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The Icelandic Shrimp Fishery (*Pandalus borealis* Kr.) at Flemish Cap in 1993-2002

by

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Abstract

Some 3 Icelandic vessels have been fishing for shrimp in the waters at Flemish Cap in 2002 as compared to 5 in 2001. In this paper there are logbook information on the Icelandic fishery for the years 1993 through 2002. The standardized catch rate has recently increased considerably or from 203 kg/hour in January-September 1997 to 289 in 2001 to rise to 367 kg/hour in 2002, the highest since 1993 when it was 344 kg/hour.

The observer samples show a very strong year-class of 3 year olds in the first of the half of year 2002 appearing first as two year olds in September 2001.

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 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 48 thousand tons. Since then the fishery decreased to some 25 thousand tons in 1997. The total catch of all countries has since increased to about 50 thousand tons in 2000 and 2001.

In this paper all the information from the Icelandic side is gathered. From the logbooks come effort, catch and size of trawl. From this CPUE is calculated. From the biological samples taken by Icelandic observers come various information on length and sex distribution of shrimp. From these the age assessments can be carried out as well as deviations in length frequencies of every year by months. There is also detailed information on length frequency distributions by depth strata.

Materials and Methods

The logbook data include catch and effort. Sometimes information on landings as obtained from the Fisheries Directorate in Iceland exceeds the logbook information. The effort is then raised by dividing the nominal catch of each month/half year with the calculated CPUE from the logbooks in the years 1993-1996. 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. When twin trawls were used the effort was always multiplied by 1.9 for those but the catch was kept the same.

Icelandic observers sampled shrimp onboard Icelandic vessels since 1996 at Flemish Cap. The shrimp was measured fresh to the nearest 0.5 mm using Vernier callipers. Observers then sorted each length class into males and

females using the method of Rasmussen (1953) and the females further into primiparous and multiparous using the sternal spine criterion of McCrary (1971).

Catch and Effort Data

In 2001 the fishery was carried out since January. The catch in 2001 so far is 4 380 tons (Table 1) as compared to 7 400 tons at the same time in 2000. Iceland increased the total allowable catch (TAC) for Icelandic vessels from 6 800 tons in 1998 to 9 300 tons for the year 1999 and about 10 000 tons for years 2000 and 2001. In spite of this high TAC the total catch was only 8 978 tons in year 2000, 5 300 tons in 2001 and 4 300 tons so far in 2002.

The distribution of effort is shown by months and years in Figures 1-7. Note the difference between the years 1998 and 1999 for the lack of tows in the south east area in 1998 and an increase in 1999. In years 2000 to 2002 the pattern of tow stations was similar to that of year 1999. The pattern of fishing at shallower water in the spring than in other months has been mentioned earlier (Skúladottir 2001). This is again apparent in March in 2001 (Figure 3) and in April 2002 (Figure 6).

In Table 3 is shown how the mean size of shrimp increases with depth in years 2000 and 2001. The biggest shrimp is caught at depths greater than 300 fm in years 2000 and 2001. But in 2002 the largest shrimp is found at the depth 200-300 fathoms.

The mean CPUE for the year 1997 was the lowest ever for Iceland or 177 kg per trawling hour for the period January through July (Table 1). In 1998 the mean CPUE for the same period was much higher or 282 kg and rather similar in 1999 and 2000. The average size of gear used was about 3000 meshes in most years, but increased to about 3500 meshes in years 2000 and 2001 and 3 700 meshes in 2002. Therefore it makes more sense to look at CPUE at a standard trawl size. Here the trawl size 3000 meshes circumference around the belly is used as a standard. Thus the CPUE has increased from about 240 kg/hour in 1999 and 2000 to 367 kg/hour in 2002 for the months January to September (Table 2). At the same time the use of twin trawls has increased in 1998 from a little less than 60% in 1995-1997 to about 81% in 2000 to decline again to 67% in 2001 and 74% in 2002.

In table 4 is shown the catch of Icelandic vessels at the various depth strata. Most of the shrimp is caught between 141 and 300 fathoms. It was decided in year 2000 to close the area of shallow water approximately > 140 fathoms during the summer of 2001 for the first time, in order to protect the small shrimp. In year 2002 it was decided to close the shallow water area from June to December. The shallow water (< 140 fathoms) catch is between 1 and 7 % in the years 1995-1999. In the years 2000 and 2001 the proportion of catch has increased to 14.5-11% in the shallow water area.

Length Frequencies and Age Groups

The length frequency distributions of Icelandic samples from 2001 and 2002 are shown by months in Figures 8-9. Two year olds are seen in May year 2001about 15-16 mm CL and get more prominent in the latter part of the year, namely September to December (Figure 8). Three year olds are also very prominent in year 2002. So the year-class 1999 appears to be strong.

From the Figures 10 to 18 it is possible to study the difference in occurrence of peaks going from shallow water to deeper waters. Sometimes the two year old seem to be very prominent in the shallow water like e.g. on Figure 12 the peak about 15 mm is very high in the 101-140 fm stratum in May as compared to deeper down. But the number measured is too low in shallow area. The older animals have generally a tendency to be more numerous at greater depths. By grouping the data in this manner it is possible to study the distribution of sizes with regard to depth and even calculate the gain and loss of closing an area or not closing it at all. Skuladottir and Nicolajsen (2002) carried out ageing of the shrimp in the years 1996, 1999 and 2000 in the two depth strata < or > than 140 fathoms, in order to find out how many two year olds would be spared if the area was closed from June to the end of December, the whole year or not at all. Into those calculations came also catch data per depth strata from the Faroe Islands and Iceland.

The deviations from the mean length frequency distribution of years 1993-2001 are shown in Figures 19-25. These are of great support in figuring out growth of the most prominent positive peaks from year to year. In year

2002 the most prominent peak is that of the 1999 year-class as three year old in the months March, April and May in Figures 19, 20 and 21.

By-catch

The by-catch was about 1% in the years 1999 0.9% in 2000 and 0.8% in 2001 as compared to 0.8% of the shrimp catch in 1998, 1.8% in 1997 and 3 % in 1996 (Skúladóttir, 1998). Most of this was redfish or 0.7-0.8 % in the years 1999 to 2002. Other species were wolffish, Greenland halibut and American plaice. Cod was seen for the first time in April 1999, but has not been seen since then (Table 5).

References

McCrary, J.A. 1971. Sternal spines as a characteristic for differentiating between females of some Pandalidae. J. Fish. Res. Board Can., 28: 98-100.

Rasmussen. B. 1953. On the geographical variation in growth and sexual development of the deep sea prawn (*Pandalus borealis* Kr.). Norweg. Fish. and Mar. Invest. Rep., 10 (3): 1-160.

Skúladóttir, U. 1998. The Bycatch in the shrimp fishery of Iceland at Flemish Cap in 1997 and 1998 NAFO SCR Doc. 98/29, Serial No. N3016. 5 p.

Skúladóttir, U. 2001. The Icelandic shrimp fishery (*Pandalus borealis* Kr.) at the Flemish Cap in 1993-2001. NAFO SCR Doc. 01/183, Serial No. N4573. 26 p.

Skúladóttir, U. and A. Nicolajsen 2002. The Icelandic shrimp fishery (*Pandalus borealis* Kr.) at the Flemish Cap in 1993-2001. NAFO SCR Doc. 02/77, Serial No. N4691. 13 p.

Table 1. Catch (tons) effort (trawling hours *1.9 when double trawl) and CPUE (kg/hr) of Icelandic vessels at Flemish Cap.

	January - July				August - December			
Year	Month	CPUE	Effort	Catch	Month	CPUE	Effort	Catch
1993					Aug	320,4	1334	427,4
					Sep	349,8	1034	361,7
					Oct	231,7	334	77,4
	Jun	380,2	1767	671,8	Nov	306,8	588	180,4
	Jul	342,4	1097	375,6	Dec	236,5	537	127,0
	Subtotal	365,7	2864	1047,4	Subtotal	306,7	3827	1173,9
	Total	365,7	2918	1067,0	Total	306,7	3834	1176,0
1994	Jan	228,5	144	32,9	Aug	175,3	1657	290,4
	Feb	371,8	510	189,6	Sep	126,9	476	60,4
	Mar	295,5	531	156,9	Oct	125,4	492	61,7
	Jun	256,4	1297	332,5	Nov	115,5	181	20,9
	Jul	212,9	2653	564,8	Dec	75,0	8	0,6
	Subtotal	248,6	5135	1276,7	Subtotal	154,2	2814	434
	Total	248,6	6693	1664,0	Total	154,2	4123,74	636
1995	Feb	280,0	65	18,2	Aug	178,0	4869	866,9
	Mar	246,8	711	175,5	Sep	134,1	2928	392,5
	Apr	149,9	1487	222,9	Oct	166,3	2088	347,2
	May	260,1	2617	680,7	Nov	144,4	1074	155,1
	June	248,9	3733	929,2	Dec	174,5	740	129,1
	Jul	249,5	6625	1653,0				
	Subtotal	241,5	15238	3679,5	Subtotal	161,6	11699	1890,8
	Total	241,5	16932	4088,5	Total	161,6	21868,5	3534,4
1996	Jan	207,2	1755	363,7	Aug	165,4	8156	1349,4
	Feb	251,7	1326	333,7	Sep	167,1	8089	1351,7
	Mar	261,8	4604	1205,1	Oct	129,7	5482	711,2
	Apr	211,2	10754	2271,2	Nov	137,9	1456	200,8
	May	189,1	12749	2410,2	Dec	158,1	253	40,0
	Jun	202,5	13933	2821,5				
	Jul	235,9	11963	2821,5				
	Subtotal	214,2	57084	12226,9	Subtotal	155,9	23436	3653,1
	Total	214,2	64760	13871,0	Total	155,9	43688,7	6810,0
1997	Jan	175,8	413	72,6	Aug	206,7	4252	879,0
	Feb	214,7	621	133,3	Sep	202,4	3476	703,6
	Apr	135,0	514	69,4	Oct	222,0	2519	559,1
	May	141,4	3736	528,2	Nov	192,5	1039	200,0
	Jun	167,7	5386	903,2	Dec	176,9	429	75,9
	Jul	209,2	5802	1213,7				
	Subtotal	177,3	16472	2920,4	Subtotal	206,4	11715	2417,6
	Total	177,3	19478	3453,3	Total	206,4	14681	3029,6
1998 *	Feb	217,2	297	64,5	Aug	256,4	3184	816,3
	Mar	206,8	812	167,9	Sep	184,5	5028	927,5
	Apr	229,5	880	202,0	Oct	196,3	3612	708,9
	May	261,4	2820	737,2	Nov	204,6	1761	360,3
	Jun	330,7	3537	1169,7	Dec	222,5	644	143,3
	Jul	285,3	4117	1174,7				
	Subtotal	282,1	12463	3516,0	Subtotal	207,8	14229	2956,3
	Total	282,1	12657	3570,8	Total	207,8	14446,6	3001,5
1999 *	Feb	350,5	382	133,9	Aug	250,8	3642	913,4
	Mar	289,4	1851	535,7	Sep	235,5	1371	322,9
	Apr	253,0	3483	881,2	Oct	255,6	2150	549,6
	May	249,5	5941	1482,3	Nov	256,2	2173	556,8
	Jun	285,8	5993	1712,7	Dec	230,6	989	228,1
	Jul	280,4	5224	1464,6				
	Subtotal	271,5	22874	6210,4	Subtotal	249,0	10325	2570,8
	Total	271,5	24009	6518,6	Total	249,0	10837	2698,4
2000 *	Jan	263,8	1050	277,0	Aug	244,9	2357	577,1
	Feb	280,5	2206	618,8	Sep	239,0	2134	510,2
	Mar	306,3	3297	1009,8	Oct	274,8	1787	491,1
	Apr	280,7	4378	1229,0	Nov	256,1	2984	764,3
	May	231,9	4943	1146,6	Dec	267,5	798	213,5
	Jun	304,3	3679	1119,6				
	Jul	250,1	3064	766,4				
	Subtotal	272,7	22618	6167,2	Subtotal	254,1	10060	2556,2
	Total	272,7	22618	6167,2	Total	254,1	11051	2807,8

	January - July				August - December			
Year	Month	CPUE	Effort	Catch	Month	CPUE	Effort	Catch
2001 *	Jan	285,9	538	153,7	Aug	292,6	2094	612,9
	Feb	299,9	1593	477,6	Sep	277,3	1160	321,6
	Mar	303,6	2174	660,0	Oct	267,5	1563	418,1
	Apr	239,6	45	10,8	Nov	253,4	1210	306,6
	May	271,1	917	248,7	Dec	500,8	404	202,5
	Jun	282,9	2777	785,6				
	Jul	296,5	2992	887,2				
	Subtotal	292,1	11036	3223,6	Subtotal	289,5	6431	1861,7
	Total	292,1	11036	3223,6	Total	289,5	7178	2077,8
2002 *	Jan	292,6	372	108,9	Aug	311,7	1739	542,0
	Feb	343,4	705	242,0	Sep	304,3	386	117,6
	Mar	263,5	1764	464,6				
	Apr	310,7	2010	624,6				
	May	331,7	2423	803,8				
	Jun	346,6	2103	728,9				
	Jul	444,6	1241	551,7				
	Subtotal	331,9	10618	3524,5	Subtotal	310,4	2125	659,6
	Total	331,9	10618	3524,5	Total	310,4	2502	776,5

Table 2. Nominal catch for the whole year and some averages calculated from the Icelandic logbooks to show Trends in CPUEs and size of trawl. The effort of twin trawls is multiplied by 1.9.

Year	Nominal Catch Tons	Twin trawls % of catch	Trawl size No. of meshes	Unstandardized CPUE	CPUE at size 3000 trawl January-July	CPUE at size 3000 trawl January-Sept.
1993	2 243	43,3	3063	366	0	344
1994	2 300	54,4	2994	249	0	219
1995	7623	38,2	2779	242	0	251
1996	20681	42,9	2803	214	0	211
1997	6483	53,4	2780	177	0	203
1998	6572	74,8	3016	282	0	266
1999	9217	70,6	3441	272	0	243
2000	8978	81,4	3528	273	245	240
2001	5301	67,3	3571	291	294	289
2002	4301	74,2	3732	328	373	367

Table 3. Mean lengths (Cl in mm) by depth strata at Flemish Cap in years 2000-2002

2000	Depth fm 1-100	Depth fm 101-140	Depth fm 141-200	Depth fm 201-300	Depth fm >301
Month	Mean Cl	Mean Cl	Mean Cl	Mean Cl	Mean Cl
1		19,1	20,2	20,8	22,8
2		19,0	20,1	23,5	
3		19,4	19,2	20,1	
4		19,2	18,8	21,0	22,1
5		18,0	19,7	22,8	24,0
6			21,3	23,6	20,1
7		23,0	20,8	22,1	24,8
8		19,7	20,7	21,1	24,7
9		21,2	20,2	21,3	
10		19,8	19,9	21,0	
11		19,7	20,4	22,0	
12		19,1	19,5	21,5	

2001	Depth fm 1-100	Depth fm 101-140	Depth fm 141-200	Depth fm 201-300	Depth fm >301
Month	Mean Cl	Mean Cl	Mean Cl	Mean Cl	Mean Cl
1			20,6	22,4	
2		20,1	20,8	21,6	
3		19,4	20,5	21,2	19,6
4					
5		19,1	21,9	23,0	
6			21,5	22,9	
7			21,1	22,7	
8		19,5	19,8	21,5	22,7
9		18,7	19,8	19,9	
10		19,6	21,5	23,4	22,6
11			20,1	22,9	
12			19,9	19,4	

2002	Depth fm 1-100	Depth fm 101-140	Depth fm 141-200	Depth fm 201-300	Depth fm >301
Month	Mean Cl	Mean Cl	Mean Cl	Mean Cl	Mean Cl
1					
2					
3	18,6	18,1	18,8		21,0
4		18,3	18,6	19,7	19,7
5		18,6	20,5	21,2	20,0
6			20,4	23,2	
7			20,1	23,6	
8			19,0	22,9	
9					
10					
11					
12					

Table 4. **Catch of shrimp (kgs) from log books by depth strata on the Flemish Cap 1994-2001.**

1994	Depth fm 1-100		Depth fm 101-140		Depth fm 141-200		Depth fm 201-300		Depth fm >301		Total	Total
Month	Catch kg	%	Catch kg	%	Catch kg	%	Catch kg	%	Catch kg	%	Catch kg	%
1					30577	97,4	815	2,6			31392	100,0
2			349	0,2	8082	4,4	166290	90,9	8201	4,5	182922	100,0
3					40734	27,4	29402	19,8	78634	52,9	148770	100,0
4												
5												
6					228336	72,3	87396	27,7	125	0,04	315857	100,0
7					259372	48,0	281127	52,0			540499	100,0
8					67250	23,7	213102	75,2	3093	1,1	283445	100,0
9					31448	59,5	21391	40,5			52839	100,0
10					46415	75,3	14950	24,2	300	0,5	61665	100,0
11					18017	93,0	1356	7,0			19373	100,0
12					601	100,0					601	100,0
Total 1994	0	**0,0**	349	**0,02**	730832	**44,6**	815829	**49,8**	90353	**5,5**	1637363	100,0

1995	Depth fm 1-100		Depth fm 101-140		Depth fm 141-200		Depth fm 201-300		Depth fm >301		Total	Total
Month	Catch kg	%	Catch kg	%	Catch kg	%	Catch kg	%	Catch kg	%	Catch kg	%
1												
2					16750	92,3	1400	7,7			18150	100,0
3			47550	27,4	124750	71,8	1400	0,8			173700	100,0
4			37050	17,6	153929	73,1	19500	9,3			210479	100,0
5			1500	0,2	539106	81,0	124788	18,8			665394	100,0
6					259647	28,7	635954	70,4	8107	0,9	903708	100,0
7					823551	51,3	772532	48,1	10104	0,6	1606187	100,0
8			3117	0,4	284436	33,4	564065	66,2			851618	100,0
9			2600	0,7	299596	78,7	78253	20,6			380449	100,0
10			800	0,2	256380	74,3	87650	25,4			344830	100,0
11			1700	1,1	81373	52,8	69723	45,3	1200	0,8	153996	100,0
12			26260	20,3	90288	69,9	12512	9,7	50	0,04	129110	100,0
Total 1995	0	**0,0**	120577	**2,2**	2929806	**53,9**	2367777	**43,5**	19461	**0,4**	5437621	100,0

1996	Depth fm 1-100		Depth fm 101-140		Depth fm 141-200		Depth fm 201-300		Depth fm >301		Total	Total
Month	Catch kg	%	Catch kg	%	Catch kg	%	Catch kg	%	Catch kg	%	Catch kg	%
1			1940	0,5	242356	68,5	109339	30,9			353635	100,0
2			8500	2,5	263209	78,9	61986	18,6			333695	100,0
3			246715	20,5	896472	74,4	61437	5,1	500	0,04	1205124	100,0
4			488378	21,5	1084700	47,8	453478	20,0	244672	10,8	2271228	100,0
5			9931	0,4	1009597	42,2	1131708	47,3	243318	10,2	2394554	100,0
6			10102	0,4	977909	34,7	1773075	62,9	55910	2,0	2816996	100,0
7			2049	0,1	709740	33,6	1388454	65,8	10439	0,5	2110682	100,0
8					712341	52,8	612807	45,4	24276	1,8	1349424	100,0
9			33433	2,5	963094	71,3	353343	26,2			1349870	100,0
10			18957	2,7	478687	67,3	212991	29,9	581	0,1	711216	100,0
11			295	0,1	39133	19,5	161323	80,4			200751	100,0
12					33014	82,5	6986	17,5			40000	100,0
Total 1996	0	**0,0**	820300	**5,4**	7410252	**49,0**	6326927	**41,8**	579696	**3,8**	15137175	100,0

1997	Depth fm 1-100		Depth fm 101-140		Depth fm 141-200		Depth fm 201-300		Depth fm >301		Total	Total
Month	Catch kg	%	Catch kg	%	Catch kg	%	Catch kg	%	Catch kg	%	Catch kg	%
1					64021	88,2	8567	11,8			72588	100,0
2					49140	36,9	84141	63,1			133281	100,0
3												
4	1686	2,4			43871	63,2	23850	34,4			69407	100,0
5	1112	0,2	5187	1,0	275838	52,2	196892	37,3	49140	9,3	528169	100,0
6	1530	0,2			153081	16,9	571396	63,3	177155	19,6	903162	100,0
7	3300	0,3	509	0,04	697428	57,5	510075	42,0	2376	0,2	1213688	100,0
8					331232	37,7	547082	62,3	200	0,02	878514	100,0
9			2666	0,4	369438	52,5	330459	47,0	1056	0,2	703619	100,0
10	2590	0,5	1134	0,2	250855	45,0	301366	54,1	1226	0,2	557171	100,0
11					5504	2,8	187136	96,3	1755	0,9	194395	100,0
12							72112	95,0	3767	5,0	75879	100,0
Total 1997	10218	**0,62**	9496	**0,58**	2240408	**136,83**	2833076	**173,03**	236675	**14,45**	5329873	325,5

Table 4 (continued)

1998	Depth fm 1-100		Depth fm 101-140		Depth fm 141-200		Depth fm 201-300		Depth fm >301		Total	Total
Month	Catch kg	%	Catch kg	%	Catch kg	%	Catch kg	%	Catch kg	%	Catch kg	%
1												
2					44656	69,2	19863	30,8			64519	100,0
3			1875	1,1	116085	70,1	47701	28,8			165661	100,0
4	5364	2,7	194233	96,1	2439	1,2					202036	100,0
5	3386	0,5			320321	43,5	274883	37,3	138580	18,8	737170	100,0
6	7051	0,6	24469	2,1	490260	41,9	611887	52,3	36004	3,1	1169671	100,0
7					299439	25,5	779266	66,3	96030	8,2	1174735	100,0
8					262978	32,4	544690	67,0	5100	0,6	812768	100,0
9			500	0,1	239746	25,8	647931	69,9	39288	4,2	927465	100,0
10			824	0,1	183710	25,9	519944	73,3	4448	0,6	708926	100,0
11			935	0,3	2615	0,7	269960	74,9	86742	24,1	360252	100,0
12					60952	42,5	30405	21,2	51975	36,3	143332	100,0
Total 1998	15801	**0,24**	222836	**3,45**	2023201	**31,29**	3746530	**57,94**	458167	**7,09**	6466535	100,0

1999	Depth fm 1-100		Depth fm 101-140		Depth fm 141-200		Depth fm 201-300		Depth fm >301		Total	Total
Month	Catch kg	%	Catch kg	%	Catch kg	%	Catch kg	%	Catch kg	%	Catch kg	%
1					64021	88,2	8567	11,8		0,0	72588	100,0
2			2600	1,9	54567	40,7	75842	56,6	900	0,7	133909	100,0
3			244274	45,6	184826	34,5	106410	19,9	161	0,0	535671	100,0
4			291696	33,1	556243	63,1	31077	3,5	2164	0,2	881180	100,0
5	3215	0,2			539847	36,4	593786	40,1	345465	23,3	1482313	100,0
6	7786	0,5			126598	7,4	1562477	91,5	10775	0,6	1707636	100,0
7					237537	16,2	1214893	83,0	12176	0,8	1464606	100,0
8			11350	1,2	212033	23,2	685934	75,1	4106	0,4	913423	100,0
9			57158	8,2	336417	48,2	302496	43,4	1459	0,2	697530	100,0
10			26290	4,8	290693	52,9	232628	42,3			549611	100,0
11			52929	9,5	397581	71,4	106334	19,1			556844	100,0
12							216711	95,0	11367	5,0	228078	100,0
Total 1999	11001	**0,12**	686297	**7,44**	3000363	**32,53**	5137155	**55,70**	388573	**4,21**	9223389	100,0

2000	Depth fm 1-100		Depth fm 101-140		Depth fm 141-200		Depth fm 201-300		Depth fm >301		Total	Total
Month	Catch kg	%	Catch kg	%	Catch kg	%	Catch kg	%	Catch kg	%	Catch kg	%
1			21689	7,8	144741	52,2	110607	39,9			277037	100,0
2			291663	47,1	277874	44,9	49223	8,0			618760	100,0
3			510041	50,5	406143	40,2	93611	9,3			1009795	100,0
4			211098	17,1	721950	58,4	283807	23,0	18947	1,5	1235802	100,0
5			134999	11,8	492183	42,9	371748	32,4	148414	12,9	1147344	100,0
6	300	0,0			934559	83,4	185810	16,6			1120669	100,0
7			2792	0,4	333740	43,6	429528	56,1			766060	100,0
8	9019	1,6	18283	3,2	258630	44,7	291174	50,3	1798	0,3	578904	100,0
9					207304	37,0	351734	62,8	861	0,2	559899	100,0
10			30872	6,3	336529	68,5	123745	25,2			491146	100,0
11			14730	1,9	284436	37,2	461658	60,4	3356	0,4	764180	100,0
12			40399	17,6	106943	46,5	82402	35,9			229744	100,0
Total 2000	9319	**0,11**	1276566	**14,51**	4505032	**51,20**	2835047	**32,22**	173376	**1,97**	8799340	100,0

2001	Depth fm 1-100		Depth fm 101-140		Depth fm 141-200		Depth fm 201-300		Depth fm >301		Total	Total
Month	Catch kg	%	Catch kg	%	Catch kg	%	Catch kg	%	Catch kg	%	Catch kg	%
1			10875	7,1	21426	13,9	121395	79,0			153696	100,0
2			32275	6,8	357858	74,9	87445	18,3			477578	100,0
3			242757	36,8	397058	60,2	20220	3,1			660035	100,0
4			10784	100,0							10784	100,0
5			11457	4,6	234394	94,3	2824	1,1			248675	100,0
6			4272	0,5	575409	73,2	205871	26,2			785552	100,0
7			9554	1,1	272142	30,7	604985	68,2	561	0,1	887242	100,0
8			3771	0,6	369786	60,3	228708	37,3	10610	1,7	612875	100,0
9			27675	8,6	166280	51,7	127657	39,7			321612	100,0
10			23457	5,6	216169	51,7	178447	42,7			418073	100,0
11					30751	11,1	245840	88,9			276591	100,0
12			186720	92,2	12523	6,2	3284	1,6			202527	100,0
Total 2001		**0,00**	563597	**11,15**	2653796	**52,50**	1826676	**36,13**	11171	**0,22**	5055240	100,0

Table 4 (continued)

2002	Depth fm 1-100		Depth fm 101-140		Depth fm 141-200		Depth fm 201-300		Depth fm >301		Total	Total
Month	Catch kg	%	Catch kg	%	Catch kg	%	Catch kg	%	Catch kg	%	Catch kg	%
1			7050,0	6,5	74356,0	68,3	27439,0	25,2	93,0	0,1	108938	100,0
2			31331	12,9	132852	54,9	77797	32,2		0,0	241980	100,0
3			33990	7,3	268656	57,4	165042	35,3		0,0	467688	100,0
4			157219	25,2	450673	72,2	12823	2,1	3900	0,6	624615	100,0
5			51752	6,4	657664	81,8	94366	11,7		0,0	803782	100,0
6			17790	2,4	422399	57,9	288740	39,6		0,0	728929	100,0
7			32760	5,9	253831	46,0	265060	48,0		0,0	551651	100,0
8			8320	1,5	342400	63,2	191245	35,3		0,0	541965	100,0
9				0,0	270844	87,0	40625	13,0		0,0	311469	100,0
10				0,0	53497	51,1	51206	48,9		0,0	104703	100,0
11												
12												
Total 2002	0	**0,00**	340212	**7,58**	2927172	**65,26**	1214343	**27,07**	3993	**0,09**	4485720	100,0

Table 5. Bycatch of fish in the shrimp fisheries on Flemish Cap in the years 1999-2002 as observed by Icelandic observers and the corresponding shrimp catch.

Year	Redfish		Wolffish		Greenland Halibut		American plaice		Cod		Shrimp	% bycatch
	Number	Weight kg	Number	Weight kg	Number	Weight kg	Number	Weight kg	Number	Weight kg	Weight kg	of total catch
1999	595284	23724	51694	2425	19923	3468	3794	245	70	14	3037300	0,98
2000	760647	18715	95651	9030	17008	1443	3324	217	0	0	3360800	0,87
2001	608731	14191	12304	456	2052	187	1344	68	0	0	1900280	0,78
2002	277477	5959	8599	202	1801	19	2695	58			706535	0,88

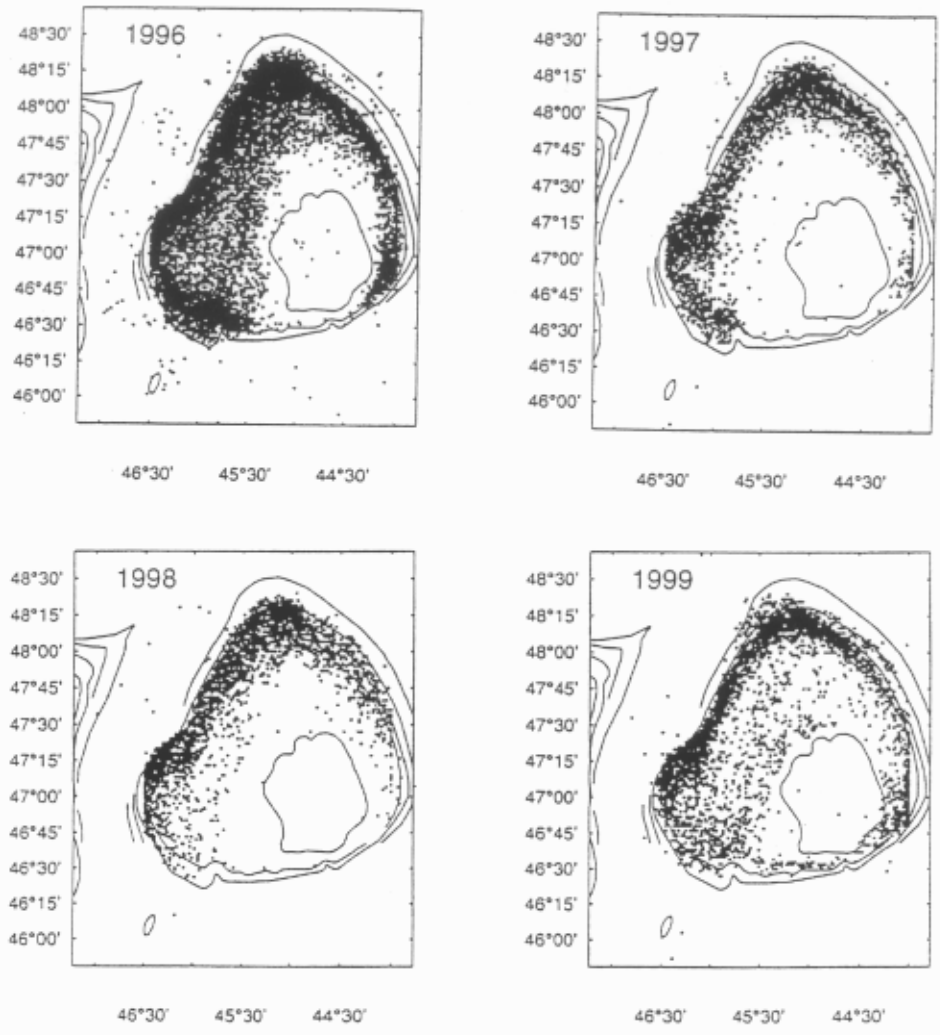
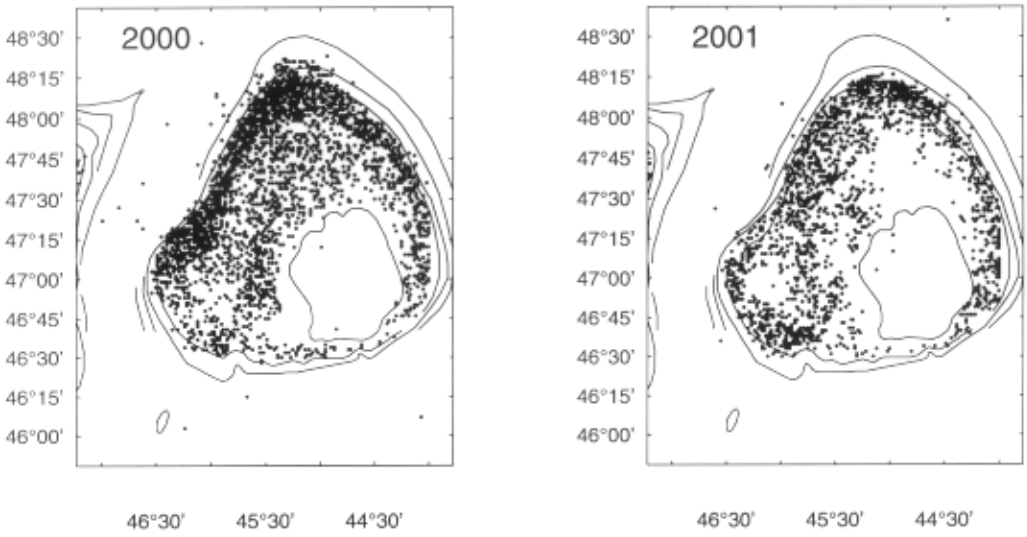


Fig. 1. Towing position in the Icelandic fleet on Flemish Cap in years 1996-1999.



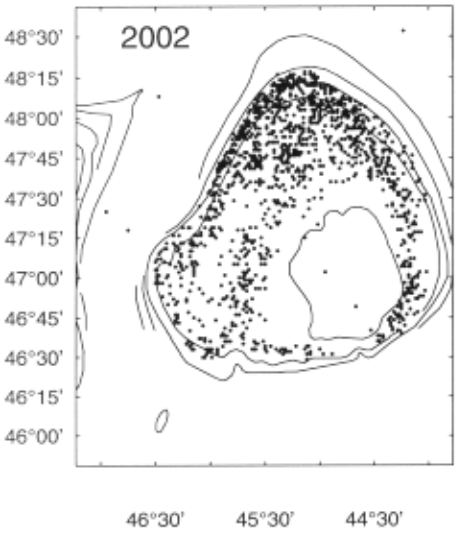


Fig. 2. Towing position in the Icelandic fleet on Flemish Cap in years 2000-2002.

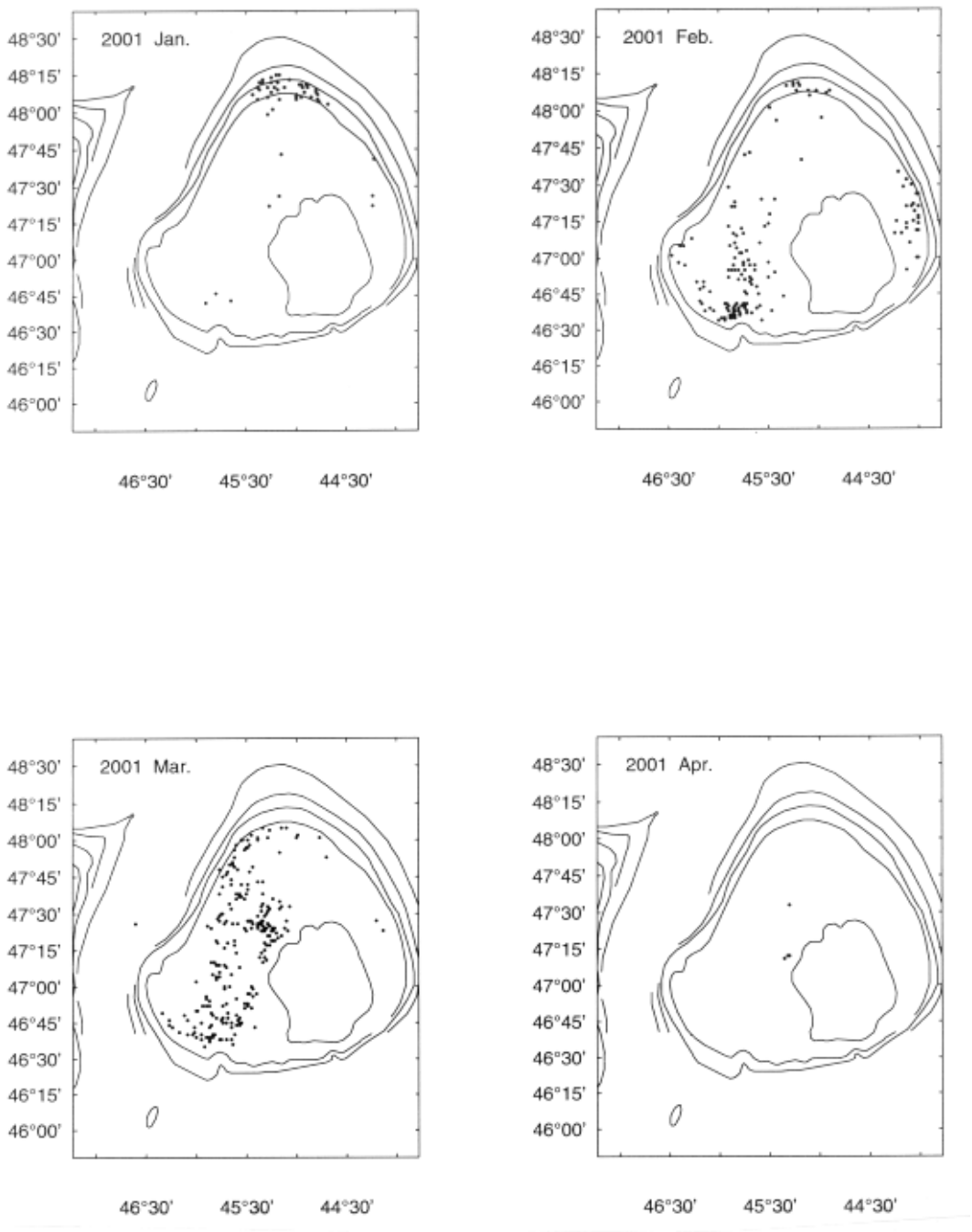


Fig. 3. Towing positions of the Icelandic fleet on Flemish Cap in year 2001 by months.

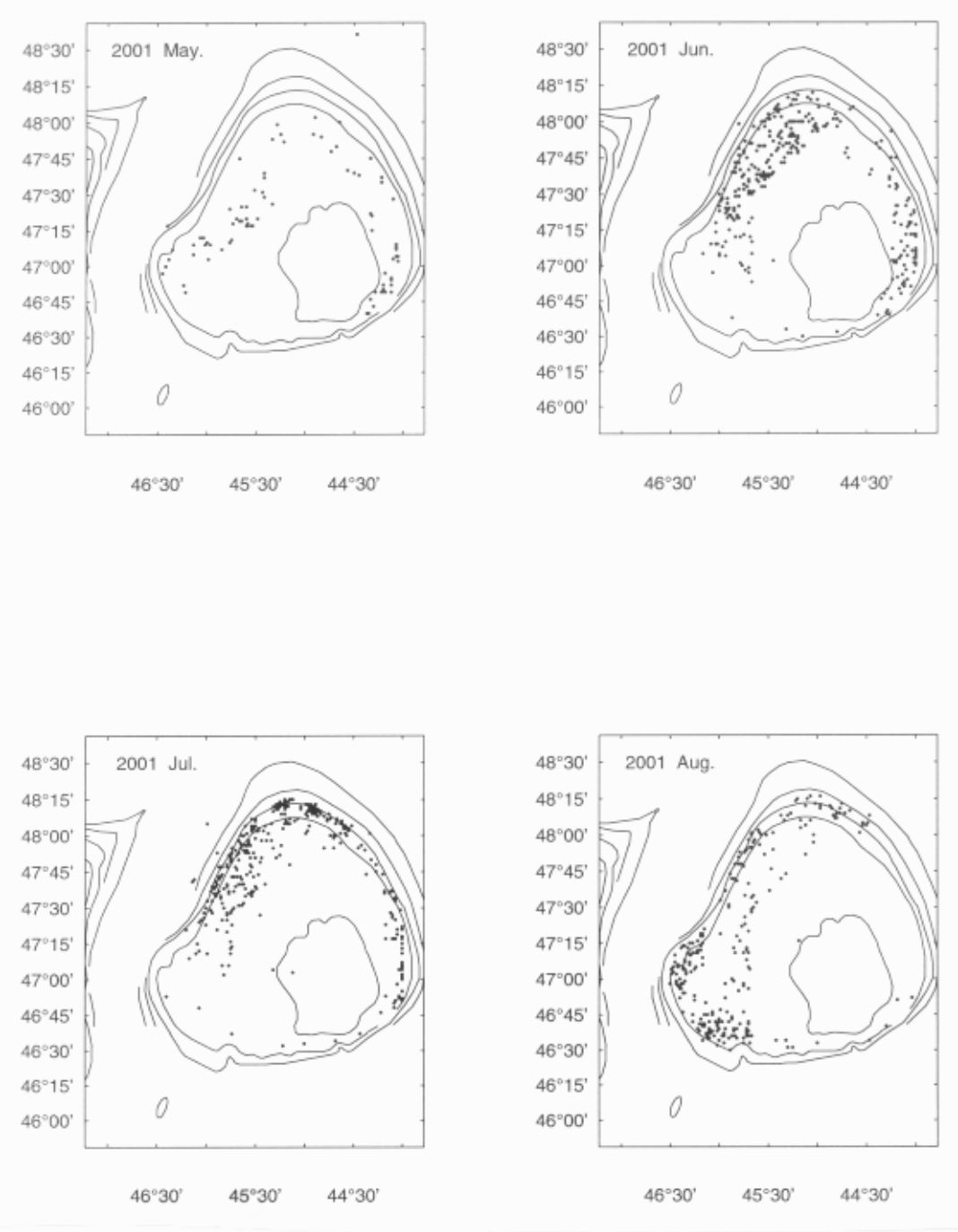


Fig. 4. Towing positions of the Icelandic fleet on Flemish Cap in year 2001 by months.

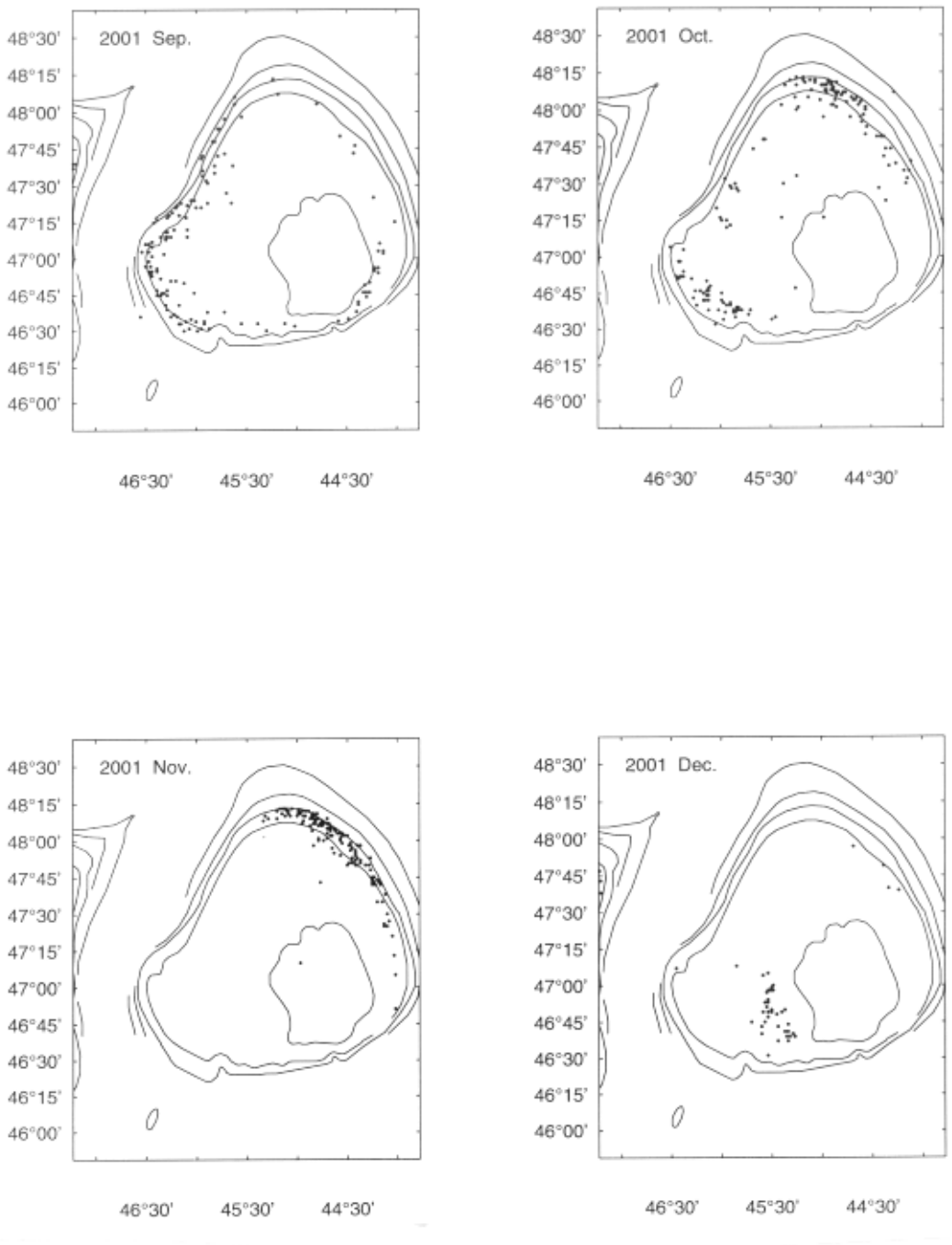


Fig. 5. Towing positions of the Icelandic fleet on Flemish Cap in year 2001 by months.

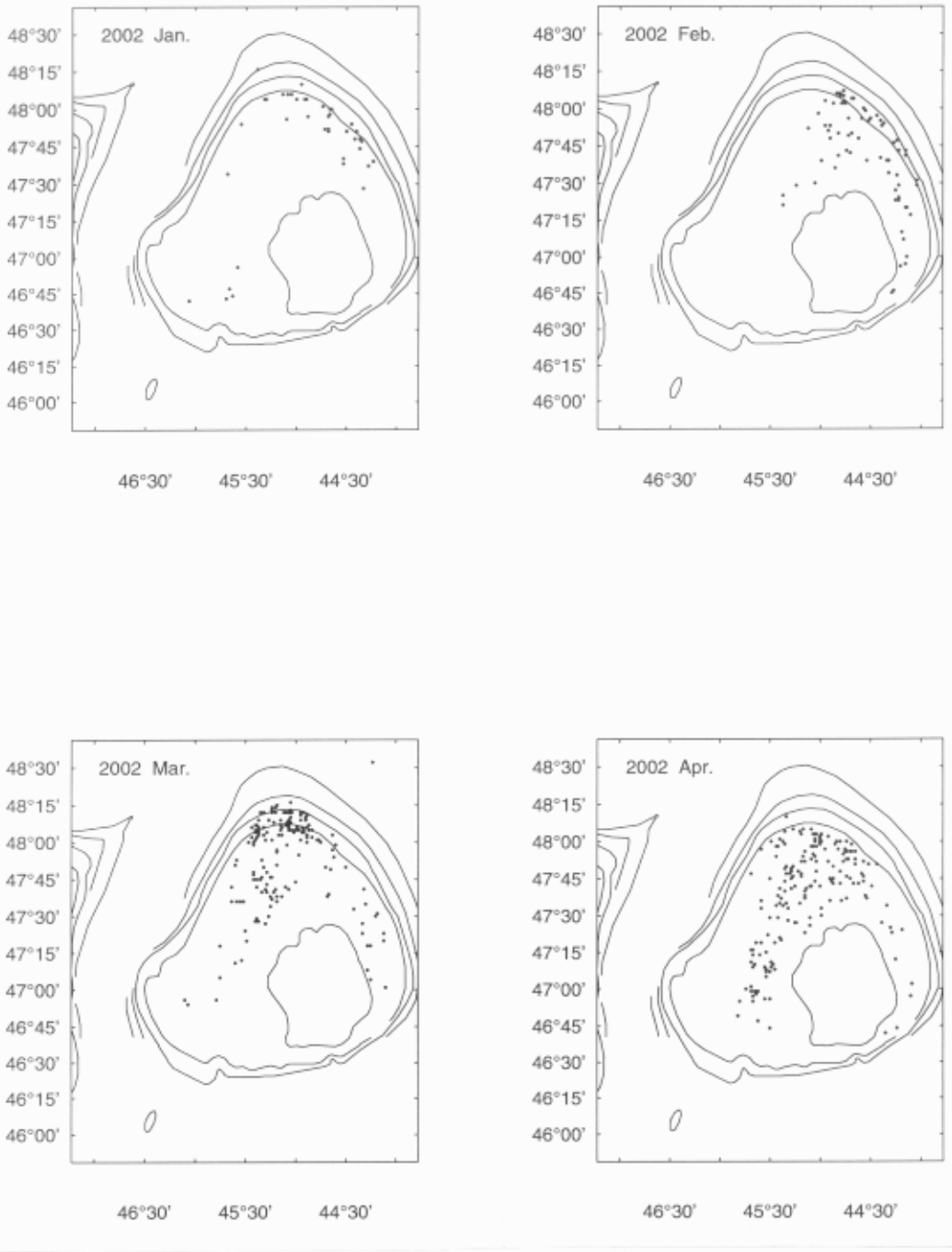


Fig. 6. Towing positions of the Icelandic fleet on Flemish Cap in year 2002 by months.

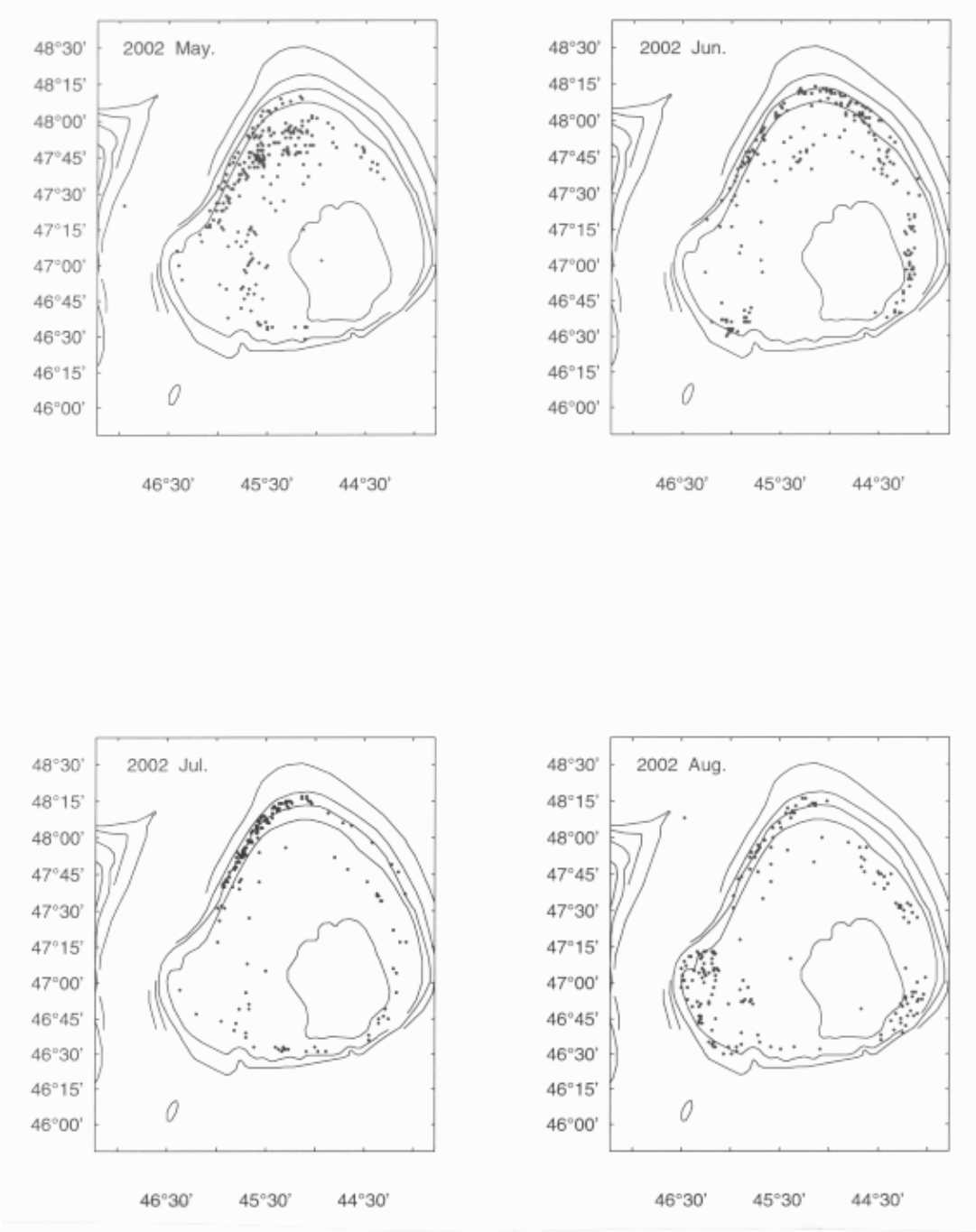


Fig. 7. Towing positions of the Icelandic fleet on Flemish Cap in year 2002 by months.

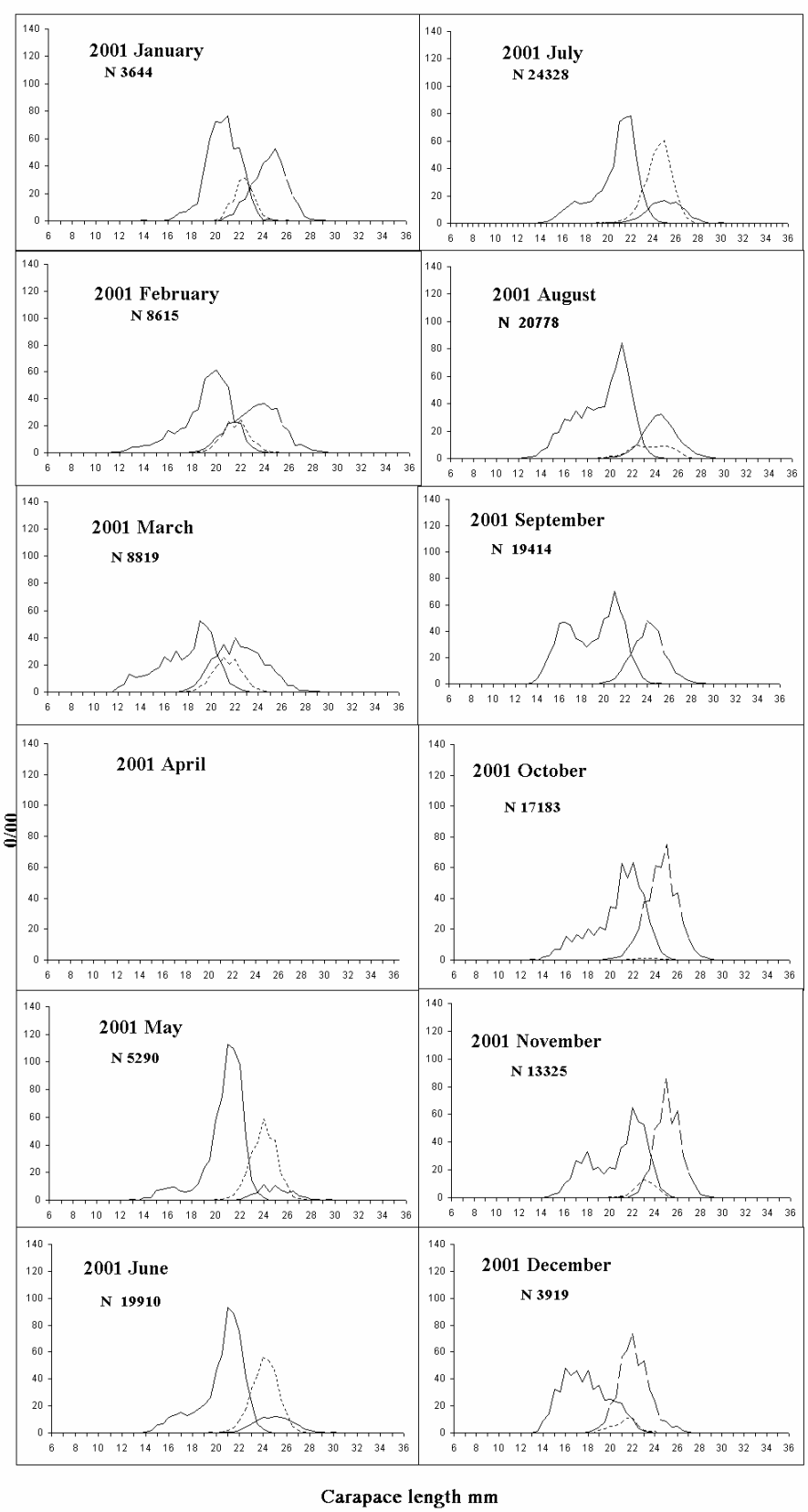


Fig.8. The length frequency distribution of northern shrimp at Flemish Cap by months in 2001.

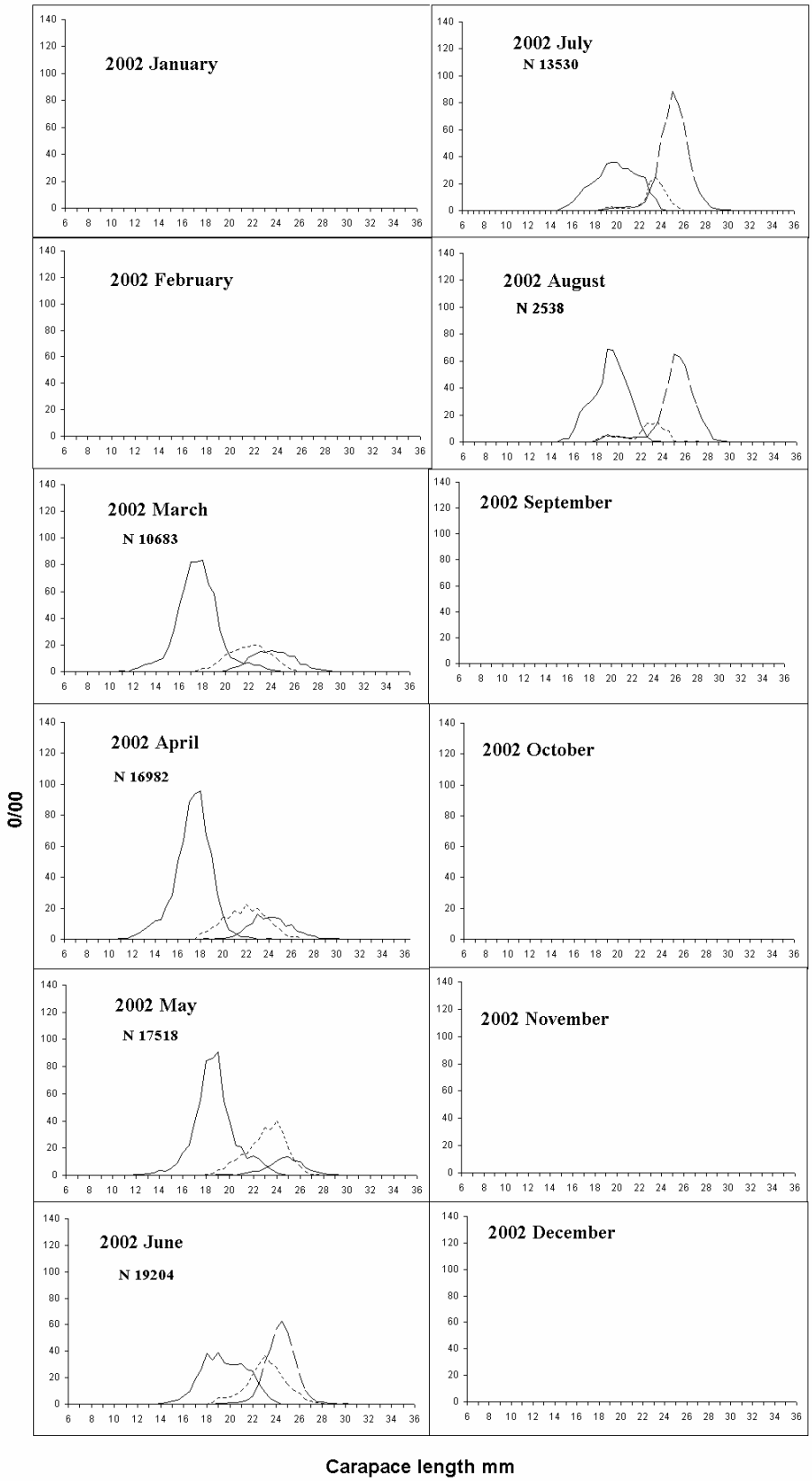


Fig.9. The length frequency distribution of northern shrimp at Flemish Cap by months in 2002.

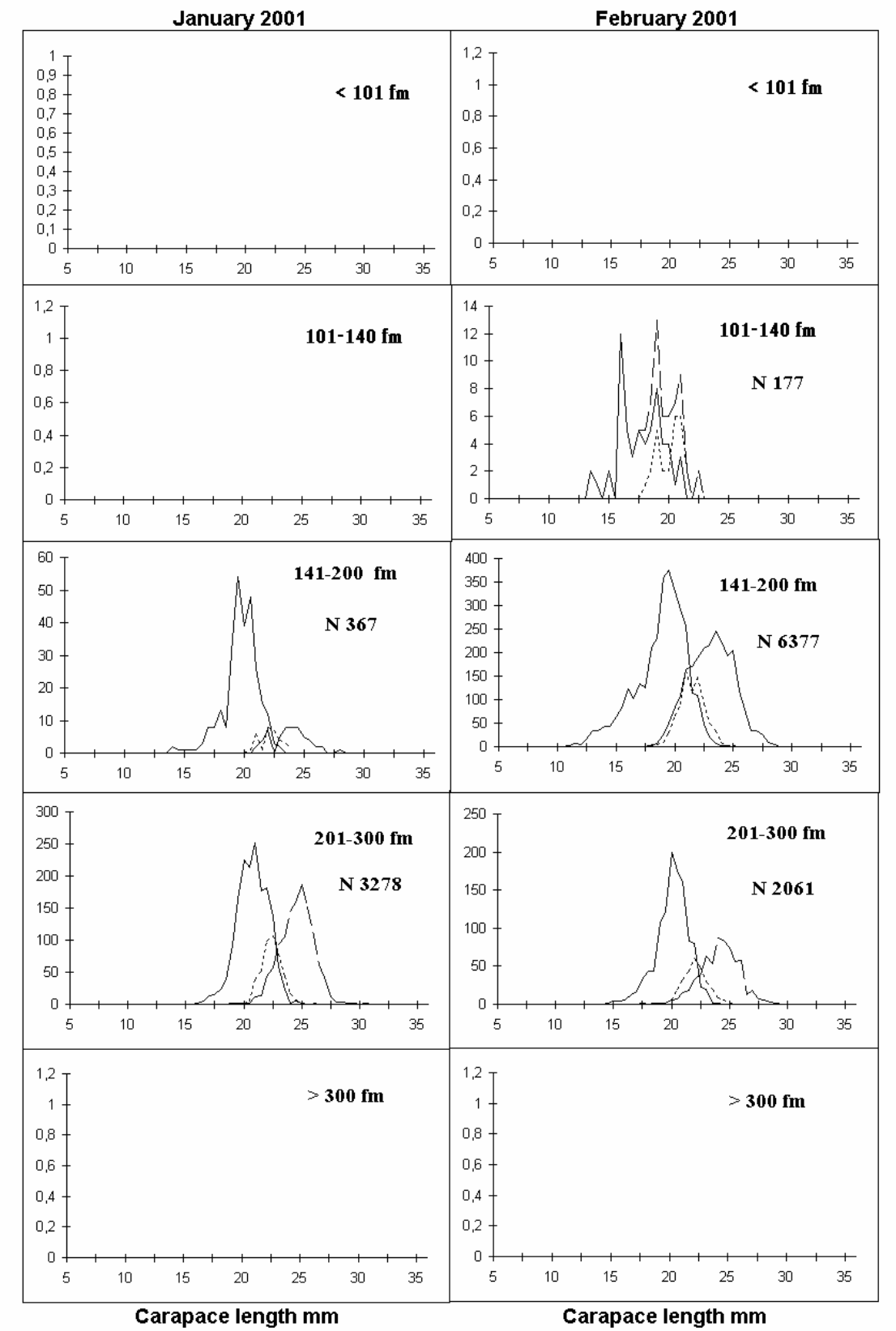


Fig. 10 The length frequency distribution of northern shrimp at Flemish Cap in January and February by depth in 2001.

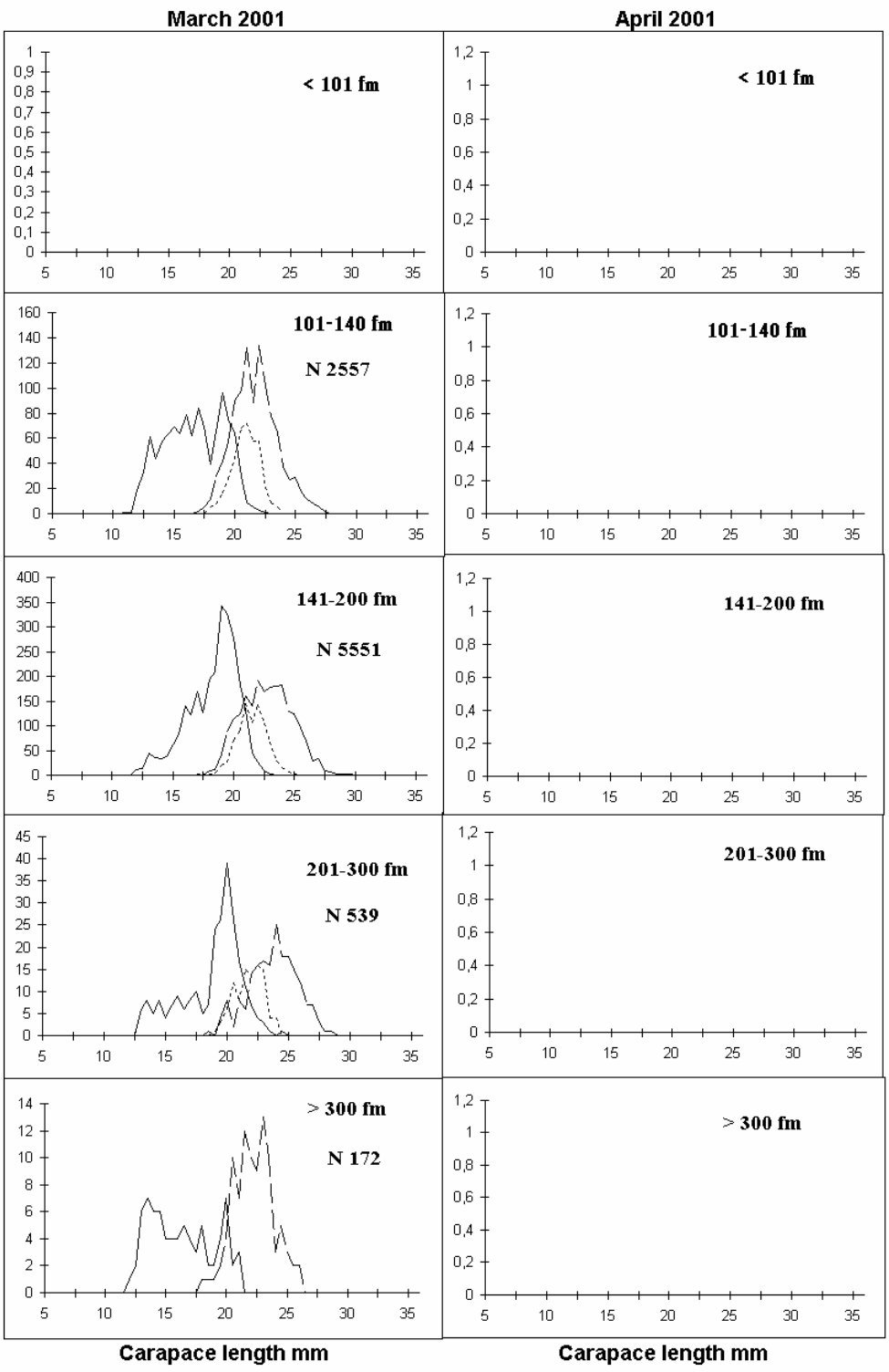


Fig. 11 The length frequency distribution of northern shrimp at Flemish Cap in March and April by depth in 2001.

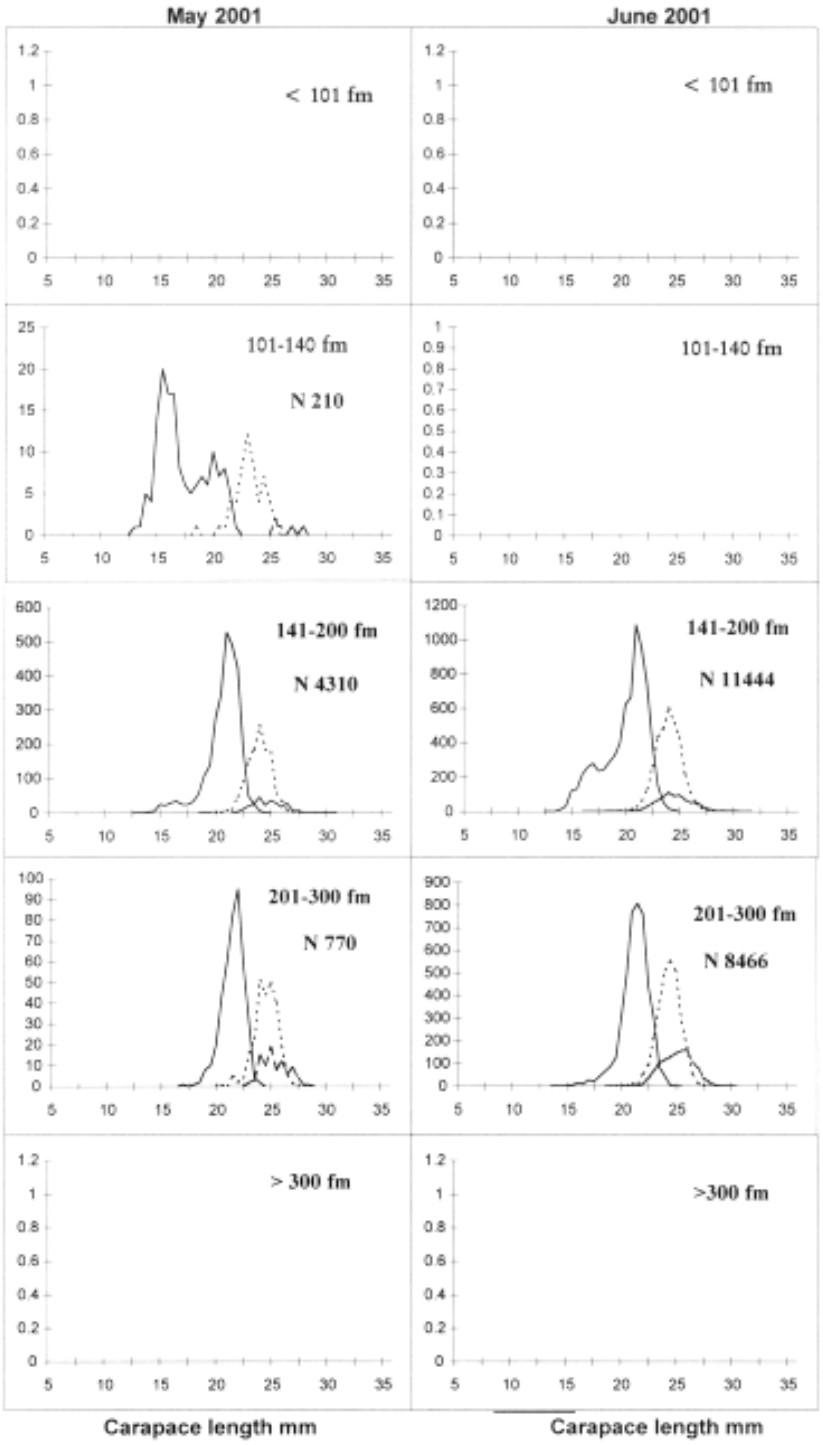


Fig. 12 The length frequency distribution of northern shrimp at Flemish Cap in May and June by depth in 2001.

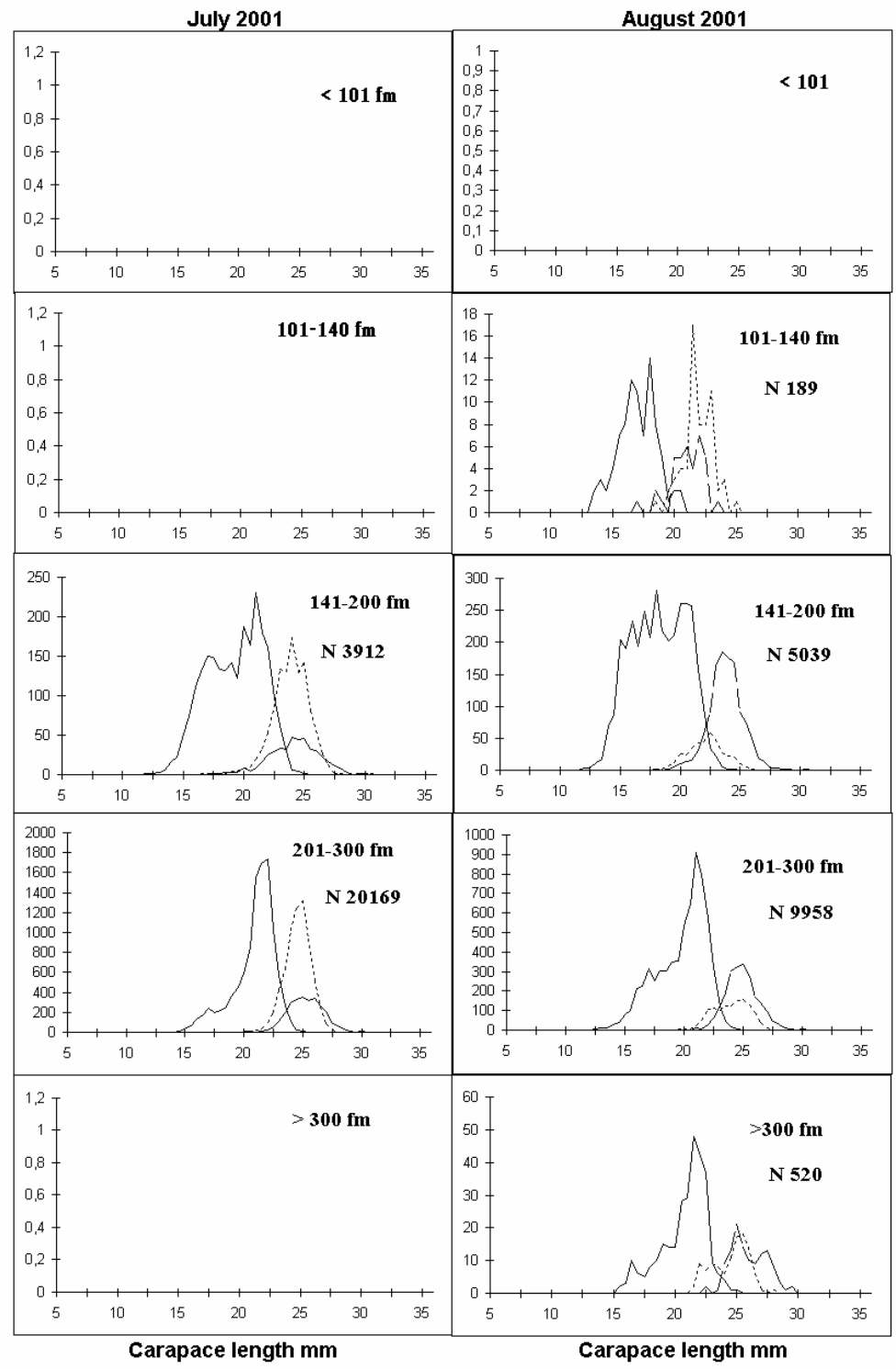


Fig. 13 The length frequency distribution of northern shrimp at Flemish Cap in July and August by depth in 2001.

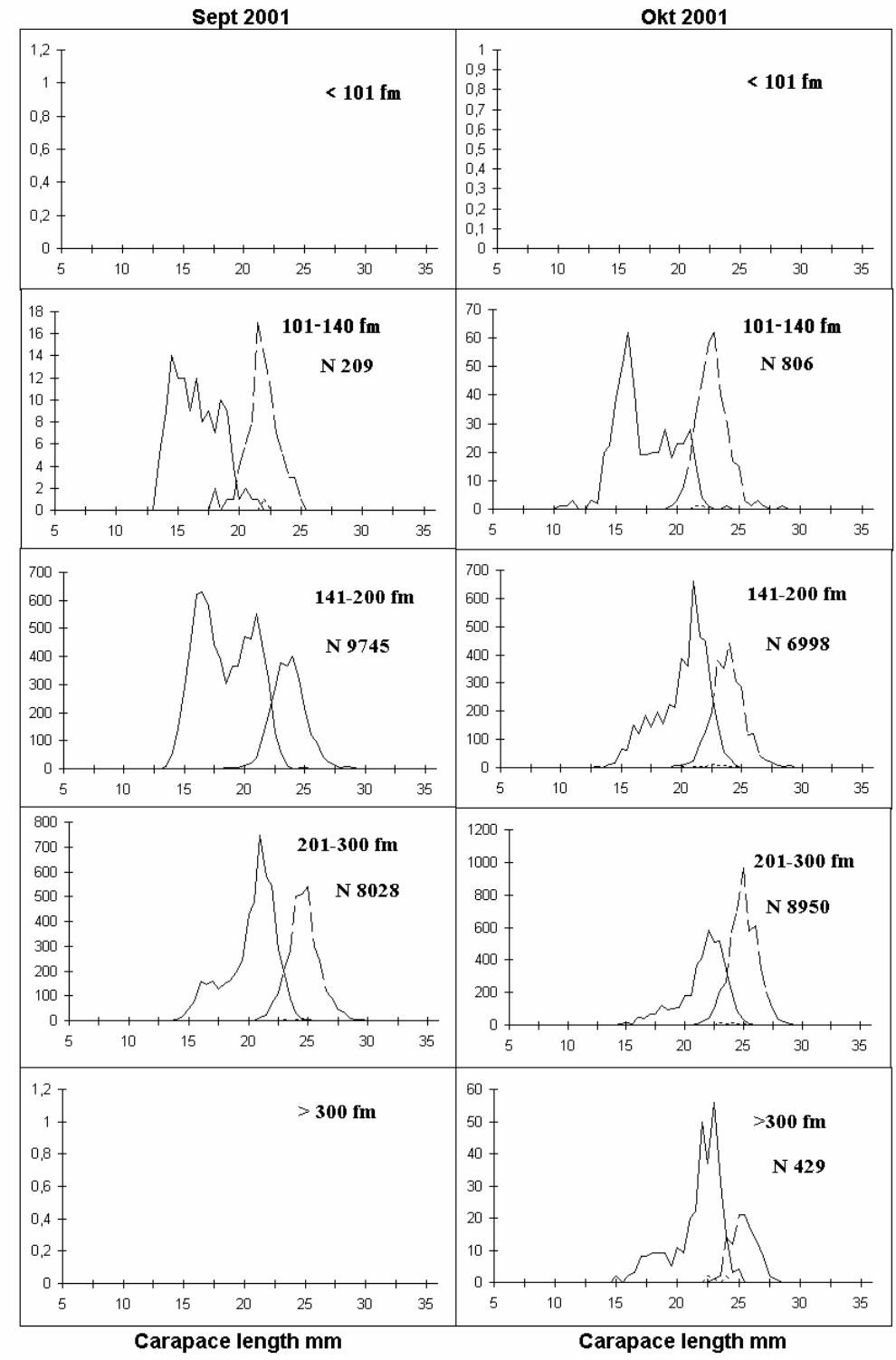


Fig. 14 The length frequency distribution of northern shrimp at Flemish Cap in September and October by depth in 2001.

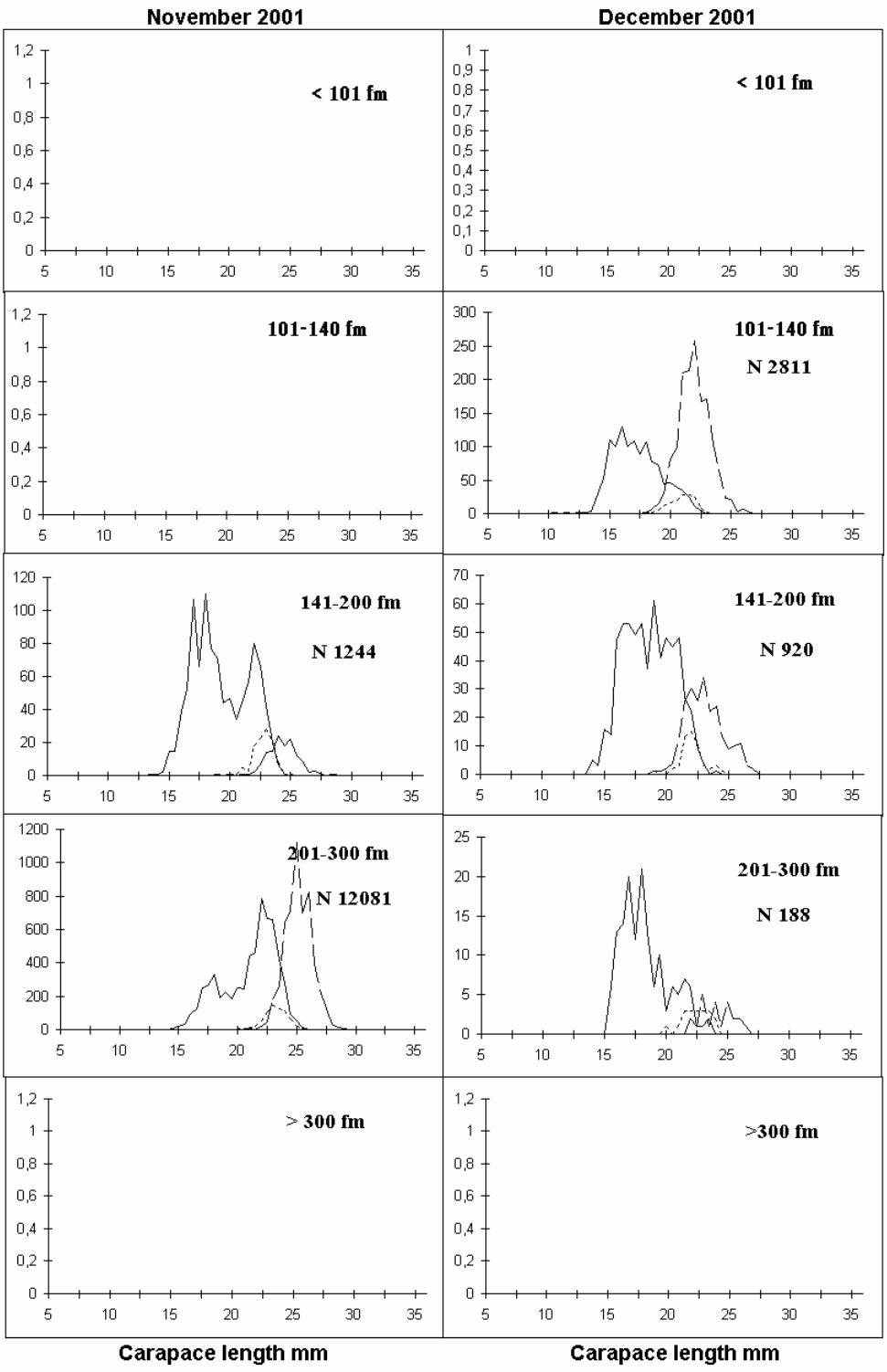


Fig. 15 The length frequency distribution of northern shrimp at Flemish Cap in November and December by depth in 2001.

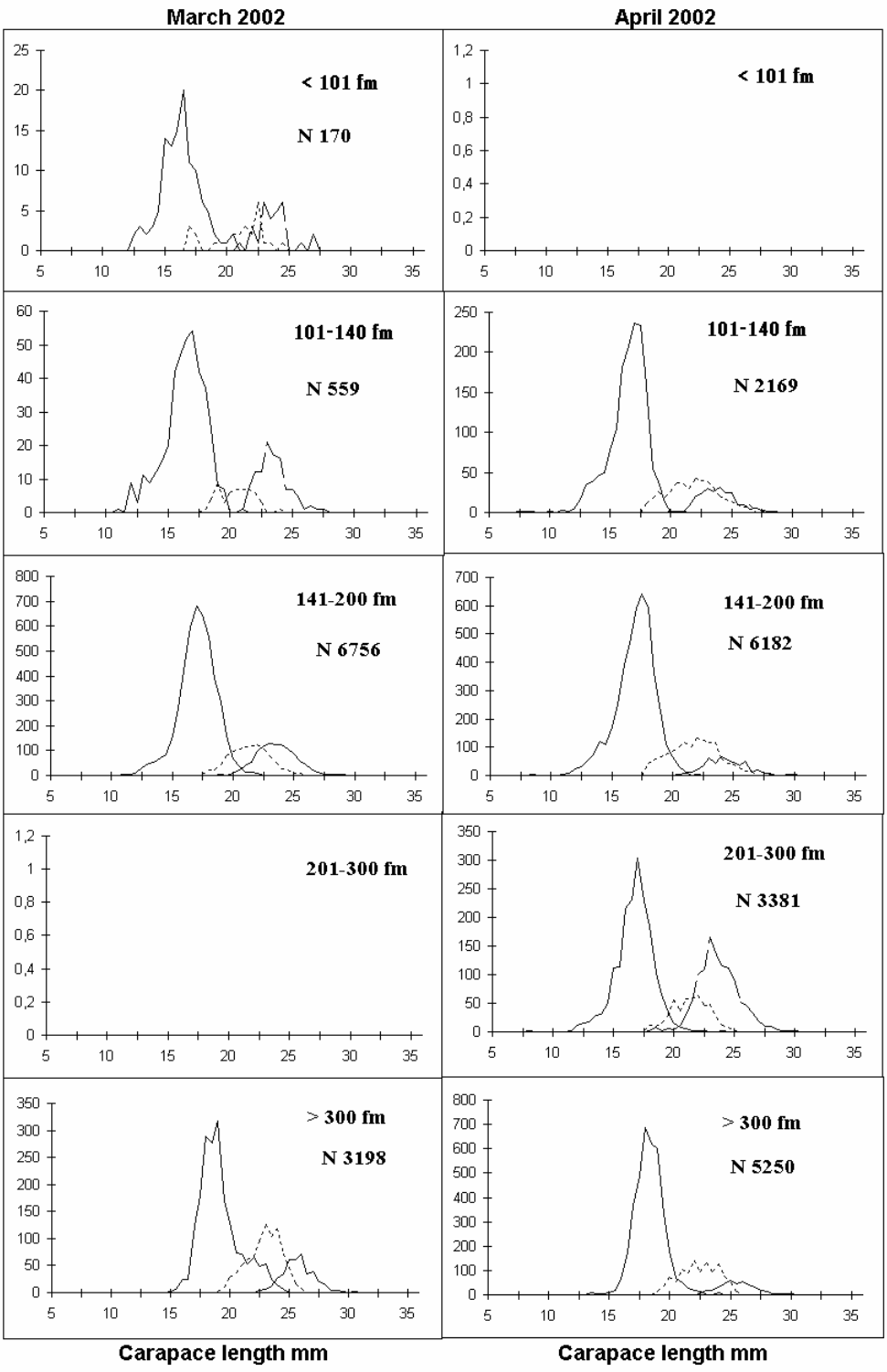


Fig. 16 The length frequency distribution of northern shrimp at Flemish Cap in March and April by depth in 2002.

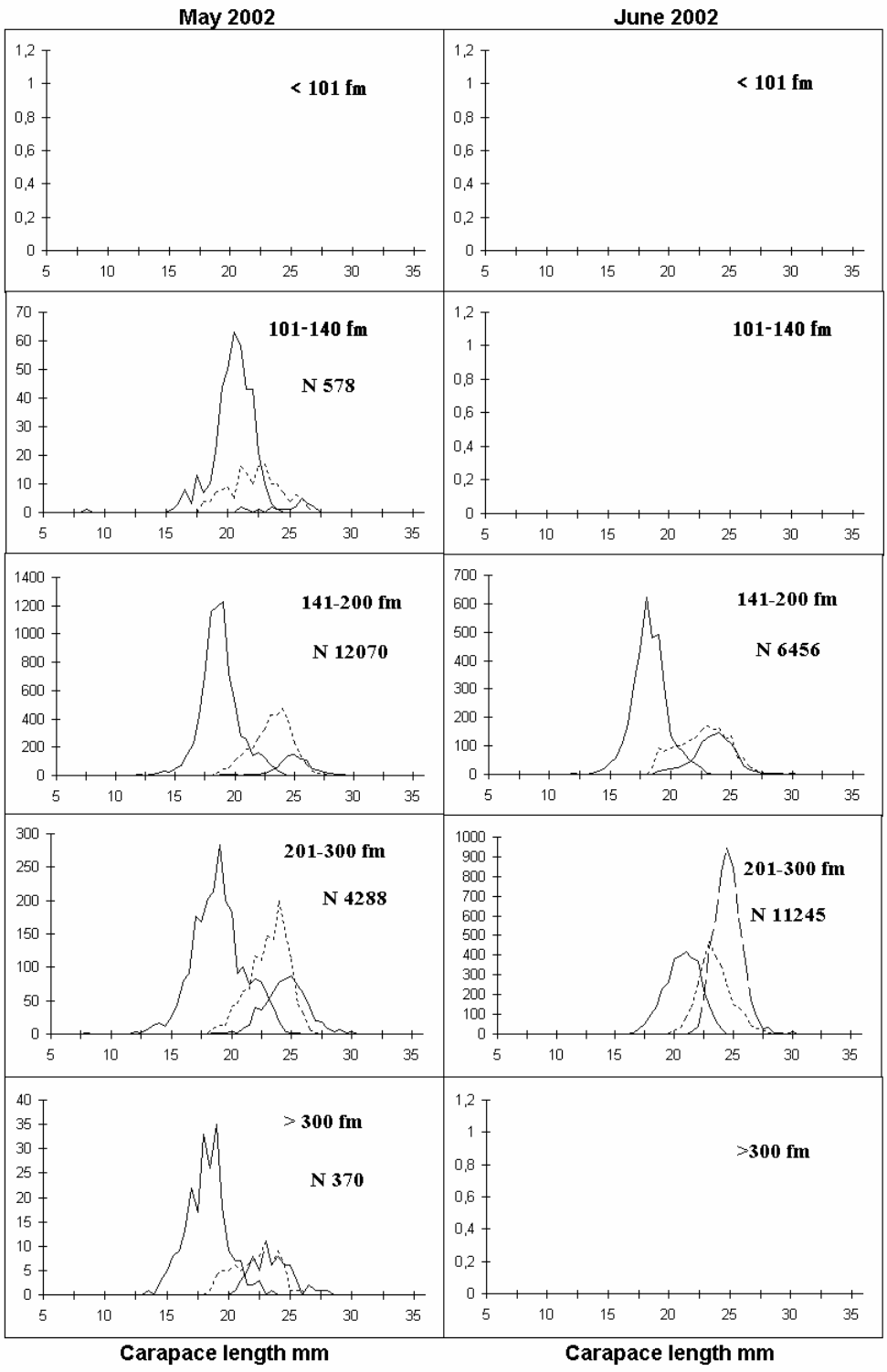


Fig. 17 The length frequency distribution of northern shrimp at Flemish Cap in May and June by depth in 2002.

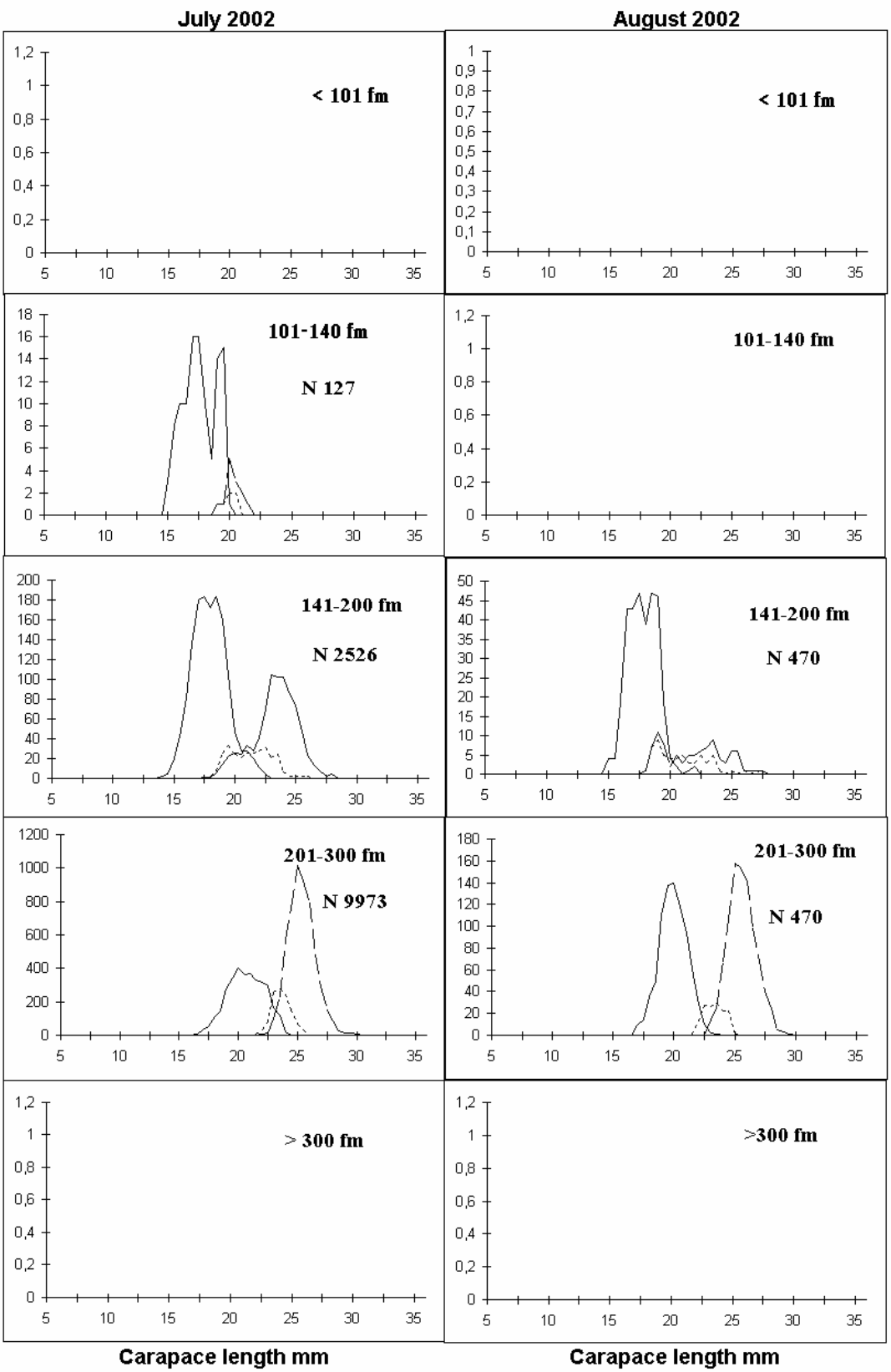


Fig. 18 The length frequency distribution of northern shrimp at Flemish Cap in July and August by depth in 2002.

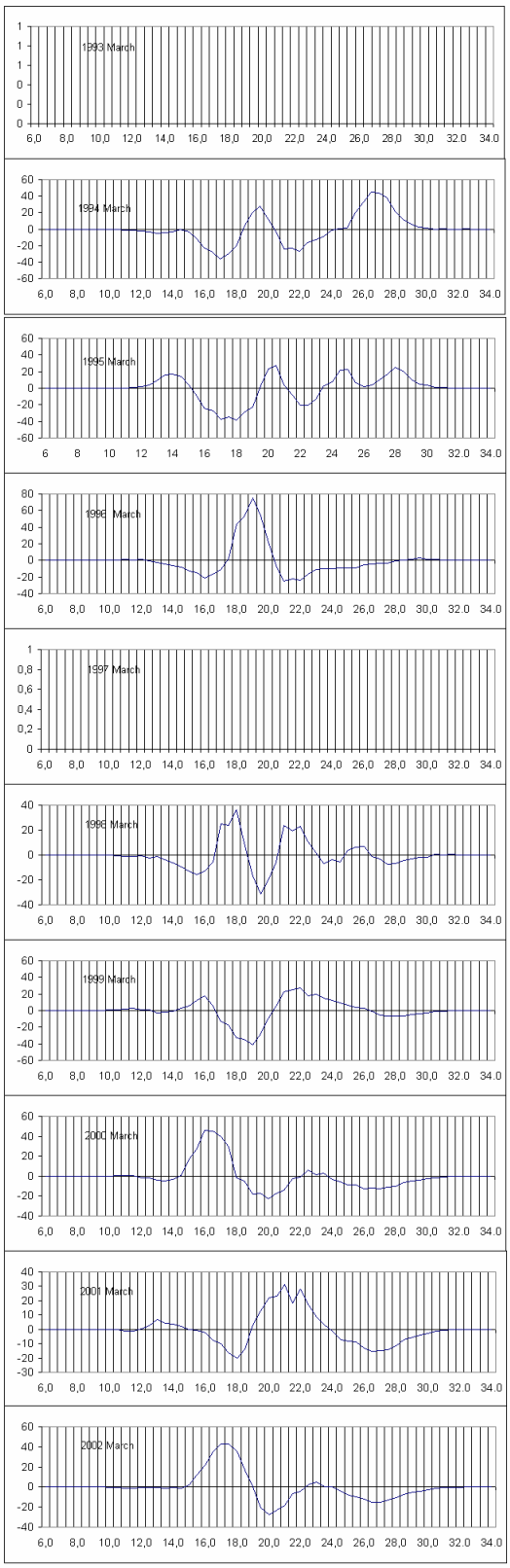


Fig. 19. The deviations of length frequencies of northern shrimp by years in March on Flemish Cap from the mean length frequency distribution of the years 1994-2002 in the same month. 1994 and 1995 are data of Canada and other countries. Since 1996 data are solely from Iceland.

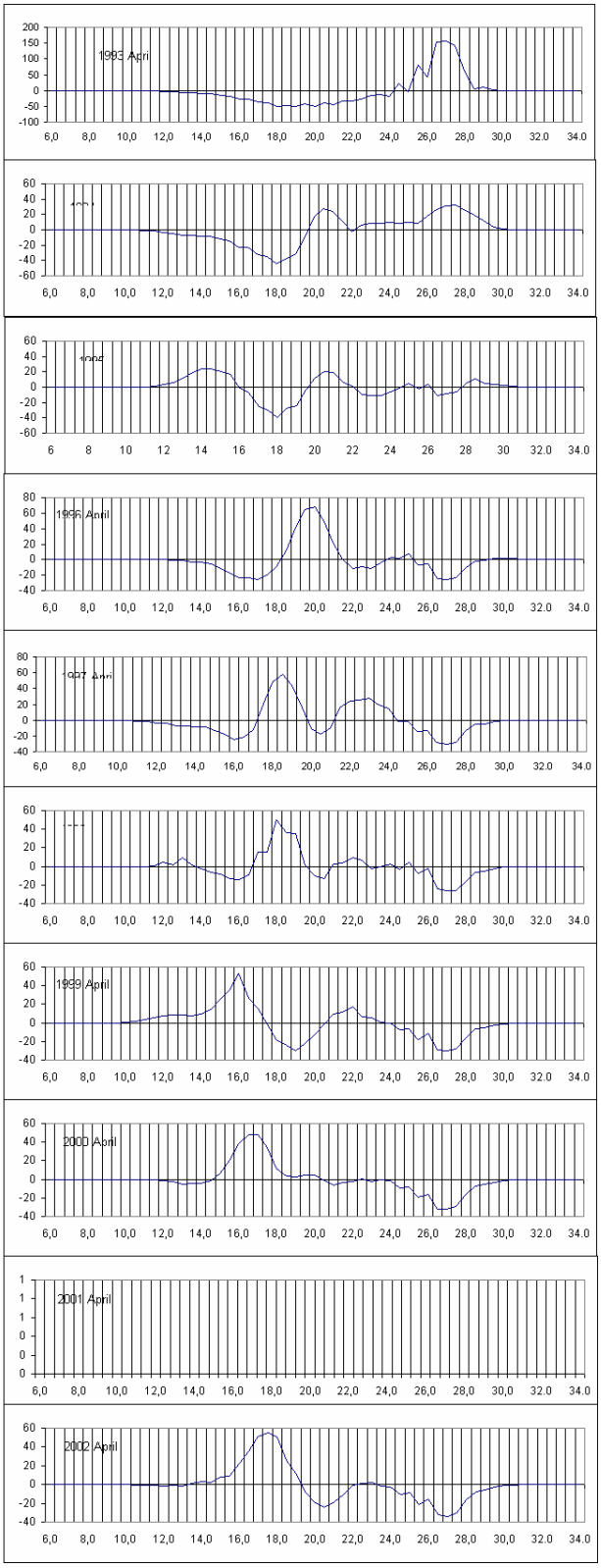


Fig 20. The deviations of length frequencies of northern shrimp by years in April on the Flemish Cap from the mean length frequency of the years 1993-2002 in the same month. 1993 through 1995 are data of Canada and other countries. Since 1996, data are solely from Iceland.

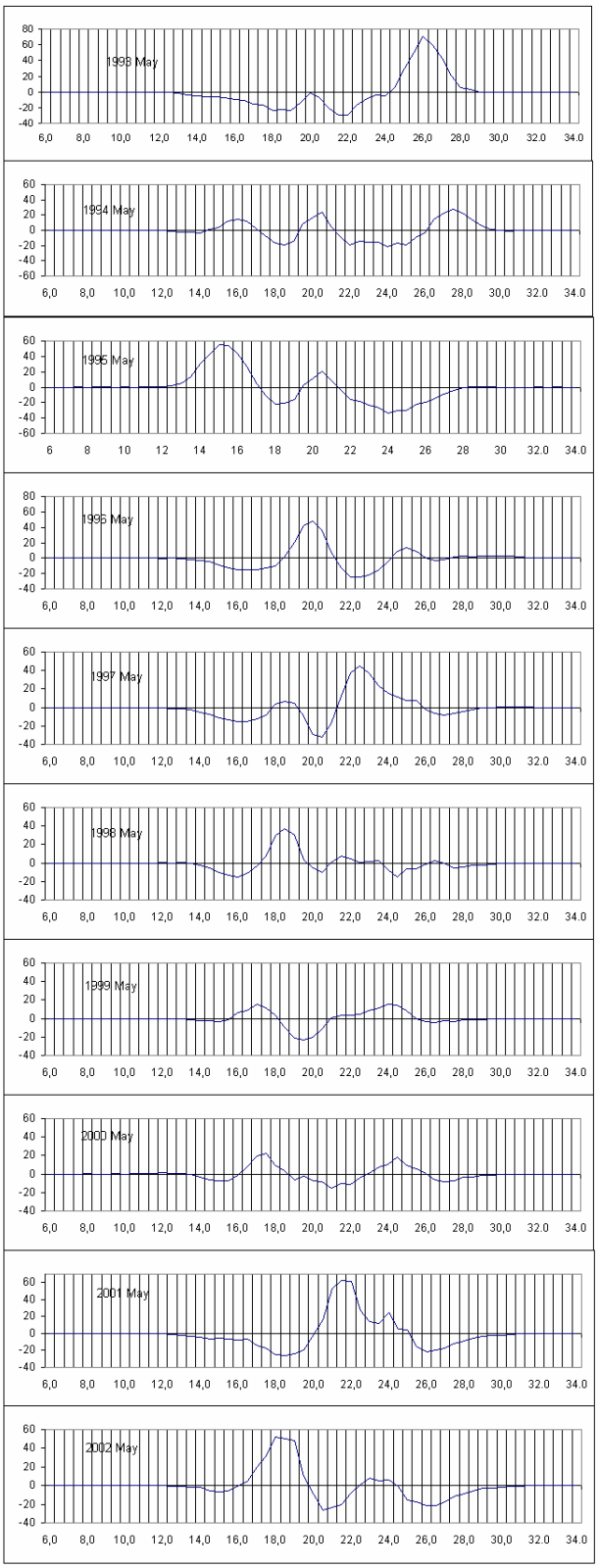


Fig 21. The deviations of length frequencies of northern shrimp by years in May on the Flemish Cap from the mean length frequency of the years 1993-2002 in the same month. 1993 through 1995 are data of Canada and other countries. Since 1996, data are solely from Iceland.

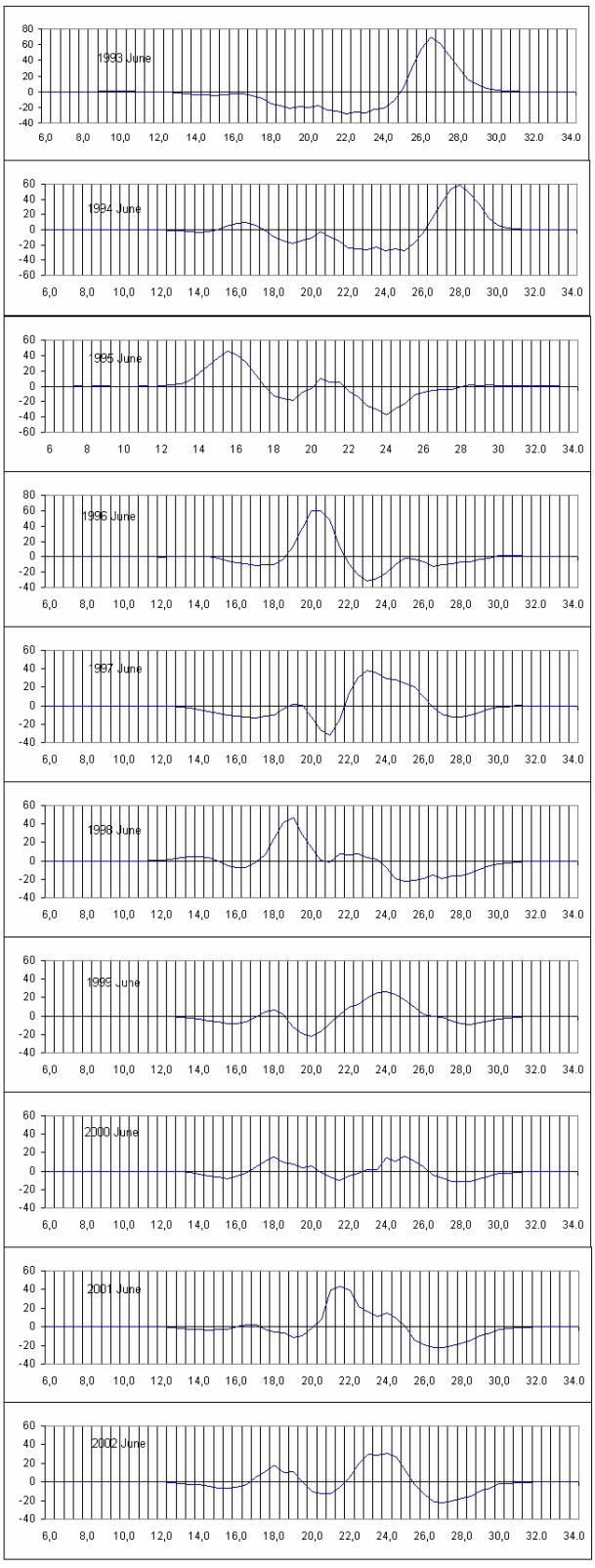


Fig 22. The deviations of length frequencies of northern shrimp by years in June on the Flemish Cap from the mean length frequency of the years 1993-2002 in the same month. 1993 through 1995 are data of Canada and other countries. Since 1996, data are solely from Iceland.

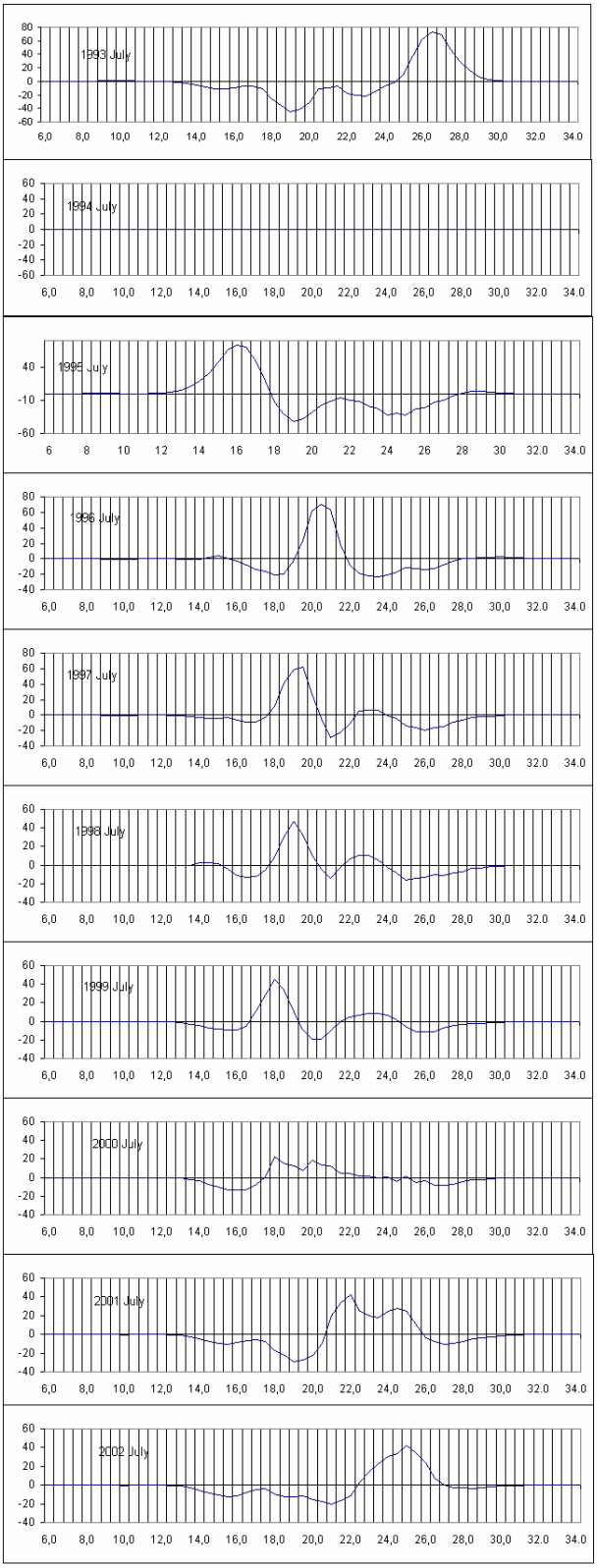


Fig 23. The deviations of length frequencies of northern shrimp by years in July on the Flemish Cap from the mean length frequency of the years 1993-2002 in the same month. 1993 through 1995 are data of Canada and other countries. Since 1996, data are solely from Iceland.

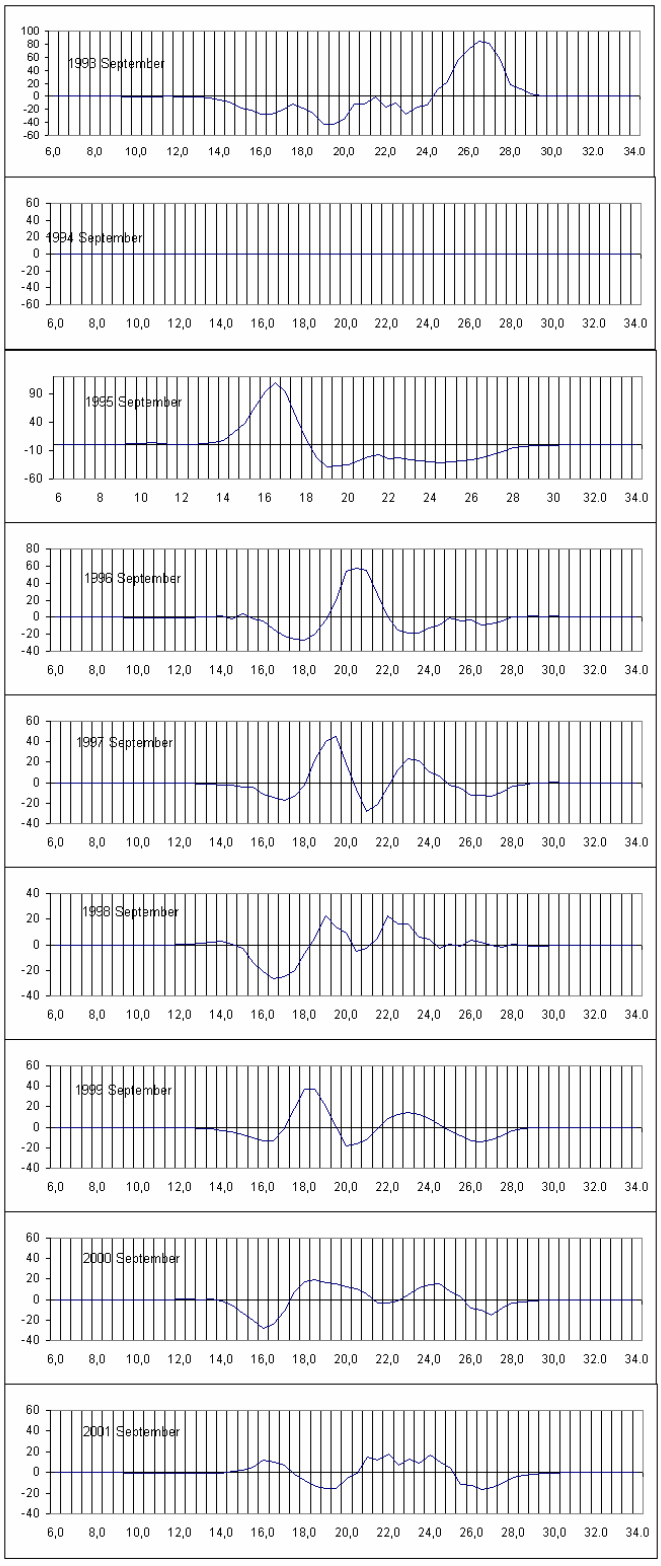


Fig 24. The deviations of length frequencies of northern shrimp by years in September on the Flemish Cap from the mean length frequency of the years 1993-2001 in the same month. 1993 through 1995 are data of Canada and other countries. Since 1996, data are solely from Iceland.

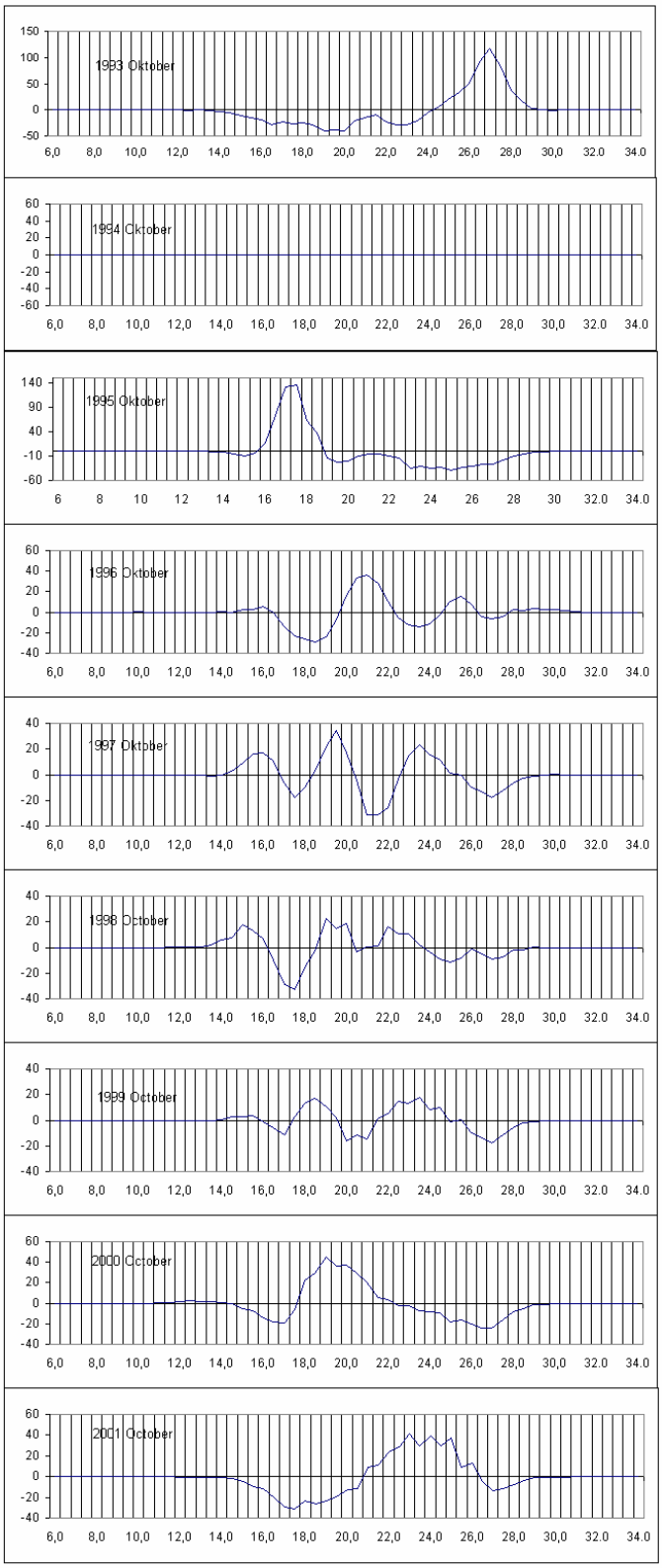


Fig 25. The deviations of length frequencies of northern shrimp by years in Oktober on the Flemish Cap from the mean length frequency of the years 1993-2001 in the same month. 1993 through 1995 are data of Canada and other countries. Since 1996, data are solely from Iceland