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Age Structure of Northern Shrimp in Division 3M in September–November 1993 and in Division 3L in March 1994

by

Árni Nicolajsen

Fisheries Laboratory, Fiskirannsóknarstovan
Nóatún, Tórshavn, Faroe Islands

Introduction

Since fishery for northern shrimp began on Flemish Cap (Div 3M) around May 1993 several attempt have been made to assess the age structure of this stock, see *e.g.* Aschan (1993), Parsons & Veitch (1993), Skúladóttir and Einarson (1993).

Material and method

Biological samples were provided by Faroese commercial shrimp vessels in the period Sep - Nov 1993 and by a Faroese observers program in Mar 1994. Sampling stations are shown in Fig. 1. The 12 samples with 2734 shrimps were investigated for sex and maturity according to methods described by Rasmussen (1953), Allen (1957) and McCrary (1971) were analysed grouped by month and areas, Tab. 1 and Fig 2.

Modal analysis (MacDonnald and Pitcher, 1979) was made for length distributions of males, females with sternal spines including intermediates, and females without sternal spines using the MIX program.

Results

The results from the modal analysis are presented in Tabs. 2, 3 and 4. The proportion in the stock is calculated and shown in Tab. 5.

On Flemish Cap age group 5 is dominant in the population and age group 4 seems to be weak. The younger age groups are about a third of age group 5 but are of course not fully recruited.

In Div 3L the catches consist allmost entirely of two age group *viz.* 3 and 4. Age group 3 is dominant with well over half the number in the catches.

Reference

Allen, J.A. 1959. On the biology of Pandalus borealis Kröyer, with reference to a population off the Northhumberland coast. J.Mar. Biol. Assoc. U.K. 38: 189-220.

Aschan, M., 1993. Report on size and sex distribution of Deep-water Prawn *Pandalus borealis* sampled at Flemish Cap, July 1993. NAFO SC working paper 93/45.

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

Parsons, D.G. and P.J.Veitch, 1993. Age and growth of northern shrimp (*Pandalus borealis*) on Flemish Cap (NAFO Division 3M). NAFO SC working paper 93/112.

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

Skúladóttir, U. and S.Einarson, 1993. The Icelandic shrimp (*Pandalus borealis)* fishery at the Flemish Cap in 1993, with a preliminary analysis of the age structure. NAFO SCR Doc. 93/101.

Table 1 OCL distributions for different sex and maturity stages group by area and month. The three rightmost columns are summations used in the figures.

Div	Year Mon	Cpx mm	Male	Inter-mediate	Female +sternal spines	Female -sternal spines	Female +headroe +sternal spines	Female +headroe -sternal spines	Female with eggs -eyespots	Female with eggs +eyespots	Female +headroe +eggs +eyespots	FEMALE WITH STERNAL SPINES	FEMALE WITHOUT STERNAL SPINES	TOTAL
3M	1993 Sep	11.5	1											1
		12.0												
		12.5												
		13.0												
		13.5												
		14.0												
		14.5												
		15.0												
		15.5	4											4
		16.0	7											7
		16.5	12											12
		17.0	20											20
		17.5	30											30
		18.0	27											27
		18.5	19											19
		19.0	7											7
		19.5	8											8
		20.0	26											26
		20.5	52											52
		21.0	56	1					1				1	58
		21.5	61	1					2				2	64
		22.0	35						1				1	36
		22.5	27		1				5			1	5	33
		23.0	7	1					1				1	9
		23.5	14			2			4				6	20
		24.0	18						7				7	25
		24.5	25	2	3	2			22			3	24	54
		25.0	23	1		2		3	41				46	70
		25.5	11	1		1	1	4	91			1	96	109
		26.0	6	4	1		7	7	99			8	106	124
		26.5	6				4	11	113			4	124	134
		27.0					5	20	100			5	120	125
		27.5					5	10	71			5	81	86
		28.0						5	24				29	29
		28.5						4	15				19	19
		29.0						1	6				7	7
		29.5						2	1				3	3
		30.0							1				1	1
			502	11	5	7	22	67	605			27	679	1219

Div	Year Mon	Cpx mm	Male	Inter-mediate	Female +sternal spines	Female -sternal spines	Female +headroe +sternal spines	Female +headroe -sternal spines	Female with eggs -eyespots	Female with eggs +eyespots	Female +headroe +eggs +eyespots	FEMALE WITH STERNAL SPINES	FEMALE WITHOUT STERNAL SPINES	TOTAL
3M	1993 Oct	15.5	1											1
		16.0	5											5
		16.5	2											2
		17.0	15											15
		17.5	13											13
		18.0	13											13
		18.5	9											9
		19.0	3											3
		19.5	1											1
		20.0	5											5
		20.5	17											17
		21.0	29											29
		21.5	27						1				1	28
		22.0	19						1				1	20
		22.5	8											8
		23.0	3	2					2				2	7
		23.5	9						1				1	10
		24.0	18	1					3				3	22
		24.5	18						10				10	28
		25.0	19	1					20				20	40
		25.5	10						34				34	44
		26.0	13						43				43	56
		26.5	7	1		2			71				73	81
		27.0	2	1					94				94	97
		27.5	1						66				66	67
		28.0							32				32	32
		28.5							16				16	16
		29.0							3				3	3
		29.5							1				1	1
		30.0												
		30.5							1				1	1
			267	6		2			399				401	674

Table 1 OCL distributions for different sex and maturity stages group by area and month. The three rightmost columns are summations used in the figures. (Continued).

Div	Year Mon	Cpx mm	Male	Inter-mediate	Female +sternal spines	Female -sternal spines	Female +headroe +sternal spines	Female +headroe -sternal spines	Female with eggs -eyespots	Female with eggs +eyespots	Female +headroe +eggs +eyespots	FEMALE WITH STERNAL SPINES	FEMALE WITHOUT STERNAL SPINES	TOTAL
3M	1993 Nov	16.5	5											5
		17.0	9											9
		17.5	12											12
		18.0	15											15
		18.5	27											27
		19.0	15											15
		19.5	10											10
		20.0	3											3
		20.5	7											7
		21.0	5											5
		21.5	10		1							1		11
		22.0	12	3										15
		22.5	1	2										3
		23.0	5	3		1							1	9
		23.5	3	4	2					1		2	1	10
		24.0	2	1					1				1	4
		24.5	4	2	2				2			2	2	10
		25.0	4	2	3				16			3	16	25
		25.5	6		5				24			5	24	35
		26.0	3		2	1			18			2	19	24
		26.5	2	2	1				29			1	29	34
		27.0							26				26	26
		27.5							23				23	23
		28.0							23				23	23
		28.5							6				6	6
		29.0							5				5	5
		29.5							1				1	1
			160	19	16	2			174	1		16	177	372

Div	Year Mon	Cpx mm	Male	Inter-mediate	Female +sternal spines	Female -sternal spines	Female +headroe +sternal spines	Female +headroe -sternal spines	Female with eggs -eyespots	Female with eggs +eyespots	Female +headroe +eggs +eyespots	FEMALE WITH STERNAL SPINES	FEMALE WITHOUT STERNAL SPINES	TOTAL
3L	1994 Mar	12.5	1											1
		13.0												
		13.5												
		14.0	1											1
		14.5												
		15.0												
		15.5	1											1
		16.0												
		16.5	2											2
		17.0	4											4
		17.5	6											6
		18.0	3											3
		18.5	7											7
		19.0	2											2
		19.5	2											2
		20.0	18											18
		20.5	26											26
		21.0	20	1	1							1		22
		21.5	28	3	1							1		32
		22.0	23	1	3							3		27
		22.5	17	4	6				2			6	2	29
		23.0	16	10	21				6			21	6	53
		23.5												
		24.0	3	5	19				7			19	7	34
		24.5	1	4	14				5			14	5	24
		25.0			9	1			11			9	12	21
		25.5			10	2			15			10	17	27
		26.0			7	3			19			7	22	29
		26.5			3	2			17			3	19	22
		27.0			3	1			22			3	23	26
		27.5							18				18	18
		28.0			2				11			2	11	13
		28.5			1				9			1	9	10
		29.0							5				5	5
		29.5							4				4	4
		30.5												
			181	28	100	9			151			100	160	469

Table 2

Northern shrimp on Flemish Cap (Div 3M) in 1993 and th Nose of the Bank (Div 3L).
Age structure derived from component analysis by the MIX program
Proportions and their standard errors.

Age group		1		2		3		4		5		No of				war-
Parameters		Prop.	S.E.	Prop.	S.E.	Prop.	S.E.	Prop.	S.E.	Prop.	S.E.	iter.	D.F.	Chi2	p	ning
Month	Sex															
3M 1993																
SEP	Males			0,254	0,021	0,530	0,027	0,216	0,022			1	14	12,72	0.549	no
	Fem+SS					0,105	0,059			0,895	0,059	43	8	18,38	0,019	yes
	Fem-SS					0,019	0,006			0,981	0,004	5	14	15,13	0,369	no
OCT	Males			0,231	0,026	0,387	0,032	0,382	0,032			13	16	13,96	0,602	no
	Fem+SS	not enough data														
	Fem-SS					0,014	0,007			0,986	0,007	15	14	22,32	0,072	yes
NOV	Males			0,604	0,047	0,254	0,051	0,142	0,033			1	12	16,26	0,180	no
	Fem+SS					0,449	0,239	0,551	0,239			500	5	5,50	0,358	no
	Fem-SS									1,000	Fixed	4	11	15,77	0,150	no
3L 1994																
MAR	Males	0,011	0,008	0,125	0,032	0,864	0,032					67	17	34,49	0,007	yes
	Fem+SS	Data are smoothed				0,844	0,164	0,156	0,164			22	11	3,11	0,989	no
	Fem-SS					0,053	0,032	0,947	0,032			6	12	15,36	0,222	no

Table 3

Northern shrimp on Flemish Cap (Div 3M) in 1993 and th Nose of the Bank (Div 3L).
Age structure derived from component analysis by the MIX program
Means and their standard errors.

Age group		1		2		3		4		5		No of				war-
Parameters		Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.	iter.	D.F.	Chi2	p	ning
Month	Sex															
3M 1993																
SEP	Males			17,55	0,099	21,18	0,063	24,60	0,131			1	14	12,72	0.549	no
	Fem+SS					21,94	0,733			26,19	0,194	43	8	18,38	0,019	yes
	Fem-SS					22,49	0,369			26,44	0,042	5	14	15,13	0,369	no
OCT	Males			17,54	0,115	21,27	0,075	24,83	0,125			13	16	13,96	0,602	no
	Fem+SS	not enough data														
	Fem-SS					22,79	0,519			26,74	0,051	15	14	22,32	0,072	yes
NOV	Males			18,30	0,124	21,69	0,211	25,11	0,277			1	12	16,26	0,180	no
	Fem+SS					22,95	0,611	25,32	0,517			500	5	5,50	0,358	no
	Fem-SS									26,66	0,088	4	11	15,77	0,150	no
3L 1994																
MAR	Males	13,18	0,519	17,65	0,305	21,43	0,103					67	17	34,49	0,007	yes
	Fem+SS	Data are smoothed				23,68	0,305	25,84	0,877			22	11	3,11	0,989	no
	Fem-SS					23,50	Fixed	26,50	Fixed			6	12	15,36	0,222	no

Table 4

Northern shrimp on Flemish Cap (Div 3M) in 1993 and th Nose of the Bank (Div 3L).
Age structure derived from component analysis by the MIX program
Sigmas and their standard errors.

Age group		1		2		3		4		5		No of				war-
Parameters		Sigma	S.E.	Sigma	S.E.	Sigma	S.E.	Sigma	S.E.	Sigma	S.E.	iter.	D.F.	Chi2	p	ning
Month	Sex															
3M 1993																
SEP	Males			0,891	0,080	0,809	0,061	0,944	0,105			1	14	12,72	0.549	no
	Fem+SS					1,012	0,758			1,014	0,174	43	8	18,38	0,019	yes
	Fem-SS					0,885	0,028			1,040	0,0393 *	5	14	15,13	0,369	no
OCT	Males			0,833	0,091	0,638	0,066	1,054	0,101			13	16	13,96	0,602	no
	Fem+SS	not enough data										0	0	0,00	0,000	
	Fem-SS					0,844	0,035			0,991	0,0371 *	15	14	22,32	0,072	yes
NOV	Males			0,918	0,101	0,873	0,236	0,896	0,236			1	12	16,26	0,180	no
	Fem+SS					0,827	0,387	0,833	0,366			500	5	5,50	0,358	no
	Fem-SS									1,165	0,064	4	11	15,77	0,150	no
3L 1994																
MAR	Males	0,665	0,152	0,890	0,050 *	1,086	0,082					67	17	34,49	0,007	yes
	Fem+SS	Data are smoothed				1,228	0,170	1,341	0,052 *			22	11	3,11	0,989	no
	Fem-SS					1,232	0,095	1,390	0,052 *			6	12	15,36	0,222	no

* = Constant coef. of var.

Table 5

Northern shrimp on Flemish Cap (Div 3M) in 1993 and th Nose of the Bank (Div 3L).
Age structure derived from component analysis by the MIX program
Proportions.

Age group		1	2	3	4	5	Total prop.
Month	Sex						
3M 1993							
SEP	Males	0,000	0,105	0,218	0,089	0,000	0,412
	Fem+SS	0,000	0,000	0,003	0,000	0,028	0,031
	Fem-SS	0,000	0,000	0,011	0,000	0,546	0,557
	TOTAL	0,000	0,105	0,232	0,089	0,574	1,000
OCT	Males	0,000	0,092	0,153	0,151	0,000	0,396
	Fem+SS						
	Fem-SS	0,000	0,000	0,008	0,000	0,595	0,604
	TOTAL	0,000	0,092	0,162	0,151	0,595	1,000
NOV	Males	0,000	0,260	0,109	0,061	0,000	0,430
	Fem+SS	0,000	0,000	0,042	0,052	0,000	0,094
	Fem-SS	0,000	0,000	0,000	0,000	0,476	0,476
	TOTAL	0,000	0,260	0,151	0,113	0,476	1,000
3L 1994							
MAR	Males	0,004	0,048	0,333	0,000	0,000	0,386
	Fem+SS		0,000	0,230	0,043	0,000	0,273
	Fem-SS	0,000	0,000	0,018	0,323	0,000	0,341
	TOTAL	0,004	0,048	0,582	0,366	0,000	1,000

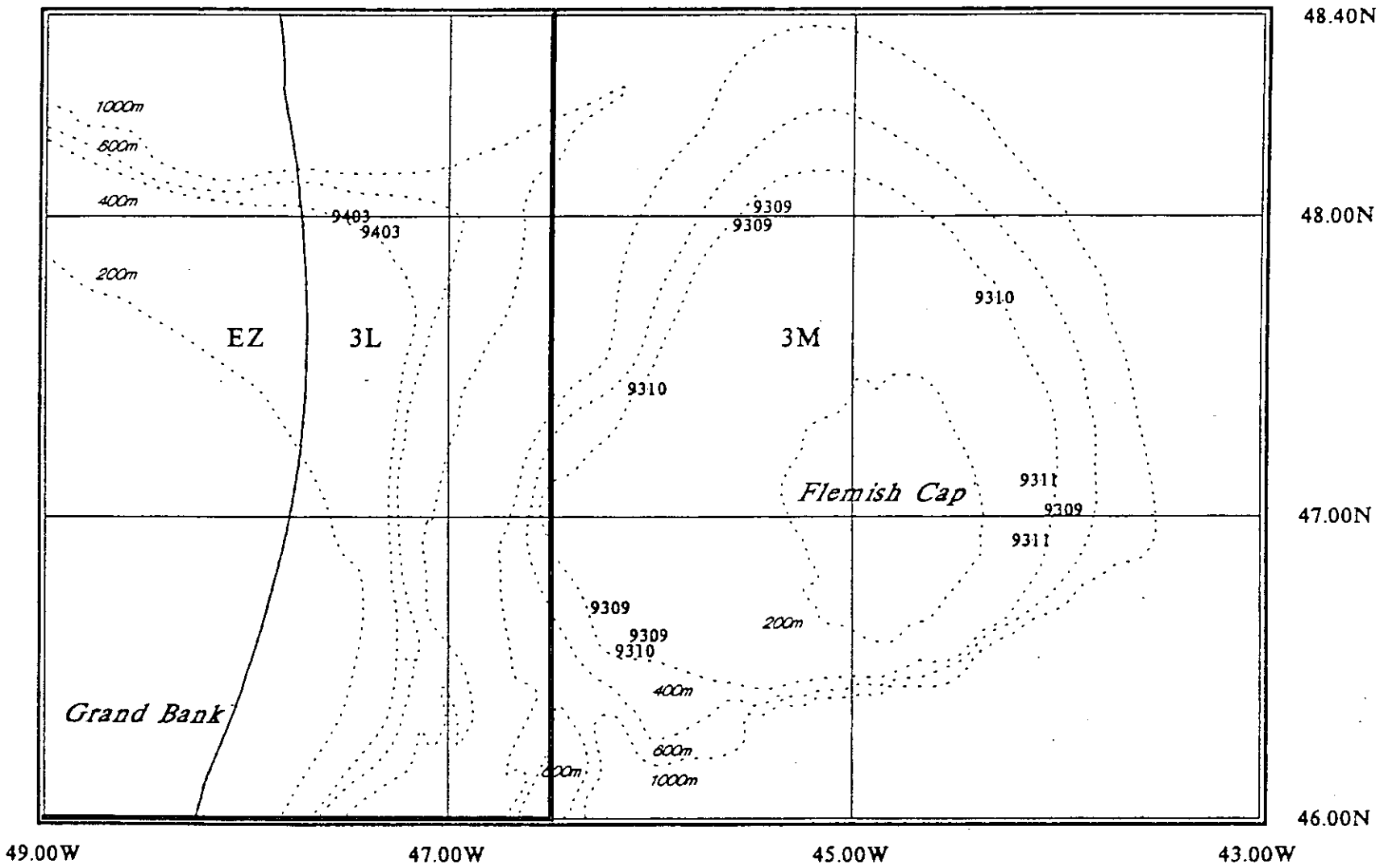

Figure 1 Geographical distribution of 12 biological samples taken in the period Sep 1993 -Mar 1994, indicated by year and month number.

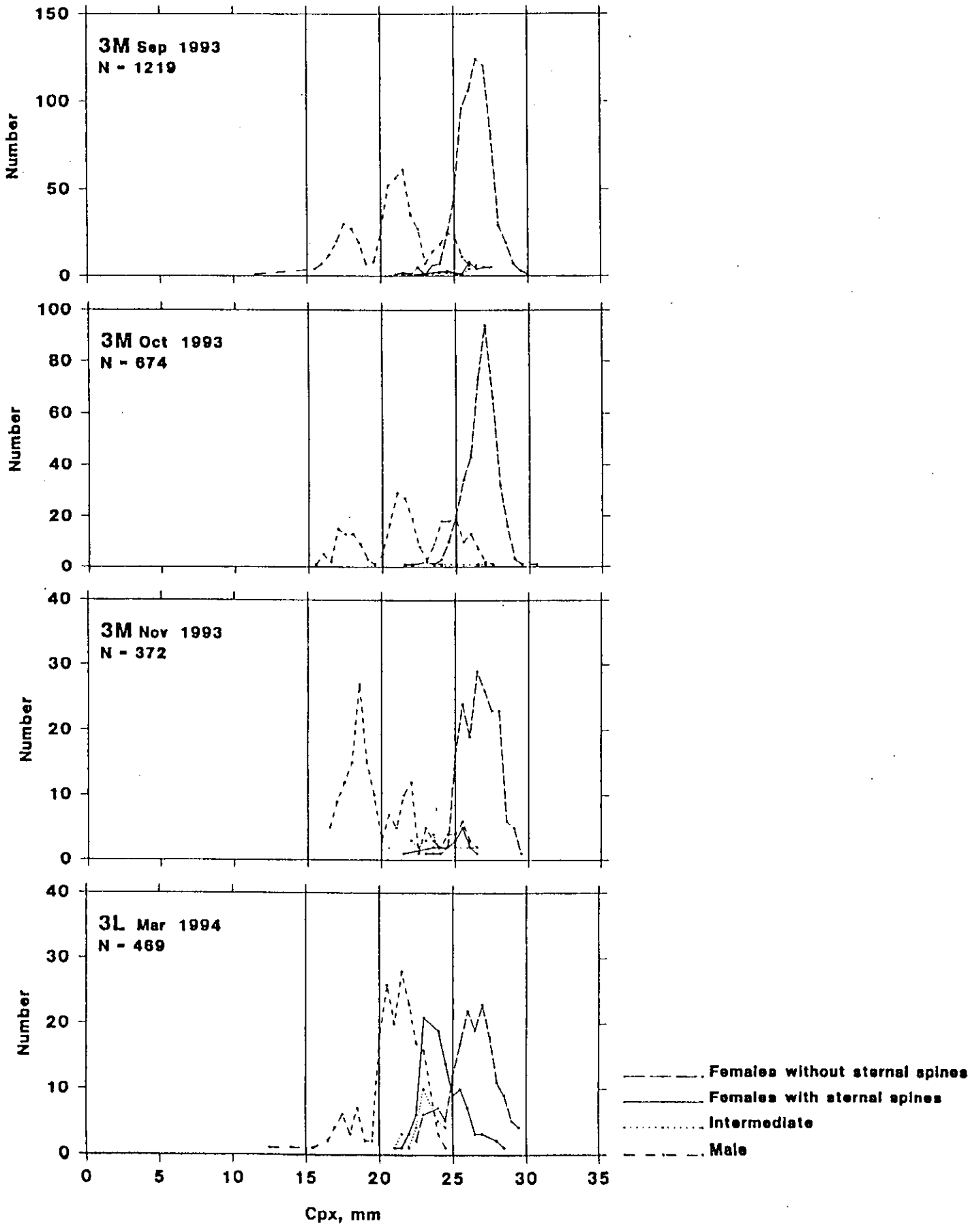

Figure 2 OCL distribution of different sex and maturity groups in Div 3M Sep - Nov 1993 and Div 3L Mar 1994.