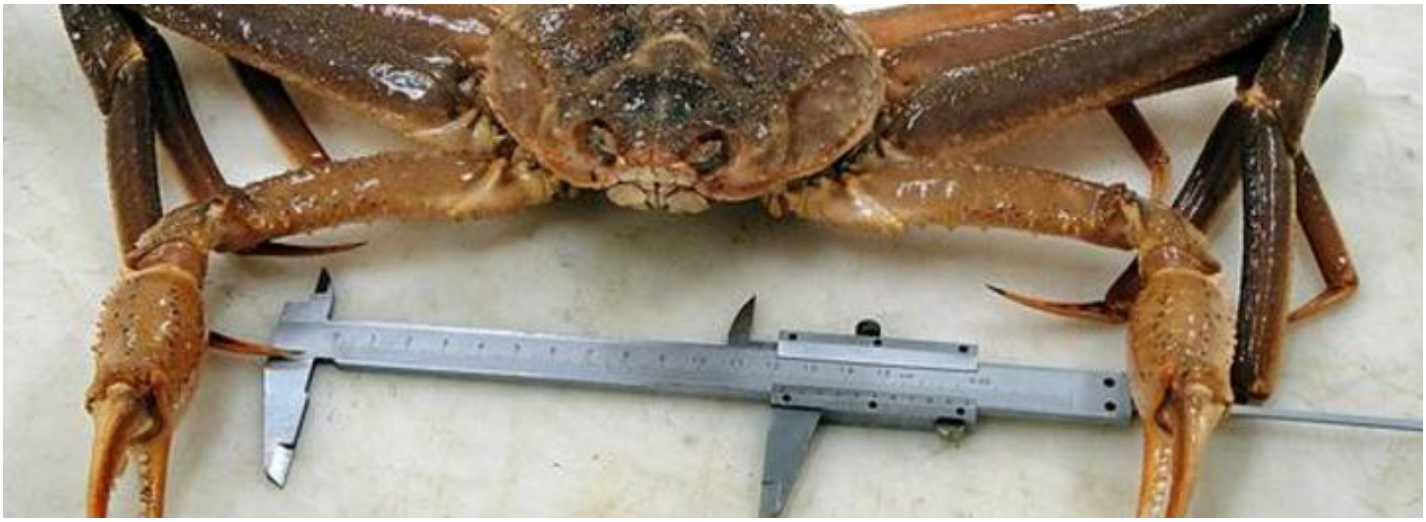
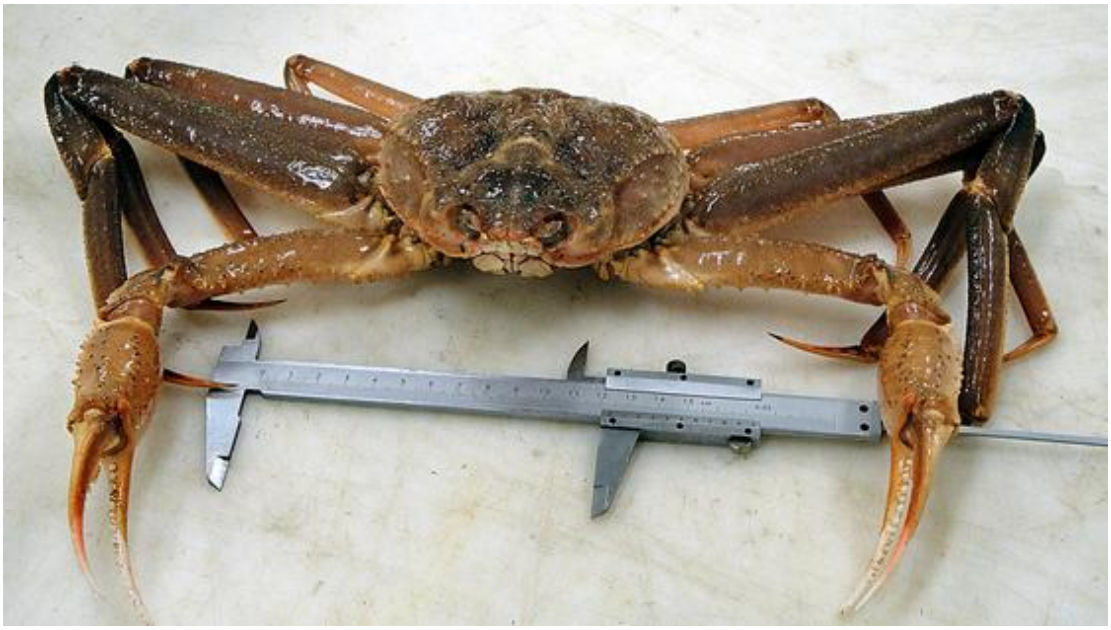


The snow crab – a new and important player in the Barents Sea ecosystem

In 1996, Russian researchers found five specimens of snow crab in the net of a trawler fishing for cold water prawn on Gåsbanken west of Novaya Zemlya. That was the first time this alien crab species had been found in the northeast Atlantic. Nearly two decades later, there is still no credible explanation for how it arrived in the Barents Sea.



A snow crab caught in Olgastredet in 2011. Photo: Jan H. Sundet

By Jan H. Sundet, Institute of Marine Research

Once the snow crab got to the Barents Sea, it had found an area where it could flourish, and in the years since 1996 the population has grown almost exponentially in terms of both numbers and distribution. While the snow crab's main habitat today is the northerly parts of the Russian Exclusive Economic Zone and in international waters of the Barents Sea (in the Loophole, or "Smutthullet" in Norwegian), it is also working its way into the Fisheries Protection Zone around Svalbard (see map). The exponential growth in snow crab numbers in the Barents Sea is a classic example of how an alien, introduced species can grow and thrive in a new environment. Russian researchers at the Knipovich Polar Research Institute of Marine Fisheries and Oceanography (PINRO) in Murmansk have estimated that in 2014, the Russian zone alone, there were over 75 000 tonnes of harvestable male crabs (with a carapace exceeding 100 mm in width). This means that the total population of snow crab is many times greater.

Biology

The life history of the snow crab is fairly well known from studies in its natural habitat, but few studies have been done on the snow crab in the Barents Sea. The crab is a typical arctic species that thrives best at temperatures below 4^{o}C but is also capable of living at temperatures down to -1.5^{o}C. Juveniles prefer temperatures below 3^{o}C. The reproductive cycle of the snow crab can span either one or two years, depending on the temperature conditions in the crab's habitat. Spawning and mating take place over an extended period – from January to May – and the old eggs hatch just before the next spawning. The larval stage is pelagic and normally lasts about two months. After settling on the seabed, the larva takes on the form of a tiny snow crab, only about 3.5 mm. The crab grows by shedding its outer shell (moulting) several times until the final (terminal) moult when it becomes sexually mature. It is then usually five years old. Size at terminal moult can vary greatly among both males and females, and males are normally considerably larger than females. Snow crabs have been observed at depths from 50 to 450 metres, but most of them are found at between 200 and 300 metres depth, where the crabs prefer to live. There they graze on animals living in and on soft bottom sediments like mud and clay. Several different kinds of prey have been identified in the stomachs of snow crabs, but mussels, polychaete worms and crustaceans appear to dominate. This indicates that the snow crab is not dependent on particular prey species for survival.

Fisheries

In 2013 and 2014, a substantial snow crab fishery developed in the Barents Sea, with up to 15 large vessels from several countries participating. All the fishing takes place in international waters, and the vessels fish

with up to 2 500 crab traps each. The traps are strung together in chains up to several kilometres long, and the large numbers involved have led to conflicts between crab and trawler fisheries in this area.

Most of the snow crab population is in the Russian zone, but this area has hitherto been closed to snow crab fisheries. Since crabs can be processed both shipboard and landed to facilities on shore, it is difficult to obtain a reliable overview of the total volume of the fishery. Snow crab landings in 2014 are expected to total around 4 000 tonnes, which is almost on a par with the tonnage of king crab landed from the Barents Sea. However, the price of snow crab is only 25–30% of the price of king crab.

In view of the fact that the snow crab population has potential to grow much larger than it is at present, we can expect considerably bigger catches once snow crab fisheries are opened up in the Russian zone. Calculations indicate that annual catches in the Barents Sea may amount to between 40 000 and 10 000 tonnes once the snow crab has spread to its full extent.

Impact on the ecosystem

Snow crab may thus become a major fishery in the future, but the important question is what role it will play in the ecosystem of the Barents Sea. A species as numerous as the snow crab is expected to become, and that constitutes so much biomass, is clearly bound to affect the existing ecosystem. There is much to indicate that arriving snow crabs will take over a niche in the food web that was previously occupied by a number of different species, primarily bottom-dwelling animals. Snow crabs will affect the ecosystem by feeding on animals that live on the seabed, which may lead to changes in the species composition of bottom-dwellers. It will also compete with – and be eaten by – other animals that find their food on the seabed. Learning more about how snow crabs affect benthic ecosystems in the Barents Sea is essential if we wish predict what changes we can expect.

Arctic marine systems are simpler than ecosystems further south. That also makes them more vulnerable to external factors such as the introduction of alien, invasive species. Arctic food webs usually only have a few species on each trophic level, making each individual species more important. Impacts on one trophic level can therefore have significant “cascade” effects upwards and downwards in the food web.

A larger proportion of the plant production sinks to the bottom in the Arctic than in southerly waters. Once at the seabed, this sedimentary organic matter is broken down into chemical elements that are then available as nutrients for growth of new plant biomass – and the benthic fauna is responsible for this transformation. Changes in bottom fauna composition and biomass can thus contribute to lower remineralisation of organic matter within the ecosystem.

Today, we are probably seeing only the beginning of the snow crab’s development in the Barents Sea, and a great deal will happen in years to come. Everything suggests that the snow crab will become a significant player in this ecosystem, with all the challenges that will imply for marine research in terms of understanding what is happening. The multidisciplinary research approach that will be required is a suitable challenge for the flagship research programmes at the Fram Centre.

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