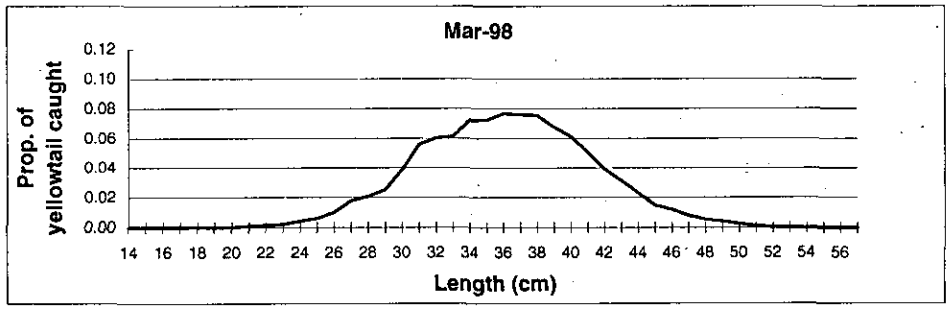
1.1% < 26 cm
5.8% < 30 cm
26.9% >= 40 cm



1.2% < 26 cm
7.7% < 30 cm
24.8% >= 40 cm

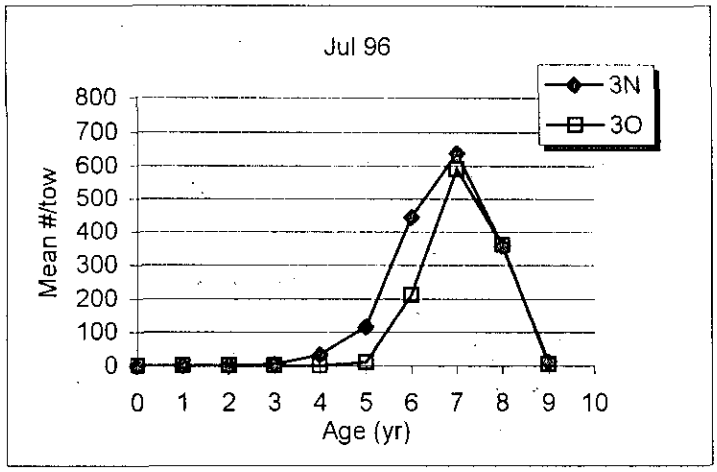


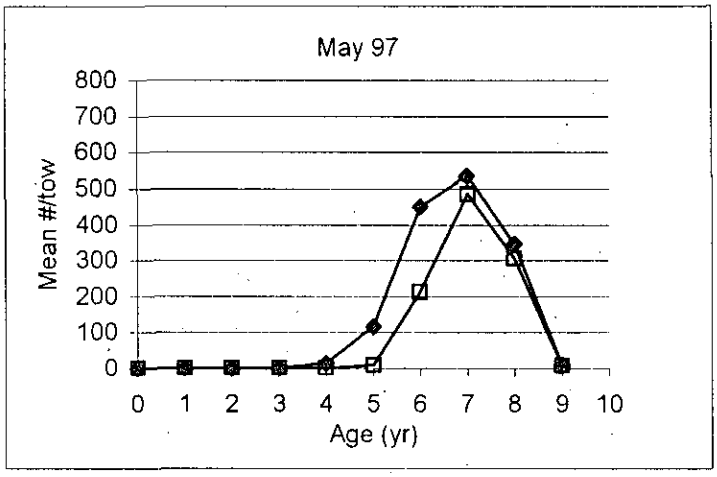
0.2% < 26 cm
2.7% < 30 cm
31.5% >= 40 cm

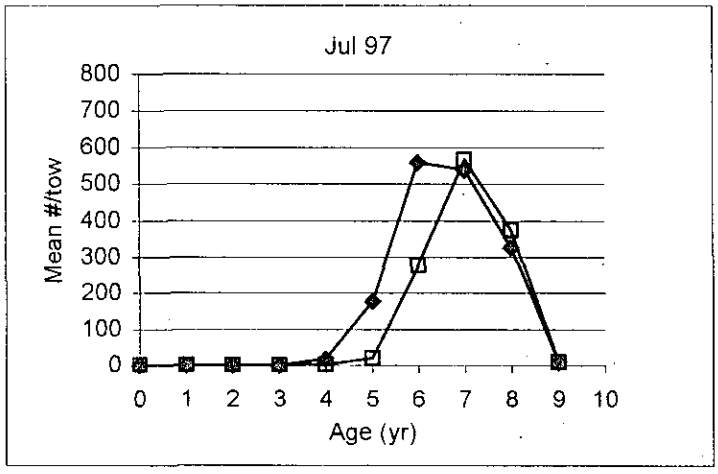


1.6% < 26 cm
9.0% < 30 cm
25.4% >= 40 cm

Fig. 14. Length composition of yellowtail flounder caught in the Atlantic Lindsey surveys.







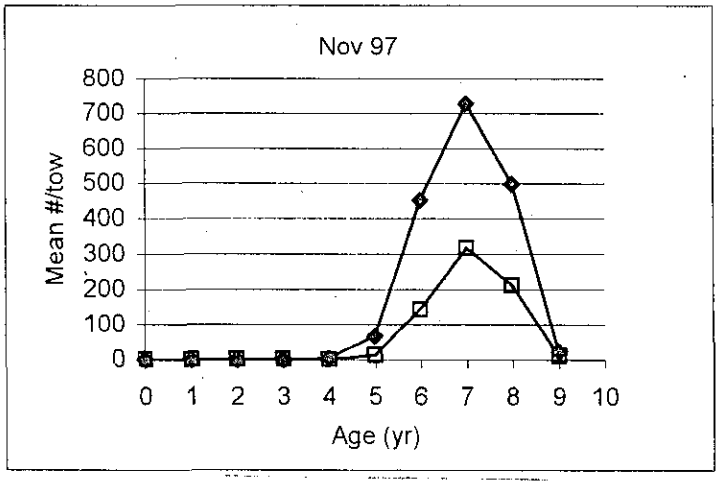


Fig. 15. Age composition of yellowtail flounder caught in the Atlantic Lindsey surveys (excluding March surveys).

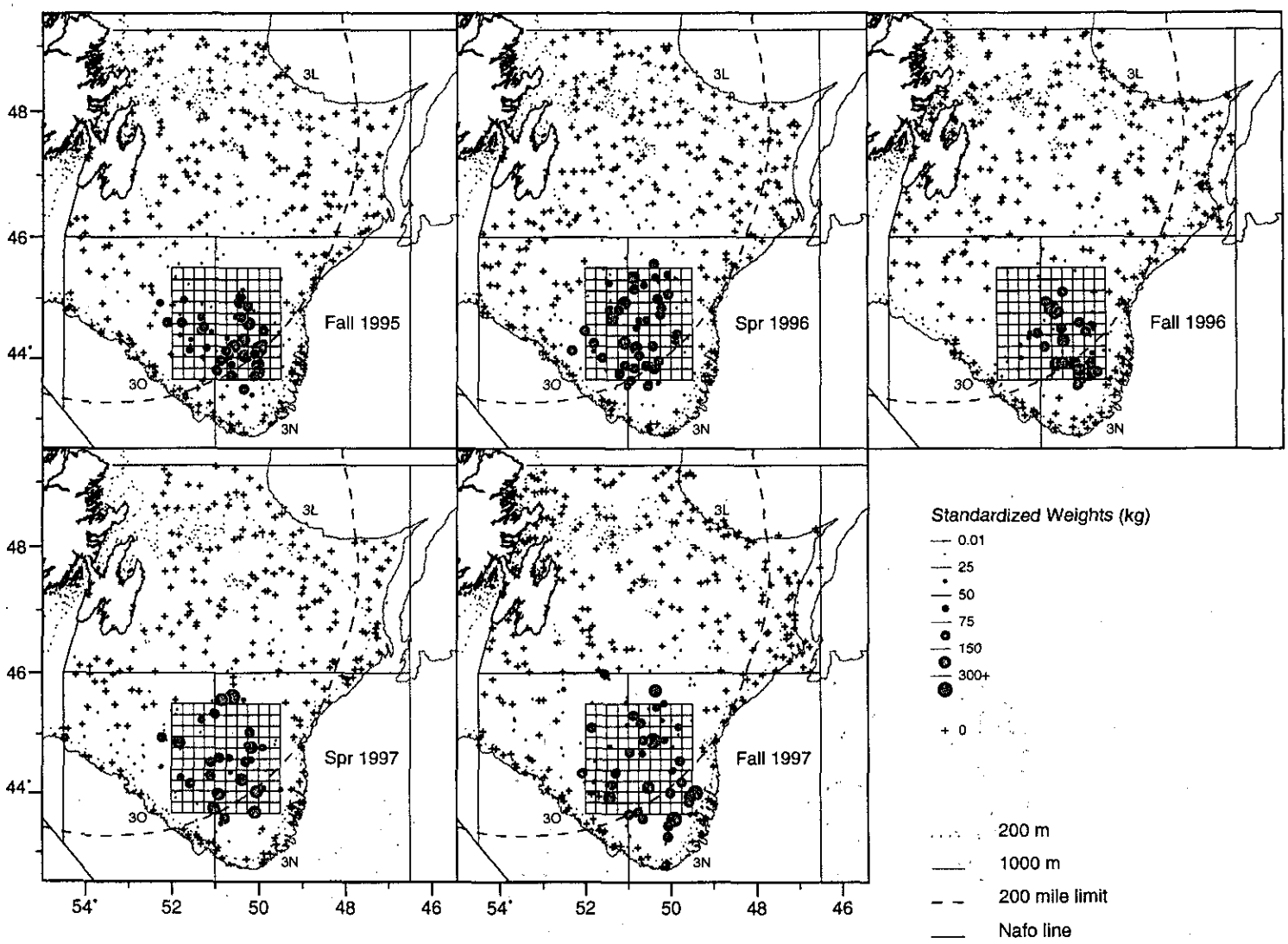


Fig. 16. Distribution of yellowtail (weight in kg. per set) from stratified random surveys conducted with a Campelen trawl in Div. 3LNO in 1995-97. Grid used in cooperative surveys is overlaid for illustration.

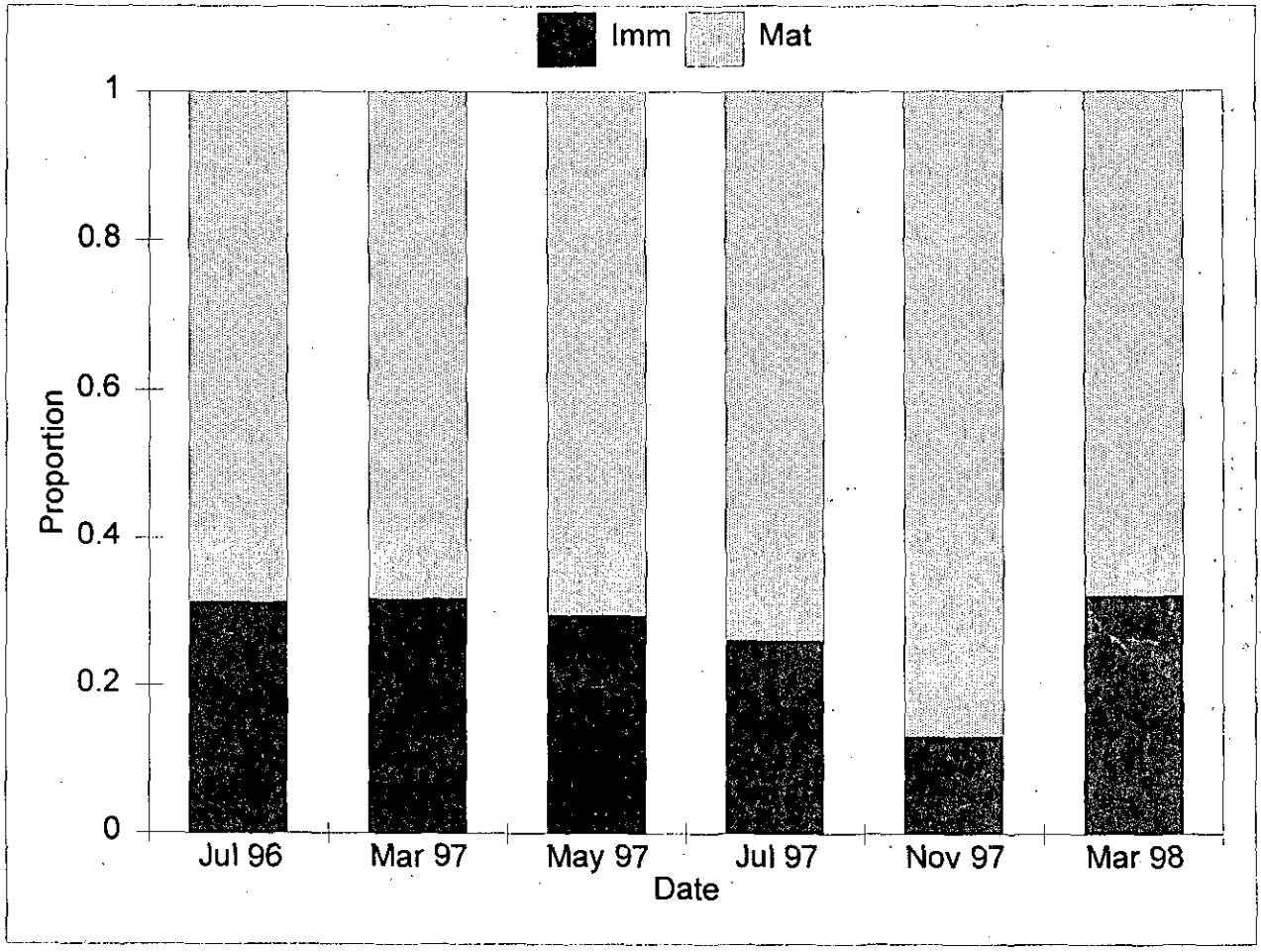


Fig. 17. Percentage of mature and immature yellowtail flounder caught on Atlantic Lindsey trips 1-6.

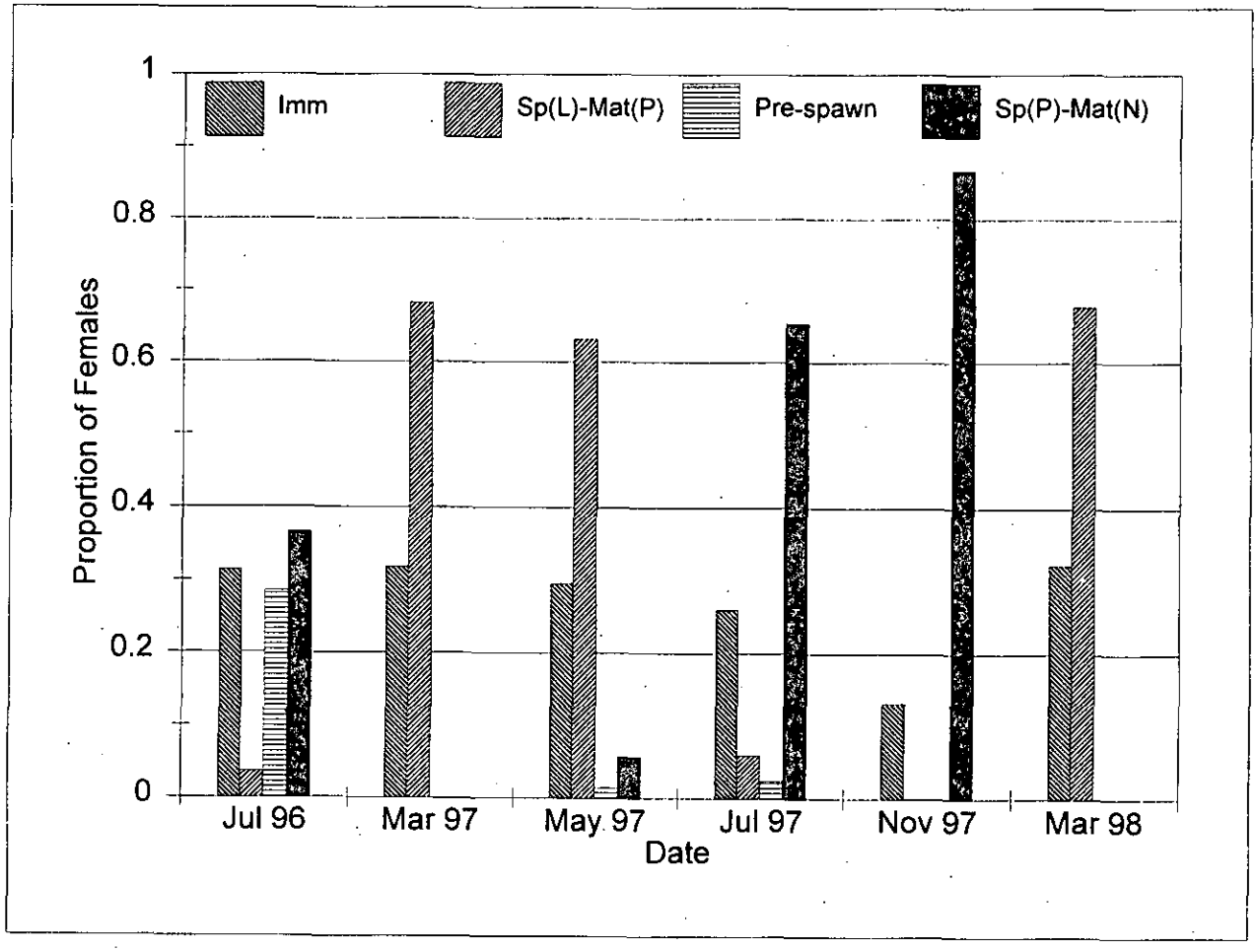


Fig. 18. Distribution of maturity stages of female yellowtail flounder caught on Atlantic Lindsey trips 1-6.

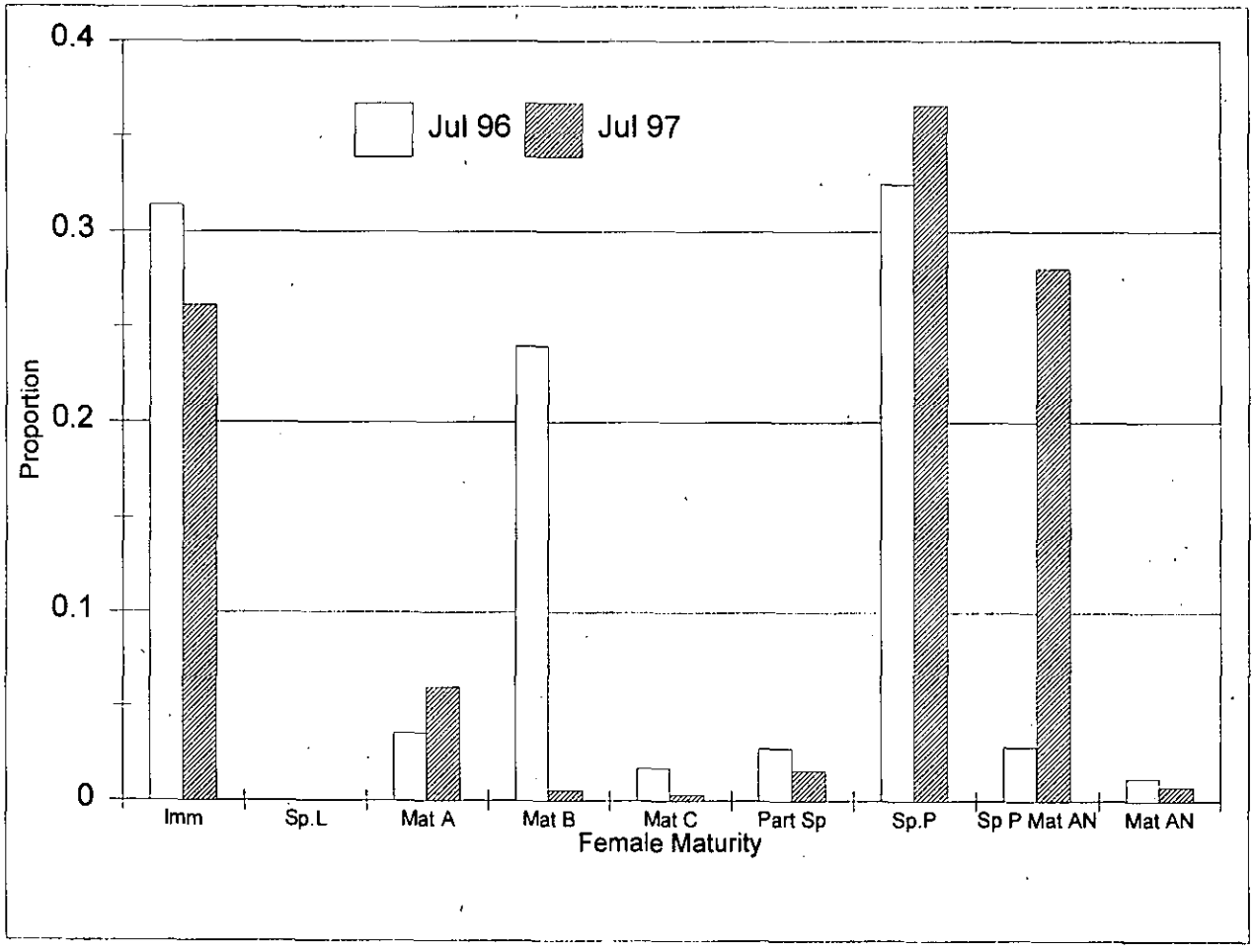


Fig. 19. Distribution of maturity stages of female yellowtail flounder caught on Atlantic Lindsey trips 1 and 4 (July 1996 and July 1997).