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Size and condition of cod in Divisions 2J+3KL during 1978-1996

by

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### Introduction

This paper documents changes in size-at-age and condition of cod in Divisions 2J, 3K and 3L, as determined from sampling during bottom-trawl surveys in the offshore during the autumns of 1978-1996 and sentinel surveys in the inshore during the summer and autumn of 1995 and 1996. Earlier studies have examined the possible relationship between changes in these biological attributes and changes in stock size, environmental temperature and the stock size of capelin, the most important prey of cod in this area (Akenhead et al., 1982; Wells MS 1984, MS 1986; Millar and Myers MS 1990; Millar et al. MS 1990; Bishop and Baird 1994; Shelton and Lilly MS 1995; Shelton et al. MS 1996; de Cárdenas 1996; Krohn et al. 1997; Krohn and Kerr 1997). There is also a possibility that some of the variability in annual means may be caused by small sample sizes and changes in sampling pattern (Lilly MS 1996a). As a prelude to additional study of factors influencing changes in growth and condition of 2J3KL cod, this paper documents the sample sizes available for determination of growth and condition, updates the time-series of both size at age (Shelton et al. MS 1996) and condition (Lilly MS 1996a), and provides average length and weight at age for the 2J3KL cod stock as a whole (ie. for offshore observations in all three Divisions combined).

### Materials and Methods

#### Research vessel surveys

Cod were caught during random-stratified bottom-trawl surveys designed to assess the biomass of demersal fish during the autumns of 1978-1996 (Lilly MS 1996c). All surveys in Divisions 2J and 3K in 1978-1994 were conducted with the 74 m stern trawler 'Gadus Atlantica'. Surveys in Division 3L in 1981-1983 and 1985-1994 were conducted with the 51 m side trawler 'A. T. Cameron' (1981-1982) and the sister 50 m stern trawlers 'Wilfred Templeman' (1983, 1985, 1987-1994) and 'Alfred Needler' (1986). There were no autumn surveys in Division 3L in 1978-1980 and 1984. The 'Gadus Atlantica', 'Wilfred Templeman' and 'Alfred Needler' deployed an Engel 145 Hi-Lift trawl, whereas the 'A. T. Cameron' deployed a Yankee 41-5 trawl (McCallum and Walsh 1997). The surveys in 1995 and 1996 differed from those in previous years in several respects (Brodie 1996). The 'Gadus Atlantica' was replaced by the 63 m stern trawler 'Teleost', the Engel 145 Hi-Lift trawl was replaced with a Campelen 1800 shrimp

trawl with rockhopper foot gear and the 'Wilfred Templeman' fished part of Division 3K. In addition, tows were made at 3.0 knots for 15 min instead of 3.5 knots for 30 min, as had been the case in all years prior to 1995. In all instances, a 29 mm meshliner was inserted in the codend. Details regarding areas and locations of strata, and changes in survey pattern, are provided by Doubleday (1981), Lilly and Davis (MS 1993), Bishop (MS 1994) and Shelton et al. (MS 1996). The most notable change in survey coverage was the addition of depths between 100 and 200 m in northwestern Division 3K (St. Anthony Shelf and Grey Islands Shelf) in 1984 and subsequent years. Fishing in all Divisions and years was conducted on a 24-h basis. The variability in ships and bottom-trawls may have resulted in numerous changes in catching efficiency. The Campelen trawl has been shown to be far more effective at catching small cod than was the Engels Hi-Lift trawl (Warren 1997). The influence of these changes in ships and trawls on estimates of mean lengths- and weights-at-age has not been investigated.

Sampling of cod for otoliths and various biological attributes was conducted using two distinct procedures. The first involved determination of biological attributes (eg. fork length, cm) and the extraction of otoliths at sea. The second involved the determination of body length at sea followed by the freezing of the fish for detailed examination in the laboratory at the Northwest Atlantic Fisheries Centre, St. John's. These frozen fish were thawed in fresh water and weighed (to the nearest 10 g) before being cut (round weight) and again after removal of the organs from the abdominal cavity (gutted weight). The liver and gonad were also weighed (g) or measured volumetrically (ml).

For each of these two methods of sampling, there were several changes in what constituted a sample and several changes in the biological attributes measured. These changes have not yet been thoroughly documented, but they were similar to changes in the sampling from research vessel surveys in Subdivision 3Ps (Lilly MS 1996b). The number of fish sampled for both length and age is reported in Table 1. Sample sizes were relatively high in Division 2J in 1984 and 1985 when the number of frozen fish was increased considerably. Sample sizes declined in all Divisions in the 1990s as catches rapidly declined. The increase in sample sizes for the younger ages (especially ages 1-3) in 1995 and 1996 reflects the change to the Campelen trawl. The number of fish sampled for length, age and round weight is reported in Table 2. There was a large increase in Division 2J in 1984 and 1985 as noted above. From 1978-1988, sample sizes were generally much smaller for weights than for lengths. This changed in 1989 in Divisions 2J and 3K and in 1990 in Division 3L when balances for weighing at sea were first used to obtain round weight, gutted weight, and weights of livers and gonads for all fish sampled at sea. The decline in sample sizes through the 1990s, and increase in sampling of young fish in 1995 and 1996, were noted above.

The condition of the fish was expressed using Fulton's condition factor ( $(\text{weight}/\text{length}^3)*100$ ). The relative size of the liver (liver index) was expressed as  $((\text{liver weight}/\text{length}^3)*100)$ .

All sampling was length-stratified by Division, so mean length, weight and condition were determined by weighting the value for each individual fish by the ratio of the population number per 3 cm length class to the number of fish sampled in the same length class, where the population number is calculated by areal expansion of the stratified mean catch at length per tow (Smith and Somerton 1981). There has also been interest in determining mean lengths and weights at age for the stock area as a whole. For this metric, a mean length or weight by year and age was calculated by averaging the values for the three Divisions, weighted by the Divisional population numbers at age.

#### Sentinel survey

A sentinel survey for cod was conducted at various sites in Divisions 2J3KL during the summer and autumn of 1995 and 1996 (Davis MS 1996). In 1995, a total of 635 cod from 18 communities were sampled for condition. The majority of these cod were caught by fishers operating from 4 communities on Fogo Island in southern Division 3K. In 1996, the number of communities sampled was reduced, and an attempt was made to sample at each site several times during the survey period. A total of 1297 cod from 13 communities were sampled, and again most of the samples came from 4 communities on Fogo Island.

The sampling on Fogo Island differed from that at other sites in several ways. In 1995, the sampling occurred during July-August, and was completed before sampling started at other sites. In 1996, sampling at sites

other than Fogo was earlier than in 1995, and tended to overlap the sampling at Fogo. In addition, sampling on Fogo Island consisted of numerous small samples, whereas at other sites there was usually a single, relatively large sample. Fish caught on Fogo Island were sampled while still fresh, whereas cod from other areas were frozen and sampled after thawing in fresh water in the laboratory at NAFC in St. John's.

## Results

### Offshore lengths and weights at age

As noted by Shelton et al. (MS 1996), mean weights at age for cod caught in the commercial fishery declined during the 1980s and early 1990s after peaking in the late 1970s or early 1980s. The research sampling (Table 3,4; Fig. 1,2) illustrates that the changes varied with Division; there was a strong decline in Division 2J, a lesser decline in Division 3K, and little or no decline in Division 3L. These Divisional differences are more apparent in Fig. 3, which focuses on changes in mean lengths and weights of cod of ages 4 and 6. Superimposed on the long-term decline are periods of relatively quicker or slower growth associated with changes in water temperature (Shelton and Lilly MS 1995; Shelton et al. MS 1996). The trend toward very low mean lengths and weights at age in the early 1990s appears to have been reversed, but sample sizes at ages greater than age 4 have been very small in recent years, so the accuracy of these estimates is suspect.

The mean lengths and weights at age for the 2J3KL cod stock as a whole (Table 5; Fig. 4) changed little after the mid-1980s. This may be largely because the decline in Divisions 2J and 3K was counteracted by the Divisional weighting. In some of the earlier years there were relatively few cod caught toward the south, giving higher emphasis to the smaller fish in the north, whereas in many of the later years relatively few cod were caught toward the north, giving higher emphasis to the larger fish in the south.

### Offshore condition at age

Average Fulton's condition for cod of ages 2-12 are provided in Tables 6 and 7 for round weights and gutted weights respectively. The gutted values for ages 3-6 are illustrated by Division in Fig.5. Illustrations for older ages are available in previous reports (eg. Bishop and Baird 1994; Taggart et al. 1994; Bishop et al. MS 1995), and are not provided in the present paper because sample sizes were very small or nil in recent years. The most notable feature of the gutted weight condition index was the dramatic decline in Division 2J in the early 1990s. A similar but less dramatic decline occurred in Division 3K, and there was no consistent change in Division 3L. Condition levels have improved in both Division 2J and Division 3K since the nadir in 1992. Levels continue to fluctuate without trend in Division 3L.

Average liver indices for cod of ages 2-12 are provided in Table 8, and values for ages 3-6 are illustrated by Division in Fig. 6. As described in earlier reports, there was a decline in liver index in Division 2J in the early 1990s, and an increase in liver index in Division 3L at about the same time. There was no change in Division 3K. Levels have remained almost unchanged in Divisions 2J and 3K, and have declined somewhat in Division 3L. In Division 2J, the continued low level in the liver index contrasts with the improvement in somatic condition.

### Inshore condition

As described by Lilly (1996a), the sampling of sentinel surveys in 1995 revealed an increase in both somatic condition and liver index during the summer in one area (Fogo Island in southern Division 3K), and high variability in mean values at 14 other sites during the autumn (Fig. 7). The sampling during 1996 (Fig. 8) confirmed the pattern of an increase in both indices during the summer, and provided evidence of a decline in the autumn. It is clear that there can be much inter-site variability in mean values on a given date, and even considerable intra-site variability over a period of just 2-3 days. In addition, there is evidence of annual variability. On Fogo Island, the increase in both indices started earlier and reached a higher peak in 1996 than in 1995.

## Discussion

This paper has simply documented some of the variability in size and condition of cod in Divisions 2J, 3K and 3L on various temporal and spatial scales. There is no new analysis. Several studies have explored the extent to which annual variability in the size and condition of cod in Divisions 2J, 3K and 3L is correlated with variability in stock size, environmental temperature, and the stock size of capelin, the cod's most important prey. While there is evidence that stock size, temperature and capelin have had an effect, the various studies have not provided sufficient explanation for the changes which have been observed; none have adequately explained why the temporal pattern of change in growth, somatic condition and liver index has differed from north to south. Annual temperature anomalies in 2J, 3K and 3L tend to be highly correlated, so why is there Divisional variability in the temporal changes in growth rate? It is thought that there is just one capelin stock in Subarea 2 and Divisions 3K and 3L, so why should growth and condition be correlated with capelin biomass in some Divisions but not in others? Part of the explanation for the Divisional variability in the influence of capelin may lie in annual variability in the extent and duration of overlap between cod and capelin. The overlap will be influenced by changes in distribution patterns and migration timing exhibited by both cod and capelin (Lilly 1994, MS 1995; Frank et al. 1996; Nakashima 1996). Additional study of factors influencing growth and condition of cod in Divisions 2J, 3K and 3L should first determine if an important portion of the observed variability is due to measurement error, associated with changes in survey timing and the way the sampling was conducted, and should then try to determine how individual components of the northern cod stock complex have been influenced by changes in oceanographic factors, such as temperature, and changes in access to prey, particularly capelin.

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Table 1. Number of fish sampled for length and age, by Division and age, during autumn bottom-trawl surveys in Divisions 2J, 3K and 3L in 1978-1996.

Division 2J

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1			19		73	43	13	6	2	8	43	18	15	1			1	117	44
2	19	16	65	101	94	121	70	54	63	40	121	193	93	61	13	27	7	116	190
3	71	40	61	81	122	97	160	102	83	103	92	125	202	56	87	15	27	108	108
4	65	88	52	57	68	88	142	190	65	69	71	92	111	187	39	29	13	43	43
5	100	73	91	35	40	63	265	133	88	149	55	59	74	96	104	12	8	12	11
6	61	105	88	77	23	34	123	195	63	143	102	55	67	37	18	15	2	2	2
7	41	47	108	87	71	21	47	123	67	91	133	113	52	35	2	1	4		2
8	20	30	35	102	81	70	37	39	57	94	57	124	125	24					
9	25	15	25	47	113	64	82	34	23	63	73	40	72	26					
10	18	14	17	25	61	74	57	63	18	22	59	37	20	15					
11	11	17	13	5	34	17	36	27	27	5	20	26	15	4					
12	5	7	15	9	23	14	17	14	19	16	12	7	6	3					

Division 3K

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1		1	16	3	21	60	26	2	33	36	60	68	72	1	4	1	3	116	94
2	14	10	88	85	110	113	98	56	79	70	166	211	106	122	60	95	10	139	183
3	68	52	80	131	84	106	110	89	56	73	175	135	168	86	118	101	38	136	123
4	93	79	47	49	89	66	107	83	90	56	101	128	124	151	73	80	21	55	44
5	86	93	102	30	59	96	71	87	73	78	86	86	84	128	164	29	11	16	16
6	69	94	125	93	29	36	87	52	64	62	130	73	73	93	81	38	2	3	2
7	42	61	68	121	68	32	38	77	49	53	98	109	64	71	31	10	4		1
8	29	60	71	68	115	68	30	44	69	57	69	89	121	45	8	1	3		
9	20	22	42	35	72	100	79	37	42	66	47	52	79	36	1			1	
10	23	14	27	21	45	48	77	43	31	46	32	50	39	24					
11	2	15	2	18	20	29	51	51	37	33	9	21	30	3					
12	6	2	18	17	9	13	30	21	21	21	11	10	9	2					

Division 3L

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1				33	34	46		1	6	16	10	4	6	13	1			15	9
2				22	203	111		75	62	102	101	75	45	80	64	53	7	52	35
3				122	118	154		115	63	76	110	115	117	71	107	95	27	80	42
4				53	148	74		105	108	78	51	80	116	88	71	107	58	43	37
5				61	59	120		104	71	94	67	51	70	91	74	60	23	24	21
6				84	54	29		74	99	81	74	71	58	90	98	45	7	17	12
7				147	81	39		94	50	74	80	92	64	29	48	15	3	4	7
8				44	104	94		40	82	52	69	60	75	31	10	2	1	1	1
9				16	29	65		53	45	77	53	74	66	40	8				1
10				7	11	25		53	24	14	43	41	31	17	7	1			
11				4	7	10		44	40	21	22	18	19	12	3				
12				3	6	5		24	28	28	19	9	16	5	2				

Table 2. Number of fish sampled for length, age and round weight, by Division and age, during autumn bottom-trawl surveys in Divisions 2J, 3K and 3L in 1978-1996.

Division 2J

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1			10			4	2	1		3	5	18	14	1			1	116	44
2	7	8	16	20	18	25	17	17	13	10	24	192	93	61	13	27	7	116	189
3	18	12	12	19	19	21	74	32	8	7	22	125	202	58	87	15	27	108	108
4	15	16	12	11	14	16	80	117	9	10	10	92	111	187	39	29	13	43	43
5	15	13	10	4	9	12	176	80	17	13	14	59	74	96	104	12	8	12	11
6	14	16	18	12	7	5	75	121	12	13	17	55	67	37	18	15	2	2	2
7	10	12	18	15	15	3	24	71	12	9	31	113	52	35	2	1	4		
8	6	8	4	19	12	12	14	13	9	8	13	124	125	24					
9	10	8	11	12	17	17	28	6	3	10	15	40	72	26					
10	8	4	5	8	9	22	21	24	5	5	24	37	20	15					
11	9	7	6	3	3	8	11	11	10	3	8	28	15	4					
12	4	3	11	4	2	11	11	8	7	4	8	7	6	3					

Division 3K

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1		1	8	1	6	8			4		9	68	72	1	4	1	3	116	89
2	7	5	22	14	25	18	11	11	11	9	31	211	106	122	60	95	10	139	165
3	12	16	11	23	10	15	20	17	8	14	32	135	168	86	117	101	38	136	117
4	26	15	6	10	20	16	20	9	14	10	25	128	123	151	73	80	21	55	43
5	22	8	14	1	7	14	9	15	14	11	14	86	84	128	163	29	11	16	16
6	16	14	30	18	6	7	16	13	16	10	28	73	73	93	81	38	2	3	2
7	10	15	8	21	10	6	7	13	5	10	20	109	64	71	31	10	4		1
8	4	14	14	15	19	8		9	11	9	19	89	121	45	8	1	3		
9	7	9	9	6	20	12	16	8	14	17	18	52	79	36	1			1	
10	7	9	6	10	12	12	16	11	6	12	23	50	39	24					
11	2	8	1	7	7	15	14	16	8	2	7	21	30	3					
12	4	1	13	8	3	2	11	8	3	10	9	10	9	2					

Division 3L

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1				4	2	7							6	13	1			15	9
2				4	18	20		8	9	17	14	10	45	79	64	53	7	52	35
3				17	7	22		22	8	14	14	17	117	71	107	95	27	80	42
4				14	1	5		16	20	16	12	18	116	87	71	106	58	43	37
5				10		18		18	9	15	11	7	70	91	74	60	23	24	21
6				15		6		11	16	14	11	13	58	90	98	45	7	17	12
7				24		7		7	13	12	11	15	64	29	48	15	3	4	7
8				14	1	14		7	12	10	16	13	75	31	10	2	1	1	1
9				10	5	22		14	10	18	8	13	66	40	8				1
10				6	5	9		13	7	2	11	10	31	17	7	1			
11				4	5	6		16	15	9	8	8	19	12	3				
12				3	4	3		6	8	14	14	3	16	5	2				

Table 3. Average length (cm) at age of cod caught during autumn bottom-trawl surveys in Division 2J3KL in 1978-1996. Mean lengths at age were calculated by adjusting to the length-frequency of the population. Shaded entries are based on sample sizes < 5.

Division 2J

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1																		19.9	19.8
2	29.3	30.1	30.6	29.9	30.0	26.6	27.4	27.0	28.2	29.4	30.3	28.1	26.5	28.1	26.5	26.2	25.8	26.2	28.0
3	38.0	41.3	39.4	38.7	37.9	38.8	34.3	33.6	35.5	36.5	37.3	36.9	33.8	32.9	33.8	32.6	36.8	33.1	34.5
4	45.6	47.3	49.6	47.0	47.0	46.1	44.4	40.1	41.1	43.4	44.2	43.7	41.9	38.7	38.8	40.1	42.3	42.1	41.8
5	54.0	55.3	54.5	54.4	53.4	53.9	50.9	48.5	47.6	48.9	48.5	50.1	46.9	43.9	41.8	43.9	46.6	46.7	49.3
6	59.7	60.9	60.7	58.2	59.3	60.0	56.6	53.2	52.7	52.4	53.6	53.8	53.4	51.1	47.0	47.5	56.8	55.4	52.6
7	66.4	67.9	64.3	62.8	61.3	62.9	63.4	57.5	56.7	57.3	55.8	57.0	56.6	56.9	56.8	47.0	56.2		61.1
8	69.7	73.9	69.5	66.9	64.5	64.7	65.8	64.3	59.5	58.9	59.8	59.6	59.4	58.3					
9	79.3	69.2	82.0	73.6	68.9	68.6	66.9	67.2	67.6	61.7	63.8	62.7	61.1	63.8					
10	80.4	76.9	83.3	84.2	77.0	73.5	71.6	70.2	68.2	67.8	66.2	64.7	63.1	65.5					
11	87.7	87.6	86.5	90.1	85.5	75.0	78.4	72.8	72.2	77.5	73.9	69.8	73.6	72.7					
12	91.6	85.9	87.9	88.6	94.6	95.0	83.0	75.9	76.2	75.5	80.5	67.8	73.5	68.5					

Division 3K

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1																		18.6	19.2
2	27.9	30.9	30.7	31.3	29.3	28.5	26.5	28.7	29.5	29.7	25.9	27.3	28.1	29.2	28.5	28.5	29.3	25.6	28.7
3	37.6	42.1	39.9	42.2	40.3	40.5	36.8	36.0	36.5	38.1	36.5	37.2	36.2	36.6	36.4	37.5	36.5	34.2	34.9
4	47.0	49.5	47.2	50.4	50.1	47.9	47.0	43.9	43.8	44.6	44.2	45.0	44.0	42.7	42.4	43.6	42.2	41.8	43.3
5	54.8	55.4	54.7	56.1	54.0	56.2	54.3	51.8	49.9	50.9	51.5	51.5	49.7	47.9	47.0	50.0	51.1	46.8	50.0
6	62.4	62.8	61.8	60.3	60.5	62.3	61.6	57.3	56.1	54.3	56.0	56.3	56.1	54.9	51.8	51.4	53.5	54.7	58.5
7	69.5	69.9	69.7	65.2	64.3	66.8	64.4	62.5	58.8	60.1	58.6	59.9	58.4	59.7	57.9	53.0	58.1		69.0
8	74.4	76.8	76.3	69.2	69.0	67.7	68.8	69.6	64.1	62.9	66.3	63.1	61.2	62.7	65.2	64.0	61.7		
9	76.6	83.3	86.0	81.7	74.8	72.5	72.9	70.2	67.3	69.7	73.1	68.1	63.6	65.6	64.0			68.0	
10	81.9	78.3	87.6	90.5	79.8	76.4	78.1	73.1	76.8	74.5	78.7	74.0	64.7	69.1					
11	88.4	86.0	103.4	91.6	89.6	84.9	84.9	79.2	75.9	80.8	82.4	75.7	69.3	60.7					
12	92.1	78.9	94.2	92.1	97.0	85.1	90.2	87.1	73.7	86.6	88.5	82.2	71.1	68.4					

Division 3L

Age	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	
1															16.8	17.7	
2		28.5	28.7	30.1		26.8	27.9	27.5	28.7	28.7	27.0	29.7	27.9	30.1	28.1	27.8	30.0
3		40.0	38.2	39.4		36.1	35.4	34.7	37.4	37.6	35.3	36.7	38.5	38.3	34.8	36.9	38.3
4		44.8	50.2	48.0		43.7	43.7	44.2	44.9	44.2	44.9	44.4	44.5	45.2	45.7	41.7	44.2
5		52.6	56.4	56.8		52.2	50.3	52.3	53.1	52.3	52.7	51.1	50.4	51.5	51.8	49.6	49.3
6		60.6	63.5	62.4		58.0	58.2	58.9	58.8	59.0	59.2	56.5	54.9	55.8	57.9	58.6	58.9
7		66.7	69.7	64.7		65.4	62.6	65.1	62.4	63.9	66.4	61.1	56.8	61.9	66.7	66.7	66.7
8		73.1	73.8	69.5		73.3	69.9	69.0	66.7	68.7	70.9	68.0	66.0	61.4	67.0	74.0	70.0
9		82.2	83.0	73.6		72.8	73.1	75.2	69.6	74.4	75.3	71.5	77.3			66.0	
10		91.2	93.1	76.3		82.6	77.7	80.8	74.3	83.7	76.2	73.2	70.4	87.0			
11		103.7	94.1	90.0		86.5	81.5	87.9	88.9	88.1	82.5	74.5	77.1				
12		119.2	110.5	87.5		97.8	86.8	85.4	96.7	94.1	86.9	81.1	84.5				



Table 4. Average weight (kg) at age of cod caught during autumn bottom-trawl surveys in Division 2J3KL in 1978-1996. Actual weights at age and length were adjusted to the length-frequency of the population. Shaded entries are based on sample sizes < 5.

Division 2J

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1																		0.064	0.064
2	0.223	0.263	0.240	0.228	0.215	0.176	0.153	0.200	0.254	0.266	0.253	0.204	0.158	0.187	0.139	0.153	0.155	0.162	0.193
3	0.487	0.882	0.528	0.548	0.501	0.587	0.384	0.363	0.350	0.545	0.553	0.488	0.355	0.307	0.318	0.300	0.433	0.319	0.371
4	0.947	1.023	1.046	1.077	0.955	0.956	0.829	0.622	0.645	0.913	0.819	0.810	0.697	0.518	0.482	0.575	0.646	0.671	0.670
5	1.580	1.593	1.363	1.663	1.601	1.554	1.303	1.138	1.054	1.355	1.145	1.263	0.987	0.743	0.620	0.751	0.909	0.898	1.160
6	2.199	2.379	2.055	1.982	2.004	1.853	1.782	1.486	1.660	1.483	1.653	1.567	1.462	1.139	0.844	0.923	1.664	1.540	1.427
7	2.515	2.748	2.548	2.519	2.392	2.252	2.388	1.880	1.914	2.067	1.690	1.907	1.784	1.540	1.478	0.860	1.700		2.160
8	3.862	2.753	3.090	3.197	2.686	2.773	2.562	2.497	2.292	2.409	2.379	2.259	2.108	1.692					
9	4.365	6.193	5.986	3.944	3.872	3.346	3.023	2.652	3.610	1.818	2.717	2.616	2.299	2.367					
10	5.771	5.428	7.628	6.586	6.507	4.022	3.459	3.223	4.513	4.648	2.880	3.143	2.539	2.721					
11	6.358	7.191	6.546	6.906	7.660	4.165	5.669	4.178	4.638	4.550	3.868	3.771	4.397	3.983					
12	9.736	6.206	7.723	10.797	10.058	8.946	6.539	4.014	6.161	4.549	6.732	3.206	4.340	3.391					

Division 3K

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1																		0.054	0.057
2	0.171	0.207	0.238	0.275	0.234	0.227	0.146	0.209	0.192	0.204	0.177	0.193	0.190	0.213	0.205	0.205	0.217	0.153	0.206
3	0.410	0.577	0.578	0.720	0.738	0.540	0.404	0.466	0.454	0.493	0.476	0.491	0.414	0.423	0.398	0.473	0.434	0.362	0.380
4	0.876	1.190	0.950	1.222	1.218	1.120	0.867	0.891	0.817	0.904	0.838	0.874	0.761	0.705	0.665	0.735	0.688	0.649	0.721
5	1.478	1.644	1.410	1.730	1.555	1.670	1.412	1.219	1.154	1.350	1.411	1.325	1.100	1.006	0.947	1.119	1.188	0.907	1.161
6	2.393	2.259	2.011	2.051	1.966	2.114	2.041	1.818	1.993	1.409	1.734	1.821	1.630	1.517	1.301	1.296	1.442	1.527	1.896
7	2.938	3.161	3.462	2.620	2.445	2.804	2.343	2.590	2.421	2.580	2.264	2.190	1.908	1.923	1.828	1.461	1.978		3.240
8	5.830	4.281	3.179	5.051	3.151	3.440		3.396	3.739	2.784	3.012	2.566	2.203	2.274	2.561	2.290	2.326		
9	4.671	4.861	6.003	7.332	4.375	3.736	3.693	4.149	3.247	3.398	4.257	3.229	2.441	2.626	2.190			3.280	
10	6.499	4.608	7.532	6.321	6.192	4.862	4.667	4.890	4.920	5.354	4.888	4.204	2.711	3.107					
11	5.243	8.365	18.000	9.326	6.515	7.512	6.300	6.520	5.847	10.831	5.408	4.604	3.251	4.833					
12	9.492	10.190	7.097	8.103	9.555	6.047	6.089	6.329	6.465	7.017	7.628	5.593	3.665	3.222					

Division 3L

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1																		0.110	0.047
2				0.224	0.169	0.236		0.167	0.223	0.179	0.224	0.186	0.173	0.248	0.198	0.240	0.198	0.235	0.256
3				0.564	0.380	0.539		0.436	0.468	0.353	0.459	0.443	0.395	0.456	0.581	0.505	0.402	0.459	0.501
4				0.820	0.480	1.142		0.801	0.796	0.735	0.764	0.789	0.810	0.836	0.883	0.849	0.880	0.668	0.785
5				1.245		1.477		1.382	1.227	1.313	1.372	1.556	1.330	1.280	1.303	1.274	1.319	1.134	1.122
6				1.980		1.984		2.049	1.807	1.796	1.879	1.937	1.902	1.748	1.700	1.764	1.893	2.055	2.084
7				2.638		2.278		2.247	2.703	2.351	2.103	2.567	2.767	2.191	1.862	2.327	2.988	3.253	3.229
8				5.077	5.440	2.930		3.521	2.579	2.818	3.043	3.653	3.481	3.089	2.781	2.550	3.160	4.200	3.440
9				5.804	6.647	4.005		4.111	4.197	3.801	3.015	3.666	4.274	3.678	4.928				3.200
10				11.762	8.339	4.390		6.132	5.476	7.540	3.483	6.830	4.557	3.949	3.349	6.440			
11				11.560	7.486	8.333		5.312	4.460	7.402	7.471	7.461	5.847	4.471	4.948				
12				18.553	10.653	9.902		12.081	10.511	5.525	9.410	11.385	6.642	5.307	8.652				

Table 5. Average length and weight at age of cod in the offshore regions of Divisions 2J3KL combined, as calculated from catches during autumn bottom-trawl surveys in 1981-1996. The mean for each age and year was calculated as the mean of Divisional means at age and year, weighted by the Divisional population numbers at age and year. The years 1978-1980 and 1984 are not provided because there were no surveys in Division 3L in those years.

Mean length (cm) at age

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1				17.8	18.4	19.0		18.7	18.9	19.6	17.1	18.1	19.8	20.1	18.6	19.0	20.0	19.0	19.3
2				30.1	29.2	27.7		27.3	28.7	28.1	28.1	27.7	27.6	29.0	28.1	28.7	27.3	26.1	28.5
3				40.6	38.2	39.4		35.3	35.8	36.3	37.1	37.2	35.5	35.6	37.6	37.7	36.3	34.6	35.4
4				47.5	49.3	46.8		42.2	42.8	44.1	44.4	44.7	44.2	41.7	44.0	44.5	43.8	41.8	43.2
5				54.5	54.5	55.5		50.9	48.7	50.4	51.0	51.3	51.0	47.9	48.8	50.7	50.5	48.2	49.5
6				59.4	60.9	61.0		55.2	54.9	54.5	55.2	56.0	57.2	55.1	54.2	53.6	57.0	57.9	58.2
7				64.5	63.2	64.6		61.4	58.2	60.5	57.4	59.2	61.6	59.6	56.9	57.9	60.8	66.7	66.0
8				68.1	67.0	66.2		69.0	63.4	62.2	63.1	62.0	64.1	62.9	65.7	62.5	62.0	74.0	70.0
9				76.3	70.6	70.8		70.5	69.0	68.2	66.3	68.1	68.2	66.9	76.6			88.0	66.0
10				87.2	78.9	74.6		74.2	74.7	73.5	70.0	73.0	70.3	69.3	70.4	87.0			
11				93.1	87.9	80.4		79.7	76.7	82.8	80.5	75.3	77.3	74.8	77.1				
12				93.5	99.4	89.7		86.7	77.5	83.5	89.1	80.5	82.4	73.4	94.5				

Mean weight (kg) at age

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1				0.037	0.053	0.070		0.030	0.059	0.058	0.042	0.048	0.062	0.070	0.053	0.080	0.068	0.060	0.059
2				0.239	0.195	0.199		0.186	0.219	0.189	0.215	0.197	0.181	0.215	0.197	0.208	0.182	0.167	0.205
3				0.615	0.504	0.556		0.418	0.411	0.447	0.480	0.480	0.398	0.398	0.518	0.485	0.428	0.376	0.399
4				1.032	0.811	1.024		0.734	0.748	0.838	0.808	0.848	0.778	0.664	0.838	0.807	0.769	0.661	0.731
5				1.553	1.575	1.571		1.266	1.109	1.342	1.300	1.338	1.201	1.019	1.158	1.212	1.189	1.024	1.139
6				2.009	1.987	1.949		1.701	1.795	1.548	1.722	1.766	1.732	1.561	1.616	1.534	1.784	1.951	1.993
7				2.581	2.411	2.434		2.171	2.193	2.295	1.824	2.125	2.257	1.916	1.855	1.935	2.280	3.253	3.052
8				3.841	3.157	2.964		3.128	2.920	2.608	2.691	2.512	2.602	2.332	2.717	2.439	2.366	4.200	3.440
9				4.886	4.088	3.593		3.728	3.596	2.902	2.954	3.179	3.193	2.881	4.778			3.280	3.200
10				7.167	6.501	4.274		4.477	4.956	5.434	3.284	4.237	3.624	3.230	3.349	6.440			
11				9.129	7.262	5.878		5.554	5.170	9.170	5.380	4.634	4.841	4.440	4.946				
12				9.957	10.086	7.891		7.400	7.428	5.765	8.036	5.741	5.825	4.097	8.652				

Table 6. Average Fulton's condition (round weight) at age for cod caught during autumn surveys in Div. 2J3KL.

Division 2J

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
2	0.846	0.845	0.848	0.916	0.835	0.853	0.849	0.859	0.881	0.863	0.881	0.879	0.828	0.820	0.745	0.834	0.882	0.834	0.847
3	0.872	0.900	0.920	0.958	0.904	0.949	0.938	0.927	0.920	0.980	0.932	0.942	0.886	0.845	0.800	0.851	0.850	0.847	0.864
4	0.898	0.923	0.814	0.973	0.886	1.005	0.961	0.955	1.038	0.979	0.999	0.954	0.924	0.870	0.809	0.872	0.851	0.868	0.892
5	0.937	0.907	0.948	0.957	0.956	0.944	0.983	0.979	1.033	0.985	0.979	0.992	0.935	0.854	0.829	0.869	0.888	0.864	0.953
6	0.909	0.995	0.927	1.022	0.945	0.897	0.955	0.978	1.079	1.036	1.030	0.996	0.947	0.839	0.794	0.842	0.908	0.895	0.769
7	0.879	0.922	0.930	1.004	0.930	0.861	0.945	0.962	1.041	0.969	1.010	1.020	0.967	0.821	0.805	0.828	0.953		0.824
8	0.905	0.818	0.935	1.058	0.896	1.015	0.931	0.973	0.974	1.102	1.013	1.052	0.994						
9	0.959	1.041	1.037	0.921	0.900	1.001	0.961	0.831	1.127	0.960	1.158	1.040	0.992	0.895					
10	0.979	0.995	1.077	1.066	1.005	0.951	0.947	0.931	1.004	0.974	1.071	1.141	0.966	0.948					
11	1.038	1.061	0.991	1.018	1.061	0.969	0.986	0.987	1.136	1.061	1.065	1.067	1.048	1.033					
12	1.149	1.031	1.116	1.059	1.105	0.955	1.007	0.988	1.054	1.039	1.098	1.003	1.079	0.983					

Division 3K

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
2	0.801	0.790	0.795	0.917	0.813	0.829	0.775	0.861	0.845	0.863	0.859	0.851	0.817	0.835	0.840	0.847	0.837	0.851	0.846
3	0.807	0.859	0.917	0.922	0.949	0.860	0.835	0.896	0.900	0.904	0.921	0.912	0.841	0.846	0.810	0.868	0.869	0.862	0.866
4	0.848	0.910	0.946	0.886	0.882	0.934	0.850	0.873	0.970	0.932	0.958	0.932	0.875	0.885	0.853	0.871	0.882	0.846	0.861
5	0.856	0.928	0.892	0.934	0.886	0.898	0.892	0.936	0.983	0.952	0.984	0.949	0.884	0.892	0.883	0.872	0.865	0.868	0.906
6	0.863	0.926	0.869	0.959	0.860	0.862	0.889	0.951	1.071	0.962	1.012	1.013	0.911	0.906	0.912	0.935	0.936	0.892	0.900
7	0.853	0.887	0.846	0.892	0.877	0.934	0.930	0.909	1.052	1.073	1.029	1.004	0.943	0.890	0.926	0.959	0.979		0.986
8	0.903	0.898	0.822	0.915	0.894	0.962		0.933	1.015	0.997	1.089	1.004	0.948	0.900	0.917	0.874	0.973		
9	0.947	0.918	0.907	1.046	0.858	0.958	0.941	1.067	1.044	1.034	1.020	1.006	0.922	0.915	0.835			1.043	
10	0.908	0.962	0.955	0.925	0.960	0.952	0.860	0.924	1.102	1.118	1.057	0.997	0.966	0.936					
11	0.778	0.952	1.032	1.098	0.901	1.048	1.031	0.969	1.086	1.126	0.998	1.023	0.951	0.907					
12	1.066	1.117	0.982	1.025	1.017	0.906	0.969	1.037	1.028	1.029	1.088	0.967	1.025	0.978					

Division 3L

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
2				0.841	0.798	0.824		0.771	0.882	0.842	0.878	0.846	0.801	0.890	0.859	0.840	0.870	1.087	0.887
3				0.906	0.904	0.830		0.876	0.878	0.856	0.917	0.874	0.861	0.889	0.977	0.877	0.920	0.894	0.864
4				0.914	0.875	0.847		0.875	0.887	0.864	0.884	0.878	0.861	0.931	0.979	0.902	0.893	0.889	0.893
5				0.924		0.846		0.882	0.931	0.877	0.925	0.926	0.892	0.931	1.000	0.923	0.937	0.912	0.900
6				0.884		0.810		0.838	0.913	0.837	0.955	0.919	0.906	0.946	1.001	0.999	0.959	0.990	0.999
7				0.903		0.917		0.844	0.966	0.855	0.890	0.917	0.929	0.909	0.974	0.979	0.996	1.071	1.064
8				1.004	0.886	0.897		0.871	0.851	0.883	0.912	0.997	0.952	0.965	0.945	1.057	1.051	1.036	1.003
9				0.955	0.968	0.895		0.957	0.965	0.895	0.970	0.924	0.965	0.970	1.013				1.113
10				1.119	0.973	0.899		0.978	1.003	1.094	0.922	1.046	0.964	0.958	0.946	0.978			
11				1.004	0.982	0.963		0.942	0.928	0.961	0.995	1.035	1.001	1.036	1.058				
12				1.104	0.938	0.903		1.019	1.029	0.943	1.051	1.107	0.969	0.980	1.019				

Table 7. Average Fulton's condition (guttred weight) at age for cod caught during autumn surveys in Div. 2J3KL.

Division 2J

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
2	0.733	0.718	0.738	0.781	0.735	0.731	0.713	0.722	0.718	0.730	0.753	0.745	0.714	0.710	0.668	0.741	0.803	0.740	0.733
3	0.729	0.755	0.788	0.811	0.775	0.772	0.758	0.741	0.779	0.813	0.786	0.764	0.741	0.736	0.710	0.758	0.755	0.743	0.755
4	0.762	0.763	0.718	0.810	0.757	0.803	0.774	0.755	0.814	0.792	0.816	0.772	0.745	0.735	0.693	0.759	0.745	0.758	0.791
5	0.771	0.750	0.764	0.816	0.816	0.774	0.784	0.769	0.816	0.770	0.786	0.786	0.744	0.724	0.709	0.752	0.773	0.736	0.809
6	0.747	0.785	0.750	0.821	0.801	0.729	0.767	0.757	0.815	0.783	0.812	0.789	0.753	0.702	0.678	0.717	0.771	0.735	0.769
7	0.731	0.762	0.738	0.795	0.757	0.661	0.776	0.751	0.814	0.783	0.798	0.782	0.743	0.707	0.687	0.722	0.779		0.824
8	0.722	0.695	0.743	0.809	0.737	0.789	0.732	0.761	0.776	0.836	0.815	0.806	0.762	0.705					
9	0.764	0.823	0.806	0.749	0.729	0.789	0.751	0.669	0.849	0.768	0.811	0.793	0.771	0.738					
10	0.779	0.794	0.814	0.859	0.814	0.758	0.755	0.724	0.794	0.772	0.813	0.874	0.748	0.783					
11	0.834	0.831	0.760	0.855	0.855	0.801	0.786	0.730	0.870	0.792	0.798	0.806	0.817	0.835					
12	0.904	0.766	0.838	0.845	0.858	0.786	0.799	0.725	0.828	0.795	0.827	0.766	0.828	0.830					

Division 3K

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
2	0.683	0.707	0.708	0.793	0.722	0.725	0.685	0.730	0.749	0.768	0.753	0.716	0.711	0.733	0.735	0.727	0.741	0.733	0.739
3	0.719	0.741	0.786	0.793	0.815	0.742	0.719	0.744	0.714	0.757	0.785	0.750	0.714	0.719	0.700	0.741	0.767	0.744	0.746
4	0.747	0.757	0.805	0.769	0.758	0.781	0.733	0.731	0.774	0.772	0.796	0.755	0.724	0.736	0.711	0.720	0.768	0.730	0.753
5	0.747	0.780	0.747	0.826	0.754	0.768	0.753	0.765	0.783	0.785	0.799	0.763	0.734	0.733	0.718	0.717	0.730	0.737	0.782
6	0.739	0.747	0.726	0.789	0.738	0.728	0.744	0.784	0.798	0.778	0.808	0.781	0.744	0.742	0.739	0.746	0.765	0.766	0.745
7	0.730	0.739	0.729	0.749	0.731	0.799	0.784	0.746	0.820	0.819	0.808	0.768	0.749	0.730	0.754	0.721	0.780		0.801
8	0.773	0.746	0.687	0.751	0.732	0.809		0.764	0.795	0.788	0.833	0.779	0.749	0.738	0.736	0.732	0.799		
9	0.784	0.738	0.758	0.847	0.721	0.760	0.781	0.841	0.821	0.796	0.819	0.791	0.732	0.755	0.679			0.795	
10	0.744	0.761	0.795	0.756	0.766	0.762	0.717	0.744	0.849	0.811	0.831	0.793	0.749	0.776					
11	0.642	0.752	0.861	0.836	0.749	0.838	0.822	0.778	0.840	0.832	0.788	0.808	0.771	0.741					
12	0.845	0.812	0.762	0.815	0.813	0.755	0.789	0.835	0.785	0.810	0.852	0.792	0.778	0.803					

Division 3L

Age	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	
2		0.718	0.707	0.718		0.680	0.769	0.721	0.748	0.734	0.716	0.746	0.744	0.721	0.750	0.935	0.772
3		0.778	0.803	0.724		0.749	0.765	0.733	0.781	0.759	0.734	0.748	0.801	0.741	0.784	0.752	0.749
4		0.794	0.765	0.746		0.740	0.757	0.745	0.730	0.764	0.729	0.769	0.788	0.737	0.741	0.758	0.770
5		0.767		0.735		0.756	0.790	0.748	0.781	0.782	0.752	0.769	0.795	0.715	0.758	0.761	0.760
6		0.729		0.700		0.717	0.781	0.714	0.796	0.776	0.742	0.773	0.796	0.777	0.776	0.804	0.806
7		0.751		0.775		0.715	0.816	0.724	0.741	0.768	0.763	0.741	0.793	0.737	0.775	0.861	0.847
8		0.824	0.767	0.764		0.708	0.730	0.735	0.758	0.804	0.777	0.763	0.723	0.741	0.725	0.780	0.825
9		0.798	0.800	0.744		0.790	0.775	0.743	0.781	0.729	0.773	0.779	0.803				0.939
10		0.888	0.827	0.749		0.783	0.808	0.852	0.746	0.798	0.785	0.758	0.743	0.787			
11		0.800	0.807	0.793		0.774	0.775	0.803	0.736	0.802	0.795	0.817	0.814				
12		0.885	0.771	0.752		0.817	0.811	0.783	0.828	0.822	0.792	0.771	0.808				

Table 8. Average liver index at age for cod caught during autumn surveys in Div. 2J3KL.

Division 2J

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	
2		0.037	0.035	0.046	0.031	0.030	0.032	0.023	0.043	0.031	0.036	0.045	0.042	0.036	0.025	0.032	0.038	0.042	0.038	
3		0.061	0.051	0.049	0.047	0.057	0.050	0.036	0.049	0.052	0.049	0.059	0.050	0.042	0.028	0.038	0.039	0.041	0.043	
4		0.062	0.034	0.069	0.048	0.078	0.061	0.048	0.079	0.061	0.067	0.067	0.060	0.045	0.040	0.037	0.035	0.041	0.040	
5		0.064	0.052	0.053	0.051	0.063	0.066	0.057	0.077	0.073	0.057	0.076	0.061	0.037	0.036	0.038	0.043	0.045	0.043	
6		0.080	0.054	0.062	0.060	0.065	0.062	0.056	0.089	0.065	0.074	0.074	0.064	0.033	0.037	0.038	0.049	0.017	0.037	
7		0.060	0.055	0.056	0.057	0.057	0.055	0.053	0.074	0.061	0.070	0.077	0.067	0.031	0.036	0.030	0.073		0.047	
8		0.040	0.041	0.067	0.051	0.077	0.055	0.061	0.051	0.077	0.076	0.089	0.066	0.033						
9		0.060	0.071	0.058	0.048	0.081	0.066	0.034	0.093	0.045	0.065	0.074	0.073	0.038						
10		0.083	0.084	0.083	0.058	0.053	0.063	0.052	0.071	0.060	0.072	0.097	0.058	0.034						
11		0.097	0.074	0.058	0.052	0.062	0.065	0.065	0.092	0.075	0.068	0.083	0.065	0.042						
12		0.076	0.083	0.061	0.099	0.050	0.053	0.052	0.098	0.089	0.082	0.073	0.084	0.043						

Division 3K

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
2	0.030	0.019	0.021	0.040	0.020	0.024	0.013	0.035	0.029	0.029	0.025	0.032	0.035	0.037	0.035	0.042	0.034	0.045	0.039
3	0.020	0.033	0.038	0.044	0.033	0.039	0.032	0.053	0.049	0.046	0.044	0.047	0.042	0.044	0.037	0.043	0.044	0.046	0.044
4	0.032	0.054	0.047	0.041	0.045	0.052	0.037	0.053	0.061	0.049	0.056	0.056	0.052	0.052	0.048	0.045	0.049	0.047	0.044
5	0.040	0.066	0.046	0.035	0.061	0.047	0.046	0.054	0.069	0.056	0.069	0.057	0.051	0.054	0.055	0.051	0.053	0.050	0.048
6	0.037	0.062	0.052	0.054	0.044	0.035	0.041	0.054	0.082	0.064	0.070	0.071	0.055	0.052	0.059	0.058	0.054	0.048	0.057
7	0.040	0.061	0.045	0.043	0.049	0.035	0.047	0.044	0.082	0.078	0.061	0.071	0.057	0.043	0.064	0.050	0.065		0.059
8	0.057	0.058	0.049	0.049	0.052	0.066		0.055	0.074	0.051	0.078	0.072	0.066	0.046	0.059	0.032	0.071		
9	0.059	0.055	0.045	0.070	0.042	0.046	0.047	0.075	0.064	0.053	0.059	0.072	0.060	0.052	0.061			0.036	
10	0.062	0.061	0.047	0.059	0.057	0.049	0.037	0.049	0.081	0.070	0.069	0.071	0.064	0.054					
11	0.033	0.066	0.051	0.077	0.055	0.063	0.065	0.066	0.080	0.091	0.073	0.075	0.062	0.038					
12	0.071	0.080	0.066	0.066	0.062	0.024	0.046	0.052	0.097	0.073	0.070	0.071	0.079	0.034					

Division 3L

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
2				0.021	0.013	0.025		0.029	0.030	0.026	0.025	0.026	0.039	0.046	0.041	0.043	0.039	0.039	0.039
3				0.041	0.025	0.022		0.031	0.032	0.032	0.028	0.036	0.038	0.056	0.067	0.053	0.078	0.048	0.040
4				0.038	0.042	0.024		0.039	0.035	0.031	0.035	0.039	0.037	0.062	0.073	0.062	0.053	0.049	0.044
5				0.039		0.027		0.039	0.047	0.035	0.043	0.052	0.042	0.059	0.076	0.066	0.052	0.050	0.044
6				0.039		0.030		0.033	0.040	0.030	0.045	0.045	0.048	0.060	0.071	0.075	0.074	0.066	0.064
7				0.041		0.041		0.030	0.045	0.029	0.051	0.053	0.057	0.059	0.073	0.066	0.044	0.080	0.078
8				0.065	0.039	0.032		0.046	0.033	0.032	0.043	0.058	0.055	0.069	0.065	0.033	0.035	0.053	0.102
9				0.049	0.061	0.039		0.051	0.056	0.036	0.050	0.051	0.059	0.075	0.070				0.137
10				0.077	0.054	0.041		0.066	0.052	0.091	0.039	0.059	0.057	0.066	0.074	0.098			
11				0.052	0.068	0.042		0.060	0.048	0.059	0.044	0.067	0.069	0.074	0.090				
12				0.068	0.066	0.045		0.071	0.060	0.050	0.070	0.055	0.065	0.056	0.068				

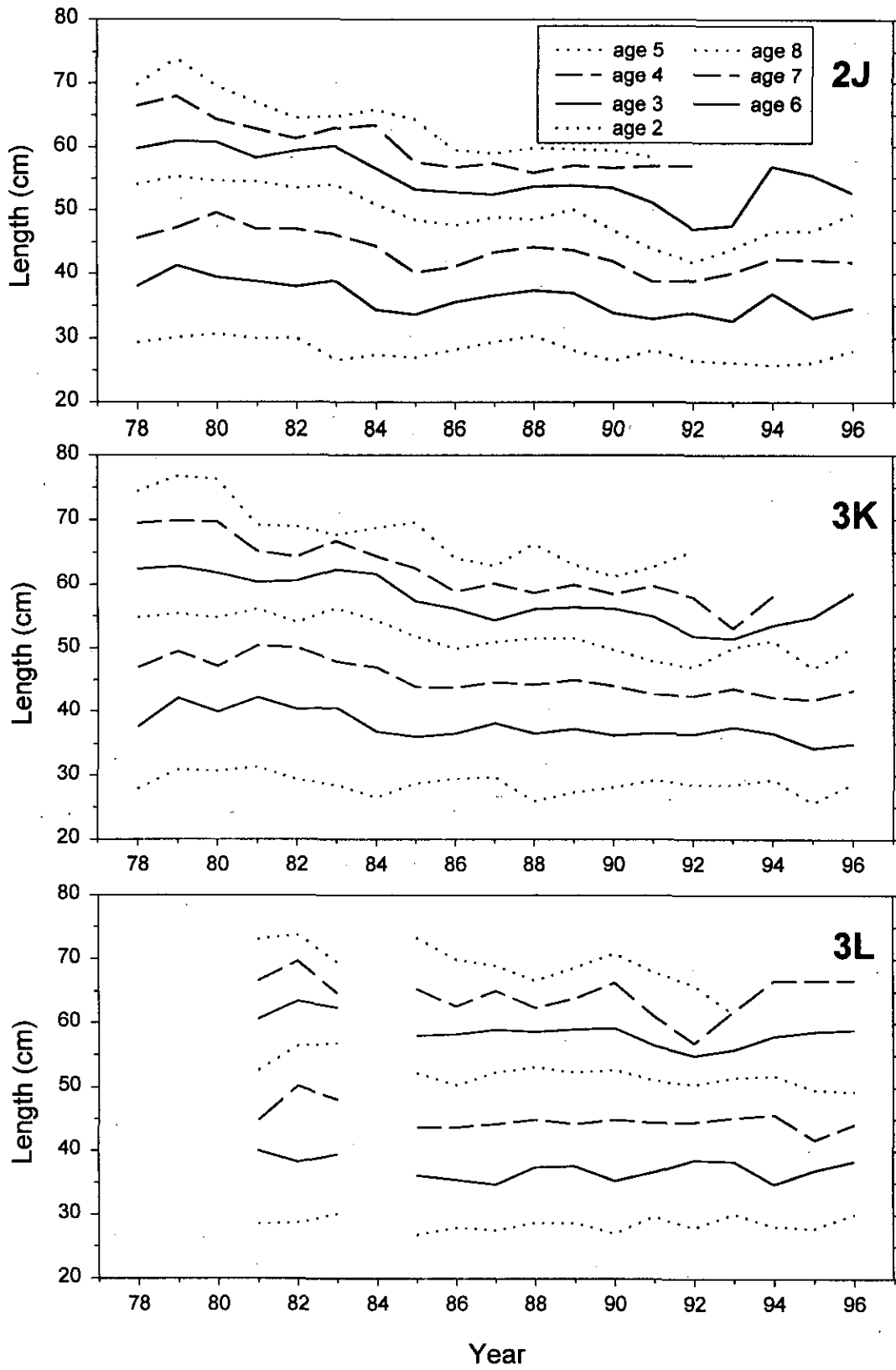


Fig. 1. Mean lengths at age for cod caught during the autumn bottom-trawl surveys. Data from Table 3.

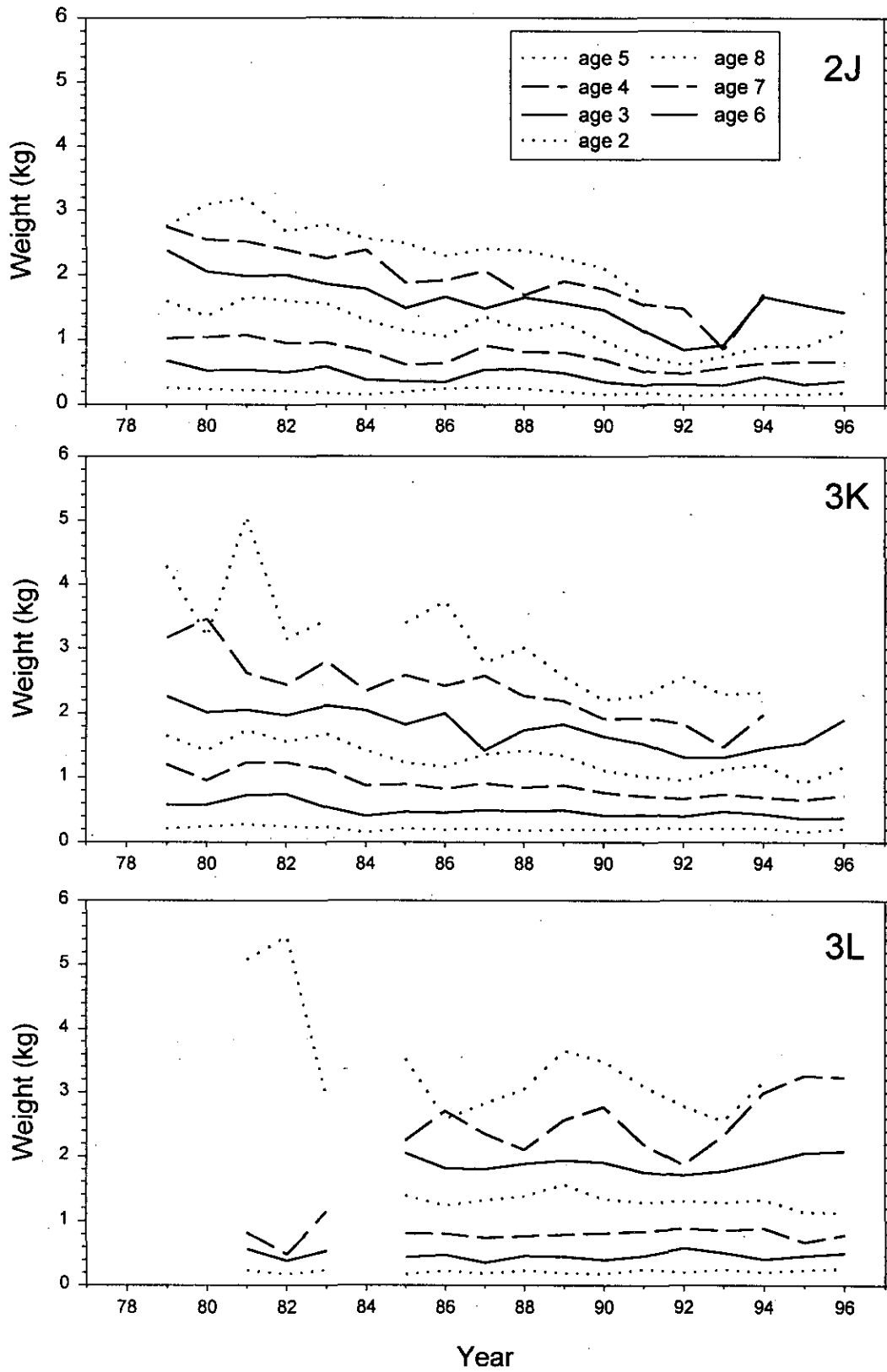


Fig. 2. Mean weights at age for cod caught during the autumn bottom-trawl surveys. Data from Table 4.

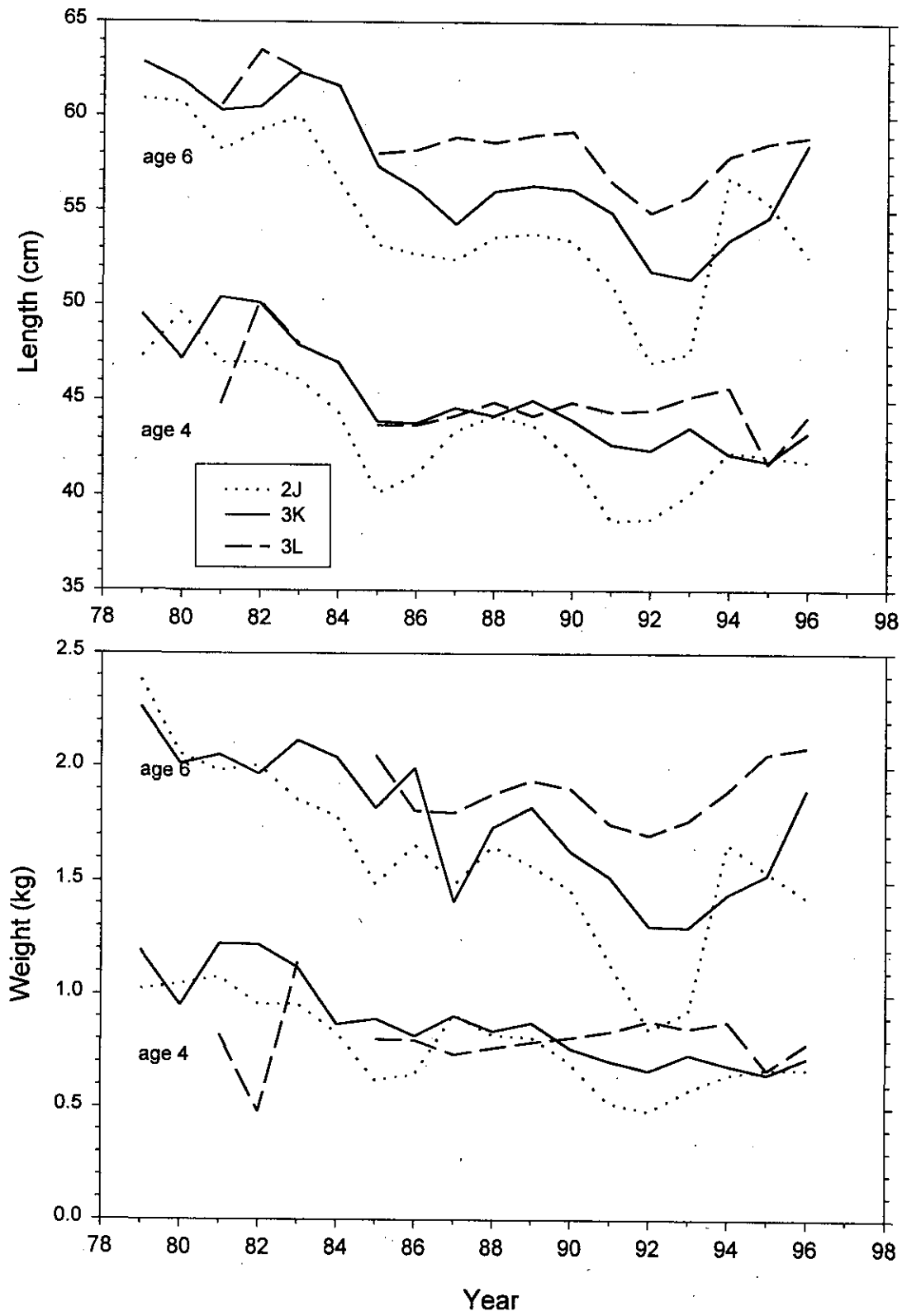


Fig. 3. Mean lengths and weights by Division for cod of ages 4 and 6 caught during the autumn bottom-trawl surveys in Divisions 2J, 3K and 3L.



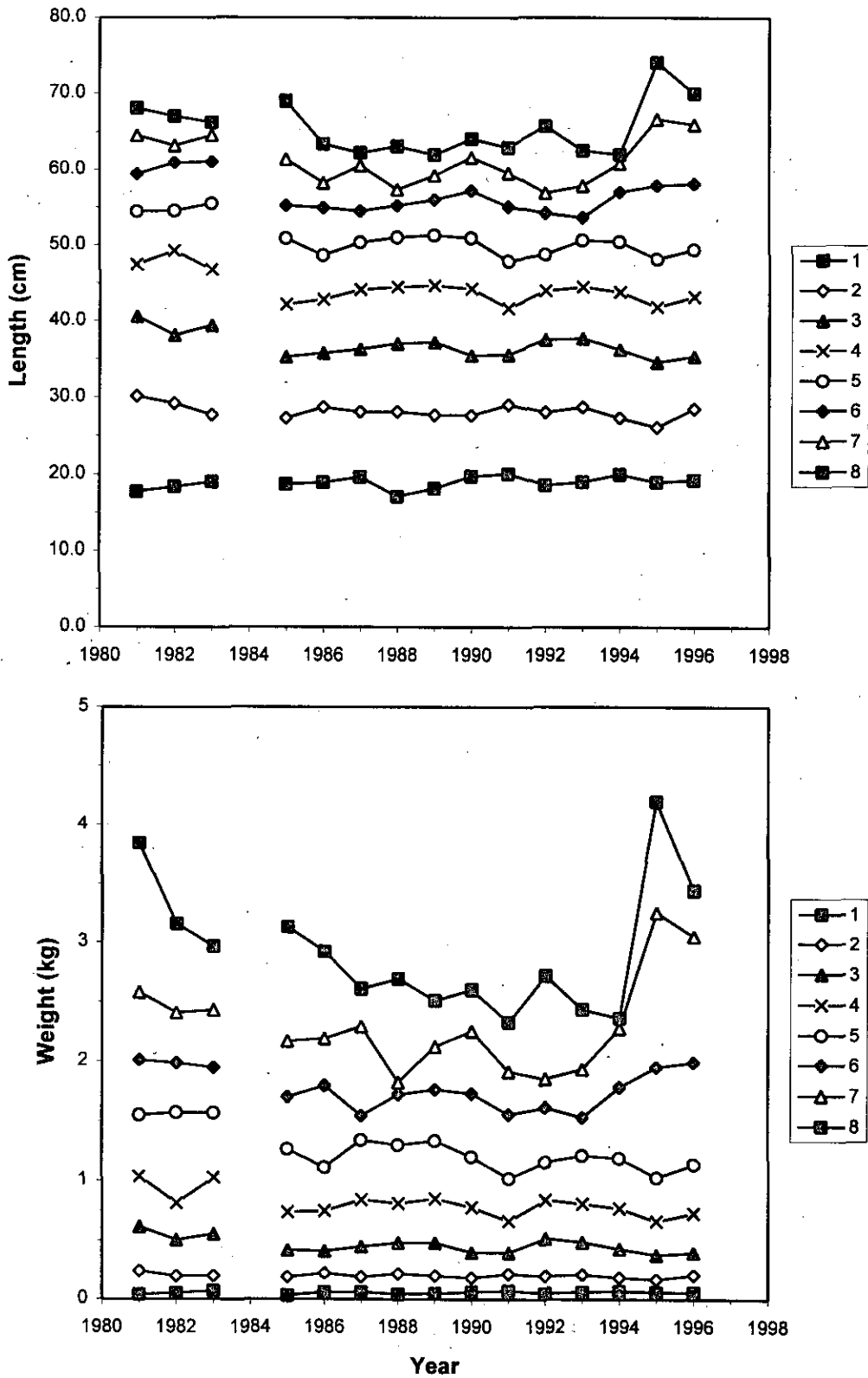


Fig. 4. Mean lengths and weights at age for the cod stock in the offshore area of 2J3KL during the autumns of 1981-1983 and 1985-1996.

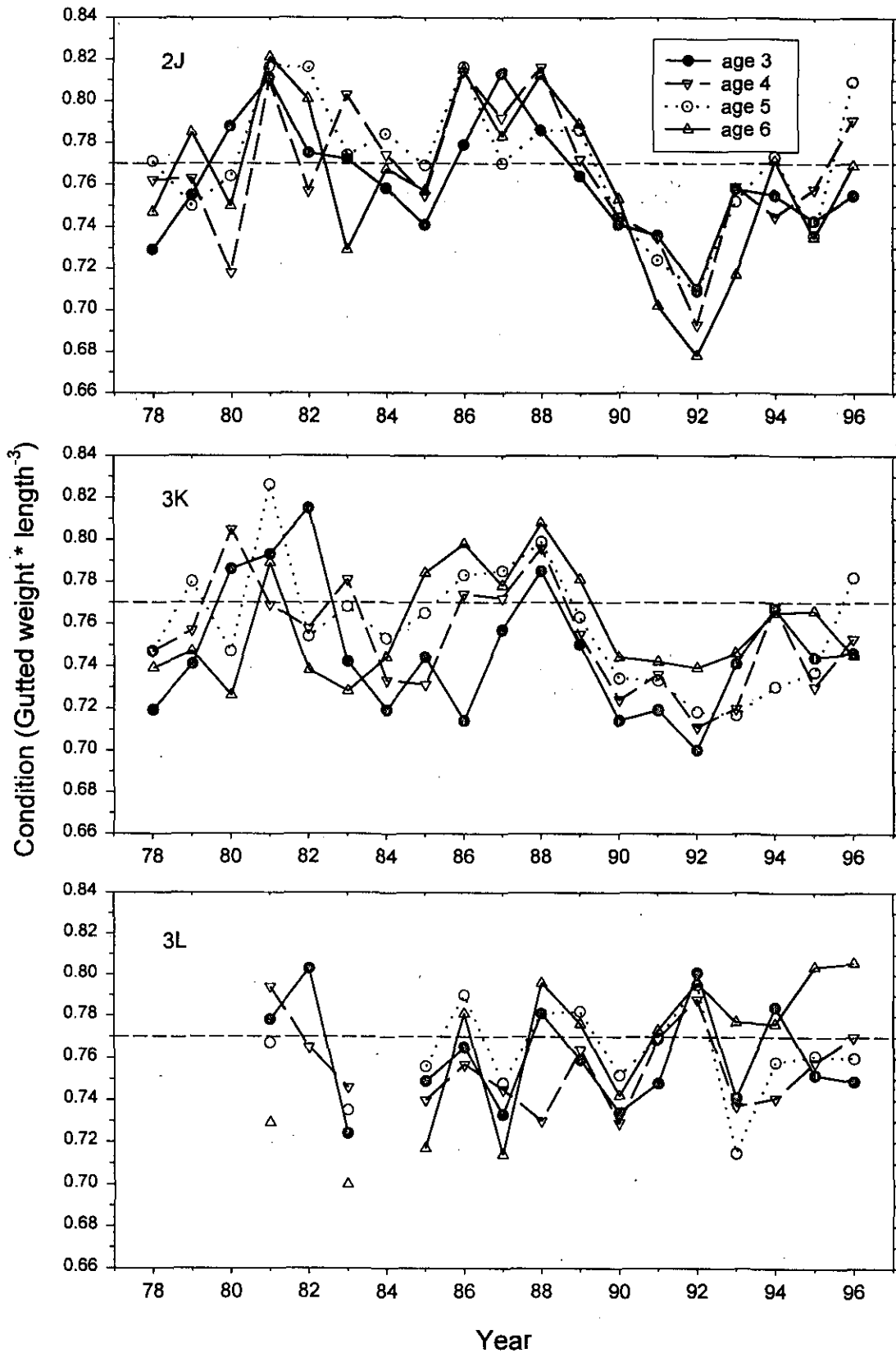


Fig. 5. Average Fulton's condition (gutted weight) at ages 3-6 for cod sampled during autumn surveys in Divisions 2J3KL. A condition factor of 0.77, which is the overall average reported by Taggart et al. (1994), is shown for reference.

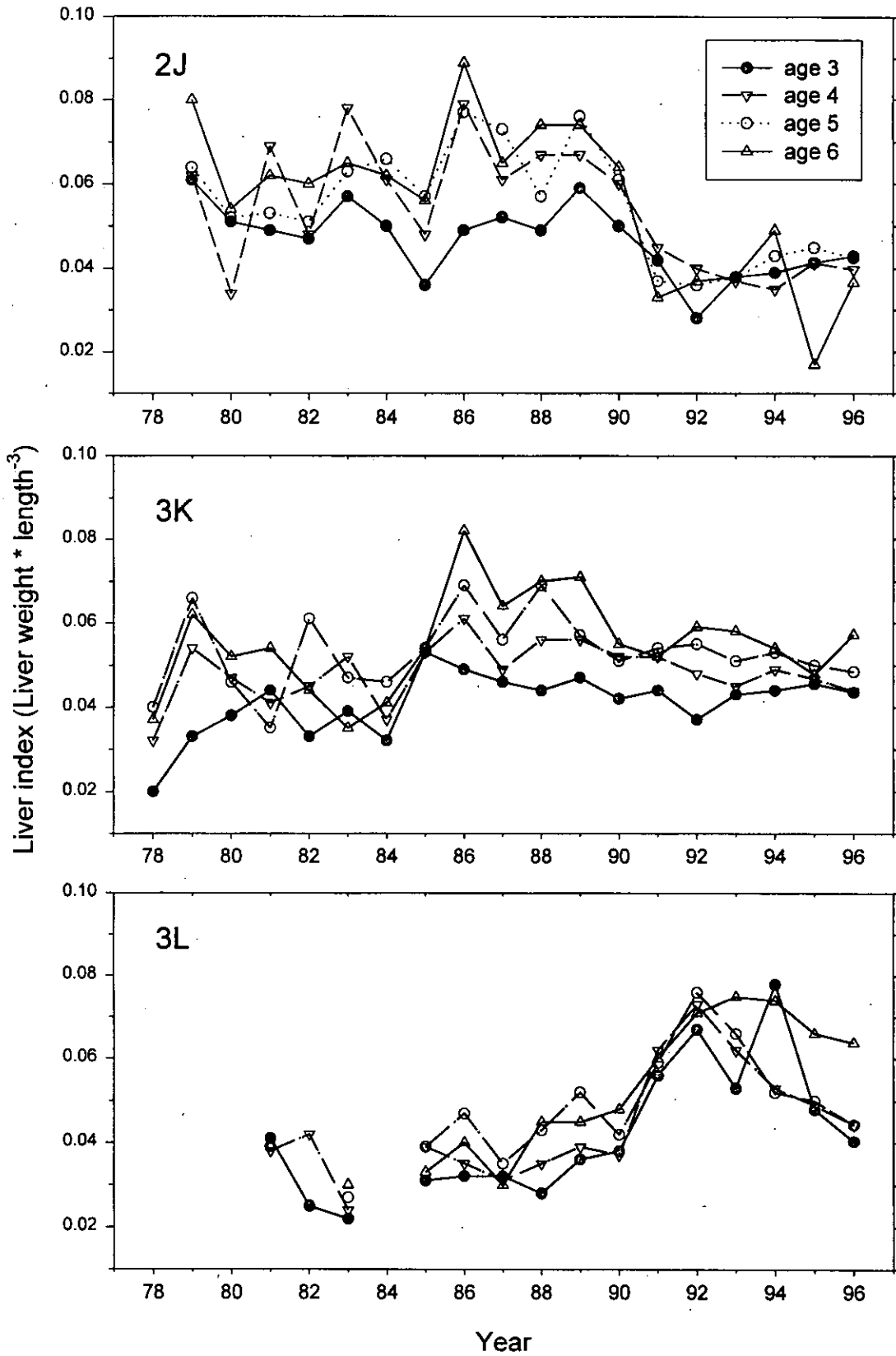


Fig. 6. Average liver index at ages 3-6 for cod sampled during autumn surveys in Divisions 2J3KL.

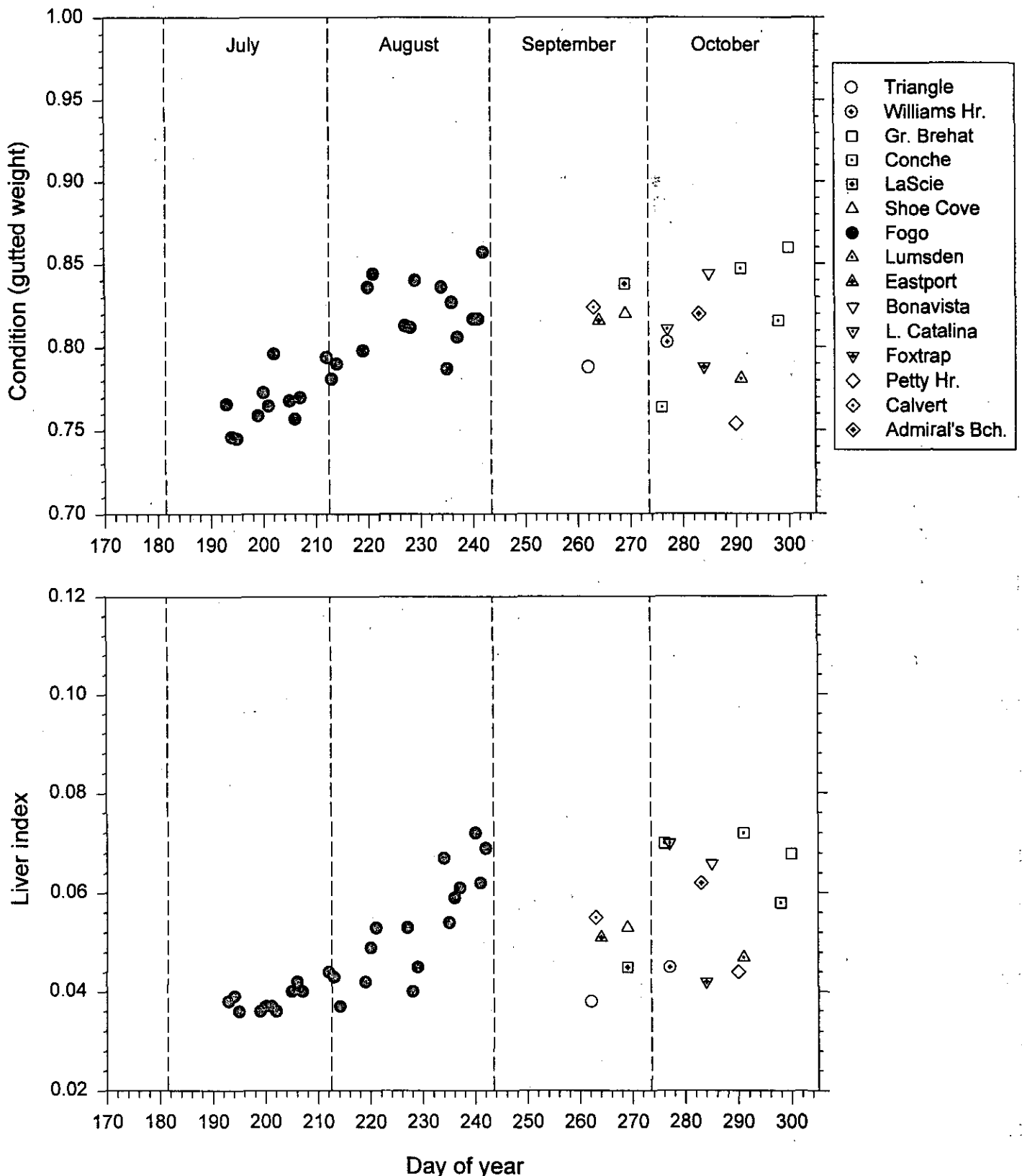


Fig. 7. Condition of cod sampled during the sentinel survey in Division 2J3KL in 1995. The data are aggregated by community and day of year. Any influence of fish size has been ignored. All samples collected from communities on Fogo Island on a specific day are aggregated. In the legend, communities are ordered from north (top) to south.

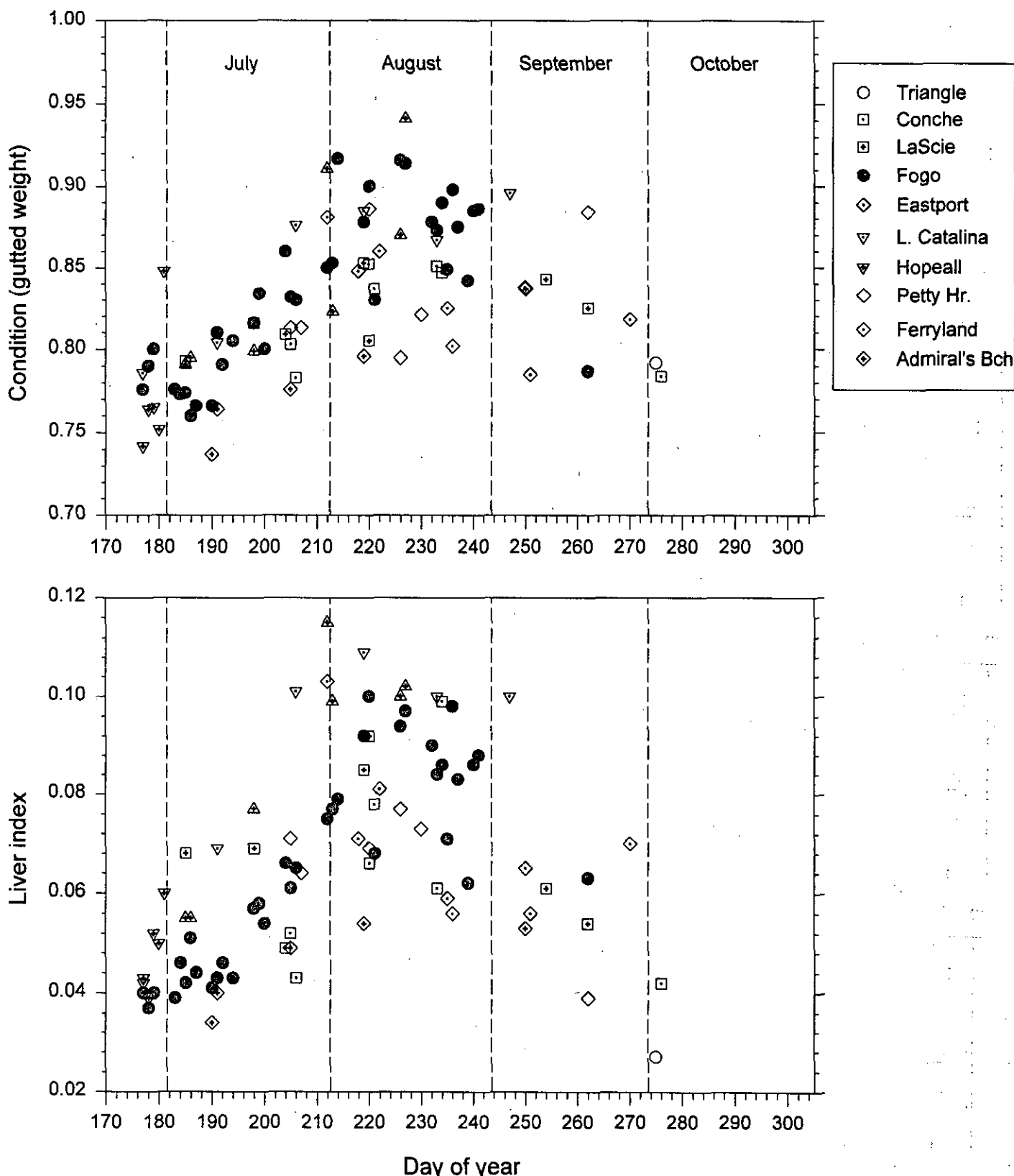


Fig. 8. Condition of cod sampled during the sentinel survey in Division 2J3KL in 1996. The data are aggregated by community and day of year. Any influence of fish size has been ignored. All samples collected from communities on Fogo Island on a specific day are aggregated. In the legend, communities are ordered from north (top) to south.