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Indices of Female Biomass of Shrimp (*Pandalus borealis* Kr.) at the Flemish Cap

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 51 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 Sainsa, 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 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 of the Canadian data for 1993-1995 and Icelandic data of 1996 and 1997. In order to get the 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 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 (Table 1). In the case of the Icelandic samples for the years 1996 and 1997 the proportions and mean lengths were presented by months. Thus the average mean lengths and proportions were first weigted 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 3).

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. 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 (1996). In 1996 and 1997 there were many shrimp measured by Iceland in 1996 and 1997, with very good coverage both spatially and temporally (Skúladóttir, 1997). Therefore samples for the last two years were taken solely from the Icelandic database. Age assessment had been carried out already by Canada for the years 1993-1996 using modal analysis (Macdonald and Pitcher, 1979) on the length distributions of males, primiparous and multiparous females respectively (Parsons and Veitch, 1996). Modal analysis was done on the Icelandic data of the years 1996 and 1997 (Skúladóttir, 1997).

In 1996 the no./hr. was quite high for 3 year olds, the presumed 1993 year class. 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 (proportion was 31%, Table 1). Then the rest of the 1993 year class will change sex in the winter 1997/98. Thus as is common with a strong year class its members change sex at different times, or in this case over 3 years. On the whole the age of sex change is lower in 1996 and 1997 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 in table 3 where two types of CPUEs are applied, namely the standarized CPUE of several nations (Parsons, 1997) and unstandardized CPUE of Iceland for the period January -July (Skúladóttir, 1997). The kg/hr. of females has dropped between 1993 and 1994. After that the kg/hr. has been rather stable for the standardized catch rate but slightly declining for the unstandardized catch rate for Iceland (Fig. 1).

CPUE of males has been slightly fluctuating as shown by the standardized catch rate but declining since 1995 as judged by the unstandardized catch rate for Iceland (Fig. 2). The situation of females is perhabs misleading due to the sex change taking place one year earlier in 1996 and 1997 than in the previous three years, with the result that the females do not seem to go much down in numbers, where as the males do to some extent, using the unstandardized catch rate of Iceland. However the mean weight of females has gone down from 10.83 g in 1993 an 1994 to 9.32 g in 1997 (table 2).

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Table 1. Proportional split of catches into age and sex groups in each year

		93	94	95	96	97
Males	1	0.0041				
Males	2	0.1148	0.1817	0.4516	0.0425	0.0147
Males	3	0.2146	0.3629	0.2714	0.5886	0.2623
Males	4	0.1156	0.0854			0.2895
Primip.	3				0.043	
Primip.	4			0.0507	0.1795	0.293
Primip.	5	0.2619	0.1944	0.0962		
Multip	3				0.0059	
Multip	4				0.0474	0.0163
Multip	5				0.0638	0.1072
Multip	6	0.289	0.1756	0.1301	0.0326	0.0135
Multip	7					0.009
Total		1	1	1	1	1

Table 2. Mean weight at age in catches by age and sex groups in each year

		93	94	95	96	97
Males	1	0.646				
Males	2	2.772	2.576	1.965	1.743	2.158
Males	3	5.225	4.998	4.924	4.685	4.099
Males	4	8.188	7.101			6.604
Primip.	3				5.813	
Primip.	4			6.462	9.001	8.610
Primip.	5	10.441	10.080	9.611		
Multip	3				6.422	
Multip	4				8.418	8.243
Multip	5				11.330	10.409
Multip	6	11.189	11.664	10.840	14.290	13.842
Multip	7					14.719
Male mean wt		5.319	4.585	3.076	4.487	5.329
Fem. mean wt		10.833	10.832	9.612	9.380	9.322
Total mean wt		8.357	6.896	4.886	6.323	7.111
Proportions of each sex		93	94	95	96	97
Males		0.45	0.63	0.72	0.63	0.57
Females		0.55	0.37	0.28	0.37	0.44

Table 3. Sex-disaggregated biomass indices of abundance.

Standardized CPUE by sex	93	94	95	96	97
Males	95.2	78.4	104.8	82.3	85.3
Females	237.8	108.8	125.5	101.4	115.6
Total	333.0	187.1	230.3	183.7	200.8
Iceland CPUE by sex					
Males	101.5	100.1	107.1	87.7	66.4
Females	253.5	138.9	128.3	108.2	89.9
Total	355.0	239.0	235.4	195.9	156.3

Figure 1. Female biomass index from Icelandic CPUE data and standardized CPUE index.

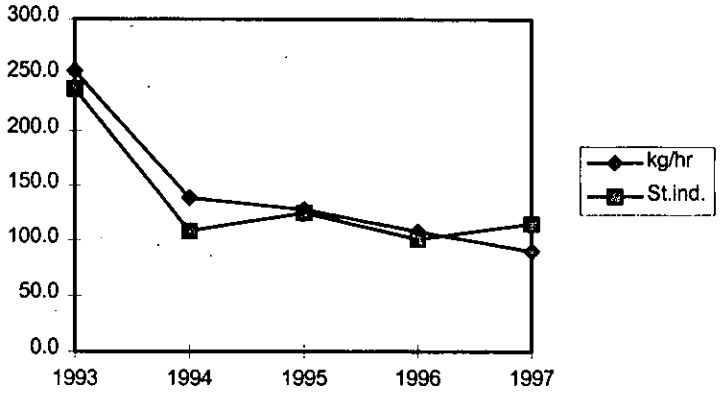

Figure 2. Male biomass index from Icelandic CPUE data and standardized CPUE index.