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Update on Cooperative Surveys of Yellowtail flounder in NAFO Divisions 3NO, 1996-2000, Including an Expanded Survey in Divisions 3LNO in 2000

by

D. Maddock Parsons, W. B. Brodie, and M. Simpson

Northwest Atlantic Fisheries Center, Science Branch, Department of Fisheries and Oceans
P.O. Box 5667, St. John's, Newfoundland, Canada AIC 5XI

Abstract

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. 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. Thirteen surveys were conducted, 1 in 1996, 4 each in 1997 and 1998, 3 in 1999, and 1 in 2000. In 2000, the grid area was expanded to cover an additional 100 blocks, an area equal in size and adjacent to the original grid. Results from the surveys indicate a large degree of spatial and temporal variability for yellowtail flounder in Div. 3NO. Comparing grid survey results with data from surveys and the commercial fishery suggests that yellowtail flounder distribution has expanded since 1997.

Introduction

Cooperative trawl surveys directed for yellowtail flounder have been conducted in Div. 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. Cooperative trawl surveys directed for yellowtail flounder have been conducted in Div. 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.

Methods and Materials

The surveys are designed to cover an area of approximately 9 500 square nautical miles (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 survey area grid is divided into l00 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 flounder 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. Thirteen surveys were conducted, 1 in 1996, 4 each in 1997 and 1998, 3 in 1999, and 1 in 2000. A July survey has been carried out in each of the 5 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). 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, 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 flounder 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 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 and cod were also collected, along with biological sampling (size and maturity) data for yellowtail flounder. 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 first 13 surveys are also compared with data from spring and fall stratified random surveys done by DFO (Walsh *et al*., 2000). Results from the fourteenth survey (expanded grid, Aug 2000), are reported separately in this paper.

Results and Discussion

Catches from the first thirteen (original grid) surveys: In the thirteen surveys of the original grid, between 50 and 85 fishing sets were conducted during each survey (Table 1). For each of the three species examined, catch weights per tow in every March survey were lower than in other surveys (Table 1). Catches for all three species are summarized by quadrant (Tables 2,3,4) and NAFO Division (Table 5) respectively. Excluding the March surveys, 37 of 40 quadrants yielded a mean CPUE for yellowtail flounder in excess of 400 kg per hour (Table 2). Mean CPUE of yellowtail flounder from 12 of 13 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 flounder and A. 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 and cod are shown in Tables 3 and 4. Mean CPUE for American plaice was generally highest in quadrants 3 and 4 (Fig. 2b) with little difference between Div. 3N and 30 (Fig. 3b). 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.

Overall, 13 common blocks were fished in the 13 trips following the original grid design. Data for yellowtail flounder are given in Table 6, American plaice in Table 7 and cod in Table 8. 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. 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 thirteen surveys (Table 9). 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 2000) have 48 common blocks. Tables 10-13 give catch rates for yellowtail flounder, American plaice and cod respectively. By-catch ratios of less than 5% are most

frequently found in the second quadrant, and three blocks have an average American plaice by-catch ratio lower than 5%.

Table 14 also gives an indication of the catches of American plaice compared to the catches of yellowtail flounder. For the four levels of yellowtail flounder catch indicated in the headings, each non-blank cell contains three numbers, with blank cells representing blocks not fished at all in the 13 grid 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 flounder founder catch criterion in the heading. The first numeral represents the number of sets where the catch of American plaice was less than 5% of the yellowtail flounder catch. Five percent was chosen as the cutoff as this is the by-catch limit imposed on the Canadian fishery in 1998. Examining the catches in these tables shows a high percentage of sets in the central portion of the grid (E, F, G) with large yellowtail flounder catches and less than 5% by-catch of American plaice. Most other areas had by-catches of American plaice in excess of 5%.

Catches from the expanded grid survey in August 2000: Catch data from the expanded grid zone, surveyed for the first time in August 2000, are included in Tables 1 and 5 and Fig. 3. For all 3 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 3O (Table 9b). Distributions of the catches are shown in Fig. 4-6.

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 surveys large yellowtail flounder catches were distributed within the original grid (July 2000) and were higher in the northern Div. 3NO portion of the expanded grid (Fig. 4) During previous grid surveys, some large catches of A. plaice were present in each of the four quadrants (Maddock *et al*., 2000). In the 2000 surveys, larger catches were found in quadrants 3 and 4 and in the Div. 3L blocks of the expanded grid area (Fig. 5). Large cod catches appear to be distributed mainly in quadrants 1 and 4 in Div. 30 (Maddock *et al*., 2000) with some large catches in the Div. 3L portion of the August 2000 survey (Fig. 6). These distributions are similarly reflected in the trawl statistics in Tables 1, 3 and 4.

Length Composition: Length composition of male and female yellowtail flounder caught during the 14 surveys are shown in Fig. 7 (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 15). 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. 8. March surveys show a higher percentage of males in the catch than surveys at other times, and an overall decline in male composition is apparent over the time series.

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 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). Most of the yellowtail flounder catch from this fleet occurred in quadrants 2 and 3 of Div 3N, with quadrant 3 usually showing the highest CPUE values. The blocks in the central parts of columns G and H (see Fig 1) had the highest overall catches of yellowtail flounder. This analysis also indicated that the northwest comer of the grid, which produced several good catches in the grid surveys, was not a primary fishing area for yellowtail flounder 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 (Div. 30), were also lightly fished historically. However, other areas which had high CPUE values in the grid surveys, such as Blocks G05, F07, and 103 in Div. 3N, were heavily fished in the past.

It must be stated again that the direct comparability of the catch rates in the grid surveys with those from the previous commercial fishery is not known. Although the fishing gear used in the grid survey is the same as that used in FPI's commercial fishery, the 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 3 March trips, suggest widespread distribution of yellowtail flounder CPUE's which are quite high relative to historic CPUE in the fishery.

Comparison of results with research vessel data: The distribution of yellowtail flounder from the 9 stratified random research vessel surveys conducted by DFO with the Campelen trawl in 1995-1999 was shown in Maddock *et al*. (2000). Comparable results from 1999 and 2000 spring and fall surveys are shown in figure 9. 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 flounder caught in the r.v. surveys are located within the boundaries of the grid. However, there is a declining trend in the percentage of yellowtail flounder found in the original grid (Table 16). In the first four surveys (fall 95 to spring 97), between 80 and 90% of yellowtail flounder were located within the grid, compared with about 40% in the fall 2000 surveys. Within the grid, r.v. survey mean catch rates of yellowtail flounder were quite similar in all 5 fall surveys, between 73 and 90 kg per 15 minute tow on average. In the spring surveys, catch per tow in the grid area showed an increasing trend, from 80-85 kg. per tow in 1996-97 to 98 and 120 kg. per tow in 1998 and 1999. However, the 2000 data point was 85 kg. per tow. Overall, these data 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 in the late 1990's (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 approximately 250 fish from each of 2 fishing sets per day, although the March 1998 data were collected from port samples immediately following the survey. Fig. 10 indicates that 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 from the 2000 survey was close to the mean. A closer look at the data from the 5 July surveys (Fig. 11) 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 earlier in 1997. The distribution of mature females among the various maturity stages in 2000 was similar to that measured in 1998, while the 1999 survey had a higher percentage of spent females. Data from the expanded grid in 2000 showed the maturity stages of female yellowtail flounder had a similar distribution compared with those in the original grid area.

Conclusions

Cooperative surveys between DFO and FPI for yellowtail flounder in Div. 3NO indicate a large degree of spatial and temporal variability. Consistently, surveys conducted in March produced lower mean catches, for both yellowtail flounder and American plaice. In a limited area. However, surveys that were conducted in July, and less so in November, produced widespread large catches of yellowtail flounder. Excluding the March data, mean catch rates of yel1owtail in the grid surveys were generally lower in July and November 1998 and in July of 1999 than in previous surveys, but were higher in the July 2000 survey. Comparing grid survey results with data from r. v. surveys and the commercial fishery suggests that yellowtail flounder distribution has expanded since 1997.

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Table 1. Catches (kg/hr) by species and trip from FPI/DFO cooperative grid surveys. Trip 15 surveys an expanded grid area.

Species	Trip	Trip #	N	Mean	StdDev	Max	Min
Yellowtail flounder	**Jul96**	**1**	83	702.23	485.77	2503.57	34.00
	Mar97	**2**	68	124.76	605.40	4972.44	0.00
	May/Jun97	**3**	82	631.23	621.59	4607.00	24.50
	Jul97	**4**	85	664.76	478.13	3369.10	17.50
	Nov97	**5**	50	627.37	926.85	5931.00	3.50
	Mar98	**6**	84	78.15	92.85	427.74	0.00
	May/Jun98	**7**	73	655.19	502.41	2872.62	67.00
	Jul98	**8**	78	807.35	531.74	2678.27	0.00
	Nov98	**9**	63	558.88	774.96	5726.06	1.00
	Mar99	**10**	73	147.81	139.62	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
	Aug00	**15**	83	419.32	346.50	1519.49	10.00
American Plaice	**Jul96**	**1**	83	107.14	124.81	942.94	3.00
	Mar97	**2**	68	20.75	44.22	234.50	0.00
	May/Jun97	**3**	82	174.55	137.91	759.80	3.50
	Jul97	**4**	85	180.71	265.59	1654.40	0.00
	Nov97	**5**	50	131.78	94.88	492.90	23.30
	Mar98	**6**	84	20.25	40.64	246.74	0.00
	May/Jun98	**7**	73	173.69	111.14	785.46	33.92
	Jul98	**8**	78	229.35	361.10	2197.82	12.72
	Nov98	**9**	63	138.03	105.69	471.60	13.78
	Mar99	**10**	73	17.59	47.53	330.00	0.00
	May/Jun99	**12**	78	173.54	158.81	890.10	21.20
	Jul99	**13**	64	151.72	175.80	975.20	8.50
	Jul00	**14**	65	219.43	203.19	1117.24	30.18
	Aug00	**15**	83.00	132.05	173.57	934.51	6.00
Cod	**Jul96**	**1**	83	111.88	288.37	2509.09	0.00
	Mar97	**2**	68	0.76	1.95	10.00	0.00
	May/Jun97	**3**	82	48.55	79.64	437.40	0.00
	Jul97	**4**	85	71.17	110.28	644.00	0.00
	Nov97	**5**	50	72.08	103.38	411.50	0.00
	Mar98	**6**	84	3.39	11.03	55.00	0.00
	May/Jun98	**7**	73	55.34	94.48	400.00	0.00
	Jul98	**8**	78	107.71	249.40	1273.80	0.00
	Nov98	**9**	63	43.13	123.37	917.70	0.00
	Mar99	**10**	73	1.98	10.25	86.00	0.00
	May/Jun99	**12**	78	72.10	140.96	1005.90	0.00
	Jul99	**13**	64	192.85	773.21	6067.20	0.00
	Jul00	**14**	65	69.71	126.80	877.80	0.00
	Aug00	**15**	83	51.96	58.05	340.80	0.00

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

Trip	Trip #	Quad	N	Mean	Sum	StdDev	Max	Median	Min
Jul96	**1**	1	22	861.58	18954.73	565.99	2503.57	730.34	224.50
		2	16	607.93	9726.82	443.18	1818.10	472.21	34.00
		3	22	727.69	16009.16	446.35	1921.09	729.15	82.00
		4	23	591.06	13594.39	451.91	1560.34	526.79	67.00
Mar97	**2**	1	14	21.30	298.20	17.56	60.00	20.75	0.00
		2	17	396.86	6746.61	1194.35	4972.44	40.50	0.00
		3	20	40.01	800.25	43.46	148.00	20.00	2.00
		4	17	37.56	638.59	26.05	88.00	29.50	5.00
May/Jun97	**3**	1	22	774.99	17049.79	1006.21	4607.00	440.05	204.00
		2	16	661.40	10582.45	492.75	1911.00	482.04	28.50
		3	22	446.33	9819.17	288.17	920.00	435.00	24.50
		4	22	650.42	14309.29	403.50	1889.64	663.50	32.50
Jul97	**4**	1	23	746.20	17162.49	754.48	3369.10	567.38	90.00
		2	16	662.16	10594.50	243.48	1396.97	589.56	451.13
		3	23	651.14	14976.18	389.38	1669.00	589.50	136.72
		4	23	598.78	13771.85	316.08	1359.84	513.20	17.50
Nov97	**5**	1	17	457.49	7777.29	415.57	1533.48	366.50	44.50
		2	8	1522.31	12178.47	1910.54	5931.00	909.65	87.00
		3	10	661.69	6616.87	681.05	2519.00	481.42	171.50
		4	15	319.74	4796.11	301.86	1016.90	276.00	3.50
Mar98	**6**	1	19	15.25	289.84	25.18	107.27	5.00	0.00
		2	15	66.63	999.48	91.86	299.60	25.91	0.45
		3	27	128.96	3482.01	108.69	427.74	83.64	7.73
		4	23	77.97	1793.31	77.45	316.00	55.41	9.74
May/Jun98	**7**	1	18	648.20	11667.51	650.95	2872.62	435.14	130.08
		2	15	870.79	13061.90	667.84	2398.70	779.70	228.99
		3	20	721.86	14437.19	344.34	1734.08	593.36	289.95
		4	20	433.10	8662.04	191.96	795.80	426.72	67.00
Jul98	**8**	1	22	780.81	17177.82	644.42	2678.27	567.79	133.22
		2	15	974.26	14613.88	516.81	2284.75	858.87	301.76
		3	20	869.76	17395.22	358.88	1611.73	830.83	204.34
		4	21	656.51	13786.64	541.99	2383.01	647.23	0.00
Nov98	**9**	1	13	458.44	5959.68	318.98	1128.83	476.20	45.00
		2	15	990.25	14853.80	1400.53	5726.06	555.04	47.50
		3	14	715.63	10018.87	399.40	1495.87	672.97	236.81
		4	21	208.44	4377.18	178.01	632.59	203.17	1.00
Mar99	**10**	1	14	84.79	1187.10	102.26	394.40	44.95	11.00
		2	15	185.59	2783.81	173.62	510.93	128.80	0.30
		3	21	231.11	4853.27	152.52	536.40	201.10	25.60
		4	23	85.49	1966.31	55.73	200.61	80.80	5.20
May/Jun99	**12**	1	17	665.21	11308.50	670.96	2289.80	457.53	132.00
		2	17	306.77	5215.10	169.38	692.10	255.00	95.60
		3	22	474.70	10443.30	181.29	905.80	456.67	173.80
		4	22	566.09	12454.00	383.63	1464.50	474.30	57.60
Jul99	**13**	1	19	616.11	11706.10	383.02	1489.00	624.04	124.50
		2	12	530.83	6369.90	258.69	915.00	534.16	163.00
		3	11	534.73	5882.00	300.62	1087.20	467.12	196.20
		4	22	608.80	13393.60	376.94	1438.50	610.25	8.00
Jul00	**14**	1	17	903.22	15354.82	820.65	3319.19	632.81	165.74
		2	14	844.77	11826.73	330.74	1471.18	851.98	398.96
		3	16	818.13	13090.12	412.63	1478.99	842.37	246.13
		4	18	661.45	11906.11	348.91	1439.33	639.83	62.00

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

Trip	Trip #	Quad	N	Mean	Sum	StdDev	Max	Median	Min
Jul96	**1**	1	22	64.29	1414.40	57.78	232.80	46.00	3.00
		2	16	56.02	896.30	45.89	183.50	42.40	8.00
		3	22	159.57	3510.63	201.36	942.94	95.25	17.00
		4	23	133.55	3071.62	86.74	420.23	125.50	29.50
Mar97	**2**	1	14	3.34	46.80	2.65	7.80	3.50	0.00
		2	17	31.58	536.88	63.27	212.44	7.03	0.00
		3	20	8.80	176.00	9.84	35.50	4.25	1.00
		4	17	38.32	651.46	56.29	234.50	17.00	1.50
May/Jun97	**3**	1	22	131.41	2890.94	78.66	414.50	114.20	49.80
		2	16	84.34	1349.42	39.59	171.00	75.00	21.00
		3	22	139.26	3063.72	87.69	389.56	133.05	3.50
		4	22	318.58	7008.86	164.83	759.80	296.00	104.30
Jul97	**4**	1	23	70.99	1632.83	54.29	211.28	44.44	5.60
		2	16	99.90	1598.38	94.00	321.55	60.92	20.58
		3	23	325.58	7488.35	453.99	1654.40	103.02	0.00
		4	23	201.76	4640.49	120.43	498.24	210.79	37.03
Nov97	**5**	1	17	107.15	1821.63	117.03	492.90	58.83	23.30
		2	8	135.17	1081.32	53.58	222.60	128.83	72.08
		3	10	107.27	1072.71	59.98	254.40	83.19	60.40
		4	15	174.22	2613.30	94.88	329.13	132.50	68.90
Mar98	**6**	1	19	0.82	15.56	0.78	2.00	0.46	0.00
		2	15	4.67	69.99	5.91	17.27	1.36	0.00
		3	27	10.93	295.03	7.53	33.45	12.36	0.45
		4	23	57.43	1320.84	64.01	246.74	35.91	3.18
May/Jun98	**7**	1	18	141.07	2539.33	93.17	339.20	106.68	39.22
		2	15	129.38	1940.74	58.15	235.32	120.84	67.84
		3	20	223.17	4463.33	157.91	785.46	206.40	33.92
		4	20	186.80	3735.97	79.39	415.52	171.72	87.45
Jul98	**8**	1	22	84.95	1868.92	79.98	271.78	43.99	12.72
		2	15	84.09	1261.37	74.44	241.15	44.52	15.90
		3	20	510.21	10204.13	615.66	2197.82	314.43	25.44
		4	21	216.91	4555.17	116.27	431.42	227.68	47.70
Nov98	**9**	1	13	139.94	1819.21	113.97	457.13	89.04	39.22
		2	15	105.99	1589.79	88.94	316.48	68.07	28.50
		3	14	141.13	1975.84	127.39	411.81	87.72	13.78
		4	21	157.67	3311.13	97.78	471.60	137.14	47.00
Mar99	**10**	1	14	1.20	16.75	0.81	2.60	1.40	0.00
		2	15	6.29	94.41	10.78	41.00	1.90	0.30
		3	21	8.45	177.53	5.20	18.20	8.20	0.00
		4	23	43.27	995.20	79.17	330.00	10.40	1.20
May/Jun99	**12**	1	17	73.51	1249.60	33.08	142.50	72.60	24.40
		2	17	56.14	954.30	28.22	129.30	47.70	21.20
		3	22	265.00	5829.90	195.43	890.10	218.92	38.60
		4	22	250.11	5502.40	136.66	644.10	228.18	41.30
Jul99	**13**	1	19	55.13	1047.40	46.48	204.60	50.46	8.50
		2	12	39.24	470.90	34.04	123.00	30.74	8.50
		3	11	322.51	3547.60	246.42	975.20	277.69	55.10
		4	22	211.10	4644.20	163.39	714.80	164.14	27.30
Jul00	**14**	1	17	123.12	2093.07	106.67	447.53	83.85	30.18
		2	14	105.86	1482.01	83.72	367.56	77.65	36.57
		3	16	373.42	5974.68	275.46	1117.24	372.59	59.36
		4	18	261.85	4713.24	168.22	542.63	217.20	42.40

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

Trip	Trip #	Quad	N	Mean	Sum	StdDev	Max	Median	Min
Jul96	**1**	1	22	226.66	4986.59	521.82	2509.09	76.50	6.00
		2	16	19.06	305.00	18.87	53.00	14.50	0.00
		3	22	42.31	930.80	79.33	295.00	5.00	0.00
		4	23	133.21	3063.79	137.93	520.00	78.00	0.00
Mar97	**2**	1	14	0.87	12.20	1.53	5.50	0.00	0.00
		2	17	0.11	1.80	0.37	1.50	0.00	0.00
		3	20	1.02	20.45	2.45	10.00	0.00	0.00
		4	17	1.00	17.00	2.47	10.00	0.00	0.00
May/Jun97	**3**	1	22	84.62	1861.70	86.53	308.00	44.60	0.00
		2	16	10.72	171.48	11.85	36.00	7.20	0.00
		3	22	5.65	124.23	13.39	51.00	0.00	0.00
		4	22	82.90	1823.73	105.27	437.40	38.40	0.00
Jul97	**4**	1	23	112.44	2586.04	110.06	380.00	66.09	0.00
		2	16	24.85	397.65	31.52	133.30	22.66	0.00
		3	23	18.52	426.02	30.42	148.17	10.00	0.00
		4	23	114.76	2639.44	156.52	644.00	63.96	0.00
Nov97	**5**	1	17	28.15	478.50	70.06	293.40	4.80	0.00
		2	8	14.06	112.50	20.54	45.60	0.25	0.00
		3	10	169.86	1698.60	120.64	383.40	166.20	9.00
		4	15	87.61	1314.20	104.28	411.50	48.00	0.00
Mar98	**6**	1	19	0.19	3.68	0.66	2.77	0.00	0.00
		2	15	0.00	0.00	0.00	0.00	0.00	0.00
		3	27	2.07	55.82	7.14	36.95	0.00	0.00
		4	23	9.78	224.87	18.35	55.00	0.45	0.00
May/Jun98	**7**	1	18	86.18	1551.26	96.01	297.86	48.30	4.80
		2	15	7.98	119.68	17.98	66.00	0.00	0.00
		3	20	40.46	809.20	114.31	400.00	0.00	0.00
		4	20	78.00	1560.00	93.96	297.60	32.70	0.00
Jul98	**8**	1	22	255.03	5610.57	404.25	1273.80	116.31	0.00
		2	15	12.49	187.40	21.12	77.20	0.00	0.00
		3	20	27.65	553.00	86.90	391.20	2.70	0.00
		4	21	97.62	2050.08	152.37	625.68	42.00	0.00
Nov98	**9**	1	13	25.15	326.90	48.75	182.40	7.20	0.00
		2	15	24.42	366.29	67.16	263.19	2.00	0.00
		3	14	29.49	412.80	39.33	126.00	12.00	0.00
		4	21	76.71	1611.00	199.52	917.70	13.20	0.00
Mar99	**10**	1	14	0.76	10.70	1.27	3.40	0.00	0.00
		2	15	0.49	7.40	1.65	6.40	0.00	0.00
		3	21	0.49	10.30	1.39	5.60	0.00	0.00
		4	23	5.03	115.80	18.02	86.00	0.00	0.00
May/Jun99	**12**	1	17	137.19	2332.20	234.39	1005.90	76.20	0.00
		2	17	20.34	345.80	41.30	135.80	0.00	0.00
		3	22	20.36	448.00	37.42	142.10	0.00	0.00
		4	22	113.55	2498.00	134.51	510.20	61.02	0.00
Jul99	**13**	1	19	501.85	9535.20	1384.48	6067.20	94.40	0.00
		2	12	28.00	336.00	45.78	115.20	0.00	0.00
		3	11	44.60	490.60	67.74	219.60	15.60	0.00
		4	22	90.03	1980.60	151.03	609.70	28.80	0.00
Jul00	**14**	1	17	98.87	1680.80	99.09	386.00	60.00	0.00
		2	14	11.65	163.10	20.19	73.20	1.75	0.00
		3	16	45.26	724.20	60.99	225.20	22.20	0.00
		4	18	109.07	1963.20	204.62	877.80	52.8	0.00

Table 5. Catches (kg/hr) by NAFO division from FPI grid surveys.

			Yellowtail flounder		American Plaice		Cod	
Trip	**Trip #**	**NAFO**	**N**	**Mean**	**N**	**Mean**	**N**	**Mean**
Jul96	**1**	**3N**	46	749.06	46	108.27	46	40.41
		3O	37	644.01	37	105.74	37	200.73
Mar97	**2**	**3N**	44	175.29	44	16.83	44	0.68
		3O	24	32.12	24	27.95	24	0.90
May/Jun97	**3**	**3N**	47	676.42	47	128.94	47	18.65
		3O	35	570.54	35	235.79	35	88.70
Jul97	**4**	**3N**	49	694.44	49	205.78	49	32.16
		3O	36	624.37	36	146.57	36	124.25
Nov97	**5**	**3N**	24	901.68	24	118.08	24	99.16
		3O	26	374.17	26	144.42	26	47.08
Mar98	**6**	**3N**	50	93.11	50	8.07	50	1.19
		3O	34	56.15	34	38.18	34	6.62
May/Jun98	**7**	**3N**	44	796.68	44	172.53	44	32.24
		3O	29	440.51	29	175.45	29	90.40
Jul98	**8**	**3N**	44	925.85	44	280.98	44	25.92
		3O	34	654.00	34	162.54	34	213.54
Nov98	**9**	**3N**	36	753.75	36	119.62	36	31.66
		3O	27	299.06	27	162.58	27	58.41
Mar99	**10**	**3N**	44	193.14	44	7.91	44	0.48
		3O	29	79.05	29	32.26	29	4.25
May/Jun99	**12**	**3N**	46	470.91	46	175.18	46	18.62
		3O	32	554.97	32	171.18	32	148.98
Jul99	**13**	**3N**	31	601.43	31	157.66	31	40.07
		3O	33	566.88	33	146.14	33	336.37
Jul00	**14**	**3N**	36	808.97	36	250.94	36	33.43
		3O	29	795.00	29	180.32	29	114.75
Aug00	**15**	**3N**	15	735.24	15	83.12	15	36.91
		3O	18	351.31	18	48.20	18	48.43
		3L	50	349.03	50	176.92	50	57.75

Table 6. Catches of yellowtail flounder (kg/hr) from common blocks fished in thirteen surveys.

Block	Jul96	Mar97	May97	Jul97	Nov97	Mar98	May/ Jun98	Jul98	Nov98	Mar99	May/ Jun99	Jul99	Jul00
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
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
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
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
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
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
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
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
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
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
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
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
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
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

Table 7. Catches of American plaice (kg/hr) from common blocks fished in thirteen surveys.

Block	Jul96	Mar97	May97	Jul97	Nov97	Mar98	May/ Jun98	Jul98	Nov98	Mar99	May/ Jun99	Jul99	Jul00
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
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	176.89
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
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
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
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	138.07
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	347.15
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	74.61
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	70.78
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	41.87
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	386.47
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	48.76
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	376.83
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

Table 8. Catches of cod (kg/hr) from common blocks fished in thirteen surveys.

Block	Jul96	Mar97	May97	Jul97	Nov97	Mar98	May/ Jun98	Jul98	Nov98	Mar99	May/ Jun99	Jul99	Jul00
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
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
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
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
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
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
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
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
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
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
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
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
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
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

Table 9. Ratio of American plaice to yellowtail flounder catch, by block, from common blocks fished in thirteen surveys. Blank cells indicate catch of yellowtail flounder was zero.

Block	Jul96	Mar97	May97	Jul97	Nov97	Mar98	May/ Jun98	Jul98	Nov98	Mar99	May/ Jun99	Jul99	Jul00	Mean
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	0.08
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	0.09
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	0.12
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	0.19
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	0.19
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	0.31
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	0.23
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	0.29
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	0.31
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	0.48
B02	0.14		0.39	0.33	1.15		0.51	0.20	1.28	0.24	0.43	0.45	0.32	0.49
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	1.10
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	6.37

Table 9b. Blocks from the expanded grid survey, August 2000, in which the ratio of plaice to yellowtail flounder catch was under 5 percent

Block	Yellowtail flounder	American Plaice	Cod	Ratio (Plaice/Ytail)
151	305.04	9.54	55.20	0.03
505	688.37	28.62	16.80	0.04
604	659.21	26.50	13.80	0.04

Table 10. Catches of yellowtail flounder (kg/hr) in the common blocks fished in July surveys.

	Yellowtail flounder				
Block	**96**	**97**	**98**	**99**	**00**
A01	1315.86	997.64	2236.80	1489.00	1132.44
A02	1828.28	211.25	449.05	400.50	1684.80
A03	1086.85	690.78	835.10	520.20	3319.19
A05	1410.51	167.00	418.65	720.20	398.90
A07	576.73	845.50	572.27	516.60	438.24
A08	325.95	637.30	270.55	554.10	301.90
B02	321.00	482.30	379.29	124.50	165.74
B03	683.73	720.50	853.90	226.80	2244.31
B04	492.90	90.00	219.58	178.80	384.38
B06	756.00	612.00	666.10	665.60	489.45
B08	642.20	857.00	506.90	649.10	340.29
B09	254.20	582.34	26.00	101.00	486.75
B10	146.50	17.50	0.00	8.00	62.00
C02	352.50	371.25	435.90	691.50	427.59
C04	324.00	462.56	380.68	669.30	619.75
C05	942.59	606.50	542.12	333.30	914.32
C07	526.79	1240.50	2383.01	747.90	928.84
C08	115.38	720.50	333.14	1438.50	174.90
C10	1430.89	1014.13	503.63	528.20	722.29
D01	720.91	2500.63	1206.56	946.30	765.43
D04	668.14	567.38	593.45	465.60	632.81
D05	739.76	635.75	928.76	624.00	796.84
D06	1560.34	1382.50	1249.69	504.50	1439.33
D07	698.05	452.50	947.91	1086.40	1127.95
D08	471.87	481.50	698.63	752.10	586.63
D09	684.76	513.20	903.64	683.00	965.14
E01	713.85	3369.10	2678.27	710.50	851.43
E02	937.32	1148.00	959.42	1435.20	488.21
E08	1167.91	506.50	898.12	883.60	651.82
E10	557.09	483.38	694.02	632.40	805.87
F02	1037.00	653.25	858.87	671.30	607.61
F04	1032.34	704.00	1869.00	529.50	1471.18
F05	1818.10	1396.97	2284.75	170.50	959.57
F06	955.94	728.30	1385.96	1087.20	1478.99
F08	1755.34	639.19	1469.34	830.30	1401.36
F09	836.83	354.25	704.09	913.40	1095.84
G01	664.77	538.50	301.76	296.00	453.21
G03	344.68	518.50	1039.25	667.30	642.23
G04	868.66	451.13	899.02	538.90	1096.56
G05	502.54	528.50	1169.70	338.30	833.59
G07	721.72	711.25	1042.11	589.40	246.13
H02	600.77	977.44	1198.47	853.30	1417.99
H04	357.56	684.70	941.39	419.60	688.98
H08	736.71	631.62	734.97	220.90	579.75
H09	485.07	269.74	463.14	344.20	888.43
I01	278.50	483.15	824.50	807.20	488.63
I03	441.88	857.50	567.89	163.00	870.36
J08	507.58	439.67	477.88	196.20	296.26
Mean	758.31	727.81	875.07	602.57	830.50

Table 11. Catches of plaice (kg/hr) in the common blocks fished in July surveys.

	American Plaice				
Block	**96**	**97**	**98**	**99**	**00**
A01	232.80	114.27	218.90	204.60	187.90
A02	180.00	45.49	42.40	86.20	447.53
A03	84.50	40.95	213.38	56.50	176.89
A05	110.00	35.00	152.64	104.40	47.70
A07	29.50	220.50	76.32	27.30	63.60
A08	220.50	111.10	100.70	138.50	142.60
B02	45.00	158.70	77.23	56.00	53.00
B03	105.00	44.44	42.40	93.20	247.50
B04	111.50	15.50	42.40	12.70	30.18
B06	34.00	37.03	56.71	68.00	72.08
B08	158.00	173.90	47.70	120.60	225.12
B09	420.23	326.93	200.10	276.20	166.10
B10	270.00	146.75	253.49	140.50	209.27
C02	25.50	40.20	45.58	53.80	58.30
C04	15.00	66.65	17.89	45.60	115.54
C05	47.00	88.64	120.84	50.50	110.72
C07	151.00	231.20	431.42	73.60	110.74
C08	53.08	88.05	179.62	714.80	403.78
C10	293.00	349.50	309.68	85.10	138.07
D01	58.00	211.28	41.34	75.40	122.72
D04	41.00	66.50	49.82	21.50	48.58
D05	10.00	149.00	222.60	39.00	74.67
D06	69.00	214.30	322.26	61.70	96.46
D07	72.00	148.50	244.32	324.20	377.45
D08	124.00	96.00	389.90	385.90	496.72
D09	163.50	232.78	330.46	190.40	479.48
E01	80.00	130.40	120.66	15.90	208.14
E02	85.60	69.96	62.54	66.40	83.85
E08	92.00	106.00	274.54	187.80	347.15
E10	147.50	265.25	189.21	263.70	352.92
F02	47.50	35.63	34.98	47.40	75.79
F04	8.00	38.09	33.92	8.50	36.57
F05	20.00	22.25	15.90	26.00	74.61
F06	23.00	0.00	56.18	55.10	95.84
F08	91.00	73.92	326.75	171.90	424.94
F09	67.50	85.12	302.10	311.10	438.84
G01	42.00	49.90	72.08	31.80	81.62
G03	47.50	39.15	54.06	15.90	70.78
G04	39.00	30.57	44.52	8.50	41.87
G05	20.00	39.78	31.80	29.70	127.73
G07	80.00	86.80	382.66	265.30	386.47
H02	67.00	92.81	80.56	123.00	367.56
H04	42.00	75.28	40.78	79.50	48.76
H08	124.00	155.40	33.92	317.20	376.83
H09	74.50	280.35	411.81	171.70	1117.24
I01	86.50	214.60	114.48	57.70	121.90
I03	81.00	274.38	216.24	9.00	79.50
J08	387.00	1654.40	2197.82	975.20	403.86
Mean	101.58	151.53	194.33	140.51	209.70

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

	Cod				
Block	**96**	**97**	**98**	**99**	**00**
A01	506.00	51.00	141.00	94.40	10.20
A02	207.00	46.00	1273.80	1358.00	182.40
A03	274.00	175.20	16.80	107.40	386.00
A05	2509.09	260.00	1208.70	6067.20	166.80
A07	131.00	30.00	38.40	9.00	8.40
A08	14.00	28.50	24.00	27.60	58.80
B02	168.00	75.60	116.82	64.50	60.00
B03	6.00	64.80	165.60	60.00	229.20
B04	50.00	35.50	399.96	144.00	56.40
B06	520.00	437.40	27.00	609.70	303.60
B08	314.00	139.80	421.20	74.40	52.80
B09	89.00	0.00	33.00	84.50	0.00
B10	282.50	27.00	21.60	20.40	12.60
C02	130.50	21.60	124.80	242.40	51.60
C04	174.00	308.00	248.91	0.00	0.00
C05	93.00	224.40	7.00	46.80	14.40
C07	206.00	132.60	625.68	0.00	52.80
C08	443.09	75.60	157.20	62.40	60.00
C10	33.00	0.00	31.20	56.40	36.00
D01	78.00	39.60	93.00	453.60	10.20
D04	49.00	20.40	0.00	528.80	99.60
D05	54.00	150.00	1168.08	13.80	88.80
D06	69.00	117.60	15.60	14.40	877.80
D07	55.00	75.08	52.80	4.80	64.80
D08	212.00	208.66	82.20	355.20	13.20
D09	24.00	24.00	130.80	290.40	144.00
E01	10.00	27.60	0.00	6.60	28.80
E02	156.00	18.00	15.00	110.10	58.80
E08	145.20	252.00	43.80	217.20	21.60
E10	32.00	0.00	42.00	0.00	120.00
F02	48.50	36.00	77.20	111.60	31.20
F04	8.00	20.40	36.00	0.00	0.00
F05	4.00	1.80	0.00	0.00	0.00
F06	0.00	0.00	7.00	0.00	10.20
F08	73.00	0.00	5.40	36.00	57.60
F09	295.00	0.00	0.00	82.80	35.00
G01	39.00	24.00	18.60	79.20	15.00
G03	2.50	11.00	0.00	0.00	1.00
G04	28.00	3.28	13.20	0.00	0.00
G05	0.00	4.20	0.00	0.00	0.00
G07	190.00	16.13	59.40	98.40	120.00
H02	1.00	12.00	0.00	12.00	12.00
H04	26.00	10.80	0.00	0.00	0.00
H08	0.00	0.00	4.20	0.00	0.00
H09	0.00	0.00	0.00	0.00	0.00
I01	2.00	9.60	2.40	18.00	7.20
I03	53.00	4.80	0.00	0.00	2.50
J08	0.00	2.00	0.00	15.60	11.40
Mean	162.59	67.12	144.78	241.20	74.43

Table 13. Ratio of American plaice to yellowtail flounder catch from common blocks fished in July surveys.

	Ratio American plaice/yellowtail flounder					
Block	**96**	**97**	**98**	**99**	**00**	**MEAN**
F04	0.01	0.05	0.02	0.02	0.02	**0.02**
F06	0.02	0.00	0.04	0.05	0.06	**0.04**
G04	0.04	0.07	0.05	0.02	0.04	**0.04**
F05	0.01	0.02	0.01	0.15	0.08	0.05
F02	0.05	0.05	0.04	0.07	0.12	0.07
G05	0.04	0.08	0.03	0.09	0.15	0.08
D04	0.06	0.12	0.08	0.05	0.08	0.08
G03	0.14	0.08	0.05	0.02	0.11	0.08
E02	0.09	0.06	0.07	0.05	0.17	0.09
D01	0.08	0.08	0.03	0.08	0.16	0.09
B06	0.04	0.06	0.09	0.10	0.15	0.09
E01	0.11	0.04	0.05	0.02	0.24	0.09
C04	0.05	0.14	0.05	0.07	0.19	0.10
C02	0.07	0.11	0.10	0.08	0.14	0.10
H04	0.12	0.11	0.04	0.19	0.07	0.11
A03	0.08	0.06	0.26	0.11	0.05	0.11
A07	0.05	0.26	0.13	0.05	0.15	0.13
D05	0.01	0.23	0.24	0.06	0.09	0.13
D06	0.04	0.16	0.26	0.12	0.07	0.13
H02	0.11	0.09	0.07	0.14	0.26	0.14
G01	0.06	0.09	0.24	0.11	0.18	0.14
C05	0.05	0.15	0.22	0.15	0.12	0.14
A01	0.18	0.11	0.10	0.14	0.17	0.14
B04	0.23	0.17	0.19	0.07	0.08	0.15
B03	0.15	0.06	0.05	0.41	0.11	0.16
C07	0.29	0.19	0.18	0.10	0.12	0.17
A02	0.10	0.22	0.09	0.22	0.27	0.18
F08	0.05	0.12	0.22	0.21	0.30	0.18
A05	0.08	0.21	0.36	0.14	0.12	0.18
I03	0.18	0.32	0.38	0.06	0.09	0.21
I01	0.31	0.44	0.14	0.07	0.25	0.24
D07	0.10	0.33	0.26	0.30	0.33	0.26
E08	0.08	0.21	0.31	0.21	0.53	0.27
B08	0.25	0.20	0.09	0.19	0.66	0.28
B02	0.14	0.33	0.20	0.45	0.32	0.29
F09	0.08	0.24	0.43	0.34	0.40	0.30
C10	0.20	0.34	0.61	0.16	0.19	0.30
D09	0.24	0.45	0.37	0.28	0.50	0.37
E10	0.26	0.55	0.27	0.42	0.44	0.39
A08	0.68	0.17	0.37	0.25	0.47	0.39
D08	0.26	0.20	0.56	0.51	0.85	0.48
H08	0.17	0.25	0.05	1.44	0.65	0.51
G07	0.11	0.12	0.37	0.45	1.57	0.52
H09	0.15	1.04	0.89	0.50	1.26	0.77
C08	0.46	0.12	0.54	0.50	2.31	0.79
B09	1.65	0.56	7.70	2.73	0.34	2.60
J08	0.76	3.76	4.60	4.97	1.36	2.71
B10	1.84	8.39		17.56	3.38	7.79

Table 14. Categorization of American plaice catch to yellowtail catch for various levels of yellowtail catch. The third number in each cell is the total number of sets in that block (same in all four tables). The second number is the number of sets which fit the yellowtail catch criterion in the heading. The first number is the number of sets in which the catch of American plaice was less than 5% of the yellowtail catch. Blank cells were not fished in any of the thirteen surveys.

Yellowtail Catch >100 Kg

	A	B	C	D	E	F	G	H	I	J
1	0, 10, 13	0, 6, 7	1, 5, 7	2, 9, 11	5, 10, 12	1, 2, 2	0, 8, 12	1, 1, 1	0, 9, 12	
2	0, 8, 10	0, 8, 13	0, 9, 11	0, 6, 9	1, 9, 12	2, 9, 12		0, 9, 12		0, 6, 11
3	1, 11, 13	1, 9, 10	1, 9, 12	1, 6, 8	4, 6, 6	5, 9, 10	2, 10, 13	0, 0, 1	1, 10, 12	
4		0, 8, 12	3, 9, 10	1, 8, 10	4, 8, 9	5, 11, 12	5, 13, 13	3, 13, 13		0, 2, 8
5	0, 10, 13		2, 10, 12	2, 10, 10	2, 5, 7	6, 12, 13	5, 11, 12	1, 10, 12	0, 6, 10	
6		2, 10, 12		1, 8, 12	1, 8, 11	4, 11, 12	4, 8, 9	4, 10, 12		0, 5, 10
7	0, 10, 12	0, 8, 11	0, 9, 12	1, 10, 12	0, 8, 10	4, 11, 11	2, 12, 13	3, 10, 11	1, 10, 11	
8	0, 8, 12	0, 12, 12	0, 9, 12	0, 9, 11	0, 11, 13	1, 8, 10	0, 9, 9	1, 11, 13	0, 8, 11	0, 7, 11
9	0, 3, 12	0, 7, 13	0, 10, 12	0, 10, 12	0, 9, 11	1, 10, 11	0, 9, 11	1, 10, 11	0, 8, 11	0, 6, 10
10	0, 2, 11	0, 4, 12	0, 10, 13	0, 10, 10	2, 10, 11	1, 9, 10	2, 8, 9	0, 8, 8	1, 9, 11	0, 5, 9

Yellowtail Catch >300 Kg

	A	B	C	D	E	F	G	H	I	J
1	0, 9, 13	0, 6, 7	1, 4, 7	2, 9, 11	5, 10, 12	1, 1, 2	0, 6, 12	1, 1, 1	0, 7, 12	
2	0, 7, 10	0, 4, 13	0, 8, 11	0, 1, 9	1, 8, 12	2, 8, 12		0, 9, 12		0, 4, 11
3	1, 10, 13	1, 7, 10	1, 5, 12	0, 0, 8	3, 4, 6	5, 8, 10	2, 9, 13	0, 0, 1	0, 8, 12	
4		0, 4, 12	2, 7, 10	1, 7, 10	4, 6, 9	4, 10, 12	5, 11, 13	2, 10, 13		0, 2, 8
5	0, 8, 13		1, 8, 12	1, 9, 10	2, 5, 7	6, 9, 13	4, 9, 12	1, 8, 12	0, 4, 10	
6		1, 9, 12		1, 8, 12	1, 8, 11	4, 9, 12	4, 6, 9	4, 10, 12		0, 1, 10
7	0, 9, 12	0, 5, 11	0, 8, 12	0, 8, 12	0, 6, 10	2, 7, 11	1, 10, 13	1, 7, 11	1, 9, 11	
8	0, 6, 12	0, 8, 12	0, 6, 12	0, 9, 11	0, 9, 13	0, 7, 10	0, 7, 9	1, 7, 13	0, 6, 11	0, 5, 11
9	0, 0, 12	0, 3, 13	0, 8, 12	0, 9, 12	0, 7, 11	1, 10, 11	0, 8, 11	1, 7, 11	0, 7, 11	0, 2, 10
10	0, 0, 11	0, 0, 12	0, 9, 13	0, 7, 10	2, 8, 11	0, 8, 10	1, 5, 9	0, 5, 8	0, 8, 11	0, 3, 9

Yellowtail Catch >500 Kg

	A	B	C	D	E	F	G	H	I	J
1	0, 8, 13	0, 5, 7	1, 3, 7	2, 8, 11	5, 10, 12	0, 0, 2	0, 3, 12	1, 1, 1	0, 4, 12	
2	0, 5, 10	0, 0, 13	0, 2, 11	0, 0, 9	1, 6, 12	2, 6, 12		0, 8, 12		0, 2, 11
3	0, 7, 13	1, 5, 10	0, 2, 12	0, 0, 8	2, 2, 6	4, 5, 10	1, 6, 13	0, 0, 1	0, 6, 12	
4		0, 0, 12	0, 4, 10	0, 4, 10	3, 4, 9	4, 10, 12	5, 9, 13	1, 5, 13		0, 0, 8
5	0, 4, 13		1, 4, 12	1, 7, 10	1, 3, 7	6, 8, 13	3, 7, 12	0, 5, 12	0, 2, 10	
6		1, 6, 12		1, 7, 12	1, 7, 11	4, 9, 12	3, 5, 9	3, 8, 12		0, 0, 10
7	0, 7, 12	0, 3, 11	0, 8, 12	0, 5, 12	0, 3, 10	2, 7, 11	1, 9, 13	1, 5, 11	1, 6, 11	
8	0, 3, 12	0, 6, 12	0, 2, 12	0, 4, 11	0, 8, 13	0, 7, 10	0, 7, 9	1, 6, 13	0, 3, 11	0, 2, 11
9	0, 0, 12	0, 1, 13	0, 3, 12	0, 8, 12	0, 6, 11	1, 8, 11	0, 6, 11	0, 2, 11	0, 3, 11	0, 0, 10
10	0, 0, 11	0, 0, 12	0, 8, 13	0, 5, 10	2, 7, 11	0, 5, 10	0, 2, 9	0, 4, 8	0, 6, 11	0, 2, 9

Yellowtail Catch >700 Kg

	A	B	C	D	E	F	G	H	I	J
1	0, 8, 13	0, 5, 7	1, 1, 7	2, 8, 11	5, 9, 12	0, 0, 2	0, 0, 12	0, 0, 1	0, 4, 12	
2	0, 2, 10	0, 0, 13	0, 1, 11	0, 0, 9	1, 6, 12	2, 3, 12		0, 6, 12		0, 1, 11
3	0, 3, 13	1, 3, 10	0, 1, 12	0, 0, 8	1, 1, 6	3, 4, 10	0, 2, 13	0, 0, 1	0, 4, 12	
4		0, 0, 12	0, 2, 10	0, 0, 10	1, 1, 9	3, 8, 12	5, 6, 13	1, 3, 13		0, 0, 8
5	0, 3, 13		1, 2, 12	1, 4, 10	1, 2, 7	6, 7, 13	2, 4, 12	0, 3, 12	0, 1, 10	
6		1, 2, 12		1, 5, 12	0, 2, 11	4, 7, 12	2, 4, 9	2, 6, 12		0, 0, 10
7	0, 3, 12	0, 1, 11	0, 6, 12	0, 4, 12	0, 2, 10	1, 5, 11	0, 6, 13	1, 5, 11	1, 4, 11	
8	0, 0, 12	0, 2, 12	0, 2, 12	0, 1, 11	0, 5, 13	0, 4, 10	0, 5, 9	1, 2, 13	0, 2, 11	0, 1, 11
9	0, 0, 12	0, 0, 13	0, 1, 12	0, 3, 12	0, 0, 11	0, 4, 11	0, 5, 11	0, 1, 11	0, 2, 11	0, 0, 10
10	0, 0, 11	0, 0, 12	0, 6, 13	0, 2, 10	1, 3, 11	0, 1, 10	0, 0, 9	0, 1, 8	0, 4, 11	0, 1, 9

Table 15. Length composition of Yellowtail flounder (sexes combined).

		Percentage of Yellowtail flounder		
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 (New grid)	15	0.15	2.65	18.12

Table 16. Numbers and weights of yellowtail flounder caught in grid area during DFO stratified random surveys in Div. 3LNO.

Yr/season	**Yellowtail flounder in grid area**		**Yellowtail flounder 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%

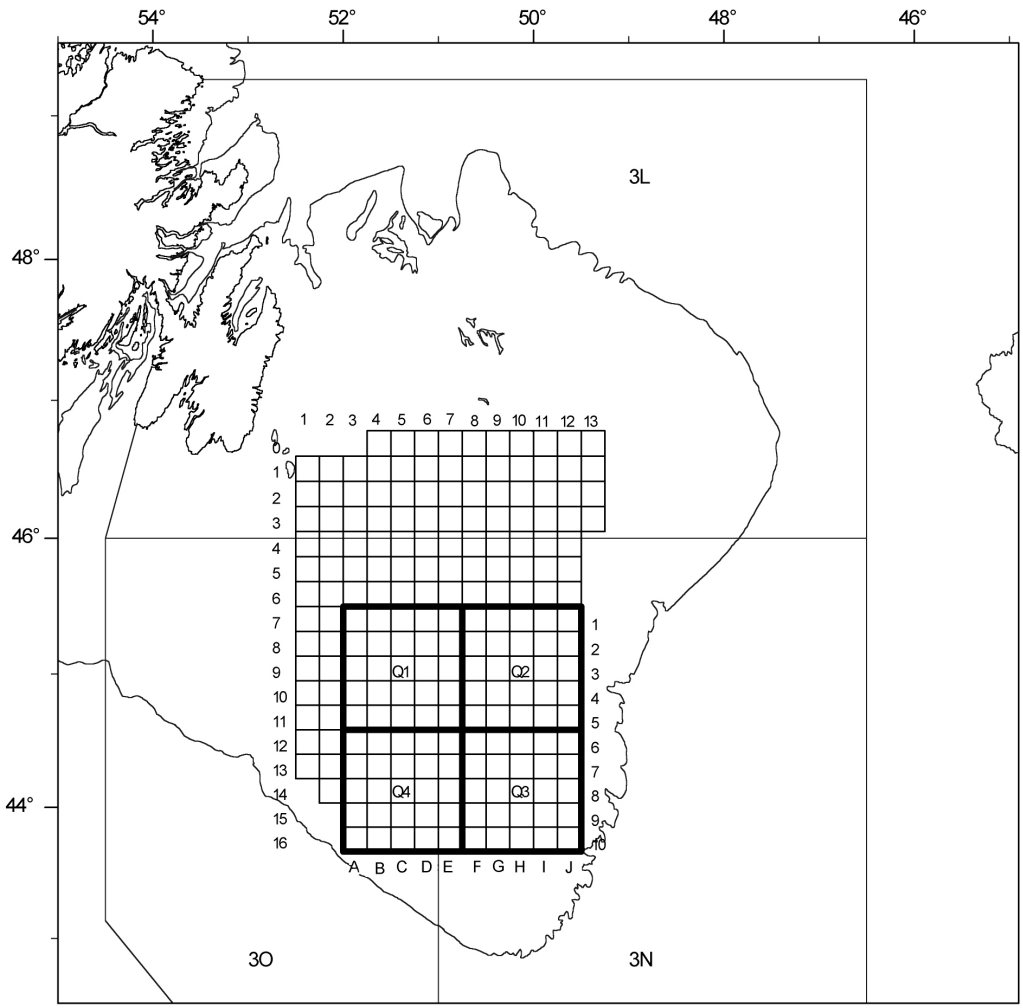
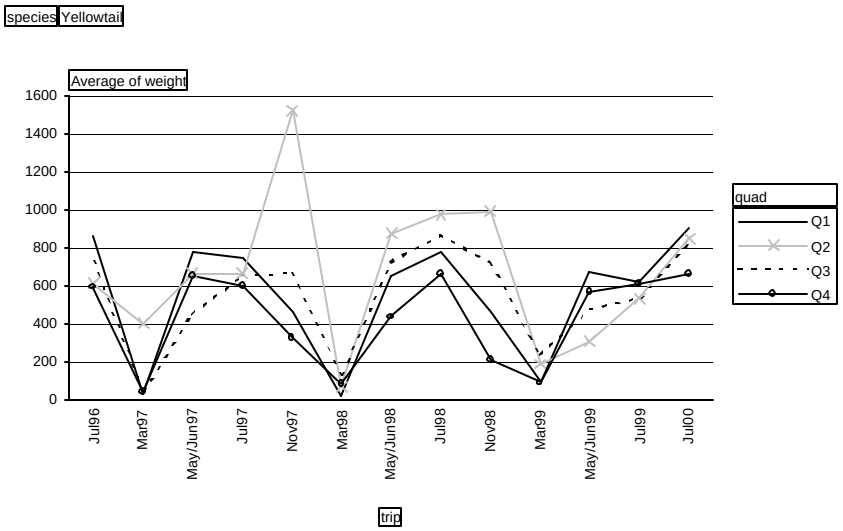
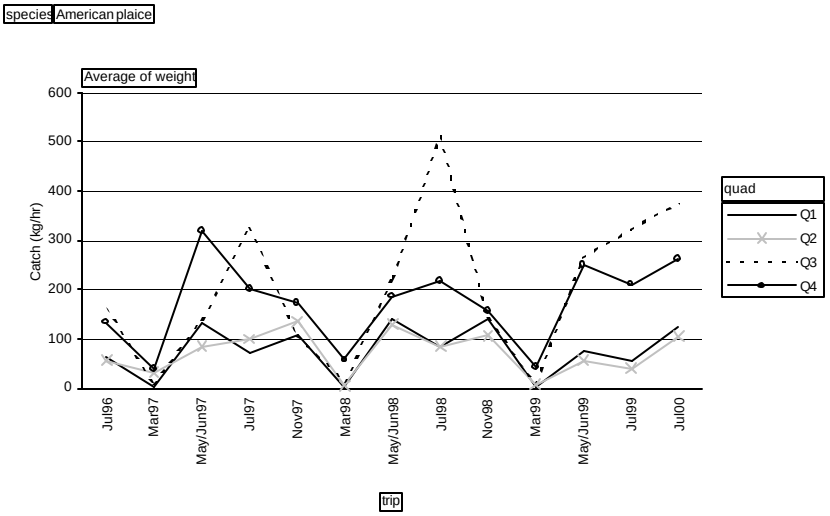


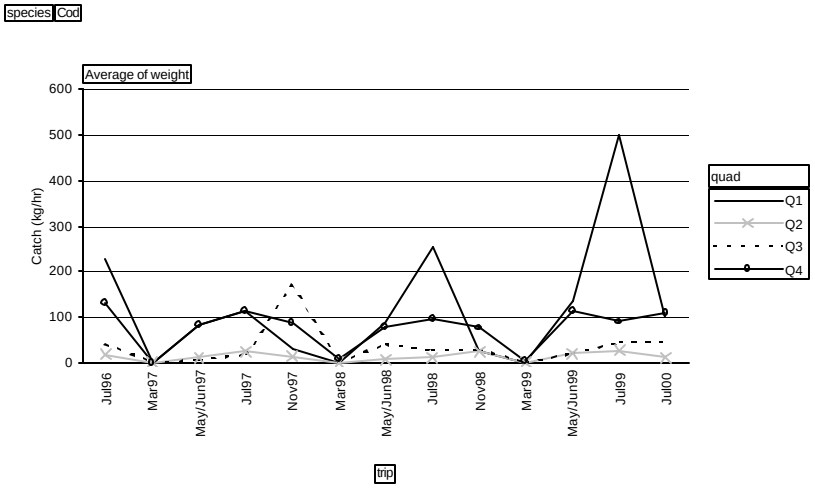
Figure 1: Location of grid used in cooperative surveys directed at yellowtail flounder in NAFO Div. 3NO. Quadrants are groups of 5x5 blocks.



a.

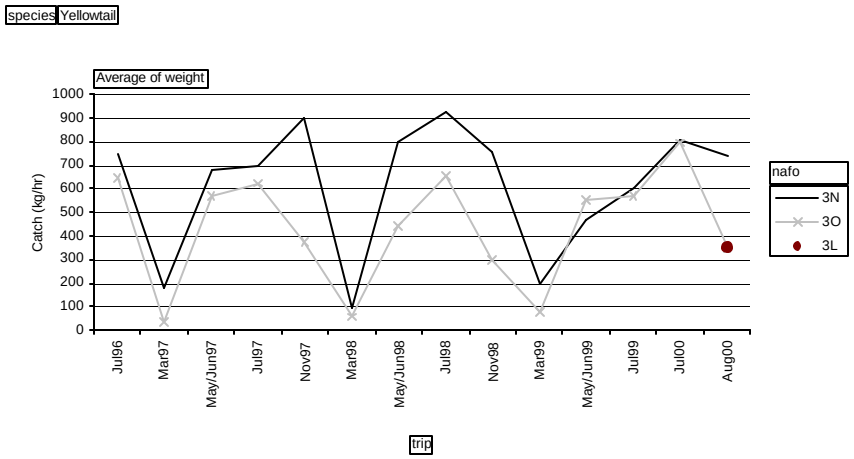


b.

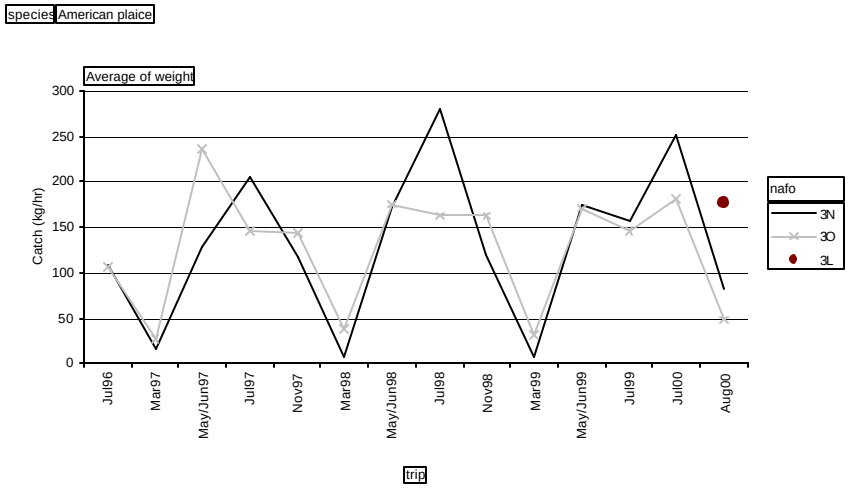


c.

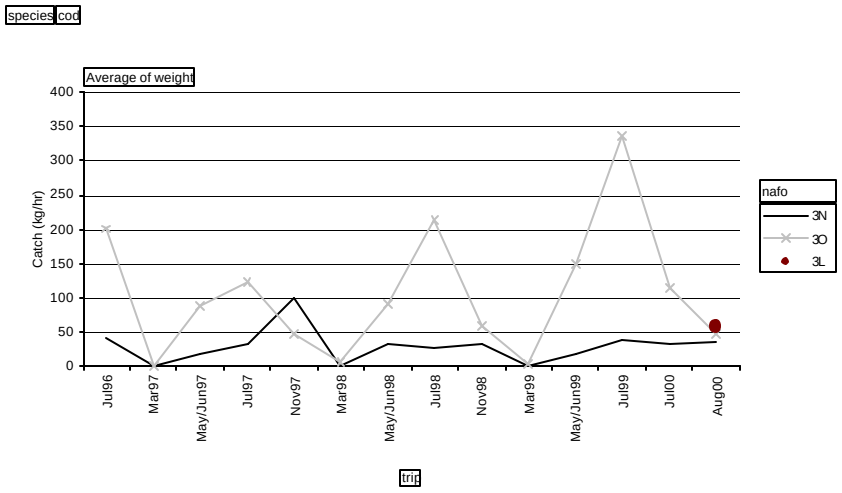
Figure 2. Catch (kg/hr) of Yellowtail, American plaice and cod by quadrant, caught in cooperative surveys from 1996-2000.



a.



b.



c.

Figure 3. Catch (kg/hr) of yellowtail, American plaice and cod by NAFO Division, caught in cooperative surveys from 1996-2000.

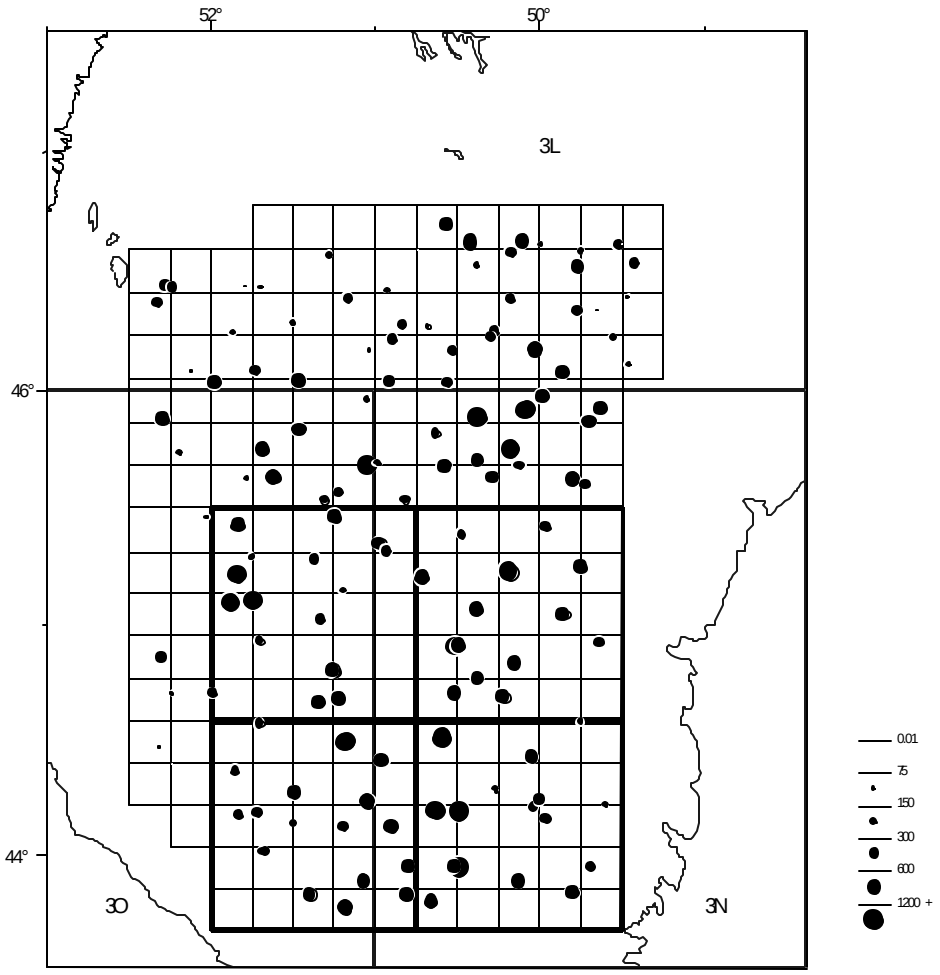


Figure 4 . Distribution of yellowtail flounder catches (kg per standard 3Nm. tow) from industry grid surveys conducted in NAFO Div. 3LNO in 2000.

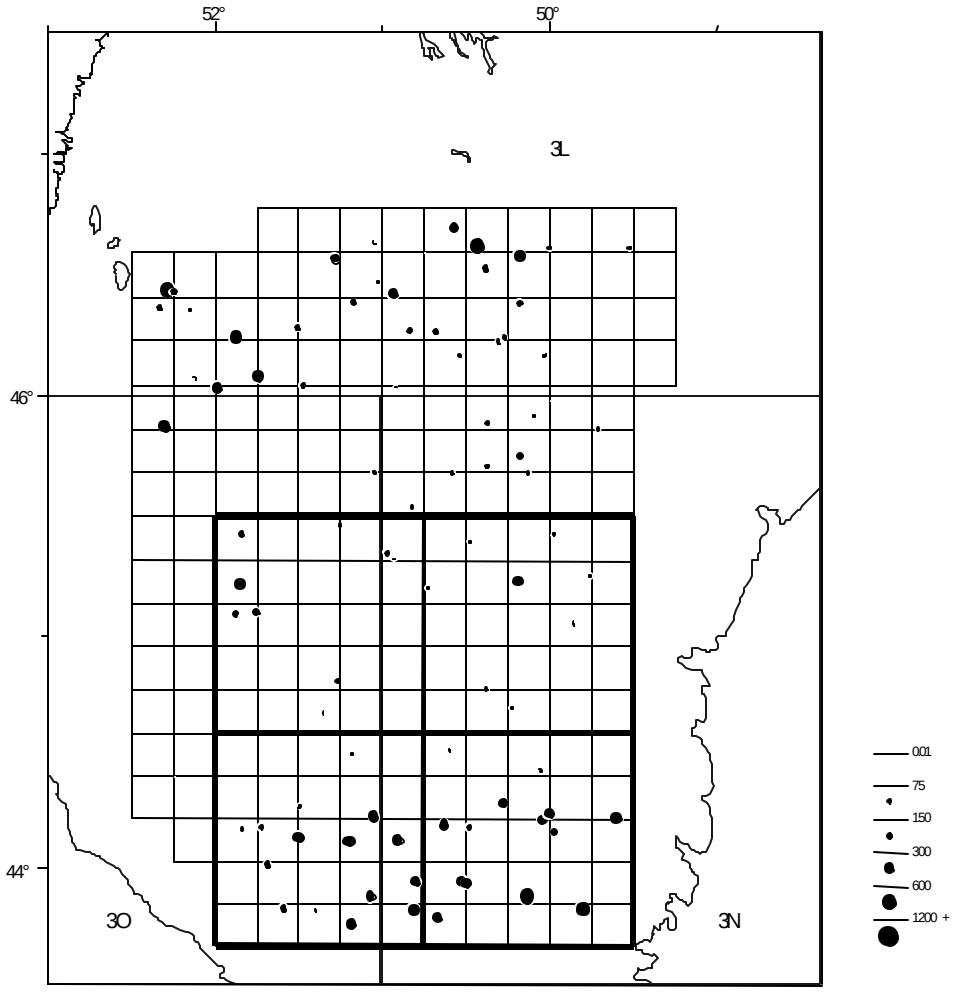


Figure 5. Distribution of American plaice catches (kg per standard 3Nm. tow) from industry grid surveys conducted in NAFO Div. 3LNO in 2000.

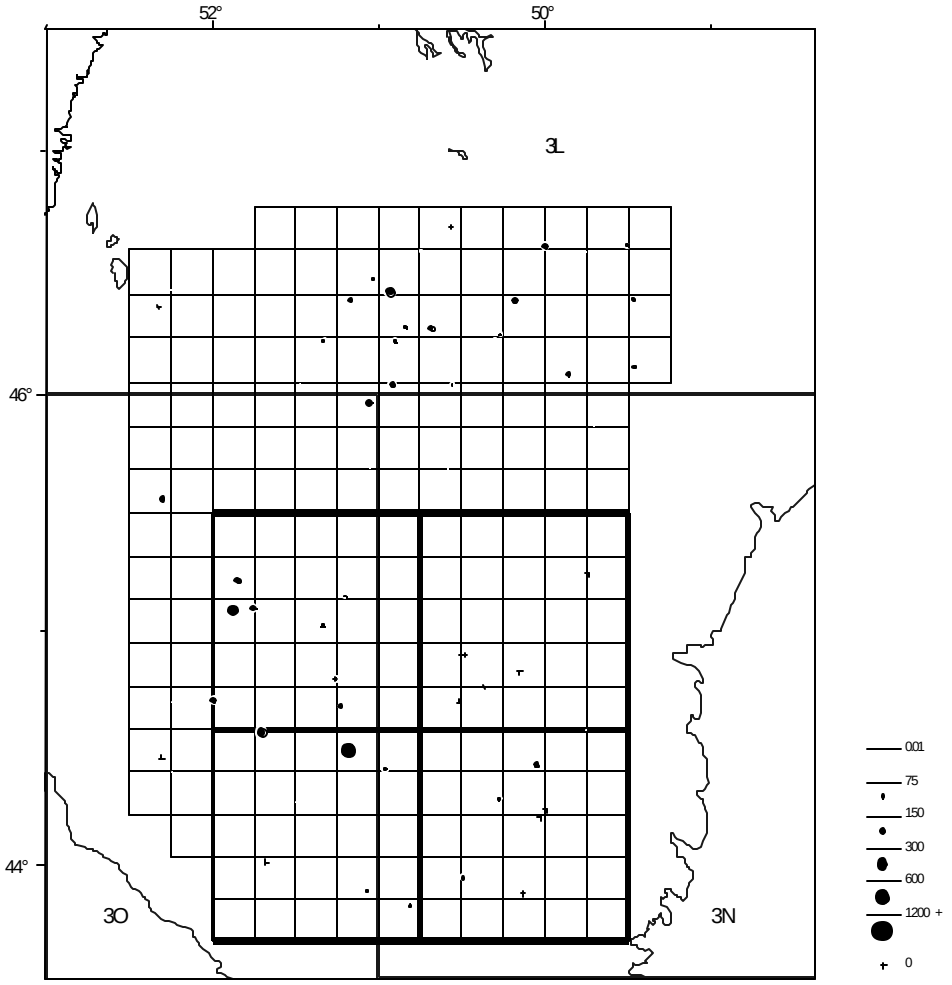


Figure 6. Distribution of Atlantic cod catches (kg per standard 3Nm. tow) from industry grid surveys conducted in NAFO Div. 3LNO in 2000.

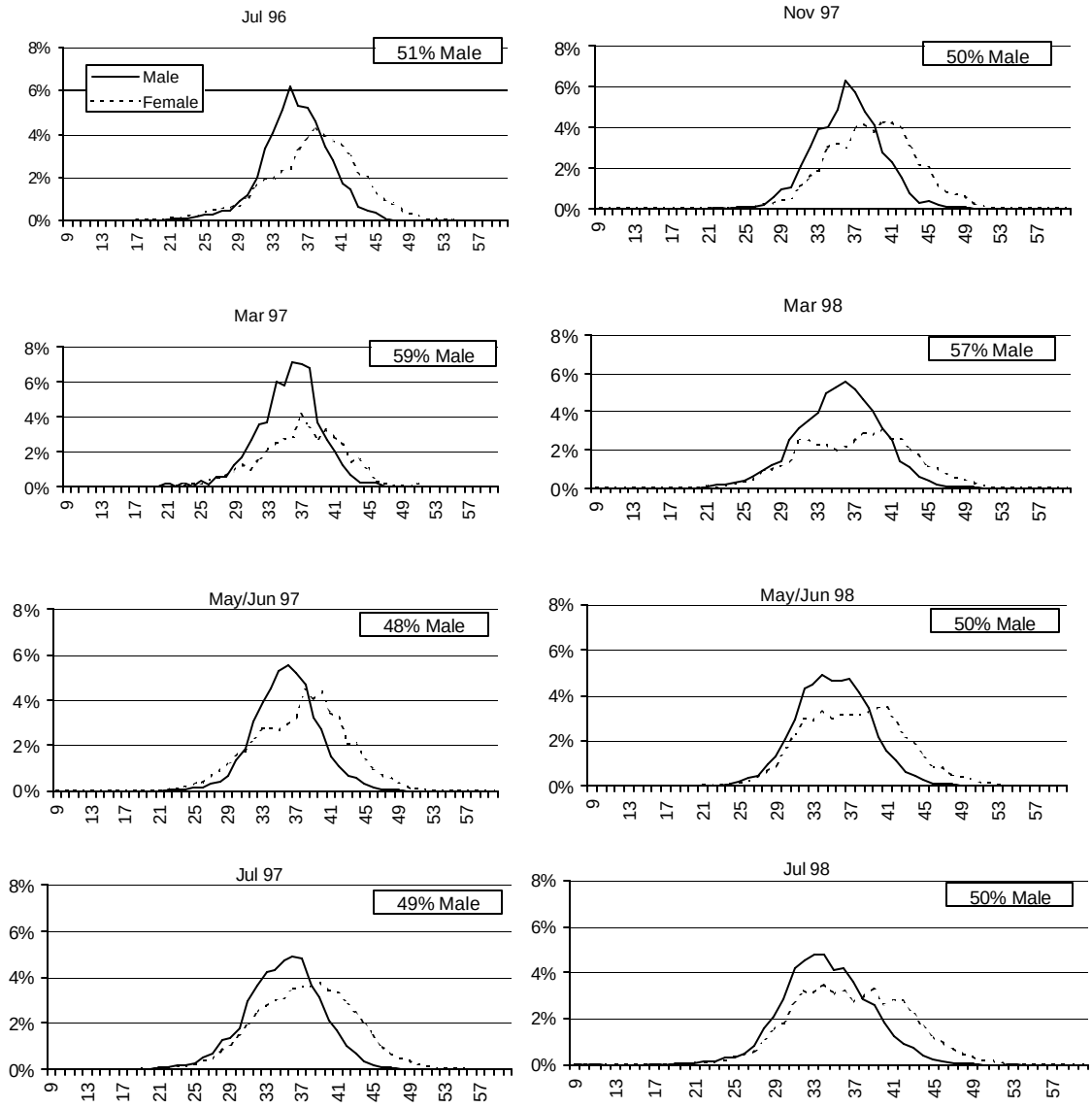


Figure 7a. Length composition of yellowtail flounder caught in the Atlantic Lindsey surveys.

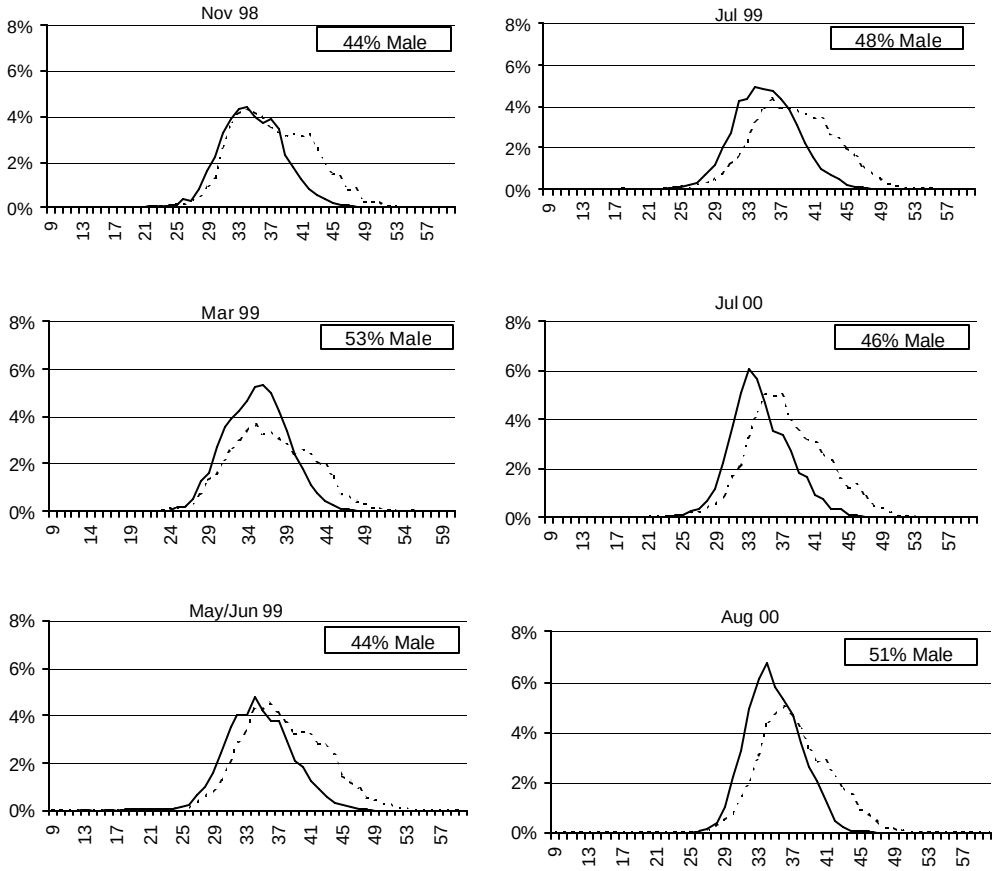


Figure 7b. Length compostion of yellowtail flounder caught in the Atlantic Lindey surveys.

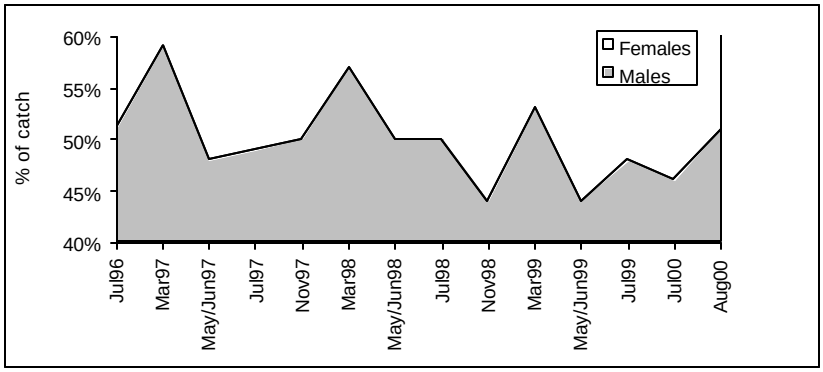


Figure 8. Sex ratio of yellowtail flounder catch for the Atlantic Lindsey surveys.

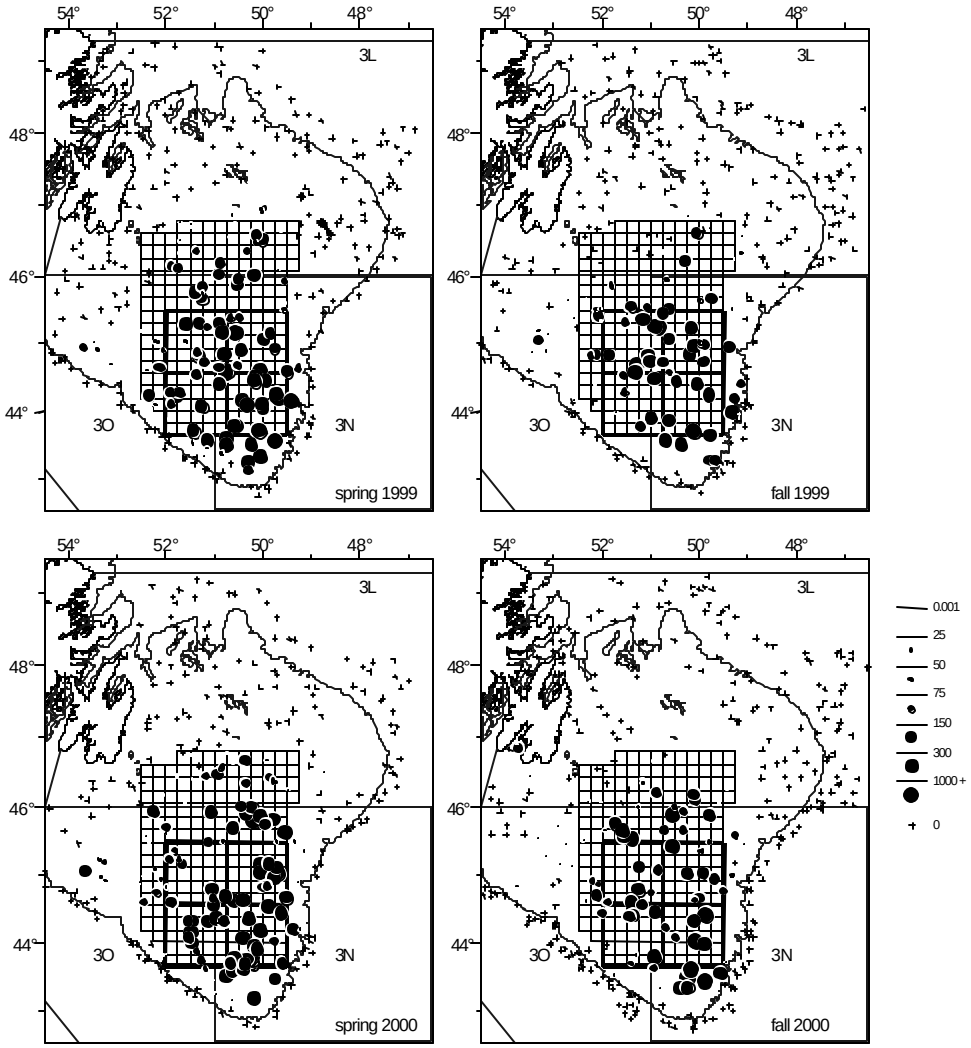


Figure 9. Distribution of yellowtail flounder catches (number/tow) from stratified random spring and fall surveys conducted with a Campelen 188 trawl in Div. 3LNO. Grid used in industry surveys is depicted for illustration.

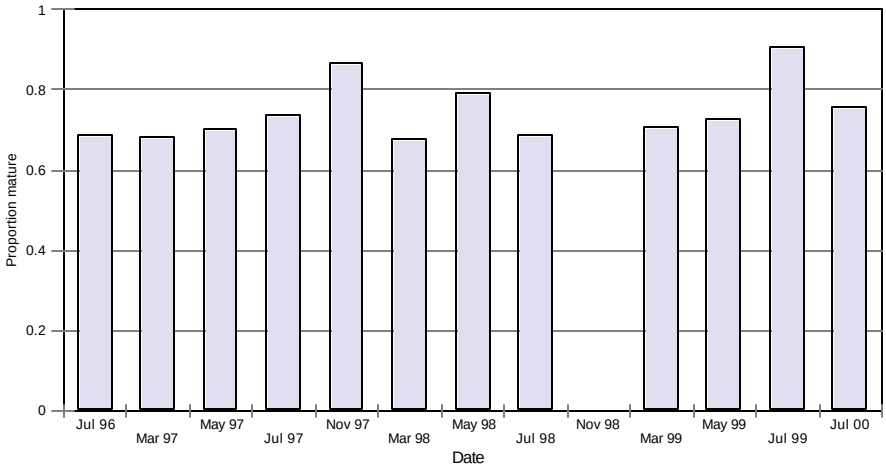


Fig 10. Proportion of mature female yellowtail flounder from grid surveys in Div. 3NO, 1996-2000.

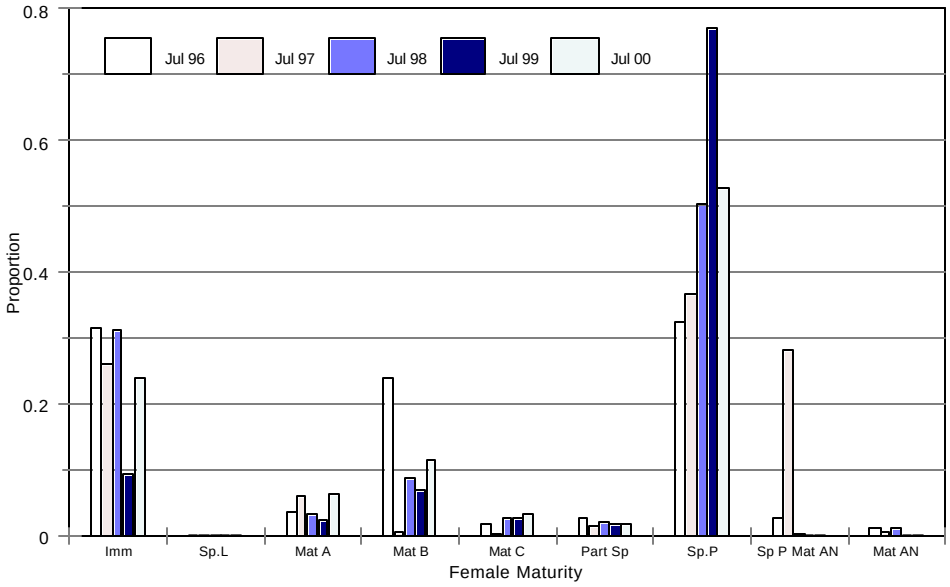


Fig 11. Comparison of maturity stages of female yellowtail flounder from the grid surveys conducted each July, 1996-2000.