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The Icelandic Shrimp Fishery (*Pandalus borealis* Kr.) at the Flemish Cap in 1993-1997

by

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Abstract

Some 12 Icelandic vessels have been fishing for shrimp in the waters at the Flemish Cap in 1997. In this paper there are logbook information on the Icelandic fishery for the years 1993 through 1997.

The results of deviation analysis of the shrimp samples from all nations is shown. Length frequencies by month and depth are shown for 1996 and 1997. Several indices, and age divided catch rates are also discussed.

Introduction

The Spanish investigators (EU) have been measuring the biomass index of northern shrimp at the flemish Cap since 1988 in their annual bottom trawl survey at the Flemish cap. In 1993 the fishery was initiated by Canada, followed closely by Faroe Islands and Iceland.
The fishery was some 24-33 thousand tons in the years 1993-1995 to increase in 1996 to 51 thousand tons.

In this paper all the information from the Icelandic investigators is gathered. From the logbooks comes effort, catch and CPUE are calculated. From the biological samples taken by Icelandic observers comes various information on lenght and sex distribution of shrimp. From these the age asessments are carried out.

Materials and Methods

Icelandic observers sampled shrimp onboard all Icelandic vessels in the years 1996 and 1997 at the Flemish Cap. The shrimp was measured fresh to the nearest 0.5 mm using Vernier calipers. Observers then sorted each length class into males and females (Rasmussen, 1953) and the females further into primiparous and multiparous (McCrary, 1971).

Age was assessed in two ways. First there was the deviation analysis (Sund, 1939 and Skúladóttir, 1979) which was built on summing all shrimp (unsorted) measured by the countries Canada, Norway, Greenland, Faroe Islands and Iceland in the years 1993-1997 by months. The length frequency distribution per month was turned into a promille distribution per month, where after all promille distributions of e.g. all April months from 1993 through 1997 were summed. From the resulting mean promille distribution each year's April distribution was subtracted. From this the positive anomalies could be detected as indicators of strong year classes.

Secondly age assessment was carried out using modal analysis (Macdonald and Pitcher, 1979) on the length distributions of males, primiparous and multiparous females respectively. In

order to see the actual numbers in the stock at Flemish Cap, the total number per age group and male or female was calculated by using the results from the modal analysis of the Icelandic data of 1994 (Skúladóttir, 1994) and 1996 and 1997 Icelandic data from the present paper. In order to make this possible length/weight relations ships were formed from weighing shrimp individually from shrimp samples obtained at the Flemish Cap in 1996 and brought frozen to the laboratory. Shrimp was thawed in air, measured to the nearest 0.5 mm, sorted and weighed to the nearest 0.1 g.

In order to get the number per hour of each age group, length/weight relationships were applied in the following manner. Using length/weight relationships, mean length at age was turned into weight at age in each month. The sum of weight times proportion in each age and sex class was divided into the catch per month to get the total number of shrimp fished per month. Then the numbers of all the months January through July were summed and divided by the total number of hours fished (table 4).

The logbook data include catch and effort. Not all skippers send in the logbooks, but information on landings can be obtained from the Fisheries Directorate in Iceland. Thus effort was raised by dividing the nominal catch of each month with the calculated CPUE from the logbooks. The overall CPUE of the January-July was then obtained by summing nominal catch of all months and corresponding effort. Nominal catch for the whole period was then divided by "nominal effort" to get the CPUE for the period January-July. The data where updated from the logbook information reported on previously for the years 1993-1996 (Skúladóttir, 1996).

Standardization of the CPUE was done by fitting a regression to CPUE of every haul in the period January through July against the size of trawl (cirqumference of the belly, measured in number of standard size meshes). Then the CPUE at trawl size 2900 meshes was calculated.

The occurrence of different age groups

First of all there are the results from the deviation analysis (Sund, 1939, Skúladóttir, 1979). This analysis was applied to many samples from five nations (Table 1). The deviations as percentiles are shown in Figures 1-7. In April there are two positive modes, where the one to the left represents the 1994 year class of about 18 mm (Fig. 1). The strong 1993 year class can be followed as a positive mode since 1995 where it appears as a two year old of about 15 mm, growing to about 19.5 mm in 1996 and to about 22.5 mm in 1997. Although the 1994 year class appears to be quite as strong as the 1993 year class in april 1997 this is not so in the following months May and June (Figs. 2 and 3). But in July the 1994 year class appears to be even stronger than the 1993 year class (Fig. 4). It is difficult to see whether the 1993 year class is dwindling very rapidly or whether this is a variation between months.

The length frequency distributions of Icelandic samples from 1996 and 1997 are shown in Figures 8 and 9. The highest peak represents the 1993 year class. It is to be noted that a small fraction of it appears to be changing sex in 1996.

The length frequency distributions were run through the modal analysis (Macdonald and Pitcher, 1979) in the three categories, namely, males, primiparous and multiparous females. The results, overall proportions of each sex group and mean weight at age from the age asessments are shown in Table 3. The mean weights as shown in Table 3 were calculated by using different length/weight relationships according to whether within the ovigerous period or not. The male length/weight relationsship was used in all months for males and primiparous females. As multiparous females are sometimes ovigerous and sometimes not the length/weight relationships for these were found to fall into three categories. Firstly there is the onset of spawning, namely July where very few have spawned and secondly August where most have spawned. Then thirdly there is the ovigerous period where all the multiparous females are egg-bearing, namely September through March. The fourth is when all multiparous females have hatched and before spawning starts again, namely the period April through June (Table 2).

Number per trawling hour

Number per trawling hour of each age group should be proportional to the number in stock if the coverage of samples is sufficient. The coverage of Icelandic samples in 1994 was poor and covered only the months June, July and August where some 2 thousand shrimp were measured. In 1996 and 1997 there were over a million shrimp measured with good coverage both spatially and

temporally (Figs. 8 and 9). In 1997 The no./hr. was quite high for 3 year olds in 1996, the presumed 1993 year class. A small proportion of it changed sex and spawned as 3 year olds or 1185 (Table 4). About half of what is left of the 1993 year class changed sex and spawned for the first time in August 1997 (Fig 9 and Table 4). Then the rest of the 1993 year class will change sex in the winter 1997/98. This is accordance with previous experience of strong year classes in Icelandic waters, namely its members changing sex at different times, or in this case over 3 years. The no./hr. of 4 year olds seemed higher than that of 4 year olds in1994. in both 1996 and 1997 although nothing to compare with a strong year class like the 1993 year class. The number per hour of males appears to be going down in the next year as the rest of the strong 1993 year-class changes sex. On the other hand the no./hr. of females is stable and does not seem likely to decrease much in 1998 assuming the total catch will be a great deal lower in 1997 than in 1996. However, there is the big question will the males year classes of 1994 and 1995 be sufficiently numerous.

Spatial and Temporal occurrence of sex groups

The proportions of sex groups, males, primiparous and multiparous females are calculated first by area and month from the samples (Table 6). An average can be taken for every sex category and area. Males are of the same proportion in all areas in 1997 (January-August), but the multiparous females are of highest proportion in the south west area as was the case in 1996 also, whereas primiparous are in highest proportions in the north east in 1997. This was not quite so in 1996 where males were in highest proportions in the north east area. In the months September-December multiparous females became more apparent in the catches than earlier, especially in the southwest area.

The biological samples can also be grouped according to depth strata in 1996 and 1997 (Figures 10-19). In 1997 the fishing takes mainly place in depths between 140 and 300 fathoms (Figures 16-19) The same is evident from looking at Figure 21, namely less fishing in shallow water than was the case in 1996.

Catch and Effort data

In 1997 the fishery was carried out mainly since April. The catch so far is 4285 tons (Table 5 and 7) as compared to some 16 thousand tons at the same time 1996 (Skúladóttir, 1966). The difference is mainly due to the fishery being unlimited from Iceland's side in 1996, whereas Iceland set a total allowable catch (TAC) for Icelandic vessels at 6 800 tons for the year 1997.

Figure 20 shows the proportion of catch taken by Iceland every year by the 4 sub areas. In 1993 the shrimp appears to have been caught in the same proportions in all areas except the south east (SE). In the years 1994 through 1997 the north west (NW) area seems to be the most important area.

The mean CPUE for the year 1997 was the lowest ever for Iceland or 156 kg per trawling hour for the period January through July (Table 7). In 1996 the mean CPUE for the same period was 196 kg. The average size of gear used was 2826 in 1997, or almost the same as used in 1996 (2 805 meshes). At the same time the use of twin trawls has increased in 1997 (Table 5). Standardized CPUE has also gone down or from 269 kg in 1995 to 210 kg in 1996 and further to 172 kg in 1997 (Table 5).

By-catch

The by-catch was found to be mainly redfish or 0.5% of the shrimp catch in 1997 as compared to 1.6% in 1996. Other species were wolffish 0.3% in 1997 as compared to 1.1% in 1996 and greenland halibut was 0.1% in 1997 as compared to 0.3% in 1996. No cod was detected and no american plaice.

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Table 1. Number of Pandalus borealis measured in each month at Flemish Cap by Canada, Norway, Greenland, Faroe Islands and Iceland for use in the deviation analysis of length frequency distributions (Figs. 1-7). In 1997 there are only Icelandic samples.

	1993	1994	1995	1996	1997
January				13086	7975
February				18642	10930
March		16051	8864	58678	
April	160	8817	13399	141569	5536
May	11455	31942	32703	179066	41819
June	40902	20098	37352	221607	61374
July	10420		32989	188395	48200
August			9508	123220	2040
September	1219		7616	169230	
October	674		1026	92239	
November	4311		6063	35563	
December			1245	15198	
Σ	69141	76908	150765	1256493	177874

Table 2. Length-weight relationships for different sex groups of northern shrimp, where y is the weight and x is the carapace length.

Month	Sex group	No. of specimens	Equation	r squared
March-Dec	Male	953	ln y = 3.037*ln x - 7.549	0.939
March	multip. fem	51	ln y = 3.258*ln x - 8.166	0.86
April-June	multip. fem	127	ln y = 2.778*ln x - 6.689	0.919
July	multip. fem	122	ln y = 2.921*ln x - 7.144	0.941
August	multip. fem	66	ln y = 3.111*ln x - 7.689	0.897
September	multip. fem	97	ln y = 2.753*ln x - 6.565	0.921
October	multip. fem	114	ln y = 3.050*ln x - 7.458	0.899
November	multip. fem	147	ln y = 2.636*ln x - 6.083	0.846
December	multip. fem	133	ln y = 2.812*ln x - 6.745	0.863
Sept.-March	multip. fem	542	ln y = 2.929*ln x - 7.085	0.863

Table 3. Some results of the modal analysis by sex and presumed age groups in 1996 and 1997. Weight is calculated from length-weight relationsships shown in table 2.

January 1996

Age	2	3	3	4	4	5	6
Sex	Male	Male	Primi. Fe.	Primi. Fe.	Multi. fe.	Multi. fe.	Multi. fe.
CL (mm)	12.13	19.10	20.21	23.09	23.11	26.72	28.77
Weight (g)	1.03	4.09	4.86	7.28	8.27	12.65	15.71
Per cent	0.18	58.14	0.23	19.75	8.04	10.31	3.35

February 1996

Age	2	3	3	4	4	5	6
Sex	Male	Male	Primi. Fe.	Primi. Fe.	Multi. fe.	Multi. fe.	Multi. fe.
CL (mm)	12.71	18.93	20.86	23.83	23.03	25.91	28.53
Weight (g)	1.19	3.98	5.35	8.01	8.19	11.56	15.33
Per cent	0.38	48.12	2.96	16.88	6.64	16.59	8.44

March 1996

Age	2	3	3	4	4	5	6
Sex	Male	Male	Primi. Fe.	Primi. Fe.	Multi. fe.	Multi. fe.	Multi. fe.
CL (mm)	12.95	18.85	20.58	23.80	22.85	26.16	28.39
Weight (g)	1.26	3.93	5.13	7.98	8.00	11.89	15.11
Per cent	0.54	68.57	4.86	6.28	5.93	8.81	5.01

April 1996

Age	2	3	3	4	4	5	6
Sex	Male	Male	Primi. Fe.	Primi. Fe.	Multi. fe.	Multi. fe.	Multi. fe.
CL (mm)	13.28	19.61	21.07	24.56	22.82	26.22	28.42
Weight(g)	1.36	4.43	5.51	8.78	7.39	10.86	13.59
Per cent	3.78	61.92	6.21	15.13	3.76	5.61	3.60

May 1996

Age	2	3	3	4	4	5	6
Sex	Male	Male	Primi. Fe.	Primi. Fe.	Multi. fe.	Multi. fe.	Multi. fe.
CL (mm)	14.35	19.88	21.23	24.80	23.23	25.95	28.51
Weight (g)	1.72	4.62	5.64	9.05	7.76	10.56	13.71
Per cent	1.95	52.50	5.04	27.99	3.24	5.59	3.53

June 1996

Age	2	3	3	4	4	5	6
Sex	Male	Male	Primi. Fe.	Primi. Fe.	Multi. fe.	Multi. fe.	Multi. fe.
CL (mm)	14.81	20.30	21.95	25.01	24.33	26.96	29.31
Weight (g)	1.89	4.92	6.24	9.28	8.83	11.74	14.80
Per cent	3.28	56.37	4.91	22.80	2.46	7.10	2.95

July 1996

Age	2	3	3	4	3	4	5	6
Sex	Male	Male	Primi. Fe.	Primi. Fe.	Multi. fe.	Multi. fe.	Multi. fe.	Multi. fe.
CL (mm)	15.52	20.38	21.69	25.11	21.70	25.03	27.10	29.32
Weight (g)	2.18	4.98	6.02	9.39	6.33	9.60	12.11	15.24
Per cent	8.86	62.27	2.54	11.20	0.59	7.78	4.43	2.21

August 1996

Age	2	3	3	4	3	4	5	6
Sex	Male	Male	Primi. Fe.	Primi. Fe.	Multi. fe.	Multi. fe.	Multi. fe.	Multi. fe.
CL (mm)	15.63	20.41	21.32	25.67	21.98	25.15	27.17	29.39
Weight (g)	2.23	5.01	5.72	10.04	6.85	10.42	13.25	16.91
Per cent	14.20	61.37	0.61	0.23	2.02	17.06	2.97	1.55

September 1996

Age	2	3	3	3	4	5	6
Sex	Male	Male	Primi. Fe.	Multi. fe.	Multi. fe.	Multi. fe.	Multi. fe.
CL (mm)	15.94	20.47		22.50	25.20	27.47	29.45
Weight (g)	2.36	5.05		7.65	10.66	13.72	16.83
Per cent	14.72	60.25		3.44	17.71	2.57	1.16

Table 3 continued

October 1996

Age	1	2	3	3	3	4	5	6
Sex	Male	Male	Male	Primi. Fe.	Multi. fe.	Multi. fe.	Multi. fe.	Multi. fe.
CL (mm)	11.06	16.48	20.87	21.97	22.45	25.28	28.26	29.63
Weight (g)	0.78	2.61	5.36	6.26	7.60	10.76	14.91	17.13
Per cent	0.26	17.67	43.66	0.40	4.41	28.52	4.18	0.72

November 1996

Age	2	3	3	3	4	5	6
Sex	Male	Male	Primi. Fe.	Multi. fe.	Multi. fe.	Multi. fe.	Multi. fe.
CL (mm)	16.83	21.35	22.46	22.27	25.35	28.24	29.13
Weight (g)	2.79	5.74	6.69	7.42	10.85	14.88	16.30
Per cent	7.24	31.74	20.85	2.48	31.66	5.41	0.63

December 1996

Age	2	3	3	3	4	5	6
Sex	Male	Male	Primi. Fe.	Multi. fe.	Multi. fe.	Multi. fe.	Multi. fe.
CL (mm)	17.11	21.31	22.48	21.36	25.27	28.30	29.71
Weight (g)	2.93	5.71	6.71	6.57	10.75	14.97	17.27
Per cent	9.87	35.08	23.60	1.38	25.36	4.20	0.51

January 1997

Age	3	4	4	4	5	6	7
Sex	Male	Male	Primi. Fe.	Multi. fe.	Multi. fe.	Multi. fe.	Multi. fe.
CL (mm)	18.65	21.90	23.35	22.87	25.73	27.89	29.40
Weight (g)	3.81	6.20	7.53	8.02	11.33	14.35	16.74
Per cent	4.95	40.72	15.96	1.10	29.42	4.51	3.34

February 1997

Age	3	4	4	4	5	6
Sex	Male	Male	Primi. Fe.	Multi. fe.	Multi. fe.	Multi. fe.
CL (mm)	18.43	22.11	23.72	21.94	25.70	28.60
Weight (g)	3.67	6.38	7.90	7.10	11.29	15.44
Per cent	21.42	34.49	18.95	1.12	19.65	4.37

April 1997

Age	3	4	4	4	5	6
Sex	Male	Male	Primi. Fe.	Multi. fe.	Multi. fe.	Multi. fe.
CL (mm)	18.55	21.89	23.47	23.99	25.85	28.18
Weight (g)	3.75	6.19	7.65	8.49	10.44	13.27
Per cent	50.66	18.11	20.73	3.15	5.45	1.66

May 1997

Age	2	3	4	4	4	5	6	7
Sex	Male	Male	Male	Primi. Fe.	Multi. fe.	Multi. fe.	Multi. fe.	Multi. fe.
CL (mm)	14.92	18.83	22.11	24.29	23.61	25.82	28.20	29.25
Weight (g)	1.93	3.92	6.38	8.49	8.12	10.41	13.30	14.72
Per cent	0.92	22.44	36.31	27.49	1.23	9.75	0.88	0.90

June 1997

Age	2	3	4	4	4	5	6
Sex	Male	Male	Male	Primi. Fe.	Multi. fe.	Multi. fe.	Multi. fe.
CL (mm)	15.72	19.36	22.54	24.57	23.83	25.80	28.81
Weight (g)	2.27	4.26	6.77	8.79	8.33	10.39	14.11
Per cent	0.08	16.30	31.11	35.64	1.29	13.69	1.84

July 1997

Age	2	3	4	4	4	5	6
Sex	Male	Male	Male	Primi. Fe.	Multi. fe.	Multi. fe.	Multi. fe.
CL (mm)	15.84	19.25	22.45	24.37	23.71	25.84	28.92
Weight (g)	2.32	4.19	6.69	8.58	8.20	10.54	14.64
Per cent	5.79	51.55	13.55	18.80	2.83	6.31	0.91

Table 4. No./hour of shrimp calculated from age asessments, nominal catch and effort for the period January-July.

		Males			∑ males	Females					∑ females
Years	Age groups	2	3	4		3	4	5	6	7	
1994	No./hr. (000)	8658	10118	2059	20835		125	3660	7720		11505
1996	No./hr. (000)	1310	15676		16986	1185	6209	1522	789		9705
1997	No./hr. (000)	362	6258	6348	12968		6811	2337	297	64	9509

Table 5. Landings and some averages calculated from the Icelandic logbooks.

Year	Nominal Catch Tons	Twin trawls % of catch	Trawl size No. of meshes	Standardized CPUE
1993	2 243	46.0	3 087	370
1994	2 300	56.2	2 975	235
1995	7 622	57.6	2 688	269
1996	21 077	57.8	2 805	210
1997	4 285	67.6	2 826	172

Table 6. Percentage of sex groups by strata and months.

NW stratum 1996			
Month	Males	Primip. females	Multip. females
Jan	63.61%	17.05%	19.34%
Feb	63.34%	18.23%	18.44%
Mars	70.97%	10.09%	18.94%
April	64.26%	23.54%	12.20%
May	57.73%	30.50%	11.77%
June	57.14%	28.50%	14.36%
July	75.08%	10.41%	14.51%
Aug	74.49%	0.90%	24.61%
Mean	65.83%	17.40%	16.77%

NE stratum 1996			
Month	Males	Primip. females	Multip. females
Jan	54.37%	22.12%	23.50%
Feb	53.51%	28.10%	18.39%
Mars	82.52%	11.73%	5.74%
April	80.58%	15.78%	3.64%
May	63.11%	28.88%	8.01%
June	69.28%	22.67%	8.05%
July	69.43%	19.64%	10.93%
Aug	81.38%	0.52%	18.10%
Mean	69.27%	18.68%	12.05%

SW stratum 1996			
Month	Males	Primip. females	Multip. females
Jan	42.04%	30.09%	27.88%
Feb	46.93%	19.58%	33.49%
Mars	54.47%	15.63%	29.90%
April	61.22%	18.00%	20.77%
May	45.03%	39.38%	15.59%
June	55.93%	31.15%	12.92%
July	66.97%	15.63%	17.40%
August	72.45%	0.78%	26.76%
Mean	55.63%	21.28%	23.09%

SE stratum 1996			
Month	Males	Primip. females	Multip. females
Jan			
Feb			
Mars			
April	60.76%	38.40%	0.84%
May	32.78%	54.44%	12.78%
June	58.08%	31.55%	10.37%
July	71.61%	14.76%	13.63%
August	82.87%	1.12%	16.02%
Mean	61.22%	28.05%	10.73%

Table 6 continued.

NW stratum 1996			
Month	Males	Primip. females	Multip. females
Sep	78.52%	0.71%	20.77%
Oct	71.26%	3.25%	25.49%
Nov	36.66%	21.79%	41.55%
Dec	48.83%	22.80%	28.37%
Mean	58.82%	12.14%	29.05%

NE stratum 1996			
Month	Males	Primip. females	Multip. females
Sep	84.32%	1.30%	14.38%
Oct	71.80%	4.92%	23.28%
Nov	33.67%	20.46%	45.87%
Dec	35.42%	26.36%	38.23%
Mean	56.30%	13.26%	30.44%

SW stratum 1996			
Month	Males	Primip. females	Multip. females
Sep	68.03%	0.61%	31.36%
Oct	42.68%	4.10%	53.22%
Nov	54.81%	17.76%	27.43%
Dec	42.43%	23.90%	33.66%
Mean	51.99%	11.59%	36.42%

SE stratum 1996			
Month	Males	Primip. females	Multip. females
Sep	85.42%	1.54%	13.04%
Oct	88.95%	4.12%	6.93%
Nov	41.58%	11.88%	46.53%
Dec			
Mean	71.98%	5.85%	22.17%

NW stratum 1997			
Month	Males	Primip. females	Multip. females
Jan	53.98%	22.49%	23.53%
Feb	56.89%	18.68%	24.43%
Mars			
April	70.14%	19.58%	10.28%
May	56.10%	29.85%	14.05%
June	47.36%	34.97%	17.67%
July	71.04%	18.97%	9.98%
Aug	84.37%	6.19%	9.44%
Mean	62.84%	21.53%	15.63%

NE stratum 1997			
Month	Males	Primip. females	Multip. females
Jan	64.92%	12.04%	23.04%
Feb	51.98%	17.48%	30.54%
April	66.02%	23.17%	10.81%
May	58.86%	31.18%	9.96%
June	48.34%	39.01%	12.65%
July	71.06%	22.07%	6.87%
Aug			
Mean	60.20%	24.16%	15.65%

SW stratum 1997			
Month	Males	Primip. females	Multip. females
Jan	43.21%	14.61%	42.18%
Feb	57.89%	21.65%	20.46%
Mars			
April	67.68%	21.21%	11.11%
May	68.44%	20.04%	11.53%
June	46.00%	30.43%	23.57%
July	70.52%	14.57%	14.91%
August	72.04%	6.65%	21.31%
Mean	60.83%	18.45%	20.72%

SE stratum 1997			
Month	Males	Primip. females	Multip. females
Jan			
Feb			
Mars			
April			
May			
June			
July	65.87%	30.29%	3.85%
August			
Mean	65.87%	30.29%	3.85%

Table 7. Catch effort and CPUE of Icelandic vessels at the Flaemish Cap.

	January - July				August - December			
Year	Month	CPUE	Effort	Catch	Month	CPUE	Effort	Catch
1993					Aug	311	1363	424
					Sep	342	1064	364
					Oct	215	372	80
	June	374	1848	691	Nov	297	606	180
	Jul	324	1160	376	Dec	221	579	128
	Total	355	3008	1067	Total	295	3985	1176
1994	Jan	216	194	42	Aug	203	2025	411
	Feb	325	880	286	Sep	159	748	119
	Mar	281	719	202	Oct	125	632	79
	June	252	1698	428	Nov	113	230	26
	Jul	204	3461	706	Dec	75	13	1
	Total	239	6953	1664	Total	174	3648.5	636
1995	Jan							
	Feb	278.7	94	26.2	Aug	174.6	9283	1620.5
	Mar	246.8	1003	247.5	Sep	130.9	5605	733.7
	Apr	146.0	2155	314.7	Oct	162.4	3997	649.0
	May	257.8	3068	790.8	Nov	143.4	2022	289.9
	June	244.1	3993	974.6	Dec	175.9	1372	241.3
	Jul	245.8	7053	1733.7				
	Total	235.4	17366	4087.5	Total	158.6	22279	3534.4
1996	Jan	203.3	2016	409.9				
	Feb	243.6	1548	377.1	Aug	163.1	12700	2071.0
	Mar	255.8	4124	1055.0	Sep	167.6	9967	1670.0
	Apr	207.5	10251	2127.0	Oct	127.4	14674	1870.0
	May	185.7	12970	2409.0	Nov	134.1	5465	733.0
	June	199.8	19931	3982.0	Dec	158.4	3762	596.0
	Jul	177.0	21342	3777.0				
	Total	195.9	72182	14137	Total	149.0	46568	6940.0
1997	Apr	129.0	910	117.4	Aug	203.5	6427	1307.9
	May	135.7	6580	893.0	Sep			153.0
	June	160.1	8042	1287.3	Oct			
	Jul	207.4	2538	526.3	Nov			
	Total	156.3	18070	2824	Total		6427	1460.9

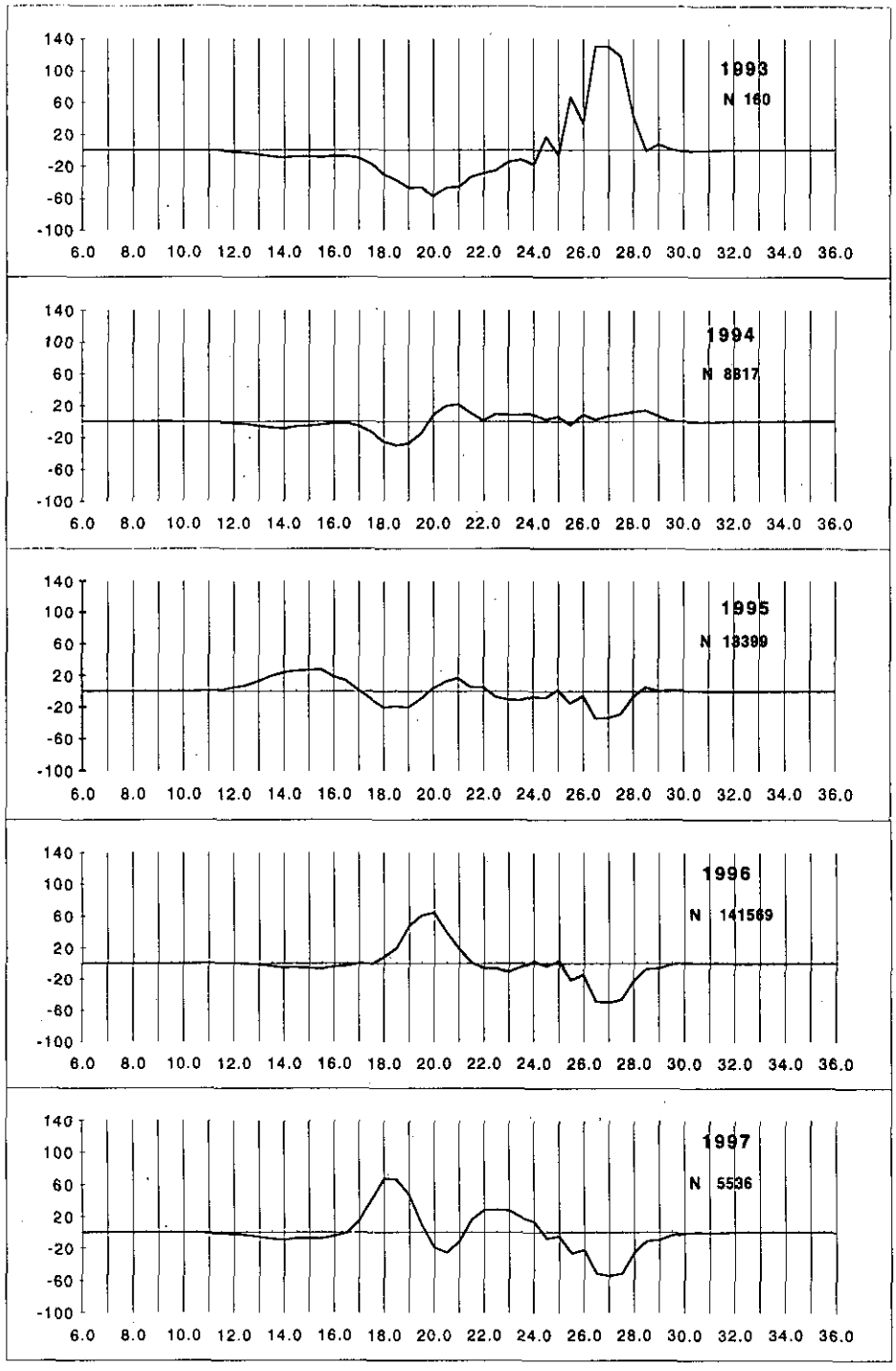

Fig. 1. The deviations of length frequencies of northern shrimp by years in April in 3M from the mean length frequency distri bution of the years 1993-1997 in April.

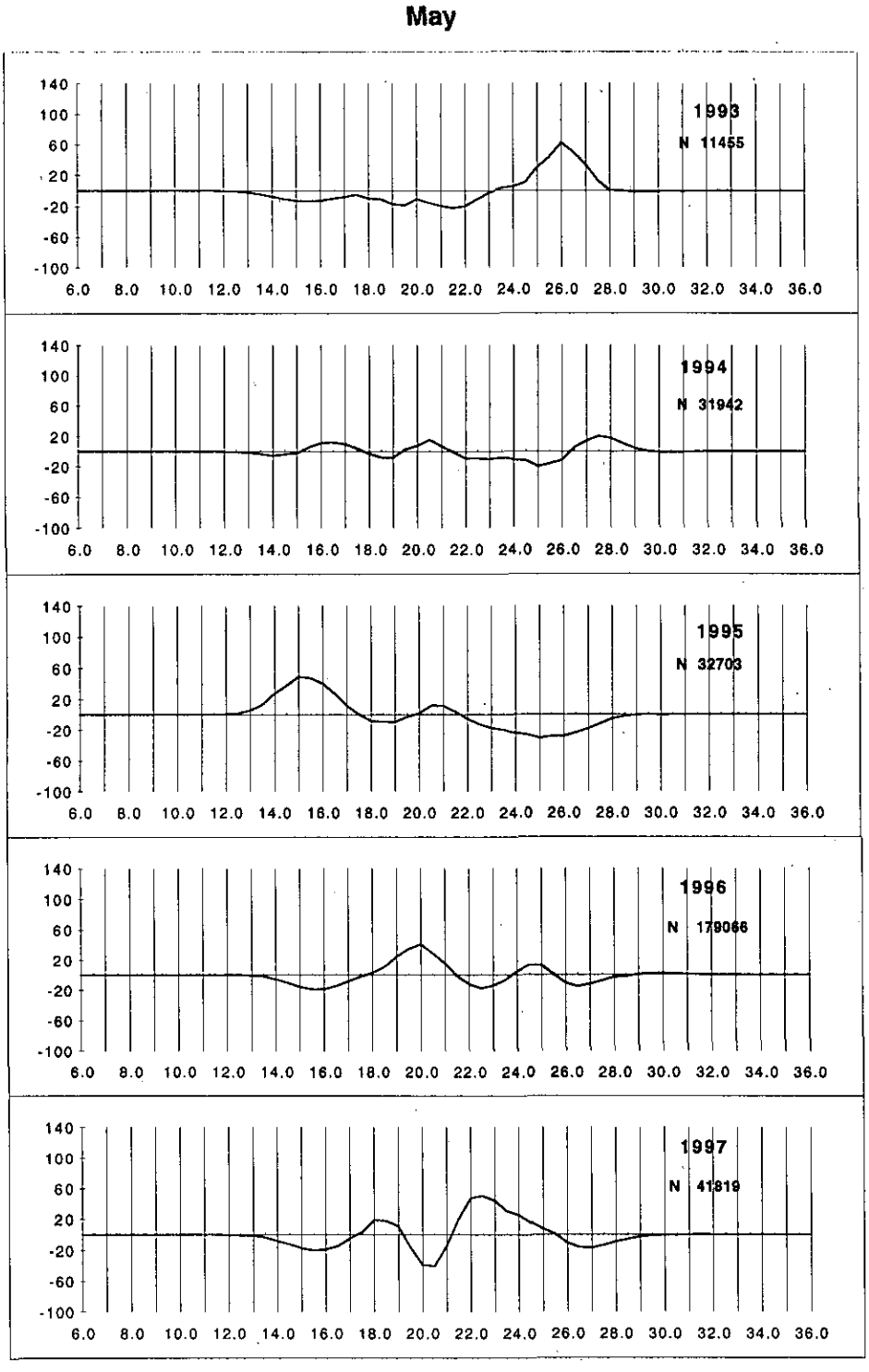

Fig. 2. The deviations of length frequencies of northern shrimp by years in May in 3M from the mean length frequency distri bution of the years 1993-1997 in May.

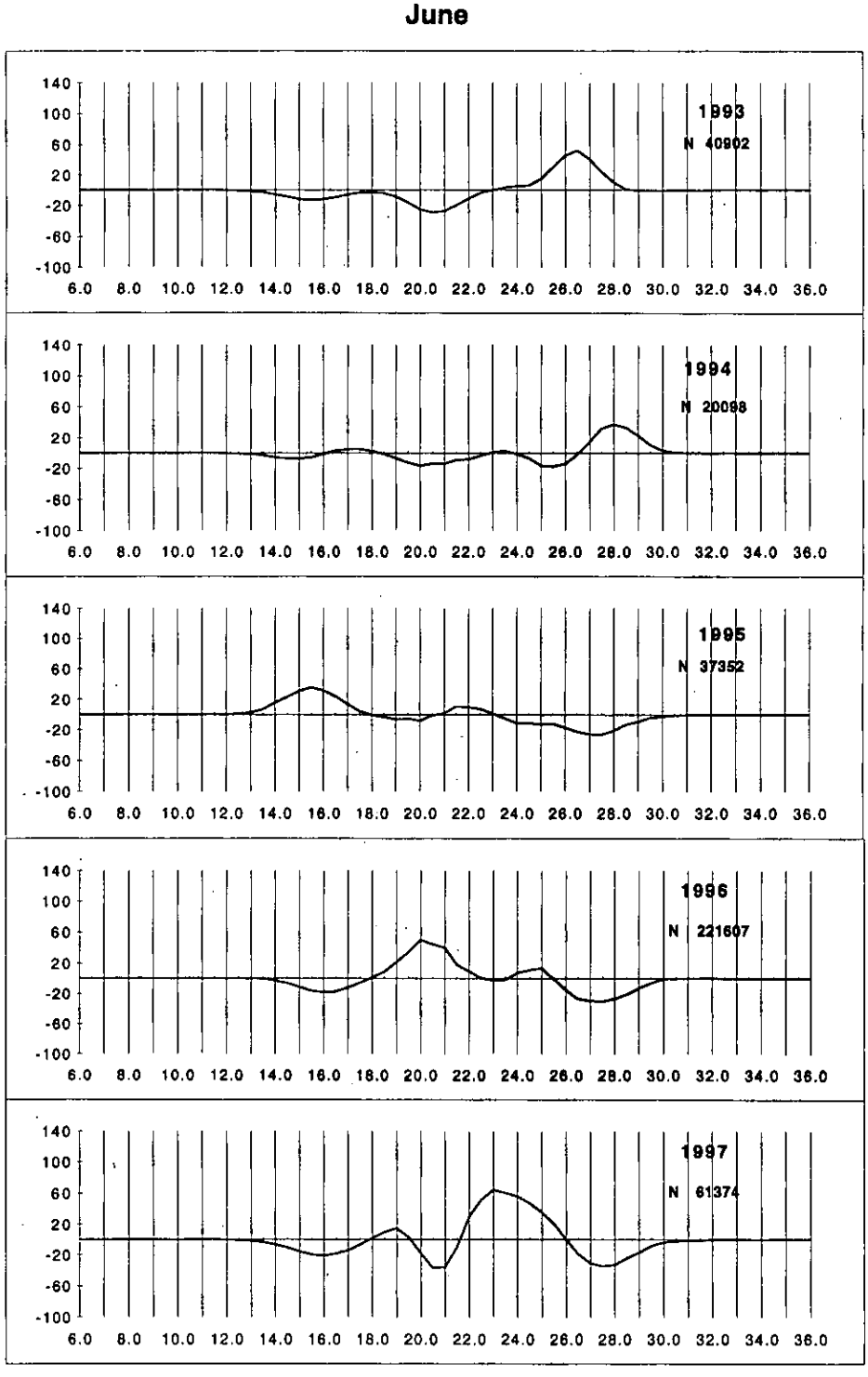

Fig. 3. The deviations of length frequencies of northern shrimp by years in June in 3M from the mean length frequency distri bution of the years 1993-1997 in June.

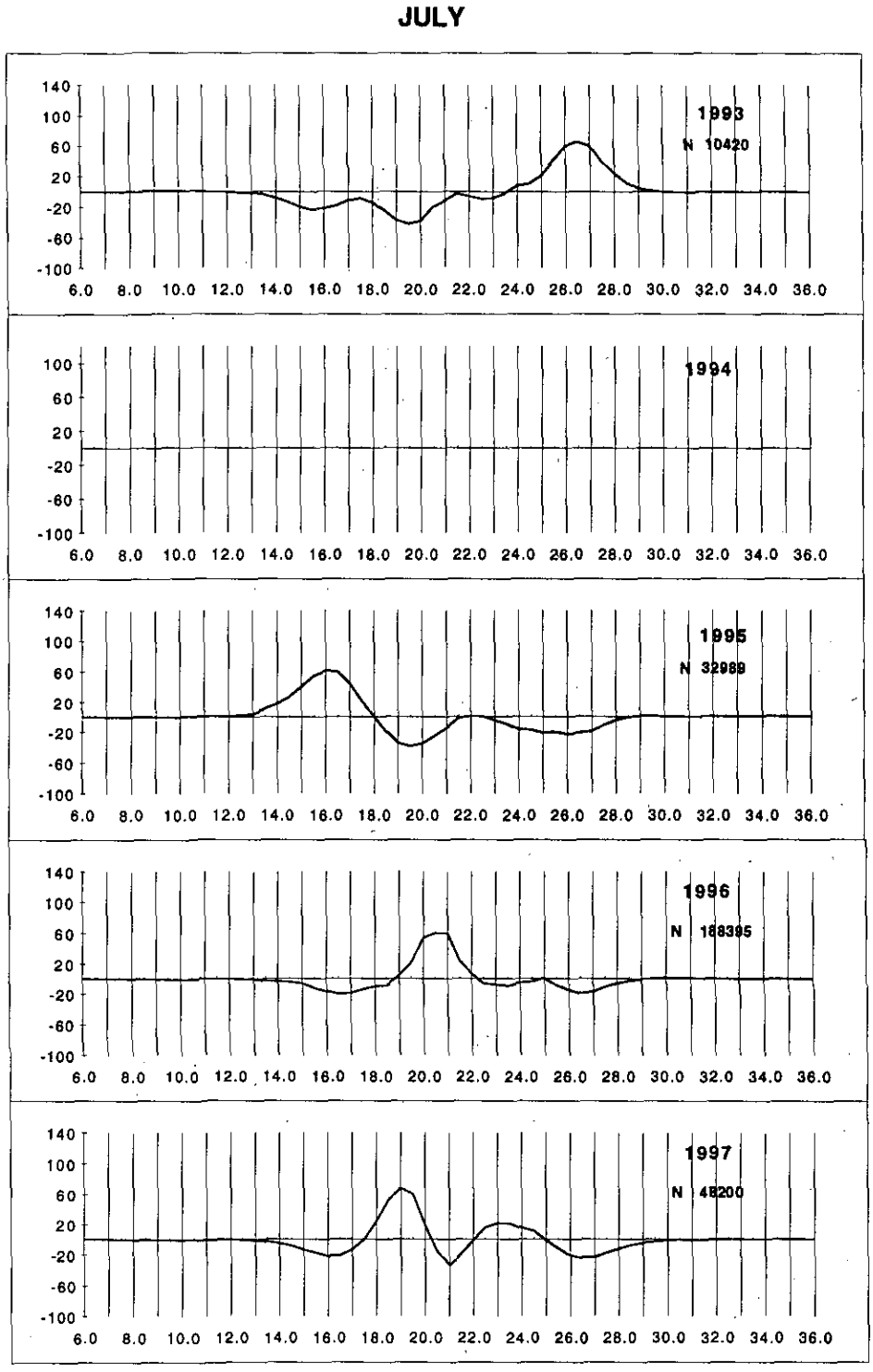

Fig. 4. The deviations of length frequencies of northern shrimp by years in July in 3M from the mean length frequency distri bution of the years 1993-1997 in July.

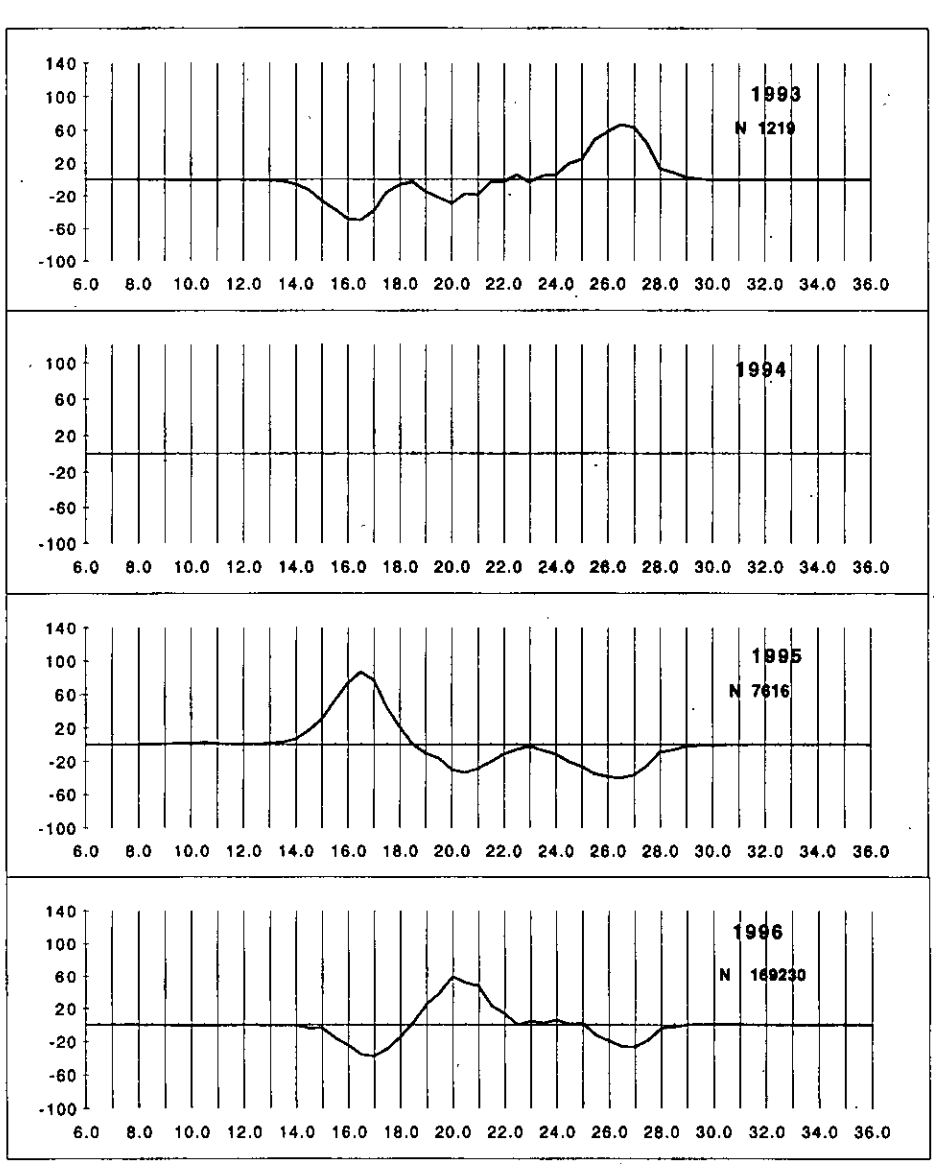

Fig. 5. The deviations of length frequencies of northern shrimp by years in September in 3M from the mean length frequency distri bution of the years 1993-1997 in September.

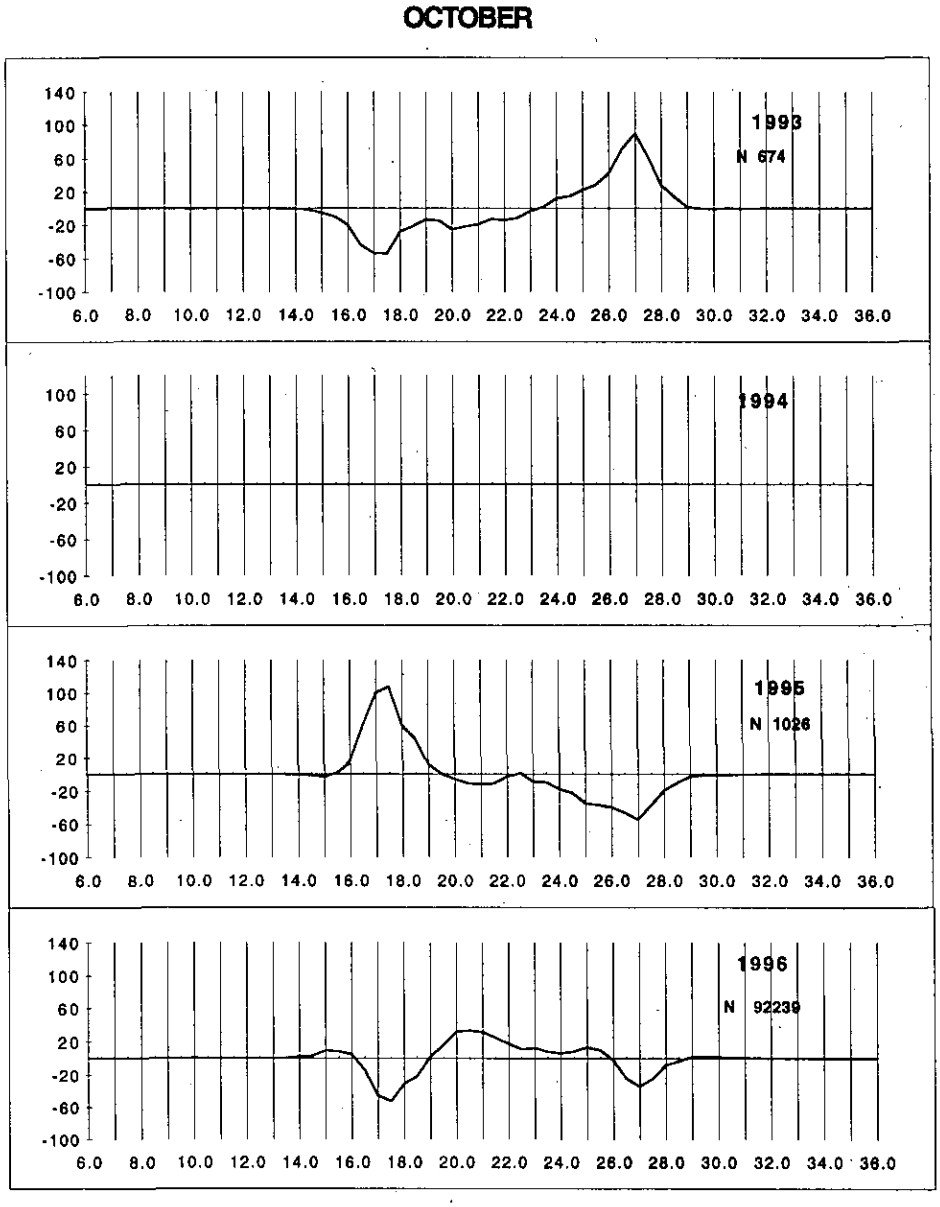

Fig. 6. The deviations of length frequencies of northern shrimp by years in October in 3M from the mean length frequency distri bution of the years 1993-1997 in October.

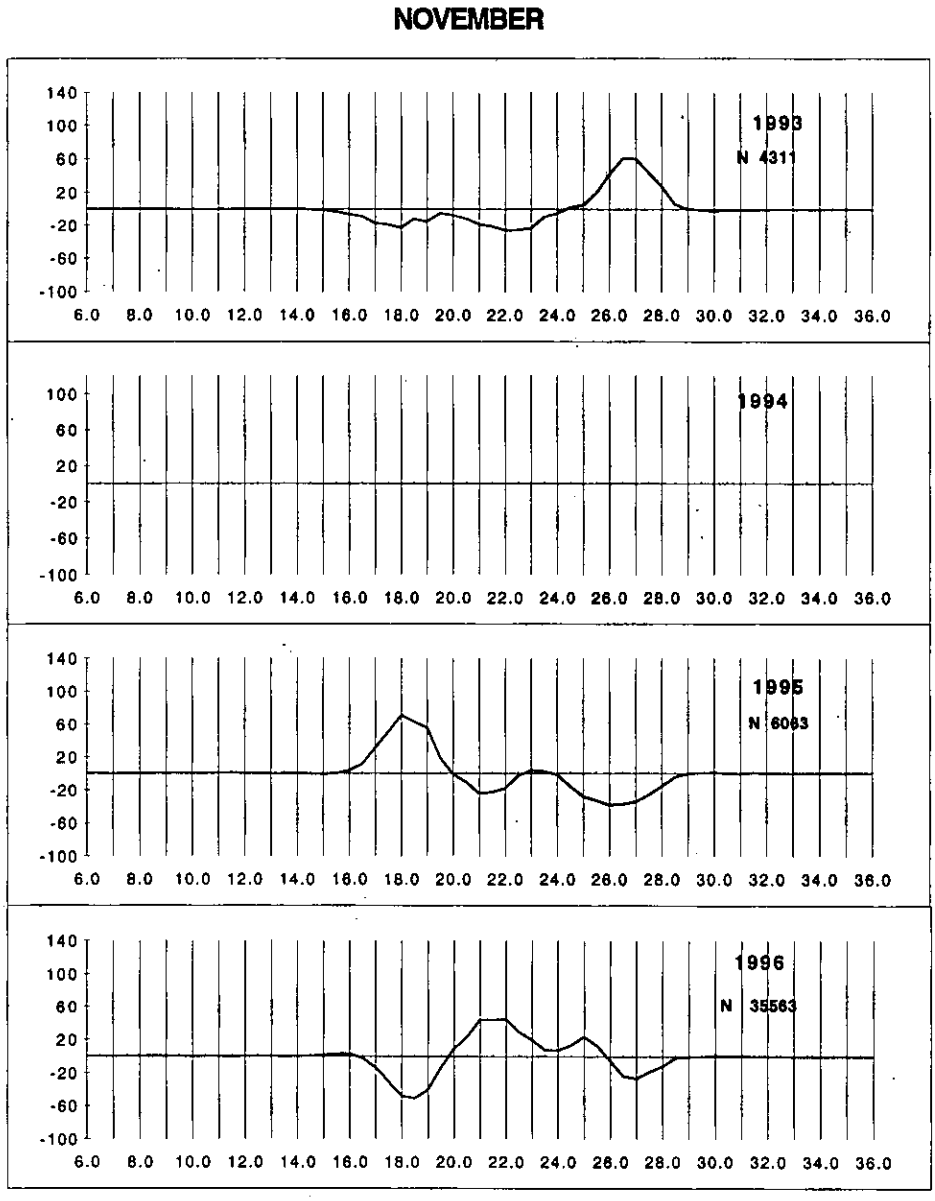

Fig. 7. The deviations of length frequencies of northern shrimp by years in November in 3M from the mean length frequency distri bution of the years 1993-1997 in November.

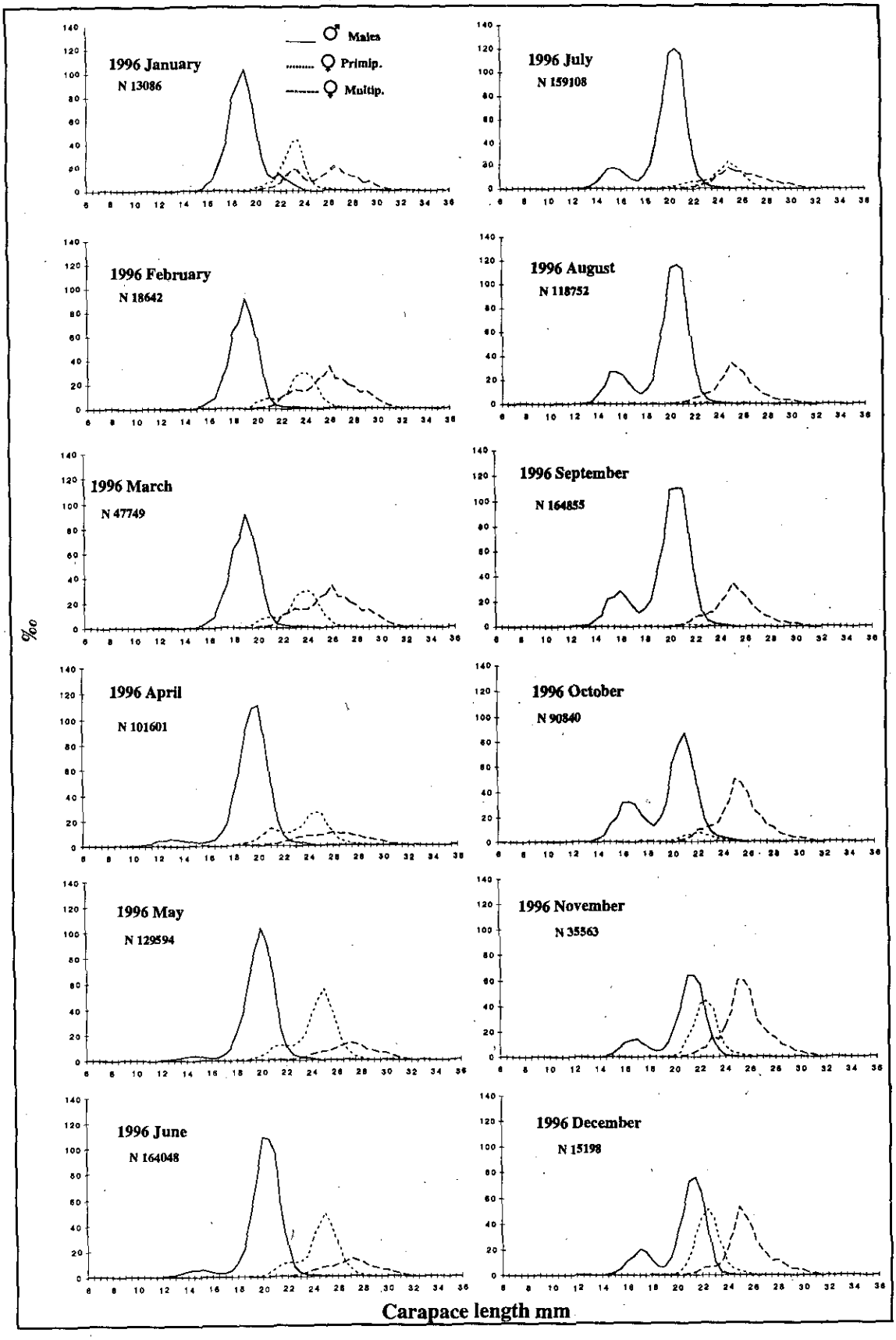

Fig. 8. The length frequecy distribution of northern shrimp at Flemish Cap by months in 1996.

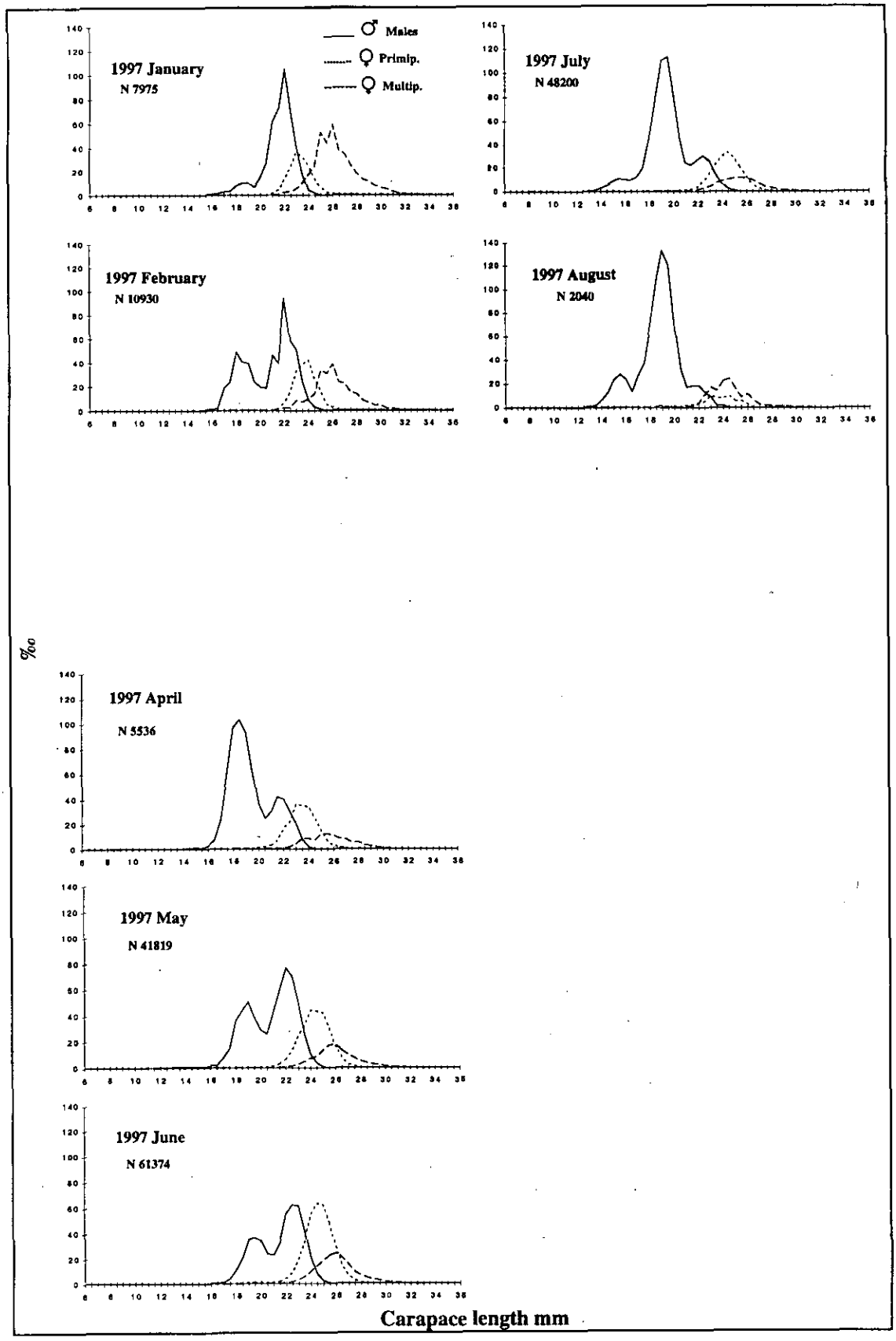

Fig. 9. The length frequecy distribution of northern shrimp at Flemish Cap by months in 1997.

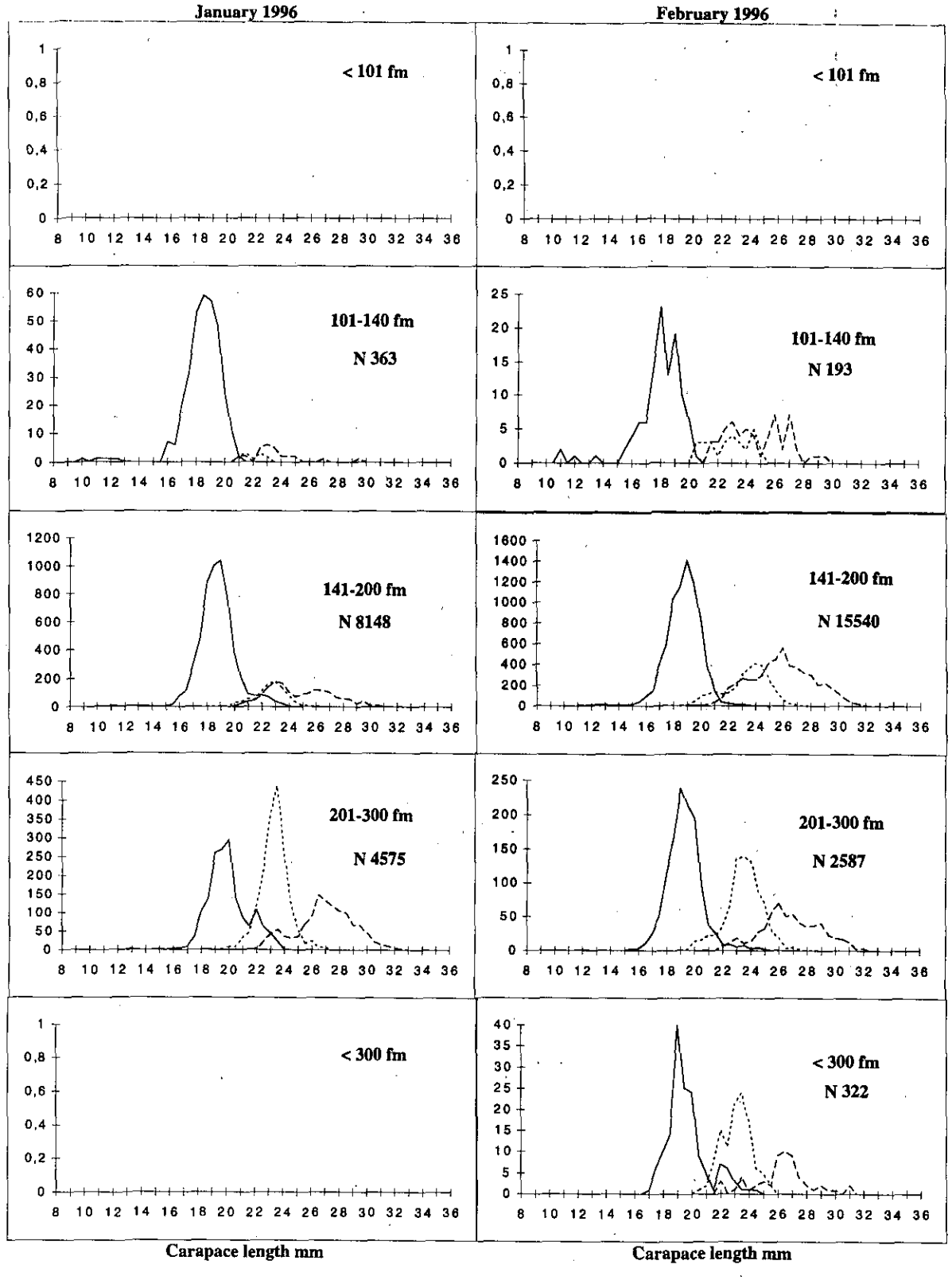

Fig. 10. The length frequecy distribution of northern shrimp at Flemish Cap in January and February by depth in 1996.

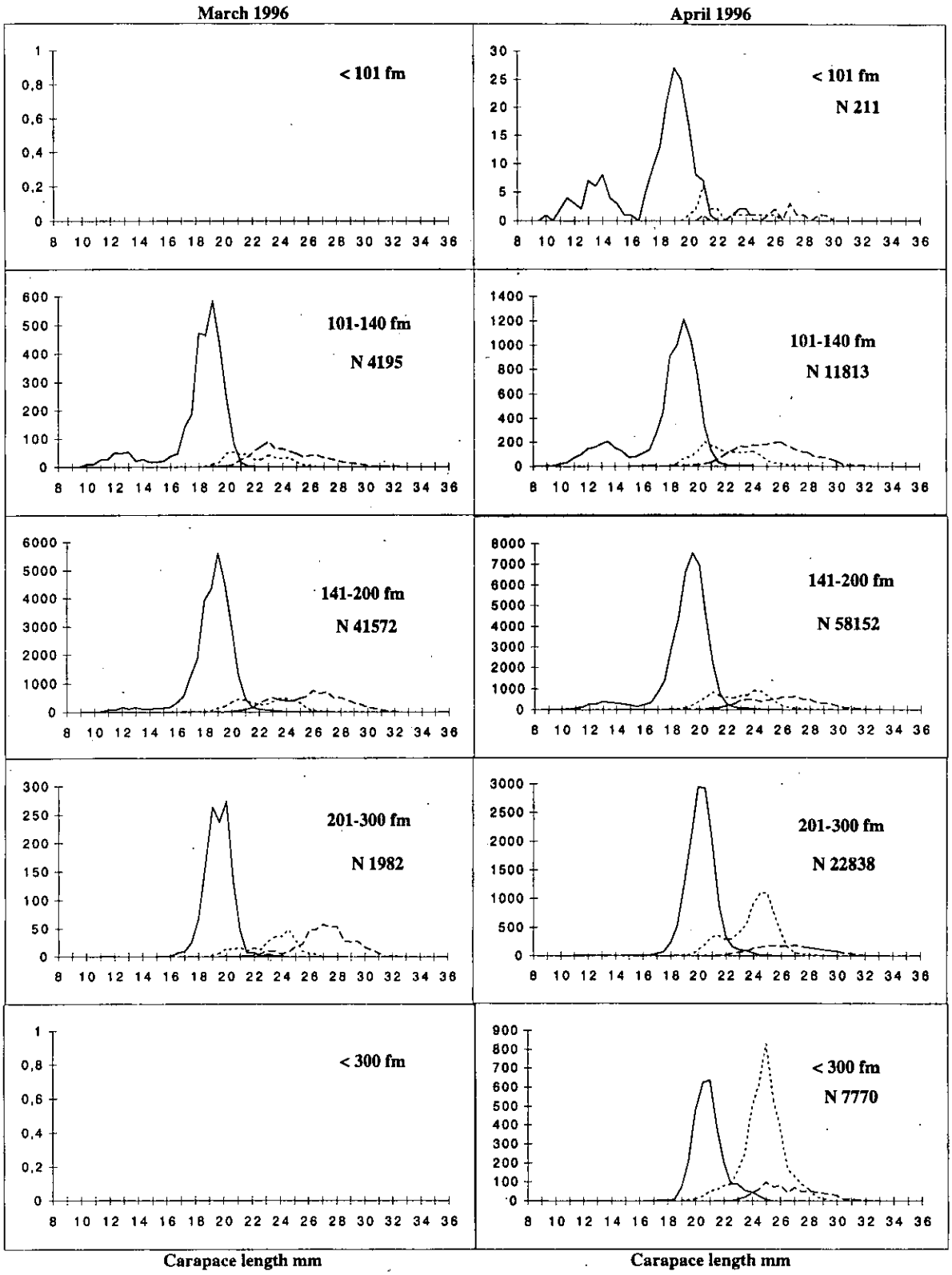

Fig. 11. The length frequecy distribution of northern shrimp at Flemish Cap in March and April by depth in 1996.

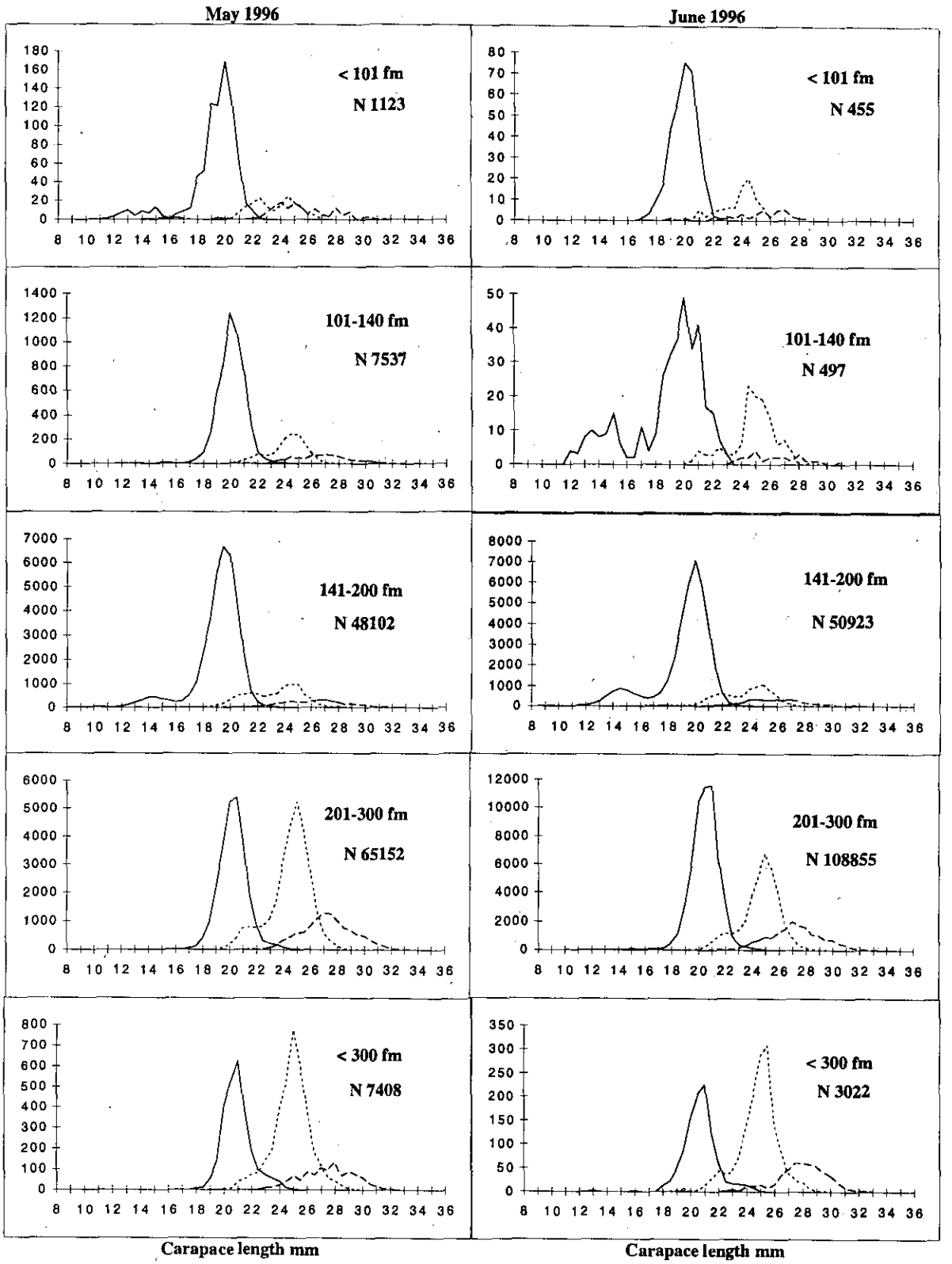

Fig. 12. The length frequecy distribution of northern shrimp at Flemish Cap in May and June by depth in 1996.

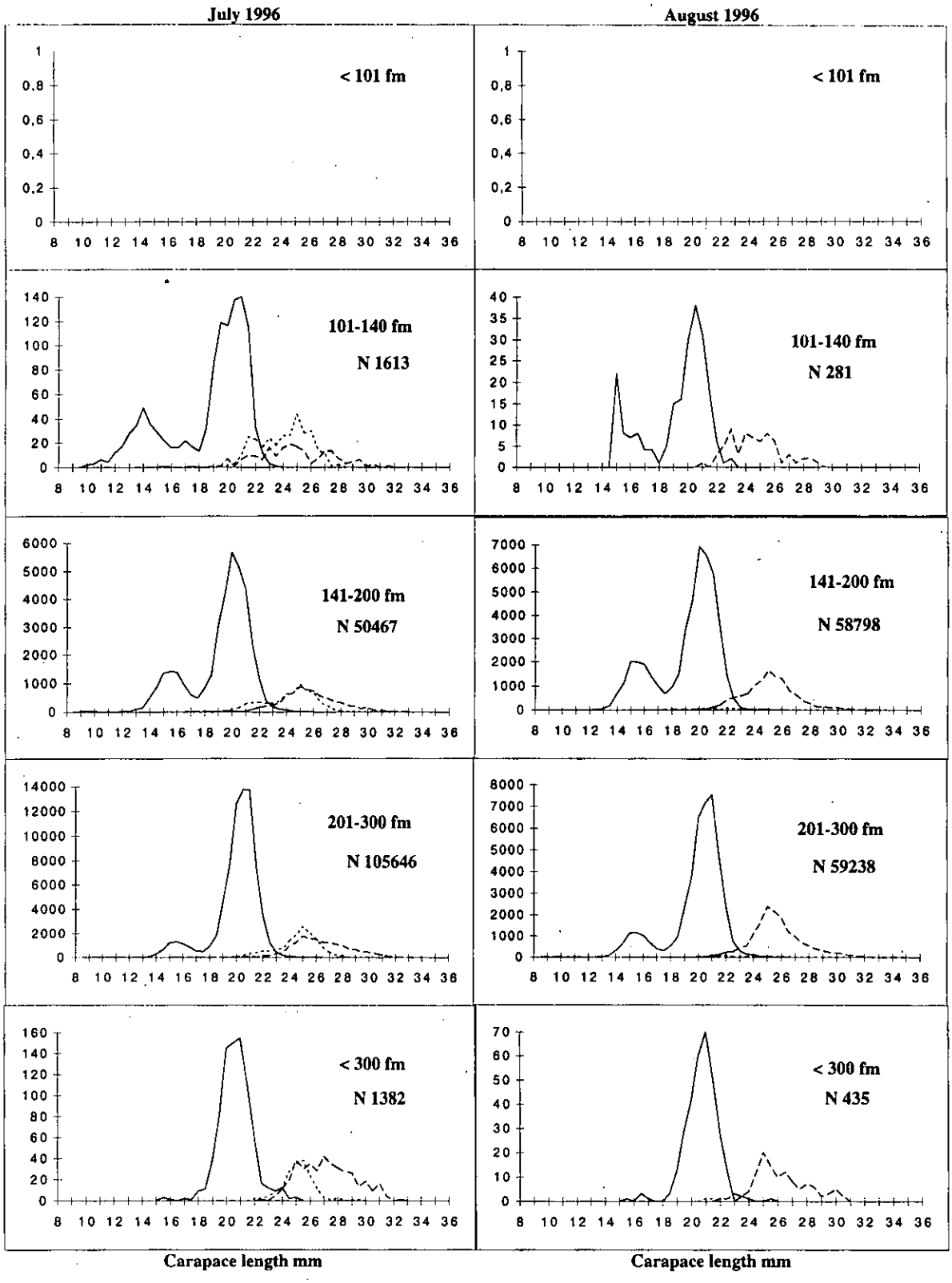

Fig. 13. The length frequecy distribution of northern shrimp at Flemish Cap in July and August by depth in 1996.

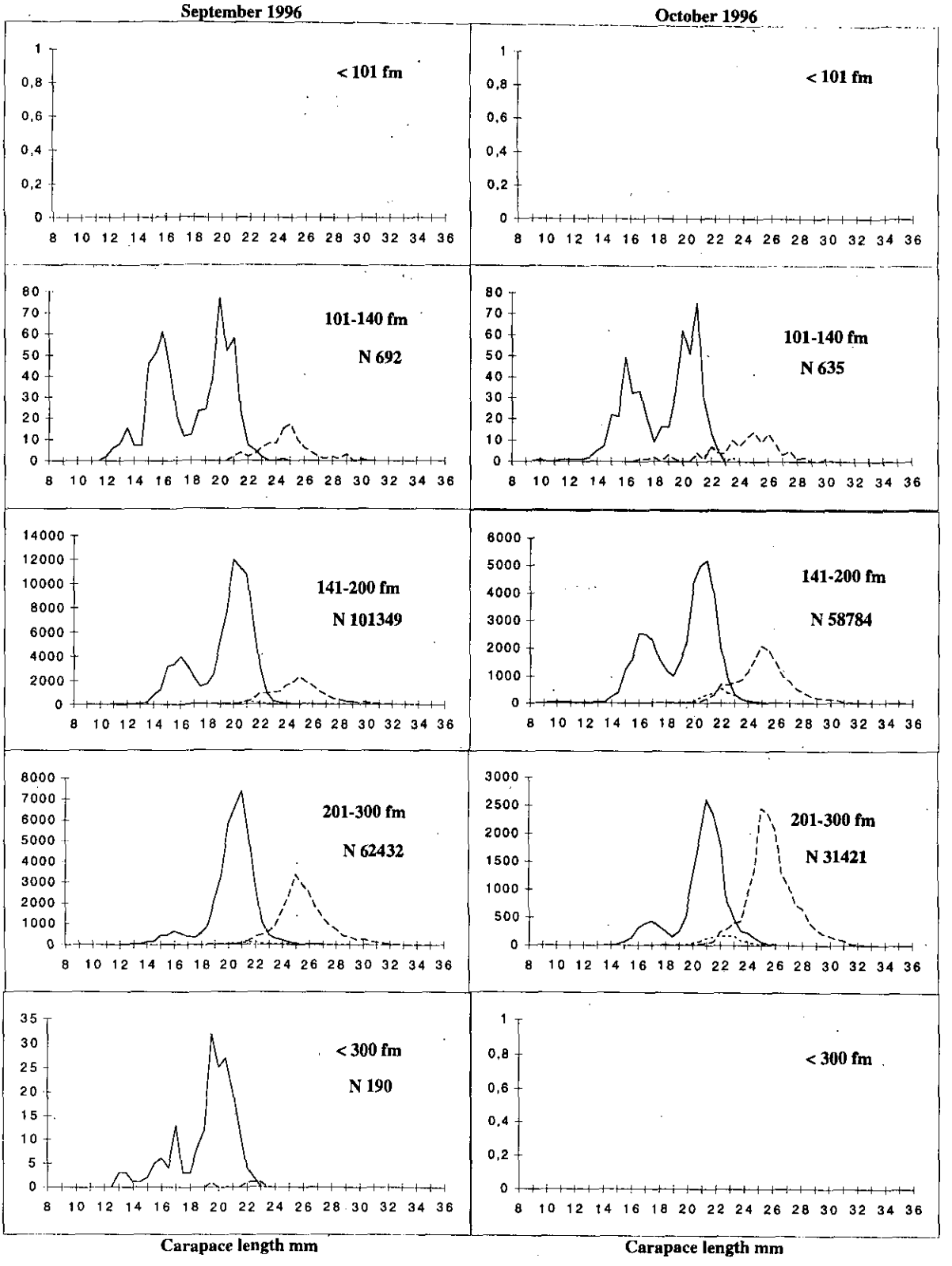

Fig. 14. The length frequecy distribution of northern shrimp at Flemish Cap in September and October by depth in 1996.

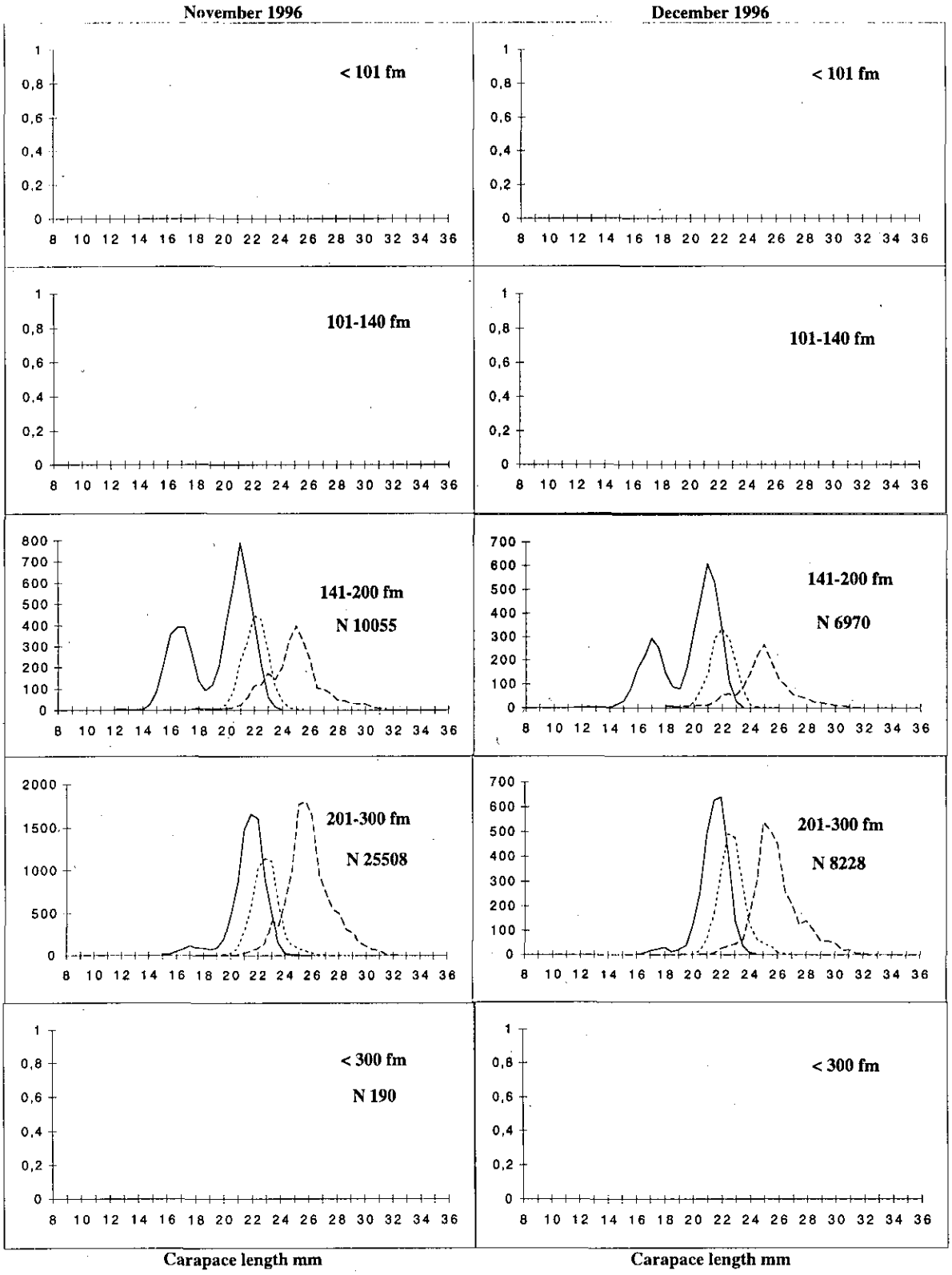

Fig. 15. The length frequecy distribution of northern shrimp at Flemish Cap in November and December by depth in 1996.

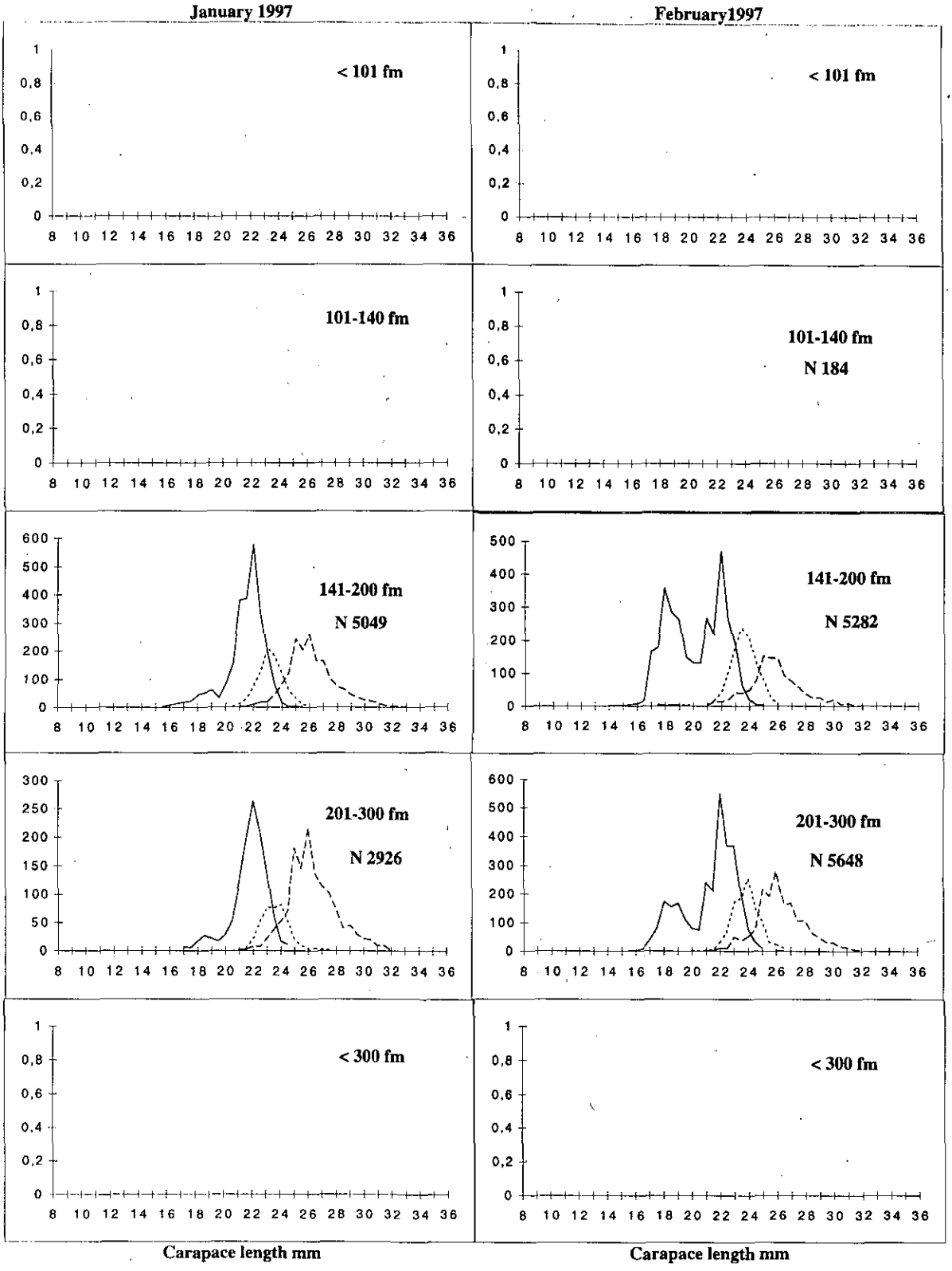

Fig. 16. The length frequecy distribution of northern shrimp at Flemish Cap in January and February by depth in 1997.

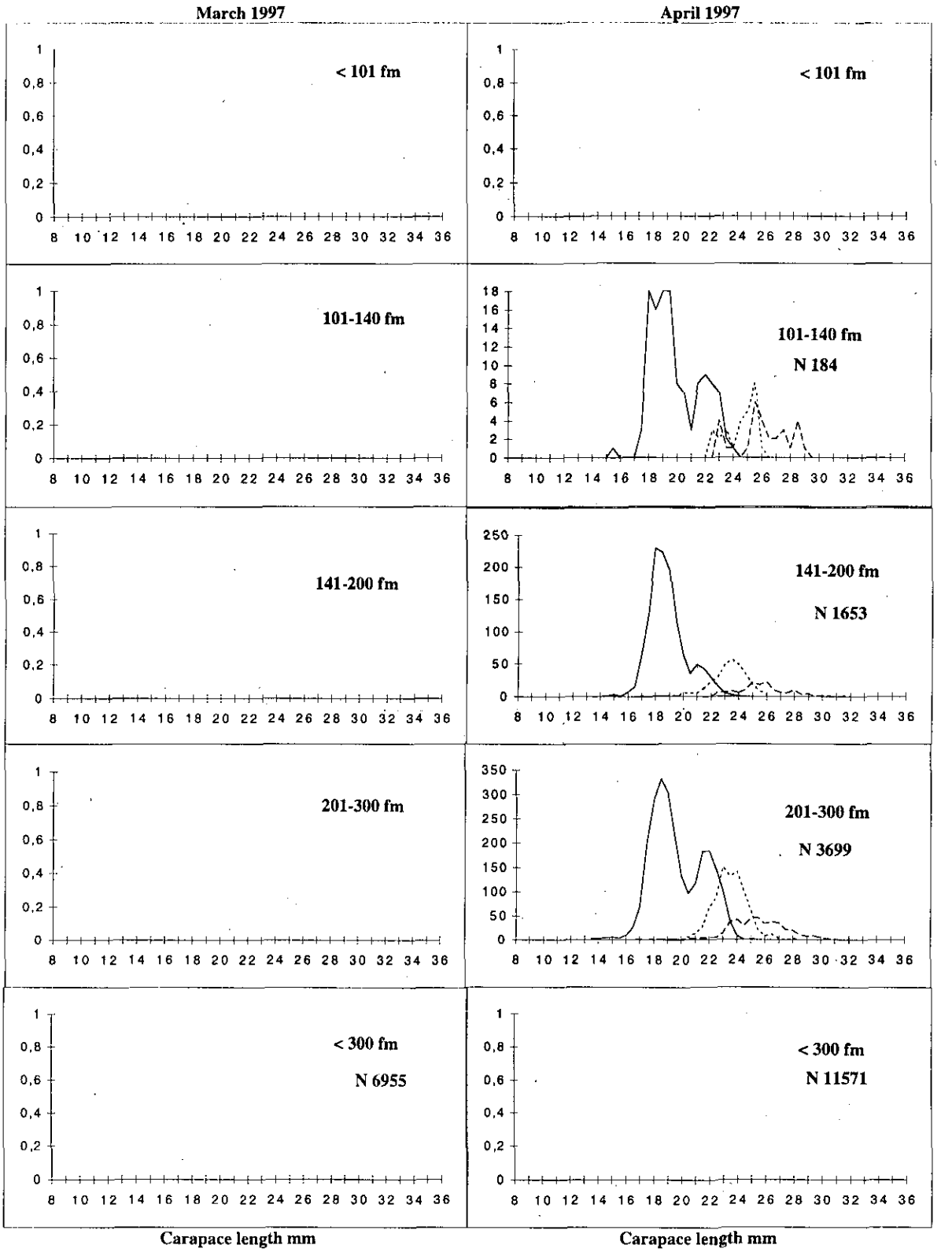

Fig. 17. The length frequecy distribution of northern shrimp at Flemish Cap in April by depth in 1997. There were no samples obtained in March.

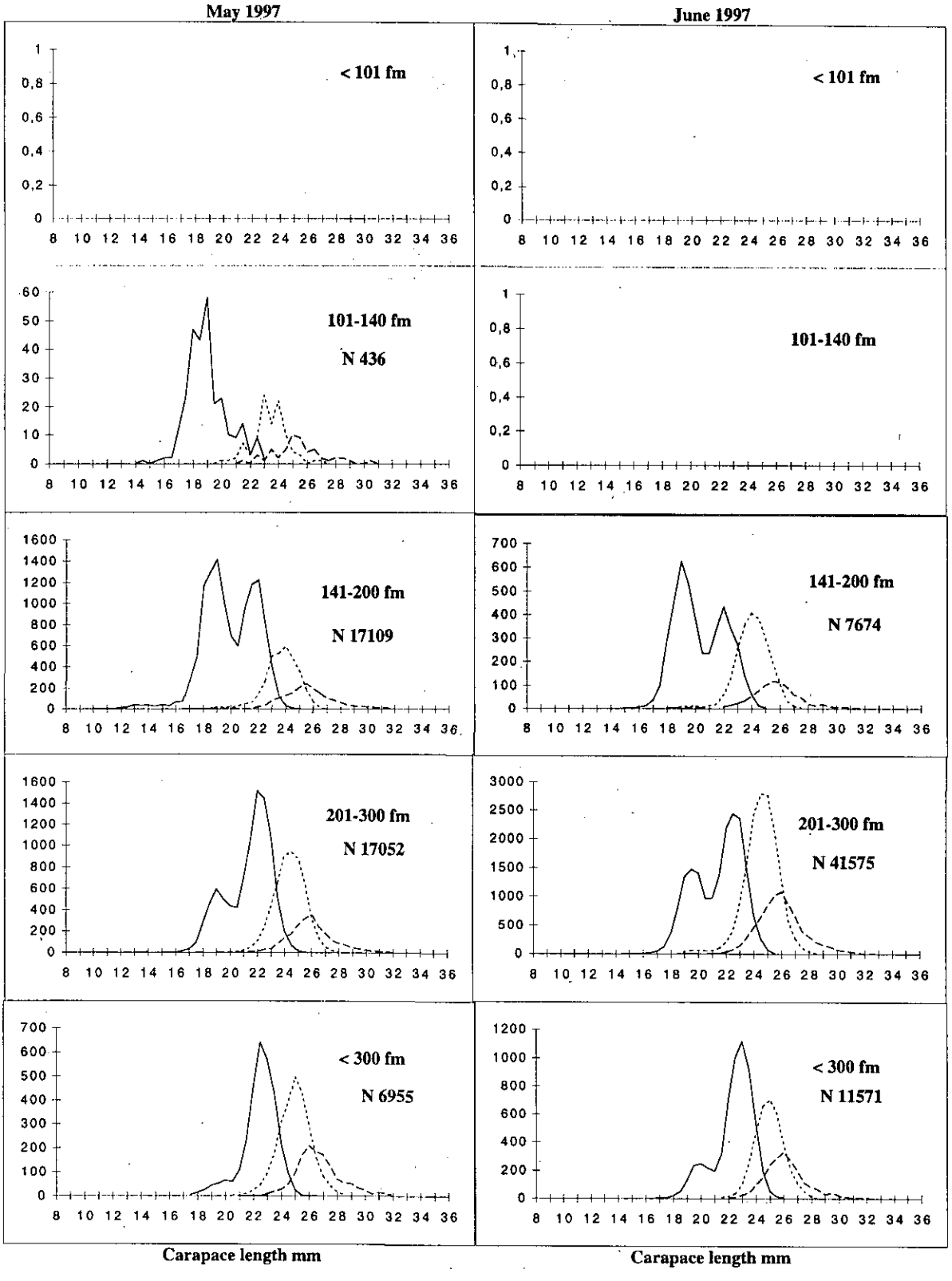

Fig. 18. The length frequecy distribution of northern shrimp at Flemish Cap in May and June by depth in 1997.

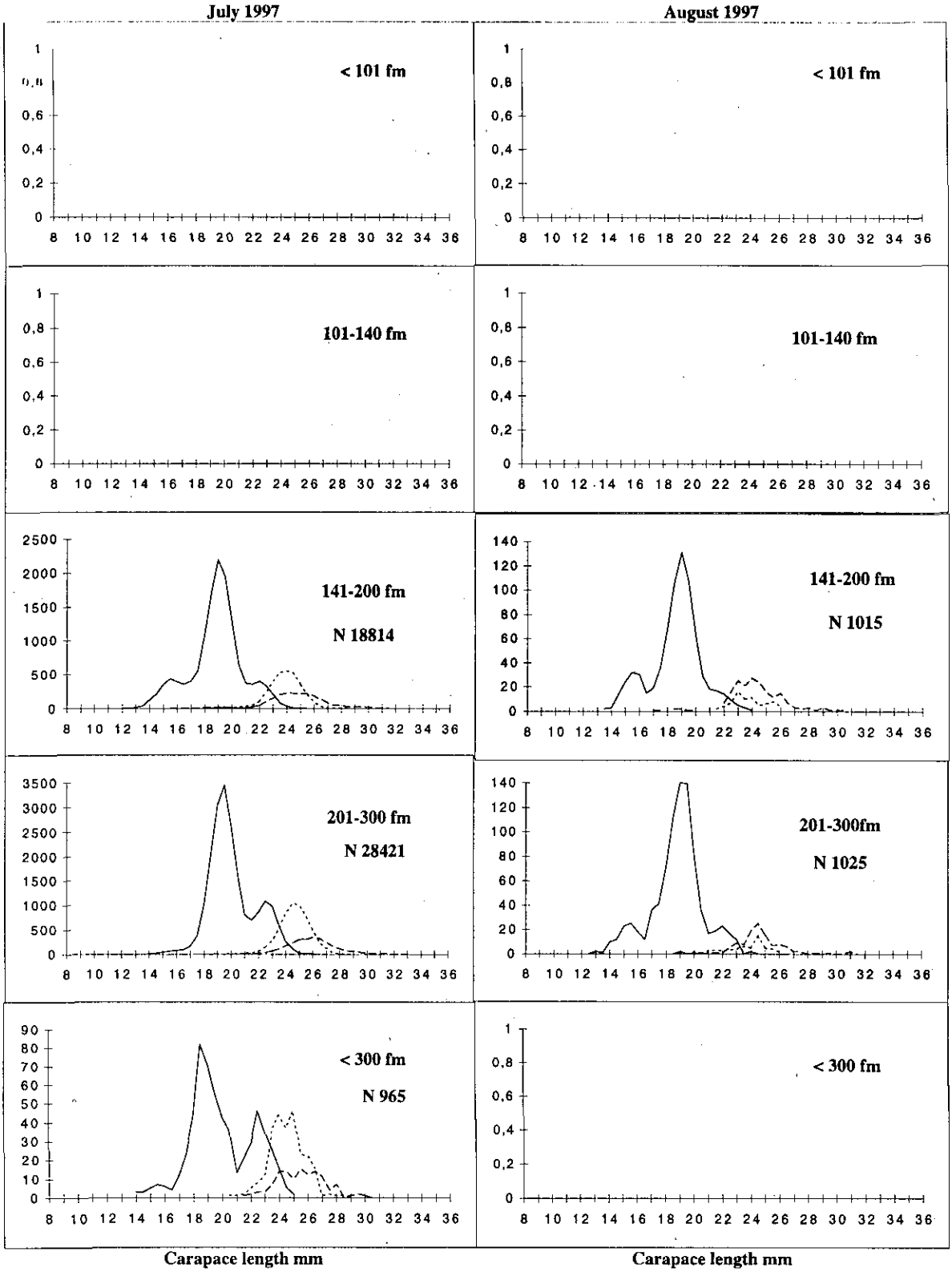

Fig. 19. The length frequecy distribution of northern shrimp at Flemish Cap in July and August by depth in 1997.

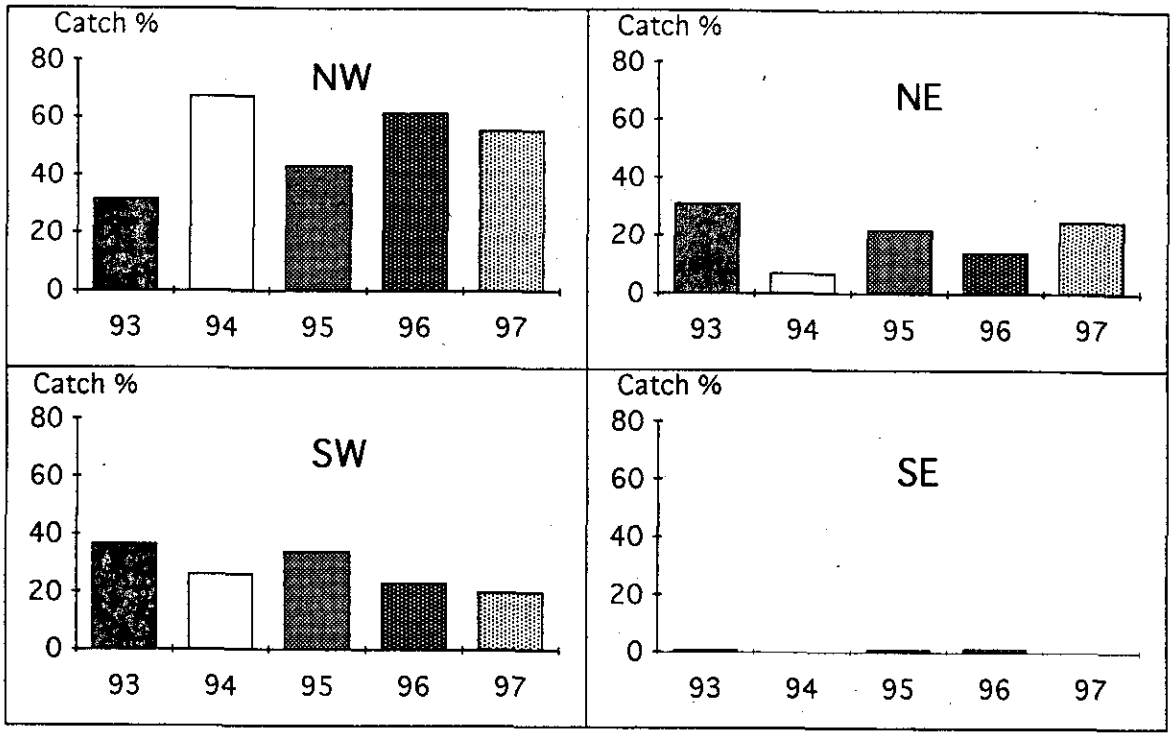

Fig. 20. The proportions of shrimp catch of Iceland at Flemish Cap by areas and years

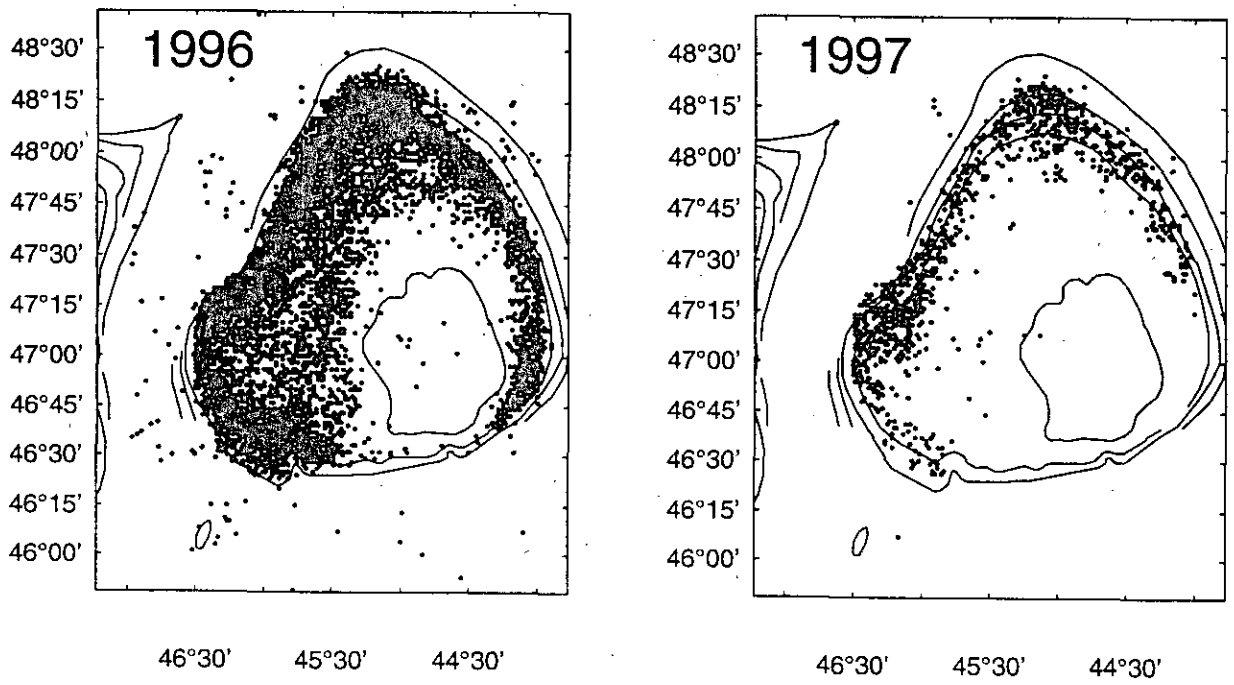

Fig. 21. Towing positions of the Icelandic fleet on Flemish Cap in 1996 and 1997.