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The age composition and proportion of males and females in the commercial catches of shrimp (*Pandalus borealis* Kr.) at Flemish Cap in 1993-1998

by

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Abstract

In this paper several indices, where biological samples from Canada and biological samples from Iceland are combined with CPUE of Icelandic fishery on one hand and standardized international CPUE on the other.

Introduction

The fishery was some 24-33 thousand tons of all fleets in the years 1993-1995 to increase in 1996 to 49 thousand tons. The EU has been carrying out at bottom trawl survey with a small mesh (35 mm) cod-end since the year 1988 at the Flemish Cap (Rio and Sainza, 1997). Apart from the indices that can be calculated from the EU surveys of males and females, there is need for other indices that may give information on status of stock. Here the biological samples from the fishery if turned into number in age groups per trawling hour or better still kg per trawling hour of age groups can give additional information on the number in each age group in the sea.

Results of age analysis of Canada and Iceland are used to form CPUEs by age groups. These indices of males and females are then compared.

Materials and Methods

For calculating the indices of numbers in the stock at Flemish Cap, the total number per age group, male or female was calculated by using the results from the modal analysis (Macdonald and Pitcher, 1979) on the length distributions of males, primiparous and multiparous females respectively of the Canadian data for 1993-1995 (Parsons and Veitch 1996). As the Canadian samples were only published as yearly results and there was need to turn these into number per hour of each age group, length/weight relations ships were chosen to be the ones for the month april, from Skúladóttir (1997) namely the two following equations for the years 1993-1995:

For males and primiparous females: $\ln y = 3.037 * \ln x - 7.549$

For multiparous females: $\ln y = 2.778 * \ln x - 6.689$

These equations were applied in the following manner: Mean length at age was turned into weight at age for the years 1993-1995 (Table 2).

In the case of the samples for the years 1996 through 1998 however the samples were compiled by months and run through the modal analysis proportions and mean lengths were presented by months using the respective weigth/length relationships per month (Skúladóttir, 1997). Thus the average mean lengths and proportions were then weighted by catch in the months January- July each year to get average mean length at age and average proportion for the afore

mentioned period. The sum of weight at age times proportion in each age and sex class was divided into the CPUE per year so as to get CPUE of each age class (table 4).

The indices of males and females

Number per trawling hour should be proportional to the number in stock if the coverage of samples is sufficient and there is no change in gear technology. The coverage of Canadian samples in 1993 to 1995 was quite good and age asessment had already been carried out, so the proportions of age classes of those years were taken from Parsons and Veitch (1996). The multiparous group was not age asessed but all the mutiparous females were assumed to be of age 6. In 1996 and 1997 there were many shrimp measured by Iceland, with very good coverage both spatially and temporally (Skúladóttir, 1997). Therefore samples for the years 1996 and 1997 were taken solely from the Icelandic database. In 1998 an international database was initiated with data from Iceland and Canada. Modal analysis (Macdonald and Pitcher, 1979) was carried out on all these data.

Table 1 shows the proportions every year and the strength of a year-class can be valuated somewhat from the proportions. In 1996 the no./hr. was quite high for 3 year olds, the presumed 1993 year class. In retrospect the 1994 year class was also rather strong. A very small proportion of 3 year olds (4.8%, primiparous + multiparous females) changed sex and spawned in 1996 (Table 1). About half of what is left of the 1993 year class changed sex at the age class 4 and spawned for the first time in August 1997. The same was true for the 1994 year-class that about half of it changed sex at the age of 4 (Table 1). Then the rest of the 1993 year class will change sex in the winter 1997/98. On the whole, the age of sex change is lower in 1995 and 1996 as compared to the years 1993 and 1994 (Parsons, 1997).

The catch per trawling hour of males on one hand and females on the other are presented where two types of CPUEs are applied, namely the standarized CPUE of several nations (Parsons, 1998) and unstandardized CPUE of Iceland for the period January -July (Skúladóttir, 1998) (tables 4 and 5). There is a great drop in CPUE. of females between 1993 and 1994 for both CPUE rates. After that the CPUE has been rather stable for the standardized catch rate but slightly declining for the unstandardized catch rate for Iceland to increase slightly in 1998 for both rates (Fig. 1).

The catch rates of males has been slightly different in the beginning of the period where the standardized catch rate decreased between 1993 and 1994 but the unstandardized first declined after 1995 to 1997 to increase again in 1998 (Fig. 1). The situation of females is perhabs misleading due to the sex change taking place one year earlier in 1995 and 1996 than in the previous two years with the result that the females do not seem to go much down in weight.

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Table 1. Proportional split of catches into age and sex groups each year (January-July).

	Age	1993	1994	1995	1996	1997	1998
Males	1	0.0041					
Males	2	0.1148	0.1817	0.4516	0.0425	0.0147	0.0469
Males	3	0.2146	0.3629	0.2714	0.5886	0.2623	0.3698
Males	4	0.1156	0.0854			0.2895	0.2018
Primip.	3				0.0430		
Primip.	4			0.0507	0.1795	0.2930	0.1946
Primip.	5	0.2619	0.1944	0.0962			0.0233
Multip.	3				0.0059		0.0052
Multip.	4				0.0474	0.0163	
Multip.	5				0.0638	0.1072	0.0829
Multip.	6	0.2890	0.1756	0.1301	0.0326	0.0135	0.0739
Multip.	7					0.0090	0.0010
Total		1.0	1.0	1.0	1.0	1.0	1.0

Table 2. Mean weight (g) at age in catches by sex groups in each year (January-July).

	Age	1993	1994	1995	1996	1997	1998
Males	1	0.646					
Males	2	2.772	2.576	1.965	1.743	2.158	1.5770
Males	3	5.225	4.998	4.924	4.685	4.099	3.6770
Males	4	8.188	7.101			6.604	5.4770
Primip.	3				5.813		
Primip.	4			6.462	9.001	8.610	7.2240
Primip.	5	10.441	10.080	9.611			10.2710
Multip.	3				6.422		4.9790
Multip.	4				8.418	8.243	
Multip.	5				11.330	10.409	9.0110
Multip.	6	11.189	11.664	10.840	14.290	13.842	10.8170
Multip.	7					14.719	14.8740

Table 3. Proportions of each sex by numbers.

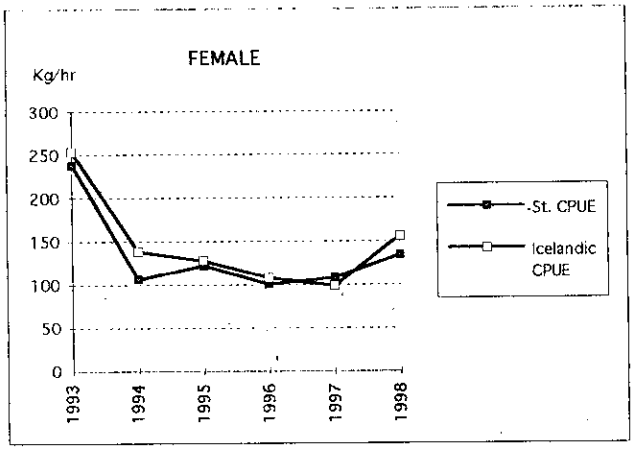
	1993	1994	1995	1996	1997	1998
Males	0.45	0.63	0.72	0.63	0.57	0.62
Females	0.55	0.37	0.28	0.37	0.44	0.38

Table 4. Sex- disaggreggated indices of abundance from Icelandic and Canadian samples. Using standarized CPUE.

	1993	1994	1995	1996	1997	1998
Males	95.2	77.1	102.4	81.5	80.3	105.3
Females	237.8	106.9	122.6	100.5	108.7	134.7
Total	333.0	184.0	225.0	182.0	189.0	240.0

Table 5. Sex- disaggreggated indices of abundance from Icelandic and Canadian samples. Using unstandarized CPUE of Iceland for the January- July period..

	1993	1994	1995	1996	1997	1998
Males	101.5	100.1	107.1	87.7	73.1	122.3
Females	253.5	138.9	128.3	108.2	99.0	156.5
Total	355.0	239.0	235.4	195.9	172.1	278.8



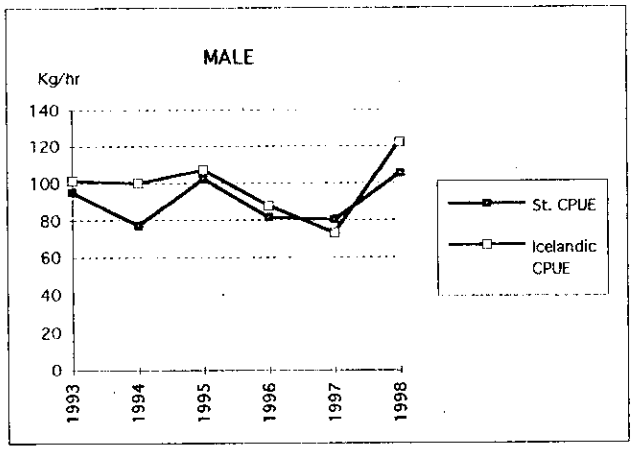


Fig. 1. Shrimp in Div 3M: upper panel, female index from Icelandic CPUE data and standardized CPUE index, lower panel, male index from Icelandic CPUE data and standardized CPUE index.