

## THE NORWEGIAN MANAGEMENT OF THE RED KING CRAB

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### ABSTRACT

The Norwegian government has recently put forward a white paper concerning the management of the red king crab in the Barents Sea. The crab is an introduced species in the Barents Sea. The motive of the introduction was to improve the economy of the Russian coastal fisheries, as the crab is a highly valuable commercial species. Since the introduction the crab population has grown and expanded along the Norwegian coast. Norwegian authorities have throughout 30 years of presence from the red king crab in Norwegian waters faced several management challenges; however, it also contributes as a valuable resource for many communities in the northernmost county of Finnmark. Thus a management plan must place emphasis on an ecosystem approach and also secure the economic and social interests. The main objective of the new management strategy is to limit the stock of red-king crab in Norwegian waters, and at the same time to secure the commercial harvest. The major steps are: maintaining and limiting the size of the commercial area, limited access and a new harvest strategy within the commercial area, and keeping the stock at a minimum level outside the commercial area. In order to achieve the last step, the Government has proposed to establish a fund to support a decimation catch. However, these issues need to be investigated further. The White Paper was approved in the Norwegian Parliament March 3<sup>rd</sup> 2008.

**Keywords:** Red king crab, introduced species, Norwegian waters, management challenges, conflicting objectives, management strategies, future challenges

### INTRODUCTION

The red king crab is an introduced species in Norwegian waters. It was deliberately put out by Russian scientist between 1961 and 1969, and it was first discovered in the Norwegian Economic Zone (NEZ) in 1977. Norwegian authorities have throughout 30 years of presence of the red crab faced several management challenges and conflicting objectives. As an invasive species the red king crab could have a negative impact on the ecosystem, on the other hand the red king crab is a highly valuable and demanded resource which could generate large revenues and wealth creation when harvested.

What makes the management of the red king crab stand out from traditional management of fisheries and ordinary management of introduced species, are the above mentioned to-side characteristics of the species. This, in combination with the shift from joint management with the Russians to a national management from 2007, is why the Norwegian government decided to prepare a white paper on the Norwegian management of the red king crab for the Norwegian Parliament. The aim of the white paper was to review the previous management and to address future challenges and international obligations, and in light of these propose applicable management measures to meet conflicting objectives.

In September 2007 the Norwegian government presented a white paper which proposed several new management principles. The white paper was approved in the Parliament on March 3<sup>rd</sup> 2008. In this paper these principles will be summarized, but first the historical context and development leading to the proposed measures will be presented.

## A BRIEF HISTORICAL OUTLINE

Red king crab (also known as the Kamsjatka-crab) was placed in the Murmansk-fjord by the Kola-peninsula in the period between 1961 and 1969. The natural habitat of the species is in the northern Pacific Ocean (see distribution in figure 1). This was done by Russian scientists through a sort of a “replacement-program for red king crab”, where red king crab was collected in the Japanese Sea outside of Vladivostok and transported through Soviet to the Murmansk coast. A total of 3340 adults, 10 000 juveniles and 1,6 million larvae was placed in the Barents sea. The aim was to establish a large stock within 30 years and improve the economy of Russian coastal fisheries.



Figure 1 Distribution of red king crab in the Pacific Ocean and the Barents Sea

No other governments were informed about this extensive project, thus Norwegian authorities had no possibilities to prevent the introduction before the stock was considerable established in the Barents Sea.

In 1974 the first red king crab was caught in Russian waters, and the first discovery in Norwegian waters was in 1977. In a Soviet scientific publication from 1978 it was stated that the red king crab was to be considered as a permanent inhabitant of the Barents Sea. During the 80's the by-catch of red king crab increased, and it turned out to become a major problem in several ground-fish fisheries. Especially in the spring of 1992 a large quantity of red king crab was caught as by-catch in the coastal areas with a local gillnet and line fishery for cod, haddock and lump-fish. The by-catch of crab resulted in damaged and lost gear, in addition to time delays in vessel operations.

The Norwegian collaboration with Russian authorities has since 1975 been formalized in the joint Norwegian-Russian commission. In the annual commission meetings the Total Allowable Catch (TAC) is fixed and divided between Norway, Russia and a third country. In the “Grey-zone”-agreement between Norway and Russia from 1978 red king crab regulations was included, and it was decided to have a joint management of the crab, however, the crab wasn't considered

in the joint Norwegian- Russian commission until 1992. It was then made consensus on enhanced research activities and exchange of research results. The scientific advice was to become the basis for the regulation. From 1994 it was decided to carry out a research fishery for the crab.

On the 29<sup>th</sup> session in the joint Norwegian-Russian commission in 2000 it was agreed that the contracting parties could carry out a commercial fishery on the red king crab from 2002. Principles for harvest were approved the subsequent year, including exploitation rates, minimum sizes, period of harvest and regulations for use of gear.

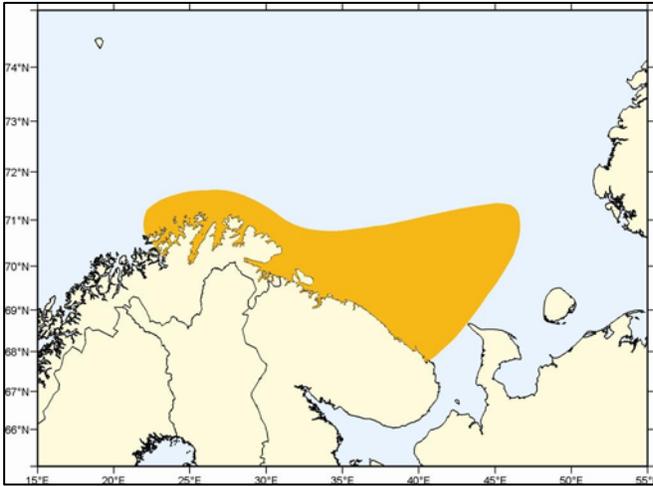
In 2006 it was decided to shift from a joint to a national management of the red king crab in the joint Norwegian - Russian fisheries commission, with effect from 2007. This represented a new era for the Norwegian management, and it was decided to review the management of the red king crab and come up with national strategies to meet some of the challenges Norwegian authorities had faced throughout the years of crab presence.

From one point of view the crab is an alien species which could have a negative impact on the ecosystem. At the same time the red king crab is a highly valuable resource which could generate large revenues and wealth creation in fishing communities in rural areas. Another important factor to take into consideration for future management is the borderline between the NEZ and the Russian Economic Zone (REZ) (with parts of the borderline still unresolved and the Grey-zone), as the Russian management will have implications on the stock in Norwegian waters. At present Russian authorities only regard the red king crab as commercial specie with no intentions on limiting the stock from a precautionary perspective; hence, there will be natural immigration of crabs into Norwegian waters from the Russian stock.

## **STATUS OF KNOWLEDGE**

The introduction of an alien species in the Barents Sea also represented research challenges for the scientists. There has been performed a lot of biological and ecological research in the natural habitats in the Bering sea and the northern pacific, but the results and discoveries from that research is not necessarily transferable to the conditions of the Barents sea. Thus it has been necessary to obtain similar knowledge on the red king crab in the Barents Sea.

Since 1993 Norwegian and Russian scientists have put a lot of effort into the research of the red king crab, and now there is a larger comprehension of the biology of the crab and how the species has adapted in the Barents Sea compared to its natural habitat. Figure 2 shows the distribution of the red king crab in Norwegian and Russian waters in 2007.



**Figure 2 Distribution of red king crab in Norwegian and Russian waters**

However, there are still many unresolved issues. A lot of the research carried out until now has focused on stock surveys and assessment. These are still prioritized research fields, as they are prerequisites to maintain a commercial fishery and to consider measures to prevent further expansion of the crab. However, also increased research effort in examining the effects the crab has on the ecosystem will be of importance in forthcoming years.

The introduction of the red king crab also has an influence on some of the local communities in the affected areas. This includes both social aspects of a coastal culture in change, the interaction between culture and nature and socio-economic effects. There has not been performed a lot of social and economic studies on the red king crab, and several issues needs to be investigated further. This can bring forth a more holistic understanding of the species and its effects.

The government has proposed following prioritized areas for research: development and improvement of stock assessment, biology of the crab in the Barents Sea (including reproduction and larvae drift), the effects the crab has on the ecosystem, development of new harvest methods, bio-economic and socio-economic effects and social impact on local communities.

### **FROM A RESEARCH TO A COMMERCIAL FISHERY**

From 1994 until 2001 a research fishery for the red king crab was carried out. In these years Norway and Russia agreed upon a fixed annual TAC divided equally among the two countries. In 2002 it was opened for a commercial catch of 100 000 crab in the NEZ, where 10 000 crabs was set aside for research purposes. In advance of this, Norwegian authorities appointed a working group to prepare the process of the shift from a research to a commercial fishery. The work of the group constituted the basis for the Norwegian management of the red king crab in subsequent years.

The principles of the management strategies was (also in accordance with decisions within the joint Norwegian-Russian commission) an exploitation rate of up to 20 % of the amount of male crabs above a fixed minimum size of 132 mm carapace length, this to secure a stable reproduction of the stock. In the Norwegian harvest this size was set to 137 mm carapace length in order to focus harvest on the larger individuals. It was considered that the stock still would

increase with an exploitation rate of 20 %. However, this was based on experiences from Alaskan fisheries, and it can be discussed whether these experiences were directly transferable to the Barents Sea harvest.

In the commission it was also approved to follow other management strategies used in Russian and American waters in the Pacific Ocean, including a prohibition on female harvest, thus only allowing for a harvest of large male crabs. It was also concluded that only fish pots were to be used as harvest gear and that by-catch of red king crab in other fisheries was not allowed. A restraining order to throw out any by-catch of red king crab was consequently introduced. Legalizing the by-catch would imply that Norwegian authorities had to deduct these individuals from the TAC, thus reducing the quotas of the vessels with permit to fish. This was not politically desirable. However, the by-catch of crab remained a problem in some ground-fish fisheries.

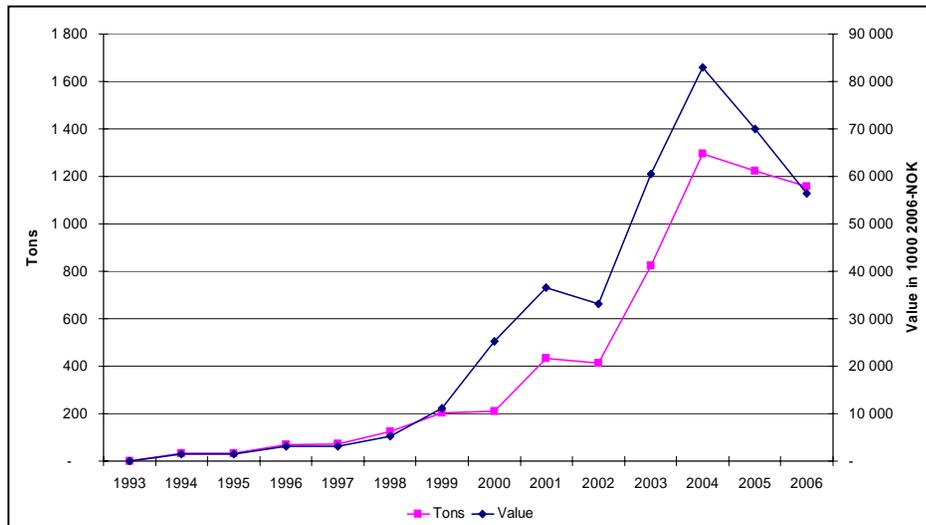
The regulation of the participation in the commercial fishery for red king crab was based on the principle that the fishermen that were the most affected by the by-catch were to be given permissions to fish. Hence, fishermen could qualify for participation if they in previous years had harvested a certain quantity of cod with gillnets or line, or lump-fish with gillnets, in red king crab areas. The vessels were further regulated into two groups with different quotas and the period of harvest was in 2002 from the October 21<sup>st</sup> until the December 31<sup>st</sup>. 127 vessels were given an annual permit to access the fishery.

**Table I Number of vessels and TAC in commercial crab fishery from 2002 until 2007**

Year	Vessels	Norwegian TAC
2002	127	100 000
2003	193	200 000
2004	260	280 000
2005	273	280 000
2006	264	300 000
2007	245 <sup>1</sup>	300 000

In subsequent years regulations were slightly adjusted. In 2004 the quota was 280 000 crabs, with 10 000 set aside for research purposes. This year a total of 260 vessels participated. In table I the Norwegian TAC and the number of participating vessels between 2002 and 2007 are shown. The peak of participating vessels was reached in 2005. The following decline is probably due to a restriction on sales of red king crab vessels, with access permits no longer following the vessels from 2005. In figure 3 the quantities harvested and the ex-vessel prices achieved from the research and commercial fishery from 1993 until 2006 is presented. The peak in total quantity and ex-vessel price was reached in 2004. The subsequent decline was probably due to reduced average crab size and price.

<sup>1</sup> Temporary numbers



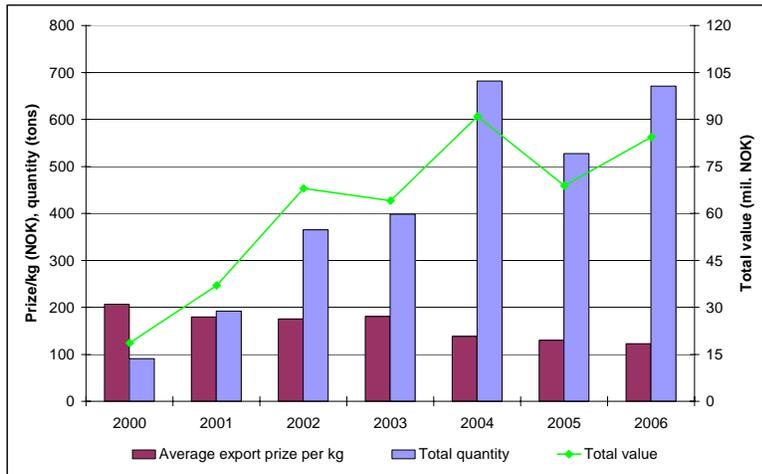
**Figure 3 Quantity and ex-vessel price in the research and commercial fishery of red king crab from 1993 until 2006**

In 2003 the joint Norwegian-Russian commission decided that Norway was to establish a western limit for the joint management of the red king crab. The purpose of this border was to prevent further spread of the red king crab. Norwegian authorities was now free to implement management measures west of this border, however, under the condition that it would not affect the stock-development in Russian waters. From august 2004 the border was established and an open access fishery was implemented west of the border, with an additional prohibition against throwing out crabs in the fishery. However, the open access harvest has not been significant. This is mainly due to low abundances of commercial crabs; hence there are not enough economic incentives for vessels to participate in this fishery.

According to figure 3 above, the total ex-vessel price has varied between 60 and 80 million Norwegian Kroner (NOK) (12-16 million USD) the latest years. The majority of the value creation is based on harvest of red king crab in small-scale fisheries in rural areas in the eastern part of the northernmost county of Finnmark. Thus the red king crab has been of importance for some communities, and given a larger industrial base and new employment opportunities. There has not been performed a lot of research of the socio- and business economic impact the crab has entailed. However, one study carried out indicates that the fishery is profitable (Wessel 2004), especially for the small coastal vessels. Another study has investigated how the crab has made a contribution to industrial growth in a specific fishing community in Finnmark (Monsen 2004). The study concludes that the production system in this community has been rebuilt due to the introduction of a new resource, in this case the red king crab. A bio-economic study carried out in 2005 (Eriksen 2005) has examined the predation costs of the red king crab stock in Norwegian waters. This study concludes that the stock has low predation costs; however, at present there is not enough knowledge and data basis to perform comprehensive bio-economic analyses. There are also several ongoing projects focusing on the social impacts of the red king crab.

Analyses carried out in the white paper show, on the basis on catch statistics, that the crab has been an important contribution for smaller coastal vessels, and also that these vessels have given

priority to the fishery of red king crab on behalf of other fisheries. As there has only been a commercial fishery for 5 years when the white paper was approved, there are still too short data series to perform comprehensive and adequate economic analyses on the species. However, there is little doubt that utilization of the red king crab represents possibilities for wealth creation and growth in some communities. The future development of the industry will considerably depend on the market situation (demand) and the management strategies put forward by the authorities.



**Figure 4 Average export prize/kg, total quantity exported and total export-value exported in the years 2000-2006**

In figure 4 export numbers in the years between 2000 and 2006 are shown, and the trend is an increase in total export-value and in total quantity exported throughout the period. The peak was in 2004, with a subsequent decline in 2005. The average prize has slightly decreased the latest years. This can be due to many factors, but the main reason is probably less demand in the Asian market, and an increased supply of Russian crabs into the market.

## **PRINCIPLES FOR MANAGEMENT PRESENTED IN THE WHITE PAPER**

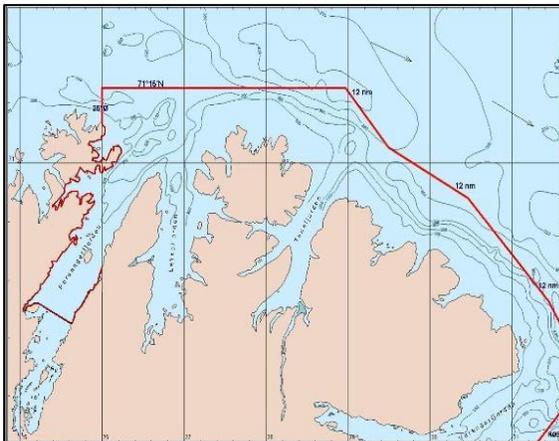
The nature of the red king crab in terms of being a possible threat to the ecosystem, whereas on the other hand being a valuable resource, leads to several conflicting policy objectives and perceptions on how the crab should be managed. In addition there are still many unresolved research issues and an incomplete comprehension of the ecological, economic and social effects of the species. What is undoubtedly is that the red king crab has to be considered as an established species in the Barents Sea.

A management strategy with a precautionary approach implies that actions should be taken to decimate the species to the largest extent, as it is impossible to predict the possible effects the species could have on the ecosystem. According to international obligations through the Convention on Biodiversity (CBD), Norway has to put forward measures in order to prevent potential negative effects the crab has on the ecosystem. At present, however, no documented negative effects have been observed. Even though there is not enough knowledge on the impact of the red king crab on the ecosystem, precautionary measures must be taken. In addition the crab causes a problematic by-catch in other fisheries and could have negative bio-economic consequences by being omnivorous species in a productive ecosystem.

After the shift from a joint to a national management, Norwegian authorities have obtained a larger freedom of action of what strategies to adopt. However, the Russian management strategies still have to be taken into consideration, as the NEZ is situated against the REZ (with still unresolved borderlines in certain areas). At present, there are no indications on that the Russians will implement measures to reduce the stock. Hence, there will be a constant spread of crabs from REZ to NEZ in coming years.

In light of the above mentioned conditions, the main objective in the government's management strategy is to reduce the spread of the red king crab along the Norwegian coast, and to keep the stock outside a fixed commercial area to a minimum level.

Thus, the government has proposed to establish a commercial area where a profitable and sustainable fishery is maintained, whereas the stock is to be reduced to a minimum outside the area. A commercial area will ensure that the logistics of the red king crab industry will remain, and in that way make a basis to utilize and trade crabs from a decimation catch outside the area and a commercial harvest within the area (with supply of Russian crabs crossing the NEZ-border). The area is shown in figure 5.



**Figure 5 Area for commercial harvest**

The government has proposed following measures to secure a low stock outside the commercial area:

- Open access for harvesting red king crab, non-regards of sex and size, and a prohibition to throw out crabs
- Further investigation for establishing a fund for a decimation catch of red king crab to reduce the stock
- Arrange support to initiatives concerning development of red kin crab-products
- Prohibition on fish-farming crabs outside the limited area

The government has proposed following steps to be taken in the area for commercial harvest:

- Maintaining a western border and establishing a northern border (see figure 5)

- Several harvest strategies within the commercial area including: harvest of males and females (with separate quotas), annual fixed exploitation rates, and minimum sizes, harvest of injured crabs as a share of the quota and permit for by-catch of red king crab in certain fisheries
- Open access for all vessels under 11 meter from the county of Finnmark
- Vessels over 11 meters from the eastern part of Finnmark with former access permits will also be permitted in the fishery
- Increased research activity (specifications presented earlier in paper)
- Harvest strategies and consequences of the strategies must be evaluated when the management of the red king crab will be reviewed in five years

## **CONCLUDING REMARKS**

The red king crab is the center of attention in many political and social circles, and there are still many unresolved issues with regards to management of, and research on the species. Onwards there has to be a stronger focus on marketing and product development in order to optimize utilization of the species. In terms of regulations, enforcement of the fisheries and how to arrange for a decimation catch outside the commercial area, Norwegian authorities still face several challenges. These challenges will be subject to further investigation and analyses in subsequent years.

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