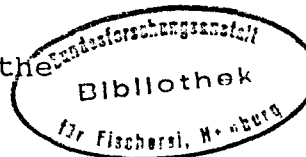


International Council for the
Exploration of the Sea



CM 1995/K:29
Shellfish Committee

SOME PECULIARITIES OF REPRODUCTION OF KING CRAB

PARALITHODES CAMTSCHATICA (TIL.)

IN THE BARENTS SEA

by

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ABSTRACT

On the basis of 1993-1994 data, minimum and maximum size of berried females was determined as well as limits of variation of absolute and relative individual fecundity of king crab in the Barents Sea were defined.

Parameters of equation of relation between absolute individual fecundity and width of carapace of females were identified both in the Barents Sea and in the natural area of king crab habitation in the Pacific Ocean. Preliminary results of the comparative analysis of those parameters show that habitat conditions of king crab in the Barents Sea are not extreme.

INTRODUCTION

Introduction of king crab Paralithodes camtschatica (Til.) in the Barents Sea was mainly conducted in 1961-1969 (Orlov, 1994). Investigations of the recent years have shown an increase in abundance of king crab in the new area of habitat, appearance of strong yearclasses and expansion of their distribution area in the Barents Sea.

Some parameters characterizing successful reproduction can be considered as reliable indicators of the king crab population status. Those parameters are: age and size of maturation, absolute and relative individual fecundity, percentage of mature crabs participating in reproduction. In this paper we tried to suggest a preliminary estimation of the above parameters for the Barents Sea population of king crab.

MATERIAL AND METHODS

The present paper is based on the materials collected in Russian research cruises in August-September 1993-1994. Research harvesting of king crab in 1993 was carried out by bottom traps and in 1994 both traps and bottom trawl were used.

Crabs caught were measured for weight, length and width of carapace, width of the right claw. Sex and moulting stage were determined as well as damages of carapace and legs were registered. Stage of eggs maturity was recognized according to 4-point scale (Instruction ..., 1979).

Values of absolute and relative individual fecundity were determined for 50 females of king crab. In 1993 those investigations were conducted on fresh material during the cruise; in 1994 eggs were taken from female pleopods, fixed in 4% solution of formaldehyde and counted in the laboratory. When estimating absolute fecundity, number of eggs in two samples 500 mg each was counted. The mean number of eggs in the sample was converted to the total weight of eggs. Relative fecundity was determined as a ratio of absolute fecundity to weight of female without considering weight of eggs.

RESULTS AND DISCUSSION

Width of carapace of berried females selected for estimation of fecundity varied within 112-220 mm, weight of an egg varied from 0.52 to 0.73 mg in 1993 and from 0.53 to 0.70 mg in 1994.

Absolute individual fecundity of the individuals examined varied within the range of 76-704 thou. eggs. In the other areas of king crab habitat absolute individual fecundity varied within 43-500 thou. (The Bristol Bay) and 25-390 thou. (Alaska, the Kachemak Bay) (Kruse, 1992; Haynes, 1968).

The least length of a berried female in the Barents Sea is 93 mm. Whithin the natural area of king crab this value varies from 55 mm (northwestern Sea of Okhotsk) to 112 mm (the southern Kurile Isles) (Table 1).

To judge by an availability of external eggs, 50% of king crab females in the Barents Sea mature when 130 mm carapace width is reached (Fig. 1). Nearly all the females with carapace width more than 150 mm have external eggs which probably indicate the lack of miss of spawning. Presence of large mature females without eggs in the natural populations can also be a consequence of low abundance of males, considerable part of which is withdrawn by fishery (Otto, 1986). So far, fishery for king crab in the Barents Sea is not conducted and sex ratio in this population constitutes 1:1 according to 1993 estimation.

There is a close relation between size of females (W) and value of their absolute individual fecundity (F), which can be

expressed by equation: $F=aW^b$. The parameter a for the Barents Sea population in 1993 and 1994 constituted 0.00514 and 0.000747, respectively; the parameter b was equal to 2.53 and 2.17 (Fig. 2). Variations of those parameters observed during two years in the Barents Sea are confined to their fluctuations within the natural area of king crab in the Pacific Ocean (Table 2).

According to data by Takeuchi, year-to-year variations of parameters of equation of relation between fecundity and size of king crab females observed in the Barents Sea were also revealed in the southeastern Bering Sea (Takeuchi, 1967) and in the Kachemak Bay (Haynes, 1968). The common peculiarity of those variations is that coefficient of regression remains nearly stable. In many representatives of crustaceans orders a correlation between fecundity and intensity of energy metabolism was found (Khmeleva, 1973). Energy metabolism in its turn is closely related to habitat conditions of an individual, in particular, to temperature. Probably, year-to-year fluctuation of water temperature in areas of king crab habitat is one of the main reasons for variations of the observed individual fecundity.

According to preliminary data relative individual fecundity in the Barents Sea population reaches its maximum in females with 160-180 mm carapace width (Fig. 3). Comparative analysis of that parameter involves difficulties because in many natural populations king crab females in great numbers do not reach such size.

At present crabs from the strong yearclass appeared approximately in 1982 or 1983 constitute the bulk of spawning stock of the Barents Sea king crab population. Width of carapace of females from that yearclass in the study period constituted 120-160 mm. In 1997-1998 size of those females will reach 160-180 mm, besides, the spawning stock will be recruited with individuals from the second abundant yearclass of 1986 (1987). In case of favourable hydrographic conditions in the Barents Sea in that period, appearance of abundant yearclasses of king crab can be expected.

CONCLUSIONS

Studies of the recent years showed that after 30 years of the introduction, king crab survived in the Barents Sea, reproduced and formed self-reproducing independent population capable to the further increase of abundance.

A number of quantitative parameters we succeeded to estimate (fecundity, size of females at maturation etc.) are limited to their fluctuations within the natural area of king crab. This permits us to suggest that the Barents Sea population of king crab is not subjected to oppression usually observed along the area margins.

To judge by some parameters (maximum size of females, maximum individual fecundity) the population of king crab in the Barents

Sea reaches extremely high values. This is quite probably indicates that king crab abundance in the new area of habitat does not reach its limit and natural mechanisms restricting its increase do not act for now.

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Table 1. Length of carapace of king crab females at maturation.

Region	Carapace length, mm	Reference
Western Kamchatka	78-82	Powell and Nickerson, 1965
Sea of Nemuro (Hokkaido)	92-96	- " -
Bering Sea	86-102	- " -
Chiniak Bay	95	- " -
Bristol Bay	89	Kruse, 1992
NW Sea of Okhotsk	55	Rodin and Myasoedov, 1982
Eastern Sakhalin	93	Kochnev, Galimzyanov, 1986
Tatarsky Channel	106	- " -
Southern Kuriles	112	- " -
Barents Sea	93	Our data

Table 2. Correlation coefficient (R) and parameters of equation of relation between carapace width of king crab females (W) and their absolute individual fecundity (F).

Region	R	ln a	b	References
Alaska	0.929	-8.8	2.82	Haynes, 1968
Hokkaido	0.944	-17.23	4.48	Takeuchi, 1967
Western Kamchatka	0.949	-11.68	3.46	Rodin, 1985
Bristol Bay	0.989	-7.36	2.59	Rodin, 1985
SE Bering Sea (1955)	0.967	-10.96	3.29	Takeuchi, 1967
SE Bering Sea (1961)	0.972	-10.21	3.16	Takeuchi, 1967
Sakhalin	0.897	-4.32	1.94	Klitin, 1992
Barents Sea (1993)	0.715	-7.2	2.53	Our data
Barents Sea (1994)	0.787	-5.14	2.17	Our data

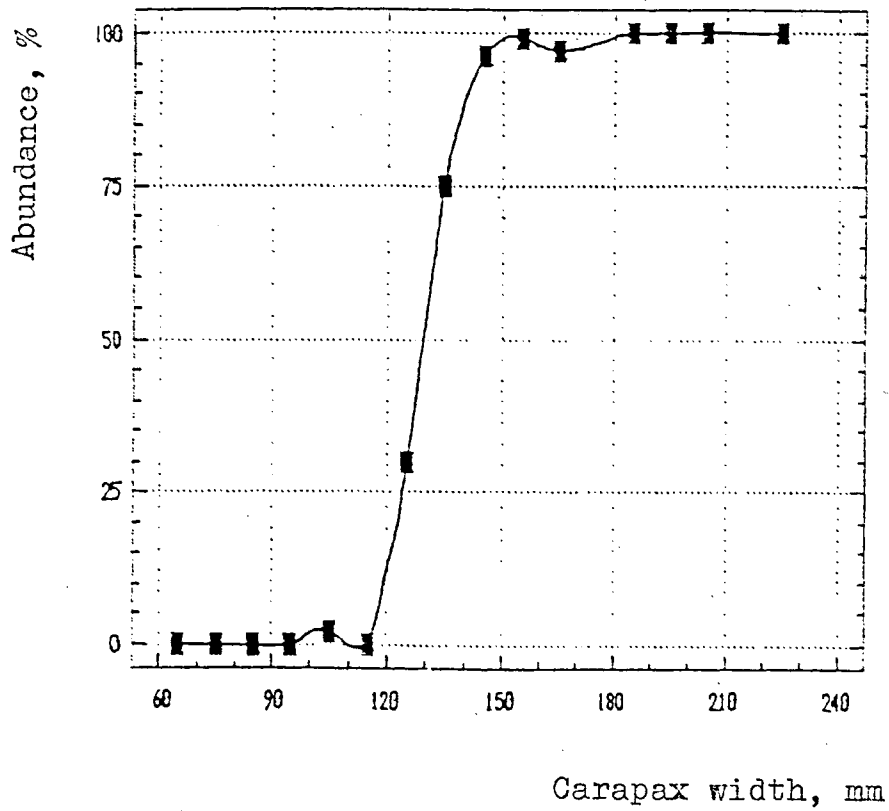


Fig. 1. Relative abundance of berried females of king crab in different size groups (Kuzmin and Olsen, 1994).

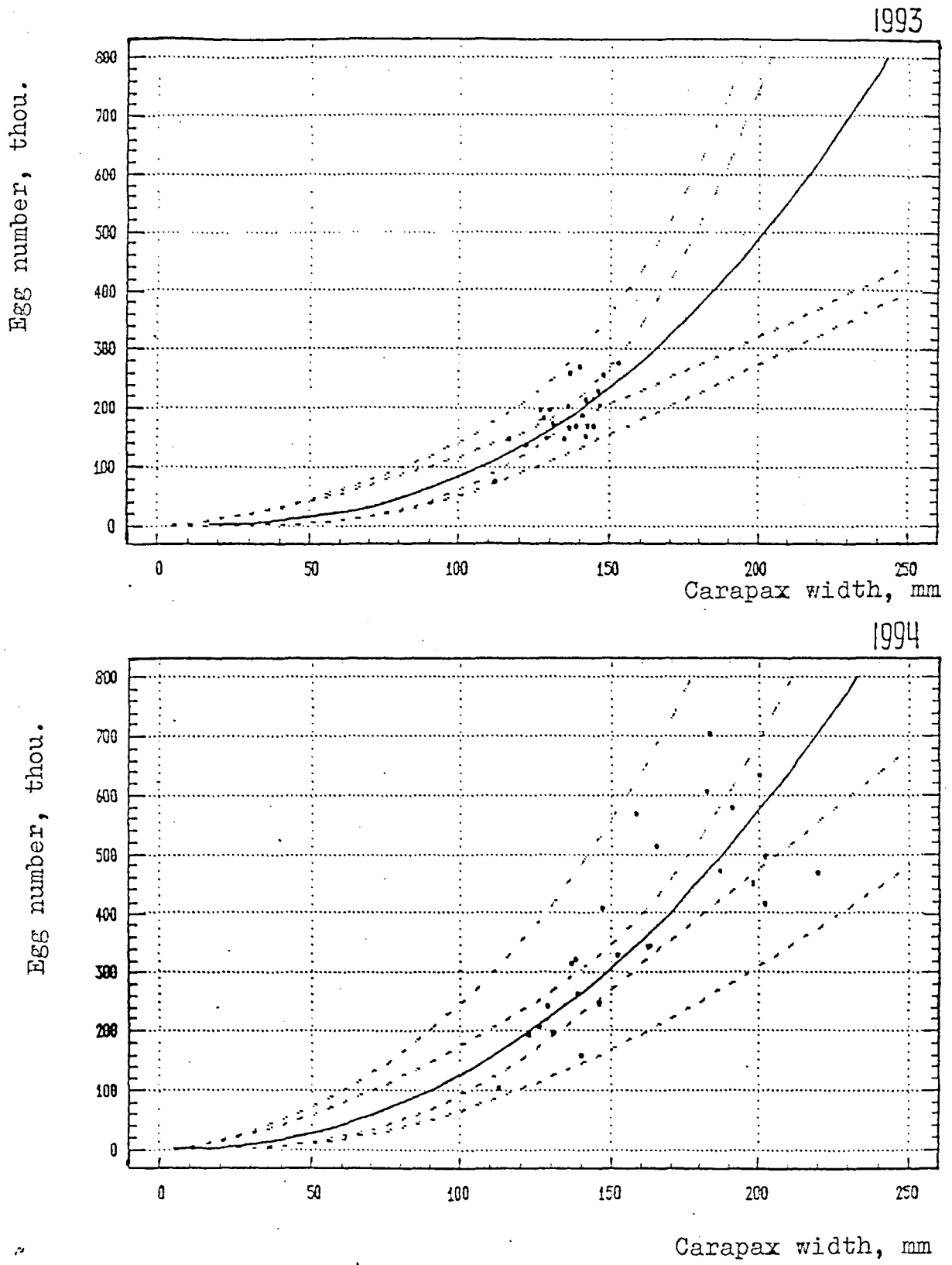


Fig. 2. Relation between size of king crab females and their absolute individual fecundity in the Barents Sea in 1993 and 1994.

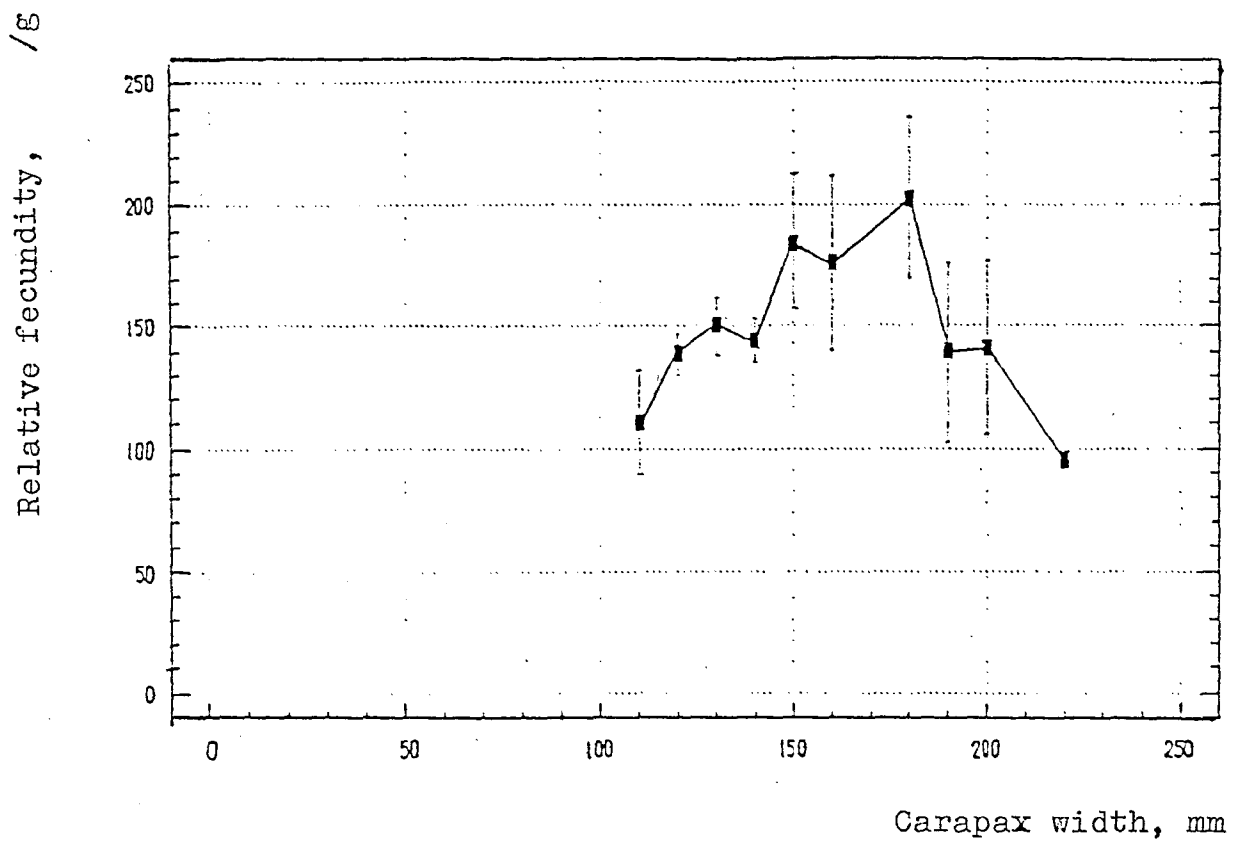


Fig. 3. Variation of relative individual fecundity of king crab females with their growth.