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BARENTS SEA KING CRAB *(Paralithodes camtschatica)* The transplantation experiments were successfull

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Abstract

As a result of the USSR tranplantation experiments, a viable, self-reproducing poulation of king crab, *(Paralithodes camtschatica),* is now well established in the Barents Sea. Commercial fishing for king crab is prohibited in both Russia and Norway, but these crabs are frequently taken as bycatches in coastal fisheries. Mature crabs are most numerous in the Varangerfjord area where experimental trap fishing by the two institutes have yielded catch rates comparable to those of recent years in the Bering Sea. The size distribution of mature Barents Sea king crabs is very similar to that of Alaska waters. The observations also suggest a similar annual vertical dsitribution as in the native North Pacific area with migrations to shallow waters for mating and moulting in winter and spring. The ecologic impact of this new element in the Barents Sea fauna cannot be evaluated on the basis of the present limited and fragmentary knowledge of the Barents sea king crab's population structure, distribution and abundance, and of its food and feeding habits.

Introduction

The first attempts of transplanting the commercially valuable king crab *Paralithodes camtschatica* (Tilesius) into the Barents Sea were carried out by USSR in the 1930-ies, but they failed because of the poor transportation facilities of that time. (Orlov and Karpevich, 1965)

Under the leadership of Prof. A. F. Karpevich of the USSR Ichtyological Commission Yu. I. Orlov prepared a new transplantation projet which was presented to and approved by the USSR Scientific Consultative Committe on the Problem of Acclimatization on March 3, 1961 (Orlov and Ivanov, 1978) Subsequently, from 1961 to1969 a large scale transplantation experiment with king crab was undertaken. About 2,500 adult specimens of the Kamchatka king crab, and 10,000 juveniles were transferred to the Barents Sea. Also king crab eggs were incubated and after hatching 1.5 million larvae were realesed into the sea. Most of the crabs used in the transplantion project were caught in Peter the Great Bay and transported in cointainers by air or railway. The locations of crab release were mainly near the Kolsky Bay. Again in 1977-78 1200 adult king krabs were transferred from the far East and released in Kolsky Bay (Sennikov 1989).

On August 3 1974 a large (18 cm carapax width, CPW) female king crab was caught in Kolsky Bay. Subsequent reports of king crab bycatches in Russian coastal waters were received almost annuallly, and from the beginning of 1990 king crab bycatches became more frequent and not only single speciemens were taken. The crabs were mainly caught in the cod trawl and longline fisheries and in scallop dredging. King crab observations were also reported by sport divers and amateur fishermen.

The first reported king crab in Norwegian waters was a 6.3 kg crab caught by halibut gillnet in 1976 in the inner part of Varangerfjord. In the 1980-ies bycatches of king crab in the Norwegian coastal fisheries gradually became more frequent. These were mainly from the winter bottom set gillnet fisheries for cod in depths over 40 fathoms, and during spring for lumpfish in shallow waters less than 15 fathoms. In recent years, sport divers have also frequently observed king crabs in the South Varanger fjords.

While in the late 1970-ies bycatches of king crab were rare, they have become more frequent in recent years. However, until 1992 they were only taken in single or small numbers. Then, in April/May 1992 gill net fishermen started to get them by the hundreds in the South Varanger fjords. Since landings and sale of king crabs are prohibited by law, this sudden bounty was just a menace to the fishermen, destroying their nets and in the worst cases effectively stopping gill net fishing on the traditional fishing grounds. Acordingly, the matter was brought to the attention of the Joint Russian-Norwegian Fisheries Commission, which at its meeting in November 1992 requester both countries to intensify and coordinate their investigations on king crab.

Russian and Norwegian king crab investigations 1992-93

In August- September 1992 PINRO carried out a three week king crab survey.(Sennikov, 1993). During the last three months of 1992 IMR collected data on incidental catches and observations in Norwegian waters and obtained the first sample of king crab from Bugøyfjord in South Varanger.

As from February 1993 IMR organized monthly sample fishing with traps in Bugøyfjord and in July carried out a three week research vessel survey in the Varangerfjord area. PINRO in August-September completed a six week crab survey with traps, covering the coastal area from the Russian-Norwegian border to 40 degree East on the Kola coast. (Gerasimova and Kuzmin, 1994). The main transplantation area and the currently known king crab distribution, including verified incidental observations, are illustrated on the map of Fig. 1.

A scaled down Alaska type king crab trap, 150x150x75 cm, set with separate buoy lines, was the main trap used by IMR. From July onwards also conical shaped traps with a base of 120 cm diameter were operated, usually in fleets of three. PINRO used similar conical traps throughout.

King crabs caught during the PINRO survey were weighed and measurements of carapax length and width and right chela height were taken. Sex and stage of egg development were

recorded, as well as condition (hardness) of exoskeleton. Stomack contents were examined and samples preserved. In 1993 PINRO tagged and released alltogether 172 king crabs at 5 different locations. In the IMR survey the crabs were, with few exceptions, weighed, and measurements were taken of carapax length and width, and of right chela height. Sex and stage of egg development were recorded. Catches of the monthly sample fishing were sexed, and in some cases weighed and carapax width measured.

The mean monthly catches per Alaska type trap in the Norwegian sample fishing are shown on Fig. 2. Considering the smaller size of the traps used, the July and August catch rates are quite comparable to the recent level of king crab catch rates in the Bering Sea (Stevens et al. 1993). In the Barents Sea the maximum crab size is > 8 kg, and the size distribution of mature males is rather similar to that of the Bering Sea (Stevens and MacIntosh 1986).

Soak time varied much in the monthly sample fishing and the effect of this on the catch rates seems rather different for males and females (Fig. 3). The monthly Norwegian catch rates have therefore been adjusted for the variations in soak time as shown on Fig. 4, choosing a soak time of 1 day (24 hours) as standard. The seasonal variation in adjusted CPUE may reflect not only changes in crab density, but also varying feeding activity due to the annual cycle in reproduction and moulting as well as variations in ambient temperature. This calls for standardization in time and methods of operation in future annual trap surveys for abundance studies.

The size distributions of the Russian and Norwegian survey samples are shown in Fig. 5. The Russian samples include a number of crabs with carapax width between 6 and 10 cm, which are virtually absent in the Norwegian material. Also, while the right hand side of the size distributions are fairly similar for both sexes, the Russian samples contain more crabs less than 13 cm CPW than the Norwegian ones. This difference is, however, not apparent for the Russian samples from the Varanger area, and in general along the Russian coast the frequency of large, mature crabs is increasing from the East towards the West, indicating a contranatant migration with age.

Few bycatches of king crab have been reported from the extensive offshore trawl fisheries and the present Barents Sea king crab distribution is therefore largely confined to coastal waters. This is a striking departure from the Bering Sea king crab which also inhabit offshore waters. If in future the Barents Sea king crab extends its area of coastal habitat and reaches a higher level of abundance the total distribution might also include offshore areas.

The chela height measurements (Fig. 6) show a change in relative male chela size at about 11 cm CPW (10 cm CPL). This corresponds fairly well to comparable king crab data from Alaska waters. (e.g. Stevens et al, 1993) and, therefore, similar male size at maturity. On the other hand the lack of ovigerous females below 11.5 cm CPW (10.5 cm CPL) and the findings of non-ovigerous females upto 14.5 cm CPW (Fig. 7) suggest a somewhat larger size at maturity for the female Barents Sea king crab than that in its native Pacific region (Stevens and MacIntosh, 1986).

From February to June 1993 trap catches in the South Varanger tributary fjords were negligible, while good catches of mature king crabs of both sexes were made in July and August at depths of 90 to 210 m. Catch rates dropped greatly in September and first part of October, particularly of females. Simultaneously fishermen using flounder nets in shallow waters, < 30 m, frequently caught female king crabs. In November and early December catch rates of both sexes increased in the traps set at depths > 90 m, but thereafter the females disappeared alltogether from the trap catches, and in January - February 1994 also the catches of males drastically declined. At the end of January and again in early April 1994 sport divers observed large crabs grasping smaller ones at about 40 and 20 m depth off Kirkenes. In February and April empty exoskelotons were observed in the same area. With the exception of the female migration into shallow waters in September - October, these observations thus indicate an annual migration cycle similar to that described for the Alaska king crab, i.e. a feeding migration into deeper waters in the summer and from December onwards towards shallower areas where hatching, mating and moulting take place. The moulting season may start somewhat earlier than in the Bering Sea, but as evidenced by the frequent bycathes of king crabs during spring time in the shallow water gillnet fisheries for lumpfish, the main moulting - mating season is likely to be in April - May.

The PINRO survey in August - September 1993 located three areas with dense concentrations of young, immature king crabs of 6 to 9 cm CPW. Similarly, in Bugøyfjord incidental high catches of juvenile crabs, upto 430 in one trap, were made from end of August to beginning of December. (Fig. 1). Small king crabs < 6 cm CPW are known to be quite stationary, and these findings, therefore, document successfull local reproduction in Norwegian waters as well as at the Russian coast. The main reproduction potential appears to be in the Varangerfjord area (within both REZ and NEZ) and in the Motovsky Bay.

Conclusions

As a result of the USSR transplantation experiments 1961-69 a viable, self-reproducing stock of king crab, *(Paralithodes camtschatica),* is now well established in the Barents Sea.

Until 1992 only scattered, incidental bycatches of king crab were made from about 40 degree East on the Kola coast to North Cape. The distribution is at present largely confined to inshore waters. In the eastern part juveniles are dominating and the frequency of mature crabs increases towards west, indicating a contranatant migration with age.

The sudden dramatic increase in 1992 of king crab bycatches in the coastal fisheries on the southern side of the Varangerfjord most likely indicates a significant recent increase in stock size. Successfull reproduction is documented in both Russian and Norwegian coastal waters. However, the population should be allowed to grow further before regular commercial exploitation commences.

The size distribution of mature Barents Sea king crabs is very similar to that of Alaska waters, suggesting that conditions for life and growth are not inferiour to those of the native North Pacific area. Maximum size of Barents Sea males > 8 kg.

Sex differences in distribution and migration patterns are confirmed also in the Barents Sea. Apart from a migration in September - October into shallow waters, especially by the females, the annual cycle in vertical distribution conforms with that established for the Bering Sea king

crab. Thus, starting in December-January a major migration is evident to shallow coastal areas where mating and moulting take place. Feeding migrations to deeper areas in the Varanger area in 1993 did not start until June. Maximum trap catch rates were obtained in July and August.

The present state of knowledge of the Barents Sea king crab's general biology is quite limited and fragmentary and the immedeate aims of future research should be to fill the most serious gaps to facilitate assessments of abundance, and to evaluate the ecological impact of this new element in the Barents Sea fauna. This will in particular require more detailed knowledge of migrations, distribution and relative abundance and of the king crab's food and feeding habits.

Acknowledgements

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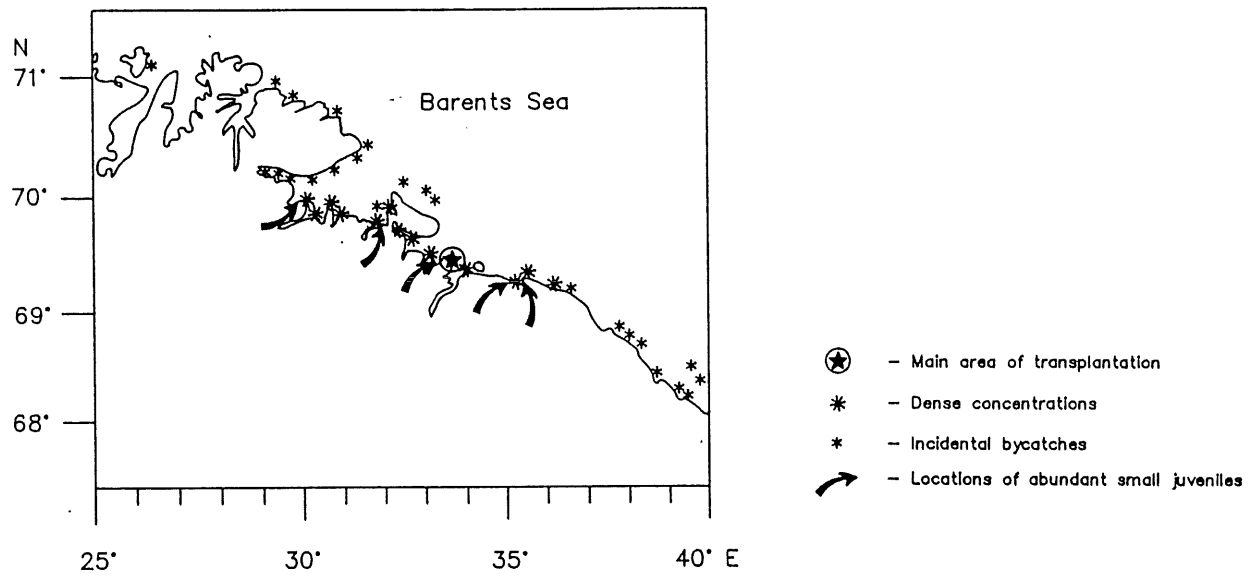


Figure 1. Currently known area of Barents Sea king crab distribution.

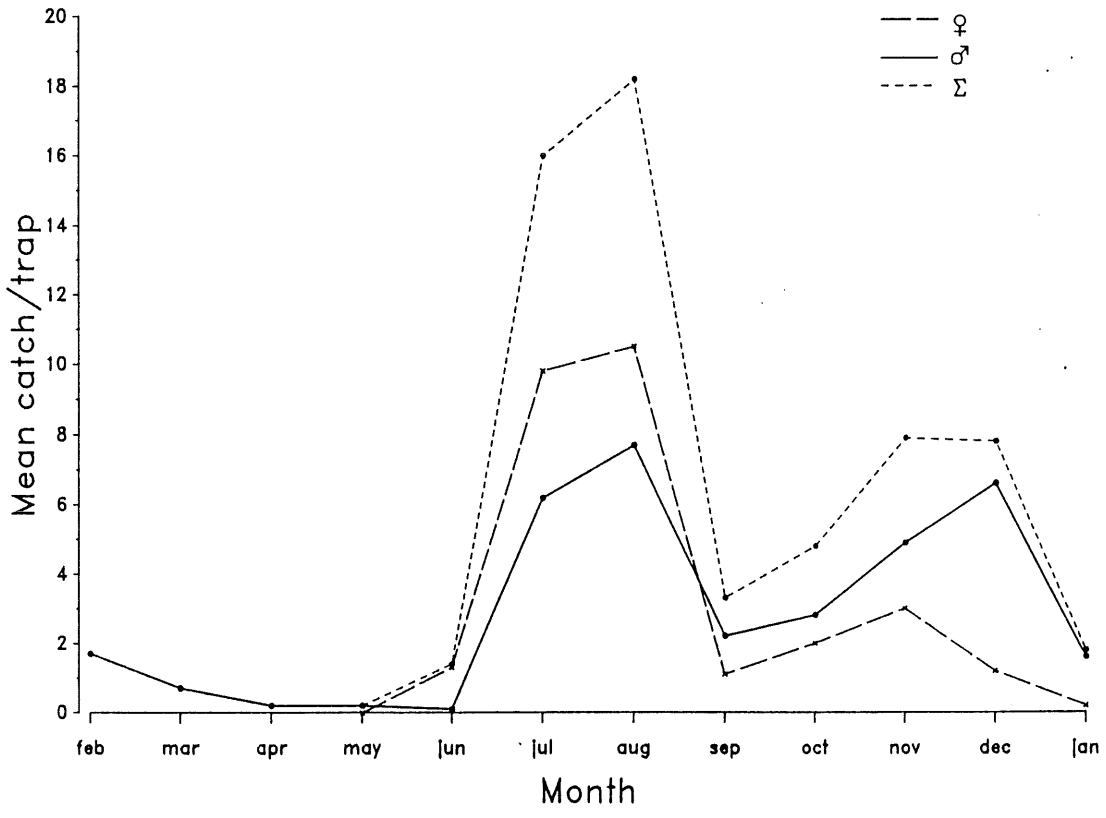


Figure 2. Mean monthly catch rates of king crab in the Norwegian sample fishing.

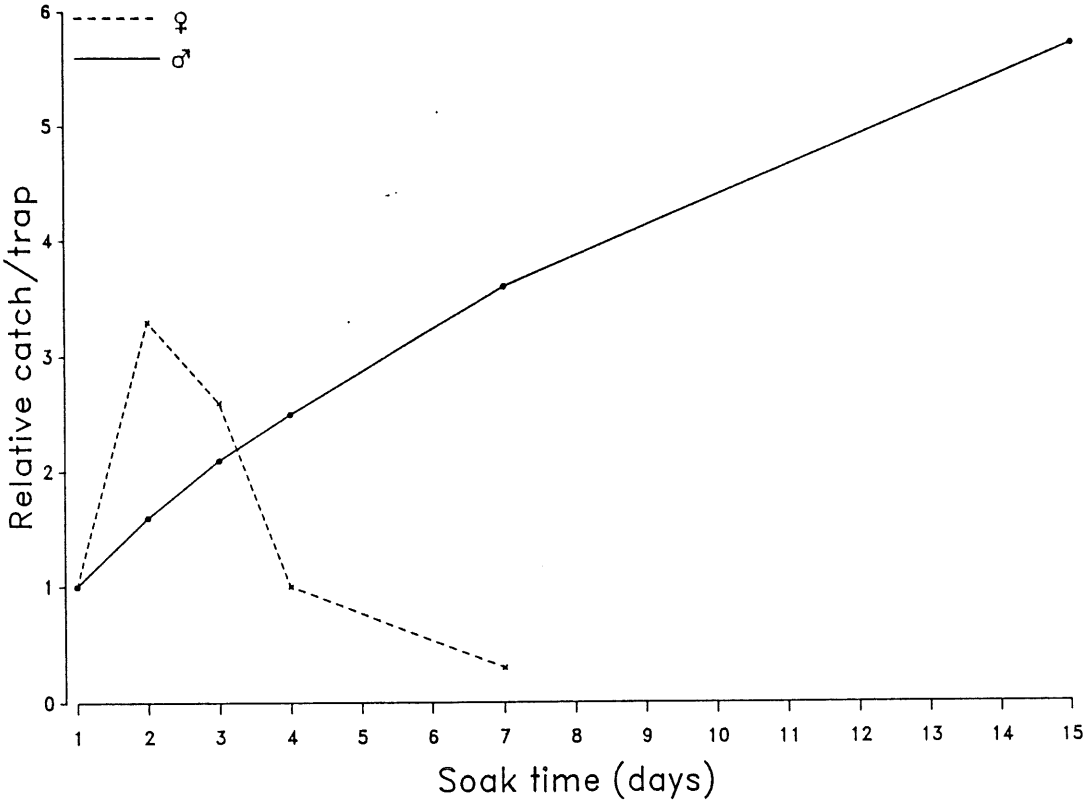


Figure 3. Relative catch rates as function of soaktime.

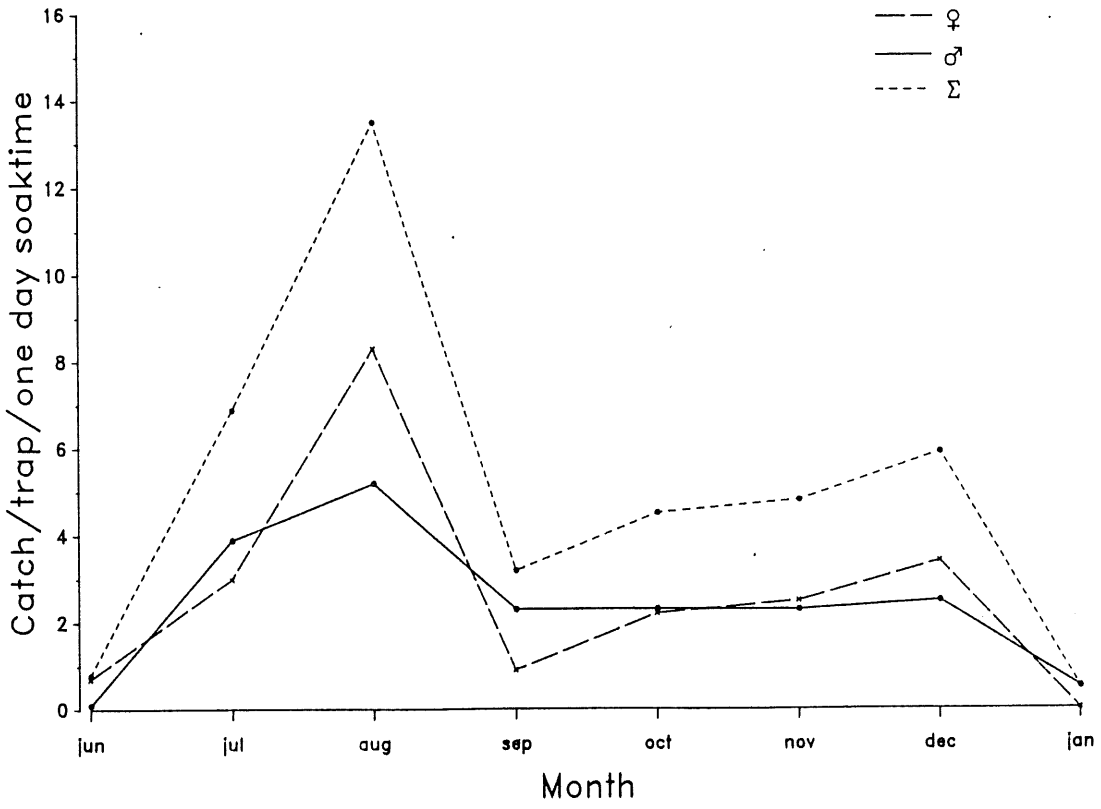
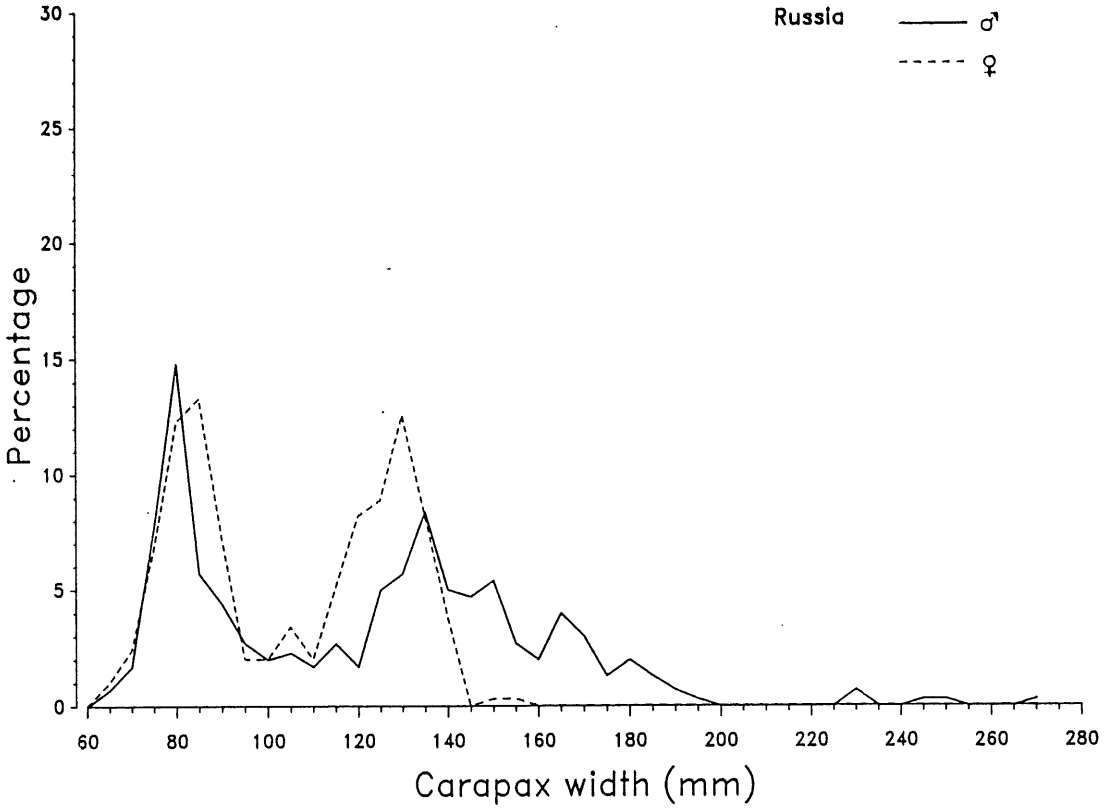


Figure 4. Norwegian mean monthly catch rates adjusted to a one-day soaktime.



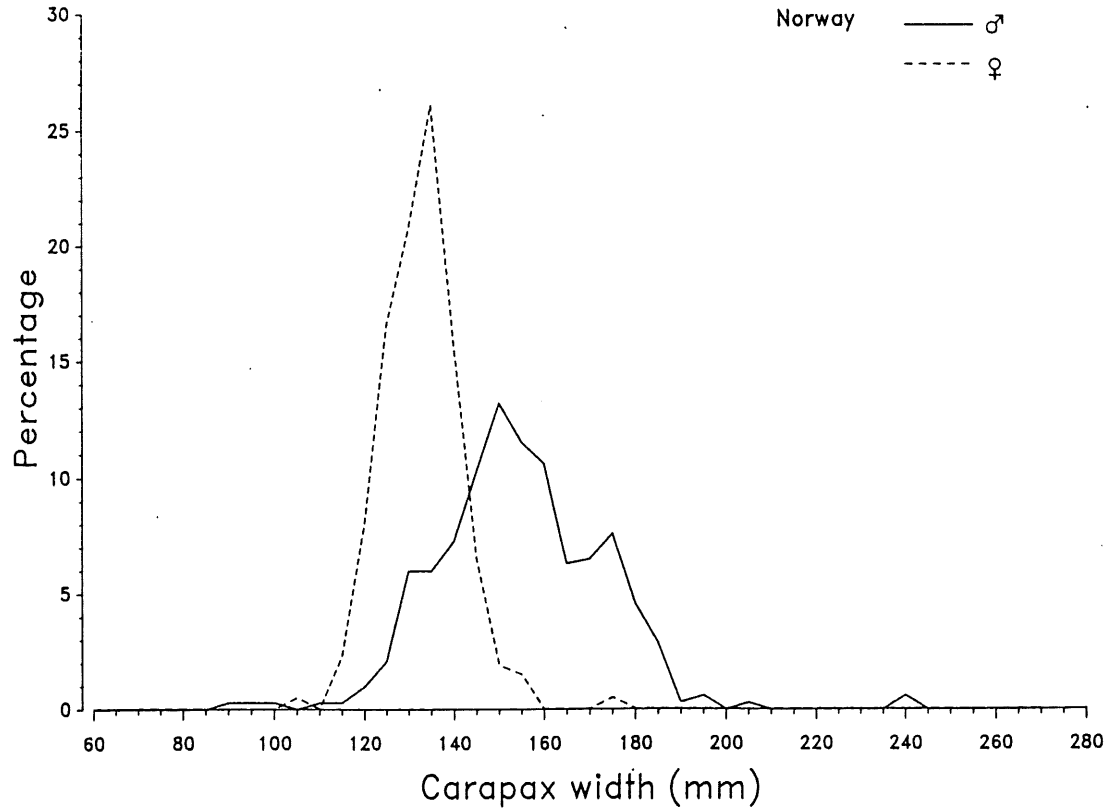


Figure 5. Percentage size distributions of Russian and Norwegian survey samples.

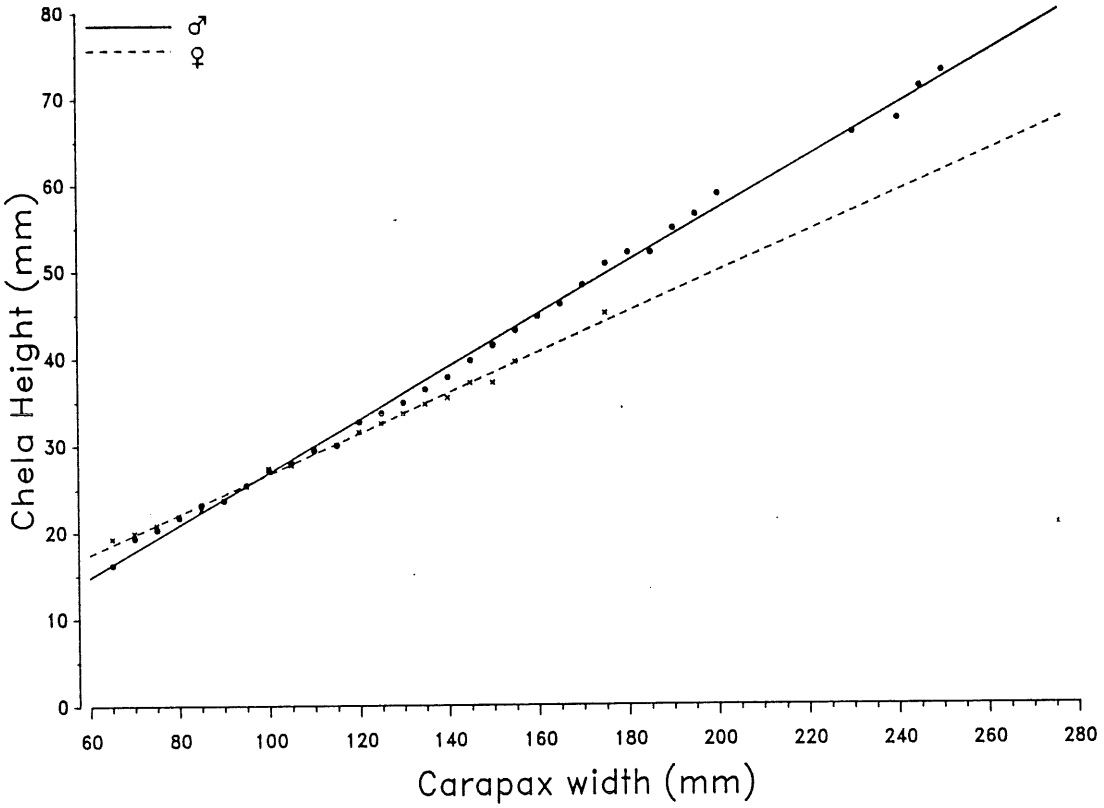


Figure 6. Chela heigth in relation to carapax width.

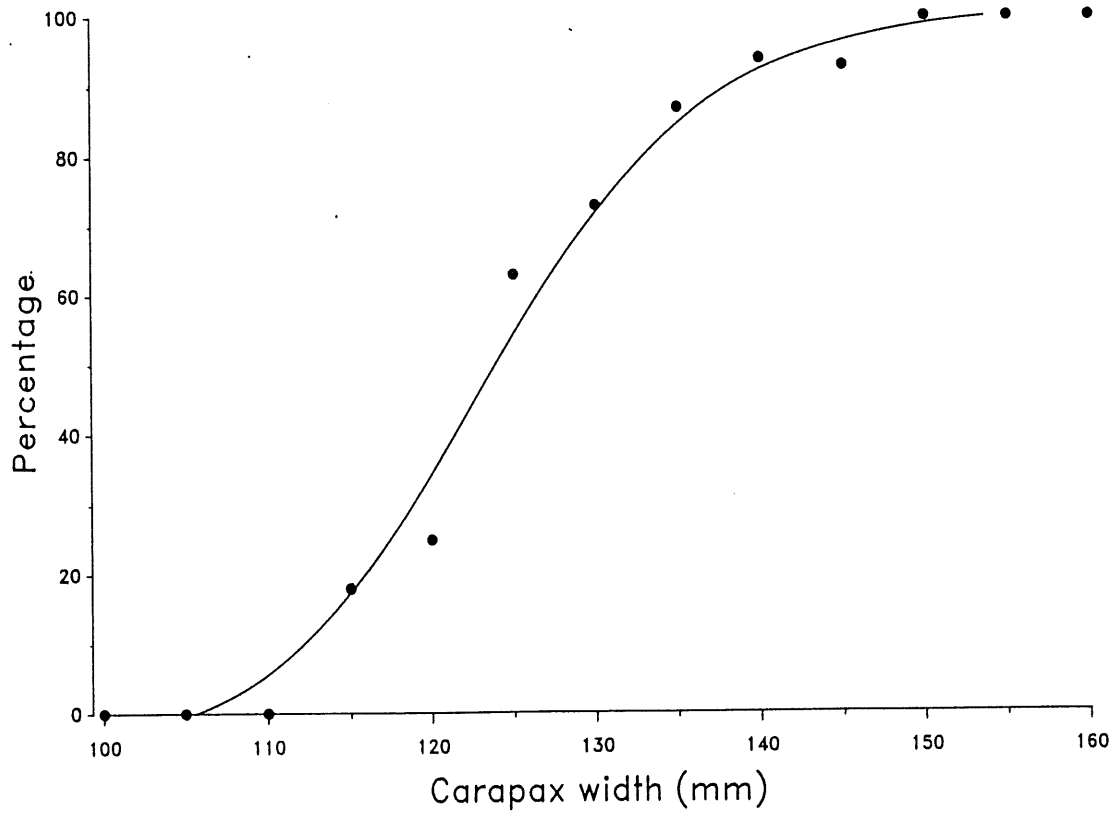


Figure 7. Percentages of egg-bearing females in relation to carapax width.