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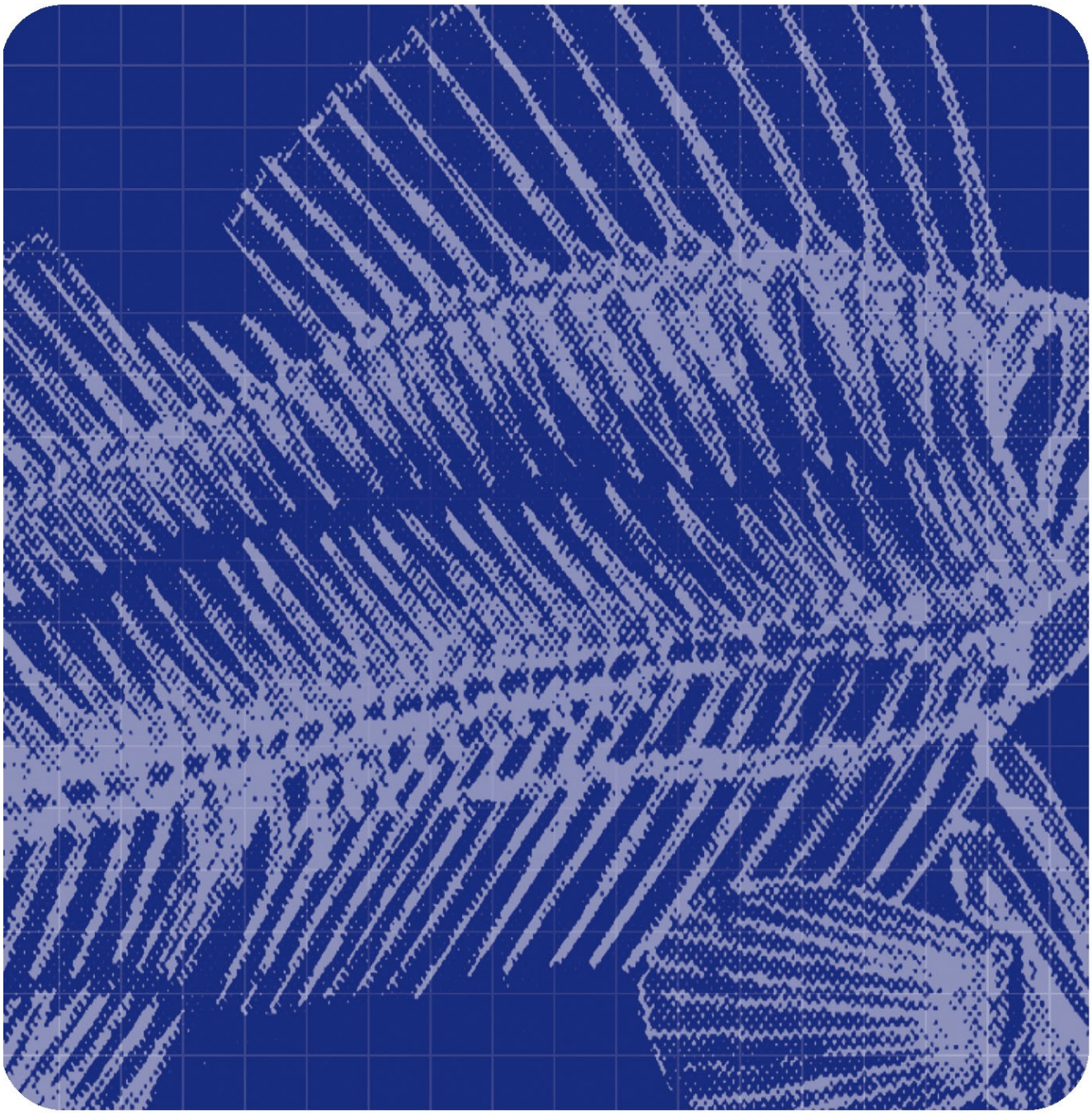
Joint report for 2000 on the red king crab *(Paralithodes camtschaticus)* investigations in the Barents Sea. Basic requirements for management of the stock

Report to the 29th Session of the Mixed Russian-Norwegian Fisheries Commission

Sergey Kuzmin (PINRO) and Jan H. Sundet (Fiskeriforskning)



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REPORT

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Summary:

The present mean estimates of legal males above 150 mm CW in REZ and NEZ are 1 513 000 and 676 000 respectively. Estimates of total stock with CL > 60 mm in REZ are 12 546 000. There are no such estimates in NEZ. In NEZ the relative abundance of pre-recruits (115 mm< CL <132 mm) has increased from 6.5 % in 1999 to ca 25 % in 2000, indicating good recruitment to legal size stock within the next couple of years. The stock estimate of egg-carrying females in 2000 was 1 576 490 in NEZ and 693 888 in REZ. The surveys in 2000 revealed only minor recruitment to the crab stock in the Barents Sea. Moulting frequency of pre-recruits in NEZ and in REZ are high in 2000: 83 % and 95.6%, respectively.

There are no signs of any effects of the one sex harvest strategy on the sex ratio in the crab stock. The crabs in NEZ are still inhabiting new areas along the coast of Finnmark and new parts of the coast will soon be of interest for fishery. The crab density is increasing in eastward in REZ. The crabs in the NEZ show only minor migrations. In Varanger there is mainly a westwards migration.

Bycatch of king crabs is a major problem in the gillnet and longline fishery in the eastern Finnmark. In 1999 ca 120000 crabs were estimated caught as bycatch in the gillnet fishery for cod alone in NEZ and 30 000 crabs in the trawl fishery for whitefish in REZ. Several regulations are given for commercial fishery conserning a possible opening of
a aiming to improve the management of the king crab in the Barents Sea are proposed.

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1 BACKGROUND

Since 1993, scientists from PINRO and IMR have jointly estimated the stock of the king crab in the Barents Sea using trap-catch efficiency surveys. In the report to the 27th Session of the Commission Kuzmin & Løkkeborg (1998) presented the results of alternative assessment methods on the crab stock in these areas. They concluded that more data and research are necessary if the trap efficiency method should become a reliable method.
In the Russian zone of the Barents Sea this method was rejected in 1995 and changed to an assessment of the crab stock using a swept area method. In the Norwegian zone the swept area method was adopted in 2000. According to the Norwegian areas, the advice to the Commission on the crab stock is additionally based on indexes from research surveys and the research fishery. The advice given will also be based on knowledge of stock structure, growth and recruitment. Investigations on bycatch of king crabs in gillnet, trawl and longline fisheries have been carried out, and provides also important knowledge for the management actions suggested.

2 MATERIAL AND METHODS

In April 2000, PINRO conducted a research trawl survey with hydrological and plankton surveys as in the period 1995-1999. Further, PINRO carried out an assessment trawl survey in September 2000. The crab tagging was continued. The trial fishery in the Russian Economic Zone (REZ), started with five fishing vessels in the Russian part of the Varangerfjord and Motov Bay in the middle of October, using standard conical traps. The minimum legal size is 150 mm CW in the Russian trial fishery. As earlier, a PINRO scientist participated in the FF research cruises in May.

Fiskeriforskning and Norwegian College of Fishery Science/University of Tromsø have carried out two research surveys for the king crab in 2000. Annually, since 1994, one cruise in spring and one in autumn have been done to collect biological data on the crab, in Norwegian waters. In 2000 the first cruise went on in May, and the second in August. During these cruises, data on growth and reproduction, and recruitment were collected, in addition to tagging experiments to study migration. Because bycatch of king crabs has been a major problem in the coastal fishery with gillnets and long-line in Norway, registration of by-catches has been carried out by selected fishermen since 1997. Such registrations are also done in 2000. The research fishery in Norwegian waters, in 2000, was divided in two periods. The first period was an exploratory fishery where all participating fishermen were given a certain geographical area to assess the king crab stock. In the second period the fishermen are free to choose fishing grounds, but are still obliged to do registrations for scientific use.
In total, 33 vessels (overall length > 10 m) participated in the Norwegian research fishery for the king crab in 2000 and registrations of catch efficiency, and sex and size of crabs will be carried out throughout the fishing period.
During the Norwegian research cruises crabs are caught both using traps (two types) and a small trawl (Agassiz). When the crab fishery and the research started in the Barents Sea, conical traps were used both in Norwegian and Russian waters. In 1997, however, a new square type were introduced because of its operational advantages and being more efficient in

catching large males. In 2000 only the square type traps are used in the Norwegian research fishery.

For the stock assessments in REZ, data from the PINRO trawl survey in September 2000 have been used. A research bottom trawl was used (Hufthammer et al., 1997). Stock estimates were based on 85 stratified random sample tows of one hour duration at 3.2 knots in depths from 40 to 320 m.

3 ABUNDANCE

Crabs 20-240 mm CW were in research trawl catches in April and 70-240 in September. Applying the swept area assessment model with a trawl catchability coefficient of 0.75, gives a total stock estimate in 2000 of about 12 546 200 (95% C.I. = ±13 988 452, CV = 55,8%) crabs in REZ (table 1). Of these about 1 513 000 (95% C.I. = ±538 961, CV = 17,8%) were males above 150 mm CW. The alternative spline-approximation gave an estimate of 15 609 300 and 1 140 000 respectively (table 1). Spatial distribution by this method is presented in figure 1 and 2.
The present estimate in REZ of males above 150 mm CW amounts to 1513 000. With maximum sustainable exploitation rate of 20% (Kuzmin & Sundet, 2000), 302 600 male crabs above 150 mm CW (≈1150 t) might be harvested in REZ. Alternatively, an exploitation rate of 25 % gives 378 250 respectively.

In the Norwegian zone the crab stock estimates are based on data from the survey in August 2000. In total 48 stratified random trawl hauls were carried out in the coastal areas east of Makkaur (30^{o} E) with a special designed crab trawl. Using bottom gear such as fish and shrimp trawls demands smooth bottom substrate and particularly in the Norwegian coastal areas most of the habitats of the crab is fairly rough and not feasible for trawling. This limits the sampling possibilities and thereby the accuracy of the stock estimates. In addition, the crab is usually highly patchy distributed which entails a need for a high sample number in particular areas. Both these obstacles contribute to large coefficients of variation of the mean assessment. The current estimate of legal males gave a mean estimate in NEZ of 676 314 crabs (table 2), with a 95 % confidence interval of the mean (CI) of $\pm$ 562 681 and a coefficient of variation (CV) on 49 %.
Due to no information about the representation of small crabs in the catches, there are no estimates of the total crab stock in the Norwegian zone.

Table 1. King crab stock estimating in REZ in 1999 and 2000

1999				
Estimating method	Total, (in numbers x 1000)	Legal male stock		
		Abundance, (in numbers x 1000)	Abundance index (spec./tow)	CV
Random-stratification	min 1 721.8 4 948,4 max 8 175.1	min 577,9 1 507.9 max 2 437,9	min 2.3 5.9 max 9.5	30,8%
Spline-approximation	3 714.7	1 229,0	-	-
2000				
Estimating method	Total, (in numbers x 1000)	Legal male stock		
		Abundance, (in numbers x 1000)	Abundance index (spec./tow)	CV
Random-stratification	min –1 442,2 12 546,2 max 26 534,7	min 974,1 1 513,0 max 2 052,0	min 1,9 2.9 max 3,9	17,8%
Spline-approximation	15 609,3	1 140,0	-	-

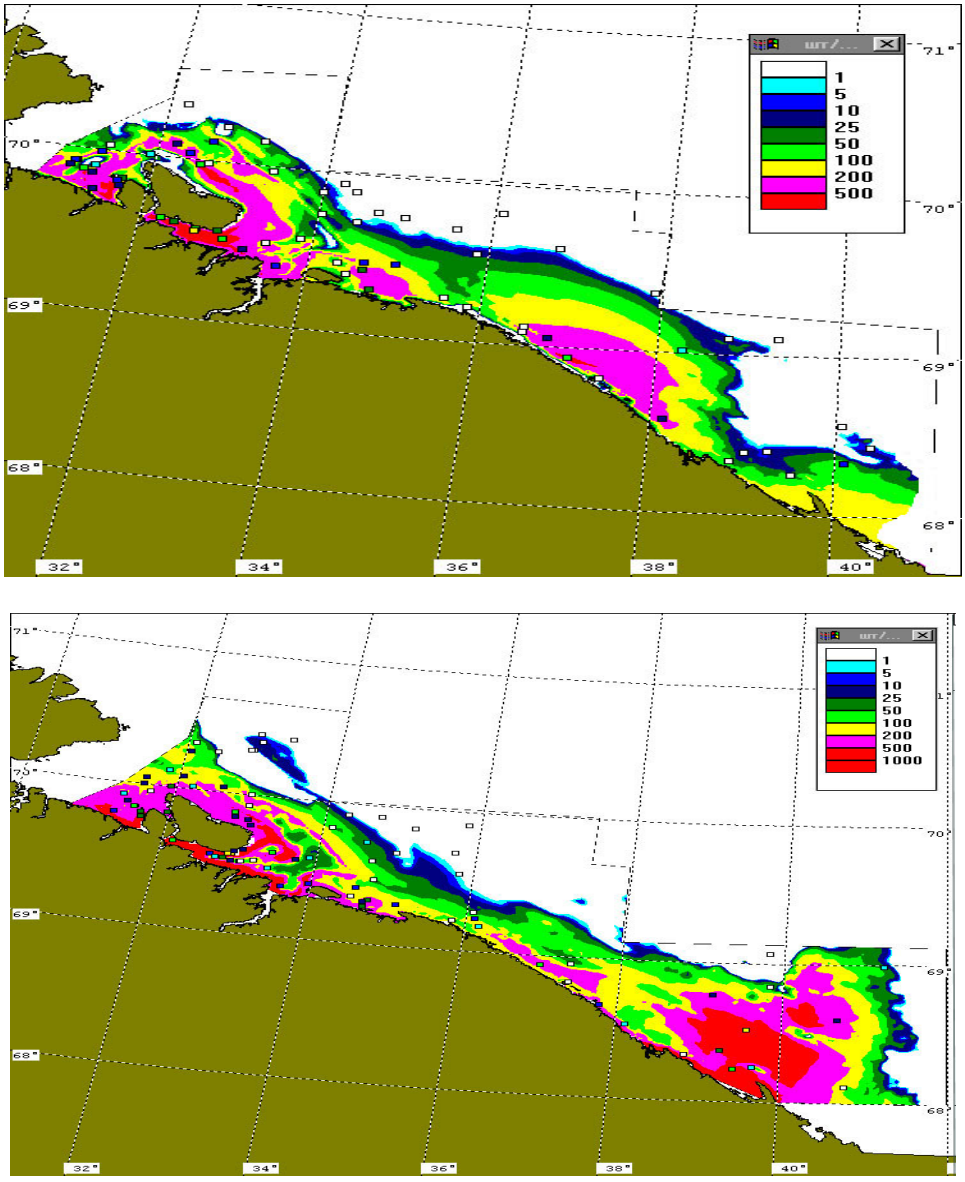

Figure 1. Total crab stock distribution (spec/square km) in REZ in August-September 1999 (at the top) and in September 2000 (below).

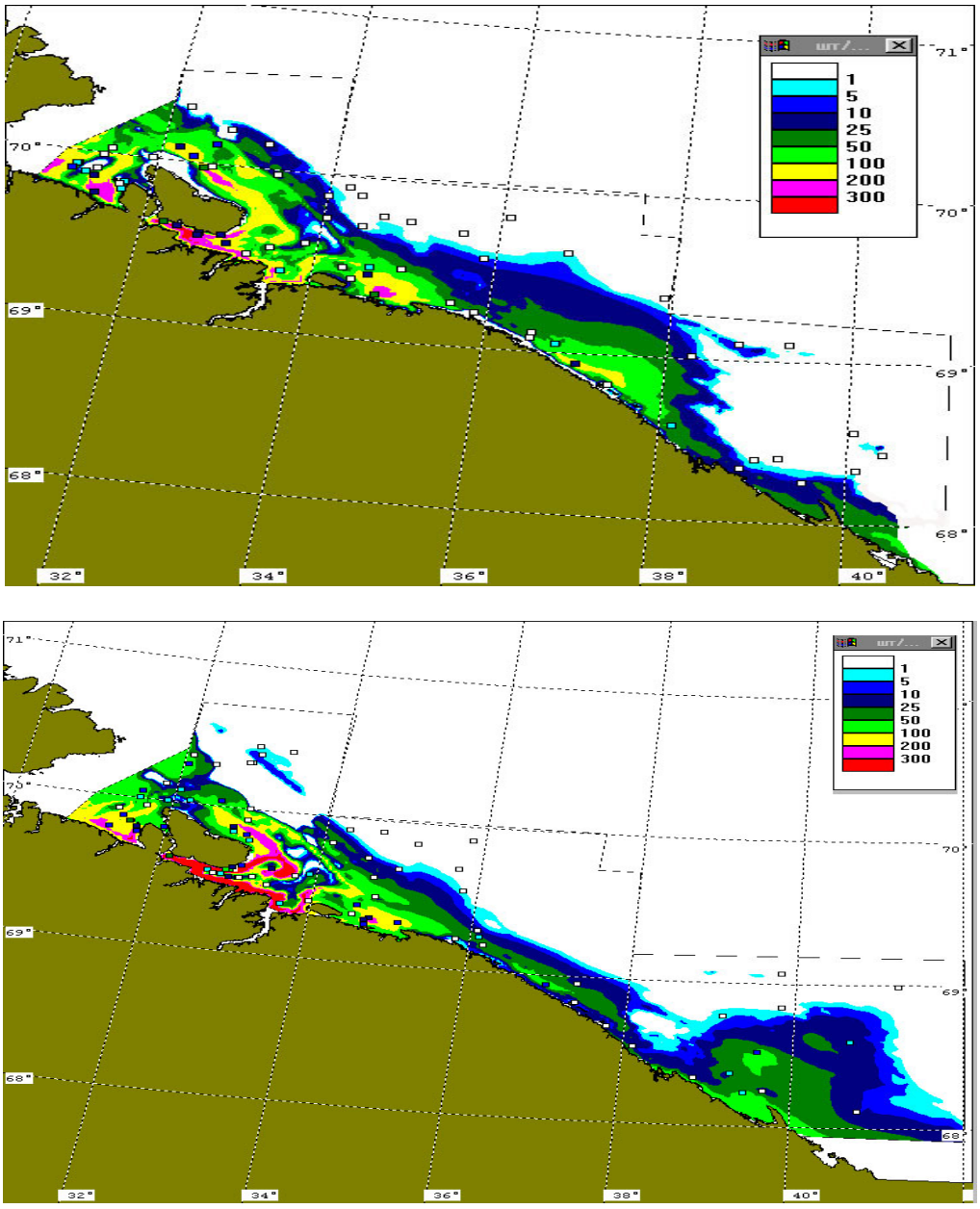

Figure 2. Legal males distribution (spec/square km) in REZ in August-September 1999 (at the top) and in September 2000 (below).

Table 2. Stock abundance estimates for 1993-2000 (in numbers x 1000).

Year	Total abundance		Total legal males	
	Russia	Norway	130 mm	150 mm
1993	117	95	75	
1994	310	62	149	
1995	660	140	374	304
1996	272	165	-	242
1997	510	206	-	426
1998	6 768	495	-	951
1999	4 948	na	-	1 508*+na**
2000	12 546	na		1513* + 676**

In 1993 the estimate was based on the research survey. In 1994-1999 the Russian estimate was based on the research survey, while the Norwegian estimate was based on both the research survey and the trial fishery. In 1993, 1994 and the beginning of 1995 minimum legal size was 130 mm carapace width. From 1995 minimum legal size was 150 mm carapace width.

na – not available;

* - in REZ;

** - in NEZ

4 STOCK STRUCTURE

The crab stock in Varanger seems to have a polymodal size distribution where the peaks of size-groups seem to appear quite frequently. The interpretation of this is that the stock produces abundant yearclasses with short time intervals (figure 3). The cohort of juvenile crabs, with a carapace length of ca 50 mm, appearing in the sample from May 1997, were the first time high numbers of juvenile crabs were recorded in Varanger. This cohort may be seen in all succeeding samples as modes, which increase in mean carapace length for each year. In May 1999 this cohort have a mean carapace length of ca 100-mm. It is not possible to reveal whether this cohort is constituted of one or more yearclasses but the data from 2000 show that this cohort is now totally dominating the stock in Norwegian zone. The surveys during 2000 also revealed that this size-group was also the major part of the crab stock elsewhere along the coast of Finnmark. This stock structure implies that there will be a significant recruitment to the legal stock the next couple of years.

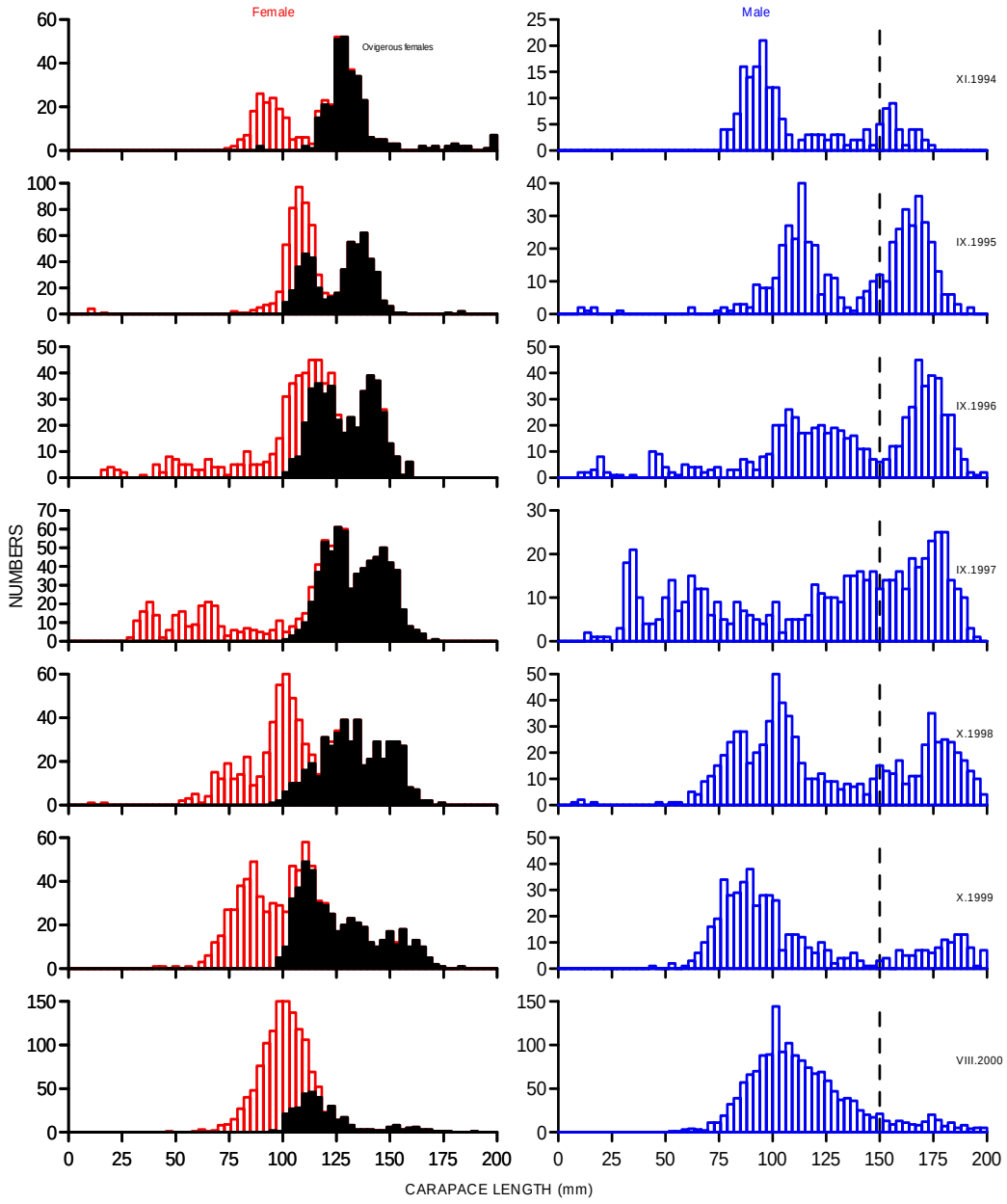

Figure 3. Carapace length distribution of king crabs caught in the Norwegian part of Varanger, at different cruises in the period November 1994 – August 2000. Right part of the figure are males and left part females. Filled bar are ovigerous females.

The length frequency distribution for the research catches in Russian water shows several peaks for adult males as in previous years. The base of legal part was males with 150-200 mm CW (figure 4). The young part of population in Russian waters has two peaks for both sexes: 50-70 mm CW and 90-130 mm CW. As in 1999, in 2000 Russian trawl data, the female to male ratio was 1:2.

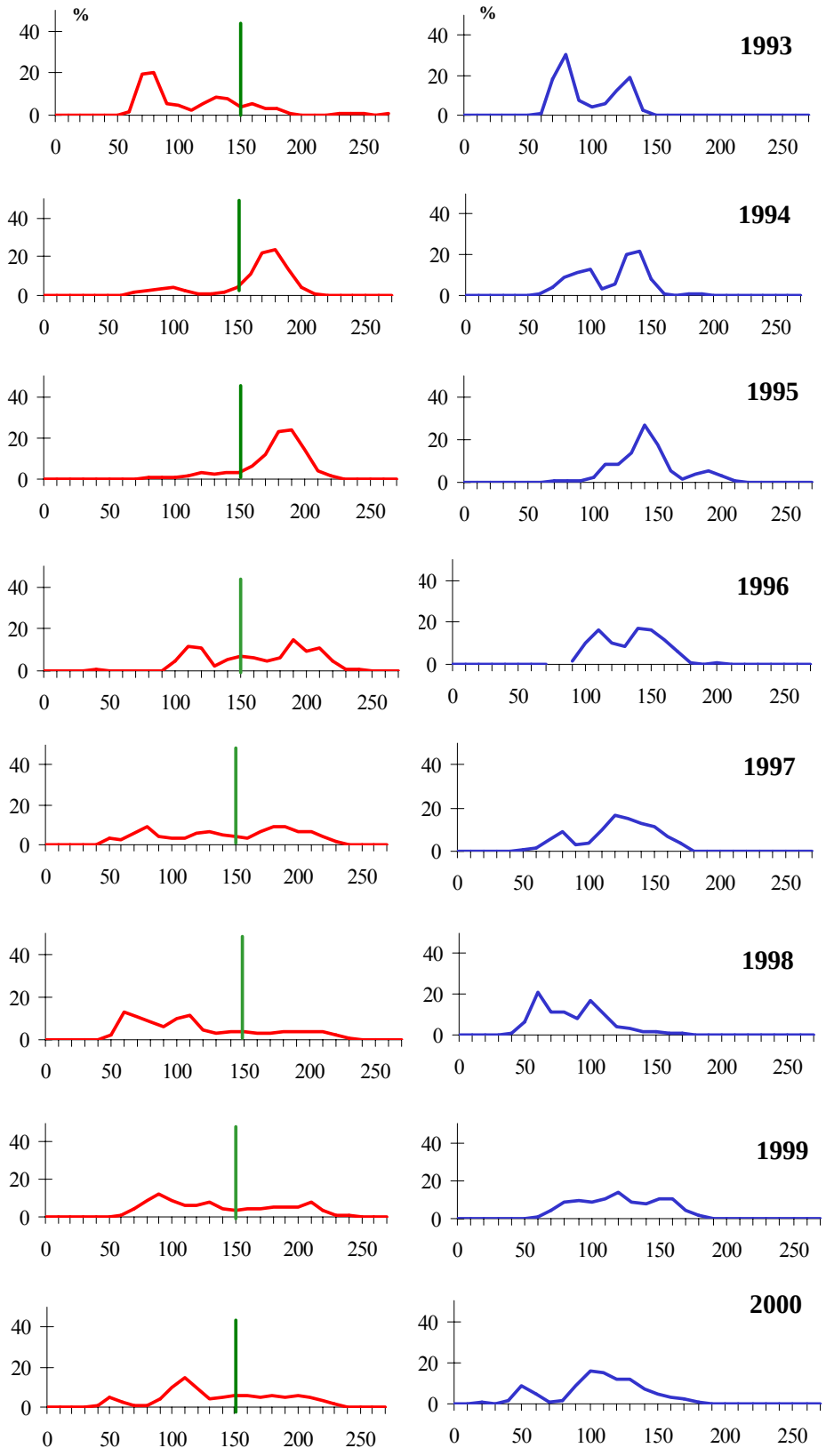

Figure 4. Carapace width distribution of king crabs in REZ from research cruises 1993-2000. Red line – male; blue line – female; green bar – legal size limit.

5 PRE-RECRUITS

Russian and Norwegian scientists have agreed to define pre-recruits as male king crabs with carapace length between 115 and 132 mm (130 and 150 mm carapace width). The rationale behind this is that crabs of these sizes have a mean increment of ca 17 mm at moulting. They will therefore grow into the legal size group at the first moult. In the Norwegian zone the relative abundance of pre-recruits has increased from ca 6.5 % in 1999 to ca 25 % in 2000. This increase is probably due to that significant parts of the abundant yearclasses (92 – 93) have reached this size now (see figure 3).
In the Russian zone the pre-recruit group indicate moderate recruitment to legal size stock in 2001 and good recruitment to legal stock in 2002.

6 STOCK OF EGG-CARRYING FEMALES

The management of the king crab stock is based on the assessment of several biological parameters and one of the most important is the number of functionally mature females. In the Barents Sea no estimates of this part of the stock has been presented earlier. In the Norwegian zone the mean estimate of the number of egg-carrying females in 2000 was 1 576 490 with a 95 % confidence interval (CI) of $\pm$ 1 007 860. In the Russian zone abundance of egg-carrying females (ECF) by stratified random method in 2000 was 693 888 with a 95% CI of $\pm$ 332 108. The spline-approximation method gave – 938 666 females in 2000, compared to 618 666 in 1999 (fig. 5). This is far below the threshold for fishing set in Bristol Bay, Alaska, which are 8.4 million female crabs.
Additional studies with traps in untrawlable areas show that large numbers of berried females inhabit these areas. For examples: Medvezhya Bay – 54.8 specimens ECF per trap, 91.4% of total catch was females with eggs; Eina Bay – 10.7 ECF/trap, 49.2%; Malaya Volokovaya Bay – 32.2 ECF/trap, 66.1%. The depth of each catch was less 100 m (mean depth – 80 m). Previous and this year hydrological studies show that this behaviour of ECF may be connected with care for posterity since in Autumn-September season temperature of bottom water in coast bays are warmer (close 7-6°C) than neighbouring deeper waters (4°C and less).

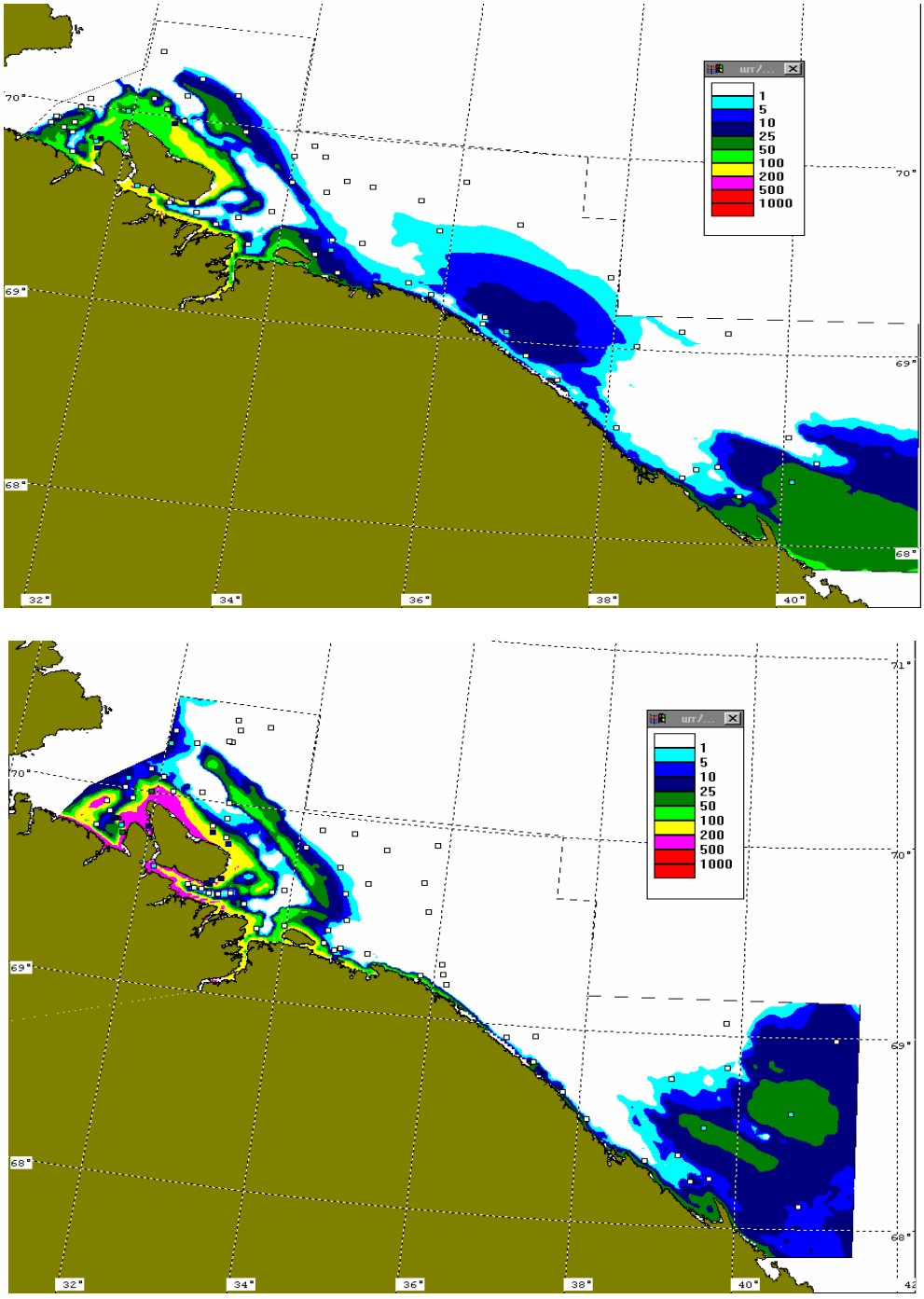

Figure 5. Distribution (spec/square km) of egg-carrying females in REZ in August-September 1999 (at the top) and in September 2000 (below).

7 RECRUITMENT TO THE STOCK

Juvenile crabs inhabit shallow waters (<30 m) during the first years of their life. Therefore, they are not represented in our trawl-samples before they reach the size of ca 50 – 60 mm carapace length and it is not possible to achieve any measures of young age (size) – classes before that size.

We have recorded high abundance of small sized crabs only in 1997 in NEZ. This group may consist of 2 – 3 yearclasses (91 – 93) and have been a prominent group in the samples from this area in later cruises (see figure 3). Since 1997 no such recordings of abundant yearclasses have been done, indicating low recruitment to the stock during this period.
In Russian waters small crabs (50-70 mm CW) were caught during the April cruise in 2000, indicating recruitment to the stock in REZ.

8 MOULTING FREQUENCY

Like all other crustaceans the king crab increases in size only by moulting. The frequency of moulting in each size-group therefore determines the growth rate of the crab. This frequency is of great importance in the pre-recruit group and the Norwegian results from Varanger show that between 70 and 90 % of the individuals of this size moult annually. The same pre-recruit moulting frequency is recorded in Russian waters (Figure 6 and 7). This means that most of the pre-recruits will become legal size males the next year in Norwegian waters (2001) and in Russian waters in year after next year (2002). The main moulting season is spring (Figure 7).

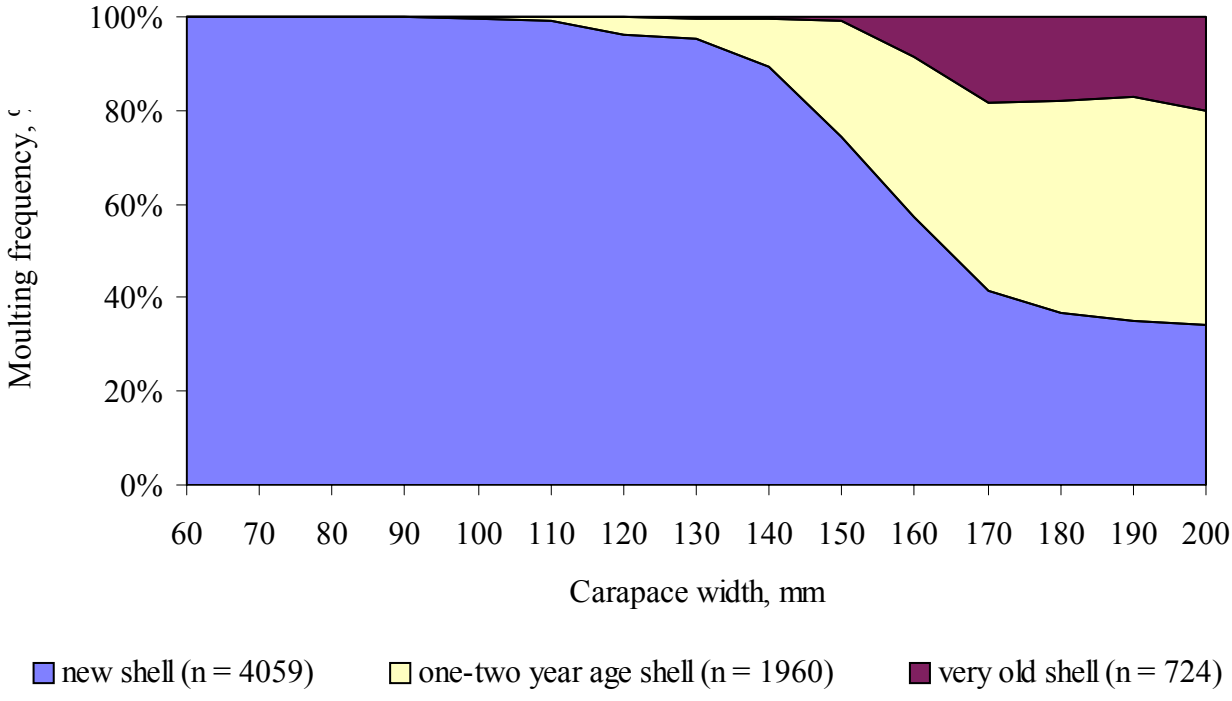

Figure 6. Moulting frequency of red king crab males based on 1994-1999 study in Russian area. Crab in moulting (soft-shelled) and pre-moulting stage are not included.

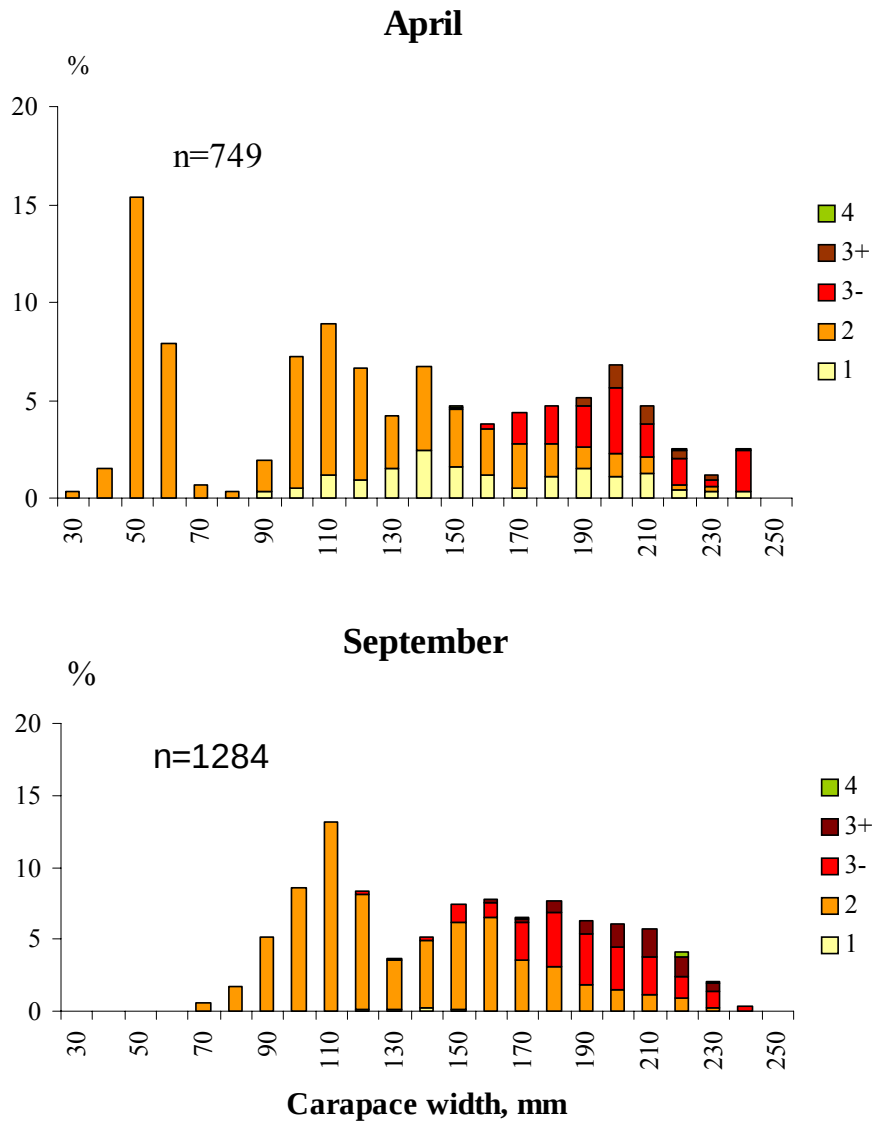

Figure 7. Results of males moulting analyses from trawl catches in April and September 2000. 1 – new softshell; 2 – new hard shell (current year); 3- - one-two years old shell; 3+ - very old shell; 4 - pre-moulting stage.

9 SEX COMPOSITION

Catching males only in the fishery of the king crab may lead to a skewed sex ratio in the stock in the long term. Theoretically there is probably a threshold for how low the relative numbers of males might be before failure in fertilisation of the female stock occurs.
Throughout the period from 1994 – 99 the ratio between females and males in Varanger has been about 60 : 40. In 2000 however, this has changed to 54 : 46 indicating no effects of the one sex harvest strategy on the sex ratio.
In 2000 in Russian area 28:72 females : males sex ratio was observed in September in trawl survey.

10 DISTRIBUTION

The crab reached its natural temperature border (0°C) in the Southeastern Barents Sea (figure 8). The core area of the king crab distribution in the Barents Sea is between Varanger and Cape Teribersky. In Russian waters there was an increase in catch rates of young and adult crabs eastwards from Cape Teribersky in 1999 compared to previous year. In 2000, considerable numbers (max. - 553 spec./tow) of young crabs were caught in East Coast region. These crabs probably migrate from Seven Islands archipelago, were small crabs was observed in 1998 (Kuzmin & Løkkeborg,1998).

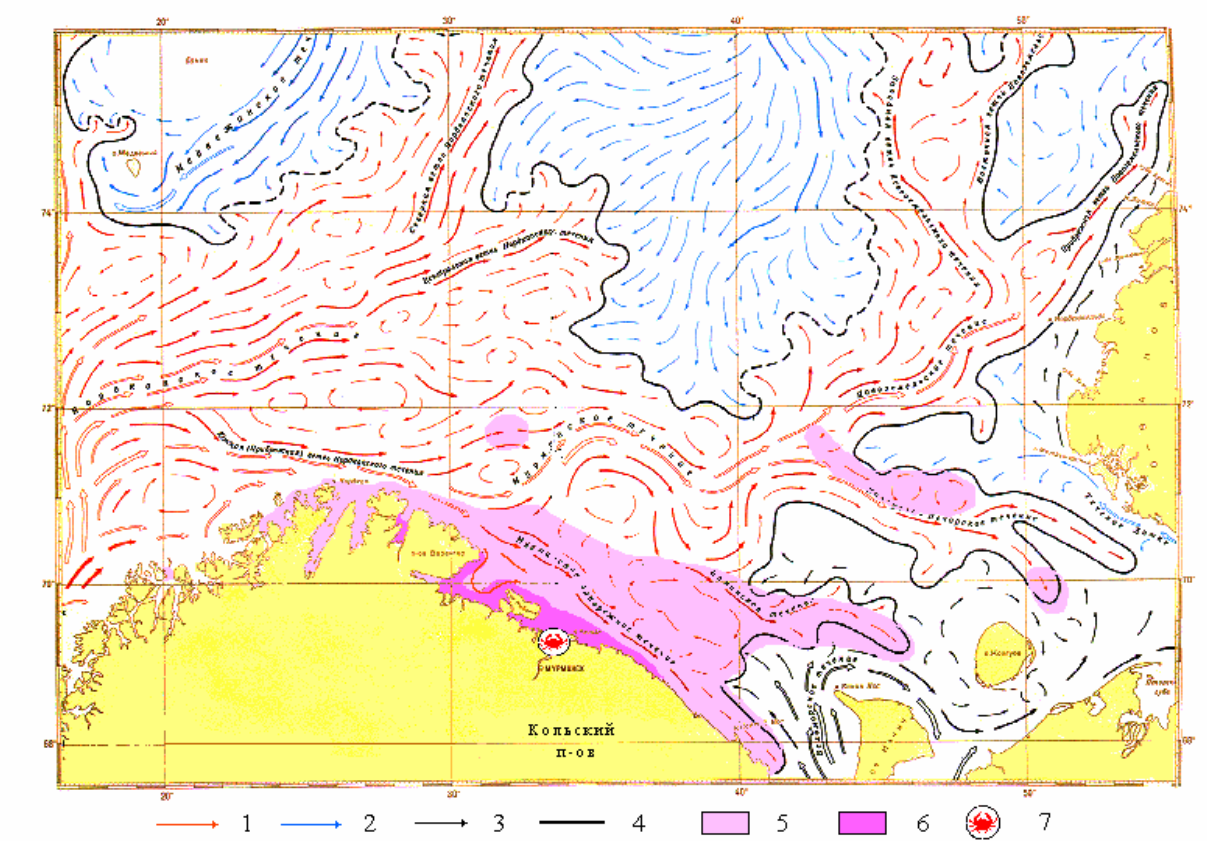

Figure 8. Barents Sea surface current (by Tantzyura, 1959) and king crab distribution (author's data): 1 – "warm" current; 2 – "cold" current; 3 – local coast current; 4 – hydrological front; 5 – crab distribution based on bycatch data; 6 – high density distribution; 7 – release region in introduction work in 1961-1969.

In Norwegian waters, the core area of king crab distribution is still the Varanger fjord with its side branches, but significant aggregations of crabs have been found west of Vardø. The crab have been present in Tanafjord for several years now and this area will probably soon be of interest for the fishery. It has also been recorded several catches of king crabs in Laksefjorden and Porsangerfjorden. West of North Cape the crab is still uncommon.

11 MIGRATION

Tagging experiments in Varanger show that the proportion of crabs that migrate from one area to another is relatively small. In Varanger there seems to be a higher migration westward then eastwards. Few recaptures have been made on the northern side of Varanger fjord of those released on the south side and the crabs are also crossing the national border in both directions. In figure 9 shows that crabs migrate to Norwegian waters from Russian waters. Also several Norwegian tags were found in Russian part of Varanger.

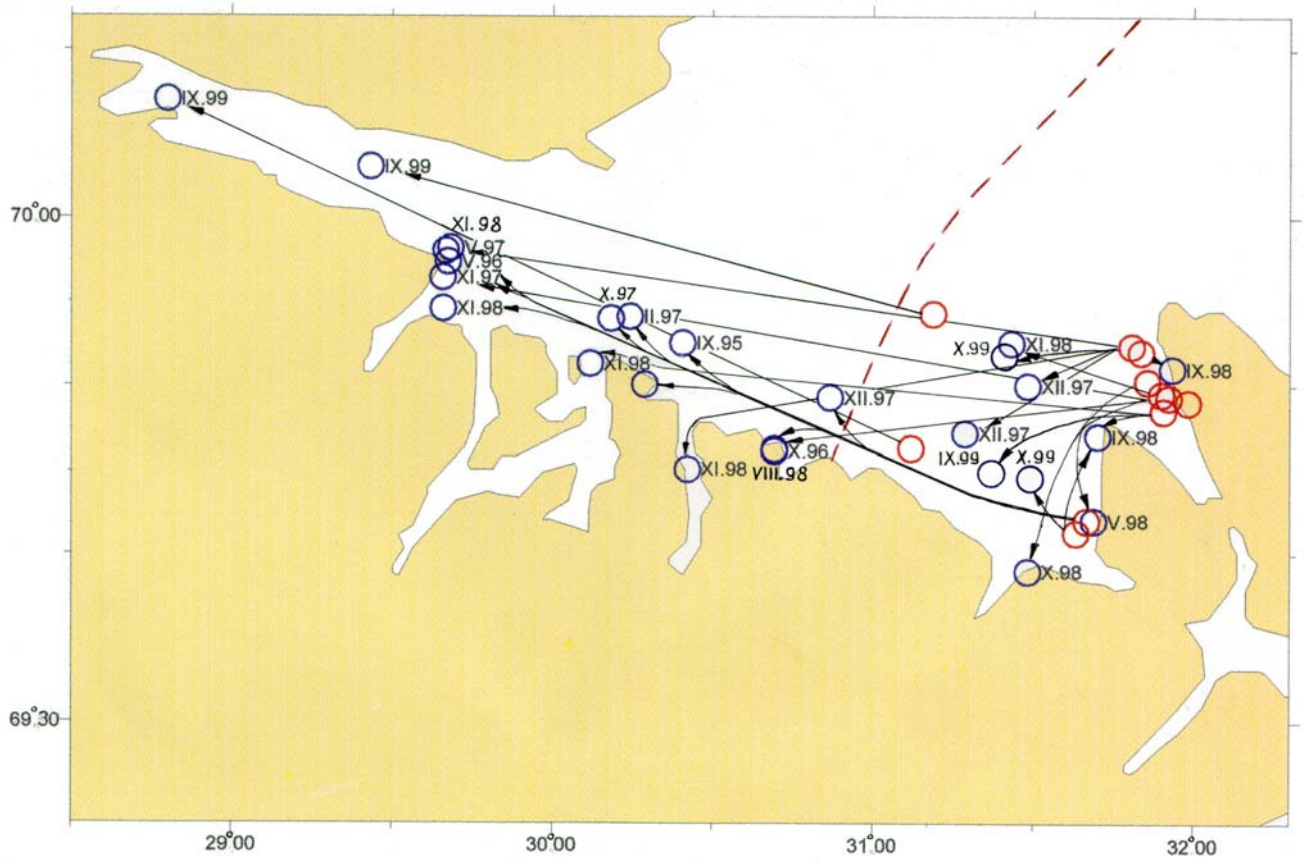

Fig. 9. Tagging and recapture place of red king crab during PINRO tagging experiment in Varanger area in 1993-1999. Red circle – tagging position; blue circle – recapture date and position.

Tagging experiments in Motove Bay revealed no recaptures outside the area.

The history of the king crab expansion in the southern Barents Sea is shown in figure 10. This show that the most pronounced expansion has taken place during the 1990s.

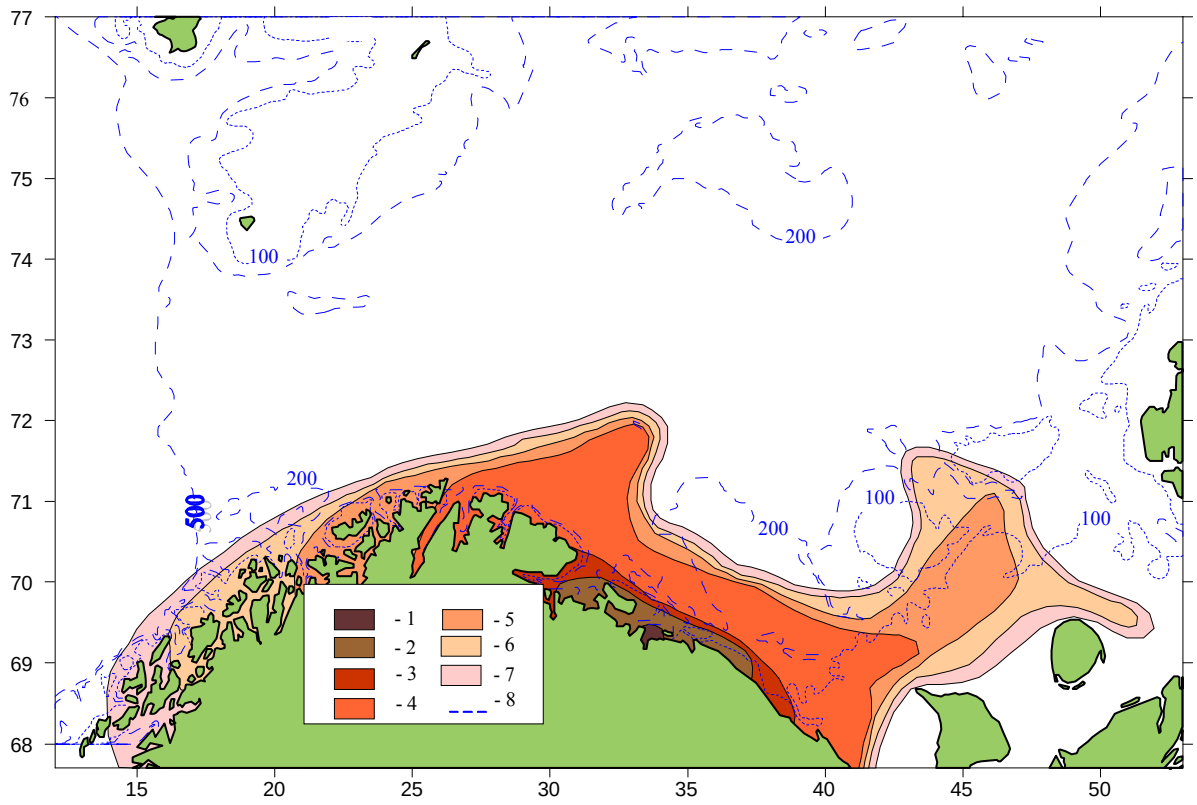

Figure 10. Historical red king crab invasion in Barents and Norwegian Seas:
1 – introduction place in 1961-1969 гг.; 2 – areal till 1977; 3 – till 1990; 4 – till 1994; 5 – till 1995 г.; 6 – till 1997; 7 – till 1999; 8 – isobaths, m;

12 BYCATCH OF CRABS IN OTHER FISHERIES

Registration of crab bycatch in coastal regions trawl fisheries has been carried out in Russian waters since 1996, revealing fairly high numbers of crab bycatches. In 1999 the total bycatch of king crabs in Russian waters was estimated to be about 30 000 crabs. We have no data in 2000.
Comparing legal males abundance from trawl surveys with king crab bycatch rates, we find that the same trends as in the stock development (Kuzmin & Sundet, 1999).

Registration of crab bycatch in gillnet and longline fisheries has been carried out in Norwegian coastal waters since 1997, revealing fairly high numbers of crab bycatches, particularly in the gillnet fishery for cod and lumpsucker (Sundet 1999). An additional study shows that this is a serious problem for the fishermen causing loss of catches, ruining gear and increasing significantly the hours at sea.
The bycatch problems seem to be higher in some areas than others. In fact, some of the traditional fishing grounds for gillnet and long-line in south Varanger have become almost inaccessible for fishermen using this gear.
In 1998 the total bycatch of king crabs in Norwegian waters was estimated to be about 36 000 crabs. From interviews with local fishermen, one concludes that the majority of these crabs die because of rough treatment when unfastened from the nets (Sundet & Hjelset 1999).

13 BIOLOGY

Investigations on the stomach contents of the king crab in Varanger show that small mussels and polychaeta are the most important food for this species. There are, however, a large number of food items appearing in the stomachs including echinoderms, algae and fish. The crab seems to feed on what is available; therefore, the diet changes with seasons (Sundet et al 1998). Small crabs and parts of adult crabs were found in stomach of cod, wolfish (*Anarhichas lupus*) and skate (*Raja radiata*) (Kuzmin, 2000).
The fecundity of the crabs in Varanger seems to be higher than in other areas (Rist, 1999, Gerasimova et al., 1995).
There is still little knowledge about the larvae and the juvenile phases of the king crab in the Barents Sea, but occasional findings of small crabs indicate a lower growth rate of juvenile crabs in Varanger than in the Bering Sea and in the northern Pacific.
Growth of adult crabs from the recapture of ca 150 tagged crabs show that males increase in carapace length of between 14 – 18 mm at each moulting. The growth increments in females decrease from about 12 mm to about 3 – 5 mm at maturation, while nothing similar happens among males.

14 PARASITES

There are no descriptions of any new parasites in the Norwegian part of the Barents Sea, which can be associated with the king crab. A study on symbionts on the crab in Varanger revealed five new species which never have been described as endemic to the Barents Sea (Haugen 1999; Bakay et al., 1998). The leech *Johanssonia arctica,* is a host blood parasite *Trypanosoma sp.* and are a common symbiont on the crab. Ongoing studies are therefore testing whether the crab may be a vector in the dispersion of this blood parasite.
Research in PINRO during 2000 added to parasite list on crab three genus: Monogenea gen. sp., Cestoda gen. sp., Trematoda gen. sp.

15 BASIC REQUIREMENTS FOR MANAGEMENT OF THE COMMERCIAL CRAB FISHERY.

The research fishery in the Barents Sea has now been carried out for seven years. Throughout this period our knowledge of this species has grown both according to biology and fishery aspects. We therefore would like to make suggestions on some management actions aiming to improve management of the king crab stock.

- We recommend the male sex harvest strategy to be continued in the fishery in the
- Barents Sea.
- Only traps should be permitted in the fishery and the traps should be provided with
- devices such as degradable net panels to prevent ghost fishing.
- Minimum legal size (MLS) of males should refer to the carapace length (CL) in stead of carapace width (CW) in NEZ. The existing MLS of 150-mm CW corresponds to a CL of ca 132-mm. In REZ 150 mm CW will be use as MLS.

- The fishery should only be allowed from July to January due to moulting/mating periods.
- The main fishing period should be in middle autumn due to highest meat content.
- A minimum fishing depth of 100 m, in addition to closure of certain areas to protect the non-commercial part of the stock should be enforced.

In the management of the Bristol Bay (Alaska) king crab stock they have decided upon a strategy with a constant harvest rate set at 20% of the mature male population, provided that no more than 60% of the legal male population is harvested. Further, no fishing is allowed when the population of mature females is at or below a certain threshold. Assuming the present stock indices, we suggest a harvest rate of 20 % of the legal male stock in both zones. Such a harvest rate will provide a sustainable harvest and a continued growth of the stock.

16 CONCLUSIONS

The present mean estimates of legal males above 150 mm CW in REZ and NEZ are 1 513 000 and 676 000 respectively.

Estimates of total stock with CL > 60 mm in REZ are 12 546 000. There are no such estimates in NEZ.

In NEZ the relative abundance of pre-recruits (115 mm< CL <132 mm) has increased from 6.5 % in 1999 to ca 25 % in 2000, indicating good recruitment to legal size stock within the next couple of years.

The stock estimate of egg-carrying females in 2000 was 1 576 490 in NEZ and 693 888 in REZ.

The surveys in 2000 revealed only minor recruitment to the crab stock in the Barents Sea.

Moulting frequency of pre-recruits in NEZ and in REZ are high in 2000: 83 % and 95.6%, respectively.

There are no signs of any effects of the one sex harvest strategy on the sex ratio in the crab stock.

The crab in NEZ still inhabits new areas along the coast of Finnmark and new parts of the coast will soon be of interest for fishery. The crab density is increasing in eastward in REZ.

The crab in the NEZ shows only minor migrations. In Varanger there is mainly a westwards migration.

Bycatch of king crabs is a major problem in the gillnet and longline fishery in the eastern Finnmark. In 1999 ca 120 000 crabs were estimated caught as bycatch in the gillnet fishery for cod alone in NEZ and 30 000 crabs in the trawl fishery for whitefish in REZ.

Several regulations for commercial fishery starting aiming to improve the management of the king crab in the Barents Sea are proposed.

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Red King crab in the Barents Sea waters - assessment and stock evaluation.

Research fishery	Research quotas (TAC) for 2000 the same as in 1999 : 75 000 crabs; 37500 on each nation. Mean weight of landed crabs in NEZ high in 1999: 5.46 kg, but reduced quality of crabs due to meat content. Fishery in NEZ started 16th of October. Mean weight of landed crabs in REZ in 1999: 3.8 kg and reduced quality of crabs due to meat content too. Fishery 2000 in REZ started in mid October.
Effort	In NEZ 33 vessels participate in the fishery in 2000. Nine more than in 1999. Only square traps permitted in the fishery this year. In REZ 5 vessels participate in fishery in 2000 for the present. One ship is working as processor. Only conical traps permitted in the fishery in REZ as in earlier years.
Bycatch	Large bycatches of crabs in the Norwegian coastal fishery with gillnets for cod and lumpsucker. An ongoing program for registration of bycatches in NEZ. Considerable bycatches of crabs in the Russian coastal fishery with bottom trawl for cod, haddock and plaice.

INDEX	OBSERVATION	INTERPRETATION	EVALUATION
FISHERY DATA			
CPUE-index traps	In NEZ: a general increase in CPUE for both sexes and most large (CL>~90 mm) crabs. In REZ: a small increase in total CPUE.	Indicates a general increase in abundance and availability.	• •
Fishing areas	In NEZ: New areas for fishing crabs were exploited during the fishery in 1999. Probable new areas in 2000. In REZ in 1999 two areas were exploited. Same two areas in 2000.	Indicates a general increase in legal male stock.	• •

Size of legal males	In NEZ: Mean weight of landed crabs increase from 5.14 in 1998 to 5.46 kg in 1999. In REZ: Mean weight of landed crabs decrease from 3.8 in 1999 to 3.4 kg in 2000.	Probable low harvest rate. Accumulated stock?	• •
Sex ratio	High proportion of females in NEZ recorded earlier years changed to ca 50:50 in 2000. In REZ: in 2000 high proportion females registrated 68:38	No visible effects of harvesting males only	• •

RESEARCH DATA			
CPUE- trawl	Increase in catch per trawl-hour from 24 in 1999 to 142 in 2000, for selected areas in NEZ. In REZ: catch per trawl –hour 24 specimens in 2000.	Large increase in availability of crabs in selected trawl-areas in Norwegian part of Varanger	• •
Stock estimate legal males – swept area	In 2000: NEZ REZ High estimate: 1 238 995 2 052 004 Medium estimate: 676 314 1 513 043 Low estimate: 113 096 974 082	Large increase in estimates in NEZ since 1998. Same abundance level as in 1999 in REZ	• •
Recruitment to legal stock	In NEZ: Pre-recruit (115 mm<CL<132 mm) group increased from 6.5% in 1999 to 24% in 2000 In REZ: Pre-recruit males group decreased from 13.0% in 1999 to 9.08% in 2000.	Good recruitment to legal stock in NEZ in 2001. Good recruitment to legal stock in REZ in 2002 and weak in 2001.	• •
Stock estimate egg-carrying females	In 2000: NEZ REZ High estimate 2 584 350 1 025 996 Medium estimate 1 576 490 693 888 Low estimate 469 426 361 780	Not available earlier Considerable shortage of egg-carrying females abundance in REZ during autumn survey	?
Recruitment to total stock	No observations of recruitment to stock since 1997 in NEZ. Significant recruitment to total stock observed in 2000 in REZ	Minimal recruitment to stock last year	–
Moulting – pre-recruits	In 2000 : 83% of pre-recruits have moulted in NEZ. In 2000 95.6% of pre-recruits have moulted in REZ.	High growth rate among pre-recruits	• •

Sex ratio	In NEZ: female : male ratio of 54:46 in autumn cruises. In REZ: female : male ratio of 28:72 in September cruise in 2000. In autumn in 1999-46:54.	More males than in surveys earlier. Harvest strategy is not affecting sex ratio.	:
Distribution area	In NEZ: High abundance of crabs in new areas such as Syltefjord, Båtsfjord and Kongsfjord. Increased abundance in Tana. In REZ: Higher abundance of crabs in East Coast region as previous years. In Voronka of the White Sea had high catch for the first time.	Steady widening of the crabs distribution area westwards along the North-Norwegian coast and eastwards the East Coast area.	?

OTHER FACTORS			
Ecological impacts of the crab	No ecological impacts of the introduced king crab recorded in Norwegian and Russian waters.		?
Marine climate	In NEZ: A General increase in temperature along the North Norwegian coast during recent years. In REZ: in Kola Section was observed positive anomalies in coast region in April: +0.88°C; in September: +0.35°C during research cruisers. Extremely high temperature was observed in April in East Coast region in 2000.	Higher temperatures will probably lead to a more north-easterly distribution of the crab.	:
Perspectives on fishery	In NEZ and REZ: abundance increasing, high prices and a cost-effective fishery makes this fishery very attractive. New fishing areas and growth of the stock may increase the number of fishers participating and start commercial fishery in 2001/2002.		:

ASSESSMENT			
Stock status	The main part of the stock consist of crabs with carapace length between 100 and 125 mm in NEZ. In REZ The main part of the stock consist of crabs with carapace width between 90 and 130 mm (84 –115 mm CL) Minimal recruitment to stock. In NEZ: crab inhabit new areas continuously.	The stock is growing. Good recruitment to legal stock next year (NEZ) and in 2002 (REZ). No recording of failure in reproductive potential in the stock.	:
Harvest rate	**Low harvest rate (<10%) until now in the Barents Sea. Suggest an increase in harvest rate to 20% of legal stock.**	:	

Concerns for current status/future prospects –

Uncertainty regarding index quality or impact ?

Positive evaluation :

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