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Update on Cooperative Surveys of Yellowtail Flounder in NAFO Divisions 3NO, 1996-2001, Including Expanded Grid Surveys in Divisions 3LNO in 2000 and 2001.

by

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Abstract

Results from cooperative grid surveys indicate a large degree of spatial and temporal variability for yellowtail flounder in Div. 3LNO. Catches of yellowtail flounder were variable, but consistently high in July surveys (600-800 kg/hr) from 1996 through 2001. Catches of American plaice, cod and thorny skate also varied but were relatively stable at a lower level (less than 230 kg/hr) in those same surveys. The 2001 survey of the expanded grid area showed similar catch rates as the 2000 expanded grid survey, although higher yellowtail flounder catch rates shifted to the Div. 3L portion of the grid in 2001 from the northern Div. 3NO area in 2000. Other species showed catch rates and distribution similar to the 2000 survey.

Introduction

Cooperative trawl surveys directed for yellowtail flounder have been conducted in NAFO Divisions 3NO by the Canadian Department of Fisheries and Oceans (DFO) Newfoundland Region and a Newfoundland based fishing company, Fisheries Products International (FPI) Ltd. since July 1996. While the scientific and technical support for the surveys are the responsibility of DFO, FPI provides the vessel, crew, fishing gear, and related operating expenses for the surveys. These surveys are designed to provide data on the spatial distribution and abundance of yellowtail flounder in the survey area. This paper summarizes the results from the sixteen completed surveys in the period 1996 to 2001.

The surveys were designed to cover an area of approximately 9 500 square nautical miles, corresponding to the area where the yellowtail flounder stock is mainly distributed. Fourteen surveys covering the original grid area were conducted, 1 in 1996, 4 each in 1997 and 1998, 3 in 1999 and 1 each in 2000 and 2001. In 2000 and 2001 surveys that covered an expanded grid area were conducted. The additional 100 blocks were adjacent to the original grid, and covered an area equal in size.

Methods and Materials

Originally, the surveys were designed to cover an area of approximately 9 500 square nautical miles (bolded grid, Fig. 1), corresponding to the area where the yellowtail flounder stock is mainly distributed, and where the FPI fishery operated in most years prior to the 1994 NAFO-imposed moratorium on fishing. The original survey area grid is divided into l00 equal-sized blocks, and the same pre-selected position is fished, if possible, 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 flounder, 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. Fourteen surveys of the original grid area were conducted, 1 in 1996, 4 each in 1997 and 1998, 3 in 1999, and 1 each in 2000 and 2001. A July survey has been carried out in each of the 6 years.

In 2000, the grid area was expanded to cover an additional 100 blocks, an area equal in size and adjacent to the original grid (Fig. 1). Blocks in the expanded grid area are identified by row and column, with the exception of the labelled blocks. This expansion was necessary so that the survey would cover a larger portion of the yellowtail flounder stock, which has expanded its range since the start of the grid survey series in 1996. This expanded grid was surveyed immediately following the July survey of the original grid in 2000 and 2001, using the same vessel and fishing protocols.

The vessel used in all surveys to date was the *Atlantic Lindsey*, a 44 m total length, 665 G.R.T., 1500 HP commercial stern trawler in FPI's Newfoundland fleet. The fishing gear used is an Engel (96) 145 Hi-Lift otter trawl, with rockhopper footgear, and is reflective of trawls historically used by FPI in the yellowtail fishery (see Walsh and McCallum, 1999 for details). Brodie *et al.,* (1997) give an in-depth comparison of this trawl used onboard the *Atlantic Lindsey* with the standard survey gears (Enge1 145 Hi-Lift otter trawl, and Campelen 1800 shrimp trawl) 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 156 mm codend of this commercial trawl. 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 (see Walsh and McCallum, 1999).

Catch numbers and weights of all yellowtail flounder in the catch of each set were recorded. Similar catch data on other species such as American plaice, cod and thorny skate were also collected, along with biological sampling (size and maturity) data for yellowtail. Some temperature data have been collected using XBT's. To facilitate comparisons, as in the previous analysis (Maddock *et al.,* 2000), 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 (Fig. 1). Results from the original grid surveys are also compared with data from spring and fall stratified random surveys done by DFO (Walsh *et al.,* 2000). Results from the expanded grid surveys (August 2000 and 2001), are reported separately in this paper.

Results and Discussion

Catches from the original grid surveys: In the surveys of the original grid, between 50 and 85 fishing sets were conducted during each survey (Table 1). Data have been updated from previous years to correct a minor error in standardizing catch rates. For each of the four species examined, catch weights per tow in every March survey were lower than in other surveys (Table 1, Fig. 2). Catches for all four species are summarized by quadrant (Tables 2, 3, 4; Fig. 4) and NAFO Division (Table 5, Fig. 5) respectively. Excluding the March surveys, 41 of 44 quadrants yielded a mean CPUE for yellowtail flounder in excess of 400 kg per hour (Table 2). Mean CPUE of yellowtail flounder from 13 of 14 surveys was higher in Div. 3N, quadrants 2 and 3, than in quadrants 1 and 4 in Div. 30 (Table 5, Fig. 2a, 3a). Overall yellowtail and American plaice CPUE were highest in July of 1998 and July of 2000, and yellowtail flounder was lowest (excluding March data) in May-June of 1999 (Table 1).

Similar data for American plaice, cod and thorny skate are shown in Tables 3 and 4. Mean CPUE for American plaice was generally highest in quadrants 3 and 4 (Fig. 2b). For cod, mean CPUE was highest for quadrants 1 and 4, in Div. 3O (Fig. 2c and 3c). Quadrants 2 and 3 in Div. 3N had low catches. Quadrants 2 and 3 had higher thorny skate catches, in general, with little difference between Div. 3N and 3O (Fig. 2d and 3d).

Overall, 13 common blocks were fished in the 14 trips following the original grid design. Data for yellowtail flounder are given in Table 7, American plaice in Table 8, cod in Table 9 and thorny skate in Table 10. Yellowtail flounder mean CPUE is lowest in March for common blocks and generally highest in the July surveys. American plaice catch rates were highest in May and June of most years. Average cod catches were lowest in March and highest in July surveys. Thorny skate catch rates were more variable, but were generally lower in spring and higher in July and November surveys. To investigate the by-catch of American plaice, the ratio of American plaice to yellowtail flounder was calculated in each of the 13 common blocks fished in all fourteen surveys (Table 11). Several sets produced by-catch ratios less than 5% (highlighted), but no block consistently produced by-catch ratio

of less than 5%, the current by-catch limit in the Canadian fishery for yellowtail flounder. Furthermore, the overall mean by-catch for all blocks exceeded the 5% by-catch ratio. Excluding the ratios from the March 1999 survey, the majority of catches with a by-catch less than 5% occurred in the central portion of the grid (bounded by F4-H7). Largest by-catches of plaice are found in the southwest corner (quadrant 4) of the grid in Div. 30.

The July surveys (conducted from 1996 through 2001) have 43 common blocks. Tables 12-15 give catch rates for yellowtail flounder, American plaice, cod, and thorny skate respectively. By-catch ratios of less than 5% are most frequently found in the second quadrant (Table 16), and two blocks have an average American plaice by-catch ratio lower than 5%.

Figure 10 also gives an indication of the distribution of yellowtail flounder catches and American plaice by-catch. For each July survey, blocks fished are marked to indicate whether or not the catch criterion of >700 kg/hr was met (Π or O). A shaded block indicates that for that level of yellowtail flounder catch, the by-catch of American plaice was less than 5% (plots on the left) or 10% (plots on the right). Blank blocks were not fished. High catch rates of yellowtail were variable between years and in distribution over the grid area. Fewer blocks had by-catch of American plaice less than 5% or 10% in 2000. Figure 11 shows the same information for yellowtail flounder catches greater than 500 kg/hr. Many of the blocks surveyed met this yellowtail flounder catch criteria and 2000 had fewest with American plaice by-catch below 5% or 10%.

Catches from the expanded grid survey in August 2000 and 2001: Catch data from the expanded grid zone, surveyed for the first time in August 2000, and again in 2001, are included in Tables 1 and 6 and Fig. 3. For all 4 major species, catches were lower in the expanded grid compared to the original grid. Mean catch weight of yellowtail flounder was higher than that for cod and American plaice in both grid zones. The ratio of American plaice to yellowtail flounder catch was less than 5% in three blocks in Div. 3O (Table 6). Distributions of the catches are shown in Fig. 6-9.

Geographic distribution of trawl catches: ACON symbol plots (Black, 1993) of trawl catches for yellowtail flounder from previous surveys show that large catches, >300kg/trawl, were distributed throughout the region in the May/June, July, and November surveys (Maddock *et al*., 2000). During March surveys, large catches of yellowtail flounder were rare. For the 2000 and 2001 surveys large yellowtail flounder catches were distributed within the original grid (July 2000, July 2001). Of the expanded grid area surveyed, catches of yellowtail were higher in the northern Div. 3NO portion of the expanded grid in 2000 and in Div. 3L blocks in 2001 (Fig. 6) During previous grid surveys, some large catches of American plaice were present in each of the four quadrants (Maddock *et al*., 2000). In the 2001 surveys, larger catches were found in quadrants 3 and 4 and in the Div. 3L blocks of the expanded grid area (Fig. 7). Large cod catches appear to be distributed mainly in quadrants 1 and 4 in NAFO Div. 30 (Maddock *et al*., 2000) with some large catches in the Div. 3L portion of the August 2000 survey, and also outside the original grid in the Div. 3O portion of the 2001 surveys (Fig. 8). Large catches of thorny skate were dispersed over the original grid area in the 2000 surveys and were more prevalent in quadrants 3 and 4 in the 2001 surveys (Fig. 9). These distributions are similarly reflected in the trawl statistics in Tables 1-5.

Length Composition: Length composition of male and female yellowtail flounder caught during the 15 surveys are shown in Fig. 12 (a, b). In all surveys, less than 2% of fish captured were smaller than 26 cm in length and less than 11% of the catch was composed of individuals less than 30 cm in length (Table 17). Typically, yellowtail flounder 26-46 cm in length make up the bulk of the length frequencies of the catches and furthermore, female frequencies tended toward larger sizes than male frequencies in all surveys. Otoliths were not collected during the grid surveys and therefore age compositions were not calculated.

The male portion of the catch is given on each of the length frequency plots and is summarized in Fig. 13. March surveys show a higher percentage of males in the catch than surveys at other times, and a slight decline in male composition is apparent over the time series.

Comparison of results with commercial fishery data: Brodie *et al.* (1997) examined Div. 3N commercial CPUE data from the same class of vessel as the Atlantic Lindsey for the years 1970-91. This comparison indicated that the July 1996 survey CPUE for yellowtail flounder was similar to the maximum July CPUE, which occurred in the 1985 fishery. The low CPUE values seen in the March surveys of 1997-99 were not observed in the commercial fishery data.

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) and compared with grid survey results (e.g. Maddock *et al.*, 2001). Results from all grid surveys, with the exception of the 3 March trips, suggest widespread distribution of yellowtail flounder CPUE's which are quite high relative to historic CPUE in the fishery. However, caution must be used when making any comparisons between grid surveys and commercial fishing results. Although results from the commercial fishery, since it re-opened in 1998, have also shown relatively high CPUE for yellowtail flounder (Walsh *et al.*, 2001), it is unlikely that the CPUE from the current fishery is directly comparable with the pre-moratorium fishery, given changes in these fisheries.

Comparison of results with research vessel data: The distribution of yellowtail flounder from the 11 stratified random research vessel surveys conducted by DFO with the Campelen trawl in Div. 3LNO from 1995-2000 (6 fall surveys and 5 spring) was shown in Maddock *et al.,* (2000 and 2001). Results from the 2001 surveys, compared with 2000 are shown in Fig. 14. The grids, which are not part of the design of the DFO r.v. surveys, were superimposed on these plots. The original grid is bolded and the expanded grid, surveyed in 2000 and 2001 is also shown. In most surveys, the majority of the yellowtail is caught within the boundaries of the grid. However, there is a declining trend in the percentage of yellowtail found in the original grid (Table 18). In the first four surveys (fall 1995 to spring 1997), between 80 and 90% of yellowtail flounder were located within the grid. Since then, less than 72% of yellowtail flounder in any survey (except spring 2001) was located in the grid area. The lowest values occurred in the fall surveys during 2000 and 2001, when only 40-47% of yellowtail flounder in the surveys was found within the original grid.

For the spring surveys, about 90% of yellowtail flounder were contained within the expanded grid boundaries. However, during these 2 most recent fall surveys, only 56-67% of yellowtail flounder was found inside the expanded grid. Most yellowtail flounder outside the grid, both in spring and fall, were located to the south. Overall, these observations are consistent with observed increases in the area of distribution of yellowtail flounder in recent years, as seen in both the survey and commercial fishery data. These increases in the range of distribution are also consistent with increases in stock size since the late-1990s (Brodie *et al.,* 1998).

Observations on sexual maturity of yellowtail flounder: In all surveys thus far, with the exception of November 1998, observations on sexual maturity of yellowtail flounder have been collected. These were generally obtained at sea by sampling 300-400 fish from each of 2 fishing sets per day, although the March 1998 data were collected from port samples immediately following the survey. Fig. 15 indicates that on average, about 75% of the female yellowtail flounder caught were mature, and that there was a slight increasing seasonal trend in the 4 surveys in 1997 and the 3 in 1999. The July 1999 survey had the highest percentage of mature females in the time series, while the proportion mature from the 1999-2001 surveys was higher than that from 1996 to 1998. A closer look at the data from the 6 July surveys (Fig. 16) showed that most mature females had spawned prior to the surveys, although in 1996 spawning had not been completed in the grid area by July, as evidenced by the higher number of females with hydrated eggs (Mat B and Mat C stages). By comparison, the July 1997 survey had the highest percentage of females judged to be maturing following a recent spawning (Sp. P Mat AN), and the lowest percentage of females with hydrated eggs, suggesting that spawning may have been earliest in 1997. The percentage of spent females in 2001 was similar to the low value seen in 1996, and this combined with the highest percentage of pre-spawning females (Mat A), suggests that spawning may have been later in 2001 than in the other years.

Conclusions

Cooperative surveys between DFO and FPI for yellowtail flounder in Div. 3LNO indicate a large degree of spatial and temporal variability. Catches of yellowtail flounder and American plaice in July surveys of the original grid have been consistent at around 600-800 kg/hr and 100-200 kg/hr respectively. Catch rates in the expanded grid surveys are slightly lower for all species considered when compared to the original grid, but are similar in 2001 to those in 2000.

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Table 1a. Catches (kg/hr) by species and trip from FPI/DFO cooperative grid surveys, original grid area.

Species	Trip	Trip #	N	Mean	StdDev	Max	Min
Yellowtail Flounder	Jul96	1	83	693.51	478.81	2503.57	34.00
	Mar97	2	68	123.99	605.47	4972.44	0.00
	May/Jun97	3	82	608.03	602.88	4607.00	24.50
	Jul97	4	85	666.41	478.62	3369.10	17.50
	Nov97	5	50	627.37	926.85	5931.00	3.50
	Mar98	6	84	74.99	91.65	427.74	0.00
	May/Jun98	7	73	653.62	504.02	2872.62	67.00
	Jul98	8	78	803.78	533.24	2678.27	0.00
	Nov98	9	63	553.61	776.78	5726.06	1.00
	Mar99	10	73	145.21	136.96	536.40	0.30
	May/Jun99	12	78	505.40	405.31	2289.80	57.60
	Jul99	13	64	583.62	341.75	1489.00	8.00
	Jul00	14	65	802.74	521.12	3319.19	62.00
	Jul01	16	72	752.24	416.05	1979.66	6.36
American Plaice	Jul96	1	83	106.73	125.89	942.94	3.00
	Mar97	2	68	20.44	44.23	234.50	0.00
	May/Jun97	3	82	168.57	133.70	759.80	3.50
	Jul97	4	85	180.92	265.55	1654.40	0.00
	Nov97	5	50	131.78	94.88	492.90	23.30
	Mar98	6	84	19.49	40.31	246.74	0.00
	May/Jun98	7	73	173.18	111.74	785.46	33.02
	Jul98	8	78	229.29	361.15	2197.82	12.72
	Nov98	9	63	136.74	106.51	471.60	13.78
	Mar99	10	73	17.53	47.55	330.00	0.00
	May/Jun99	12	80	176.22	158.31	890.08	21.20
	Jul99	13	64	151.72	175.80	975.20	8.48
	Jul00	14	65	219.43	203.19	1117.24	30.18
	Jul01	16	72	187.95	269.04	1534.35	22.79
Cod	Jul96	1	83	105.64	282.99	2509.09	0.00
	Mar97	2	68	0.76	1.95	10.00	0.00
	May/Jun97	3	82	43.82	65.66	308.00	0.00
	Jul97	4	85	71.38	110.58	644.00	0.00
	Nov97	5	50	72.08	103.38	411.50	0.00
	Mar98	6	84	3.09	10.46	55.00	0.00
	May/Jun98	7	73	55.47	95.07	400.00	0.00
	Jul98	8	78	106.47	248.92	1273.80	0.00
	Nov98	9	63	41.18	121.01	917.70	0.00
	Mar99	10	73	1.94	10.24	86.00	0.00
	May/Jun99	12	80	70.91	139.40	1005.87	0.00
	Jul99	13	64	192.85	773.21	6067.20	0.00
	Jul00	14	65	69.71	126.80	877.80	0.00
	Jul01	16	72	74.28	109.88	739.20	0.00
T. Skate	Jul96	1	83	62.48	74.05	435.50	0.00
	Mar97	2	68	28.00	50.74	281.00	0.00
	May/Jun97	3	82	33.61	36.77	135.00	0.00
	Jul97	4	85	96.99	174.70	922.50	0.00
	Nov97	5	50	166.27	239.29	1216.00	0.00
	Mar98	6	84	43.48	88.55	502.74	0.00
	May/Jun98	7	73	25.04	60.55	450.00	0.00
	Jul98	8	78	113.97	160.28	975.00	0.00
	Nov98	9	63	102.82	108.36	440.00	0.00
	Mar99	10	73	45.28	106.55	595.00	0.00
	May/Jun99	12	80	54.10	47.81	258.67	5.40
	Jul99	13	64	72.27	68.38	429.00	0.00
	Jul00	14	65	114.68	142.23	743.75	3.00
	Jul01	16	72	70.43	74.85	318.00	0.00

Table 1b. Catches (kg/hr) by species and trip from FPI/DFO cooperative grid surveys, expanded grid area.

Yellowtail Flounder	Aug00	15	83	419.32	346.50	1519.49	10.00
	Aug01	17	80	451.42	374.19	1704.48	14.50
American Plaice	Aug00	15	83	132.05	173.57	934.51	6.00
	Aug01	17	80	129.90	205.68	1159.46	5.30
Cod	Aug00	15	83	51.96	58.05	340.80	0.00
	Aug01	17	80	88.30	199.69	1674.40	0.00
T. Skate	Aug00	15	83	12.47	30.64	227.50	0.00
	Aug01	17	80	14.51	37.39	224.00	0.00

Table 2. Catch statistics by quadrant for yellowtail flounder within FPI/DFO original grid survey area.

Trip	Trip #	Quad	N	Mean	Sum	StdDev	Max	Median
Jul96	1	1	22	861.58	18954.73	565.99	2503.57	730.34
		2	16	607.93	9726.82	443.18	1818.10	472.21
		3	22	736.49	16202.83	442.81	1921.09	729.22
		4	23	551.17	12676.86	413.57	1560.34	526.79
Mar97	2	1	14	21.30	298.20	17.56	60.00	20.75
		2	17	394.16	6700.67	1195.12	4972.44	40.50
		3	20	40.01	800.25	43.46	148.00	20.00
		4	17	37.18	632.12	26.50	88.00	29.50
May/Jun97	3	1	22	774.99	17049.79	1006.21	4607.00	440.05
		2	16	668.62	10697.90	490.99	1911.00	539.76
		3	22	433.23	9531.09	271.63	850.00	435.00
		4	22	571.80	12579.58	279.51	976.63	633.94
Jul97	4	1	23	747.16	17184.77	754.39	3369.10	567.38
		2	16	664.71	10635.33	243.14	1396.97	600.97
		3	23	651.24	14978.46	389.24	1669.00	589.50
		4	23	602.03	13846.67	319.92	1382.50	513.20
Nov97	5	1	17	457.49	7777.29	415.57	1533.48	366.50
		2	8	1522.31	12178.47	1910.54	5931.00	909.65
		3	10	661.69	6616.87	681.05	2519.00	481.42
		4	15	319.74	4796.11	301.86	1016.90	276.00
Mar98	6	1	19	14.52	275.93	24.94	107.27	5.00
		2	15	66.63	999.48	91.86	299.60	25.91
		3	27	121.00	3266.87	108.59	427.74	83.18
		4	23	76.38	1756.81	77.91	316.00	48.63
May/Jun98	7	1	18	649.05	11682.89	650.48	2872.62	435.14
		2	15	862.14	12932.14	677.52	2398.70	779.70
		3	20	721.86	14437.19	344.34	1734.08	593.36
		4	20	433.10	8662.04	191.96	795.80	426.72
Jul98	8	1	22	768.13	16898.91	648.31	2678.27	535.64
		2	15	974.26	14613.88	516.81	2284.75	858.87
		3	20	869.76	17395.22	358.88	1611.73	830.83
		4	21	656.51	13786.64	541.99	2383.01	647.23
Nov98	9	1	13	458.44	5959.68	318.98	1128.83	476.20
		2	15	978.03	14670.40	1406.47	5726.06	555.04
		3	14	715.63	10018.87	399.40	1495.87	672.97
		4	21	201.34	4228.18	177.23	632.59	175.17
Mar99	10	1	14	84.79	1187.10	102.26	394.40	44.95
		2	15	185.59	2783.81	173.62	510.93	128.80
		3	21	222.04	4662.87	148.79	536.40	190.40
		4	23	85.49	1966.31	55.73	200.61	80.80
May/Jun99	12	1	17	665.20	11308.44	670.96	2289.83	457.53
		2	17	306.77	5215.13	169.38	692.11	255.00
		3	23	483.40	11118.16	181.99	905.78	459.60
		4	23	559.90	12877.65	376.10	1464.48	456.35
Jul99	13	1	19	616.10	11705.82	383.01	1488.97	624.04
		2	12	530.82	6369.80	258.67	914.95	534.16
		3	11	534.74	5882.09	300.62	1087.21	467.12
		4	22	608.80	13393.53	376.94	1438.47	610.25
Jul00	14	1	17	903.22	15354.82	820.65	3319.19	632.81
		2	14	844.77	11826.73	330.74	1471.18	851.98
		3	16	818.13	13090.12	412.63	1478.99	842.37
		4	18	661.45	11906.11	348.91	1439.33	639.83
Jul01	16	1	19	805.51	15304.63	528.87	1979.66	709.14
		2	14	736.65	10313.12	391.60	1606.27	723.76
		3	19	746.28	14179.26	271.80	1228.91	693.66
		4	20	718.22	14364.47	450.18	1449.69	661.98

Table 3. Catch statistics by quadrant for American plaice within FPI/DFO original grid survey area.

Trip	Trip #	Quad	N	Mean	Sum	StdDev	Max	Median
Jul96	1	1	22	64.29	1414.40	57.78	232.80	46.00
		2	16	56.02	896.30	45.89	183.50	42.40
		3	22	162.94	3584.67	202.29	942.94	95.25
		4	23	128.84	2963.31	89.71	420.23	124.00
Mar97	2	1	14	3.34	46.80	2.65	7.80	3.50
		2	17	31.39	533.60	63.35	212.44	3.75
		3	20	8.80	176.00	9.84	35.50	4.25
		4	17	37.28	633.69	56.61	234.50	15.00
May/Jun97	3	1	22	131.41	2890.94	78.66	414.50	114.20
		2	16	85.32	1365.17	39.34	171.00	78.60
		3	22	134.07	2949.45	75.52	292.17	133.05
		4	22	300.77	6616.99	172.23	759.80	228.25
Jul97	4	1	23	71.05	1634.15	54.25	211.28	44.44
		2	16	100.04	1600.61	93.90	321.55	60.92
		3	23	325.66	7490.07	453.96	1654.40	104.74
		4	23	202.30	4653.01	120.24	498.24	214.30
Nov97	5	1	17	107.15	1821.63	117.03	492.90	58.83
		2	8	135.17	1081.32	53.58	222.60	128.83
		3	10	107.27	1072.71	59.98	254.40	83.19
		4	15	174.22	2613.30	94.88	329.13	132.50
Mar98	6	1	19	0.81	15.34	0.78	2.00	0.46
		2	15	4.67	69.99	5.91	17.27	1.36
		3	27	9.83	265.42	6.37	25.45	11.82
		4	23	55.94	1286.69	64.07	246.74	35.91
May/Jun98	7	1	18	141.41	2545.29	93.10	339.20	104.68
		2	15	126.50	1897.56	61.92	235.32	120.84
		3	20	223.17	4463.33	157.91	785.46	206.40
		4	20	186.80	3735.97	79.39	415.52	171.72
Jul98	8	1	22	84.74	1864.30	80.45	271.78	43.99
		2	15	84.09	1261.37	74.44	241.15	44.52
		3	20	510.21	10204.13	615.66	2197.82	314.43
		4	21	216.91	4555.17	116.27	431.42	227.68
Nov98	9	1	13	139.94	1819.21	113.97	457.13	89.04
		2	15	104.10	1561.43	90.10	316.48	65.72
		3	14	141.13	1975.84	127.39	411.81	87.72
		4	21	155.15	3258.13	99.84	471.60	137.14
Mar99	10	1	14	1.20	16.75	0.81	2.60	1.40
		2	15	6.29	94.41	10.78	41.00	1.90
		3	21	8.24	173.13	5.28	18.20	7.20
		4	23	43.27	995.20	79.17	330.00	10.40
May/Jun99	12	1	17	73.51	1249.60	33.08	142.46	72.60
		2	17	56.14	954.36	28.22	129.32	47.70
		3	23	269.44	6197.16	192.12	890.08	233.36
		4	23	247.66	5696.24	134.13	644.07	227.40
Jul99	13	1	19	55.13	1047.45	46.47	204.56	50.46
		2	12	39.24	470.83	34.03	122.96	30.74
		3	11	322.51	3547.66	246.42	975.20	277.69
		4	22	211.09	4644.02	163.38	714.75	164.14
Jul00	14	1	17	123.12	2093.07	106.67	447.53	83.85
		2	14	105.86	1482.01	83.72	367.56	77.65
		3	16	373.42	5974.68	275.46	1117.24	372.59
		4	18	261.85	4713.24	168.22	542.63	217.20
Jul01	16	1	19	87.71	1666.47	92.03	388.49	50.88
		2	14	85.66	1199.30	56.32	237.44	74.47
		3	19	414.85	7882.13	437.72	1534.35	227.37
		4	20	139.23	2784.53	83.85	306.09	123.23

Table 4. Catch statistics by quadrant for cod within FPI/DFO original grid survey area.

Trip	Trip #	Quad	N	Mean	Sum	StdDev	Max	Median
Jul96	1	1	22	226.66	4986.59	521.82	2509.09	76.50
		2	16	19.06	305.00	18.87	53.00	14.50
		3	22	42.31	930.80	79.33	295.00	5.00
		4	23	110.67	2545.32	90.43	314.00	78.00
Mar97	2	1	14	0.87	12.20	1.53	5.50	0.00
		2	17	0.11	1.80	0.37	1.50	0.00
		3	20	1.02	20.45	2.45	10.00	0.00
		4	17	1.00	17.00	2.47	10.00	0.00
May/Jun97	3	1	22	84.62	1861.70	86.53	308.00	44.60
		2	16	10.77	172.25	11.82	36.00	7.20
		3	22	5.59	122.89	13.35	51.00	0.00
		4	22	65.31	1436.71	65.36	252.00	38.40
Jul97	4	1	23	112.83	2595.09	110.67	380.00	66.09
		2	16	25.01	400.15	31.59	133.30	22.66
		3	23	18.52	426.02	30.42	148.17	10.00
		4	23	115.05	2646.17	156.71	644.00	63.96
Nov97	5	1	17	28.15	478.50	70.06	293.40	4.80
		2	8	14.06	112.50	20.54	45.60	0.25
		3	10	169.86	1698.60	120.64	383.40	166.20
		4	15	87.61	1314.20	104.28	411.50	48.00
Mar98	6	1	19	0.15	2.85	0.48	1.94	0.00
		2	15	0.00	0.00	0.00	0.00	0.00
		3	27	1.17	31.60	3.01	14.78	0.00
		4	23	9.78	224.87	18.35	55.00	0.45
May/Jun98	7	1	18	87.01	1566.15	97.99	312.75	48.30
		2	15	7.62	114.25	18.00	66.00	0.00
		3	20	40.46	809.20	114.31	400.00	0.00
		4	20	78.00	1560.00	93.96	297.60	32.70
Jul98	8	1	22	250.63	5513.88	404.81	1273.80	120.30
		2	15	12.49	187.40	21.12	77.20	0.00
		3	20	27.65	553.00	86.90	391.20	2.70
		4	21	97.62	2050.08	152.37	625.68	42.00
Nov98	9	1	13	25.15	326.90	48.75	182.40	7.20
		2	15	17.11	256.63	39.65	153.53	2.00
		3	14	29.49	412.80	39.33	126.00	12.00
		4	21	76.10	1598.00	199.70	917.70	13.00
Mar99	10	1	14	0.76	10.70	1.27	3.40	0.00
		2	15	0.49	7.40	1.65	6.40	0.00
		3	21	0.36	7.50	0.94	3.20	0.00
		4	23	5.03	115.80	18.02	86.00	0.00
May/Jun99	12	1	17	137.20	2332.35	234.38	1005.87	76.20
		2	17	20.34	345.86	41.30	135.80	0.00
		3	23	19.48	448.00	36.80	142.08	0.00
		4	23	110.72	2546.52	132.05	510.24	59.04
Jul99	13	1	19	501.85	9535.15	1384.48	6067.20	94.40
		2	12	28.00	336.00	45.78	115.20	0.00
		3	11	44.60	490.60	67.74	219.60	15.60
		4	22	90.03	1980.63	151.03	609.73	28.80
Jul00	14	1	17	98.87	1680.80	99.09	386.00	60.00
		2	14	11.65	163.10	20.19	73.20	1.75
		3	16	45.26	724.20	60.99	225.20	22.20
		4	18	109.07	1963.20	204.62	877.80	52.80
Jul01	16	1	19	118.42	2250.00	174.97	739.20	76.80
		2	14	20.27	283.80	16.88	64.20	14.10
		3	19	49.83	946.80	63.32	261.60	28.80
		4	20	93.39	1867.80	83.89	351.60	82.80

Table 5. Catch statistics by quadrant for thorny skate within FPI/DFO original grid survey area.

Trip	Trip #	Quad	N	Mean	Sum	StdDev	Max	Median
Jul96	1	1	22	40.89	899.50	62.24	232.50	16.00
		2	16	26.53	424.50	32.71	107.00	13.00
		3	22	99.44	2187.77	104.34	435.50	73.00
		4	23	72.80	1674.35	52.30	195.00	56.00
Mar97	2	1	14	5.54	77.50	6.19	19.00	2.75
		2	17	5.63	95.75	6.88	22.50	3.50
		3	20	19.70	394.00	22.90	74.00	12.50
		4	17	78.62	1336.50	79.37	281.00	83.50
May/Jun97	3	1	22	6.05	133.00	8.25	29.50	2.50
		2	16	10.27	164.28	11.45	33.00	8.75
		3	22	46.68	1026.99	37.46	135.00	40.57
		4	22	65.06	1431.39	34.99	127.00	61.75
Jul97	4	1	23	35.07	806.60	77.03	378.00	16.00
		2	16	23.14	370.25	32.51	132.00	14.00
		3	23	234.35	5390.00	274.78	922.50	164.00
		4	23	72.94	1677.59	77.93	336.00	43.00
Nov97	5	1	17	35.50	603.50	66.40	216.00	10.50
		2	8	379.29	3034.35	438.75	1216.00	140.13
		3	10	329.46	3294.56	194.25	799.25	251.41
		4	15	92.07	1381.00	56.96	192.00	76.00
Mar98	6	1	19	4.35	82.60	5.70	22.00	3.18
		2	15	3.51	52.72	3.24	10.00	2.73
		3	27	17.08	461.12	13.83	56.82	15.00
		4	23	132.87	3056.09	133.04	502.74	106.36
May/Jun98	7	1	18	5.22	94.00	14.98	60.00	0.00
		2	15	8.13	122.00	16.86	58.00	0.00
		3	20	15.80	316.00	21.07	74.00	4.00
		4	20	64.80	1296.00	103.37	450.00	27.50
Jul98	8	1	22	56.88	1251.39	98.28	423.50	28.07
		2	15	57.37	860.50	92.10	370.00	32.00
		3	20	157.70	3154.00	184.33	760.50	97.00
		4	21	172.57	3624.00	197.59	975.00	147.00
Nov98	9	1	13	71.69	932.00	116.36	440.00	38.00
		2	15	59.61	894.09	80.78	301.33	27.00
		3	14	183.87	2574.18	133.76	440.00	193.00
		4	21	98.91	2077.12	73.71	240.00	71.00
Mar99	10	1	14	8.38	117.30	8.09	28.40	5.10
		2	15	7.61	114.20	8.16	23.60	5.40
		3	21	16.30	342.20	12.12	41.40	11.40
		4	23	118.76	2731.58	169.29	595.00	34.40
May/Jun99	12	1	17	31.04	527.60	27.04	101.40	22.00
		2	17	24.86	422.70	18.72	78.50	23.00
		3	23	58.55	1346.67	50.00	258.67	43.00
		4	23	88.30	2030.91	51.04	175.00	87.31
Jul99	13	1	19	39.13	743.50	26.24	89.00	38.00
		2	12	63.13	757.50	117.22	429.00	33.25
		3	11	63.09	694.00	15.30	95.50	64.00
		4	22	110.45	2430.00	59.30	241.00	104.00
Jul00	14	1	15	71.23	1068.50	83.44	304.00	47.50
		2	14	94.29	1320.00	193.71	743.75	33.00
		3	11	160.95	1770.42	208.51	740.67	88.50
		4	14	151.74	2124.33	89.80	330.00	103.50
Jul01	16	1	11	106.43	1170.75	96.00	315.00	22.00
		2	83	12.47	1034.68	30.64	227.50	21.50
		3	72	70.43	5070.95	74.85	318.00	52.00
		4	74	15.63	1156.63	38.67	224.00	87.25

Table 6. Catches (kg/hr) by NAFO division from FPI grid surveys.

			Yellowtail		American Plaice		Cod		T. Skate	
Trip	Trip #	NAFO	N	Mean	N	Mean	N	Mean	N	Mean
Jul96	1	3N	46	749.06	46	108.27	46	40.41	46	65.20
		3O	37	644.01	37	105.74	37	200.73	37	59.10
Mar97	2	3N	44	175.29	44	16.83	44	0.68	44	12.12
		3O	24	32.12	24	27.95	24	0.90	24	57.10
May/Jun97	3	3N	47	676.42	47	128.94	47	18.65	47	31.37
		3O	35	570.54	35	235.79	35	88.70	35	36.61
Jul97	4	3N	49	694.44	49	205.78	49	32.16	49	135.38
		3O	36	624.37	36	146.57	36	124.25	36	44.74
Nov97	5	3N	24	901.68	24	118.08	24	99.16	24	291.64
		3O	26	374.17	26	144.42	26	47.08	26	50.54
Mar98	6	3N	50	93.11	50	8.07	50	1.19	50	11.62
		3O	34	56.15	34	38.18	34	6.62	34	90.34
May/Jun98	7	3N	44	796.68	44	172.53	44	32.24	44	10.59
		3O	29	440.51	29	175.45	29	90.40	29	46.97
Jul98	8	3N	44	925.85	44	280.98	44	25.92	44	114.93
		3O	34	654.00	34	162.54	34	213.54	34	112.73
Nov98	9	3N	36	753.75	36	119.62	36	31.66	36	115.33
		3O	27	299.06	27	162.58	27	58.41	27	86.13
Mar99	10	3N	44	193.14	44	7.91	44	0.48	44	13.72
		3O	29	79.05	29	32.26	29	4.25	29	93.16
May/Jun99	12	3N	46	470.91	46	175.18	46	18.62	47	42.50
		3O	32	554.97	32	171.18	32	148.98	33	70.62
Jul99	13	3N	31	601.43	31	157.66	31	40.07	31	63.31
		3O	33	566.88	33	146.14	33	336.37	33	80.68
Jul00	14	3N	36	808.97	36	250.94	36	33.43	36	114.04
		3O	29	795.00	29	180.32	29	114.75	29	115.47
Jul01	16	3N	41	811.05	41	246.46	41	35.52	41	64.72
		3O	31	674.46	31	110.57	31	125.55	31	77.98
*Trips 15 and 17 survey an expanded area outside the original grid design.										
*Aug00	15	3N	15	735.24	15	83.12	15	36.91	15	5.80
		3O	18	351.31	18	48.20	18	48.43	18	18.17
		3L	50	349.03	50	176.92	50	57.75	50	12.41
*Aug01	17	3N	15	538.80	15	84.04	15	58.08	15	12.43
		3O	17	450.82	17	69.95	17	203.22	17	42.26
		3L	48	423.89	48	165.42	48	57.56	48	5.33

Table 7. Catches of yellowtail flounder (kg/hr) from common blocks fished in fourteen original grid surveys.

Block	Jul96	Mar97	May97	Jul97	Nov97	Mar98	May/ Jun98	Jul98	Nov98	Mar99	May/ Jun99	Jul99	Jul00	Jul01
A01	1315.9	7.0	234.9	997.6	436.8	26.8	797.0	2236.8	741.9	23.8	1981.5	1489.0	1132.4	1979.7
A03	1086.9	23.7	204.0	690.8	300.8	6.0	603.5	835.1	621.8	394.4	378.2	520.2	3319.2	797.4
A05	1410.5	35.5	421.8	167.0	1533.5	17.0	323.0	418.7	628.9	39.5	195.4	720.2	398.9	403.4
B02	321.0	0.0	210.0	482.3	44.5	0.0	477.6	379.3	45.0	11.0	168.0	124.5	165.7	163.1
B09	254.2	36.0	142.0	582.3	9.0	59.1	469.1	26.0	9.5	9.4	214.0	101.0	486.8	302.6
C10	1430.9	88.0	716.5	1014.1	50.5	316.0	795.8	503.6	59.9	100.4	1464.5	528.2	722.3	556.4
E08	1167.9	11.0	714.0	506.5	313.9	15.5	594.1	898.1	250.6	100.2	1069.3	883.6	651.8	1228.2
F05	1818.1	498.3	935.6	1397.0	5931.0	66.4	2245.0	2284.8	589.8	252.5	182.9	170.5	959.6	959.3
G03	344.7	81.0	322.0	518.5	87.0	47.7	907.7	1039.3	695.6	375.7	172.2	667.3	642.2	742.4
G04	868.7	4972.4	610.2	451.1	2023.2	299.6	592.6	899.0	5726.1	251.7	410.4	538.9	1096.6	837.7
G07	721.7	28.5	638.9	711.3	548.5	1231.4	1734.1	1042.1	934.5	201.1	481.3	589.4	246.1	655.7
H04	357.6	205.0	457.0	684.7	377.1	141.4	779.7	941.4	1245.7	432.8	191.0	419.6	689.0	641.6
H08	736.7	7.5	697.4	631.6	414.4	58.2	695.7	735.0	236.8	138.7	294.2	220.9	579.8	884.3
Mean	910.4	461.1	484.9	679.6	928.5	175.8	847.3	941.5	906.6	179.3	554.1	536.4	853.1	780.9

Table 8. Catches of American plaice (kg/hr) from common blocks fished in fourteen surveys.

Block	Jul96	Mar97	May97	Jul97	Nov97	Mar98	May/ Jun98	Jul98	Nov98	Mar99	May/ Jun99	Jul99	Jul00	Jul01
A01	232.8	3.5	102.7	114.3	41.0	0.5	285.7	218.9	184.9	0.4	118.7	204.6	187.9	388.5
A03	84.5	7.8	186.0	41.0	196.1	2.0	269.6	213.4	238.7	1.8	142.5	56.5	176.9	149.5
A05	110.0	3.5	162.2	35.0	492.9	2.0	125.2	152.6	204.1	0.3	96.6	104.4	47.7	26.5
B02	45.0	0.0	81.0	158.7	51.0	0.0	245.5	77.2	57.5	2.6	72.6	56.0	53.0	30.7
B09	420.2	45.0	519.4	326.9	176.1	246.7	169.6	200.1	267.5	105.0	315.6	276.2	166.1	149.1
C10	293.0	85.0	362.5	349.5	329.1	89.1	217.3	309.7	213.7	38.2	405.6	85.1	138.1	81.8
E08	92.0	3.5	198.0	106.0	82.7	6.4	100.2	274.5	184.4	8.6	201.6	187.8	347.2	293.1
F05	20.0	170.6	42.3	22.3	106.0	17.3	67.8	15.9	37.1	16.8	21.2	26.0	74.6	54.1
G03	47.5	18.0	91.0	39.2	72.1	1.4	178.1	54.1	74.2	12.5	55.0	15.9	70.8	80.6
G04	39.0	212.4	83.3	30.6	169.6	15.5	103.9	44.5	163.8	41.0	47.7	8.5	41.9	42.4
G07	80.0	3.0	185.7	86.8	70.0	68.3	367.3	382.7	111.3	8.2	233.4	265.3	386.5	185.0
H04	42.0	15.0	78.0	75.3	72.1	5.5	82.7	40.8	183.7	7.8	42.8	79.5	48.8	23.9
H08	124.0	3.5	181.9	155.4	82.7	15.0	244.7	33.9	90.6	12.8	494.5	317.2	376.8	1395.0
Mean	125.4	43.9	174.9	118.5	149.3	36.1	189.0	155.3	154.7	19.7	172.9	129.5	162.8	223.1

Table 9. Catches of cod (kg/hr) from common blocks fished in fourteen surveys.

Block	Jul96	Mar97	May97	Jul97	Nov97	Mar98	May/ Jun98	Jul98	Nov98	Mar99	May/ Jun99	Jul99	Jul00	Jul01
A01	506.0	0.0	51.0	101.3	0.0	0.0	5.4	141.0	1.5	2.4	66.8	94.4	10.2	52.8
A03	274.0	0.0	175.2	280.6	4.8	0.0	28.8	16.8	12.0	0.0	125.6	107.4	386.0	111.0
A05	2509.1	0.0	260.0	232.9	19.2	0.0	312.8	1208.7	182.4	0.0	1005.9	6067.2	166.8	739.2
B02	168.0	1.2	75.6	38.0	0.5	0.0	63.6	136.3	3.6	0.0	84.6	64.5	60.0	29.4
B09	89.0	0.0	0.0	87.0	6.0	1.4	66.0	33.0	30.0	0.0	303.7	84.5	0.0	49.2
C10	33.0	0.0	0.0	16.0	20.4	55.0	47.4	31.2	0.0	0.0	65.3	56.4	36.0	28.8
E08	145.2	0.0	252.0	65.0	66.0	1.8	201.0	43.8	205.8	0.0	0.0	217.2	21.6	85.2
F05	4.0	0.0	1.8	5.3	0.0	0.0	0.0	0.0	30.0	0.0	0.0	0.0	0.0	13.8
G03	2.5	0.0	11.0	24.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	9.0
G04	28.0	0.0	4.1	32.0	22.0	0.0	0.0	13.2	1.2	0.0	0.0	0.0	0.0	4.2
G07	190.0	0.7	14.8	22.4	312.0	0.0	0.0	59.4	71.4	0.0	142.1	98.4	120.0	30.6
H04	26.0	0.0	10.8	24.5	44.4	0.0	0.0	0.0	0.0	0.0	135.8	0.0	0.0	7.2
H08	0.0	0.0	0.0	0.0	9.0	0.0	0.0	4.2	0.0	0.0	0.0	0.0	0.0	13.2
Mean	305.8	0.1	65.9	71.5	38.8	4.5	55.8	129.8	41.4	0.2	148.4	522.3	61.7	90.3

Table 10. Catches of thorny skate (kg/hr) from common blocks fished in fourteen surveys.

Block	Jul96	Mar97	May97	Jul97	Nov97	Mar98	May/ Jun98	Jul98	Nov98	Mar99	May/ Jun99	Jul99	Jul00	Jul01
A01	232.5	3.5	0.0	15.0	0.0	5.5	0.0	32.0	138.0	19.6	22.0	89.0	217.0	141.0
A03	103.0	12.5	8.5	27.1	15.0	5.0	9.0	42.0	22.0	16.4	96.0	52.0	100.5	34.0
A05	180.0	12.0	29.5	46.0	126.0	22.0	60.0	144.0	440.0	4.2	101.4	42.5	304.0	123.0
B02	101.0	2.0	5.0	32.0	12.0	0.0	0.0	29.1	9.0	3.2	18.4	35.5	49.0	0.0
B09	61.0	83.5	120.0	90.0	38.0	289.3	70.0	179.0	200.0	214.7	105.0	161.0	119.0	65.5
C10	28.0	281.0	127.0	135.0	76.0	502.7	450.0	216.0	51.0	240.5	165.0	141.0	40.0	68.0
E08	99.0	13.0	36.0	192.5	160.0	9.6	23.0	120.0	238.5	34.2	21.0	161.0	224.0	120.0
F05	43.0	0.0	10.5	0.0	124.3	0.5	0.0	15.0	0.0	5.4	8.0	14.0	177.0	24.0
G03	25.0	21.0	4.0	35.0	82.0	10.0	0.0	41.0	34.0	22.4	41.6	45.0	8.0	18.0
G04	81.0	5.5	13.8	16.0	891.0	7.3	6.0	32.0	27.0	6.4	25.2	10.0	13.0	19.0
G07	117.0	0.0	42.9	86.5	241.5	141.8	38.0	126.0	66.0	23.0	34.0	64.0	45.0	160.0
H04	11.0	22.5	33.0	35.0	95.0	6.8	0.0	370.0	112.0	0.0	27.4	429.0	14.0	42.0
H08	75.0	15.0	34.0	265.5	799.3	20.5	74.0	24.0	203.7	41.4	67.0	62.0	166.3	172.0
Mean	89.0	36.3	35.7	75.0	204.6	78.5	56.2	105.4	118.6	48.6	56.3	100.5	113.6	75.9

Table 11. Ratio of American plaice to yellowtail flounder catch, by block, from common blocks fished in fourteen surveys of the original grid area.

Block	Jul96	Mar97	May97	Jul97	Nov97	Mar98	May/ Jun98	Jul98	Nov98	Mar99	May/ Jun99	Jul99	Jul00	Jul01	Ratio Mean	Total plaice/ Total ytail
G04	0.04	0.04	0.14	0.07	0.08	0.05	0.18	0.05	0.03	0.16	0.12	0.02	0.04	0.05	0.08	0.05
F05	0.01	0.34	0.05	0.02	0.02	0.26	0.03	0.01	0.06	0.07	0.12	0.15	0.08	0.06	0.09	0.04
H04	0.12	0.07	0.17	0.11	0.19	0.04	0.11	0.04	0.15	0.02	0.22	0.19	0.07	0.04	0.12	0.11
G03	0.14	0.22	0.28	0.08	0.83	0.03	0.20	0.05	0.11	0.03	0.32	0.02	0.11	0.11	0.19	0.12
A01	0.18	0.50	0.44	0.11	0.09	0.02	0.36	0.10	0.25	0.02	0.06	0.14	0.17	0.20	0.19	0.16
A05	0.08	0.10	0.38	0.21	0.32	0.12	0.39	0.36	0.32	0.01	0.49	0.14	0.12	0.07	0.23	0.23
E08	0.08	0.32	0.28	0.21	0.26	0.41	0.17	0.31	0.74	0.09	0.19	0.21	0.53	0.24	0.29	0.25
A03	0.08	0.33	0.91	0.06	0.65	0.33	0.45	0.26	0.38	0.00	0.38	0.11	0.05	0.19	0.31	0.18
G07	0.11	0.11	0.29	0.12	0.13	0.06	0.21	0.37	0.12	0.04	0.48	0.45	1.57	0.28	0.31	0.25
H08	0.17	0.47	0.26	0.25	0.20	0.26	0.35	0.05	0.38	0.09	1.68	1.44	0.65	1.58	0.48	0.56
B02	0.14		0.39	0.33	1.15		0.51	0.20	1.28	0.24	0.43	0.45	0.32	0.19	0.49	0.36
C10	0.20	0.97	0.51	0.34	6.52	0.28	0.27	0.61	3.57	0.38	0.28	0.16	0.19	0.15	1.10	0.36
B09	1.65	1.25	3.66	0.56	19.57	4.18	0.36	7.70	28.15	11.17	1.47	2.73	0.34	0.49	6.37	1.25

Table 11b. Blocks from the expanded grid surveys, August 2000 and 2001, in which the ratio of plaice to yellowtail catch was under 5 percent.

Trip	Block	Yellowtail (kg/hr)	American Plaice (kg/hr)	Cod (kg/hr)	Thorny Skate (kg/hr)	Ratio (Plaice/Ytail)
Aug00	151	305.04	9.54	55.20	34.00	0.03
Aug00	505	688.37	28.62	16.80	0.00	0.04
Aug00	604	659.21	26.50	13.80	9.00	0.04
Aug01	162	196.98	5.30	410.40	224.00	0.03

Table 12. Catches of yellowtail (kg/hr) in the common blocks fished in July surveys (original grid).

	Yellowtail					
Block	**96**	**97**	**98**	**99**	**00**	**01**
A01	1315.86	997.64	2236.80	1488.97	1132.44	1979.66
A02	1828.28	211.25	449.05	400.50	1684.80	1846.73
A03	1086.85	690.78	835.10	520.21	3319.19	797.39
A05	1410.51	167.00	418.65	720.18	398.90	403.37
A07	576.73	845.50	572.27	516.58	438.24	779.90
A08	325.95	637.30	270.55	554.12	301.90	651.60
B02	321.00	482.30	379.29	124.50	165.74	163.06
B03	683.73	720.50	853.90	226.84	2244.31	709.14
B04	492.90	90.00	219.58	178.76	384.38	304.06
B06	756.00	612.00	666.10	665.60	489.45	1074.30
B08	642.20	857.00	506.90	649.10	340.29	563.70
B09	254.20	582.34	26.00	101.00	486.75	302.58
B10	146.50	17.50	0.00	8.00	62.00	34.45
C05	942.59	606.50	542.12	333.26	914.32	594.98
C07	526.79	1240.50	2383.01	747.90	928.84	620.79
C08	115.38	720.50	333.14	1438.47	174.90	337.20
C10	1430.89	1014.13	503.63	528.18	722.29	556.38
D04	668.14	567.38	593.45	465.55	632.81	1328.60
D05	739.76	635.75	928.76	624.04	796.84	760.83
D06	1560.34	1382.50	1249.69	504.48	1439.33	1449.69
D08	471.87	481.50	698.63	752.12	586.63	1083.22
D09	684.76	513.20	903.64	682.98	965.14	1360.21
E01	713.85	3369.10	2678.27	710.46	851.43	751.58
E08	1167.91	506.50	898.12	883.57	651.82	1228.21
E10	557.09	483.38	694.02	632.36	805.87	1096.10
F02	1037.00	653.25	858.87	671.33	607.61	1275.68
F04	1032.34	704.00	1869.00	529.45	1471.18	1606.27
F05	1818.10	1396.97	2284.75	170.50	959.57	959.32
F06	955.94	728.30	1385.96	1087.21	1478.99	886.68
F08	1755.34	639.19	1469.34	830.30	1401.36	1063.85
F09	836.83	354.25	704.09	913.36	1095.84	675.05
G01	664.77	538.50	301.76	296.04	453.21	373.86
G03	344.68	518.50	1039.25	667.28	642.23	742.41
G04	868.66	451.13	899.02	538.87	1096.56	837.70
G05	502.54	528.50	1169.70	338.33	833.59	705.11
G07	721.72	711.25	1042.11	589.41	246.13	655.72
H02	600.77	977.44	1198.47	853.26	1417.99	944.28
H04	357.56	684.70	941.39	419.57	688.98	641.64
H08	736.71	631.62	734.97	220.94	579.75	884.33
H09	485.07	269.74	463.14	344.20	888.43	569.87
I01	278.50	483.15	824.50	807.22	488.63	391.93
I03	441.88	857.50	567.89	163.00	870.36	496.83
J08	507.58	439.67	477.88	196.20	296.26	484.86
Mean	775.96	697.67	885.41	560.33	847.33	813.33

Table 13. Catches of plaice (kg/hr) in the common blocks fished in July surveys (original grid).

	American Plaice					
Block	**96**	**97**	**98**	**99**	**00**	**01**
A01	232.80	114.27	218.90	204.56	187.90	388.49
A02	180.00	45.49	42.40	86.24	447.53	262.88
A03	84.50	40.95	213.38	56.53	176.89	149.46
A05	110.00	35.00	152.64	104.41	47.70	26.50
A07	29.50	220.50	76.32	27.32	63.60	29.68
A08	220.50	111.10	100.70	138.48	142.60	49.70
B02	45.00	158.70	77.23	56.00	53.00	30.74
B03	105.00	44.44	42.40	93.22	247.50	62.54
B04	111.50	15.50	42.40	12.72	30.18	26.50
B06	34.00	37.03	56.71	68.04	72.08	97.52
B08	158.00	173.90	47.70	120.58	225.12	137.20
B09	420.23	326.93	200.10	276.16	166.10	149.10
B10	270.00	146.75	253.49	140.50	209.27	116.60
C05	47.00	88.64	120.84	50.46	110.72	73.14
C07	151.00	231.20	431.42	73.60	110.74	113.42
C08	53.08	88.05	179.62	714.75	403.78	148.86
C10	293.00	349.50	309.68	85.10	138.07	81.84
D04	41.00	66.50	49.82	21.52	48.58	71.55
D05	10.00	149.00	222.60	39.01	74.67	47.17
D06	69.00	214.30	322.26	61.65	96.46	45.58
D08	124.00	96.00	389.90	385.90	496.72	218.56
D09	163.50	232.78	330.46	190.37	479.48	272.14
E01	80.00	130.40	120.66	15.90	208.14	87.98
E08	92.00	106.00	274.54	187.78	347.15	293.07
E10	147.50	265.25	189.21	263.73	352.92	306.09
F02	47.50	35.63	34.98	47.40	75.79	118.19
F04	8.00	38.09	33.92	8.48	36.57	42.40
F05	20.00	22.25	15.90	26.00	74.61	54.06
F06	23.00	0.00	56.18	55.12	95.84	83.74
F08	91.00	73.92	326.75	171.92	424.94	146.28
F09	67.50	85.12	302.10	311.11	438.84	158.26
G01	42.00	49.90	72.08	31.80	81.62	28.62
G03	47.50	39.15	54.06	15.90	70.78	80.56
G04	39.00	30.57	44.52	8.48	41.87	42.40
G05	20.00	39.78	31.80	29.68	127.73	74.20
G07	80.00	86.80	382.66	265.27	386.47	184.97
H02	67.00	92.81	80.56	122.96	367.56	237.44
H04	42.00	75.28	40.78	79.50	48.76	23.85
H08	124.00	155.40	33.92	317.21	376.83	1394.96
H09	74.50	280.35	411.81	171.72	1117.24	631.58
I01	86.50	214.60	114.48	57.71	121.90	142.04
I03	81.00	274.38	216.24	9.00	79.50	106.53
J08	387.00	1654.40	2197.82	975.20	403.86	1534.35
Mean	107.43	156.67	207.35	143.70	216.46	194.67

Table 14. Catches of cod (kg/hr) in the common blocks fished in July surveys (original grid).

	Cod					
Block	**96**	**97**	**98**	**99**	**00**	**01**
A01	506.00	101.27	141.00	94.40	10.20	52.80
A02	207.00	190.80	1273.80	1358.00	182.40	232.80
A03	274.00	280.62	16.80	107.40	386.00	111.00
A05	2509.09	232.86	1208.70	6067.20	166.80	739.20
A07	131.00	230.26	38.40	9.00	8.40	88.80
A08	14.00	15.00	24.00	27.60	58.80	102.00
B02	168.00	38.00	136.29	64.50	60.00	29.40
B03	6.00	380.00	165.60	60.00	229.20	21.60
B04	50.00	60.20	399.96	144.00	56.40	148.80
B06	260.00	49.04	27.00	609.73	303.60	351.60
B08	314.00	644.00	421.20	74.40	52.80	180.00
B09	89.00	86.99	33.00	84.50	0.00	49.20
B10	282.50	29.85	21.60	20.40	12.60	27.60
C05	93.00	0.00	7.00	46.80	14.40	79.20
C07	206.00	165.22	625.68	0.00	52.80	97.80
C08	184.62	88.53	157.20	62.40	60.00	37.20
C10	33.00	16.00	31.20	56.40	36.00	28.80
D04	49.00	7.46	0.00	528.75	99.60	21.60
D05	54.00	0.00	1168.08	13.80	88.80	355.80
D06	69.00	245.60	15.60	14.40	877.80	136.80
D08	212.00	200.40	82.20	355.20	13.20	80.40
D09	24.00	103.40	130.80	290.40	144.00	235.20
E01	10.00	26.10	0.00	6.60	28.80	7.80
E08	145.20	65.03	43.80	217.20	21.60	85.20
E10	32.00	0.00	42.00	0.00	120.00	38.40
F02	48.50	39.94	77.20	111.60	31.20	15.60
F04	8.00	21.32	36.00	0.00	0.00	23.40
F05	4.00	5.33	0.00	0.00	0.00	13.80
F06	0.00	18.12	7.00	0.00	10.20	0.00
F08	73.00	19.19	5.40	36.00	57.60	126.60
F09	295.00	0.00	0.00	82.80	35.00	21.60
G01	39.00	133.30	18.60	79.20	15.00	64.20
G03	2.50	24.00	0.00	0.00	1.00	9.00
G04	28.00	31.98	13.20	0.00	0.00	4.20
G05	0.00	0.00	0.00	0.00	0.00	6.60
G07	190.00	22.39	59.40	98.40	120.00	30.60
H02	1.00	23.99	0.00	12.00	12.00	24.00
H04	26.00	24.50	0.00	0.00	0.00	7.20
H08	0.00	0.00	4.20	0.00	0.00	13.20
H09	0.00	6.93	0.00	0.00	0.00	13.20
I01	2.00	11.06	2.40	18.00	7.20	13.20
I03	53.00	2.10	0.00	0.00	2.50	33.60
J08	0.00	44.77	0.00	15.60	11.40	12.00
Mean	155.64	85.71	149.64	250.39	78.77	87.70

Table 15. Catches of thorny skate (kg/hr) in the common blocks fished in July surveys (original grid).

	Thorny skate					
Block	**96**	**97**	**98**	**99**	**00**	**01**
A01	232.50	15.00	32.00	89.00	217.00	141.00
A02	76.00	25.00	27.00	30.00	88.00	33.00
A03	103.00	27.10	42.00	52.00	100.50	34.00
A05	180.00	46.00	144.00	42.50	304.00	123.00
A07	125.00	43.00	210.00	52.00	69.00	144.00
A08	195.00	0.00	70.00	104.00	266.00	219.00
B02	101.00	32.00	29.14	35.50	49.00	0.00
B03	0.00	0.00	40.00	57.50	83.00	22.00
B04	26.00	8.00	42.00	0.00	22.00	35.00
B06	94.00	165.00	59.00	38.00	194.00	123.00
B08	56.00	22.00	147.00	74.00	214.00	189.00
B09	61.00	90.00	179.00	161.00	119.00	65.50
B10	241.00	0.00	96.00	196.00	81.00	36.00
C05	31.00	25.00	17.00	38.50	35.50	25.00
C07	66.00	42.00	181.00	150.00	240.33	114.00
C08	13.85	0.00	288.00	241.00	76.00	105.00
C10	28.00	135.00	216.00	141.00	40.00	68.00
D04	8.00	15.00	14.00	38.00	47.50	63.00
D05	0.00	64.00	36.00	64.50	158.75	31.50
D06	52.00	120.00	84.00	32.00	122.00	13.00
D08	47.00	336.00	225.00	65.00	214.00	252.00
D09	37.00	70.00	114.00	104.00	88.00	318.00
E01	0.00	0.00	245.00	10.00	23.00	20.00
E08	99.00	192.50	120.00	161.00	224.00	120.00
E10	117.00	28.00	0.00	75.00	52.00	36.50
F02	0.00	26.25	0.00	45.00	38.00	8.00
F04	44.00	12.00	38.00	10.00	38.00	10.00
F05	43.00	0.00	15.00	14.00	177.00	24.00
F06	0.00	0.00	32.00	59.00	13.00	38.00
F08	132.00	60.00	234.00	72.00	315.00	85.00
F09	77.00	62.00	70.00	48.00	142.00	34.00
G01	13.00	25.00	0.00	15.00	27.00	5.00
G03	25.00	35.00	41.00	45.00	8.00	18.00
G04	81.00	16.00	32.00	10.00	13.00	19.00
G05	65.00	35.00	38.00	81.00	141.25	53.00
G07	117.00	86.50	126.00	64.00	45.00	160.00
H02	0.00	12.00	29.00	30.00	36.00	3.00
H04	11.00	35.00	370.00	429.00	14.00	42.00
H08	75.00	265.50	24.00	62.00	166.25	172.00
H09	36.00	200.00	22.00	34.00	172.50	11.00
I01	0.00	0.00	74.00	36.50	30.00	29.00
I03	13.00	0.00	30.00	4.00	14.00	33.00
J08	13.00	62.00	38.00	64.00	66.00	51.00
Mean	63.59	56.58	90.00	73.81	106.59	72.69

Table 16. Ratio of American plaice to yellowtail flounder catch from common blocks fished in July surveys (original grid).

	Ratio American plaice/yellowtail						
Block	96	97	98	99	00	01	MEAN
F04	0.01	0.05	0.02	0.02	0.02	0.03	0.02
G04	0.04	0.07	0.05	0.02	0.04	0.05	0.04
F06	0.02	0.00	0.04	0.05	0.06	0.09	0.05
F05	0.01	0.02	0.01	0.15	0.08	0.06	0.05
F02	0.05	0.05	0.04	0.07	0.12	0.09	0.07
D04	0.06	0.12	0.08	0.05	0.08	0.05	0.07
G05	0.04	0.08	0.03	0.09	0.15	0.11	0.08
G03	0.14	0.08	0.05	0.02	0.11	0.11	0.08
B06	0.04	0.06	0.09	0.10	0.15	0.09	0.09
H04	0.12	0.11	0.04	0.19	0.07	0.04	0.09
E01	0.11	0.04	0.05	0.02	0.24	0.12	0.10
D06	0.04	0.16	0.26	0.12	0.07	0.03	0.11
A07	0.05	0.26	0.13	0.05	0.15	0.04	0.11
D05	0.01	0.23	0.24	0.06	0.09	0.06	0.12
A03	0.08	0.06	0.26	0.11	0.05	0.19	0.12
G01	0.06	0.09	0.24	0.11	0.18	0.08	0.13
C05	0.05	0.15	0.22	0.15	0.12	0.12	0.14
B04	0.23	0.17	0.19	0.07	0.08	0.09	0.14
B03	0.15	0.06	0.05	0.41	0.11	0.09	0.15
A01	0.18	0.11	0.10	0.14	0.17	0.20	0.15
H02	0.11	0.09	0.07	0.14	0.26	0.25	0.15
A05	0.08	0.21	0.36	0.14	0.12	0.07	0.16
A02	0.10	0.22	0.09	0.22	0.27	0.14	0.17
F08	0.05	0.12	0.22	0.21	0.30	0.14	0.17
C07	0.29	0.19	0.18	0.10	0.12	0.18	0.18
I03	0.18	0.32	0.38	0.06	0.09	0.21	0.21
I01	0.31	0.44	0.14	0.07	0.25	0.36	0.26
E08	0.08	0.21	0.31	0.21	0.53	0.24	0.26
B02	0.14	0.33	0.20	0.45	0.32	0.19	0.27
B08	0.25	0.20	0.09	0.19	0.66	0.24	0.27
C10	0.20	0.34	0.61	0.16	0.19	0.15	0.28
F09	0.08	0.24	0.43	0.34	0.40	0.23	0.29
A08	0.68	0.17	0.37	0.25	0.47	0.08	0.34
D09	0.24	0.45	0.37	0.28	0.50	0.20	0.34
E10	0.26	0.55	0.27	0.42	0.44	0.28	0.37
D08	0.26	0.20	0.56	0.51	0.85	0.20	0.43
G07	0.11	0.12	0.37	0.45	1.57	0.28	0.48
H08	0.17	0.25	0.05	1.44	0.65	1.58	0.69
C08	0.46	0.12	0.54	0.50	2.31	0.44	0.73
H09	0.15	1.04	0.89	0.50	1.26	1.11	0.82
B09	1.65	0.56	7.70	2.73	0.34	0.49	2.25
J08	0.76	3.76	4.60	4.97	1.36	3.16	3.10
B10	1.84	8.39		17.56	3.38	3.38	6.91

Table 17. Length compostion of Yellowtail flounder (sexes combined). Asterisk indicates expanded grid surveys.

		Percentage of Yellowtail		
Trip	Trip #	<26cm	<30cm	>=40cm
Jul96	1	1.90	6.31	26.41
Mar97	2	1.62	6.72	21.05
May/Jun97	3	1.11	5.80	26.88
Jul97	4	1.19	7.70	24.81
Nov97	5	0.16	2.73	31.49
Mar98	6	1.56	8.97	25.36
May/Jun98	7	0.88	6.05	24.81
Jul98	8	1.74	10.28	21.61
Nov98	9	0.79	5.81	24.56
Mar99	10	0.55	6.63	22.37
May/Jun99	12	0.62	5.99	24.90
Jul99	13	0.34	3.67	28.41
Jul00	14	0.64	4.45	21.88
Aug00 *	15	0.15	2.65	18.12
Jul01	16	0.63	4.84	20.05
Aug01 *	17	0.15	2.72	18.01

Table 18. Numbers and weights of yellowtail caught in the original grid area during DFO stratified random surveys in Div. 3LNO.

Yr/season	Ytail in original grid area		Yellowtail in survey		Pct of total catch in grid	
	Numbers	Weight (kg)	Numbers	Weight (kg)	% nos	%wt
95F	19842	4528	22276	4997	89.1%	90.6%
96S	14695	3878	16937	4619	86.8%	84.0%
96F	7038	1899	8640	2141	81.5%	88.7%
97S	12059	2807	15010	3882	80.3%	72.3%
97F	10640	2928	17349	5037	61.3%	58.1%
98S	14841	4016	21134	5822	70.2%	69.0%
98F	8987	2507	12512	3696	71.8%	67.8%
99S	21718	5147	34998	9895	62.1%	52.0%
99F	12778	2946	18570	4978	68.8%	59.2%
00S	14183	3924	23131	7263	61.3%	54.0%
00F	9091	2784	22438	6507	40.5%	42.8%
01S	26003	6900	32446	8939	80.1%	77.2%
01F	15396	4365	32783	9475	47.0%	46.1%

Table 19. Numbers and weights of yellowtail caught in expanded grid area during DFO stratified random surveys in Div. 3LNO during 2000 and 2001.

Yr/Season	Ytail in exp. grid area		Yellowtail in survey		Pct in grid	
	Number	Wgt (kg)	Number	Wgt (kg)	% nos	% wgt
00S	20798	6453	23131	7263	89.9	88.8
00F	12574	3759	22438	6507	56.0	57.8
01S	29295	8000	32446	8939	90.3	89.5
01F	21456	6338	32783	9475	65.4	66.9

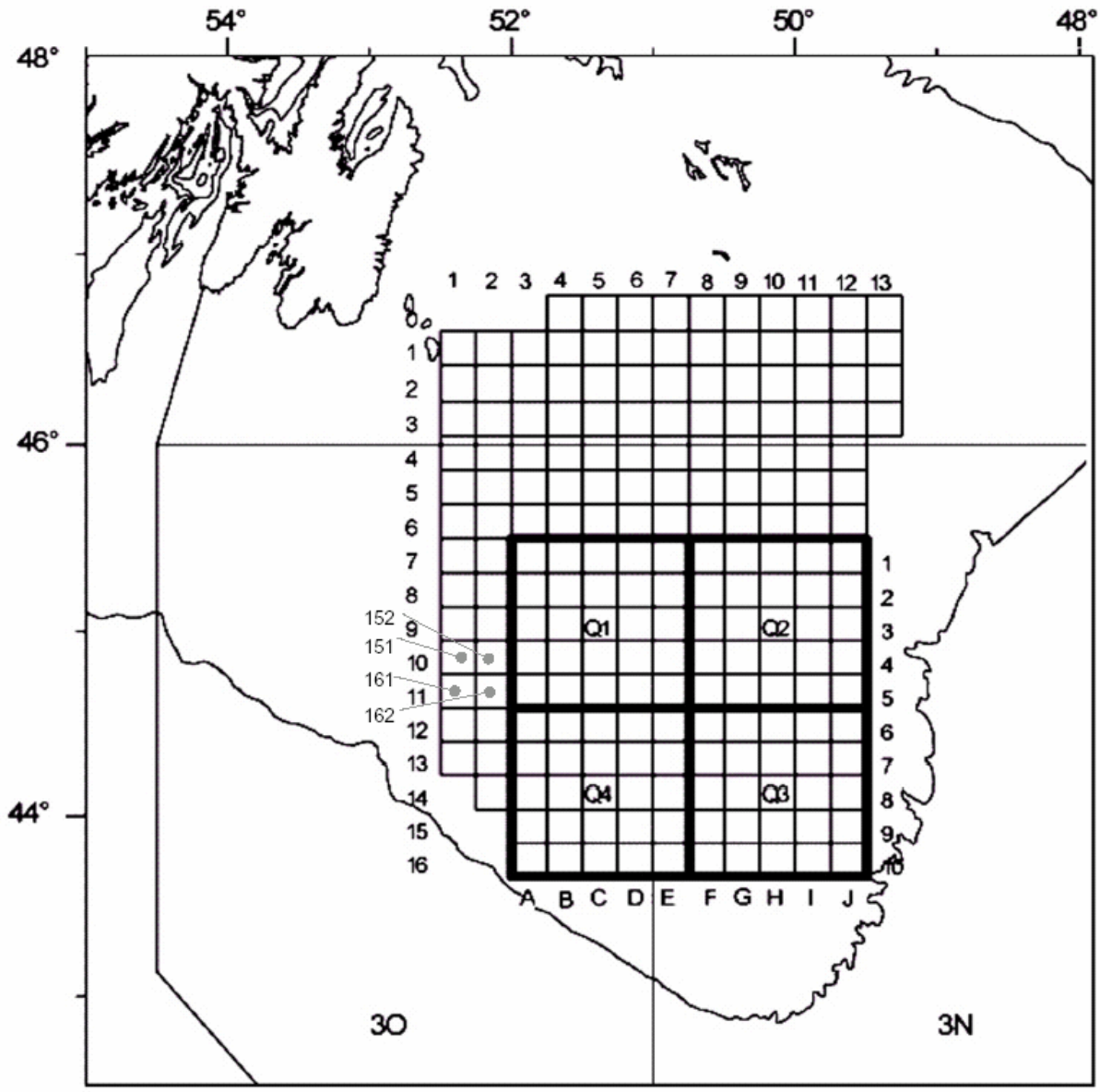

Figure 1. Location of grid used in cooperative surveys directed at yellowtail flounder. Original grid bolded with 5x5 blocks per quadrant. Expanded grid surveyed in 2000-2001.

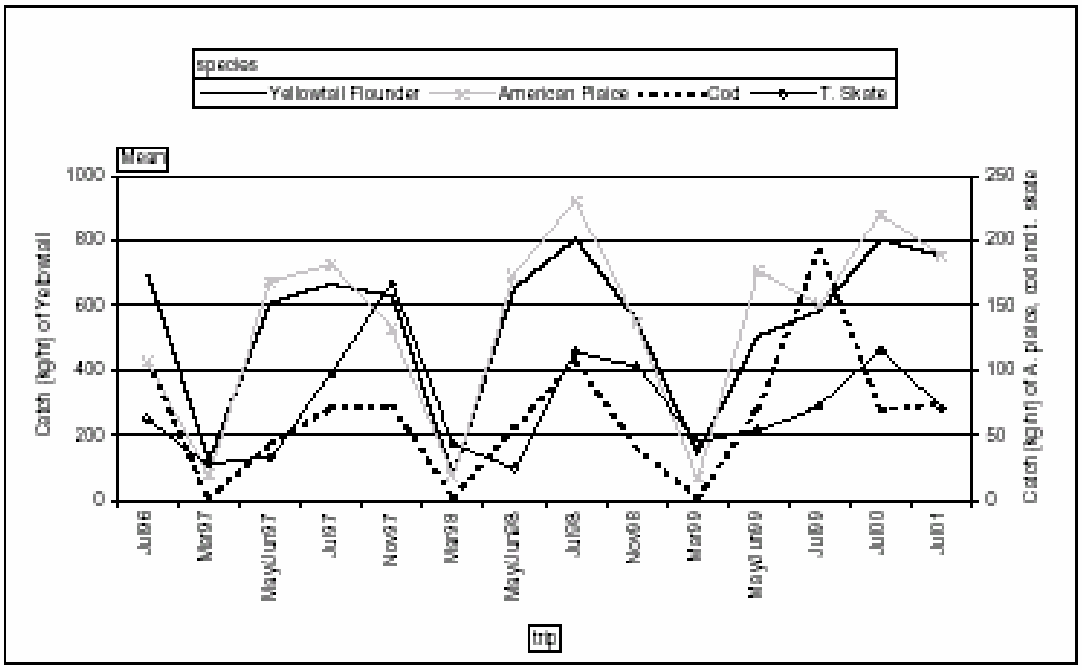

Figure 2. Mean catch (kg/hr) of yellowtail, American plaice, cod and thorny skate caught in original grid surveys from 1996-2001.

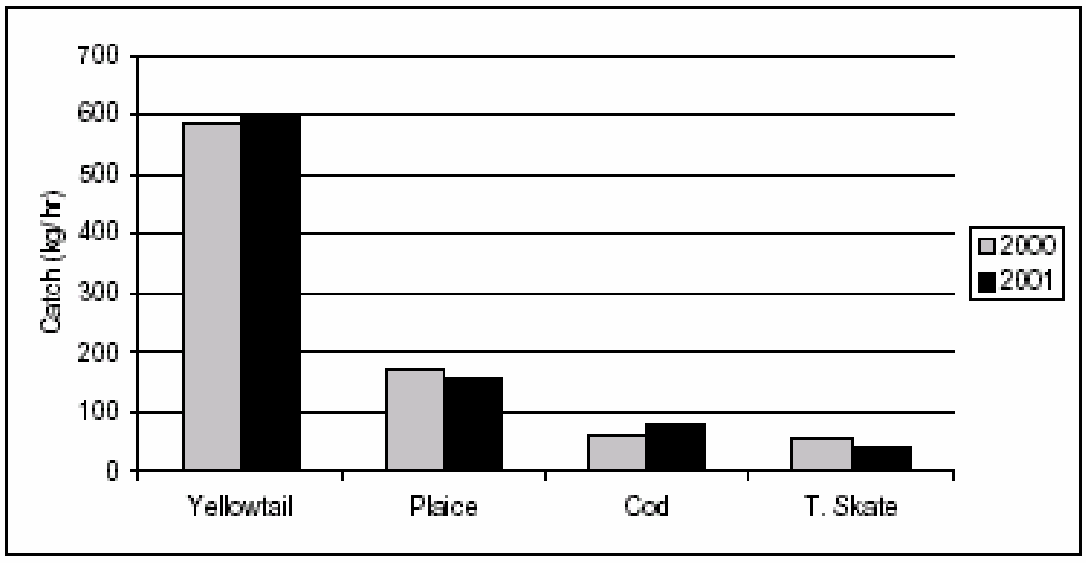

Figure 3. Catch (kg/hr) of yellowtail, American plaice, cod and thorny skate caught in surveys covering the original grid area in addition to an expanded grid area in 2000 and 2001.

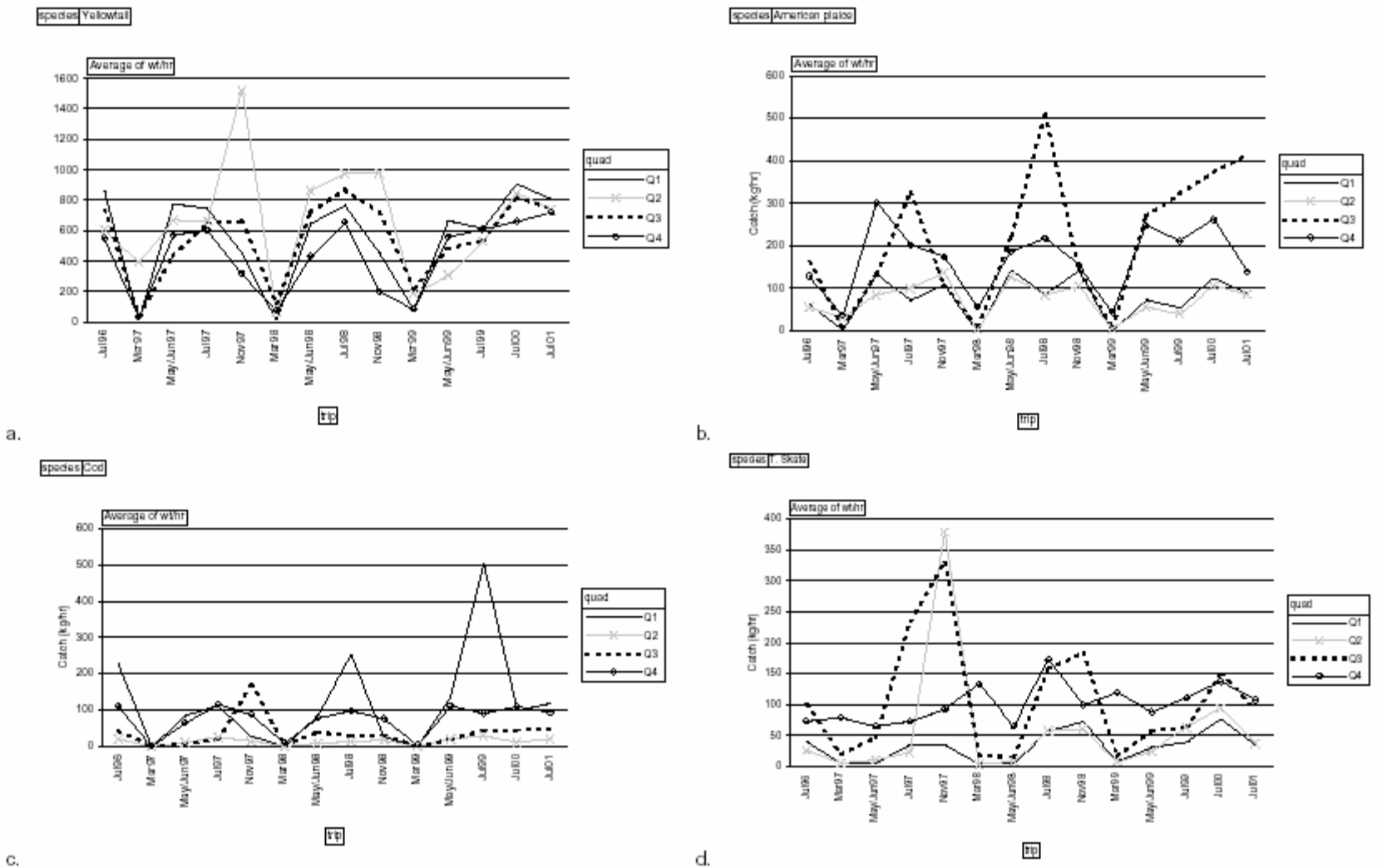

Figure 4. Catch (kg/hr) of Yellowtail, American plaice, cod, and thorny skate by quadrant, caught in cooperative surveys from 1996-2001.

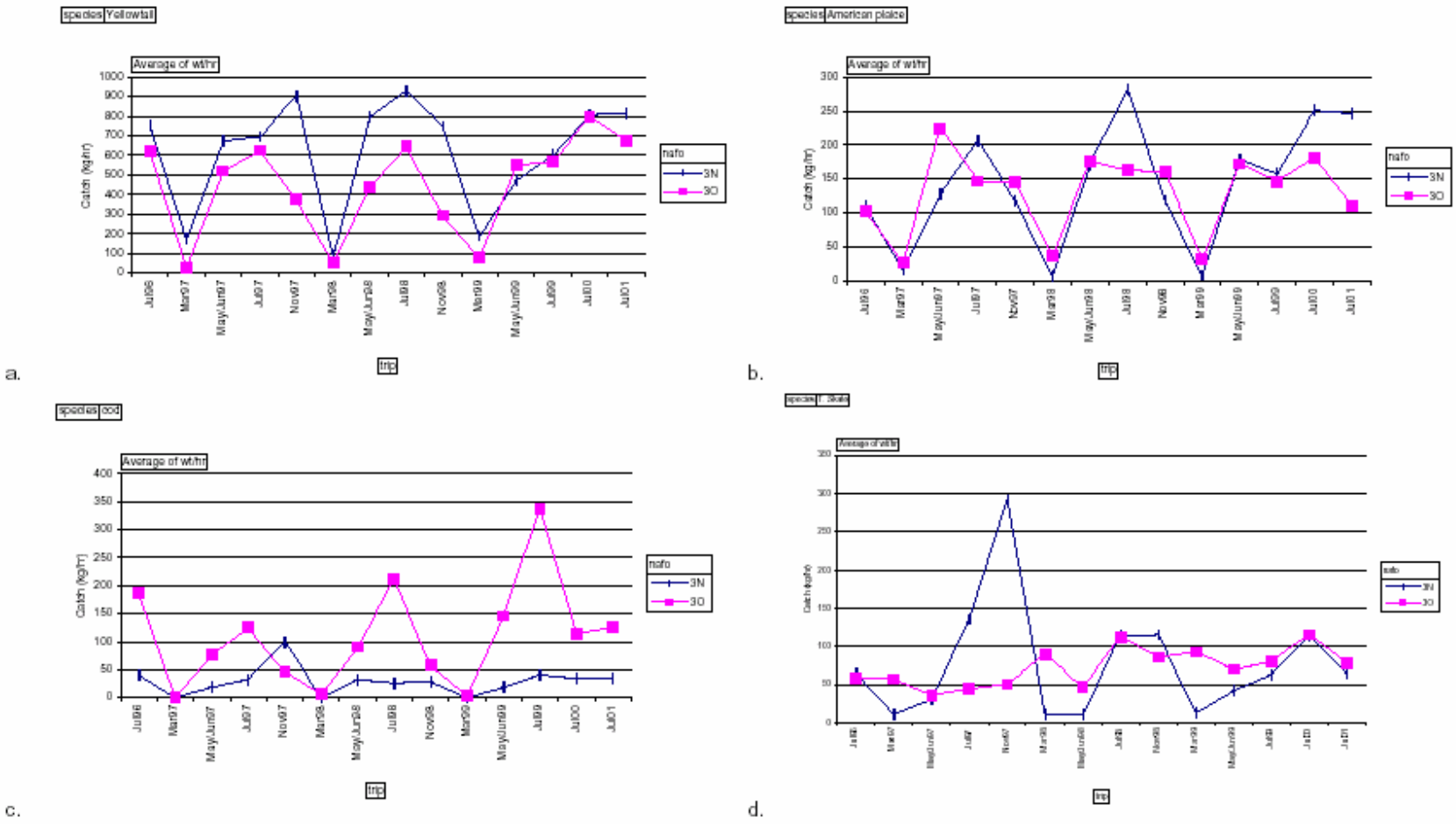

Figure 5. Catch (kg/hr) of yellowtail, American plaice and cod by NAFO Division, caught in cooperative surveys (original grid) from 1996-2001.

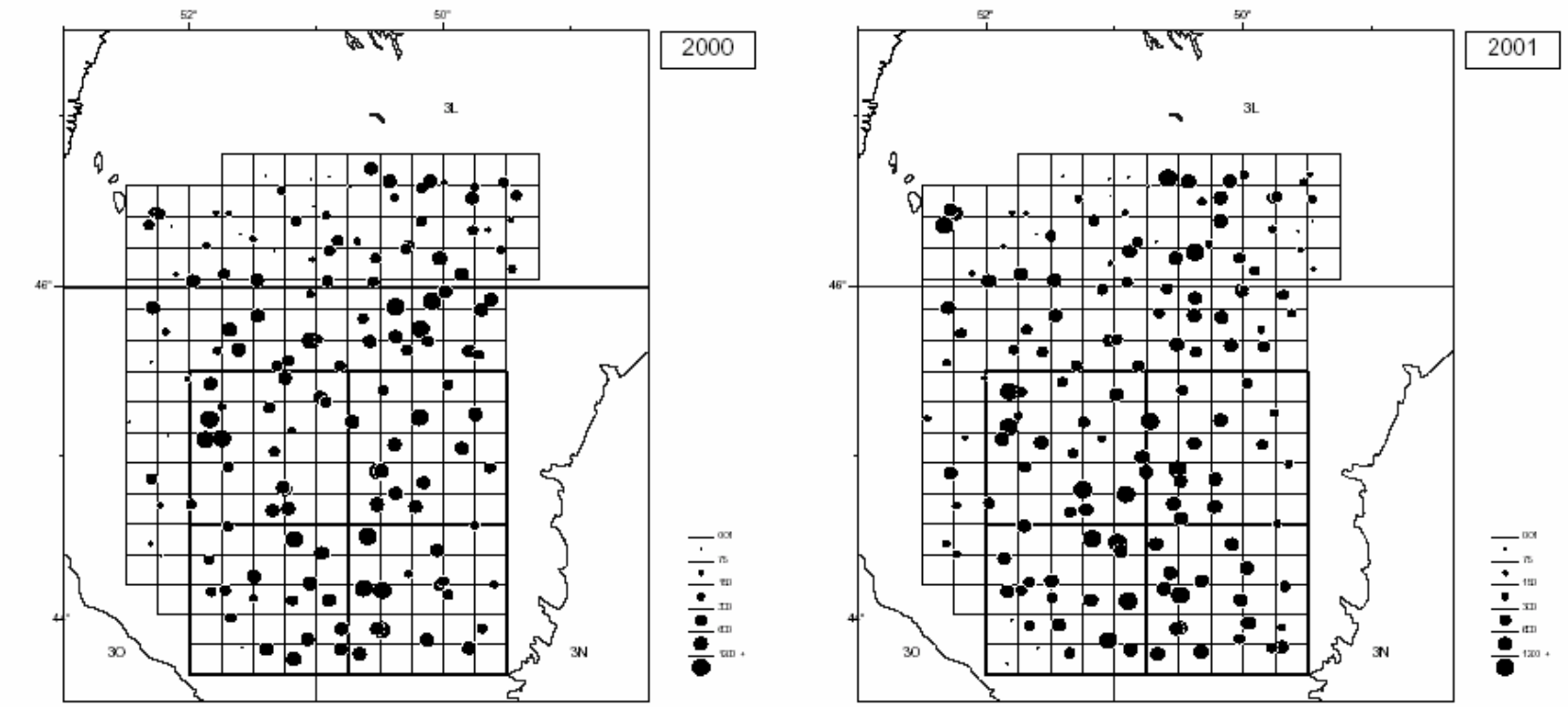

Figure 6. Distribution of yellowtail flounder catches (kg per standard 3Nm. tow) from industry grid surveys conducted in NAFO Div. 3LNO in 2000 and 2001.

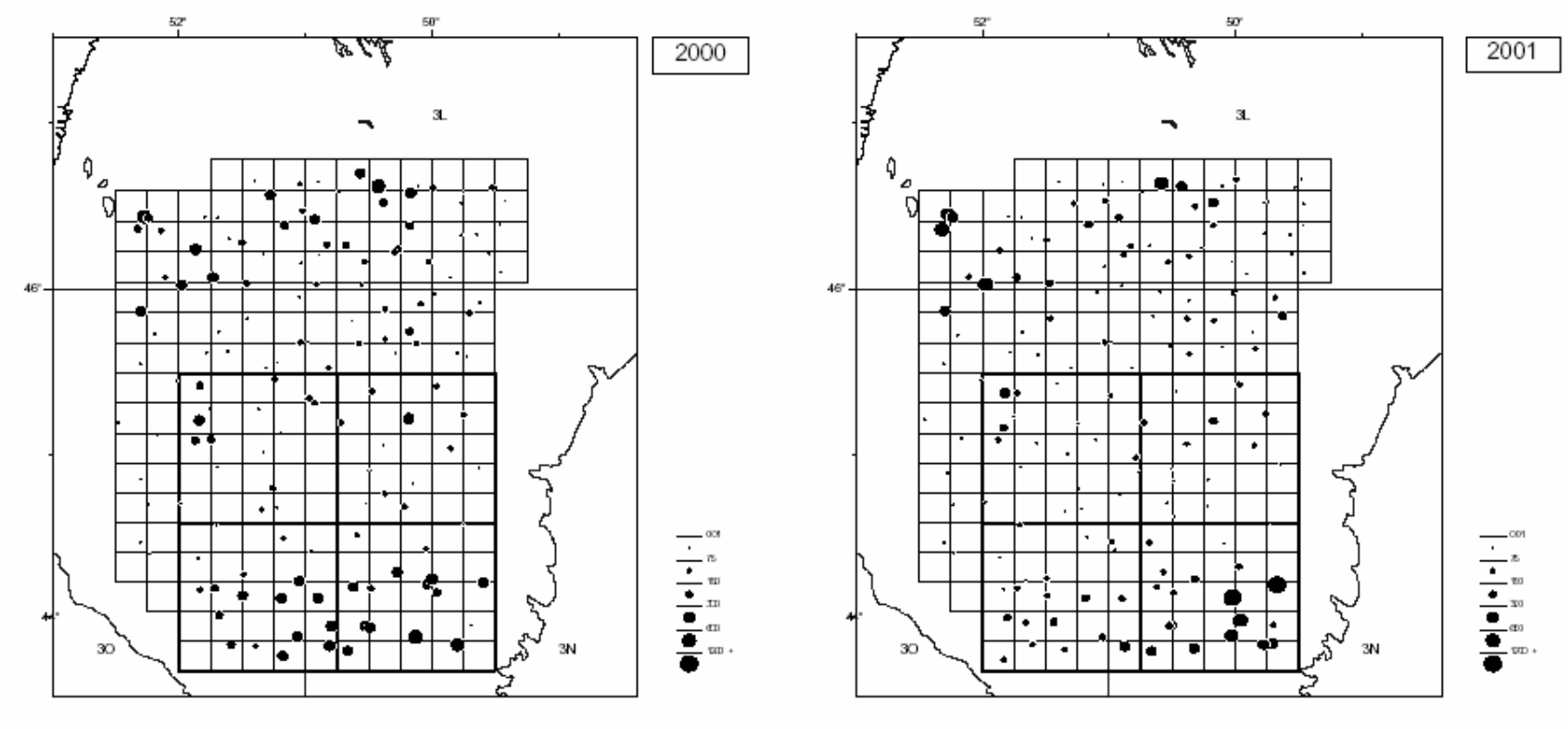

Figure 7. Distribution of American plaice catches (kg per standard 3Nm. tow) from industry grid surveys conducted in NAFO Div. 3LNO in 2000 and 2001.

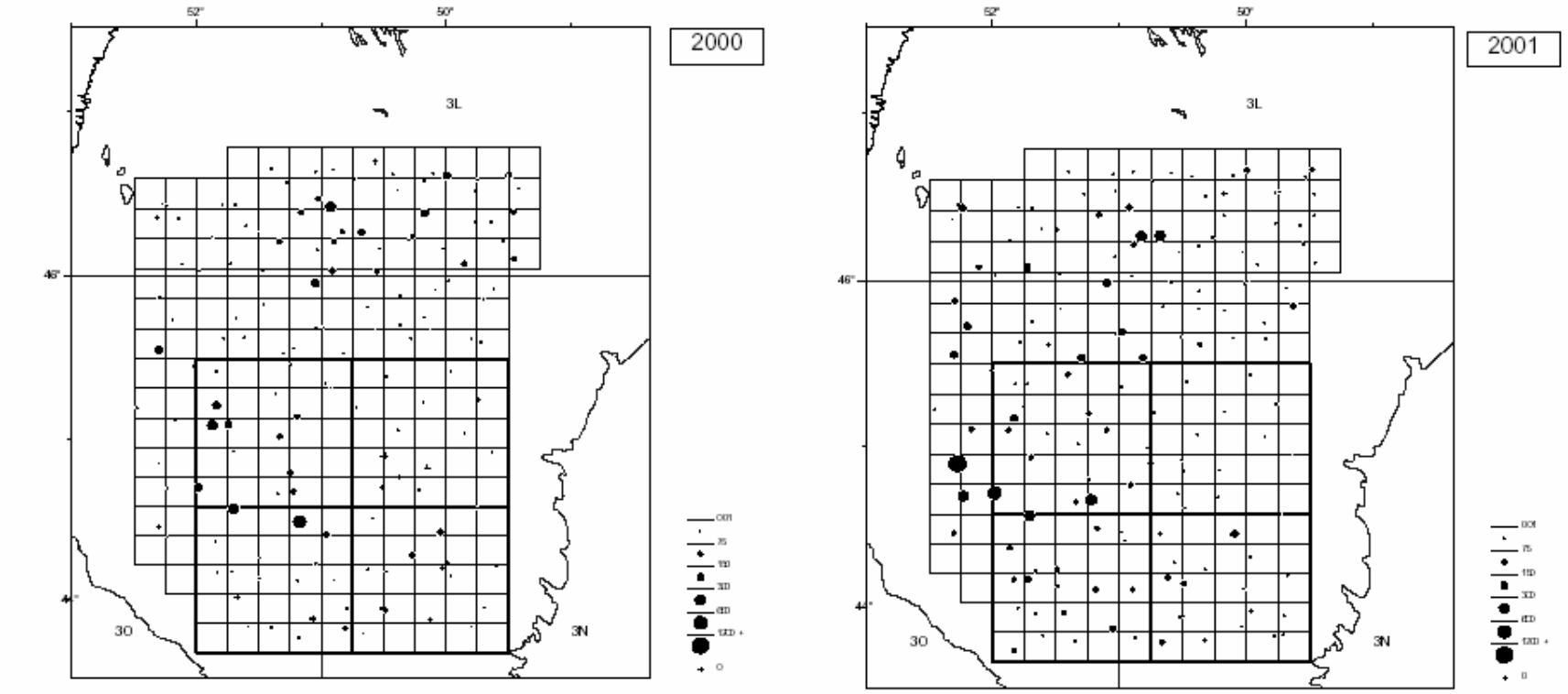

Figure 8. Distribution of atlantic cod catches (kg per standard 3Nm. tow) from industry grid surveys conducted in NAFO Div. 3LNO in 2000 and 2001.

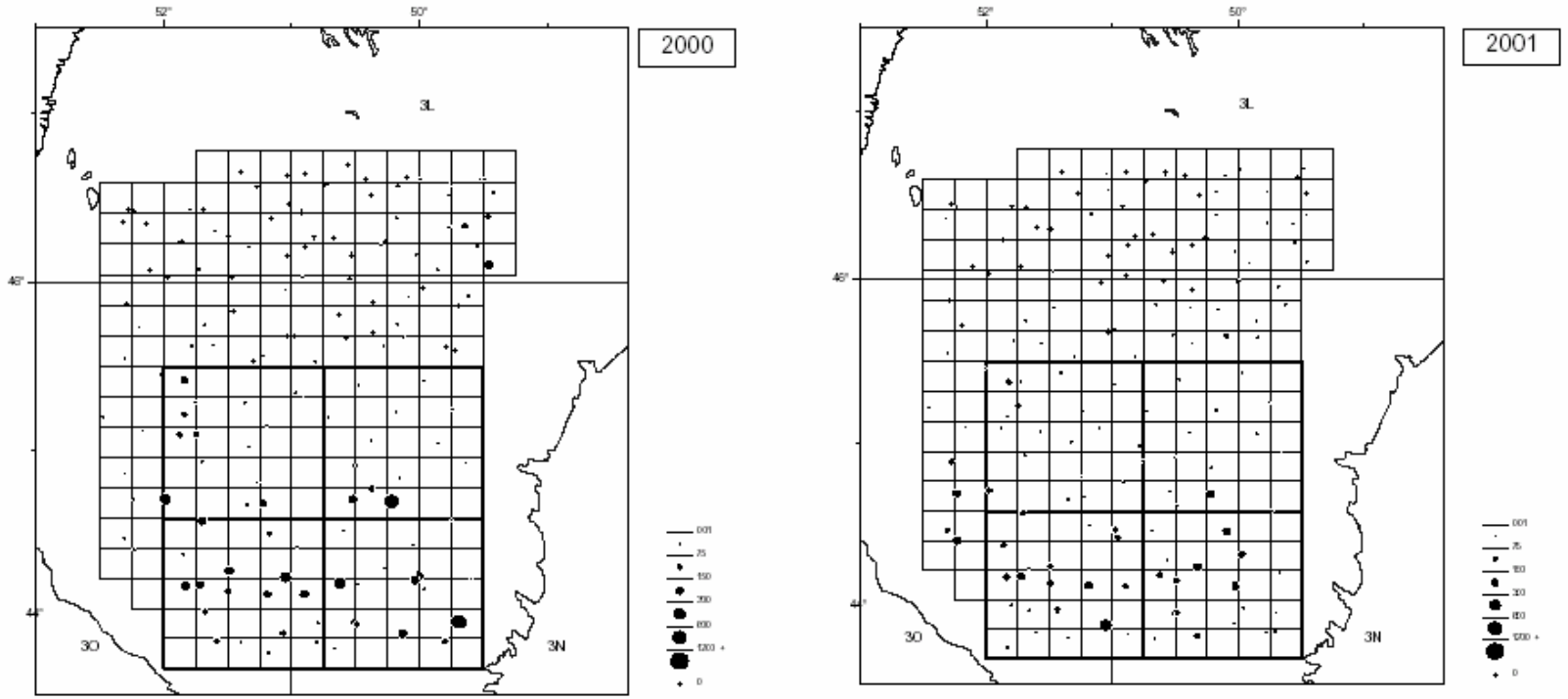

Figure 9. Distribution of thorny skate catches (kg per standard 3Nm. tow) from industry grid surveys conducted in NAFO Div. 3LNO in 2000 and 2001.

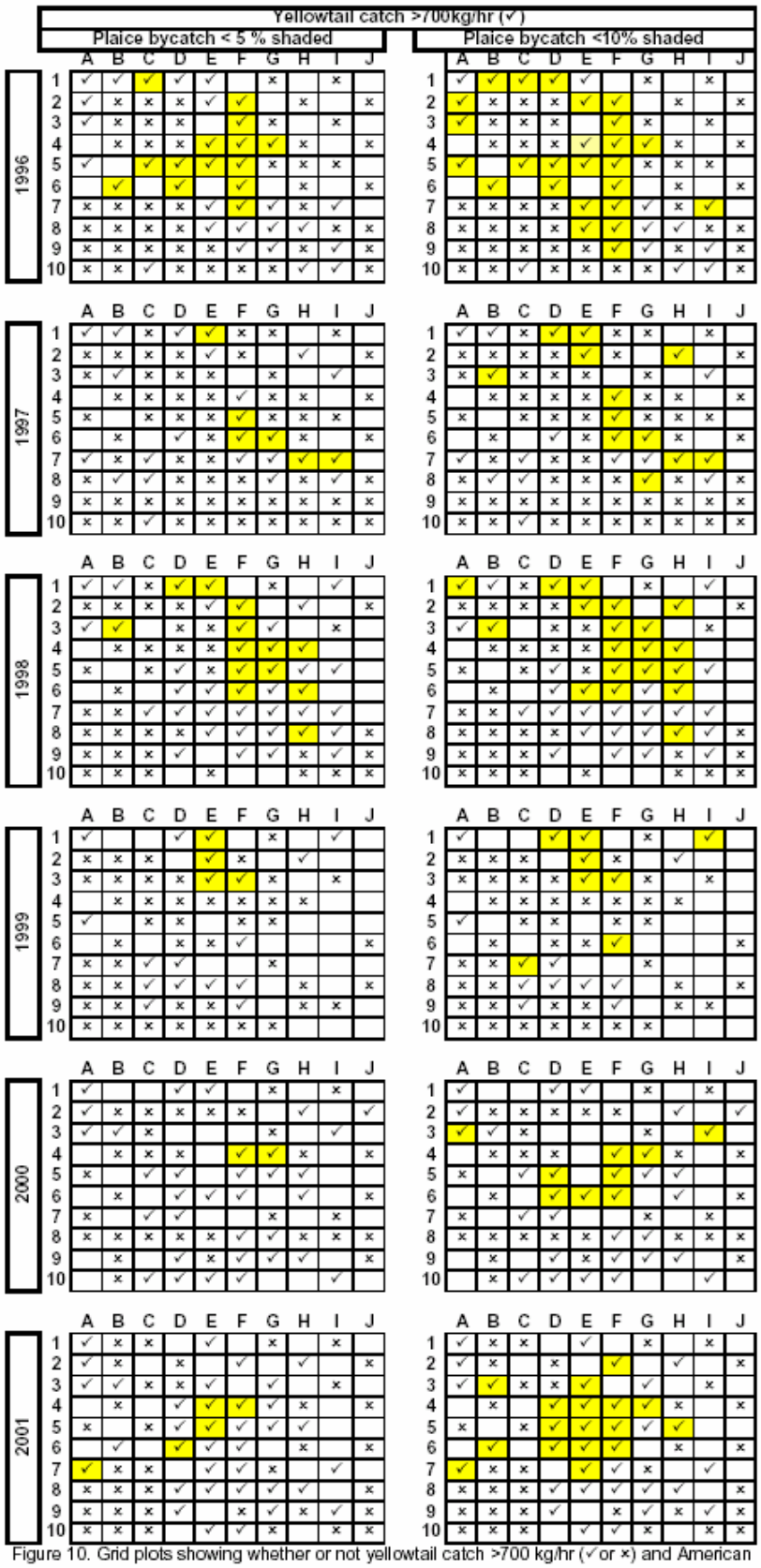

Figure 10. Grid plots showing whether or not yellowtail catch >700 kg/hr (✓or ×) and American plaice bycatch less than 5% or 10% at this catch level (shaded blocks) for July surveys.

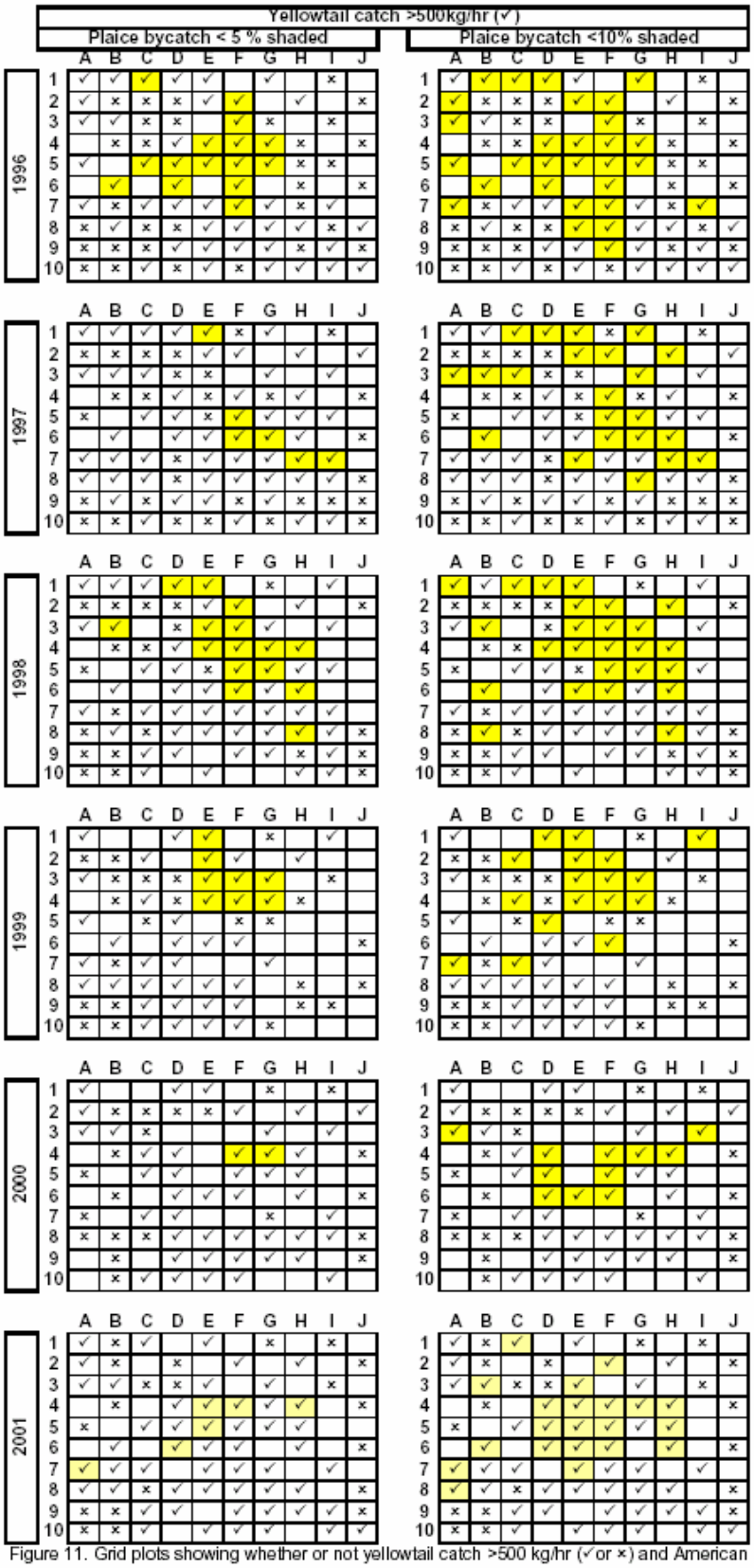

Figure 11. Grid plots showing whether or not yellowtail catch >500 kg/hr (✓or ×) and American plaice bycatch less than 5% or 10% at this catch level (shaded blocks) for July surveys.

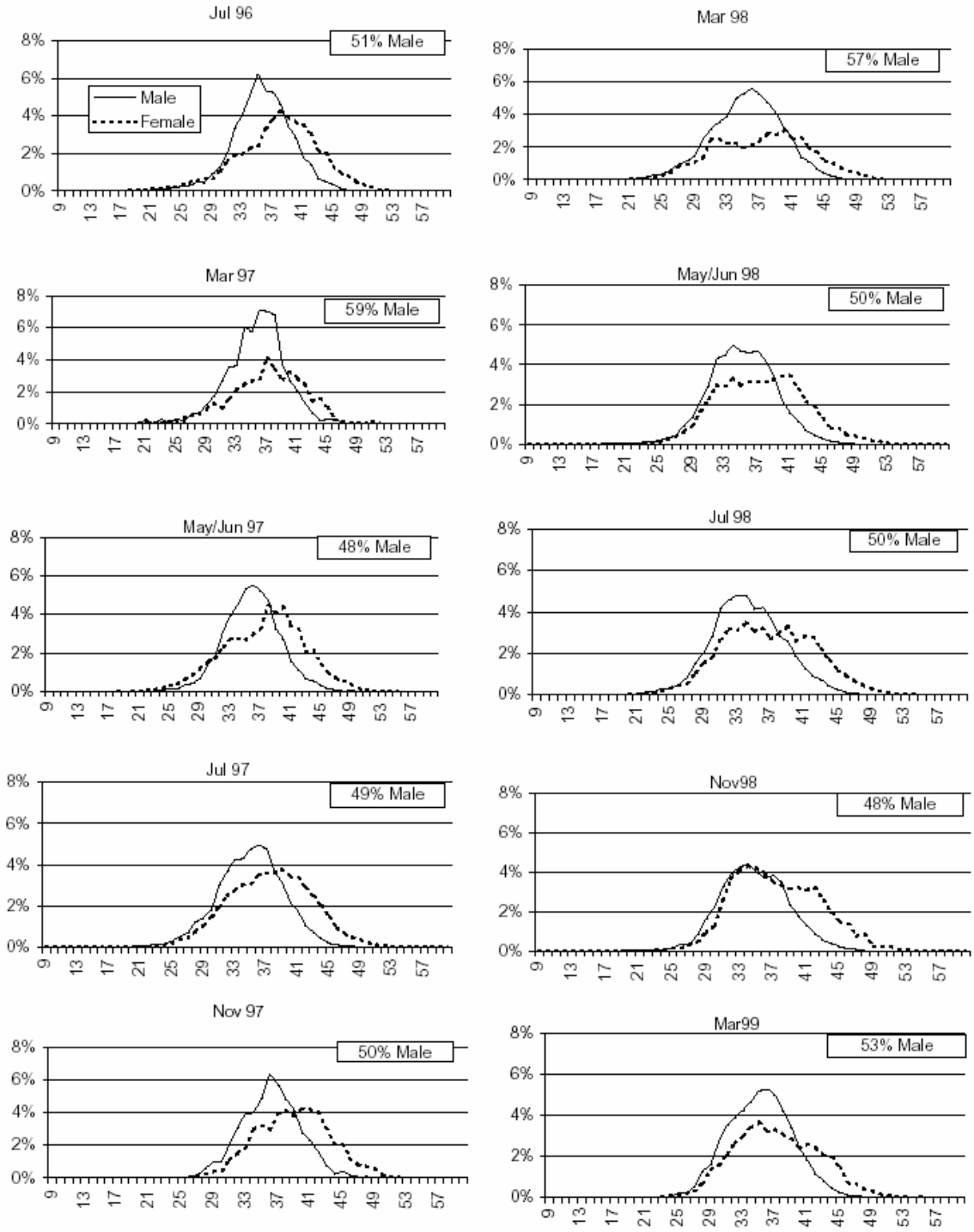

Figure 12a. Length compostion of yellowtail flounder caught in the Atlantic Lindey surveys.

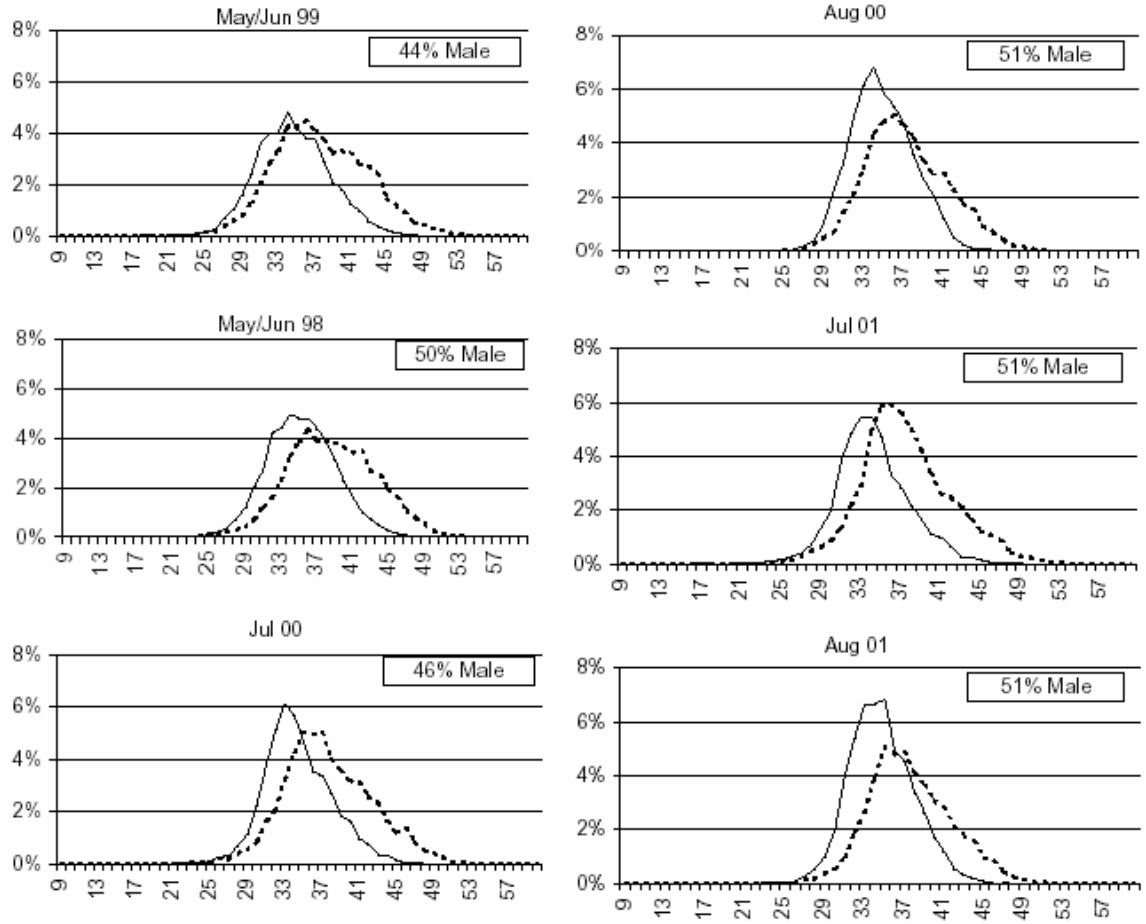

Figure 12b. Length compostion of yellowtail flounder caught in the Atlantic Lindey surveys.

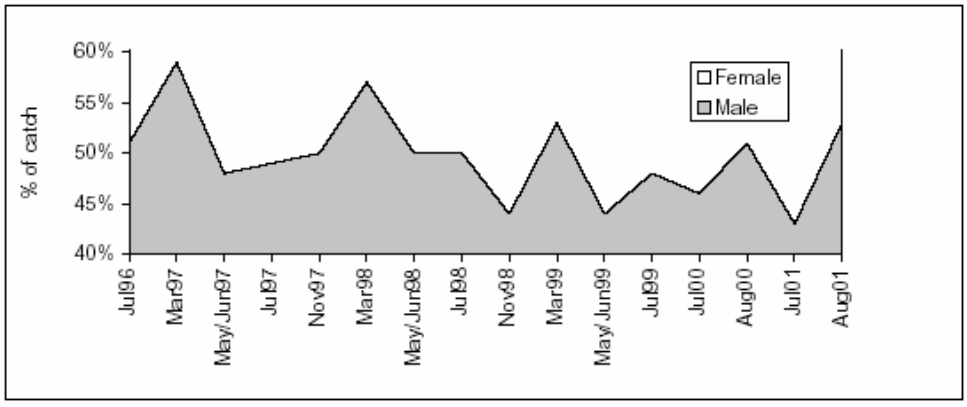

Figure 13. Sex ratio of yellowtail flounder catch for the Atlantic Lindsey surveys.

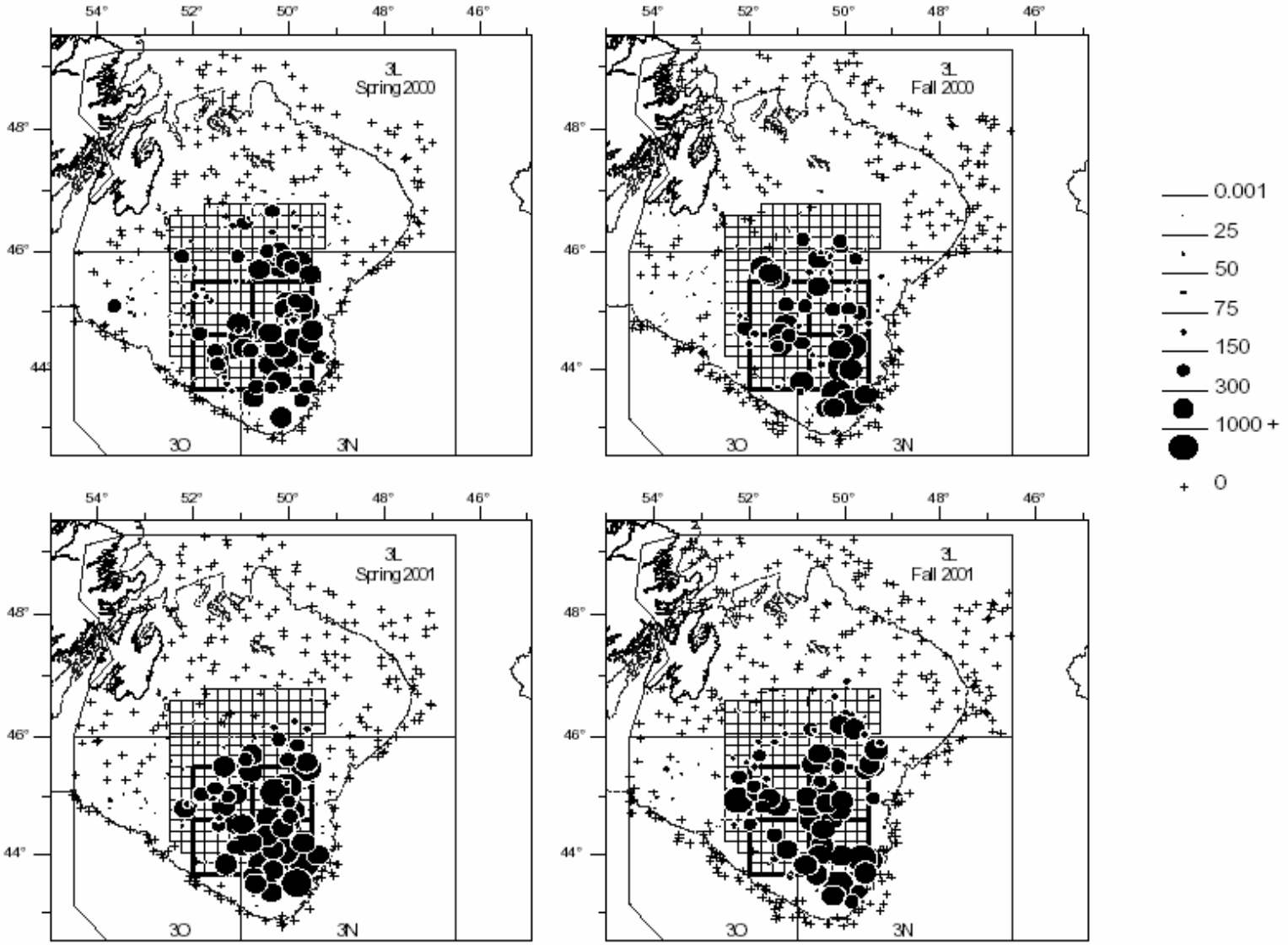

Figure 14. Distribution of yellowtail flounder catches (number/tow) from stratified random spring and fall surveys conducted in 2000 and 2001with a Campelen 1800 trawl in Div. 3LNO. Grid used in DFO-FPI suveys is depicted for illustration.

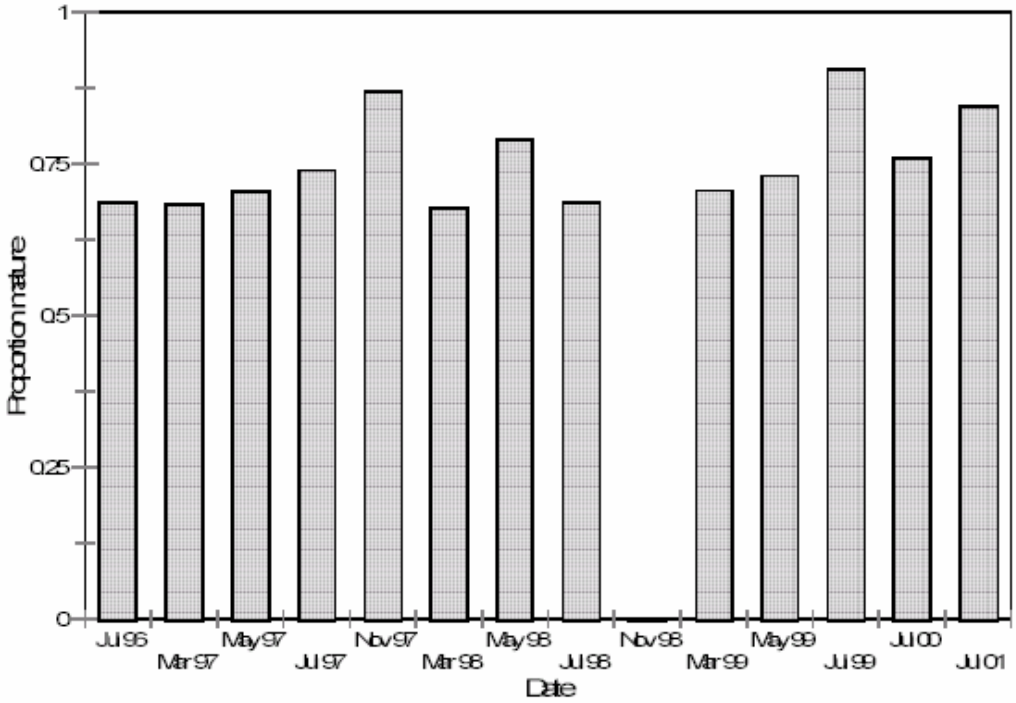

Fig 15. Proportion of female yellowtail flounder considered to be sexually mature, from grid surveys in Div. 3NO.

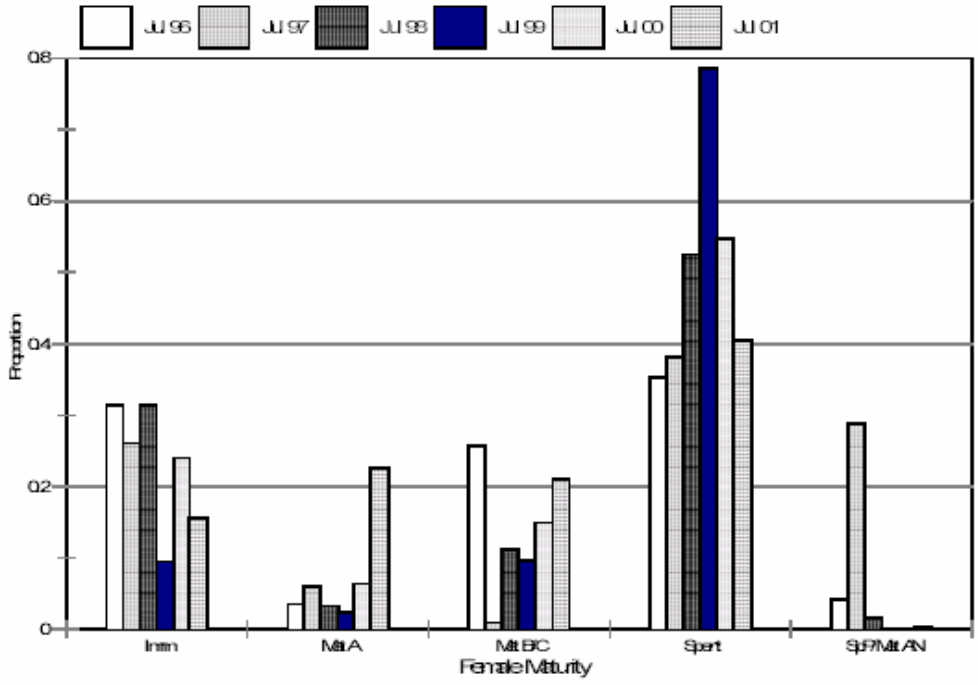

Fig 16. Maturity stages of female yellowtail flounder, from grid surveys conducted in July in Div. 3NO.