BK-0015

**Marine Stewardship Council fisheries assessments**

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# Antey Sever Barents Sea Crab

# Announcement Comment Draft Report

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|---|---|
| Conformity Assessment Body (CAB) | **Lloyd's Register** |
| Assessment team | Geir Honneland, Gudrun Gaudian and Alexei Sharov |
| Fishery client | **Far Eastern Crab Catchers Association** |
| Certificate Holder | Antey Sever LLC. |
| Assessment type | Initial Assessment |
| Date | December 2020 |

# Assessment Data Sheet

| | | |
|---|---|---|
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| | P2 Assessor | Gudrun Gaudian |

# Contents

## 1.1 List of Tables

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# 2 Glossary

| | |
|---|---|
| BBTA | Barents Sea and White Sea Territorial Administration (Russia) (name changed to Severomorsk Territorial Administration in 2019) |
| CBD | Convention of Biological Diversity |
| CITES | Convention on International Trade in Endangered Species of Wild Fauna and Flora |
| CMS | Convention on the Conservation of Migratory Species of Wild Animals |
| CW | Carapace width |
| EEZ | Exclusive economic zone |
| ETP | Endangered, threatened or protected species |
| FFA | Federal Fisheries Agency (Russia) |
| FPZ | (Svalbard) Fishery Protection Zone |
| FSB | Federal Security Service (Russia) |
| GLM | Generalised Linear Model |
| HACCP | Hazard Analysis (and) Critical Control Point |
| HCR | Harvest control rule |
| ICES | International Council for the Exploration of the Sea |
| IMR | Institute of Marine Research (Norway) |
| IUCN | International Union for the Conservation of Nature |
| JNRFC | Joint Norwegian–Russian Fisheries Commission |
| LTL | Low trophic level |
| MLS | Minimum legal landing size |
| MSY | Maximum sustainable yield |
| NAFO | Northwest Atlantic Fisheries Organization |
| NAMMCO | North Atlantic Marine Mammal Commission |
| NEAFC | North-East Atlantic Fisheries Commission |
| PINRO | Knipovich Polar Research Institute for Marine Fisheries and Oceanography (Russia) (since 2019: Polar branch of VNIRO) |
| REZ | Russian Economic Zone |
| RFMO | Regional fisheries management organisation |
| SDM | Species distribution modeling |
| TAC | Total allowable catch |
| TNASS | Trans-north Atlantic Sightings Survey |
| VME | Vulnerable marine ecosystem |
| VMS | Vessel monitoring system |
| VNIRO | All-Russian Research Institute of Fisheries and Oceanography |

# 3 Executive summary

### Draft determination to be completed at Public Comment Draft Report stage

- This report is the Announcement Comment Draft Report (ACDR) which provides details of the MSC assessment process for the fishery for Antey Sever Barents Sea Crab. The process begins with publication of the ACDR on 14th December 2020 and was concluded (to be determined at a later date).
- A review of information presented by the client has been scored by the assessment team – please note this **does not** represent a final scoring outcome or a certification decision.
- The scoring presented in this report has not been reviewed by stakeholders, peer reviewers or the client – these steps will all take place from here onwards. Insert site visit details.
- Stakeholders are encouraged to review the scoring presented in this assessment and use the Stakeholder Input Form to provide evidence to the team of where changes to scoring are necessary.
- **All** stakeholder comments will be published ahead of the site visit. Stakeholders can meet with the assessment team remotely week commencing the 15th February 2020.
- The **Target Eligibility Date** for this assessment is date of certification.

The assessment team for this fishery assessment comprised of Geir Honneland, who acted as team leader and primary Principle 3 specialist; Gudrun Gaudian who was primarily responsible for evaluation of Principle 2 and Alexei Sharov who was primarily responsible for evaluation of Principle 1.

Client strengths

- Russia has a well-developed legal framework for crab fisheries;
- Both stocks appear to be in good shape;
- There are biological reference points and associated harvest control rules;
- The number of fishing vessels directing for crab in the Barents Sea is low (20<) and their activity is closely monitored;
- There is little bycatch of non-target species. The client is in the process of rolling out a detailed bycatch-recording system across the fleet, in cooperation with PINRO and WWF;
- The company clearly demonstrates commitment to long-term sustainability of its fishing operations through its desire to have its catches become MSC certified;
- The harvest strategy for both species of crabs is designed to maintain high productivity and result in a low probability of recruitment overfishing. Important features of the strategy are spatial measures (e.g. fishing closure inside of 12 nautical miles) and technical measures (e.g. protection of all females) that protect a proportion of mature crab. There is good evidence the harvest strategy is effective.

Client weaknesses

- Levels of dead discards of snow crabs in trawl fisheries are not known;
- Information on catches of ETP species needs to be improved;
- There is no external review of the stock assessment or the fishery-specific management system;
- The information on all other fishery removals needs improving;
- Although subject to internal reviews, the fishery-specific management system is not subject to external review;
- The client is a new actor both in the Barents Sea Opilio and the Red King crab fishery, and thus there is no established track record, both in terms of P2-relevant data collection, nor in terms of compliance;
- Although bycatch information is available through observer reports, there are no on-board measures in place to record P2-related bycatch and observations (see list of Recommendations);
- Existing bycatch information is presented in such a way that trends over time cannot be evaluated, nor can comparisons be made between different observer reports;

- There is no indication available (as yet, at the ACDR stage) that the fishery is working with already MSC certified fisheries in order to coordinate P2-related bycatch data gathering and analysis;
- There is no indication available (as yet, at ACDR stage) whether the client is cooperating with PINRO and WWF to improve habitat management;
- VMS tracks were provided just prior to publication of the ACDR, information will be reviewed ahead of the site visit;
- Compliance levels have not been confirmed by enforcement authorities.

Summary of Key Issues for Further Investigation

- Confirm IBSF scope criteria, discussed at ACDR stage under Section 5.1.3.
- Dead discard estimates in directed fishery as well as in finfish bottom trawls, longline and dredge fisheries as well as foreign fleet direct catch (PI 1.2.3, both species).
- How much bait is used for this specific red king crab fishery (PI 2.1.1, red king crab)
- Observer coverage (PI 2.1.3, red king crab)
- Additional info on data collection relevant to the vessels (PI 2.3.1, red king crab)
- Implement self-reporting system on bycatch? (PI 2.3.3, red king crab)
- More detailed data over a longer time period to support measures to manage the impacts on ETP species (PI 2.3.3, opilio)
- Information on how stakeholders perceive their opportunities to get involved in the management process (PI 3.1.2, both species)
- Confirmation of inspection coverage and compliance level by enforcement authorities (PI 3.2.3, both species)
- Information about possible external reviews of the fishery-specific management system (i.e. Russian management of red king and opilio crab) (PI 3.2.4, both species)

For interested readers, the report also provides background to the target species and fishery covered by the assessment, the wider impacts of the fishery and the management regime, supported by full details of the assessment team, a full list of references used and details of the stakeholder consultation process.

Lloyd's Register confirm that this fishery is within scope.

# 4 Report details

## 4.1 Authorship and peer review details

All team members listed below have completed all requisite training and signed all relevant forms for assessment team membership on this fishery.

**Assessment team leader:** Geir Honneland

Primarily responsible for assessment under Principle 3

Geir Hønneland holds a PhD in political science from the University of Oslo (2000) and has studied international fisheries management (with main emphasis on enforcement and compliance issues), international environmental politics and international politics in Polar regions. He was affiliated with the Fridtjof Nansen Institute in Oslo for more than 20 years, as PhD student and research fellow (1996-2006), research director (2006-2014) and director (2015-2019). Among his fisheries-related books is Making Fishery Agreements Work (Edward Elgar, 2012; China Ocean Press, 2016). Before embarking on an academic career, he worked five years for the Norwegian Coast Guard, where he was trained and certified as a fisheries inspector. Geir has been involved in MSC assessments since 2009 and has acted as P3 expert in approx. 50 full assessments and re-assessments, as well as a number of pre-assessments and surveillance audits. His experience from full assessments includes a large number of demersal, pelagic and reduction fisheries in the Northeast Atlantic, North Pacific and Southern Ocean, as well as inland, bivalve and enhanced salmon fisheries. In the Northeast Atlantic, he has covered the international management regimes in the Barents Sea, Norwegian Sea, North Sea, Skagerrak, Kattegat and the Baltic Sea, and the national management regimes in Norway, Sweden, Denmark, Russia, Iceland, Faroe Islands, Greenland, Scotland and Germany, as well as the EU level. He is qualified as an MSC Team Leader (Fisheries Standard v2.0, Fisheries Certification Process v2.1) and Chain of Custody Auditor (v2.0) and has also passed the ISO 19011-2018 course as Lead Auditor – Management Systems Auditing. Since 2019, he has been affiliated with Lloyd's Register as Senior Project Manager for Northern Europe, Scandinavia and Russia.

Geir has passed MSC training and has no Conflict of Interest in relation to this fishery. Full CV available upon request

**Expert team member:** Alexei Sharov

Primarily responsible for assessment under Principle 1

Dr Alexei Sharov is the head of Stock Assessment and Analysis Program, Fisheries and Boating Service, Maryland Department of Natural Resources, USA. He is responsible for the quantitative evaluation of Chesapeake Bay and Atlantic coast fishery resources and management advice. Dr. Sharov received his Master's and Ph. D degrees from the Lomonosov's Moscow State University, Moscow, Russia. He has more than 30 years of experience in fish stock assessment and fishery management. Dr. Sharov served as an independent expert or reviewer for multiple US agencies, including NOAA Northeast and Southeast Fisheries Science Centers, US/Canada Transboundary Assessment Committee, Fish and Wildlife Service. He also provided scientific advice for Food and Agriculture Organization (FAO), Convention on International Trade in Endangered Species (CITES).

Dr Sharov has previously carried out MSC pre assessment work for the Western Bering Sea and Navarinsky pollock fisheries and assisted with the MSC certification of the Sea of Okhotsk pollock fishery. He has passed MSC training and has no Conflict of interest in relation to this fishery. Full CV available upon request.

**Expert team member:** Gudrun Gaudian

Primarily responsible for assessment under Principle 2

Gudrun Gaudian is an experienced marine ecologist and taxonomist, including coastal and marine surveys, EIA's for coastal development and tourism, and research projects in tropical and temperate seas. Work experience also includes coastal and marine management issues, such as identifying sustainable coastal development projects, as well as addressing conservation issues, including selection and planning of marine parks and reserves, sustainable utilisation of natural resources and community based management programmes. Projects have been undertaken in temperate, polar and tropical marine regions. Since 2010 Dr Gaudian has been working on fisheries certification applying the Marine Stewardship Council standard for sustainable fisheries, primarily as Principle 2 assessor, both as Team Leader and Team Member. Other relevant work carried out includes pre-assessments, fisheries improvement plans, peer reviews and MSC workshops. Furthermore, Dr Gaudian holds an LLM degree in Environmental Law and Management, giving a deeper understanding of law and policy dealing with such relevant issues as the Common Fisheries Policy, water and waste management, and international environmental law including EU environmental policy and Law of the Sea.

Gudrun has passed MSC and ISO training and has no Conflict of Interest in relation to this fishery. Full CV available upon request.

## 4.2 Peer Reviewers

Peer reviewers used for this report were PR1 and PR2. A summary CV for each is available in the **Assessment downloads** section of the fishery's entry on the MSC website.

Justification to be added here as to why these particular peer reviewers were appointed - to be framed in terms of their specific areas of expertise relevant to this particular fishery and why they will be in a position to provide expert reviews to ensure the scores and rationales given by the assessment team have taken account of all the available information and can be scientifically justified.

## 4.3 RBF Training

RBF was not used for this fishery assessment.

## 4.4 Version details

**Table 1: Fisheries program documents versions**

| Document | Version number |
|---|---|
| MSC Fisheries Certification Process | **Version 2.2** |
| MSC Fisheries Standard | **Version 2.01*** |
| MSC General Certification Requirements | **Version 2.4.1** |
| MSC Reporting Template | **Version 1.2** |

*Modified default assessment tree see Section 10.2.4

# 5 Unit(s) of Assessment and Unit(s) of Certification and results overview

## 5.1 Unit(s) of Assessment and Unit(s) of Certification

### 5.1.1 Unit(s) of Assessment

**Table 2: Unit(s) of Assessment (UoA)**

| UoA 1 | Description |
|---|---|
| Species | Red King Crab (*Paralithodes camtschaticus*) |
| Stock | Barents Sea Russian stock |
| Fishing gear type(s) and, if relevant, vessel type(s) | Traps |
| Client group | Far Eastern Crab Catchers Association |
| Other eligible fishers | None |
| Geographical area | FAO 27, Russian continental shelf, Barents Sea |

| UoA 2 | Description |
|---|---|
| Species | Snow Crab / Opilio Crab (*Chionoecetes opilio*) |
| Stock | Opilio Snow Crab (FAO Area 27, ICES Ia, Ib) |
| Fishing gear type(s) and, if relevant, vessel type(s) | Traps |
| Client group | Far Eastern Crab Catchers Association |
| Other eligible fishers | None |
| Geographical area | FAO 27, Russian continental shelf, Barents Sea |

### 5.1.2 Unit(s) of Certification

If there are changes to the proposed Unit(s) of Certification (UoC), the CAB shall include in the report a justification.

Reference(s): FCP v2.2 Section 7.5

**Table 3: Unit(s) of Certification (UoC)**

| UoC 1 | Description |
|---|---|
| Species | |
| Stock | |
| Fishing gear type(s) and, if relevant, vessel type(s) | |
| Client group | |
| Geographical area | |

| UoC 2 | Description |
|---|---|
| Species | |
| Stock | |
| Fishing gear type(s) and, if relevant, vessel type(s) | |
| Client group | |
| Geographical area | |

### 5.1.3 Scope of assessment in relation to introduced fisheries

The MSC definition of an Introduced Species Based Fishery (ISBF) is:

"Any fishery which prosecutes a target fin or shellfish species that was intentionally or accidentally transported and released by human activity into an aquatic environment beyond its natural distribution range." (MSC Vocabulary v1.1, dated 20 February 2015)

MSC Fisheries Certification Process v2.2, paragraph 7.4.7 states that "a CAB shall only accept an application for certification from a fishery targeting an introduced species if it meets the scope criteria contained in Table 2."

The assessment team have therefore considered whether the fishery for red king crab, which was deliberately introduced in the Barents Sea, and the snow crab, which was accidentally introduced into the Barents Sea, meets the scope criteria as an Introduced Species Based Fishery (ISBF) as described below. Scope criteria will be confirmed at the site visit.

**Table 4: Scope criteria for ISBF; Red King Crab (taken from Table 2 MSC FCP v2.2 7.4.2.13)**

| | | |
|---|---|---|
| **A** | **Irreversibility of the introduction in the new location** | |
| **i** | The introduced species has a large population size (comparable to or larger than the population sizes of other native species occupying similar ecological niches in the new location). | 'Red king crab is the most abundant decapod crustacean in the Barents Sea' (Dvoretsky & Dvoretsky, 2010)<br>40-50 million 2003-2005 Russian Barents Sea (Britayev et al., 2010) |
| **ii** | The species has spread to a range beyond that of its initial introduction in the new location. | Yes.<br>Falk-Peterson et al., 2011; Anisimova et al., 2005; Oug et al., 2011 |
| **iii** | There is evidence to demonstrate that the species cannot be eradicated from the location by known mechanisms without serious ecological, economic and/or social consequences. | 'The king crab has clearly come to stay in the Barents Sea' (Falk-Peterson et al., 2011)<br>Applied management in Norwegian waters is limiting spread of crab but aimed at being able to exploit stock for economic gain over long period (Sundet, 2014)<br>Species not being treated as an invasive species in Russia; Norway has unclear classification. (Kourantidou et al., 2015)<br>'Unfortunately, there is clear evidence that international agreements and instruments have been ineffective in dealing with the problem, despite efforts of various international and national organizations, and further westward expansion of the red king crab can be expected.' (Johnsen et al., 2010)<br>The fishery is generally presented as being of high economic significance for the coastal population along the northern shores of the Barents Sea, even 'lucrative'. |
| **B** | **History of the introduction** | |
| **i** | The species was introduced to the new location prior to 1993; this being the year that the Convention on | 'Species introduced to Barents Sea 1961 – 1969' (Kuzmin & Olsen, 1994); Peterson et al., 2011; Britayev et al., 2010 |

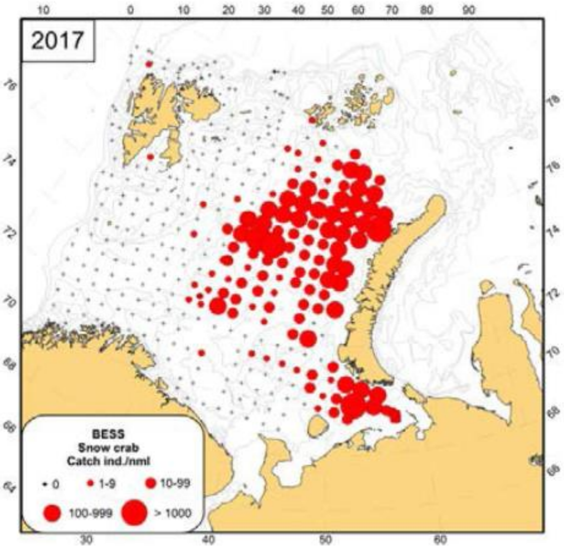
| | | |
|---|---|---|
| | Biological Diversity (CBD), which includes provisions on introduced species was ratified. | The species was introduced to the new location by Soviet authorities prior to 1993. The red king crab, *P. camtschaticus*, is native to the Okhotsk and Japan seas, the Bering Sea and the northern Pacific Ocean. During the period from 1961 to 1969, 1.5 million zoea larvae (considering the fecundity of one female ranges between 15,000 to 220,000 eggs), 10,000 1-3 year old juveniles (50% females and 50% males) and 2,609 5-15 year old adults (1,655=females, 954=males) *P. camtschaticus* from West Kamchatka, were intentionally released by Russian scientists in the Kolafjord in the east Barents Sea (Russia) to create a new and valuable fishing resource in the region (Jørgensen et al. 2005). Since then, the crab has spread both east along the Kola Peninsula, and westwards into the Norwegian zone[1]. Russian scientists believe that the red king crab in the Barents Sea has reached the limits of its eastern distribution (probably due to salinity and temperature)[2]. |
| **ii** | If the introduction occurred after the CBD was ratified such fisheries shall only potentially be in scope if the introduction was non-deliberate and occurred at least 20 years prior to the date the application is made for assessment against the MSC standard. | N/A |
| **C** | **No further introductions** | |
| **i** | There is no continuing introduction of the introduced species being considered for certification to the location (i.e., the species is now entirely self-sustaining in its new location). | ‘As a result of the USSR transplantation experiments, a viable, self-reproducing population of king crab, (*Paralithodes camtschatica*), is now well established in the Barents Sea.’<br>‘Successful reproduction is documented in both Russian and Norwegian coastal waters.’ (Kuzmin & Olsen, 1994);<br><br>In 2012, 300,000 juveniles were released by VINRO (Russian Federal Research Institute of Fisheries and |

| | | |
|---|---|---|
| | | Aquaculture) as a one off artificial reproduction experiment on the cultivation of Red King Crab (K.Nicolina, 2012[3]). This was a one off experiment, and considering the fecundity of one female (up to 220,000 eggs) then 300,000 juveniles is insignificant.<br><br>Conclusion: there is no continuing introduction. |

The Default Assessment Tree was modified for P2, Ecosystem management (PI 2.5.2) in order to reflect the fact that this is an introduced species, albeit prior to 1993 (see section 10.2.4).

**Table 5: MSC Scope criteria for ISBF; Opilio Crab (Taken from Table 2 MSC FCP v2.2 7.4.2.13)**

| **A** | **Irreversibility of the introduction in the new location** | |
|---|---|---|
| **i** | The introduced species has a large population size (comparable to or larger than the population sizes of other native species occupying similar ecological niches in the new location). | Snow crab, *Chionoecetes opilio,* was first observed in the Barents Sea in 1996 (Kuzmin, S.A., Akhtarin, S.M. and Menis, D.T. 1998), and the index of snow crab abundance estimated from research surveys conducted by PINRO since 2005 show that the population increased slowly during the 2000s, but then increased significantly from 2011 onwards, such that it now supports a major fishery in the Barents Sea. The median estimate of legal-sized stock across Russian, Norwegian and international waters was 450,000 tonnes in 2016 (Bakanev, 2016). Variations in size composition of snow crab catches during the surveys indicate that abundant year-classes appear frequently. The IMR/PINRO ecosystem report for 2017 stated that snow crab biomass was now at the highest value recorded for the whole period of ecosystem surveys. |
| **ii** | The species has spread to a range beyond that of its initial introduction in the new location. | Since its accidental introduction in the Barents Sea, the snow crab has spread westwards and is now common in the eastern and northeastern Barents Sea primarily in the Russian EEZ but also in the international waters managed by NEAFC (see figure below). Consequently, fisheries have been developed in Russia and Norway (Sundet, 2014). The IMR/PINRO ecosystem report for 2017 stated that snow crab biomass was now at the highest value recorded for the whole period of ecosystem surveys. |

| | | |
|---|---|---|
| | |  |
| **iii** | There is evidence to demonstrate that the species cannot be eradicated from the location by known mechanisms without serious ecological, economic and/or social consequences. | Size composition data from the annual research surveys show that there are regular pulses of recruitment demonstrating that eradication of snow crab would be almost impossible. More than 20 years since its introduction, the population is therefore self-sustaining and snow crab have been found in the stomachs of a wide range of demersal fish species and eradication would have significant ecological consequences. The fishery is now considered to be of high economic significance for populations along the coast of the Barents Sea, and so eradication would have economic and social consequences. |
| **B** | **History of the introduction** | |
| **i** | The species was introduced to the new location prior to 1993; this being the year that the Convention on Biological Diversity (CBD), which includes provisions on introduced species was ratified. | The first observation of significant numbers of *Chionoecetes opilio* in the Barents Sea occurred in 1996 (Kuzmin, S.A., Akhtarin, S.M. and Menis, D.T. 1998) i.e. after the year in which the Convention on Biological Diversity was ratified, and therefore this criterion is not met. |
| **ii** | If the introduction occurred after the CBD was ratified such fisheries shall only potentially be in scope if the introduction was non-deliberate and occurred at least 20 years prior to the date the application is made for assessment against the MSC standard. | The introduction of *Chionoecetes opilio* in the Barents Sea occurred in 1996 after the CBD was ratified. The introduction was non-deliberate and occurred more than 20 years prior to the date (2018) that the application was made for assessment against the MSC standard. The fishery is therefore considered to be in scope. |
| **C** | **No further introductions** | |

| | | |
|---|---|---|
| **i** | There is no continuing introduction of the introduced species being considered for certification to the location (i.e., the species is now entirely self-sustaining in its new location). | There is no deliberate continuing introduction of *Chionoecetes opilio* to the Barents Sea. It is of course feasible that a further accidental introduction could occur through, for example, ballast water, but as the species is now entirely self-sustaining in the Barents Sea, such an accidental introduction would have a negligible impact on the current widely distributed population. |

In conclusion, the snow crab, *Chionoecetes opilio*, has been accidentally transported and released by human activity into the Barents Sea which is outside its natural distribution range. The most likely method of transport and release was through ballast water (Sundet and Bakanev, 2014) The assessment team therefore concluded that the fishery for *Chionoecetes opilio* in the Barents Sea met the criteria on (a) irreversibility of the introduction in the new location, and (b) history of the introduction as set out in Table 2 of the MSC FCR v2.2 and can therefore be considered as in scope for an Introduced Species Based Fishery (ISBF). The Default Assessment Tree was modified for P2, Ecosystem management (PI 2.5.2) in order to reflect the fact that this is an introduced species (see section 10.2.4).

## 5.2 Overview of the fishery

### 5.2.1 Summary of development of the fishery

Red King crab was introduced deliberately into the Murmansk Fjord in the Barents Sea in the 1960s by Soviet scientists, as a way to increase local incomes[4]. Since then, the stock has increased in abundance as well as spread in distribution (ICES 2005[5]). The development of the fishery can be summarised as follows (adapted from Bakanev 2014):

**1994 – 2001**

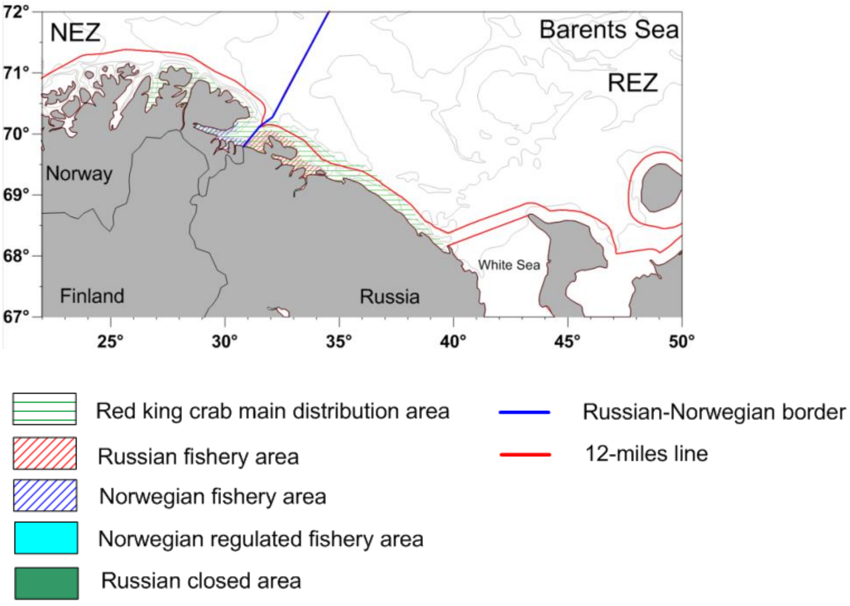



**Figure 1:** Main distribution of king crab and fishing areas – 1994-2001 (Source: Bakanev, 2014[6])

**Stock status:** coastal distribution within 12-miles zone, stock increasing, area expanding, prevalence of large males.

**Management:** trial fishery, "joint" TAC regulation (25% of assessing legal stock), sex-size-season limitation.

**Russian fishery:** trawl fishery mostly, 2-9 vessels less than 55m, non-crabbers. Annual catch 9-300t.

**Norwegian fishery:** traps, up to 24 vessels less than 20m. Annual catch was 40-350t.

**2002-2006**

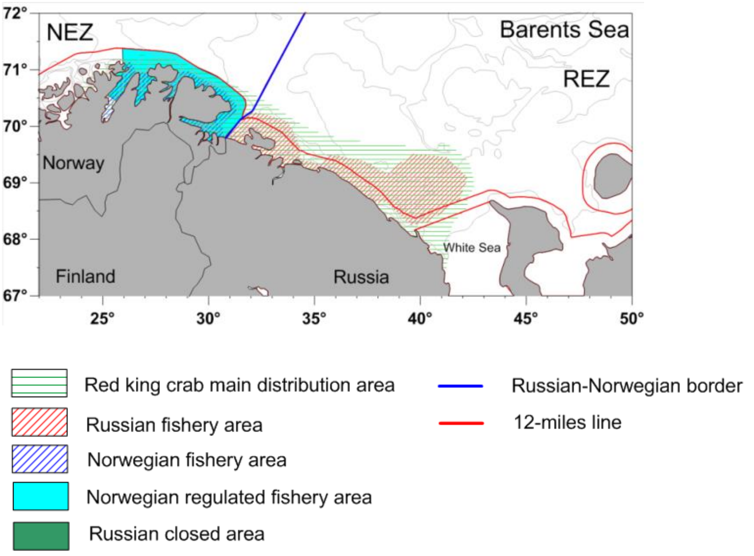



**Figure 2: Development of the management of the fishery (Source: Bakanev, 2014)**

**Stock status:** coastal distribution in NEZ and expanding offshore area in REZ, increasing total stock to 2005, but overfishing area in REZ since 2006.

**Management:** Opening of a commercial fishery, the fishery only by traps is permitted, "joint" TAC regulation (25% of assessing legal stock), sex-size-season limitation. REZ: The minimal depth of fishery (100m); NEZ: Free fishery to the west from 26° E.

**Russian fishery:** coastal mosquito fleet, big crabbers in open water, unreported fishery in open waters and coastal area, up to 34 vessels, annual official catch 900-12600t, and annual unofficial catch was up to 25500t.

**Norwegian fishery:** mosquito fleet and crabbers (up to 272 vessels), annual catch was up to 2000 t

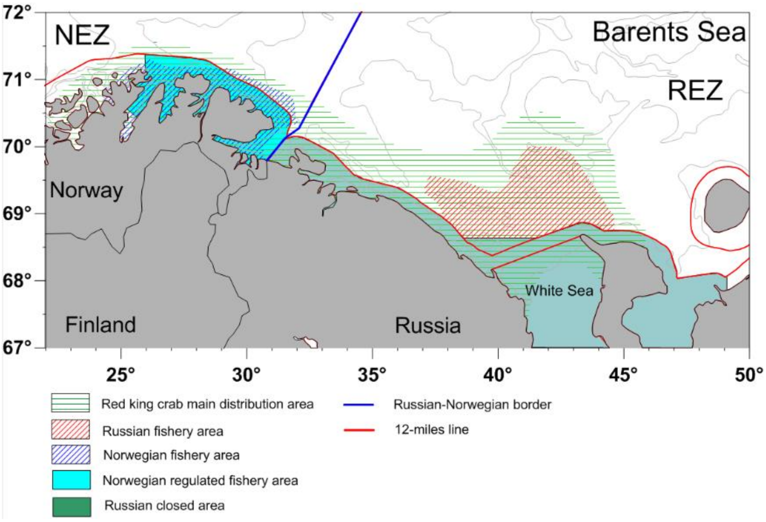



**Figure 3: Separate management and current fishery (Source: Bakanev, 2014)**

**Stock status:** legal stock recovery in REZ due to good recruitment, sustainable good concentration of total stock in the east of distribution offshore area.

**Management:** Separate (national) management of a stock. REZ: Closing of 12-miles zone because of by-catch of females and young crabs; NEZ: Free fishery to the west from 26° E, using any gears, females fishery

**Russian fishery:** no coastal mosquito fleet only crabbers out of 12-miles zone, one stakeholder in 2012-2013. Annual catch 3700-9300t.

**Norwegian fishery:** mosquito fleet and crabbers (up to 282 vessels), annual catch 1150-6000t.

From the above it can be seen that the red king crab fishery in the Barents Sea started as an experimental fishery in 1994 with a quota of 11,000 crabs in both the Norwegian and Russian zones. This quota increased during the 1990s to 100,000 in 2001. In 2002, the Norwegian king crab fishery became a commercial fishery with vessel-quotas, while the Russians introduced a licensed commercial fishery in 2004. Despite agreements during 2005-2007 to establish common principles of management of a new biological resource, both Norway and Russia managed fisheries for the red king crab stock separately within their respective economic zone, and agreed to inform each other about the national measures taken[7].

In Norway, the main research goals have been to reveal the effects of red king crab on the ecosystem and to prevent further expansion in Norwegian waters. In Russia, the main focus is on rational harvesting of the stock. In Norway, the crab fishery is subjected to two different regimes: a limited commercial area east of 26° East, where the crab stock is harvested as a sustainable commercial species; while outside this area there is a non-regulated free fishery aiming to prevent further spreading of the crab. In the Russian zone, fishery regulations are still based on principles agreed upon with the Norway. Thus, fisheries for the red king crab stock are subjected to three different management principles:

1) in Russian waters they are based on elements of the precautionary approach;

2) in open Norwegian waters and to the west of North Cape, there is an open fishery to prevent spreading; and

3) in the Norwegian fjords of eastern Finnmark the fishery is aimed to maintain a calculated stock level.[8]

## 5.2.2 Description of gear and deployment

**Red King crab and Opilio**

### 5.2.2.1 Regulatory requirements

The requirements for the fishing gear are established by the Fishing Rules for the Northern Basin (Order of the Ministry of Agriculture No. 414 of October 30, 2014). All the used fishing gear is subject to mandatory individual marking, and is strictly controlled by inspectors of the Russian Federal Security Service's Border Office for the Western Arctic region. These identification markings must bear the company name and catch permit number (Client information, Oct 2020)

With regard to crabbing in the Barents Sea, the Fishing Rules forbid the use of any fishing gear except for traps that have a rectangular net plate cut out on a flank of a size not less than 350mm in width and 400mm in height, that is seamed with the trap's main net webbing with a plant-based twine, 2-3mm in diameter, and not soaked with substances to prevent rotting; or that have a plant-based lacing twine with a diameter of 2-3mm fixing the net webbing to the frame and not soaked with substances to prevent rotting. This ensures that the twine biodegrades after a period of time and the panels come loose, therefore not continue trapping any marine species (Client information Oct 2020)

The Fishing Rules set the mesh minimum inner size and spacing:

| | Traps, mesh inner size (mm) |
|---|---|
| Red King crab | 70 |
| Snow crab | 50 |

#### 5.2.2.2 Gear Design

a) Conical trap

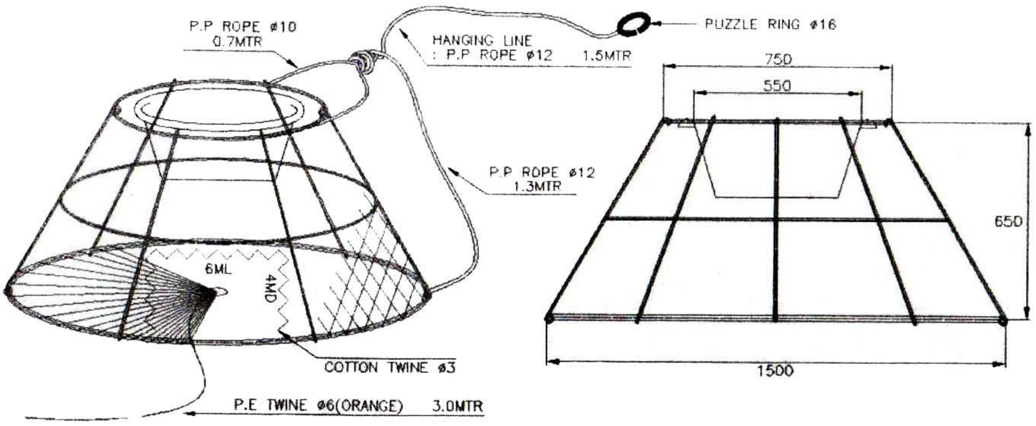




**Figure 4: Design of conical trap (Source: Client information Oct 2020)**

The trap frame is 1,500 mm × 750 mm × 650 mm, 3 rings – upper, middle and lower, stiffening ribs. The frame is made of round steel with a size from 10 to 16 mm. The upper ring is 12 mm, the lower ring is 14–16 mm, the upright of frame (stiffening ribs) and the middle ring with a diameter of 10 mm. The net webbing is made of 100% polyethylene, the mesh spacing is 60–70 mm, mesh – 120–140 mm, green or black colour.

The net webbing flank has a rectangular flap of at least 400 mm in height, 350 mm in width, that is, with the mesh spacing of 60 mm (mesh 120 mm), height not less than 5 meshes and width not less than 4 meshes. The flap (selective insert) is seamed along the perimeter with the main net webbing of the trap with a plant-based twine of 3 mm in diameter, decomposing in sea water within 30 days. The plastic entry is white or red for a crab 550 mm in diameter. The snood has the diameter of 12 mm, 1.8 metre long. The connecting link is metallic, diameter – 16 mm.

The weight of an empty cone-shaped trap is approximately - 15 kg (between 14.5kg to 16.5kg, depending on the producer; Client information 8th Dec 2020).

b) Pyramid Trap

Starting from September 2020, the vessel *Arctic Wolf* will be using pyramid traps (the so-called "American trapezoidal box" type) in the Red king crab fishing. The ship will handle 800 traps and 32 series. The vessel *Zvezda Rybaka* will also work with pyramid traps. Since *Zvezda Rybaka* is a small size vessel, it will set short series of traps, consisting of 5 to 25 traps. All trap series are marked with a buoy.

The pyramid trap (American trapezoidal box net 175/70/135) parameters:

- the steel frame is made by welding of structural steel, the diameters of the rods of the frame's outer binding are 32 mm, those of the inner binding and reinforcements – 25mm, 18 and 16 mm;
- the outer cover of the trap's frame with black net webbing of polyethylene with a diameter of 4 mm and 60-mm mesh spacing and with a diameter of 4 mm with 120-mm mesh spacing of the bottom; the entries are sewn round with white capron net webbing of PA with a diameter of 3,1 and mesh spacing 45 mm;
- entry panels are made of stainless steel with a diameter of 10 mm, the panels' size is 800mm × 220 mm. Rubbers with hooks of stainless steel are mounted for pull-up;
- stainless rings are mounted along the drawrope;
- a trap is equipped with a connecting link with a diameter of 19 mm.
- the weight of an empty pyramid/ trapezoidal trap is - 160 kg;

**Figure 5: Pyramid trap (Source: Client information, Oct 2020)**

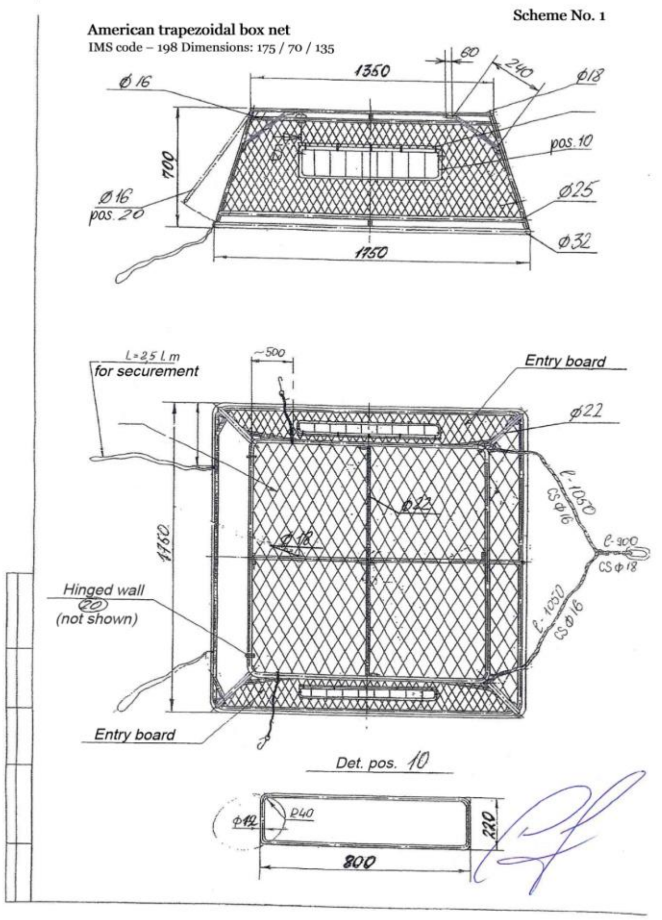



**Figure 6: Pyramid trap (Source: Client information, Oct 2020)**

The design of the traps (both types) does not include any special devices which would prevent fish from entering. However, it is considered that the mesh size (240 mm) of the pyramidic traps is large enough to allow finfish as well as other non-target species leaving the trap. This is confirmed by the small number of fish being bycaught, which can be counted in single numbers (Client information 8th Dec 2020).

The trap fisheries under assessment use only the cone and trapezoid type traps, and do not use the heavier angular traps as deployed by other crab fisheries elsewhere. (Client interview, 14 Sept 2020)

#### 5.2.2.3 Gear deployment

**Fishing Season:**

The fishing season for opilio is open all year around, the Fishing Rules do not have a restricted period. In practice, however, opilio fishing is usually conducted from the end of January to July, and then from October to December.

The fishing season for RKC is permitted from August 16th to December 15th. Fishing for RKC is banned outwith those permitted dates. (Client information 8th Dec 2020).

**Conical**: In 2020, the company's vessels used between 4200 to 4500 traps per vessel. The traps are attached to lines, each line of traps (called 'series') contains 120 - 150 traps. Each vessel can place about 30-35 series. he amount depends on the vessel's technical capabilities, catching tactics, and season (Client information 8th Dec 2020)

A crabber series consists of the following components (per 120–150 traps in a series):

• mainline with a diameter of 26 mm and 2,920–3,400 metres long, the material is danline;

• snood: diameter 12 mm and 0.6 metre long, the material is danline;

• toggles are made of ferrous or oxidized metal with a diameter of 16 mm;

• interval between snoods: 20 metres × 120–150 traps;

• free end 100 metres on either side;

• weight snood: with a diameter of 24 mm and 1.0 metre long, material – danline;

• weight toggles with a diameter of 22 mm × 2 pcs, interval – 10 metres;

• buoy-rope: a PP rope with a diameter of 26 mm × 150 metres × 2 lines.

The empty weight of a conical trap is 14.5kg – 16.5kg

**Pyramid** (also called trapezoid): When pyramid traps are deployed, there are about 25 pyramid traps in a series, with a vessel capable of laying 28-32 series. A vessel holds about 700-800 pyramid traps.

A crabber series for pyramid traps consists of the following components (i.e. 25 traps in a series):

• mainline with a diameter of 24 mm 4,250 metre long, the material is danline;

• snood: double with a diameter of 16 mm and 0.7 metre long, the material is danline;

• toggles are made of ferrous or oxidized metal with a diameter of 20 mm;

• interval between snoods: 180 metres × 25 traps;

• free end 100 metres on either side;

• buoy-rope: a PP rope with a diameter of 24 mm × 150 metres × 2 lines;

• various manufacturers may have insignificant differences in the components' dimensions.

The empty weight of a Pyramid/ trapezoid trap is 132kg – 150kg

The small vessel Zvezda Rybaka deploys 5-25 traps in a series, and can only hold 75 traps on the vessel.

**Deployment depth**:

Red King crab: between 70m – 140m (Client information 8th Dec 2020; PINRO 2019 Observer report)

Opilio: between 220m – 320m (Client information, 8th Dec 2020)

**Deployment speed**

Setting one series of 120 conic traps for 220m-230m depth takes about 18 minutes, and for one series of 25 pyramid traps it takes about 15 minutes to the depth of 70-130m (Client information 8th Dec 2020).

#### 5.2.2.4 Gear loss

The following information on gear loss was provided by the client (Oct 2020):

Fishing gear losses can occur due to difficult weather conditions (high winds/ waves) when hauling/setting of a series is performed. Wherever possible, the crew will attempt to lift the lost fishing gears. This is generally possible by using specialised trawl winches that are mounted in addition to the available fishing mechanisms. These trawl winches are mounted on the company's vessels for this purpose.

It should be noted that a crab series (line of traps) as an independent fishing gear can be located and retrieved. However, where an individual trap has been torn from a series, it is physically impossible to find and lift it. For that reason, the traps are designed with biodegradable components, whereby a special flap is cut out on the net part of the trap and is then seamed with the main net webbing with biodegradable twine.

A Crabber series can also be damaged by other fishing gears, such as demersal trawls for fishing shrimp, and interaction with pelagic gears too. Despite information sharing, trawlers' captains sometimes perform trawling along the positioned traps.

The company keeps an inventory and registration of the fishing gear losses. In 2020 three pyramid traps and 300 conic traps were lost (Client information 8th Dec 2020). A loss of a crabber series is registered in the catch and effort logbook with indication of the coordinates and the measures taken to search for the lost series and lift it aboard the vessel. The vessel's captain is also obliged to record the loss of fishing gear in a vessel daily report (VDR) that is transmitted to the Industry Monitoring System (IMS). The loss of a trap is also recorded in the vessel's documents (inventory report) and sent to the company. The catch supervisor is responsible for the fishing gear inventory aboard. Border office inspectors and controlling authorities check the reliability of the vessel's when there is an inspection of vessels at sea. The Fishing Rules state that it is the duty of the vessel's captain to ensure that all necessary measures are undertaken to search for the lost gear. Abandonment of passive fishing gear in water beyond the permit's validity is prohibited (Client information 8th Dec 2020)

During the opilio fishery in April 2020, 11 series set by *Arctic Wolf* and 6 series set by *Tamango* were covered by sea ice, therefore lifting the set series was only possible a month after the change in the ice situation. Also, a series of the vessel *Arctic Wolf* in the snow crab fishery was torn by a shrimp fishing vessel, some of the traps (about 100) were lost.

Interestingly, a recently published article in Fishing Daily, a fisheries news website (https://thefishingdaily.com/latest-news/2400-snow-crab-pots-removed-from-the-barents-sea-in-2020-clean-up/), describes the removal of 2400 snow crab pots and over 100km of rope removed from the Norwegian part of the Barents Sea. This action was organised by the Norwegian Directory of fisheries. It appears from the article that most of the pots were recovered from the Svalbard area.

#### 5.2.2.5 Bait

Bottom traps are a passive fishing gear, whereby the bait (generally oil-rich fish and squid) placed within the trap, lures in the target species. Other predators living at the depths of deployment can also be lured to the trap by the smell of the bait, including benthic fish species living at that depth.

The following information was provided by the client (Oct 2020): Frozen Atlantic herring, squid, and cod heads are used as bait. The main bait is herring which is purchased from suppliers both in Norway (Domstein AS) and in Russia. The Norwegian herring fishery has the MSC certification. The squid is purchased in Chile and Norway (from Domstein AS, which supplies from Argentina). Cod heads were used in small quantities due to the inefficiency of this type of bait, purchased in Norway from Domstein AS. The Atlantic cod fishery also has MSC certification.

The bait consumption depends on the fishing season, the level of fishing, the number of gear operated by the vessel, and the activity of the target species. With poor catches, bait consumption is estimated to be 20–30% higher than with good fishing conditions. Consumption per trap is 0.4 to 0.8 kg per day of fishing (on average 0.5 kg). Chopped herring and squid are placed into a 1 litre bait can; in addition, usually one, less often two whole herrings are put into a bait bag. The company estimates that about 450–500 tons of bait will be required to catch its quota of crabs in the Barents Sea for 2020 (6,127.686 tons of crabs; this applies to both species RKC and opilio). However, the actual use of bait during the 2020 season was lower than expected, 160t instead of 450t, see the following itemised table (Client information 8th Dec 2020).

| | Herring | Squid | Cod heads |
|---|---|---|---|
| Opilio fishery 2020 | 43.12t | 6.84t | - |
| Red King crab fishery | 77.55t | 27.39t | 5.63t |

### 5.2.3 Observer coverage

**Red King crab and Opilio**

These are new fisheries for this client, they have only started fishing for crab (both species) in 2020. The fishery under assessment has an agreement with PINRO on the allocation of scientific observers on the fishery's vessels. In other words, the fishery is part of the PINRO science and observer programme.

One detailed observer report for Red King crab is available for this assessment, covering the period 2nd Sep. – 9th Nov. 2019[9], which was conducted by a PINRO scientist on another Red King crab fishing vessel (not this client's fleet). A detailed Monitoring Report is available for the Opilio fishery, based on research conducted by PINRO during voyage No. 11 during March 29 – July 15, 2019[10]. In 2020, there were two observers on vessels of the fishery under assessment. The vessel 'Sparta' had a PINRO observer from 15th Sept to 1st Nov, and the vessel 'Rashkov' had a VNIRO observer from 9th Sept to 2nd Nov. At the time of writing this MSC – ACDR the observer reports were not available.

The observers check the shell condition of the crabs, how many legs, sizes, size structure, and legal size limit of 150mm. They also make observations on whether parasites are present on the carapace, distribution changes, and ecological changes. The observers also make observations and record any non-target species bycatch.

### 5.2.4 Client group, list of vessels, market

The following information was provided by the fishery under assessment (Client information for ACDR Oct 2020):

Crab Catchers Association of the Far East (CCA) was established in 2009. The Association currently consists of 14 companies (members of the association), specializing in crabbing in the Far Eastern and Northern fishery basins. The aggregate of the association members' crab allocations is approximately 38,700 tons, which constitutes about 44% of the all-Russian account. CCA includes the company Antey Sever that fishes crab in the Barents Sea.

CCA works together with the state authorities of the Russian Federation regarding fishery management and the conservation of aquatic biological resources, including participation in the development of regulatory documents and crab fishing requirements. CCA is actively engaged in fishery science, facilitates research and monitoring of the crab stocks as well as the implementation of other works related to research, sustainable exploitation and restoration of the aquatic biological resources of the Russian Federation. CCA also implements a series of projects on the improvement of crabbing in the Far Eastern basin with the purpose of obtaining MSC certification. (http://crab-dv.ru/)

**Antey group of companies**

The company Antey Sever LLC was registered in Murmansk city on September 3, 2019. Antey Sever is a part of the group of companies Antey. The company Antey is one of the largest fishing companies in Russia. Antey is an experienced crabbing company, predominantly working in the Far Eastern Basin and Argentina. The company Antey was established in 1993. The company owns a fleet of 24 vessels, including 21 catching vessel. The company fishes crab, finfish (pollock, saffron cod, flatfish, cod), as well as pelagic species (sardine-iwashi and scomber). Since 2010 the company has also been participating taken part in the Southern Ocean CCAMLR area toothfish fishery. The company has allocations for catch of 4,333 tons of crab and 528 tons of fish in the Far Eastern Basin, the pelagic species (scomber and sardine-iwashi) are fished according to the declarative principle.

The group of companies Antey supplies fish products to the markets of the USA, Japan, Korea, and China, as well as to the domestic market of Russia. (https://antey.group/main.html)

**Antey Sever**

Antey Sever began crabbing in the Barents Sea after the auctions held in 2019 for the purchase of the quota shares for red king crab and snow crab in the Barents Sea. Under the adopted amendments to the Federal Law "On Fishery and Conservation of

Aquatic Biological Resources", 50% of the total allowable catch of crabs was allocated to a special type of quota – investment. This quota was distributed among users based on the auction results for the next 15 years (until 2033). The winner of the auction was the company that offered a higher fee for the lot. In addition, the winner of the auction assumed responsibility for construction of new fishing vessels over the next 7 years.

In 2019 50% of the catch quotas for red king crab and snow crab in the Barents Sea were auctioned. Antey Sever bought 40% of the investment quota for red king crab and 60% of the investment quota for snow crab. In accordance with the order of the Federal Agency for Fishery No. 692 of December 13, 2019 (supplemented by order No. 359 of July 07, 2020), quotas for catching crab in the amount of 6,127 tons, including 2,171.53 tons of red king crab and 3,956.385 tons of snow crab, were allocated to Antey Sever.

**Vessels**

Currently, the Antey Sever fleet includes 8 fishing vessels and 4 transport vessels. In 2020, the company's fleet was replenished with a new modern ship *Rus* built in St. Petersburg as part of the investment quota program. By the end of 2020, the fleet will be replenished with 4 more fishing vessels.

**Table 6: Vessel list**

| Vessel name | Length (m) | Year | Type of products |
|---|---|---|---|
| Tamango | 48.98 | 1967 | Processor. Boiled-frozen of brine refrigerating, raw-frozen (clusters, cut, abdomen) |
| Rashkov | 48.12 | 1986 | Processor |
| Arctic Wolf | 51.47 | 1982 | Processor |
| Sparta | 48.07 | 1988 | Processor |
| Ugulan | 48.00 | 1988 | Processor |
| Andrei Smirnov | 48.12 | 1992 | Live |
| Zvezda Rybaka | 23.47 | 2004 | Live |
| Zvezda Udachi | 23.47 | 2004 | Live |
| Katran | 44,56 | 1986 | Transport vessel |
| Orion-1* | 86.76 | 1986 | Transport vessel |
| Antares* | 71.00 | 1984 | Transport vessel |
| Petr Gusenkov* | 45.45 | 1995 | Transport vessel |

The small vessels conduct harvesting in standard RK crab areas (i.e. the same areas where all RK crab vessels operate, including those of other companies) in depth 60-120 meters. The small vessels use pyramidic traps. Traps can be set both as a single trap, and small series of 5-10 traps. Single traps are marked with floating buoy, setting coordinates are registered in the logbooks and in GPS chart plotter. Same is true for the series (Client interview 14th Sept 2020).

## 5.3 Assessment results overview

### 5.3.1 Determination, formal conclusion and agreement

**To be drafted at Public Comment Draft Report stage**

The CAB shall include in the report a formal statement as to the certification determination recommendation reached by the assessment team on whether the fishery should be certified.

The CAB shall include in the report a formal statement as to the certification action taken by the CAB's official decision-maker in response to the determination recommendation.

Reference(s): FCP v2.2, 7.20.3.h and Section 7.21

### 5.3.2 Principle level scores

**To be drafted at Client and Peer Review Draft Report stage**

The CAB shall include in the report the scores for each of the three MSC principles in the table below.

Reference(s): FCP v2.2 Section 7.17

**Table 7: Principle level scores**

| Principle | UoA 1 | UoA 2 |
|---|---|---|
| Principle 1 – Target species | | |
| Principle 2 – Ecosystem impacts | | |
| Principle 3 – Management system | | |

### 5.3.3 Summary of Performance Indicator Scores

**Table 8: Summary of Performance Indicator level scores**

| Principle | Component | Performance Indicators | | UoA 1 Red King Crab | UoA 2 Opilio |
|---|---|---|---|---|---|
| 1 | Outcome | 1.1.1 | Stock status | ≥ 80 | ≥ 80 |
| | | 1.1.2 | Stock rebuilding | NA | NA |
| | Management | 1.2.1 | Harvest strategy | ≥ 80 | ≥ 80 |
| | | 1.2.2 | Harvest control rules & tools | ≥ 80 | ≥ 80 |
| | | 1.2.3 | Information & monitoring | 60 - 79 | 60 - 79 |
| | | 1.2.4 | Assessment of stock status | ≥ 80 | ≥ 80 |
| 2 | Primary species | 2.1.1 | Outcome | ≥ 80 | ≥ 80 |
| | | 2.1.2 | Management | ≥ 80 | ≥ 80 |
| | | 2.1.3 | Information | ≥ 80 | ≥ 80 |
| | Secondary species | 2.2.1 | Outcome | ≥ 80 | ≥ 80 |
| | | 2.2.2 | Management | ≥ 80 | ≥ 80 |
| | | 2.2.3 | Information | ≥ 80 | ≥ 80 |
| | ETP species | 2.3.1 | Outcome | ≥ 80 | ≥ 80 |
| | | 2.3.2 | Management | ≥ 80 | ≥ 80 |
| | | 2.3.3 | Information | 60 - 79 | 60 - 79 |
| | Habitats | 2.4.1 | Outcome | ≥ 80 | ≥ 80 |
| | | 2.4.2 | Management | ≥ 80 | ≥ 80 |
| | | 2.4.3 | Information | ≥ 80 | ≥ 80 |
| | Ecosystem | 2.5.1 | Outcome | ≥ 80 | ≥ 80 |
| | | 2.5.2 | Management | ≥ 80 | ≥ 80 |
| | | 2.5.3 | Information | ≥ 80 | ≥ 80 |
| 3 | Governance and policy | 3.1.1 | Legal & customary framework | ≥ 80 | ≥ 80 |
| | | 3.1.2 | Consultation, roles & responsibilities | ≥ 80 | ≥ 80 |
| | | 3.1.3 | Long term objectives | ≥ 80 | ≥ 80 |
| | | 3.2.1 | Fishery specific objectives | ≥ 80 | ≥ 80 |

| Principle | Component | Performance Indicators | | UoA 1 Red King Crab | UoA 2 Opilio |
|---|---|---|---|---|---|
| | Fishery specific management system | 3.2.2 | Decision making processes | ≥ 80 | ≥ 80 |
| | | 3.2.3 | Compliance & enforcement | ≥ 80 | ≥ 80 |
| | | 3.2.4 | Monitoring & management performance evaluation | 60 - 79 | 60 - 79 |

## 5.3.4 Summary of conditions

**To be drafted at Client and Peer Review Draft Report stage**

The CAB shall include in the report a table summarising conditions raised in this assessment. Details of the conditions shall be provided in the appendices. If no conditions are required, the CAB shall include in the report a statement confirming this.

Reference(s): FCP v2.2 Section 7.18

**Table 9: Summary of conditions**

| Condition number | Condition | Performance Indicator (PI) | Deadline | Exceptional circumstances? | Carried over from previous certificate? | Related to previous condition? |
|---|---|---|---|---|---|---|
| | | | | **Yes / No** | **Yes / No / NA** | **Yes / No / NA** |
| | | | | **Yes / No** | **Yes / No / NA** | **Yes / No / NA** |
| | | | | **Yes / No** | **Yes / No / NA** | **Yes / No / NA** |

## 5.3.5 Recommendations

**To be drafted at Client and Peer Review Draft Report stage**

If the CAB or assessment team wishes to include any recommendations to the client or notes for future assessments, these may be included in this section.

## 5.3.6 Scoring Elements

### 5.3.6.1 Scoring elements – Red King crab UoA

| Component | Scoring elements | Designation | Data-deficient |
|---|---|---|---|
| P1 | Red King Crab | Target Species | No |
| Primary | Cod | minor | No |
| Primary | haddock | minor | No |
| Primary | GL halibut | minor | No |
| Primary | European plaice | minor | No |
| Primary | herring | minor | No |
| Primary | Deepwater redfish | minor | No |
| Secondary | Atlantic, Northern and Spotted wolffish | minor | No |
| Secondary | Thorny /starry ray | minor | Yes |
| Secondary | lumpfish | minor | Yes |
| Secondary | BS stone crab | minor | Yes |
| Secondary | Iceland scallop | minor | Yes |
| Secondary | sea urchin | minor | Yes |
| Secondary | squid | minor | Yes |
| ETP | none | ETP | Na |
| Habitat | Soft sediment | Commonly encountered habitats | No |
| Habitat | VMEs | none | Na |

### 5.3.6.2 Scoring Elements – Opilio UoA 2

| Component | Scoring elements | Designation | Data-deficient |
|---|---|---|---|
| P1 | Opilio Crab | Target species | No |
| Primary | Cod, | minor | No |
| Primary | GL halibut | minor | No |
| Primary | Herring | minor | No |
| Primary | Deepwater redfish | minor | No |
| Primary | Ling | minor | No |
| Secondary | Northern and Spotted wolffish | minor | No |
| Secondary | Thorny (Starry) ray | minor | Yes |
| Secondary | Arctic skate | minor | no |
| Secondary | Squid | minor | Yes |
| Secondary | American plaice | minor | Yes |
| Secondary | Arctic eelpout | minor | Yes |
| Secondary | Grey gurnard | minor | Yes |
| Secondary | Spider crab | minor | Yes |
| ETP | none | ETP | Na |
| Habitat | Soft sediment | main | No |
| Habitat | VMEs | none | Na |

# 6 Traceability and eligibility

## 6.1 Eligibility date

The **Target Eligibility Date** for this fishery will be the date of certification. This means that any fish caught by the certified fleet following that date will be eligible to enter the chain of custody as a certified product, if and when certification is granted.

The measures taken by the client to account for risks within the traceability of the fishery are detailed in the rest of this section.

## 6.2 Traceability within the fishery

There is a multistage control system in the Russian crab fishery. The first stage is conducted by Coast Guard vessels in the region of catching. Inspectors check catch permits, number of and construction (technical parameters) of traps, production ratios, quantity of production and so on. The second stage is conducted in port. If a vessel goes to port it is obliged to send out preliminary information 72 hours before landing and more detailed information 24 hours before landing, where the status of the information about catch permits, quantity of production, quantity of crab caught (in green weight) is checked. All unloading procedures are made under the control of Border Control authorities. Thus, the risk of non-certified gear used within the fishery and a possibility of vessels from the UoA fishing outside the UoA or in different geographical areas are close to zero.

All vessels are equipped with VMS, which permanently sends information about the vessel's coordinates to the State Monitoring Centre at BBTA. If any vessel from outside enters the crab catching region, the State Monitoring Centre informs Border Control authorities and the vessel's owner will have to explain their activity in the region. All logistic procedures (including moving products from catching vessel to transport one) in the Russian Economic Zone must be fulfilled in the presence of a Border Control inspector who checks the catch permits, production ratios, quantity of production and so on. In addition, the vessel will have to fulfil all above-mentioned procedures, so it will almost be impossible to catch crab illegally.

There are strict internal procedures on board the vessels (required by Russian law) and a sophisticated system of enforcement measures at sea and on land to ensure that these requirements are complied with. Therefore, the risk of substitution of mixing certified (target species) and non-certified (by-catch species) catch is minimal.

All planned trans-shipments have to be reported in advance to Russian enforcement authorities, so that they have the possibility to check the operations physically. Logbooks are kept on both catch and transport vessels for one year; then they are kept by the fishing company for three more years. Separate written documentation is also issued for the transaction. Catching vessel may tranship products to transport vessel at sea, then transport vessel will land the products in Russian and/or foreign port (but transport vessels will deliver cargo via Russian port as all marine living resources caught in the Russian EEZ or on the Russian continental shelf have to be taken to Russian port before being exported). Also, the catching vessel may land products in Russian port by itself. Catching vessels have on board only products caught and processed by themselves. There are two points of ownership change for the products (that is points from which subsequent Chain of Custody should start): transport vessel or port.

**Table 10: Traceability within the fishery**

| Factor | Description |
|---|---|
| Will the fishery use gears that are not part of the Unit of Certification (UoC)?<br><br>If Yes, please describe:<br>- If this may occur on the same trip, on the same vessels, or during the same season; | There is a well-developed and multi-level control and enforcement system in the Barents Sea crab fisheries. All fishing operations including gear, permits, vessel documentation, catch and production, are checked by the Coastguard inspectors. The inspections include checking of gear (number of traps, size and mesh size, other technical parameters and their correspondence to the Fishing Rules). Also, all gears |

| | |
|---|---|
| - How any risks are mitigated. | used in the fishery must be labelled with the fishing company and permit number plate.<br><br>According to the Russian legislation, all catches (products) must be delivered to Russian port for clearance and documentation. At the port, all catches (products) and vessels are checked by the Coastguard, Customs, and Veterinary service. All transhipments at sea are subject to mandatory monitoring and control by the Coastguard, and products (catches) must still be delivered to the port for clearance.<br><br>Crab fishing is conducted by traps of two types. No other gear is appropriate for crab catching. |
| Will vessels in the UoC also fish outside the UoC geographic area?<br><br>If Yes, please describe:<br>- If this may occur on the same trip;<br>- How any risks are mitigated. | The fishing takes place on the Russian continental shelf. All vessels harvesting crabs in the Barents Sea are equipped with satellite VMS transferring positions to the Fishery Monitoring Centre operated under the FFA system and used by the Coastguard for monitoring and enforcement. The Coastguard checks vessels operating within the fishery, as well as other fishing vessels operation in other fisheries. |
| Do the fishery client members ever handle certified and non-certified products during any of the activities covered by the fishery certificate? This refers to both at-sea activities and on-land activities.<br><br>- Transport<br>- Storage<br>- Processing<br>- Landing<br>- Auction<br><br>If Yes, please describe how any risks are mitigated. | There are two types of products: frozen and live.<br>There are only two crab species in the Barents sea – Opilio and Kamchatsky (red king crab). Both species are included in the UoA of the present assessment, so there is no substitution risk. The client represents a share of the total catch, the remaining Russian fishery for red king crab was certified in 2018 and the remaining fishery for opilio was certified in 2020. So, if the present fishery is also certified, all Russian crab fishery in the Barents Sea will be certified, so no risk of non-certified products will occur. |
| Does transhipment occur within the fishery?<br><br>If Yes, please describe:<br>- If transhipment takes place at-sea, in port, or both;<br>- If the transhipment vessel may handle product from outside the UoC;<br>- How any risks are mitigated. | Transhipments may occur within the fishery at the port or at sea. However, transhipment does not create any risk, but brings an additional element of enforcement and control system by the Coastguard. Transhipment must be conducted only in presence of a Coastguard inspector, who issues a specific document that is needed for further clearance. During transhipments the vessels, all documentation including permits, and all products are checked and verified with the previously reported catches. |
| Are there any other risks of mixing or substitution between certified and non-certified fish?<br><br>If Yes, please describe how any risks are mitigated. | As the UoA includes two species of crab (Opilio and Kamchatsky), in case of certification, there will not be a risk of non-certified products from the client. Also, there is the second client group operating within the fishery |

| | |
|---|---|
| | that has been already certified towards MSC. So, potentially 100 % of Russian Barents Sea crab catches may be MSC-certified. |

## 6.3 Eligibility to enter further chains of custody

**To be drafted at Client and Peer Review Draft Report stage**

The CAB shall include in the report a determination of whether the seafood product will be eligible to enter certified chains of custody, and whether the seafood product is eligible to be sold as MSC certified or carry the MSC ecolabel.

The CAB shall include in the report a list of parties, or category of parties, eligible to use the fishery certificate, and sell product as MSC certified.

The CAB shall include in the report the point of intended change of ownership of product, a list of eligible landing points, and the point from which subsequent Chain of Custody certification is required.

If the CAB makes a negative determination under FCP v2.2 Section 7.9, the CAB shall state that fish and fish products from the fishery are not eligible to be sold as MSC certified or carry the MSC ecolabel. If the client group includes other entities such as agents, unloaders, or other parties involved with landing or sale of certified fish, this needs to be clearly stated in the report including the point from which Chain of Custody is required.

Reference(s): FCP v2.2 Section 7.9

# 7 Scoring Principle 1

## UoA1. Barents Sea Red King Crab

## 7.1 Red King Crab - background

This section relies extensively on available species overviews, and updates or accesses more recent literature as appropriate. Jørgensen et al. 2005 and Jørgensen 2013 provide a comprehensive overview of the introduction of red king crab to the Barents Sea and of the biology and ecology of the species. Jewett and Onuf (1988) summarize much of the early literature on red king crab biology in its native range. The original older documents cited by Jewett and Onuf (1988) are not referenced directly here.

### 7.1.1 Taxonomy

Paralithodes camtschaticus (Tilesius, 1815) is most commonly known in English as red king crab. Common names in other languages are provided in Jørgensen (2013): krab kamčatský (CZ), Königskrabbe, Kamtschatkakrabbe (DE), kongekrabbe, kamchatkakrabbe (DK), Kamtšatka ebakrabi (EE),kuningasrapu (FI), rød kongekrabbe, kamtsjatkakrabbe (NO), Kamtschatca crab (RU). Paralithodes is a lithodid crab (in Family Lithodidae). A taxonomic hierarchy for red king crab is provided below (from ITIS, 2017)

| | |
|---|---|
| Phylum | Arthropoda |
| Subphylum | Crustacea |
| Order | Decapoda – crabs, crayfishes, lobsters, prawns, shrimp |
| Suborder | Pleocyemata |
| Infraorder | Anomura – includes hermit crabs |
| Superfamily | Paguroidea |
| Family | Lithodidae - stone and king crabs |
| Genus | Paralithodes |
| Species | Paralithodes camtschaticus (Tilesius, 1815) |

As lithodid crabs, red king crabs are within the Infraorder Anomura, which differ fundamentally from “true crabs” within the Infraorder Brachyura (e.g. Cancer crabs such as the edible or brown crab, C. pagurus). In anomuran crabs the last one or two pairs of walking legs is reduced and females have an asymmetrical abdomen. Lithodid crabs are primarily polar in distribution.

Red king crab is one of the largest crabs and is the target of significant commercial fisheries in its native range. The largest male red king crab recorded off Alaska was 10.9kg. Females are not as large (maximum weight recorded off Alaska = 4.8kg). Maximum male carapace length (CL) recorded off Alaska is 227 mm (Stevens and Lovrich 2014); in the Barents Sea a crab of 270 mm has been recorded (Sundet et al. 2009).

### 7.1.2 Distribution

The red king crab is native to the Okhotsk and Japan Sea, the Bering Sea, and the Northern Pacific Ocean (Figure 7). Russian scientists intentionally introduced different life history stages to the Barents Sea in the 1960s. About 2,500 specimens of Paralithodes camtschaticus (approximately 5 to 15 years old) and about 10,000 juveniles (approximately 1 to 3 years old), were released into the Barents Sea from 1961 to 1969 (Orlov and Ivanov, 1978). By the mid-90s a self-reproducing population was established (Berenboim et al. 2004). Since then, the crab has spread both to the east, and to the west into Norwegian waters (Figure 8). Its spread from the location of introduction appears to have been due to both natural dispersal of larvae by coastal currents, and by adult migration. Despite the fact that red king crab and another invasive crab (snow crab) have formed self-reproducing populations in the Barents Sea, the process of acclimatization of these species is not complete (Bakanev and Anisimova 2013). Russian scientists believe that the red king crab in the Barents Sea has reached the limits of its eastern distribution (probably due to salinity and temperature) (Jørgensen 2013).


**Figure 7:** **Distribution of red king crab in its native range in the Bering Sea and North Pacific and in the area in which it was introduced. (Source: Jørgensen 2013).**

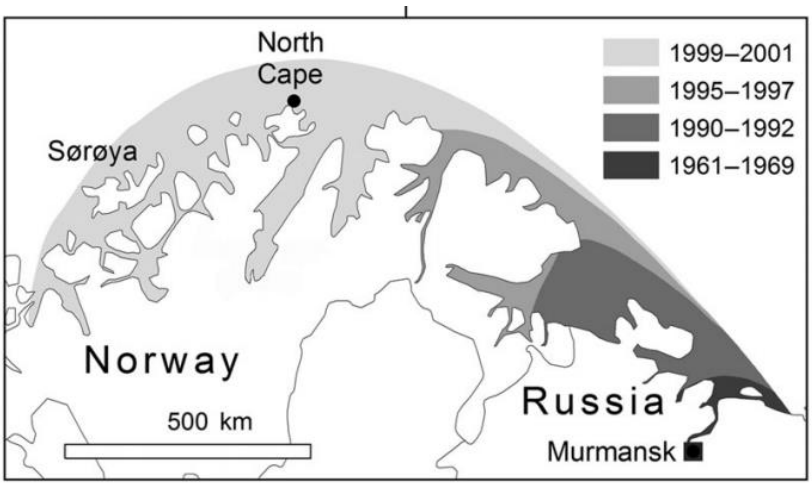



**Figure 8:** **Range expansion of red king crab from location of introduction. (Source: Windsland et al. 2014; original figure also shows locations of observations further to the west in Norway).**

Temperature preferences of red king crab differ by life history stage and possibly geographically. Jewett & Onuf (1988) summarized the earlier literature for red king crab in their native range:

"…based on laboratory and field data, king crab of different life stages have specific temperature tolerances and optima. Optimal temperatures for eggs are 3-8 °C. Although larvae may tolerate water-column temperatures of -1.8 -18 °C, survival appears to be best at 5-10 °C. Juveniles can tolerate temperatures at least 0-15 °C, but their optimal temperatures are thought to be 5-10 °C. While adults are in shallow waters, mainly from March through May, they may be exposed to temperatures of -1.8 to 9 °C, but 2-7 °C is assumed to be optimal, based on our interpretation of the NMFS survey analyses."

Laboratory studies in Norway indicate that immature *P. camtschaticus* prefer temperatures below 4-6ºC (Jørgensen 2013). Recent hatchery studies of red king crab from Alaska (Stoner et al. 2010) found that temperatures of 1.5-12°C had no significant effect on survival of newly settled red king crab but did have a significant effect on growth. Growth was slow at 1.5°C and increased rapidly with temperature with both a shorter intermolt period and larger increase in growth increment. Twenty percent of the crabs held at 1.5°C never molted, while more than 90% of the crabs in 12°C reached juvenile stage 4 or high (Stoner et al. 2010).

With regard to salinity tolerance of red king crab, Jewett & Onuf (1988) reported that less is known compared to temperature tolerance. They summarized lab experiments showing that the growth rate of larvae was not affected by salinities within the range of 21.7-39.7 parts per thousand (ppt) and that the optimal salinity for larvae, under various temperatures, was 26.8 - 40.2ppt. Jewett and Onuf (1988) acknowledged that salinities approaching 40ppt are unlikely to be encountered in nature. Sampling in Bristol Bay (Alaska) in April and June of 1983 revealed that the greatest densities of red king crab larvae occurred at salinities between 30 and 32ppt (Jewett and Onuf 1988).

### 7.1.3 Biology (life history, growth, reproduction)

The Red king crab has a complex life history with several planktonic larval stages followed by benthic juvenile and adult stages. Like all crustaceans, red king crab grows by molting. The adult female red king crab typically produce one clutch of eggs per year; once fertilized, eggs are held by the female for 11-12 months (Jewett and Onuf 1988). Fecundity, measured within a few months after deposition, varies from 15,000 to nearly 447,000 (Jewett and Onuf 1988). In Alaskan waters, fecundity increases with size up to about 138mm and varies within and between years (Swiney et al. 2012). Fecundity also increases with size in Norwegian waters, but fecundity declined between 2000 and 2007, possibly because of increased fishing pressure (Hjeslet et al. 2012).

Upon hatching, the pre-zoeal larvae molt, usually within minutes, into the zoeal form. The planktonic zoea larvae molt through four stages, with a total duration of a month or more (Stevens and Swiney 2005). The post-larval stage (glaucothoe) is transitional between the larval and juvenile stage. It is non-feeding (Stevens and Swiney 2005) but has swimming ability and claws, and is the stage that begins life on the seabed. Once on the bottom the red king crabs have multiple molts per year. Juveniles in the southeast Bering Sea typically reach sizes of 11mm CL after 1 year and 80mm CL after 4 years (Jewett and Onuf 1988). Red king crabs in their native range are thought to have a longevity of 15-20 years (Jewett and Onuf 1988), as are red king crabs in the Barents Sea (PINRO 2015).

Size at sexual maturity for females appears to be larger in the Barents Sea than in its native range. Estimates of the size at which 50% of the females bear eggs, in 3 locations in the Norwegian portion of the Barents Sea, ranged from 108-112mm CL, and Sundet (2014) reported that size at maturity for both male and female red king crabs seemed to be about 110mm carapace length. In its native range, estimates range from 71-102mm CL (Hjelset et al. 2009). Maturity of males and females within its native range is often attained at similar sizes and red king crab are thought to reach sexual maturity at 5-6 years old (Jewett and Onuf 1988).

Generation time of a species can be estimated as (MSC 2014, Box GSA4):

$$1/M + \text{Age at 50\% maturity (when } 0.1 \le M \le 2\text{) where } M \text{ is natural mortality.}$$

For red king crab in the Barents Sea, M is estimated at approximately 0.2 (0.23) by Windsland (2015). Given an age at maturity of 5-6 years, generation time is approximately 10 years for Russian Barents Sea red king crab.

Upon leaving the plankton, post-larvae seek shelter in structured habitats, and survival depends on shelter availability (Figure 9). Red king crabs with smaller than 20mm carapace length (CL) have no podding behaviour[11] and remain solitary and cryptic in the first year. After two years they typically migrate to deeper water (20-50m depth) where they can aggregate in large, tightly packed groups, ("pods") (Jørgensen 2013). In its native range podding behavior begins at about 1.5 years of age and represents a large behavioral change (Dew, 2010). Podding juveniles, no longer reliant on complex habitat to provide shelters to avoid predation, expand their foraging to daylight hours and featureless silt or mud bottoms (Dew, 2010).

Adults occur on sand and mud substrata and aggregate according to size, life history group, or sex (Jørgensen 2013, Dvoretsky and Dvoretsky 2013). Extensive aggregations of both sexes occur during the spring spawning season. After this period, the sexes form separate aggregations for the remainder of the year (Jørgensen 2013).

Shallow waters are also important to reproduction of red king crab in the Russian Barents Sea. Diving studies of red crab demography in a coastal inlet, found that among large crabs, females dominated (Dvoretsky and Dvoretsky 2013). In their native range, adult red king crab undertake a spring/summer migration to shallow waters for mating and molting, and a fall/winter migration to deeper waters for feeding. Observations in Norwegian waters show a similar pattern, although a few adult crabs are found in shallow waters throughout the year (Jørgensen 2013)

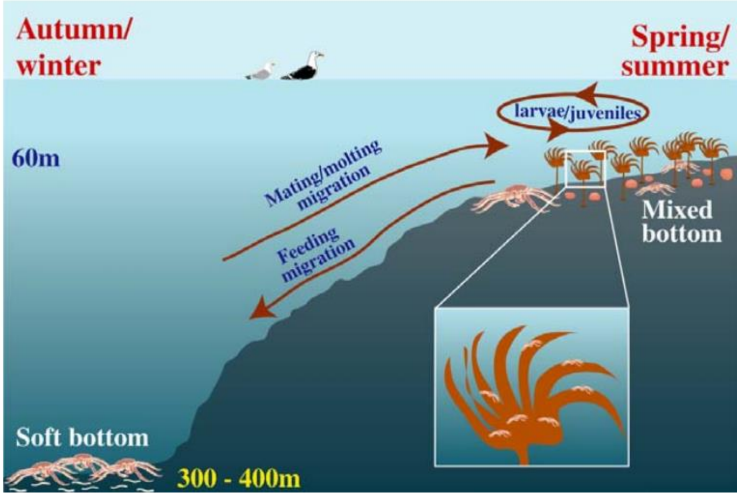



**Figure 9:** **Seasonal migration of red king crab depicting the mating/molting migration to structurally rich seabeds in shallow water, and the autumn/winter feeding migration to soft substrate habitats. (Source: Jørgensen 2013)**

Advection of red king crab larvae along the coast of northern Norway has a net transport in the eastward direction, so the westwards expansion of red king crab in Norwegian waters is likely due in part to active dispersal by adult individuals (Windsland et al. 2014). In Norwegian waters there are large individual differences in dispersal ability and the range expansion of red king crab appears to result from the presence of long-distance dispersers and time-dependent slow migration by short distance dispersers. Windsland et al. (2014) found that nearly 90% of crabs tagged in different regions of northern Norway had a displacement of < 30km, while a small percentage (2%) had moved more than 100km.

A small percentage of tagged crabs (3-8% depending on duration at large) had moved into Russian waters. They concluded that there is less dispersal in Norwegian waters than in the crab's native Bering Sea, which might be caused by differences in geographical complexity.

The ecosystem impact of red king crab as an introduced species has been discussed under Principle 2.

## 7.1.4 Stock assessment, indicators, reference points and harvest control rule

Estimation of the red king crab stock status is a complex procedure incorporating both empirical methods and analytical models for the population abundance dynamics assessment (Bakanev 2017a). The level and quality of information available on Barents Sea Russian red king crab has changed considerably since investigations began in the 1990s (Bakanev 2013). Data sources over the period 1994 to 2020 have included trawl surveys, commercial fishery catch data, trap surveys and commercial catch sampling.

### 7.1.4.1 Data sources

Trawl surveys - A large-scale survey of the Barents Sea is conducted annually by Norway and Russia with the objective of monitoring the status and changes of the Barents Sea ecosystem (Eriksen 2014). The first survey was conducted in

2004, and these surveys regularly record red king crab but at only a small proportion of trawl stations (32 of 323 stations in 2019). This trawl survey is useful for monitoring large scale distribution of red king crab, but is not sufficient for stock assessment (Figure 10). It is worth noting though that there was a record high number of crabs observed in the survey in 2019 (Table 11).

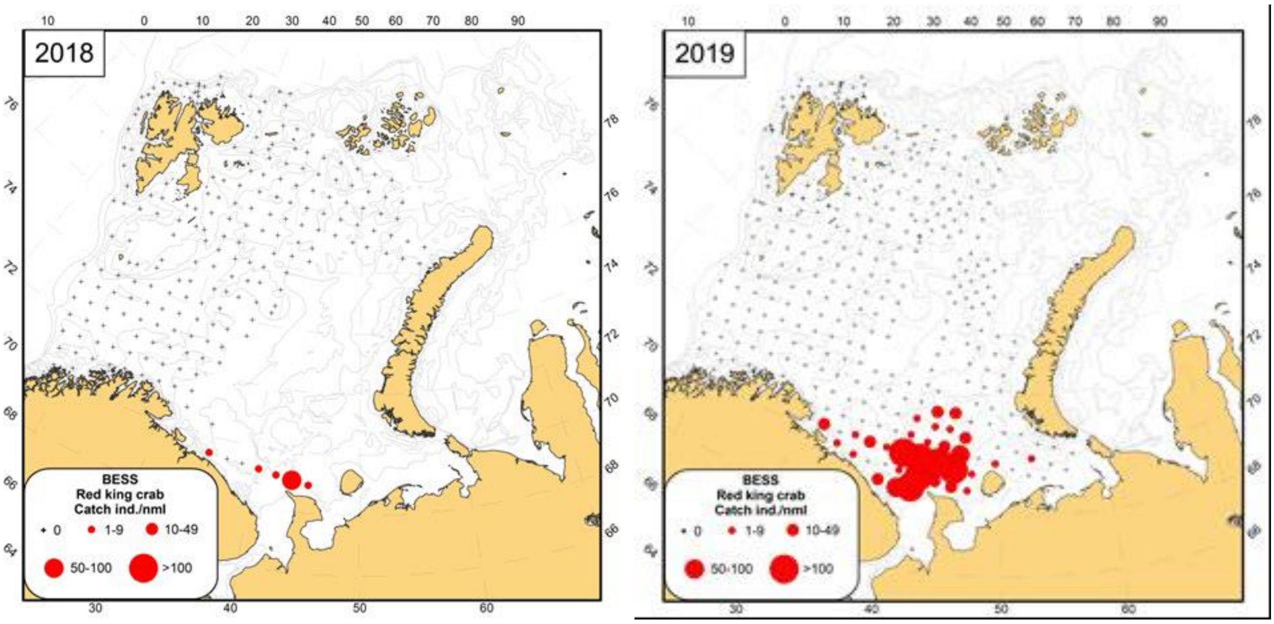



**Figure 10:** **Distribution of red king crab from Norway-Russia Barents Sea Ecosystem Survey in 2018 and 2019. Source (last accessed November 17, 2020): https://www.hi.no/resources/IMR-PINRO-Report-2019-survey.pdf**

**Table 11:** **The total catches of red king crab during BESS 2005-2018.**

| Year | Total number of station | Number of station with red king crab | Total catch, ind. | Total catch, kg |
|---|---|---|---|---|
| 2005 | 649 | 8 | 106 | 309 |
| 2006 | 550 | 66 | 1243 | 3350 |
| 2007 | 608 | 30 | 1521 | 3869 |
| 2008 | 452 | 10 | 127 | 93 |
| 2009 | 387 | 7 | 15 | 25 |
| 2010 | 331 | 6 | 12 | 25 |
| 2011 | 401 | 4 | 40 | 22 |
| 2012 | 455 | 8 | 126 | 308 |
| 2013 | 493 | 3 | 272 | 437 |
| 2014 | 304 | 11 | 168 | 403 |

| | | | | |
|---|---|---|---|---|
| 2015 | 335 | 14 | 255 | 517 |
| 2016 | 317 | 11 | 202 | 552 |
| 2017 | 376 | 13 | 299 | 687 |
| 2018 | 217 | 5 | 73 | 175 |
| 2019 | 323 | 32 | 1635 | 2897 |

A specialized trawl survey directed at red king crab in Russian waters was conducted from 1994-2011 and 2017-2019. This survey had numerous stations within the coastal area where red king crab are most abundant (Table 11, Figure 10). The number of hauls per survey ranged from 49-187 from 1994 until 2011 when the survey ended and from 98 to 130 since it was restored in 2017 (PINRO 2020a). The survey was used for abundance indices, to obtain measurements, and to conduct biological analyses of the crab.

**Table 12: Description of primary material from targeted trawl surveys in the Barents Sea in 1994-2011, 2017-2019. (Source: PINRO 2020).**

| Time of sampling | | Number | | | Abundance indices (in 1000 crabs) | | |
|---|---|---|---|---|---|---|---|
| Year | Month | Hauls | Mass measurements of crabs | Biological analysis of crabs | Pre-recruits | Recruits | Post-recruits |
| 1994 | VII–XI | 187 | 2521 | 2115 | 4 | 36 | 321 |
| 1995 | XI–XII | 57 | 1454 | 1454 | 49 | 21 | 215 |
| 1996 | IX–XII | 63 | 2597 | 577 | 54 | 58 | 129 |
| 1997 | IX | 49 | 819 | 713 | 31 | 11 | 228 |
| 1998 | VIII–IX | 80 | 1821 | 1459 | 54 | 49 | 400 |
| 1999 | VIII–IX | 68 | 1638 | 1496 | 339 | 73 | 469 |
| 2000 | IX–X | 89 | 2531 | 2531 | 493 | 288 | 706 |
| 2001 | IX–X | 91 | 2757 | 2757 | 1485 | 294 | 627 |
| 2002 | VIII–X | 97 | 2062 | 2062 | 486 | 1251 | 894 |
| 2003 | X–XI | 87 | 3764 | 3764 | 569 | 2238 | 7175 |
| 2004 | X–XI | 81 | 6327 | 6327 | 381 | 989 | 7132 |
| 2005 | IX–X | 86 | 3111 | 3111 | 470 | 503 | 6627 |
| 2006 | VIII–IX | 150 | 1769 | 1769 | 1057 | 701 | 5300 |
| 2007 | VIII–X | 167 | 2897 | 2897 | 1056 | 704 | 4582 |
| 2008 | VIII–IX | 129 | 3943 | 3943 | 2067 | 1439 | 2467 |
| 2009 | VIII–IX | 135 | 1260 | 1260 | 442 | 300 | 1062 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2010 | VII–VIII | 87 | 1105 | 1105 | 1237 | 167 | 393 |
| 2011 | XI | 56 | 396 | 396 | 666 | 636 | 414 |
| 2017 | VIII–IX | 113 | 2918 | 2918 | | | |
| 2018 | VIII–IX | 130 | 5806 | 4205 | | | |
| 2019 | VIII–IX | 98 | 6003 | 4794 | | | |

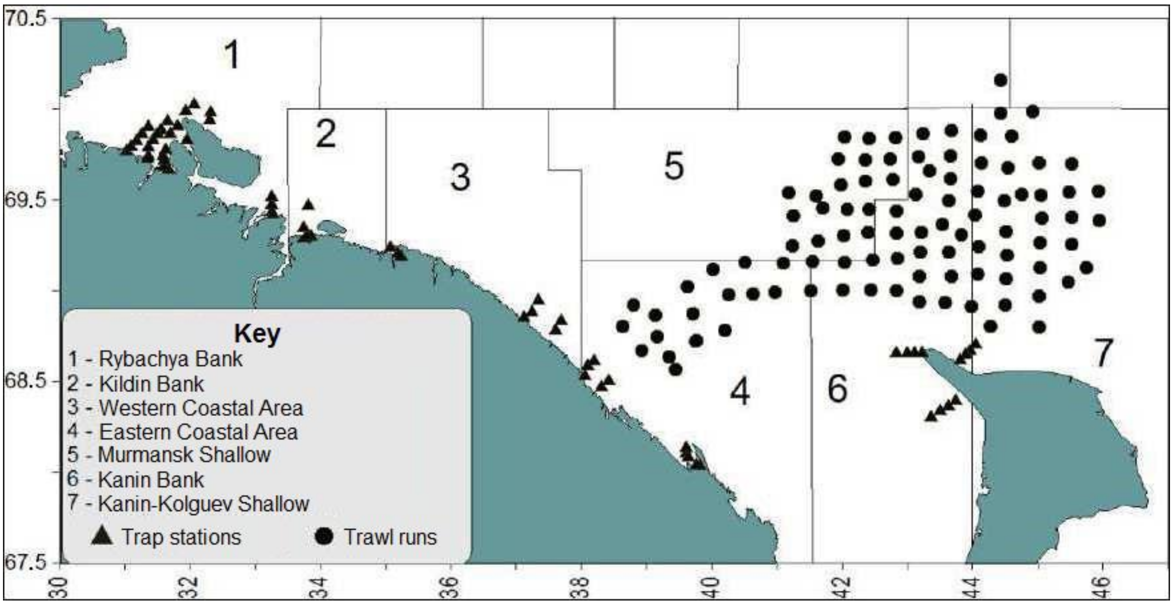



**Figure 11:** **Locations of trawl towing areas (dots) and traps (triangles) in king crab surveys in Russian Federation EEZ and Russian Federation territorial waters in the Barents Sea and contiguous waters of the White Sea in 2019. (Source PINRO 2020a).**

Trap survey - A fishery independent trap survey began in 2008 and is undertaken annually in the coastal area (the territorial sea and internal waters of the Russian Federation in the Barents Sea) where molting and mating occurs (Figure 11, Table 13).

**Table 13:** **Summary of the data collected during trap surveys in the territorial sea and internal sea waters of Russian Federation in the Barents Sea and contiguous waters of the White Sea in 2008–2019 (Source PINRO 2020).**

| Time of collection | | Quantity | | | Mean catch per trap, individuals | | |
|---|---|---|---|---|---|---|---|
| year | month | set traps | # weight measurements | # biological analysis | Legal size males | Pre recruits | Male juveniles |
| 2008 | VII | 189 | 1,185 | 1,185 | 1.2 | 2.0 | 0.6 |
| 2009 | VII-VIII | 129 | 2,358 | 2,358 | 2.1 | 5.1 | 2.4 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2010 | VII | 207 | 3,286 | 3,286 | 1.0 | 5.0 | 2.9 |
| 2011 | VII-VIII | 228 | 3,100 | 3,100 | 1.8 | 5.8 | 1.5 |
| 2012 | VII | 183 | 885 | 885 | 0.7 | 1.5 | 0.1 |
| 2013 | VII | 200 | 2,098 | 2,098 | 2.7 | 2.9 | 0.5 |
| 2014 | VII | 237 | 2,032 | 2,032 | 2.2 | 2.2 | 0.6 |
| 2015 | VII | 267 | 2,593 | 2,593 | 3.1 | 2.2 | 0.6 |
| 2016 | VII | 237 | 3,941 | 3,941 | 4.5 | 2.9 | 0.5 |
| 2017 | VII-VIII | 234 | 2,495 | 2,495 | 2.5 | 2.2 | 0.9 |
| 2018 | VII | 235 | 3,252 | 3,252 | 4.2 | 3.1 | 0.2 |
| 2019 | VII-VIII | 167 | 1,920 | 1,920 | 3.5 | 2.6 | 0.4 |

The mean catch rates in the coastal survey are not currently used directly for forecasting because the indices are highly variable for a variety of reasons. The data are used as relative indices and are considered mainly qualitatively (PINRO 2017) but were used as input to earlier modeling to attempt to evaluate recruitment.

Fishery dependent data – Scientists from PINRO estimate the actual catch per unit effort (CPUE) and the size and sex composition of catches from annual observations on board red king crab fishing vessels (Table 14). In addition, catch data are obtained from daily reports sent by fishing vessels via the national Fisheries Monitoring System. Standardized CPUE and legal stock for the harvest area are estimated on the basis of the catch data using a depletion analysis method.

| Time of sampling | | Fishing effort | | | | Information from PINRO observers | |
|---|---|---|---|---|---|---|---|
| Year | Month | Vessels (n) | Vessel/ fishing days | Fishing operations | Trap lifts (1000) | Individuals measured (N) | Biological analyses (N) |
| 2007 | I–III,X–XII | 30 | 2235 | 6264 | 274 | 15152 | 3111 |
| 2008 | I–III,X–XII | 30 | 2389 | 7609 | 312 | 12009 | 10404 |
| 2009 | IX–XII | 29 | 1935 | 6526 | 285 | 23136 | 2042 |
| 2010 | VIII–XII | 22 | 1059 | 3338 | 134 | 14007 | 1817 |
| 2011 | VIII–XI | 15 | 468 | 1678 | 69 | 17273 | 11214 |
| 2012 | VIII–X | 13 | 484 | 1721 | 67 | 8152 | 8152 |
| 2013 | VIII–X | 10 | 318 | 1130 | 38 | n/a | n/a |
| 2014 | IX–X | 9 | 305 | 820 | 31 | 16307 | 9654 |
| 2015 | IX–X | 9 | 297 | 862 | 29 | 22595 | 20199 |
| 2016 | IX–XI | 10 | 420 | 1369 | 55 | 3280 | 3280 |
| 2017 | IX–XI | 10 | 501 | 1858 | 134 | 17921 | 5457 |
| 2018 | IX–XI | 11 | 480 | 1658 | 38 | 11098 | 11098 |
| 2019 | IX–XI | 12 | 494 | 2116 | 45 | 7621 | 7621 |

**Table 14: Timing and data collected from commercial sampling of the Barents Sea Russian red king crab fishery. (Source PINRO 2020).**

### 7.1.4.2 Analytical methods

From 1994 until 2004 the main source of information for the red king crab stock assessment was trawl surveys, i.e. area swept method of abundance estimation (PINRO 2017). After the commercial fishery started in 2004, increased fisheries statistics allowed an attempt at length-based analysis (LBA). However, since 2007 a model has been used that does not require detailed data on size composition of catches from surveys and fisheries. A Catch Survey Analysis (CSA) method was developed in 2008 (Bakanev 2008). Catch-Survey Analysis (also known as Collie-Sissenwine method since it was first proposed in Collie and Sissenwine, 1983) aims at extracting the real stock abundance signal from often noisy survey data by smoothing the latter through a simple dynamic model (Mesnil, 2003). CSA is a two-stage model designed for cases in which a full age structure is lacking, but where two age or size groups (usually pre-recruits and recruits) can be distinguished.

Since 2013, following the termination of the king crab specialized survey in 2012, legal stock in the harvest area only has been estimated using a Leslie depletion model. This biomass estimate differs from the CSA estimate which would include the whole area covered by the trawl survey. The seasonal decline in fishery CPUE is illustrated in Figure 12. Red king crab biomass under the Leslie depletion model was estimated using Simple Fisheries Stock Assessment

Methods (FSA) package within the statistical program R (https://github.com/droglenc/FSA). Standardized CPUE with a time interval of one week was used as input data (Bakanev 2017a). Estimates of initial biomass of local stock by this method correlate satisfactorily with estimates of the total stock abundance from CSA (PINRO 2017).

Finally, a biomass dynamic model with integrated Bayesian framework for making quantitative assessments, predictions and risk analyses of stock status was developed and applied to the red king crab. The model proved superior to an alternative model in its ability to estimate parameters central to the assessment in the northern shrimp assessment (Hvingel, 2016). It utilizes time series of biomass indices, catch and prior distributions of model parameters. Process and observation errors were incorporated simultaneously using a state-space modelling framework. The model was initially used to estimate biological reference points Bmsy, Blim and Umsy for the Harvest Control Rule only (Bakanev, 2017). Bayesian Surplus production model estimates of biomass together with update reference points were used for the 2020 assessment, making estimates more consistent with reference points (Figure 12).

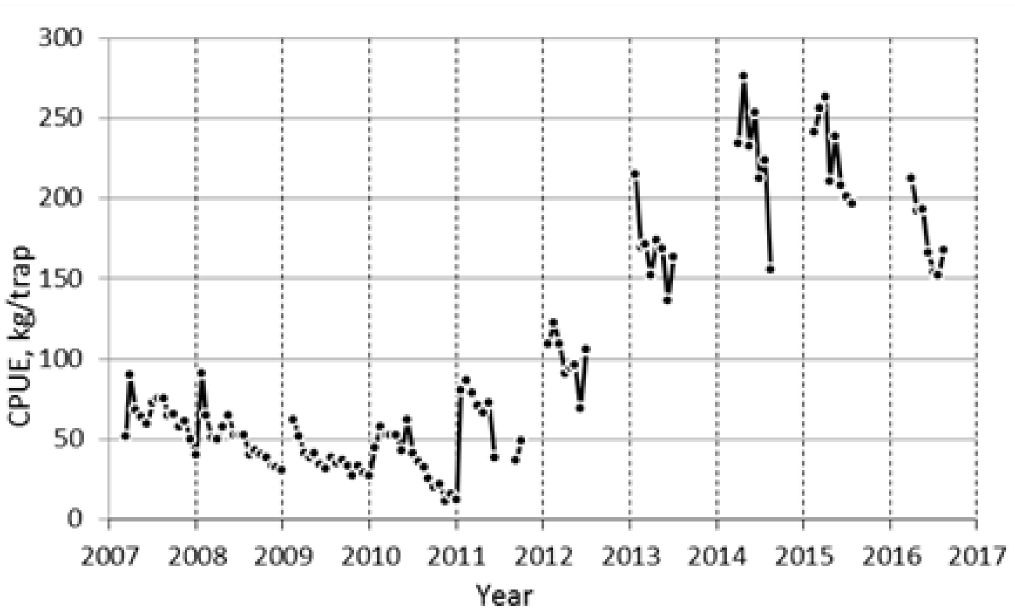



**Figure 12: Mean standardized catch rate (CPUE in kg per trap) in the Russian fishery for red king crab by week during fishing seasons of 2007-2016. (Source: PINRO 2017)**

### 7.1.4.3 Reference Points

In February 2015 the Federal Agency for Fisheries issued an Executive Order which specified that biological reference points and harvest control rules need to be developed for priority species, such as red king crab in the Barents Sea (Bakanev 2017a). The approach for estimating reference points based on data from 1994-2015 is described in Bakanev (2016a). Input data for estimating the status of the stock and reference points for red king crab were: the annual commercial catch summarized on the basis of daily catch reports from vessels, estimates of legal stock derived from fisheries statistics, research surveys data and analytical models (Table 15).

**Table 15: Catch and main indices of legal stock abundance dynamics of red king crab in the Barents Sea in 1994-2019. Source: PINRO.**

| Year | Catch (t) | CPUE* (kg/trap) | Abundance index – crabs/trap, coastal trap survey | Legal stock (1000 t) from CSA | Legal stock in harvest area (in 1000 t) – Leslie depletion analysis | Legal stock (in 1000 t) – surplus production model*** |
|---|---|---|---|---|---|---|
| 1994 | 22 | | | 2.6 | | 6 |
| 1995 | 9 | | | 2.5 | | 6 |
| 1996 | 24 | | | 3.7 | | 8 |
| 1997 | 63 | | | 4.4 | | 10 |
| 1998 | 90 | | | 5.7 | | 13 |
| 1999 | 143 | | | 6.7 | | 17 |
| 2000 | 113 | | | 9.8 | | 24 |
| 2001 | 300 | | | 13.4 | | 36 |
| 2002 | 900 | | | 35.5 | | 79 |
| 2003 | 1950 | | | 67.4 | | 144 |
| 2004 | 1105 | | | 81.1 | | 181 |
| 2005 | 3021 | | | 81.3 | | 185 |
| 2006 | 12639 | | | 76.5 | | 159 |
| 2007 | 10934 | | | 54.7 | 31.5 | 125 |
| 2008 | 9291 | | | 38.3 | 14.4 | 81 |
| 2009 | 6309 | | 2.1 | 22.5 | 11.7 | 60 |
| 2010 | 3940 | 40 | 1.0 | 21.4 | 5.8 | 56 |
| 2011 | 3702 | 49 | 1.8 | 28.4 | 9.3 | 69 |
| 2012 | 5209 | 74 | 0.7 | 39.0 | 18.9 | 103 |
| 2013 | 5531 | 121 | 2.7 | 54.8 | 27.2 | 149 |
| 2014 | 5995 | 178 | 2.2 | 94.7 | 37.9 | 219 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 2015 | 6381 | 164 | 3.1 | 90.7 | 26.2 | 201 |
| 2016 | 8300 | 129 | 4.5 | -** | 22.2 | 179 |
| 2017 | 9285 | 133 | 2.5 | -** | 15.6 | 176 |
| 2018 | 9187 | 187 | 4.2 | -** | 19.8 | 195 |
| 2019 | 9836 | 156 | 3.5 | -** | 21.0 | 198 |

(*) – GLM standardized

(**) – no estimates

(***) – recalculated following survey update in 2017-2019

Bakanev (2016a) put forward two methods for selecting reference points: an exclusively “expert-based” method using the abundance time series only, and one based on the production model in combination with expert judgment.

Using the expert-based method, the paper argues for excluding the low harvest rate period (1994-2001) from the time series because it was not representative of the potential productivity of the stock, and suggested the target biomass reference point ($B_{tr}$) could be set at a level of average legal stock size from 2002–2015 ($B_{tr}$ = 56,000t). The limit biomass reference point ($B_{lim}$) could be 0.5*$B_{tr}$ = 28,000 t. For a target exploitation rate Bakanev (2016a) suggested excluding the period of apparent overfishing (2006-2009) and used the remaining period to estimate a target exploitation rate of 0.1.

Using a stochastic version of a production model, Bakanev (2016) estimated median values with confidence intervals for $B_{MSY}$, $F_{MSY}$ and K. Estimates for legal biomass in 2015 were overestimated by the model (median=130,000t vs CSA estimate of 91,000t) but the estimate of $B_{MSY}$ (64,100t) appeared plausible based on other arguments (e.g. when using a swept area method, catch rates are estimated to correspond to 10–30% of the legal stock). The $F_{MSY}$ estimate from the model (median = 0.2) did not seem precautionary, so the 2.5, 25, 75 and 97.5 percentile estimates were averaged, resulting in a recommended $F_{MSY}$ of 0.17.

Bakanev (2016a) suggested that if biological reference points are estimated within the production model itself, then limit reference points should be estimated outside of the model. He noted that estimation of the biomass limit reference point for the Barents Sea red king crab stock could be carried out on the basis of expert judgment, given that (i) there are insufficient data to model them with confidence and (ii) technical measures currently in place to regulate fisheries in the Barents Sea offer considerable protection. A total closure of the crab fishery within the coastal 12nm zone ensures conservation of a large proportion of the legal stock even under heavy fishing pressure. In addition, a prohibition on harvesting females and males less than 150mm CW ensures conservation of a proportion of the spawning stock. As such Bakanev (2016a) concluded that $B_{lim}$ could be set at 30% of $B_{MSY}$, in line with the established fisheries schemes applied, for instance, in stocks of fishes and invertebrates evaluated using production models. So, for red king crab in the Russian Barents Sea, Bakanev stated $B_{lim}$ could be set to 19,000t (0.3*$B_{MSY}$). The guidance in the MSC Fisheries Standard v2.0 is that if $B_{MSY}$ is determined from a model, $B_{lim}$ should be ½ $B_{MSY}$. However, given the technical measures in place, 30% of the estimate of $B_{MSY}$ rather than 50% is justified.

Surplus production model based estimates of reference points reported in Bakanev (2016a) $B_{tr}$ (=$B_{MSY}$) of 64,100t, a $B_{lim}$ of 19,000t and an $F_{MSY}$ of 0.17 were used to determine the status of the stock in 2017 - 2019. Following the restoration of the crab survey in 2017, the surplus production model was rerun in 2019 with updated numbers, Consequently, biological reference points for biomass were revised to Btarget=Bmsy= 149,000 ton and Blim=45,000 ton (PINRO 2020). The reviewers consider that this level of $B_{lim}$ is precautionary for a PRI given the technical measures in place.

That there is considerable protection built into the management is clear. The technical measures highlighted by Bakenev (full protection of females, protection of an important portion of the stock in the closed inshore area, and the minimum legal size of males) provide considerable protection against recruitment impairment. The minimum legal size for males (150 mm carapace width [CW]) is above the size at which 50% of males are expected to be mature (estimated at 110 mm carapace length or approximately 131 mm CW using the length-width relationship in Tracy (1998)). Thus, a portion of the stock can continue to reproduce regardless of a fishery. Of course, there are still uncertainties as the quantity of males are required to mate with females.

#### 7.1.4.4 Harvest Control Rule

The harvest control rule was developed in 2015 and is as follows (PINRO 2017):

1. Exploitation level (proportion harvested $E_t$) is set at no higher than target exploitation level ($E_{tr}$ = 0.17) with legal stock above target biomass reference point ($B_{tr}$= 64,000t); [$B_{tr}$ set at $B_{MSY}$]

2. With legal stock (Bt) above limit biomass reference point ($B_{lim}$=19,000t), but below target reference point the exploitation level is estimated as $E_t = E_{tr} \times (B_t - B_{lim})/(B_{tr} - B_{lim})$;

3. With legal stock below limit reference point the exploitation level is $E_t$= 0 (only fishing for science is permitted);

4. Year-to-year TAC variation can be no more than ± 30 % of the previous year's TAC provided that legal stock is above the limit reference point.

Simulation results indicate that the HCR for the Barents Sea red king crab proposed in 2015 is precautionary and robust to uncertainties such as recruitment variation; the following three paragraphs describing the simulations is from Bakanev (2016b). They document how uncertainty was accounted for and provide evidence that the target exploitation rate is precautionary.

Evaluation of the harvest control rule for red king crab was carried out using the CSA model and implemented in MS Excel as a simulation model of biomass dynamics of legal stock comprised of recruits and post-recruits. Confidence intervals for legal population abundance in 1994-2015 were estimated to simulate error parameters related to stock assessment by a stochastic version of the CSA model. The confidence interval range varied substantially within the entire historic period. Therefore, several scenarios of multiplicative error in stock assessment simulated as a random variable having a normal distribution with a mean 1 and a specified standard deviation from 0 to 0.4 in increments of 0.1 were used to evaluate the HCR. Due to unavailability of data on functional dependence of "stock-recruitment", the recruitment to legal stock was simulated using its estimates from 2006-2015 derived using the CSA model. Three different scenarios of recruitment to legal stock were analysed by the simulation model.

Estimation of the HCR in the simulation model was undertaken for years 2050 to 2150, with a time step of one year. Considering the fact that stock assessment errors were taken into account in the simulations (they were simulated as a random variable at each time step of the model), simulations were run multiple times to obtain stable average values (100 iterations). In addition, analysed population characteristics were averaged for the last 100 years to exclude the effect of initial values on the results. The 5%, 50% and 95% percentiles were estimated for each parameter (abundance, biomass, catch, recruitment).

The condition that the probability (risk) of legal stock biomass being below $B_{lim}$ shall not exceed 5% (similarly to commonly accepted management approaches worldwide and in Russia) was taken as precautionary criteria for the HCR. All simulations suggest that the risk of legal stock falling below $B_{lim}$ is nil. With recruitment to the stock simulated as a random variable and with quasi-cyclic recruitment, there is a high risk of the stock falling below $B_{tr}$. Simulation of stock dynamics under different exploitation rates showed that opting for $E_{tr}$=0.17 (an exploitation rate of 17% of the legal stock) is precautionary and supports the harvest that is closest to the highest level. Increased harvest levels do not result in any substantially increased long-term mean harvest but greatly increase the risk of legal stock falling below $B_{tr}$. Various assumptions about the type of recruitment and the size of stock assessment error did not substantially affect long-term medians of harvest and legal stock (Bakanev 2017b).

#### 7.1.4.5 Stock Status

Catch survey analysis (CSA) was the main tool for evaluating the red king crab stock status to the end of 2016 and to develop a forecast of TAC for 2018 (PINRO 2017). As input to modeling of stock dynamics in 2017, the following data were used (i) the abundance indices from trawl surveys in 1994-2011, (ii) standardized catch per unit effort in the fishing seasons of 2007 to 2016, and (iii) estimates of legal stock in the harvest area in 2007-2016 from the Leslie depletion model (PINRO 2017). In addition, information provided by observers on fishing vessels was used in the analysis of fisheries-dependent and biological indices of the crab population, catch rates and selectivity. Given the discontinuation of the trawl survey, the stock dynamics estimated by the CSA model were extrapolated to the dynamics of other indices estimated (Bakanev 2017a). CSA was run in OpenBUGS (an open source software application for the Bayesian analysis of complex statistical models). With appropriate modification of the CSA model, OpenBUGS can calculate gaps of data i.e. survey indices for years with no survey.

In addition to the CSA analysis, findings from other indices indicated that the stock is in good condition (PINRO 2017). The 2016 coastal trap surveys showed that there was an increasing trend in catch per unit effort of legal males and pre-recruits of red king crab in 2008-2016. The survey did not identify any negative indicators such as massive bacterial or parasite infestation of sampled crabs, evident predominance of non-ovigerous females in the survey area, any signs of decalcification in crabs etc. Pre-recruits II (males with CL of 107-127mm) had an extensive spatial distribution and their catches were relatively high, indicative of a potentially stable recruitment to the legal stock in the near future. Catch rates in the commercial fishery were down in 2016 from the previous two years, but were still the 3rd highest in the time series. The index of initial biomass from the Leslie analysis was the 4th highest from 2007-2016.

In order to forecast stock status for 2017-2018, the recruitment to legal stock was simulated using estimates derived by CSA. Three different scenarios of recruitment to the legal stock in 2017-2018 were analysed by the simulation model: (i) constant recruitment equal to the average estimated for the period 2006 to 2015; (ii) random recruitment chosen by the bootstrap method among a number of estimates derived by CSA for the period 2006 to 2015; (iii) constant recruitment equal to minimal estimated for the period 2006 to 2015. Forecasted biomass ranged from 66,988t to 79,982t in 2017, and 52,815 to 77,711t in 2018. Due to rather long break in the specialized crab survey (no sampling (2012-2016), lack of biomass indices for pre recruits and recruits made a continuation of the CSA model impossible. In 2020 a Bayesian surplus production model estimates were used as a measure of the stock biomass relative to the updated reference points (Figure 13). The trend and the status of the stock in updated HCR plot (Figure 13) was similar to the one developed in 2017 (Bakanev, 2017).

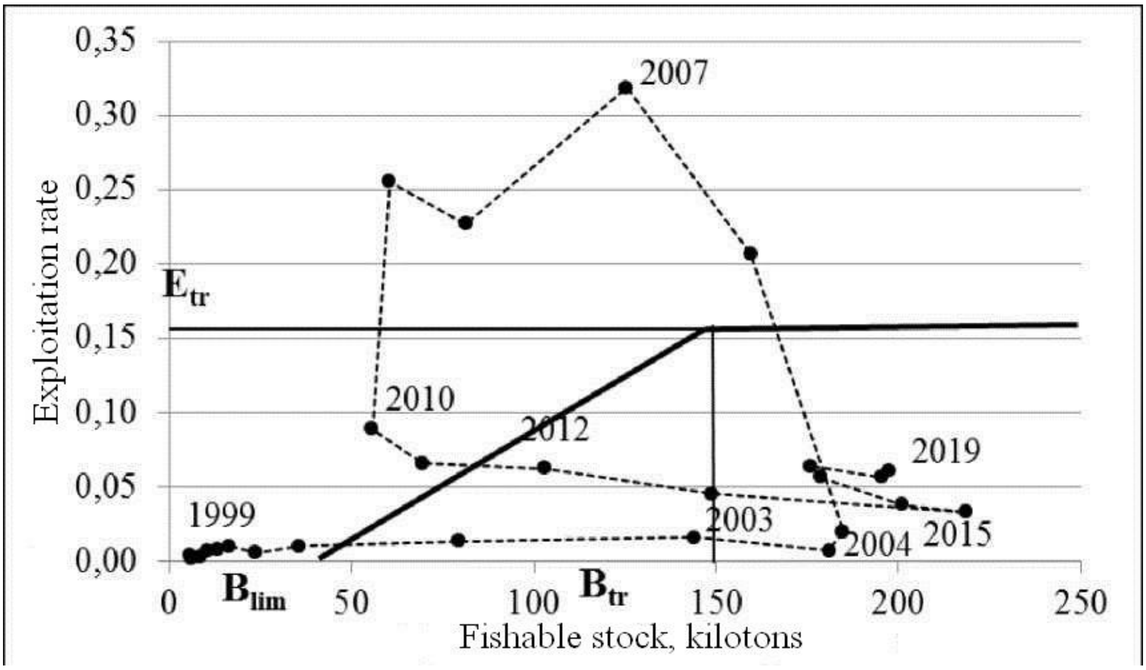



**Figure 13:** **King crab fishable stock dynamic and exploitation rate in the Barents Sea, and reference points for its stock management (Biim, Btr and Etr) in the Barents Sea in 1994–2019 according to surplus production model-based estimates.. (Source PINRO 2020a).**

### 7.1.4.6 History of fishing and management

The Joint Russian-Norwegian Fishery Commission initiated the fishery for the red king crab in the Barents Sea as a research fishery in both national waters in 1994, and at the same time surveys of the crab stock started (Jørgensen et al. 2005). This fishery lasted as a research fishery in Norway until 2002 when it became a regular commercial fishery

(Sundet 2014). Commercial fishing for red king crab in the Barents Sea began in Russia two years later, in 2004 (Sundet 2014, PINRO 2015). In 2005, a western boundary for joint Norwegian–Russian management was agreed upon. Management of the red king crab was considered by the Joint Norway–Russia Fisheries Commission for several years, until it was concluded that, from 2007 onward, each country would manage the red king crab in their waters separately (Sundet 2014).

Only traps are allowed in the red king crab fishery in both Russia and in Norway. In Norway this fishery is reserved for small vessels operating only a few (<30) traps in near coastal waters (Sundet 2014). In Russia the red king crab fishery is performed by large (mostly > 50m) vessels operating many traps outside of a closed coastal area (closed within 12 nautical miles (Figure 14).

The number of vessels operating in the Russian Barents Sea red king crab fishery decreased from 30 in 2007-08 to 22 in 2013 and 9 in 2014 (PINRO 2015). At present there are 16 vessels operating. Rectangular, trapezoidal and conical pots are typically baited with herring and fished on trawl lines. The retained legal crab is transferred to transport vessels and frozen.

The red king crab resource in the Barents Sea crosses a political boundary but is likely one genetic stock given that its point of introduction is limited in space and relatively recent. The occurrence of red king crab at increasing distances from the source with time is consistent with a point source of introduction in the Russian Barents Sea. In its current range in Russian and Norwegian waters, young crab settling to the seabed in any one location may originate from some distance away. A modeling study by Pedersen et al. (2006) reported that the general direction of advection of larvae is to the east, and this is a persistent feature, but that there was also a dispersion of larvae in westbound direction along the coast. The latter must have occurred given the spread of the crab from Russia to Norway. Successful recruitment to the seabed requires successful delivery of larvae, but also a suitable habitat and physical regime for the newly benthic stages. To date there are no studies which attempt to quantify the recruitment sources and sinks in the Barents Sea red king crab stock (as for many benthic invertebrates). With regard to movement of benthic stages between Norway and Russia, it does occur but the available evidence from a tagging study (Windsland et al. 2014) indicates this movement is limited.

The approach of having separately managed management units on a single genetic stock is viable for the following reasons (modified from PINRO, 2015):

i. There is good separation between the main concentration of crab in Russian waters from that in Norwegian waters (Figure 14, Figure 15) and most red king crab in the region do not move large distances annually. Windsland et al. (2014) found that nearly 90% of crabs tagged in different regions of northern Norway had a displacement of < 30km, while a small percentage (2%) had moved more than 100km;
ii. The 12 nautical mile zone closed to fishing in the Russian zone protects extensive spawning grounds as indicated by nearshore concentrations of egg-bearing females (Berenboim et al. 2004);
iii. Common interest of the two border states in the long-term exploitation of the population in the Russian EEZ and in the border area of the Norwegian Economic Zone (Norway has a two pronged management approach – a managed fishery in the border area and an uncontrolled fishery to the west to limit the spread of red king crab – Sundet 2014).

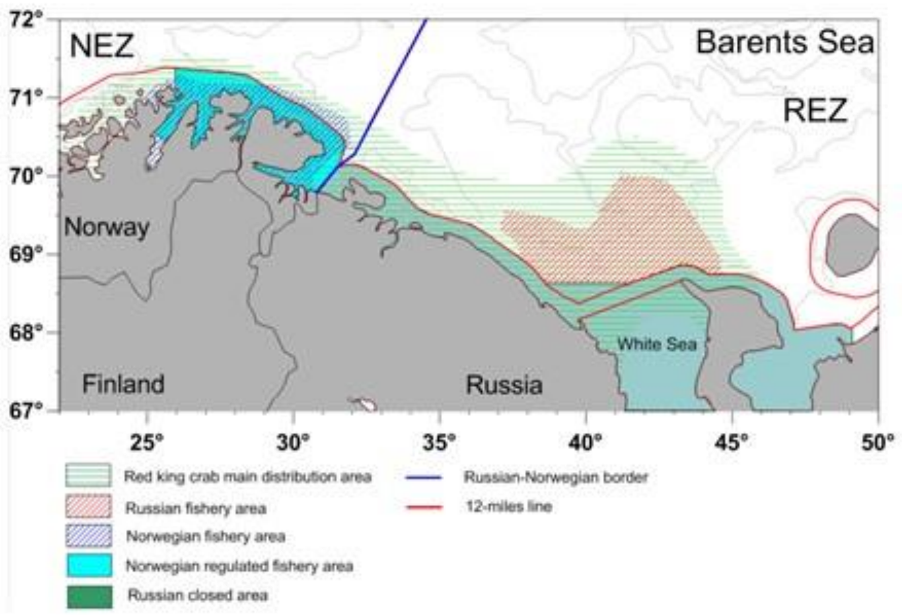



**Figure 14:** **Distribution of main concentrations of red king crab (green hatching) and fishing grounds in Russian (red hatching) and Norwegian (blue hatching) waters (Source: PINRO 2015).**

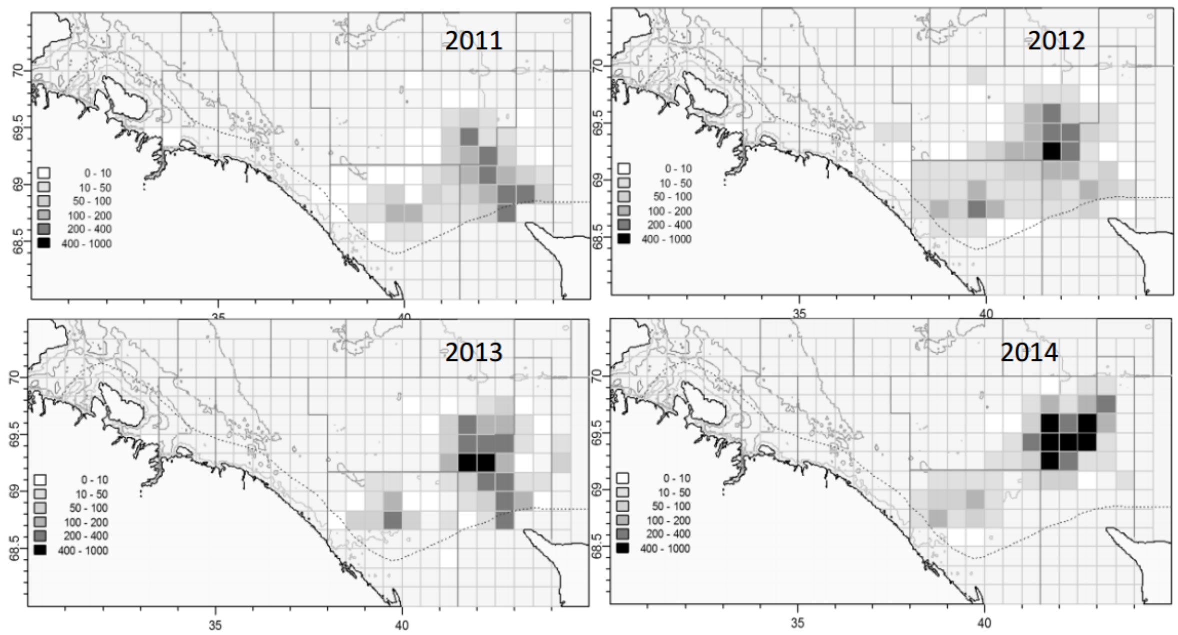



**Figure 15:** **Distribution of red king crab catches (t) in Russian waters by statistical rectangle, 2011-2014. (Source PINRO, 2015).**

Management measures in the Russian Barents Sea red king crab fishery include:

- Setting of a TAC
- Licensing of fishery
- Closed seasons (Jan-July since 2009; fishing period of 2-4 months)
- Closed areas (including but not limited to zone inside 12 nm)

- Minimal legal size (carapace width) of 150 mm
- Ban on harvesting females
- Recording of catch in vessel's log-book
- Limitations for trap design
- Catch limit per vessel

A comparison with the Norwegian king crab fishery is given in Table 16.

**Table 16: Summary of management measures for Red King Crab in Norway and Russia (Source: ICES WGCRAB report 2015)**

| Species: *Paralithodes camtschaticus* | | |
|---|---|---|
| | | |
| | Barents Sea | Barents Sea |
| Management measure | Norway | Russia |
| | | |
| Licensing | Yes | Yes |
| Limited Entry | Yes | Yes |
| Closed seasons | No | Yes |
| Days at sea | No | No |
| Closed areas | No | Yes |
| Others | | |
| | | |
| Minimum size | 130mm CL | 150mm |
| Maximum size | No | No |
| Berried female legislation | No | Yes - prohibation to land females |
| Soft crabs | | |
| Single sex fishery | No | Yes, only males |
| Claws or parts | No | Sections by different weight |
| Use as bait | Herring | Herring |
| Vessel size | 6-22 m | 49.6-54.8 m |
| Vessel power | | 700-1700 hps |
| VMS | Yes | Yes |
| Log book returns | Yes | No |
| Others | | |
| | | |
| Trap limits | Yes | Yes |
| Trap size | Yes | Yes |
| Escape vents | Yes | No |
| Biodegradable panels | No | Yes |
| Marked gear | Yes | No |

The long-term management objective for the red king crab fishery in Russian waters in the Barents Sea is to maintain the stock at a high level which ensures reproduction of the stock and a long-term sustainable fishery. This long-term objective is pursued in two primary ways: (i) regulation of the TAC to prevent overfishing of the fishable stock; (ii) technical measures to minimise mortality in non-legal-sized crabs (size and sex limitations, season and fishing area restrictions, regulations pertaining to design features of fishing gear, etc.).

Short-term management objectives for the fishery were developed when a sharp decline in the stock occurred in 2007-2009 (Table 17, Figure 16). During those years, low abundance of the fishable stock and unstable recruitment resulted in a need to develop additional measures to restrict harvesting of red king crab in the Barents Sea. Those measures, aimed at conservation of the stock and its reproductive capacity, included reduced TACs, an increased minimum legal size from 130mm to 150mm, limited winter fishing (none in Jan-Feb since 2008), and a ban on the fishery in the areas where juveniles and females were concentrated (move-on rules). In addition, there has been a complete closure of the 12 mile zone since 2010. Since the adoption of these measures the Barents Sea red king crab stock biomass has increased, with a peak in 2014 (Figure 16).

**Table 17: Total allowable catch and main indices of Russian Barents Sea red king crab fishery 2006-2016. (Source PINRO 2017).**

| Year | TAC (1000 t) | Catch (1000 individuals) | Catch (1000 t) | Catch per vessel day | Catch per trap* (kg) | Avg crab wt** (kg) |
|---|---|---|---|---|---|---|
| 2006 | 14.60 | 3086 | 12.639 | 7.7 | 120 | 4.1 |
| 2007 | 12.72 | 2729 | 10.934 | 6.3 | 95 | 4.1 |
| 2008 | 12.48 | 2389 | 9.291 | 4.2 | 66 | 4.1 |
| 2009 | 10.40 | 1971 | 6.309 | 3.6 | 57 | 3.2 |
| 2010 | 4.00 | 1313 | 3.940 | 4.4 | 58 | 3.0 |
| 2011 | 4.00 | 1246 | 3.702 | 8.2 | 83 | 2.9 |
| 2012 | 5.50 | 1736 | 5.209 | 9.7 | 103 | 3.0 |
| 2013 | 6.00 | 1784 | 5.531 | 17.4 | 163 | 3.1 |
| 2014 | 6.50 | 1712 | 5.995 | 19.7 | 283 | 3.5 |
| 2015 | 6.90 | 1725 | 6.381 | 21.5 | 288 | 3.7 |
| 2016 | 8.51 | 2075 | 8.300 | 18.7 | 208 | 4.0 |

* Standardized index against catch by American rectangular trap. **According to data from observers and end product production statistics.

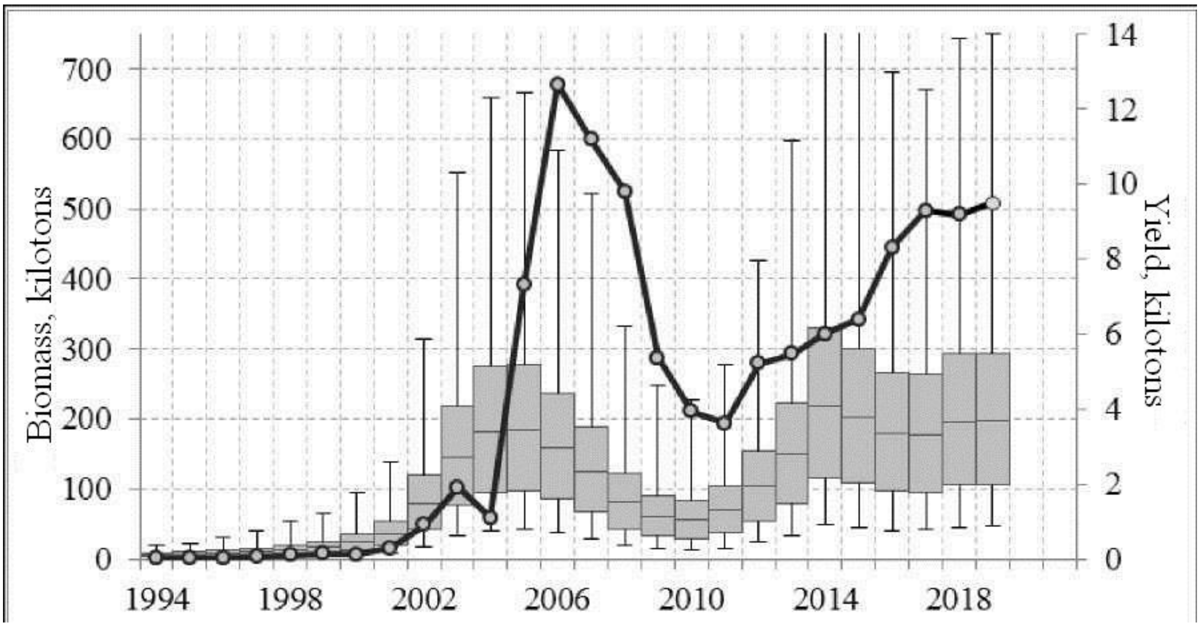



**Figure 16:** **King crab fishable stock biomass dynamic (range of quartiles with a median, error bar – 95% confidence interval) and yield in Russian Federation EEZ in the Barents Sea in 1994–2020.**

## 7.1.5 Catch profiles

The CAB shall include in the report any relevant catch profiles showing Unit of Assessment (UoA) catch over time.

## 7.1.6 Total Allowable Catch (TAC) and catch data

**Table 16. Total Allowable Catch (TAC) and catch data**

| | | | | |
|---|---|---|---|---|
| TAC | Year | **2020** | Amount | **10940 tons** |
| UoA share of TAC | Year | **2020** | Amount | **2177 tons** |
| UoA share of total TAC | Year | **2020** | Amount | **2177 tons** |
| Total green weight catch by UoC | Year (most recent) | **2020** | Amount | **2160 tons** |
| Total green weight catch by UoC | Year (second most recent) | **-** | Amount | **-** |

### 7.1.7 Principle 1 Performance Indicator scores and rationales

## PI 1.1.1 – Stock status

| PI 1.1.1 | | The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| a | Stock status relative to recruitment impairment | | | |
| | Guide post | It is **likely** that the stock is above the point where recruitment would be impaired (PRI). | It is **highly likely** that the stock is above the PRI. | There is a **high degree of certainty** that the stock is above the PRI. |
| | Met? | **Yes** | **Yes** | **Yes** |
| Rationale | | | | |

Biomass estimates have been above Blim since 2002 (Figure 13). Blim is considered to be a conservative proxy for the PRI (see below). The value of Blim was set at the level of 30% of BMSY, which corresponds to the accepted biological reference points, for example, in the North Atlantic, when assessing fish stocks using surplus production models (ICES, 2003; Hvingel, Kingsley, 2006]. Furthermore, estimated stock biomass was at or above Btarget in 1994-2006 and 2013-2019, where Btarget is more than threefold of Blim (149,000 mt vs 45,000 mt). SG60 is met.

Following the stock overfishing during the initial stage of fishery establishment, the biomass declined to near Blim by 2010. Coincident with conservation measures taken around that time, biomass increased to approximately 4 times Blim by 2016 and has stabilized at this level thereafter. Based on the probability distribution of red king crab 2019 biomass in the output of the Bayesian surplus production model, the probability of $B_{2019}$ being at or below Blim is near zero. In addition, a qualitative trap survey in the unfished nearshore indicates stable recruitment (section 7.1.1.47.1.4.5. Stock Status). SG 80 is met.

While the existing standard for $B_{lim}$ is 50% of Bmsy, $B_{lim}$ in this case estimated as 30% of $B_{MSY}$ and still is a precautionary measure of the point at which recruitment is impaired (PRI) given the technical measures in place: (i) females are fully protected, (ii) a closed inshore area (12 nautical miles) protects a substantial portion of the stock from fishing and (iii) the minimum legal size for males is above the size at which 50% of males are expected to be mature. The assessment also conducted simulations with Bayesian surplus production model that show that the risk of legal stock falling below the limit reference point $B_{lim}$ in 2021 does not exceed 3.5% even when the 2020 projected removals exceed recommended 2020 TAC by 30%. The risk of falling below Blim is less than 6.4% if the stock will be exploited in 2020 at the target rate which is equivalent to the removals being threefold of the recommended TAC. Therefore, there is a high degree of certainty that the stock is above the PRI and SG 100 is met.

| | | | | |
|---|---|---|---|---|
| b | Stock status in relation to achievement of Maximum Sustainable Yield (MSY) | | | |
| | Guide post | | The stock is at or fluctuating around a level consistent with MSY. | There is **a high degree of certainty** that the stock has been fluctuating around a level consistent with MSY or has been above this level over recent years. |

| | Met? | | Yes | No |
|---|---|---|---|---|

## Rationale

There has been a consistent trend of increase in biomass since 2010.The stock biomass was at 86% $B_{MSY}$ in 2013 and consistently above $B_{MSY}$ in 2014-2020 (Figure 13, PINRO 2020a). The biomass in 2020 and 2021 is projected by the Bayesian surplus production model to be well above Bmsy under the assumption of full utilization of recommended TAC. The stock is fluctuating around a level consistent with MSY and SG 80 is met.

The stock biomass was consistently above Bmsy only for last six years (2014-2019), which is less than one generation time (10 years). The mean and median values over past ten years was less than 90% of Bmsy (0.9Bmsy=134.1 thousand tons). Because the recent period of biomass being at or near the Bmsy is less than one generation time, the stock status does not fit the definition of the high degree of certainty that the stock is fluctuating around a level consistent with $B_{MSY}$. SG100 is not met.

## References

PINRO 2020a. Status of the red king crab stock in the Exclusive Economic Zone (EEZ) of the Russian Federation in the Barents Sea in 2019 and TAC estimation for 2020. Translation based on following technical document in Russian: “Materials for justification of the 2020 TAC for red king crab in the EEZ of the Russian Federation, PINRO, Murmansk, 2019”. Received from the client October 2020.

Bakanev S.V. 2016. Methods of estimating the biological reference points for red king crab in the Barents Sea Trudy VNIRO, Volume 161, pp 16-26”. In Russian. Available online: http://vniro.ru/files/trydi_vniro/archive/tv_2016_t_161_article_2.pdf

PINRO 2017. Status of the red king crab stock in the Exclusive Economic Zone (EEZ) of the Russian Federation in the Barents Sea in 2016 and TAC estimation for 2018. Translation based on following technical document in Russian: “Materials for justification of the 2018 TAC for red king crab in the EEZ of the Russian Federation, PINRO, Murmansk, 2016”. Received from the client May 2017.

The CAB shall list any references here, including hyperlinks to publicly-available documents.

ICES. 2003. Study group on biological reference points for Northeast Arctic cod. Svanhovd, Norway. 13–17

January 2003. ICES CM 2003/ACFM:11. 43 p.

Hvingel C., Kingsley M.C.S. 2 006. A framework to model shrimp (Pandalus borealis) stock dynamics and

quantify the risk associated with alternative management options, using Bayesian methods // ICES J. Mar. Sci.

V. 63. P. 68–82.

## Stock status relative to reference points

| | Type of reference point | Value of reference point | Current stock status relative to reference point |
|---|---|---|---|
| Reference point used in scoring stock relative to PRI (SIa) | $B_{LIM}$ | 45,000 t legal-sized male crab | *B2019/Blim=4.35*<br>*B2018/Blim= ???*<br>*B2017/Blim=3.91* |
| Reference point used in scoring stock relative to MSY (SIb) | $B_{tr}$ (set at $B_{MSY}$) | 149,000 t legal-sized male crab | *B2019/Bmsy=1.32*<br>*B2018/Bmsy= ???*<br>*B2017/Bmsy=1.18* |

| Draft scoring range | **≥80** |
|---|---|

| | |
|---|---|
| Information gap indicator | **More information sought -** Please provide 2018 biomass estimate from Bakanev and confirm mean and median Biomass for 10 years. |

**Overall Performance Indicator scores added from Client and Peer Review Draft Report stage**

| | |
|---|---|
| Overall Performance Indicator score | |
| Condition number (if relevant) | |

# PI 1.2.1 – Harvest strategy

| **PI 1.2.1** | | **There is a robust and precautionary harvest strategy in place** | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| **a** | Harvest strategy design | | | |
| | Guide post | The harvest strategy is **expected** to achieve stock management objectives reflected in PI 1.1.1 SG80. | The harvest strategy is responsive to the state of the stock and the elements of the harvest strategy **work together** towards achieving stock management objectives reflected in PI 1.1.1 SG80. | The harvest strategy is responsive to the state of the stock and is **designed** to achieve stock management objectives reflected in PI 1.1.1 SG80. |
| | Met? | **Yes** | **Yes** | **Yes** |
| Rationale | | | | |

The harvest strategy consists of the following elements: an HCR with limit and target biomass reference points and a target exploitation rate; a TAC that is annually set following an assessment; limited licenses; a minimum legal size (MLS), prohibition on retention of all females, a closed season; closed areas including but not limited to the 12nm closed area, measures to minimize mortality to females and crabs below the MLS, and specifications for trap design. To ensure compliance, a comprehensive monitoring, control and surveillance system is in place (See Section 9.1.5). The harvest strategy is expected to maintain high productivity, keep stock biomass at or above Bmsy and result in a low probability of recruitment overfishing. SG60 is met.

The harvest strategy is responsive to the state of the stock and the elements work together. Protection of reproductive stock is achieved by setting annual TAC, not harvesting females, harvesting only males above a size where some males can reproduce, closed areas, and a precautionary target exploitation rate. The TAC has been adjusted in the past in response to reduced stock size. SG80 is met.

The harvest strategy has been developed since the early 2000's and is designed to maintain high productivity and result in a low probability of recruitment overfishing. There is good evidence it is effective. The TAC was reduced from 14,600t in 2006 to 4000 t in 2010 during a decline in stock abundance. The catch was controlled and never exceeded the TAC. With the relatively small number of vessels in the fleet control of catch appears to be achievable. During the same period the MLS was increased from 130mm to 150mm carapace width, and a move-on rule was adopted for areas where juveniles and females were concentrated. The 12nm zone was completely closed to fishing in 2010. Measures were also taken to decrease illegal harvesting of red king crab in the Barents Sea (PINRO, 2015). The stock responded and its biomass surpassed Bmsy level by 2014 and has stabilized well above $B_{msy}$ thereafter (Figure 13). SG100 is met.

| | | | | |
|---|---|---|---|---|
| **b** | Harvest strategy evaluation | | | |
| | Guide post | The harvest strategy is **likely** to work based on prior experience or plausible argument. | The harvest strategy may not have been fully **tested** but evidence exists that it is achieving its objectives. | The performance of the harvest strategy has been **fully evaluated** and evidence exists to show that it is achieving its objectives including being clearly able to maintain stocks at target levels. |
| | Met? | **Yes** | **Yes** | **No** |

| Rationale |
|---|

The strategy is based on the standard harvest control rule that requires proportional reduction in fishing mortality as the population biomass falls below the target (Restrepo, 1991) Variations of this HCR were adopted around the world and were shown to work successfully (Kvamsdal et al., 2020). Other measures such as harvest limit (TAC), minimum sizes, female protection, area closures were also shown to be part of the successful management strategy in many fisheries. Thus, the harvest strategy is likely to work based on plausible argument, Evidence from the history of the fishery indicates that the strategy is working. When the TAC was reduced and other measures to reduce fishing mortality were introduced during a downturn in stock abundance (see SG1.2.1 a), the stock responded positively. Hence, it can be concluded that the harvest strategy is likely to work based both on prior experience and plausible argument. SG60 is met.

Part of the harvest strategy (harvest control rule) has been tested by simulation modeling and it was found to be robust to recruitment variation and stock assessment error (Bakanev 2016b). Evidence from the history of the fishery indicates that the strategy is working. When the TAC was reduced and other measures to reduce fishing mortality were introduced during a downturn in stock abundance (see SG1.2.1 a), the stock responded positively, showing stable growth until it stabilized in recent years at the biomass level well above Btarget. SG80 is met.

Testing of the harvest strategy and the associated HCR is done using simulations to evaluate the HCR for robust performance under the assessed starting stock conditions and uncertainties. In determining the TAC based on the HCR, the two-year projections from the terminal year of the assessment using stochastic projection model are undertaken to determine the risk of fishing mortality increasing above $F_{lim}$ and SSB decreasing below $B_{lim}$ during the projection period over a range of assumed TACs (Bakanev, 2016a). More uncertainty in the assessed stock conditions results in a greater risk for a given TAC and has the effect of reducing the TAC. The probability of the projected SSB falling below $B_{lim}$ should be less than the selected risk tolerance (usually 5%) for a selected level of TAC. If the probability of SSB < $B_{lim}$ is more than the recommended risk tolerance level, the TAC is adjusted downwards. In addition, ten-year projections are completed to confirm the robustness of the harvest strategy to stock conditions and uncertainties over the longer term. TAC values from two-year projections are applied for the first two projected years, and target fishing mortality is applied for the rest of a ten-year period. The projected range of SSB values is compared with $B_{lim}$ and the probability of SSB declining to below $B_{lim}$ is evaluated. The simulation testing appears to be consistent with the SG100. However, there has not been sufficient time to fully evaluate the performance of the harvest strategy in practice, to demonstrate that it can clearly maintain the stock at $B_{MSY}$. The adoption of reference points is recent, and the stock has been above $B_{MSY}$ for less than a generation period for red king crab. SG100 is not met.

| | Harvest strategy monitoring | | | |
|---|---|---|---|---|
| **c** | Guide post | Monitoring is in place that is expected to determine whether the harvest strategy is working. | | |
| | Met? | **Yes** | | |

| Rationale |
|---|

Monitoring of the fishery includes commercial catch rate and landings, biological measurements of the commercial catch, fishery independent trap survey within 12-mile zone and a dedicated bottom trawl survey in Russian EEZ. There is a comprehensive monitoring, control and surveillance system in place (See Section 9.1.5). These allow a determination of whether the harvest strategy is working. SG60 is met.

| | Harvest strategy review | | | |
|---|---|---|---|---|
| **d** | Guide post | | | The harvest strategy is periodically reviewed and improved as necessary. |

| | | | | |
|---|---|---|---|---|
| | Met? | | | **No** |
| Rationale | | | | |

Parts of the harvest strategy have been modified and improved over the last 10 years as evidenced by changes as a result of decreased stock abundance (see 1.2.1a). While review of measures such as seasons, areas, minimum legal sizes and move-on rules likely occurs during presentation of the TAC at meetings with other science bodies and with stakeholders, there is no record available of what has been discussed or that a periodic review is specifically planned. Target and limit biomass reference points have been recently modified as a result of assessment update (PINRO 2020). The FFA VNIRO working group on methods recommended to review HCRs once in five years, but no formal review of the HCR performance has occurred yet. SG100 is not met.

| | | | | |
|---|---|---|---|---|
| **e** | Shark finning | | | |
| | Guide Post | It is **likely** that shark finning is not taking place. | It is **highly likely** that shark finning is not taking place. | There is a **high degree of certainty** that shark finning is not taking place. |
| | Met? | **NA** | **NA** | **NA** |
| Rationale | | | | |

Sharks are not target species

| | | | | |
|---|---|---|---|---|
| **f** | Review of alternative measures | | | |
| | Guide Post | There has been a review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock. | There is a **regular** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock and they are implemented as appropriate. | There is a **biennial** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock, and they are implemented, as appropriate. |
| | Met? | **Yes** | **Yes** | **No** |
| Rationale | | | | |

There has been review of the potential effectiveness and practicality of alternative measures to minimize mortality of non-target red king crab (undersized males and all females). Move-on rules were brought in during the period of low stock abundance to minimize mortality of undersized and female red king crab. SG60 is met.

Area closures (12 miles zone), move on rule and other alternative measures are potential topics at regular meetings of the regional Science and Fishery Council, where management authorities receive feedback on management practices from the industry and other interested stakeholders, including NGOs. The Science and Fishery Council meetings are regular (held twice a year), and their notes are published on the FFA website for public view. The assessment team interprets that regular fishery council meetings provide evidence that potential measures are kept under review, and that this process meets the intent of SG80.

There is no evidence available that states that a formal biennial review is undertaken of alternative measures to minimize UoA-related mortality of unwanted catch of the target stock. SG100 is not met.

| |
|---|
| References |

PINRO 2015. Report on research works. Results of assessment of the impact of the Barents Sea red king crab trap fishery on its stock, stocks of other species and from the analysis of the Barents Sea red king crab fishery management. Polar Research Institute of Marine Fisheries and Oceanography (PINRO, Murmansk, Russia).

Bakanev S.V. 2016a. Methods of estimating the biological reference points for red king crab in the Barents Sea Trudy VNIRO, Volume 161, pp 16-26".

Bakanev S.V. 2016b. Evaluation of Harvest Control Rule for red king crab (Paralithodes camtschaticus) in Russian waters of the Barents Sea Trudy VNIRO. Vol 163. Pp. 25-35.

Bakanev S.V. 2008. Application of a stochastic cohort model CSA for red king crab, Paralithodes camtschaticus, in the Barents Sea. Voprosy rybolovstva T. 9, № 2 (34) S. 294– 306

Bakanev S.V. 2014. Stock assessment of red king crab in the Barents Sea in 1994–2011. Trudy VNIRO. T. 151. S. 27–35

Bakanev S.V. 2015. Stock assessment of the red king crab in the Russian EEZ of the Barents Sea by using depletion models. Voprosy rybolovstva. T. 16, № 4. S. 465–476.

Bakanev S.V. 2016. Estimation methods for biological reference points of king crab stock in the Barents Sea. Trudy VNIRO. T. 161. S. 16–25.

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| **Draft scoring range** | **≥80** |
|---|---|
| Information gap indicator | **More information sought –** SI (f) client to provide copies of minutes of the specific Council sessions where crabs were discussed. Or minutes of the Scientific Council of PINRO. |

**Overall Performance Indicator scores added from Client and Peer Review Draft Report stage**

| | |
|---|---|
| Overall Performance Indicator score | |
| Condition number (if relevant) | |

## PI 1.2.2 – Harvest control rules and tools

| **PI 1.2.2** | | **There are well defined and effective harvest control rules (HCRs) in place** | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| **a** | HCRs design and application | | | |
| | Guide post | **Generally understood** HCRs are in place **or available** that are **expected** to reduce the exploitation rate as the point of recruitment impairment (PRI) is approached. | **Well defined** HCRs are **in place** that **ensure** that the exploitation rate is reduced as the PRI is approached, are expected to keep the stock **fluctuating around** a target level consistent with (or above) MSY, or for key LTL species a level consistent with ecosystem needs. | The HCRs are expected to keep the stock **fluctuating at or above** a target level consistent with MSY, or another more appropriate level taking into account the ecological role of the stock, **most** of the time. |
| | Met? | **Yes** | **Yes** | **No** |
| Rationale | | | | |

The HCR is provided below (from PINRO 2017).

1. Exploitation level (proportion harvested $E_t$) is set at no higher than target exploitation level ($E_{tr}$ = 0.17) with legal stock above target biomass reference point ($B_{tr}$= 149,000t); [$B_{tr}$ set at $B_{MSY}$]

2. With legal stock (Bt) above limit biomass reference point ($B_{lim}$=45,000t), but below target reference point the exploitation level is estimated as $E_t = E_{tr} \times (B_t - B_{lim})/(B_{tr} - B_{lim})$;

3. With legal stock below limit reference point the exploitation level is $E_t$= 0 (only fishing for science is permitted);

4. Year-to-year TAC variation can be no more than ± 30 % of the previous year's TAC provided that legal stock is above the limit reference point.

Target and limit reference points for biomass and target reference point for fishing mortality rate are standard elements of Harvest Control Rule similar to the HRCs adopted by most countries around the world and are a standard for many Russian fisheries (Babayan, 2000). The ramp component of the HCR (element 2 above) is designed to reduce target fishing mortality rate when the stock biomass declines below the target and approaches zero when the biomass approaches PRI. SG 60 is met.

The HCR is well defined with a target exploitation rate of 0.17 when the legal stock biomass is greater than the target biomass and a proportional reduction in the exploitation rate if the biomass falls below the target. If $B_{lim}$ is reached (a conservative proxy for PRI), commercial fishing is stopped. This HCR is expected to keep the stock around the target biomass, which is set at the estimated $B_{MSY}$. Btarget for king crab is set at Bmsy level which was estimated quantitatively with the Bayesian surplus production model. The exploitation rate corresponding to the MSY was estimated at 0.2, but based on precautionary arguments the target exploitation rate was set at 0.17(Bakanev, 2016b). Maintaining exploitation rate at or below the Umsy is expected to keep the stock fluctuating around the target biomass consistent with MSY based on the surplus production model concept. SG80 is met.

There is no explicit consideration of the ecological role of Barents Sea red king crab in the HCR, SG100 is not met.

| | |
|---|---|
| | HCRs robustness to uncertainty |

| | | | | |
|---|---|---|---|---|
| **b** | Guide post | | The HCRs are likely to be robust to the main uncertainties. | The HCRs take account of a **wide** range of uncertainties including the ecological role of the stock, and there is **evidence** that the HCRs are robust to the main uncertainties. |
| | Met? | | **Yes** | **No** |

Rationale

The HCR was tested for its sensitivity to a variety of uncertainties including different recruitment scenarios and stock assessment error (Bakanev 2016b; see section 7.1.4.4. Harvest control rule). Simulation results indicate that the HCR for the Barents Sea red king crab established in 2015 is precautionary and robust to the main uncertainties. The simulations indicate that under a variety of recruitment scenarios, the chance of going below $Bl_{im}$ is nil. SG80 is met.

The ecological role of the stock has not been evaluated in relation to the HCR, and given the short period since the HCR has been in place, there has been insufficient time to assess robustness at the time scale of a red king crab generation (~ 10 y). SG100 is not met.

| | | | | |
|---|---|---|---|---|
| | HCRs evaluation | | | |
| **c** | Guide post | There is **some evidence** that tools used **or available** to implement HCRs are appropriate and effective in controlling exploitation. | **Available evidence indicates** that the tools in use are appropriate and effective in achieving the exploitation levels required under the HCRs. | **Evidence clearly shows** that the tools in use are effective in achieving the exploitation levels required under the HCRs. |
| | Met? | **Yes** | **Yes** | **No** |

Rationale

In 2015 the FFA issued an Executive Order that specified that biological Reference Points and Harvest Control Rules need to be developed for priority species such as king crab . The approach to selecting the tools for the HCR design and implementation is described in Bakanev 2016a. The management tools usually include management measures such as TAC and fishing limits and arrangements tor sharing TAC. The history of the red king crab stock exploitation provides evidence that tools used to implement HCR are effective in achieving the goal. Annual stock assessments, TAC setting according to the stock status and HCR, effective control of the catch, real time monitoring of the removals, strict enforcement, area and seasonal closures and other measures lead to significant stock growth and stabilization at the level above the Bmsy (PINRO 2020). Furthermore, accumulated experience in other crab fisheries indicate that the HCR based on limit and target reference points and a target exploitation rate is appropriate and effective in controlling exploitation (Kvamsdal et al., 2020). SG60 is met.

Evidence indicates that the tools in use (TAC, tight harvest monitoring, control and enforcement of compliance) are effective in achieving the required exploitation levels. Stock declined to a recent low in 2009 and the TAC began to be reduced substantially in 2010. From 2010 to 2015 the TAC remained less than 60% of what it was from 2006-2008. Reductions in TAC had the desired effect on exploitation rate. In 2010 the exploitation rate dropped to the lowest level since 2007 (~ 0.08) and thereafter stayed below 0.10 (Figure 13) and well below the HCR target of 0.17. SG 80 is met.

There is good evidence that the tools are effective, the stock has been consistently above the Bmsy level since 2014 and the exploitation rate is below the target. However, the time period since the introduction of the formal HCR is too short (five years) to ascertain its effectiveness in comparison to the generation time for red king crab (~ 10 y). SG100 is not met.

| References |
|---|
| PINRO 2020<br>Bakanev 2016a<br>(Bakanev, 2016b<br>Babayan, 2000).<br>Kvamsdal et al., 2020 |

| | |
|---|---|
| **Draft scoring range** | **≥80** |
| Information gap indicator | **Information sufficient to score PI** |

**Overall Performance Indicator scores added from Client and Peer Review Draft Report stage**

| | |
|---|---|
| Overall Performance Indicator score | |
| Condition number (if relevant) | |

## PI 1.2.3 – Information and monitoring

| PI 1.2.3 | | Relevant information is collected to support the harvest strategy | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| **a** | Range of information | | | |
| | Guide post | **Some** relevant information related to stock structure, stock productivity and fleet composition is available to support the harvest strategy. | **Sufficient** relevant information related to stock structure, stock productivity, fleet composition and other data are available to support the harvest strategy. | A **comprehensive range** of information (on stock structure, stock productivity, fleet composition, stock abundance, UoA removals and other information such as environmental information), including some that may not be directly related to the current harvest strategy, is available. |
| | Met? | **Yes** | **Yes** | **No** |
| Rationale | | | | |

Information on red king crab biology and productivity is available from studies in its native range (Stevens and Lovrich, 2014) There is a documented history of the crabs' introduction, spread in the Barents Sea (Sundet 2014; Windsland, K. 2015; Windsland et al., 2014). SG60 is met.

Barents Sea red king crab originated from an intentional introduction in Russia in the 1960s. Its spread and current distribution are well documented from national surveys in Russia and Norway and a Norway-Russian joint ecosystem survey of the Barents Sea. Barents Sea red king crab is currently the target of a fishery in northern Norway and has been recorded in southern Norway (Bergen) (Sundet 2014). The growth, reproduction and mortality are well studied in its native range in the north Pacific and there is a growing literature on productivity in the Barents Sea adjacent to Russia and Norway (see 7.1.3). Fleet composition (less than twenty vessels, two companies) and its activity directed at red king crab is well known. There is very good information on directed fishery catches and catch rates. Reliable estimates of bycatch and discards of red king crab by other fishing fleets have been made available recently (PINRO 2020b, 2020c). Detailed biological information on size, stage and sex composition, shell condition, relative abundance is collected on annual basis both in the fishery and through fishery independent trawl and trap surveys (PINRO 2020a). The red king crab resource is considered to be one genetic stock given the single source used for the introduction, the fact that its point of introduction is limited in space and relatively recent. In its current range in Russian and Norwegian waters, young crab settling to the seabed in any one location may originate from some distance away. A modeling study by Pedersen et al. (2006) reported that the general direction of advection of larvae is to the east, and this is a persistent feature, but that there was also a dispersion of larvae in westbound direction along the coast. To date there are no studies which attempt to quantify the recruitment sources and sinks in the Barents Sea red king crab stock (as for many benthic invertebrates). With regard to movement of benthic stages between Norway and Russia, it does occur but the available evidence from a tagging study (Windsland et al. 2014) indicates this movement is limited. The approach of having separately managed management units on a single stock is viable mainly because there is good separation between Russian and Norwegian fished concentrations of red king crab, and because most red king crab in the region do not move large distances annually. There is sufficient relevant information on stock structure, stock productivity, fleet composition and other relevant aspects to support the harvest strategy. The information available is generally of good quality and veracity is not an issue. SG80 is met.

Although substantial information on red king crab in Barents Sea has been accumulated to this point, it cannot be said that there is a comprehensive range of information on the above topics. Estimates of discards by bottom trawl fisheries targeting demersal finfish species (cod, haddock, plaice and others) were recently developed, but the percent survival of released crabs is unknown. Quantitative data on the levels of exchange of crab larvae and adults between Russian and Norwegian waters are not available and the effects of climate change on the future dynamics of Barents Sea red king crab population are not known. There is information on red king crab ecological relationships but the extent to which these are stable or are still evolving is not well known. Although there are a growing number of studies on stock productivity, the process of acclimation of this relatively new species is not complete (Bakanev and Anisimova 2013). The stock has grown to its current size over about 50 years and it has only been fished since 1994 (about 2.5 generations). It is not known how this relatively recently introduced species will react to the effects of climate change and how stock productivity, distribution and ecological relationships will change. The stock size and spatial distribution do not seem to have reached a dynamic equilibrium yet. Continued study is needed. SG100 is not met.

| | | | | |
|---|---|---|---|---|
| **b** | Monitoring | | | |
| | Guide post | Stock abundance and UoA removals are monitored and **at least one indicator** is available and monitored with sufficient frequency to support the harvest control rule. | Stock abundance and UoA removals are **regularly monitored at a level of accuracy and coverage consistent with the harvest control rule**, and **one or more indicators** are available and monitored with sufficient frequency to support the harvest control rule. | **All information** required by the harvest control rule is monitored with high frequency and a high degree of certainty, and there is a good understanding of inherent **uncertainties** in the information [data] and the robustness of assessment and management to this uncertainty. |
| | Met? | **Yes** | **Yes** | **No** |
| Rationale | | | | |

Unit of assessment removals and catch rates are monitored in real time using daily and cumulative catch information that is a subject to mandatory submission by fishing vessels via the national Fisheries Monitoring System. SG60 is met.

Both commercial catch and commercial catch rate are monitored through this system which obtains daily catch data. These data are used in depletion models which feed into the stock assessment and are used to support the harvest control rule. A trap survey provides a qualitative indicator of red king crab distribution and abundance. A king crab bottom trawl survey conducted in 1994-2011 and 2017-2019 covers principal areas of red king crab distribution and provides information on relative abundance by size and sex as well as are swept estimates of absolute abundance and biomass (PINRO 2020a). SG80 is met.

The HCR in place requires estimates of exploitable stock biomass and exploitation rate. Both metrics were derived in the past from the Catch Survey model output, but after 2013 were replaced with the estimated from the Delury depletion model due to the interruption in the survey. The survey came back online in 2017 and in a couple more years enough data will be accumulated to allow for a return to the CSA model. In addition, estimates of biomass and exploitation rate are available from the Bayesian surplus production model and swept area method. Regardless of the method, information required as inputs for all of these methods (catch and indices of abundance was collected annually and at the sufficient level with the exception of the discards by other fleets. Study results showed that king crab estimated removal as by-catch in the south of the Barents Sea may reach values comparable with its annual yield by the target fishery. Given that the studies in North Pacific suggested that 20% to 100% of king crab individuals caught in a trawl fishery may die (Stevens, 1990), by-catch in trawl fishing in Russia’s EEZ in the Barents Sea may reach up to 5.9% of fishable stock and up to 6.2% of total stock (Stesko and Bakanev, 2019). Although estimates of discards are available now (PINRO 2020b, 2020c), it does not seem that they are accounted for in the stock assessment yet There has been modeling of the uncertainty associated with the harvest control rule. Various assumptions about the type of recruitment and size of stock assessment error indicate they do not substantially affect long-term medians of harvest and legal stock. This modeling provides an understanding of inherent uncertainties, but given the very recent implementation of the harvest control rule (2015) some years of experience in application of the assessment and management are needed to assess robustness. Recent update of the Blim and Btarget following the update of crab survey time series indicates that the stock is evolving and so is the Harvest Control Rule. SG100 is not met.

| | | | | |
|---|---|---|---|---|
| **c** | Comprehensiveness of information | | | |
| | Guide post | | There is good information on all other fishery removals from the stock. | |
| | Met? | | **No** | |
| Rationale | | | | |

The current geographic range of king crab in the Barents Sea encompasses large areas in the southern part of the sea. This is an area where Russian cod and haddock bottom trawl fisheries and northern shrimp fishery have been traditionally operating for many decades, and king crab is one of by-catch species for these fisheries. Bottom trawls rather effectively catch king crab, and fishermen have to spend their time on sorting out catch and releasing crabs back to the sea. King crab by-catches are less typical for the cod and haddock bottom long-line fishery and Iceland scallop dredge fishery. By-catch of king crab is also observed in the seasonal inshore lumpsucker and cod net fishery. The greatest impact on the king crab population is produced by cod and haddock bottom trawl fisheries. The area in which crab by-catches in trawl fisheries were estimated included the location of current crab distribution in Russia's Exclusive Economic Zone (EEZ) occupying an area of 375,000 km2. Possible king crab removal as by-catch were recently estimated by two methods. The first method was based on expansion of king crab bycatch observed and or reported by demersal fish trawl fishery to the king crab distribution area for 2010–2017 (Stesko and Bakanev, 2019). The second method was based on specialized trawl survey of king crab carried out 2017–2018 on board PINRO-owned research vessel. Time series of estimates of the groundfish fishery bycatch were generated for 2010-2017 and values ranged from 0.3 to 2.2 thousand tons. A special king crab dedicated survey in 2017 -2018 provided a higher range of potential bycatch of 2.1-8.0 thousand tons. PINRO estimated that bottom trawl fishery may account for 1.6-5.9% of the exploitable stock of king crab males (Stesko and Bakanev, 2019). They also estimated that bycatch removals by trawls in the closed zone prior to its closure could have amounted up to 13.6 thousand tons. Since 2003, there has been substantial effort to reduce bycatch and associated mortality (PINRO 2015). This has included the closure of extensive areas to bottom trawling, including territorial and internal waters of the Russian Federation along the Kola Peninsula from the border with Norway in the west to 37°00' E in the east. Other measures include move-on rules when trawl fisheries are catching red king crab of any sex and size exceeding 10 individuals per ton of harvested (caught) resources and a required distance of not less than 5 nautical miles from the position where high by-catches of red king crab were reported. Additional measures are considered such as relocation of closure areas to the regions of the highest concentrations of crabs as the stock primary location is shifting to the east and south (Stesko and Bakanev, 2019).

Although bycatch is currently quantified, bycatch mortality is not. Some estimates by PINRO suggest that discard mortality of females and undersized males in directed fishery is low, about 5%, while mortality in bottom trawl discards is unknown (Source- PINRO communication to CAB on November 27 2020). Bycatches in other fisheries such as longlines and dredges have not been quantified yet, but are considered to be insignificant. There is no information on removals by the foreign fleet in Russian EEZ, it is known that there was some directed activity in the past. SG80 is not met.

| References |
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Bakanev, S. and N. Anisimova 2013. Crab invasions in the Barents Sea: consequences and opportunities. (Abstract) IN: J. Robbens, S. Derveaux, K. Hostens, N. Fockedey, F. Kerckhof, S. Degraer,M. De Troch and M.a Vincx (Eds). 2013. Non-indigenous species in the North-East Atlantic.Ostend, 20-22 November 2013. Institute for Agricultural and Fisheries Research (ILVO). Flanders Marine Institute (VLIZ): Oostende, Belgium. VLIZ Special Publication 66. 50 + x p.

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PINRO, 2020b. Report on research “quantitative assessment of by-catch in crab fisheries in the Barents Sea” Contract No. 65/2020 of 2020 with the Crab Catchers Association of the Far East Murmansk.

PINRO, 2020c. A summary on red kng crab bycatch in the Barents Sea. Report submitted to LR Fisheries on October 2020.

Pedersen, O. P., E. M. Nilssen, L. L. Jorgensen and D. Slagstad. 2006. Advection of the Red King Crab larvae on the coast of north Norway—A Lagrangian model study." Fisheries Research 79: 325-336.

Windsland, K., Hvingel, C., Nilssen, E. M., and Sundet, J. H. 2014. Dispersal of the introduced red king crab (*Paralithodes camtschaticus*) in Norwegian waters: a tag-recapture study. ICES J Mar Sci 71:1966-1976.

Sundet, J. H. 2014. 5. The red king crab (Paralithodes camschaticus) in the Barents Sea ". p. 71-82 IN: Fernandez, L., B. A. Kaiser and N. Vestergaard (ed). Invasive species in the Arctic. ISBN 978-92-893-2820-3 http://dx.doi.org/10.6027/TN2014-547, ISSN 0908-6692. © Nordic Council of Ministers 2014

A.V.Stesko, S.V.Bakanev. 2019Assessment of the red king crab bycatches in the bottom fish fishery within the russian waters of the barents sea and the efficiency of their regulation

| **Draft scoring range** | **60-79** |
|---|---|
| Information gap indicator | **More information sought** - More information must be sought on dead discard estimates in directed fishery as well as in finfish bottom trawls, longline and dredge fisheries as well as foreign fleet direct catch. |

**Overall Performance Indicator scores added from Client and Peer Review Draft Report stage**

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|---|---|
| Overall Performance Indicator score | |
| Condition number (if relevant) | |

# PI 1.2.4 – Assessment of stock status

| PI 1.2.4 | | There is an adequate assessment of the stock status | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| **a** | Appropriateness of assessment to stock under consideration | | | |
| | Guide post | | The assessment is appropriate for the stock and for the harvest control rule. | The assessment takes into account the major features relevant to the biology of the species and the nature of the UoA. |
| | Met? | | **Yes** | **No** |
| Rationale | | | | |

The assessment provides estimates of the biomass of legal males and of the exploitation rate as is required by the harvest control rule. The methods used (depletion analysis, CSA model, Bayesian surplus production model) have been used in other crustacean fisheries. They are appropriate for the stock and HCR. SG80 is met.

Some important features of red king crab biology are accounted for. The assessment utilizes a growth transition matrix for estimating the fraction of crabs moving from the pre-recruit group to the recruit and post recruit groups. Some uncertainty in annual recruitment is accounted for through simulation. However due to the break in fishery independent survey coverage, recent estimates are based on the depletion method or surplus production model that relies only on commercial fishery data and does not account for biomass in the closed areas. Currently trap data in the closed area is not used directly by the assessment model. Surplus production model on the other hand provides overall annual estimate of stock biomass, but by its virtue does not consider stock age size or stage structure and is not capable to fit appropriately variability in recruitment. SG100 is not met.

| | | | | |
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| **b** | Assessment approach | | | |
| | Guide post | The assessment estimates stock status relative to generic reference points appropriate to the species category. | The assessment estimates stock status relative to reference points that are appropriate to the stock and can be estimated. | |
| | Met? | **Yes** | **Yes** | |
| Rationale | | | | |

The assessment estimates stock status relative to reference points appropriate to the species category and SG60 is met.

Reference points ($B_{lim}$ and $B_{tr}$, set at $B_{MSY}$) are in place and stock biomass can be estimated in relation to these reference points. They are appropriate to the stock. The reference points were developed based on a Bayesian surplus production model fitted to a multiple time series of abundance and expert knowledge. The production model was used to estimateB0 and $B_{MSY}$. A $B_{lim}$ set at 30% of $B_{MSY}$ is appropriate given the measures in place to protect spawning stock. The 12 nautical mile coastal zone is closed to fishing, ensuring conservation of a large proportion of legal stock even under a heavy fishing pressure. In addition, a prohibition on harvesting females and of males less than 150mm CW ensures conservation of a proportion of the spawning stock. SG80 is met.

| | | | | |
|---|---|---|---|---|
| **c** | Uncertainty in the assessment | | | |
| | Guide post | The assessment **identifies major sources** of uncertainty. | The assessment **takes uncertainty into account**. | The assessment takes into account uncertainty and is evaluating stock status relative to reference points in a **probabilistic** way. |
| | Met? | **Yes** | **Yes** | **Yes** |
| Rationale | | | | |

The assessment identifies major sources of uncertainty e.g. changing level and quality of information over time; the variation associated with the annual trap survey and its current use for qualitative indicators only, and the uncertainty in predicting annual recruitment. SG60 is met.

Uncertainty is accounted for in the assessment by considering various recruitment scenarios in projecting future biomass. Uncertainty was accounted for in the development of reference points by considering different approaches to their estimation (Bayesian surplus production model in combination with expert based). Uncertainty is accounted for in depletion model estimates by providing confidence intervals. SG80 is met.

The assessment evaluates stock status relative to reference points in a probabilistic way by providing a median estimate with 50% and 95% confidence limits for exploitable stock biomass estimates. The assessment also conducted simulations by projecting the stock dynamics into the future under various removals scenarios and estimating the probability of biomass falling below Blim and Btarget. The 2020 assessment indicated that under approved TAC the risk of legal stock falling below the limit reference point $B_{lim}$ is close to zero. SG100 is met.

| | | | | |
|---|---|---|---|---|
| **d** | Evaluation of assessment | | | |
| | Guide post | | | The assessment has been tested and shown to be robust. Alternative hypotheses and assessment approaches have been rigorously explored. |
| | Met? | | | **Yes** |
| Rationale | | | | |

Four different methods have been tried through time to asses red king crab stock – length-based cohort method, Catch Survey Analysis, Leslie depletion, Bayesian surplus production. Simulations have been run to test the harvest control rule and they indicate it is robust to stock assessment error and various types of recruitment variation. CSA appeared to be the most appropriate methodology, However, given recent changes to the data for the assessment (loss of data from the trawl survey), some years of experience in application of the CSA model was not possible for the full time series. Leslie depletion method is simplistic and applicable only to the areas of fishing, while the surplus production method is not responsive to recruitment variability. Recent update of the surplus production model resulted in significant increase in historic estimates of population biomass and corresponding biomass reference points. This suggests that the stock is continuing to grow and expand, and the assessment robustness is not highly certain. SG100 is not met.

| | |
|---|---|
| | Peer review of assessment |

| | | | | |
|---|---|---|---|---|
| e | Guide post | | The assessment of stock status is subject to peer review. | The assessment has been **internally and externally** peer reviewed. |
| | Met? | | **Yes** | **Yes** |

| Rationale |
|---|

PINRO scientists conduct the stock assessment and estimate a TAC for the red king crab. Results are presented and reviewed at PINRO's Scientific Council. The assessment is modified in light of comments at the above review and if appropriate, it is forwarded to the head of the fisheries research institute, VNIRO (Moscow). Given the PINRO peer review, SG80 is met.

VNIRO scientists review the material they receive on the TAC for the Barents Sea red king crab, and make their comments and proposals at an extended meeting of Scientific Council with participation of scientists from VNIRO and other FFA fisheries institutes. PINRO then revises the draft advice in response to the VNIRO comments. The final TAC recommendations are further reviewed by the independent Ecological Council of the Ministry of Nature comprised of independent scientists representing Academy of Science and universities. The VNIRO and the Ministry of Nature Councils' peer review is external and SG100 is met.

| References |
|---|

Bakanev S.V. 2016. Methods of estimating the biological reference points for red king crab in the Barents Sea Trudy VNIRO, Volume 161, pp 16-26".

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PINRO, 2015. Report on research works. Results of assessment of the impact of the Barents Sea Red King Crab fishery on its stock, stocks of other species and from the analysis of the Barents Sea Red King Crab management. Knipovich Polar Research Institute of Marine Fisheries and Oceanography (FSBSI "PINRO"). Approved by Director of FSBSI "PINRO", K.V. Drevetnyak.

PINRO 2017. Status of the red king crab stock in the Exclusive Economic Zone (EEZ) of the Russian Federation in the Barents Sea in 2016 and TAC estimation for 2018. Translation based on following technical document in Russian: "Materials for justification of the 2018 TAC for red king crab in the EEZ of the Russian Federation, PINRO, Murmansk, 2016". Received from the client May 2017.

| **Draft scoring range** | **≥80** |
|---|---|
| Information gap indicator | **Information sufficient to score PI** |

**Overall Performance Indicator scores added from Client and Peer Review Draft Report stage**

| | |
|---|---|
| Overall Performance Indicator score | |
| Condition number (if relevant) | |

**UoA2. Snow crab.**

## 7.2 Snow crab – background

### 7.2.1 Taxonomy and distribution

The snow crab, *Chionoecetes opilio* (Fabricius, 1788) is a sub-arctic crab species of the family Oregoniidae (Ng *et al*., 2008). It is distributed in the Northwest Atlantic from the Gulf of Maine to the coast of Labrador including the Gulf of St Lawrence and the St. Lawrence estuary (Squires, 1990), along the west coast of Greenland, and is also found in the North Pacific and Beaufort Sea. In all these areas important commercial fisheries for snow crab have developed. Snow crabs have also been introduced into the Barents Sea (Kuzmin *et al*., 1998) possibly in ballast water. Genetics studies show that the snow crabs in the Barents Sea did not originate from Canada or Greenland and it is most likely that they were introduced from the Bering Strait. Since introduction in the Barents Sea, the snow crab has spread westwards and consequently new fisheries have been developed recently in Russia and Norway (Sundet, 2014; Sundet and Bakanev, 2014). The long planktonic larvae stage and high fecundity observed for *C. opilio* would suggest high connectivity between exploitable populations, and although significant genetic differences between snow crabs from Atlantic Canada and Greenland have been observed, there is an absence of genetic structure within Atlantic Canada from southern Labrador to Nova Scotia (Puebla *et al*., 2008). Similar, low levels of genetic diversity have been observed in populations of *C. opilio* in Alaskan waters (Merkouris *et al*., 1998). In view of the genetic evidence in other geographical areas, and as the snow crab has only recently been introduced to the Barents Sea, it can be assumed that there is a single stock in the Barents Sea.

### 7.2.2 Biology (life history, growth, reproduction)

Large male snow crabs are found generally on mud or mud/sand, although smaller individuals may be found on harder ground, and in the Northwest Atlantic snow crabs have been observed to undertake an ontogenetic migration from shallow cold areas with hard substrates to warmer deeper areas with soft substrates (DFO, 2012). Snow crabs generally inhabit regions of very cold water (-1° to 5° C) (Sainte-Marie *et al.*, 1996) and temperature has a profound effect on production, early survival, and subsequent recruitment to fisheries in snow crab in the Northwest Atlantic (Foyle *et al.* 1989; Marcello *et al*. 2012). Productivity has diminished in the northwest Atlantic coincident with warming over the past decade (Mullowney *et al*. 2014). Snow crab in the Barents Sea are distributed over an extensive area from its south-eastern and eastern part (coastal waters of the Novaya Zemlya archipelago) to the Svalbard archipelago in the west. Snow crab are caught in a wide depth range from 40 m to 300 m with legal males showing preference for waters deeper than 150 m with temperatures close to 0°C and below. As the snow crab is a cold-water species, it has not spread to the relatively warmer waters of the southwestern Barents Sea where there are high concentrations of red king crab (*Paralithodes camtschaticus*).

Following hatching in the spring, the planktonic larvae phase lasts between 3 to 5 months dependent on temperature. During this phase individuals go through a number of stages before settling on the bottom and taking on a benthic lifestyle. As with other crustacean species, growth occurs through moulting and once settled on the seabed the immature snow crabs subsequently moult through to juveniles, adolescents and adults. Unlike most crustaceans, snow crabs do not continue to moult and grow throughout their lives and instead exhibit a terminal moult. The size at which females reach terminal moult is much smaller than that for males giving rise to the characteristic sexually dimorphic appearance. The terminal moult in females occurs when the female reaches sexual maturity and the abdomen widens substantially in order to carry the egg mass. Male crabs reach terminal moult when the claws grow allometrically and become instrumental in mating behaviour, although males may reach maturity before the claws enlarge. As the terminal moult occurs at a smaller size in females than males, many snow crab fisheries are essentially male-only fisheries. In the Barents Sea, the fishery is a male-only fishery with a requirement to return all females to the sea. The size at which both males and females reach terminal moult is thought to be both temperature and density dependent. Following the moult, it may be many months before the shell fully hardens during which time there is a low meat content and so the crabs are not commercially exploited. In addition, these soft-shelled crabs are extremely vulnerable to handling during the fishing process and so significant pre-recruit mortality may occur.

Mating occurs when the male crab holds the female until it moults and is available for mating. This aggressive mating behaviour provides an advantage to the larger males. Female crabs' mate for the first time after terminal moult, although these primiparous females produce fewer eggs than multiparous females which are repeat spawners. On spawning, the eggs are carried in the abdomen of the females for up to two years before release of larvae into the water column in spring. Although females are protected from capture in the Barents Sea fishery, there is potential for the male-only fishery to impact on reproductive capacity with the potential for sperm limitation in snow crabs where there are insufficient males to fertilise the available females (Sainte-Marie, 1993; Rondeau & Saint-Marie, 2001).

In a major study on the prey of snow crabs including cannibalism by larger conspecifics in the Northwest Atlantic (Squires & Dawe, 2003), stomach analysis showed that snow crab prey upon a broad range of benthic and demersal species including sabellid polychaetes, a wide range of crustacean species, infaunal clams, *Pandalus borealis* and other shrimps, and capelin and other fish. Snow crabs have also been observed to eat garbage (E. Dawe, DFO, St. John's, Newfoundland pers. comm.; J.H. Sundet, IMR, Tromso, pers. comm.). Although cannibalism was most frequently exhibited by intermediate-size males, it was more widely practised by females than males, and the high level of cannibalism observed by Squires & Dawe (2003) in comparison with previous studies suggests that it may be an important density-dependent mechanism influencing recruitment patterns. Large fish, such as cod, are potentially important predators of snow crab. Although there are thought to be few predators of hard-shelled snow crabs, they are more vulnerable to predators when they are soft-shelled following moulting, but generally the natural mortality rate of snow crabs is low. Top-down control of snow crab populations by predators is therefore considered unlikely. A more likely source of major mortality in snow crabs is infection by the dinoflagellate parasite, *Hematodinium sp*., which is the causative agent of bitter crab disease (Shields *et al*., 1995). Little is known about the transmission of the parasite, but infection rates are highest in new-shelled or recently-moulted crabs and sporulation of the parasite occurs at the same time as moulting in crab, so the most likely transmission point is during the moulting process (Eaton *et al*., 1990).

Marcello *et al*. (2012) compared snow crab recruitment dynamics across both the Pacific and Northwest Atlantic and concluded that whilst there was good evidence that cold conditions during early life history stages positively influences subsequent snow crab recruitment, there was little evidence that spawning stock or predator biomasses had a significant effect on recruitment in either the Pacific or Northwest Atlantic.

Snow crab, *Chionoecetes opilio*, is not considered to be a key low trophic level (LTL) species as it does not meet the criteria for a key LTL as defined by paragraphs SA2.2.8-SA2.2.10 of the MSC Fisheries Standard v2.01 (MSC, 2018). Specifically snow crab is not considered to play a key role in the ecosystem as there is no evidence that there is significant predator dependency on snow crabs or that a large volume of energy passing between lower and higher trophic levels passes through the snow crab stock or that the ecosystem is wasp-waisted (SA2.2.9a.iii). In addition, snow crab does not meet all the life history characteristics listed in SA2.2.9b.i.

## 7.2.3 Stock assessment, indicators, reference points and harvest control rule

### 7.2.3.1 Harvest Strategy

The overarching regulation underpinning the harvest strategy for the snow crab fishery in Russian waters is the 2004 Russian Federal Act (law No.166-FZ) entitled 'About fishing and keeping of aquatic biological resources.

The key elements of the Russian fisheries regulations are:

1. establishing total allowable catch (TAC);
2. establishing a mechanism of distributing TAC relating to the kinds of catch shares of aquatic bioresources and the order of fixing catch shares to the users of aquatic bioresources;
3. laying down fishery regulations;
4. establishing measures on keeping the functions of aquatic biological resources and ecosystem functions;
5. establishing order of regulating legal disputes.

The snow crab stock is distributed across both the Norwegian and Russian EEZs, and whilst the fishery is managed through cooperation with Norway within the general framework of the Joint Norwegian Russian Fishery Commission (JNRFC), Norway and Russia manage the fishery separately on their respective continental shelves. Although snow crabs are also distributed within the international waters known as 'The Loophole' managed by the North East Atlantic Fisheries Commission (NEAFC). Russia's sovereign rights to fish for snow crab are recognized within The Loophole because the snow crab is designated as a sedentary species found on the continental shelf and national jurisdiction extends out to 350nm on the continental shelf. The biological objective is to prevent overfishing, but there is no formal management plan agreed between Norway and Russia, although regulations such as catch period and gear restrictions are agreed within JNRFC. However, JNRFC does not set TACs for snow crab, and in consequence Norway and Russia set them unilaterally for their respective EEZs.

#### 7.2.3.2 Regulations

The document “Harvest control rules for priority species of crabs” (Editor V.A.Bizikov, FSBSI “VNIRO”) and approved by the Council of Directors of Fisheries Research Institutes (Protocol No. 8 of 30 June 2016) states that the management target for the Barents Sea snow crab stock is that a TAC should be gradually increased until the time when enough fisheries data are accumulated to fully apply the precautionary approach. The total allowable catch (TAC) for the Russian Federation’s Barents Sea snow crab (*C. opilio*) fishery was set at 7870 tonnes in 2017. Since then limit and target biomass reference points have been implemented, and along with a maximum exploitation level, new harvest control rules (HCRs) have been developed through which scientists advise on TACs based upon annual estimates of stock biomass in relation to the target and limit reference points. The reference points and HCRs are set out more fully in section below. In addition to an overall quota for the fishery, each of the companies participating in the fishery has an individual quota.

All vessels must hold a fishing permission or license, thereby ensuring controlled entry to the fishery. Each vessel fishes between 6,000 and 6,300 conical traps fished in strings of approximately 150 traps, and whilst vessels are required to mark each string of traps with the vessel’s registration number and its fishery permission, there is no formal limit on the number of traps that can be fished. There is no formal limit on the length of season.

The fishery is also regulated through a series of technical conservation measures. There is a minimum legal landing size (MLS) of 10 cm carapace width (CW). The landing of females is also prohibited, and any females and juveniles caught must be returned immediately to the sea on hauling of traps. The snow crab fishery is therefore a male-only fishery. There is also a ’move-on’ rule in place where vessels must move at least 2nm if juveniles make up more than 25% of the catch of snow crabs. In addition, there is also a move-on rule if bycatch rates exceed prescribed levels.

Fishing must be using only traps according to Fisheries Regulations for the Northern Fisheries Basin covering the size of traps and the mesh size (50mm) of traps such that handling of juveniles and females returned to the sea is minimized. In addition, there is a requirement that the distance between the lowest part of the slipway for unwanted crab and the waterline must not be more than 1.5 meters, which provides further protection from damage of unwanted crab returned to the sea. Traps are baited with herring, squid and cod heads, and must be fitted with a biodegradable panel to avoid ‘ghost fishing’.

There are some areas permanently closed to fishing in the northern basin of which all fishers are fully aware. Other areas may be closed on a temporary basis for the purpose of conservation of the aquatic bioresources in the Barents Sea and both vessels and fishing companies will be informed of such temporary closures.

There are no official seasonal closures of the fishery, but the main fishing season is from March until July which is influenced primarily by the high meat content of the catch at that time of year and the high catch rates (Client, pers. comm.). It is thought that the fishing season ends in late June or early July as this coincides with the start of the molting season, but there is little data on molt cycles of snow crab in the Barents Sea.

All vessels must be fitted with a Vessel Monitoring System (VMS) and the completion of catch and effort data in logbooks is mandatory.

#### 7.2.3.3 Monitoring

The stock status of snow crab and the habitat in which snow crab is observed have been monitored annually through joint Norwegian-Russian ecosystem surveys from 2005 to 2020. The surveys are undertaken in summer/autumn by 4 or 5 research vessels using a Campelen bottom trawl with a horizontal opening of 25 metres and a vertical opening of 5 metres and an insertion in the codend made of a 22 mm mesh netting.

Fishing activity is monitored through VMS, logbooks and mandatory daily landings declarations. There is an observer program in place which records size and sex composition of the catch in addition to catch numbers.

There is a strong enforcement of all management measures in the snow crab fishery, with detailed records available of the regular boarding of vessels by the Border Guard Service of the Russian Federation's FSB in the Western Arctic District throughout the fishing season.

#### 7.2.3.4 Review of harvest strategy

At national level in Russia, the Federal Fisheries Act was adopted by the Federal Assembly (the Russian Parliament) in 2004 and has subsequently been revised several times, first and foremost through a major revision in 2007. TACs are set annually by the Federal Fisheries Agency (FFA) and all other regulations are considered on an annual basis. A significant change to the harvest strategy in 2018/19 was the development of target and limit biomass reference points and harvest control rules (HCRs) which are used to provide scientific advice on TACs based upon annual estimates of stock abundance in relation to the reference points.

#### 7.2.3.5 Data and Information

All vessels are currently equipped with an automatic vessel monitoring system (VMS) which provides records of fishing position on all fishing trips. All vessels are required to complete logbooks describing their fishing activity in terms of catch and fishing effort. At present paper logbooks are required, but electronic logbooks are currently being trialed. Each vessel hauls between 500 and 1500 traps per day with catches varying between 5 and 10 tonnes per day. Catches are recorded for each string of approximately 150 traps fished. The total catch for all traps (undersized and commercial-sized crabs) are recorded. Catches of all bycatch species including Vulnerable Marine Ecosystem (VME) species must be recorded on the logbooks.

The catch is recorded on a daily basis in the fishing log. At the end of each day the ship reports the date, soak time, fishing position, quantity of catch in each string, total daily catch, quantity of finished products produced per day and total quantity of finished products on board the vessel and these data are submitted to the supervisory bodies (Centre of Fishery Monitoring and Communications, the Barentsevo-Belomorskoe Territorial Department, State port control and the Shipowner).

There is an observer program which records size and sex composition of the catch in addition to catch numbers. This is particularly important as this is a male-only fishery and therefore all females are returned to the sea immediately on capture and therefore may not be reliably recorded on logbooks. The target for observer coverage is 20% of fishing trips.

As processing of snow crab occurs on board the vessels, the assessment team understands that there is no sampling of catches at the landing points to obtain information on size distributions of landings.

At landing sites control of compliance with size distribution of the finished products is carried out by the Inspectors of the Russian Border Guard of the Federal Security Service for the protection of Aquatic Biological Resources and state control in this area.

Landings declarations are required for the snow crab fishery. Landing of finished products on transport vessels is controlled by an inspector of the Russian Border Guard of the Federal Security Service (BBTA), following which the Bill of Landing is issued. The inspector checks the compliance of the discharging data with the logbook entries of fishing and the Bill of Landing is signed by the shipper, carrier and the inspector of the Russian Border Guard of the Federal Security Service.

BBTA undertakes cross-checks of logbook records, trans-shipment volumes and landings declarations. The threshold level of discrepancies between these figures is 5%. One infringement was recorded in 2017, but in general there is good compliance with the regulations requiring monitoring of catches and landings.

As noted above, fishery-independent surveys of the snow crab stock are undertaken annually through the joint Norwegian-Russian ecosystem surveys.

#### 7.2.3.6 Stock Assessment and Status

The abundance and geographical distribution of the snow crab stock in the Barents Sea has continued to increase in recent years, and consequently a number of approaches have been taken to make preliminary estimates of snow crab stock distribution, abundance and legal-size stock. These approaches include estimates of abundance based upon the fishery-independent joint Norway-Russia ecosystem survey including estimates of snow crab catchability in the trawls, Leslie depletion modeling to estimate catchability, Species Distribution Modelling (SDM) approaches to evaluate likely expansion of the distribution of the snow crab population, and the fitting of a Bayesian surplus production model to biomass estimates from the ecosystem survey and catch data to estimate stock size and define target and limit reference points.

#### 7.2.3.7 Ecosystem Surveys

Snow crab distribution and abundance can be estimated from the annual joint Norway-Russia ecosystem surveys. The snow crab is common in the eastern and northeastern Barents Sea primarily in the Russian EEZ but also in the international waters managed by NEAFC.

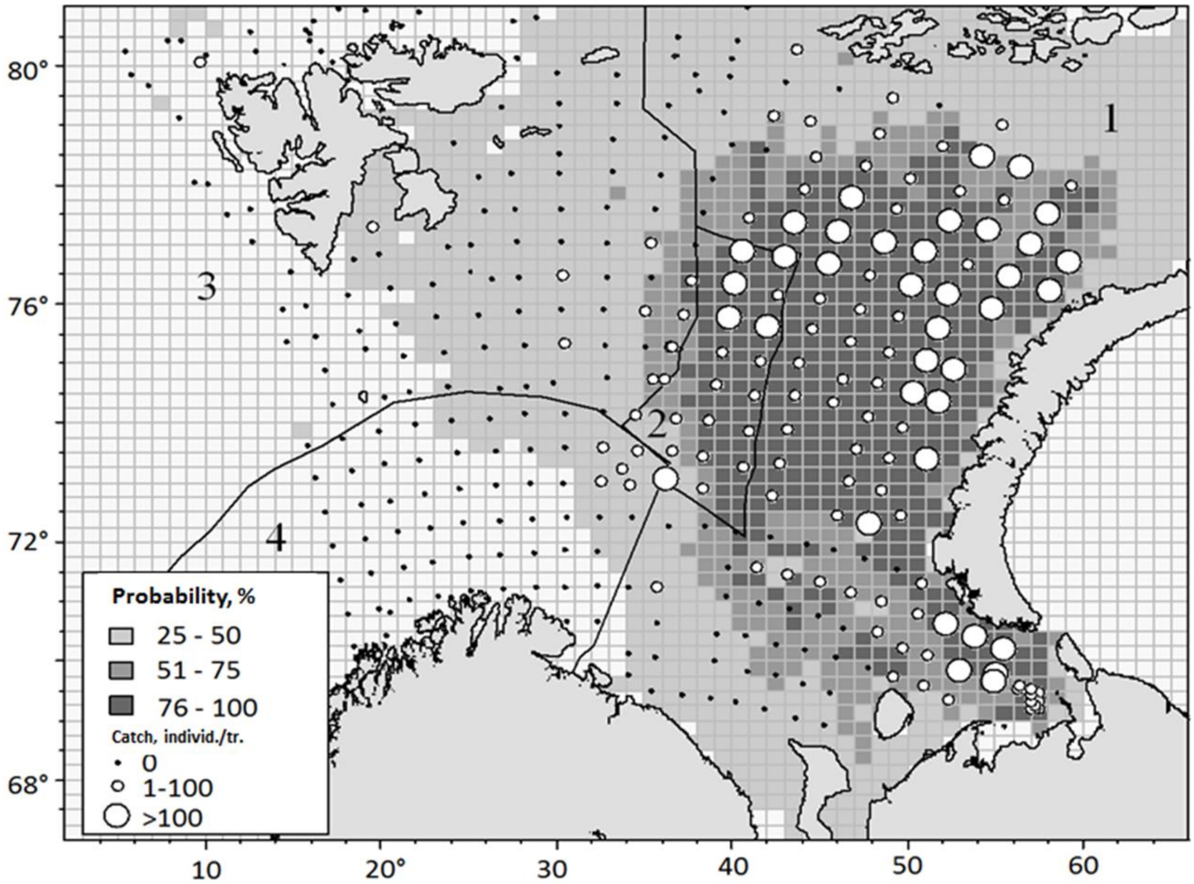


**Figure 17: The annual ecosystem surveys cover a wide geographical area, and therefore sampling stations are at a relatively low intensity over the current known distribution of snow crab. A summary of the number of stations sampled, snow crabs caught, and biological samples taken each year can be found in Table 18. (Source: PINRO)**

The ecosystem survey has the advantage that it uses a small-meshed trawl so that small snow crabs are caught in the sampling gear, but the surveys suffer from problems with variable catchability of snow crabs as the surveys are multi-purpose and not designed specifically to quantitatively estimate snow crab abundance.

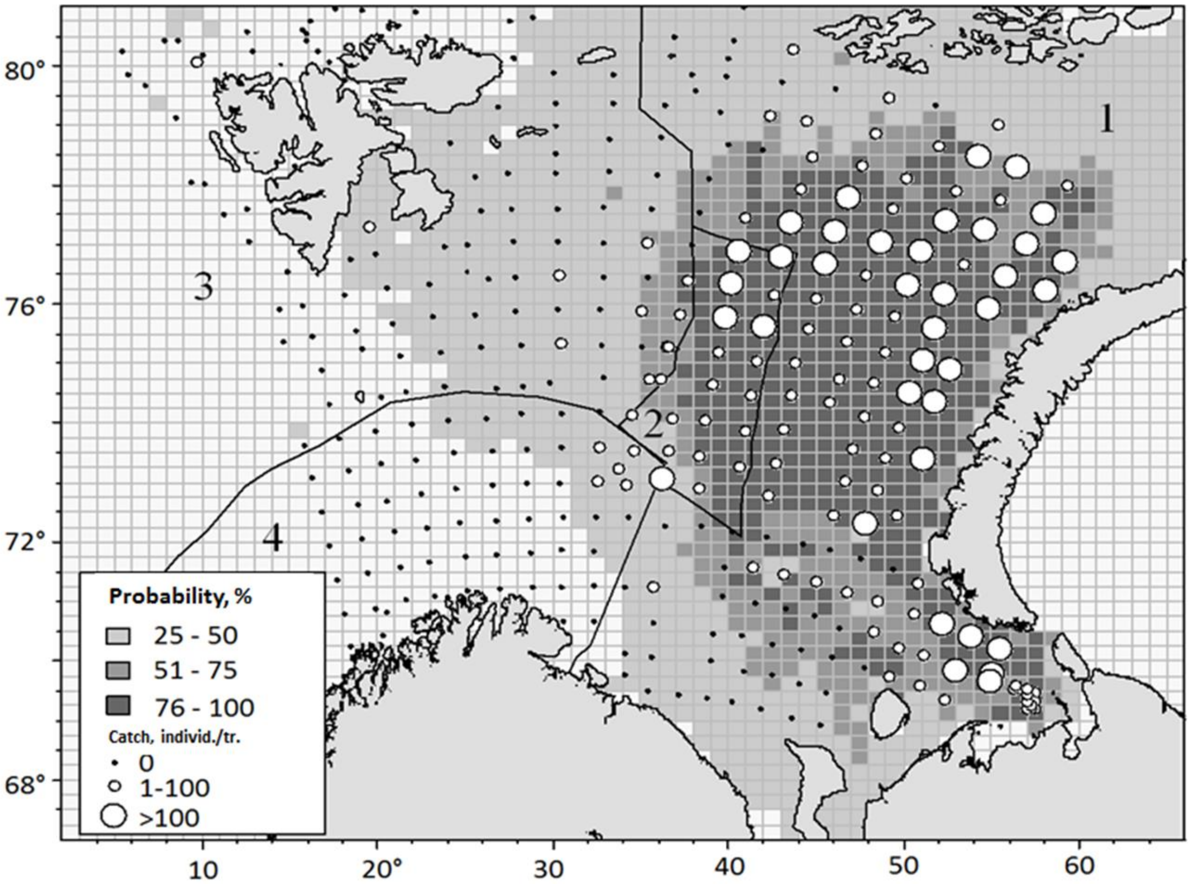


**Figure 18:** **Mean catches and likelihood of occurrence of snow crabs from bottom-trawl catches in ecosystem surveys 2010-18 in the Barents Sea: 1- Russian EEZ. 2- International waters manages by NEAFC. 3- Svalbard Fishery Protection Zone (FPZ). 4- Norwegian Economic Zone (Source: PINRO)**

**Table 18:** **Joint-Norwegian-Russian Ecosystem survey in the Barents Sea. Summary of number of stations sampled (hauls), hauls in which snow crab were captured, number of snow crabs caught, and number of biological samples taken from 2005-19 (Protzorkevich and Van der Meeren, 2020)**

| Year | Total number of station | Number of station with snow crab | Total catch, ind. | Total catch, kg |
|---|---|---|---|---|
| 2005 | 649 | 10 | 14 | 2.5 |
| 2006 | 550 | 28 | 68 | 11 |
| 2007 | 608 | 55 | 133 | 18 |
| 2008 | 452 | 76 | 668 | 69 |
| 2009 | 387 | 61 | 276 | 36 |
| 2010 | 331 | 56 | 437 | 22 |
| 2011 | 401 | 78 | 6219 | 154 |
| 2012 | 455 | 116 | 37072 | 1169 |
| 2013 | 493 | 131 | 20357 | 1205 |
| 2014 | 304 | 78 | 12871 | 658 |
| 2015 | 335 | 89 | 4245 | 378 |
| 2016 | 317 | 84 | 2156 | 137 |
| 2017 | 376 | 159 | 25878 | 1422 |
| 2018 | 217 | 61 | 19494 | 846 |
| 2019 | 323 | 87 | 15523 | 608 |

Survey results for 2017 show that there were high densities of snow crabs in 2017 in both the Russian EEZ and within the Loophole area managed by NEAFC (Figure 19). There was a similar distribution of snow crabs in 2018 in the northern and western areas of the stock, but the restricted survey in 2018 did not cover areas off the southwest coast of Novaya Zemlya where high densities of snow crabs were observed in 2017. By 2019 the population highest concentrations were observed at the eastern edge of the Barents Sea along the Novaya Zemlya (Figure 19). Variations in size composition of snow crab catches during the surveys indicate that strong year-classes appear frequently (but not in every year), and those year-classes can have an impact on the dynamics of the snow crab population (Figure 20 and Figure 21).

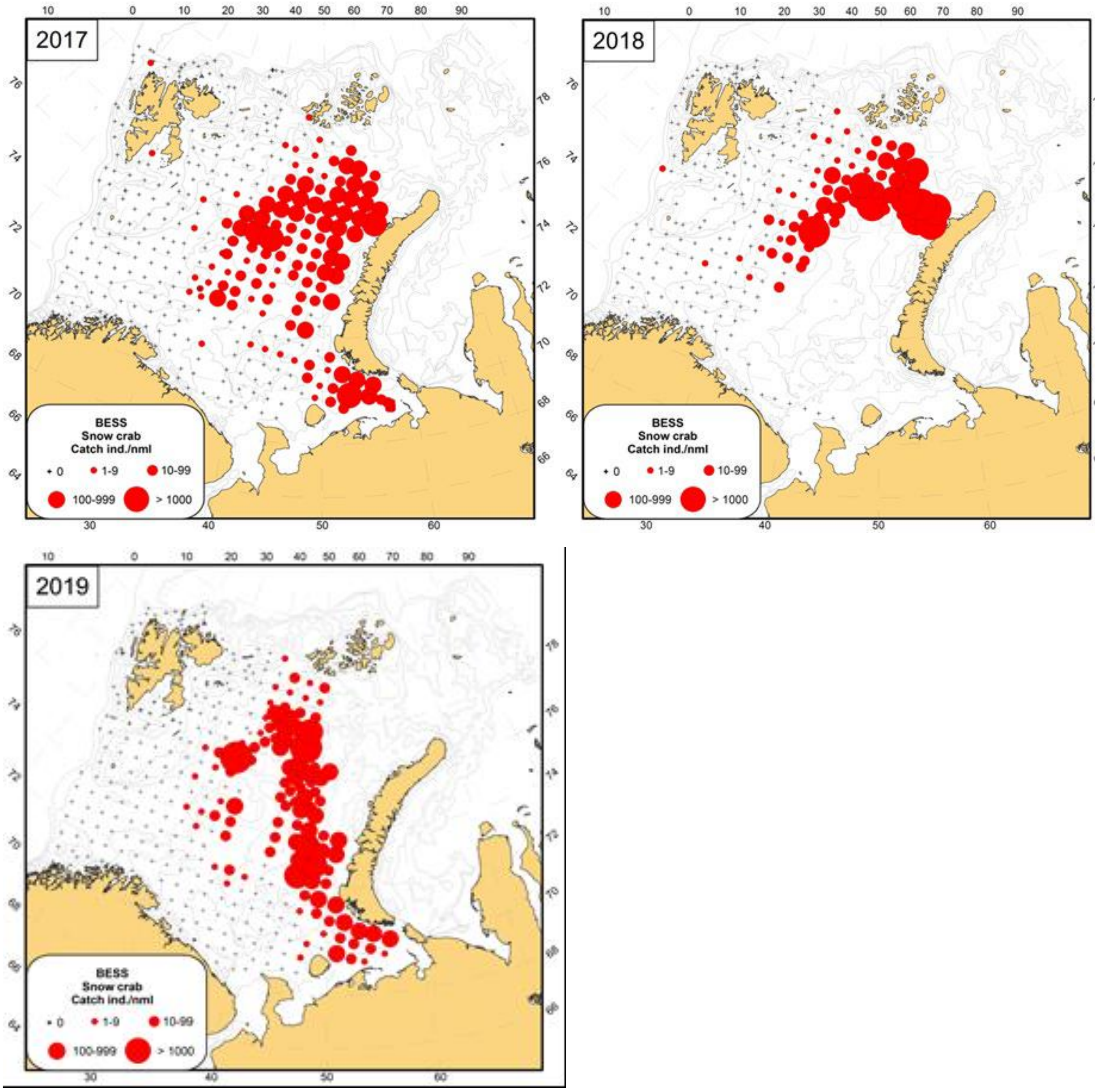


**Figure 19:** **Catch distribution of snow crab in the Barents Sea during ecosystem surveys in 2017 - 2019. (Source: Protzorkevich and van der Meeren, 2020).**

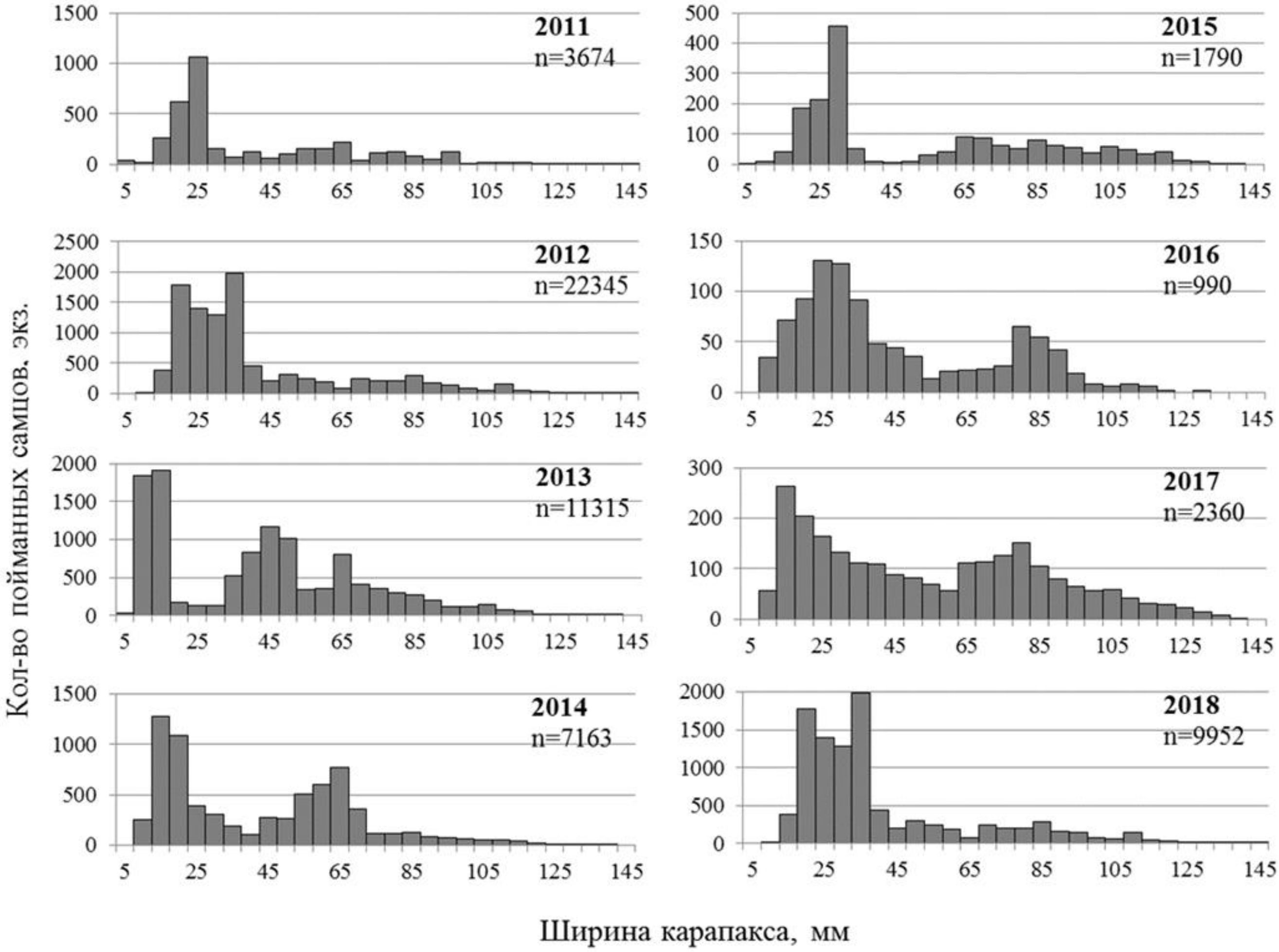


**Figure 20: Size composition of snow crab catches taken with bottom trawls in the Barents Sea according to results from ecosystem surveys in 2011- 2018. X-axis is 'carapace width (mm)', Y-axis is 'number of males caught'. (Source: PINRO)**

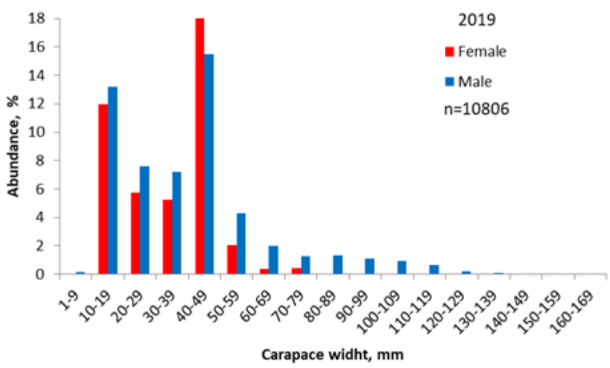

**Figure 21:** **Size composition of snow crab catches taken with bottom trawls in the Barents Sea according to results from ecosystem surveys in 2019. X-axis is 'carapace width (mm)', Y-axis is 'number of males caught'. (Source: PINRO)**

### 7.2.3.8 Geographical Distribution of Snow Crab

Tagging experiments show that adult snow crabs moved 2 to 80 km generally (S. Bakanev, PINRO, pers. comm.) but the highest distance moved was 252 km demonstrating that snow crabs have the ability to extend their distribution relatively quickly. As the geographical distribution of the snow crab has increased since its introduction in the Barents Sea, PINRO have carried out modelling studies to predict how the geographical distribution of snow crabs may change in future years. SDM within the 'biomod2' package in 'R' was used to evaluate occurrence of snow crabs in the Barents Sea and to perform an analysis of environmental factors contributing to their successful adaptation (Bakanev *et al*., 2018). In addition to temperature, the modelling studies considered depth, sediment grain size, current direction and speed, salinity, nitrate, phosphate and oxygen concentration and benthos distribution. The probability distribution of snow crab occurrence was computed under various scenarios relating to sea water temperatures to assess a potential distribution area for snow crabs in the Barents Sea. In the last few years there has been no significant expansion of the distribution, but the modelling demonstrates that there are no environmental factors limiting further expansion of the species. The results showed that snow crab distribution is likely to widen in the future if there is no change in water temperature and will continue to expand in their distribution even if water temperatures increase by 1º C in future years (Bakanev *et al*., 2018; Figure 22).

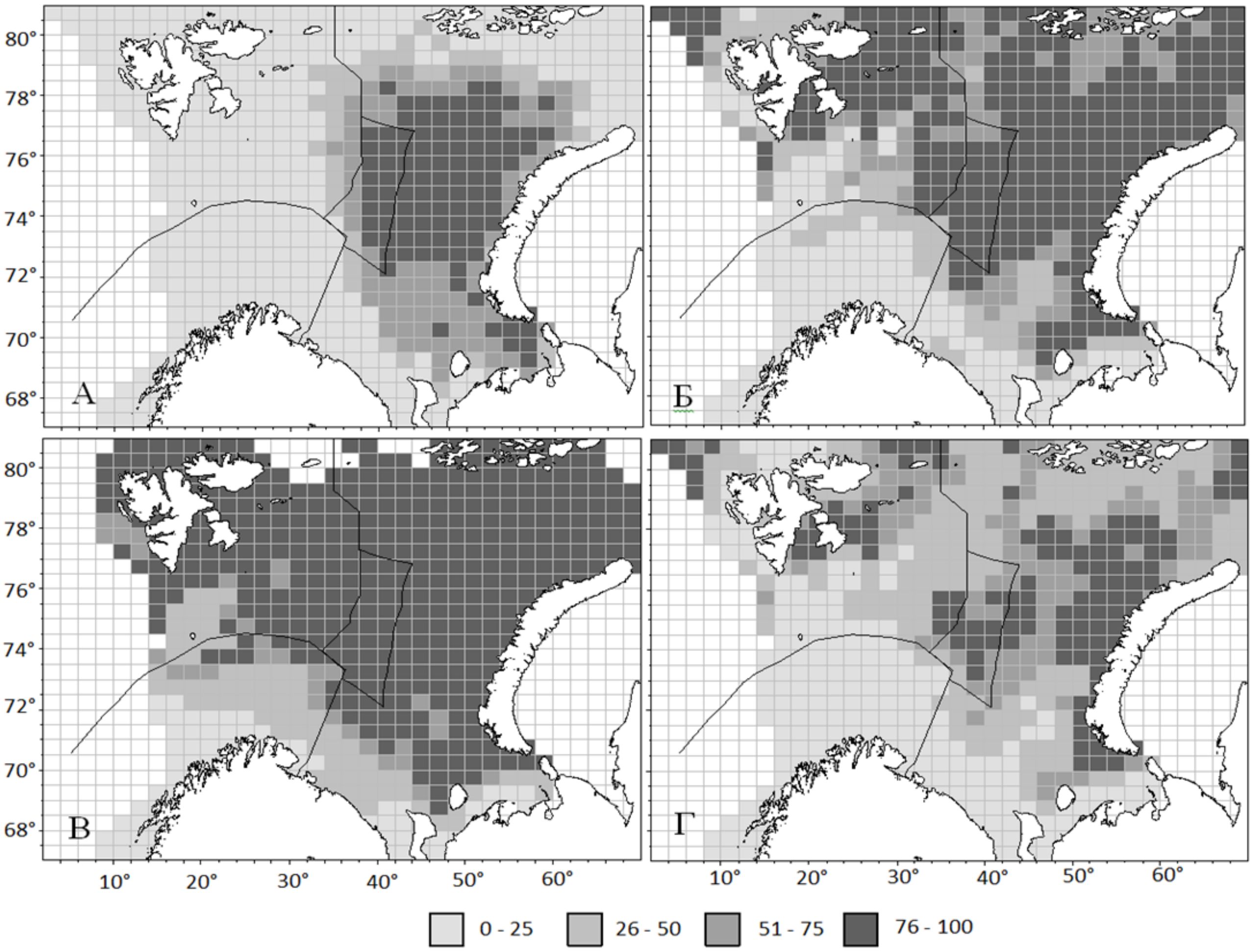


**Figure 22:** **Forecast distribution of snow crab in the Barents Sea. The probability of occurrence (%) of snow crab in the Barents Sea as observed currently in 2010-16 (А, top left), the forecast distributions at (Б, top right)**

**current annual average temperature, (B, bottom left) if 1ºC lower than current average annual temperature and (Г, bottom right) 1oC above current average annual temperature. (Source: PINRO; Bakanev *et al.*, 2018)**

### 7.2.3.9 Initial Estimates of Snow Crab Abundance (from ecosystem surveys)

The abundance index for snow crabs was calculated as the arithmetic mean catch (individuals per mile of trawling) within the ecosystem research survey area in the Russian EEZ in 2005-2016, but the low and highly variable catchability of snow crab in bottom trawls created uncertainties in relation to investigating interannual variations in snow crab abundance. To eliminate the influence of variation in trawl catchability on the snow crab abundance index, the arithmetic mean catches of snow crab (*C*, individuals per mile of trawling) was compared with the by-catches of abundant benthic species. The averaged dynamics of the relevant catchability coefficient for abundant benthic species (*q*) in 2005-2016 was estimated and along with mean catches of snow crabs ($C_t$), a snow crab abundance index (*I*) in the year *t* was calculated as follows:

$I_t = C_t/q_t$

Mean catch rates of snow crabs in the surveys suggest that there was very rapid growth of the population in 2012-2013, but a significant decline in 2015-2016 (Table 19, Column 2). However, low catchability of all benthic organisms in the most recent years suggests that this recent decline in catch rates is due to low catchability of snow crabs in the last two years (Table 19, Column 5). The snow crab population therefore appears to have been characterised by three phases of growth - low abundance in 2005-2008, strong growth in 2009-2010 and high abundance in 2011-2016.

In summary, the annual ecosystem surveys show that the stock appears to be in a good state following a period of rapid growth and that recruitment pulses are regular. However, PINRO scientists warn that stock estimates from the trawl survey have inherent uncertainties, and that these data can provide only a general description of likely long-term population trends.

**Table 19: Indicators of assessment of relative abundance of snow crab and benthos on results from ecosystem surveys in the Barents Sea in 2015-16. (Source: PINRO)**

| Year | Mean distribution density (ind./haul) | | Coefficient of relevant catchability of benthos (*q*) | Index of snow crab abundance $I_t = C_t/q_t$, ind./haul |
|---|---|---|---|---|
| | of crab according to survey, *C* | of benthos according to survey | | |
| 2005 | 0,17 | 62 | 0,04 | 4,43 |
| 2006 | 1,42 | 1006 | 1,10 | 1,29 |
| 2007 | 1,62 | 633 | 0,38 | 4,32 |
| 2008 | 7,21 | 1437 | 1,05 | 6,88 |
| 2009 | 2,78 | 130 | 0,21 | 13,19 |
| 2010 | 7,51 | 358 | 0,31 | 24,17 |
| 2011 | 53,60 | 701 | 0,52 | 103,88 |
| 2012 | 410,25 | 10442 | 5,60 | 73,20 |
| 2013 | 168,64 | 1990 | 1,48 | 113,75 |
| 2014 | 128,18 | 1737 | 0,96 | 133,93 |
| 2015 | 24,14 | 311 | 0,23 | 106,15 |
| 2016 | 12,53 | 203 | 0,13 | 96,25 |

#### 7.2.3.10 Fisheries-dependent Data

The commercial Russian fishery for snow crabs commenced in 2013 in the northeastern area of the international waters managed by NEAFC and has since expanded to cover parts of the Russian EEZ (Figure 23). However, since 2016 fishing in the international waters has been prohibited and all catches are currently from the Russian EEZ (Figure 24). The Russian fishery for snow crab in the Barents Sea is a newly developed fishery, and in 2014-2016, there was not a sufficiently long time series of fisheries data for which standard analytical stock assessments could be undertaken for the snow crab stock. Using an alternative approach, the fisheries data from the Russian fishery in the international waters managed by NEAFC were used to provide a time series of catches throughout a fishing season, and a Leslie depletion model was used to model the decline in catches over the season and hence assess the stock within the fishing area (Bakanev, S.V. 2015;Table 20). Estimates of biomass from the Leslie model were over 30,000 tonnes in 2014, with a density of 774 tonnes per thousand km$^2$, but the estimate of stock biomass had declined significantly by 2016 (Table 20).

The estimates in Table 20 were used to extrapolate to the whole area of the international waters providing an estimate of legal size stock within the international waters of 73,000 tonnes in 2014 and 34,000 tonnes in 2016. The density of snow crabs in the international waters at the start of the fishery in 2014 was then used with an estimate of the area of the stock in the Russian EEZ, the international waters and the Svalbard area to produce estimates of the legal size stock in all three fishing areas (Table 21). A number of assumptions underlie both the Leslie depletion model approach and the extrapolation to the wider fishery areas, and therefore there must be some uncertainty underlying these stock estimates.

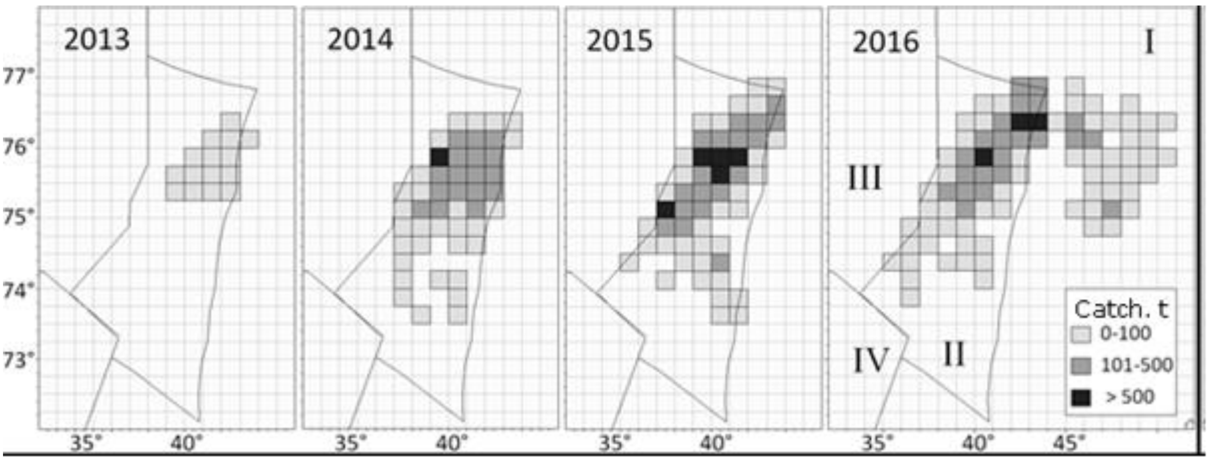


**Figure 23: Distribution of snow crab catches taken by Russian vessels in 2013-16 in the Barents Sea: I- Russian EEZ. II- International waters managed by NEAFC. III- Svalbard. IV- Norwegian EEZ. (Source: PINRO)**

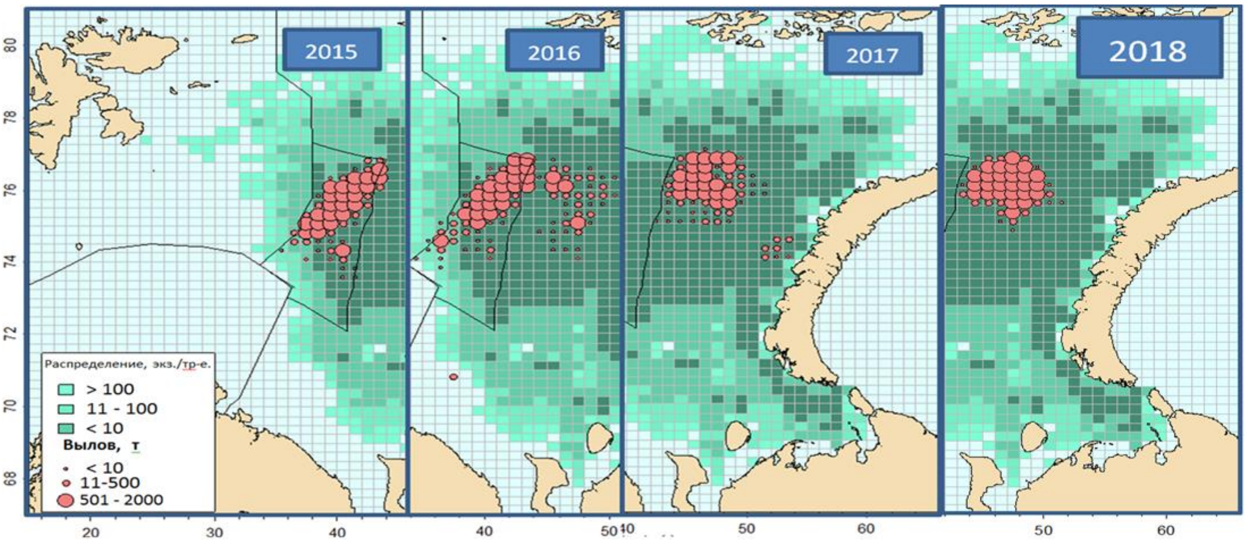


**Figure 24:** **Distribution of snow crab catches taken by Russian vessels in 2015-18 in the Barents Sea. (Source: PINRO)**

**Table 20:** **Median values of initial biomass B0 and 95% confidence interval limits in 2014-2016 derived by Leslie method of snow crab in the area of Russian Snow crab fishing activities in international waters of the Barents Sea. (Source: PINRO)**

| Year | Density of legal stock, t/thou.square km | $B_0$, t | 95% confidence interval limit for $B_0$, t | |
|---|---|---|---|---|
| | | | lower limit | upper limit |
| 2014 | 774 | 30196 | 15006 | 45385 |
| 2015 | 576 | 22482 | 11173 | 33791 |
| 2016 | 464 | 16614 | 8257 | 24972 |

**Table 21:** **Density, median and 95% confidence interval limits for the snow crab legal stock in the three Barents Sea areas estimated by the end of 2016. (Source: PINRO)**

| Area | Study area size, thou.square km | Density of legal stock, t/ thou.square km | Fishable stock, thou. t | | |
|---|---|---|---|---|---|
| | | | Median | 95% confidence interval limit | |
| | | | | Lower limit | Upper limit |
| Russian EEZ | 471 | 774 | 405 | 201 | 608 |
| International waters of the Barents Sea | 73 | 426 | 31 | 15 | 47 |
| Svalbard | 14 | 774 | 11 | 5 | 16 |
| Total | 558 | - | 447 | 221 | 671 |

#### 7.2.3.11 Updated Stock Assessment in 2018 (including catch profiles)

An updated stock assessment was undertaken by PINRO in 2018. The assessment included collation of catch per unit effort (CPUE) data from the fishery, a time series of stock biomass estimated from the ecosystem surveys and a Bayesian stock production model fitted to ecosystem survey data and recent catch data.

CPUE data are available from logbooks and the data are standardised using a Generalised Linear Modelling (GLM) approach to account for vessel and seasonal influences. As noted above, the Russian fishery has shifted from the NEAFC-managed international area known as The Loophole to the Russian EEZ, which precludes detailed evaluation of trends in CPUE. CPUE had declined in the Loophole from 2014 to 2016, and CPUE is much higher in the Russian EEZ from 2016 to 2018 (Table 22).

The updated stock assessment developed a time series of stock biomass estimates with confidence intervals calculated from estimates of snow crab abundance from the annual ecosystem surveys and using an estimate of catchability of 0.17 derived from the depletion experiments previously undertaken in the Loophole area. For 2018 the stock biomass estimate was 600,000 tonnes with the 95% lower limit of 200,000 tonnes (Figure 25).

**Table 22: Russian fishery Statistics for the snow crab fishery from 2013 to 2018 for the Loophole, International Waters (Anclave) and the Russian EEZ. (Source: PINRO)**

-
**Russian fishery statistics in 2013-2018**

| Year | Number of | | | CPUE kg per traps | CPUE, Tons per day | Catch, tons |
|---|---|---|---|---|---|---|
| | vessels | catch days | traps | | | |
| | | | ***Anclave*** | | | |
| 2013 | 2 | 22 | 2,4* | - | 2,82 | 62,0 |
| 2014 | 12 | 1153 | 788,7 | 4,80 | 3,53 | 4104,2 |
| 2015 | 20 | 3119 | 2894,7 | 3,07 | 2,77 | 8894,6 |
| 2016 | 18 | 2338 | 2489,8 | 2,49 | 2,58 | 6199,4 |
| | | | ***REZ*** | | | |
| 2016 | 5 | 178 | 91,7 | 12,49 | 7,53 | 1499,9 |
| 2017 | 10 | 889 | 410,8 | 15,64 | 9,57 | 7839,8 |
| 2018 | 11 | 971 | 582,4 | 16,70 | 9,19 | 9727,5 |

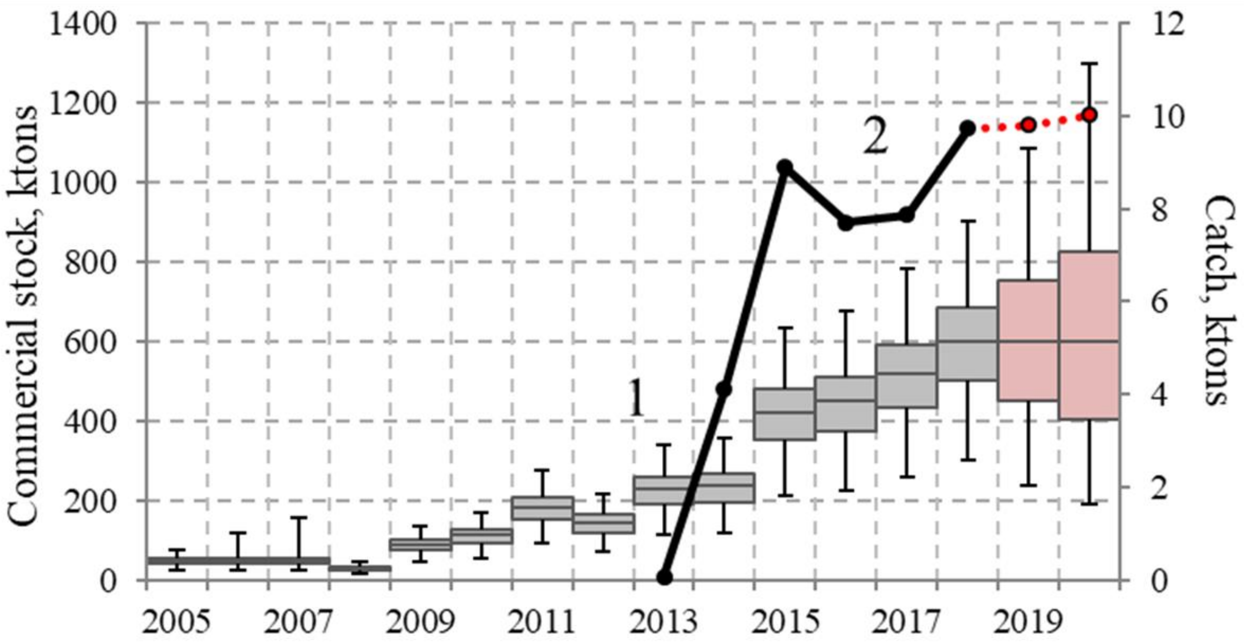


**Figure 25:** **Barents Sea snow crab stock and catches. Estimate of legal-sized stock with 95% confidence intervals (1) from 2005 to 2018 with projections to 2019 and 2020 and observed catches (2) from 2013 to 2018. (Source: PINRO)**

A Bayesian surplus production model conceptually similar to that developed for the shrimp (*Pandalus borealis*) fishery in the Barents Sea (Hvingel, 2016) was fitted to Russian snow crab fishery data (Bakanev, 2019). The model is formulated in a state-space framework and Bayesian methods are used to derive posterior likelihood distributions of the parameters (Hvingel and Kingsley, 2006). The model synthesises information from input priors including the initial population biomass, the carrying capacity (K) and Maximum Sustainable Yield (MSY), and is fitted to a series of snow crab catches and biomass estimates from the ecosystem survey calculated as a 3-year moving average of annual fishable biomass with catchability coefficient equal to 0.17 as calculated previously using the depletion model described above. The model used an input prior of the 2005 stock estimate as the initial population biomass with a normal distribution with mean of 0.01 and sigma 0.26. The prior for carrying capacity (K) was a median of 640,000 tonnes with 95% confidence intervals of 380,000 and 1,000,000 tonnes.

The model fit gave a median estimate of K of 711,400 tonnes from which an estimate of $B_{MSY}$ was derived as 0.5 x K equivalent to 356,000 tonnes. In addition, a $B_{LIM}$ of 0.3 x $B_{MSY}$ of 107,000 tonnes was derived. These biomass values of 356,000 and 107,000 tonnes have therefore been implemented as the target ($B_{tr}$) and limit ($B_{lim}$) reference points. With the accumulation of additional years of data by 2020, the Bayesian surplus production model was used as the principal stock assessment model to define the status of the stock and determine 2020 and 2021 TAC (PINRO 20202a). The assessment indicated the steady growth of snow crab population (Figure 26). The surplus production estimates of the exploitable biomass are slightly lower than those derived from the ecosystem survey, but demonstrate similar trend and are consistent with each other (which is expected, given that the survey index is used as an input for the production model).

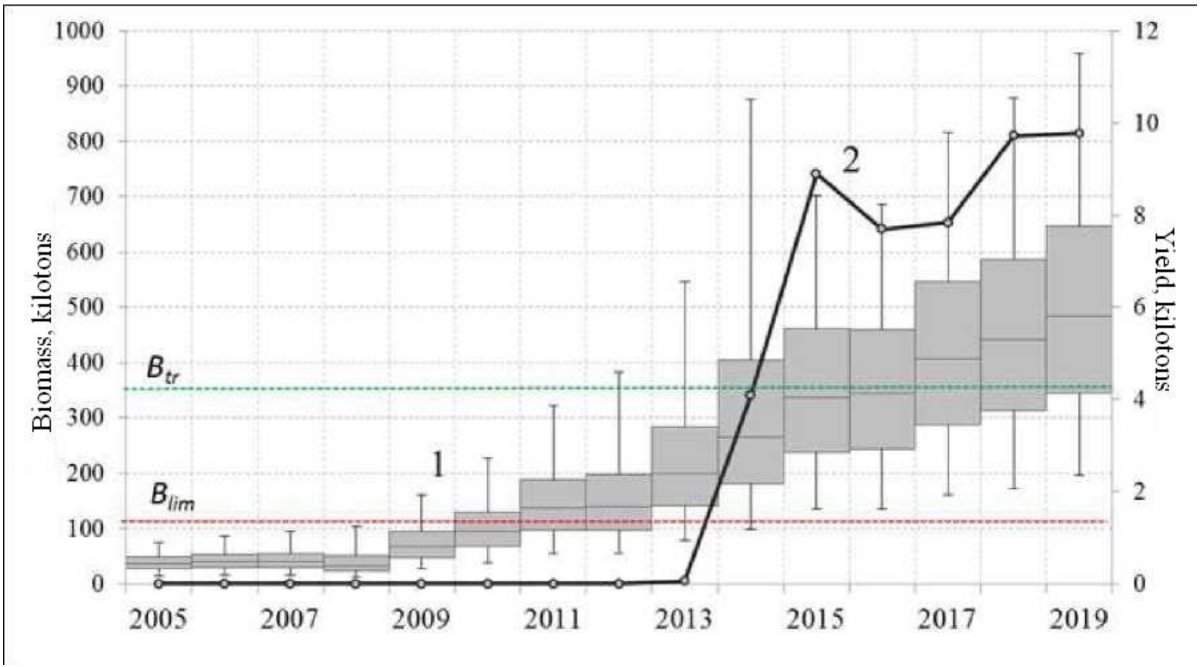


**Figure 26:** **Snow crab fishable stock biomass estimated by Bayesian surplus production model (1 – range of quartiles with a median, error bar – 95% confidence interval) and yield (2) in the open part and RF EEZ in the Barents Sea in 2005–2019. Horizontal red line represents Blim, green line – Btarget.**

**Table 23:** **Input data – biomass index from the ecosystem survey and Russian catch data – for the Bayesian stock production model for the Barents Sea Snow crab fishery. (Source: PINRO).**

| YEAR | Survey index, ktons* | CPUE, tons per day** | Russian catch, ktons |
|---|---|---|---|
| 2005 | 99 | | 0.0000 |
| 2006 | 13 | | 0.0000 |
| 2007 | 36 | | 0.0000 |
| 2008 | 38 | | 0.0000 |
| 2009 | 193 | | 0.0000 |
| 2010 | 106 | | 0.0000 |
| 2011 | 249 | | 0.0000 |
| 2012 | 77 | | 0.0000 |
| 2013 | 357 | | 0.0620 |
| 2014 | 275 | 11.26 | 4.1042 |

| | | | |
|---|---|---|---|
| 2015 | 636 | 7.36 | 8.8946 |
| 2016 | 436 | 6.08 | 7.6993 |
| 2017 | 489 | 8.23 | 7.8400 |
| 2018 | 601 | 7.74 | 9.728 |
| 2019 | 516 | 10.11 | 9.778 |

(*) – index recalculated in 2019

(**) –GLM standardized time series

**Table 24:** **Results of the fit of the Bayesian stock production model to the Russian Snow crab catch data and estimates of stock biomass. MSY = Maximum Sustainable Yield, B = Stock Biomass, F = Fishing mortality, K = carrying capacity, q = catchability. (Source: PINRO)**

| | Mean | SD | 25 % | Median | 75 % |
|---|---|---|---|---|---|
| MSY | 54.15 | 28.03 | 34.98 | 52.34 | 71.47 |
| $B_{msy}$ | 365.6 | 81.35 | 307.4 | 355.7 | 412.1 |
| K | 731.1 | 162.7 | 614.8 | 711.4 | 824.2 |
| q | 1.006 | 0.09738 | 0.941 | 1.008 | 1.071 |
| $F_{msy}$ | 0.151 | 0.07651 | 0.09945 | 0.1477 | 0.1967 |
| $B_{lim}$ | 109.7 | 24.4 | 92.23 | 106.7 | 123.6 |
| $B_{pa}$ | 182.8 | 40.67 | 153.7 | 177.9 | 206 |

### 7.2.3.12 Harvest Control Rules (HCRs)

The estimation of target and limit biomass reference points from the fitting of the Bayesian surplus production model described above allows an annual assessment of stock status in relation to these biological reference points. Scientific advice on the TAC for the forthcoming year is then based upon the status of the stock in relation to the target and limit biomass reference points and a maximum exploitation rate of 15%.

The harvest control rule for setting the annual TAC is as follows:

- If the legal-sized stock is within the healthy zone, i.e. above the target reference point ($B_{tr}$ = 356,000 tonnes), then the exploitation level (proportion harvested, $E_t$) is set at no higher than the target exploitation level ($E_{tr}$ = 0.15);

  If the legal-sized stock is in the cautious zone, i.e. above the biomass limit reference point ($B_{lim}$=107,000 tonnes), but below the target reference point, the exploitation level ($E_t$) is estimated as $E_t= E_{tr}\times(B_t-B_{lim})/(B_{tr}-B_{lim})$;

- If the legal stock is in the critical zone, i.e. below the limit reference point, the exploitation level is set to zero ($E_t$ = 0). The fishery is therefore closed and only fishing for science is permitted;

- Year-to-year TAC variation can be no more than ± 42 % of the previous year's TAC provided that the legal stock is above the limit reference point.

#### 7.2.3.13 Peer Review of Stock Assessment

Stock assessments are generally reviewed internally and externally following the multistage process, beginning with the internal PINRO review. This is followed by the scientific council review at the head VNIRO fisheries research institute in Moscow and externally by the Ecological Council of the Ministry of Nature. The 2020 snow crab assessment was subject to all steps of this process and therefore, has been reviewed by the independent experts both internally and externally.

### 7.2.4 Catch profiles

The CAB shall include in the report any relevant catch profiles showing Unit of Assessment (UoA) catch over time.

### 7.2.5 Total Allowable Catch (TAC) and catch data

**Table 25: Total Allowable Catch (TAC) and catch data**

| | | | | |
|---|---|---|---|---|
| TAC | Year | **2020** | Amount | **13250 tons** |
| UoA share of TAC | Year | **2020** | Amount | **3971 tons** |
| UoA share of total TAC | Year | **2020** | Amount | **3971 tons** |
| Total green weight catch by UoC | Year (most recent) | **2020** | Amount | **3867 tons** |
| Total green weight catch by UoC | Year (second most recent) | **-** | Amount | **-** |

## 7.2.6 Principle 1 Performance Indicator scores and rationales

### PI 1.1.1 – Stock status

| PI 1.1.1 | | The stock is at a level which maintains high productivity and has a low probability of recruitment overfishing | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| **a** | Stock status relative to recruitment impairment | | | |
| | Guide post | It is **likely** that the stock is above the point where recruitment would be impaired (PRI). | It is **highly likely** that the stock is above the PRI. | There is a **high degree of certainty** that the stock is above the PRI. |
| | Met? | **Yes** | **Yes** | **Yes** |
| Rationale | | | | |

The PRI point for snow crab was defined as 30% of Bmsy, which is estimated by a Bayesian surplus production model fitted to snow crab fishery data from 2005 to 2017. Based on Bmsy estimate from the production model, a biomass limit reference point ($B_{LIM}$) was calculated at 107,000 tonnes based on the assumption that $B_{LIM}$ is equivalent to 0.3 x $B_{MSY}$. There is a number of additional protective measures- a minimum legal landing size (MLS) of 10 cm carapace width (CW), mandatory release of all females and juvenile males (adult male fishery only), move on rule when % of juveniles exceeds 25%, some areal closures, The landing of females is also prohibited, and any females and juveniles caught must be returned immediately to the sea on hauling of traps. The snow crab fishery is therefore a male-only fishery. There is also a 'move-on' rule in place where vessels must move at least 2nm if juveniles make up more than 25% of the catch of snow crabs. In addition, there is also a move-on rule if bycatch rates exceed prescribed levels. Given these measures and the history of the stock expanding geographical distribution o and increasing stock biomass, this estimate of $B_{LIM}$ is very likely to be above the point of recruitment impairment (PRI). The stock biomass of snow crabs within Russian w estimated from the Joint Norwegian-Russian ecosystem survey was 600,000 tonnes in 2018 and 516,000 in 2019. Thus, the recent biomass level is at least five fold of the Blim. Alternatively, if the standard of half of Bmsy was used as a measure of Blim, the stock biomass would still be three times above Blim. SG60 is met.

Whilst there is some uncertainty underlying the methodology for assessing stock biomass as there are significant variations in catchability of snow crabs in the ecosystem survey, the lower 95% confidence interval of the biomass estimate is near 200,000 tonnes, which is well above the estimate of $B_{LIM}$. The ecosystem survey uses a small-meshed net and is therefore able to monitor annual variations in abundance of small pre-recruit snow crabs. The annual surveys show that recruitment pulses are regular in the snow crab population in the Barents Sea, and there is no evidence from the ecosystem surveys or commercial fisheries data that recruitment has been impaired. SG80 is met.

The lower 95% confidence interval of the biomass estimate for 2019 is about to 200,000 tonnes, which is well above the estimate of $B_{LIM}$ suggesting that there is higher than 95% probability of stock biomass being above Blim. In addition, the harvest strategy includes a prohibition on the retention of females and a move-on rule if catches of juveniles exceed certain thresholds, and survival rate of both females and undersized crabs returned to the sea is assumed to be high. The harvest strategy is therefore designed to mitigate against recruitment failure. It can be concluded that there is a high degree of certainty that the stock is above the PRI. SG100 is met.

| | |
|---|---|
| | Stock status in relation to achievement of Maximum Sustainable Yield (MSY) |

| | | | | |
|---|---|---|---|---|
| **b** | Guide post | | The stock is at or fluctuating around a level consistent with MSY. | There is **a high degree of certainty** that the stock has been fluctuating around a level consistent with MSY or has been above this level over recent years. |
| | Met? | | **Yes** | **No** |

Rationale

A Bayesian surplus production model fitted to Russian snow crab fishery data from 2005 to 2017 estimated a target reference point ($B_{TR}$) of 356,000 tonnes based on the assumption that $B_{TR}$ = 0.5 x K (carrying capacity) and is therefore equivalent to $B_{MSY}$ (PINRO 2020a). The stock biomass of snow crabs within Russian waters estimated from the Joint Norwegian-Russian ecosystem survey was 600,000 tonnes in 2018 and 516,000 in 2019 (Protzorkevich and van der Meeren, 2020), which is well above the target reference point, and therefore it can be concluded that the stock is at or fluctuating around a level consistent with MSY. The SG80 is met.

There are some uncertainties underlying the estimate of stock biomass from the ecosystem surveys, and the derivation of the target reference point equivalent to $B_{MSY}$ is based upon an initial fitting of the stock assessment model to a relatively short time series of fisheries data. The lower 95% confidence interval of the biomass estimate is 200,000 tonnes, which is just below $B_{MSY}$ and therefore, there is not a high degree of certainty that the stock is fluctuating around or above a level consistent with MSY. The SG100 is not met.

References

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## Stock status relative to reference points

| | Type of reference point | Value of reference point | Current stock status relative to reference point |
|---|---|---|---|
| Reference point used in scoring | Limit reference point ($B_{LIM}$) equivalent to 0.3 x $B_{MSY}$ | 107,000 tonnes | Stock biomass estimate in 2019 = 516,000 tonnes, i.e. 4.82 x $B_{LIM}$ |

| | | | |
|---|---|---|---|
| stock relative to PRI (SIa) | | | |
| Reference point used in scoring stock relative to MSY (SIb) | Target reference point ($B_{TR}$)<br>equivalent to $B_{MSY}$ estimated as 0.5 x K | 356,000 tonnes | Stock biomass estimate in 2019 = 516,000 tonnes, i.e. 3.33 x $B_{TR}$ or $B_{MSY}$ |

| | |
|---|---|
| Draft scoring range | **≥80** |
| Information gap indicator | **Information sufficient to score PI** |

**Overall Performance Indicator scores added from Client and Peer Review Draft Report stage**

| | |
|---|---|
| Overall Performance Indicator score | |
| Condition number (if relevant) | |

## PI 1.2.1 – Harvest strategy

| PI 1.2.1 | | There is a robust and precautionary harvest strategy in place | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| a | Harvest strategy design | | | |
| | Guide post | The harvest strategy is **expected** to achieve stock management objectives reflected in PI 1.1.1 SG80. | The harvest strategy is responsive to the state of the stock and the elements of the harvest strategy **work together** towards achieving stock management objectives reflected in PI 1.1.1 SG80. | The harvest strategy is responsive to the state of the stock and is **designed** to achieve stock management objectives reflected in PI 1.1.1 SG80. |
| | Met? | **Yes** | **Yes** | **No** |
| Rationale | | | | |

The objective of the harvest strategy is to avoid overfishing and achieve optimal exploitation by maintaining the exploitation rate and population biomass near their respective targets. The strategy consists of limited entry licensing, setting a precautionary annual TAC, a minimum landing size, a prohibition on the landing of female snow crabs, restrictions on trap design including minimum mesh size and the incorporation of biodegradable panels and move-on rules to minimise mortality of juvenile snow crabs, and implementation of closed areas. The harvest strategy is therefore expected to achieve stock management objectives and the SG60 is met.

Limit and target reference points have been implemented and the harvest control rule within the Russian fishery sets the annual TAC based upon estimates of stock biomass in relation to those reference points. The harvest strategy is therefore responsive to the state of the stock. There is a detailed monitoring programme, all vessels must have a Vessel Monitoring System (VMS) on board and logbook completion is mandatory, and there is robust enforcement of fishery management regulations through boarding of vessels at sea. Whilst it is difficult to assess whether a harvest strategy is appropriate for such a fishery where the species has been introduced only recently, and stock dynamics history is very short and, therefore, rather uncertain, it seems reasonable to conclude that the elements of the current harvest strategy will work together to maintain productivity and have a low risk of recruitment overfishing, and therefore achieve stock management objectives. The SG80 is met.

There is a number of management strategy components described above that were put together to achieve the management goals. There is an evidence present that the strategy was designed to work and it seems to be achieving tits results, understanding that we have a limited history of stock exploitation. However, this strategy applies only to the component of the stock that resides within Russian EEZ and internal waters. Whilst both Norway and Russia set TACs unilaterally, and there is discussion of common management regulations within the Joint Norwegian Russian Fishery Commission (JNRFC), the lack of a formal management plan for the fishery as a whole either through JNRFC or NEAFC means that the SG100 is not met.

| | | | | |
|---|---|---|---|---|
| b | Harvest strategy evaluation | | | |
| | Guide post | The harvest strategy is **likely** to work based on prior experience or plausible argument. | The harvest strategy may not have been fully **tested** but evidence exists that it is achieving its objectives. | The performance of the harvest strategy has been **fully evaluated** and evidence exists to show that it is achieving its objectives including being clearly able to |

| | | | | |
|---|---|---|---|---|
| | | | | maintain stocks at target levels. |
| | Met? | **Yes** | **Yes** | **No** |

Rationale

A harvest strategy based upon the use of the Harvest Control Rule, highly precautionary TACs, limited entry licensing, protection of females and measures to minimise juvenile mortality is likely to work based on similar harvest strategies in other snow crab fisheries. The SG60 is met.

There has not been any formal testing of the harvest strategy but estimates of stock biomass derived with at least two methods, intensive monitoring of size and sex composition in the commercial catch and in fishery independent surveys, identification of regular recruitment events and information on the distribution of the snow crab stock all provide evidence that the key elements of the harvest strategy to ensure that overfishing does not occur are working. The stock appears to be growing, its biomass was above Blim with the probability over 95% in the course of last six years and above the target over last three years (Figure 26) SG80 is met.

The performance of the harvest strategy has not been fully evaluated yet either through practical experience (too few years of observations) or through the simulation modelling, for example, a Management Strategy Evaluation (MSE), so SG100 is not met.

| | | | | |
|---|---|---|---|---|
| **c** | Harvest strategy monitoring | | | |
| | Guide post | Monitoring is in place that is expected to determine whether the harvest strategy is working. | | |
| | Met? | **Yes** | | |

Rationale

Fishing activity is monitored through a vessel monitoring system (VMS), logbooks and landings declarations. There is an observer programme in place which records size and sex composition of the catch in addition to catch numbers. The annual joint Russian-Norwegian ecosystem survey provides information on stock abundance, stock structure and distribution. Regular boarding of vessels by the Border Guard Service of the Russian Federation's FSB in the Western Arctic District throughout the fishing season monitors for compliance with fishery management regulations. Cross-checks of records from logbooks, transhipment volumes and landings data provide evidence that generally there is good compliance with data-recording regulations. The SG60 is met.

| | | | | |
|---|---|---|---|---|
| **d** | Harvest strategy review | | | |
| | Guide post | | | The harvest strategy is periodically reviewed and improved as necessary. |
| | Met? | | | **No** |

Rationale

TACs are set annually by the Federal Fisheries Agency (FFA) following rigorous internal and external review. All other regulations are also considered, discussed and reviewed on an annual basis. The harvest strategy has been improved significantly in 2018/19 through the derivation of limit and target reference points and the implementation of a harvest control rule to set annual TACs. The harvest strategy is reviewed annually by comparing reported landings with the TAC (a percent TAC usage is calculated), review of the seasonal dynamics of cumulative landings, compliance, review of the efficiency of regulations. Such reviews occur at the Scientific Councils of PINRO and VNIRO, Regional Science and Fishery Council and FFA. The SG100 is not met. SG 80 is awarded by default.

| e | Shark finning | | | |
|---|---|---|---|---|
| | Guide post | It is **likely** that shark finning is not taking place. | It is **highly likely** that shark finning is not taking place. | There is a **high degree of certainty** that shark finning is not taking place. |
| | Met? | **NA** | **NA** | **NA** |

Rationale

Sharks are not target species

| f | Review of alternative measures | | | |
|---|---|---|---|---|
| | Guide post | There has been a review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock. | There is a **regular** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock and they are implemented as appropriate. | There is a **biennial** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of the target stock, and they are implemented, as appropriate. |
| | Met? | **Yes** | **Yes** | **No** |

Rationale

Measures for minimising the mortality of unwanted catch of snow crabs appear to have been reviewed regularly. Since the start of the fishery in 2013, there have been changes to the mesh size of traps, a prohibition of fishing using any method other than traps has been introduced, the landing of females is prohibited, and any females caught must be returned immediately to the sea on hauling of traps. There is therefore an evidence that a review of the potential effectiveness of alternative measures to minimise unwanted mortality of snow crabs has taken place. SG60 is met.

Measures for minimising the mortality of unwanted catch of snow crabs appear to have been reviewed regularly. Since the start of the fishery in 2013, there have been changes to the mesh size of traps, a prohibition of fishing using any method other than traps has been introduced, the landing of females is prohibited, and any females caught must be returned immediately to the sea on hauling of traps. In addition, there is a requirement that the distance between the lowest part of the slipway for unwanted crab and the waterline must not be more than 1.5 metres, which provides further protection from damage of unwanted snow crab returned to the sea, and there is a move-on rule if juveniles make up more than 25% of the catch of snow crabs. Traps must be fitted with a biodegradable panel to avoid ‘ghost fishing’. There is therefore a regular review of the potential effectiveness of alternative measures to minimise unwanted mortality of snow crabs. SG80 is met.

There is no evidence available that states that a formal biennial review is undertaken of alternative measures to minimize UoA-related mortality of unwanted catch of the target stock. SG100 is not met.

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Kuzmin, S.A., Akhtarin, S.M. and Menis, D.T. 1998. The first findings of the snow crab *Chionoecetes opilio* (Decapoda, Majidae) in the Barents Sea. Zool. Zh. 77: 489-491.

Russian Federal Act 2004 (law No.166-FZ)

Fisheries Regulations for the Northern Fisheries Basin.

| **Draft scoring range** | **≥80** |
|---|---|
| Information gap indicator | **More information sought –** SI (f) When did each measure to reduce mortality of unwanted catch of snow crabs discussed come into force? Confirm when the next review is due to take place. |

**Overall Performance Indicator scores added from Client and Peer Review Draft Report stage**

| | |
|---|---|
| Overall Performance Indicator score | |
| Condition number (if relevant) | |

## PI 1.2.2 – Harvest control rules and tools

| PI 1.2.2 | | There are well defined and effective harvest control rules (HCRs) in place | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| **a** | HCRs design and application | | | |
| | Guide post | **Generally understood** HCRs are in place **or available** that are **expected** to reduce the exploitation rate as the point of recruitment impairment (PRI) is approached. | **Well defined** HCRs are **in place** that **ensure** that the exploitation rate is reduced as the PRI is approached, are expected to keep the stock **fluctuating around** a target level consistent with (or above) MSY, or for key LTL species a level consistent with ecosystem needs. | The HCRs are expected to keep the stock **fluctuating at or above** a target level consistent with MSY, or another more appropriate level taking into account the ecological role of the stock, **most** of the time. |
| | Met? | **Yes** | **Yes** | **No** |
| Rationale | | | | |

A three-zone Harvest Control Rule (HCR) was developed and tested in 2018. The key element of the Harvest Control Rule is that the annual TAC is set based upon the estimate of stock biomass in relation to designated target and limit biomass reference points as follows:

- If the legal-sized stock is within the healthy zone, i.e. above the target reference point ($B_{tr}$= 356,000 tonnes), then the exploitation level (proportion harvested, $E_t$) is set at no higher than the target exploitation level ($E_{tr}$ = 0.15);
- If the legal-sized stock is in the cautious zone, i.e. above the biomass limit reference point ($B_{lim}$=107,000 tonnes), but below the target reference point, the exploitation level ($E_t$) is estimated as $E_t = E_{tr} \times (B_t - B_{lim})/(B_{tr} - B_{lim})$;
- If the legal stock is in the critical zone, i.e. below the limit reference point, the exploitation level is set to zero ($E_t$ = 0). The fishery is therefore closed and only fishing for science is permitted;
- TAC change limits are to be established in accordance with the methodological recommendations contained in the Harvest Control Rules for Priority Crab and Stone Crab Species. If stock status is “stable”, “uncertain” or “declining”, TAC change limit is ±20% on the preceding year. If stock status is “growing”, “recovering” or “to be initially exploited”, TAC change limit is +42% on the preceding year.

Whilst the exploitation rate will be maintained at 15% in the healthy zone, when the estimate of stock biomass drops below the target reference point and approaches the limit reference point, i.e. the point at which recruitment is impaired, then the exploitation rate is reduced. The SG60 is met.

The HCR is well defined with a target exploitation rate of 0.15 when the legal stock biomass is greater than the target biomass and a proportional reduction in the exploitation rate if the biomass falls below the target. If $B_{lim}$ is reached (a conservative proxy for PRI), commercial fishing is stopped. This HCR is expected to keep the stock around the target biomass, which is set at the estimated $B_{MSY}$. Btarget for snow crab is set at Bmsy level which was estimated quantitatively with the Bayesian surplus production model. Maintaining exploitation rate at or below the Umsy is expected to keep the stock fluctuating around the target biomass consistent with MSY based on the surplus production model concept. SG80 is met.

The snow crab appears to grow in importance as a component of cod diet (PINRO 2020a). There is no explicit consideration of the ecological role of Barents Sea opilio crab in the HCR, SG100 is not met.

| | | |
|---|---|---|
| | HCRs robustness to uncertainty | |

| | | | | |
|---|---|---|---|---|
| **b** | Guide post | | The HCRs are likely to be robust to the main uncertainties. | The HCRs take account of a **wide** range of uncertainties including the ecological role of the stock, and there is **evidence** that the HCRs are robust to the main uncertainties. |
| | Met? | | **Yes** | **No** |

Rationale

The key HCR is revision of the annual TAC in response to changes in the estimates of stock biomass. There are significant uncertainties inherent in the estimation of stock biomass based upon the annual joint Norwegian-Russian ecosystem survey because of variations in catchability of snow crabs as the surveys are not designed to provide quantitative estimates of snow crab biomass. However, the estimates of stock biomass are calculated using estimates of catchability from depletion experiments which should increase the robustness of the estimates. Scientific advice on setting of the TACs uses the lower 95% confidence limit of the estimates of stock biomass to produce a highly precautionary TAC. The SG80 is met.

The setting of the TACs does not consider a wide range of uncertainties, although a range of TACs is explored with respect to their effect on the probability of resulting in an overfished or overfishing condition. The ecological role of the snow crab stock is not fully known as it is a recently introduced species in the Barents Sea. The HCR has been in place for a too short time for the evidence to be accumulated The SG100 is not met.

| | | | | |
|---|---|---|---|---|
| | HCRs evaluation | | | |
| **c** | Guide post | There is **some evidence** that tools used **or available** to implement HCRs are appropriate and effective in controlling exploitation. | **Available evidence indicates** that the tools in use are appropriate and effective in achieving the exploitation levels required under the HCRs. | **Evidence clearly shows** that the tools in use are effective in achieving the exploitation levels required under the HCRs. |
| | Met? | **Yes** | **Yes** | **No** |

Rationale

Although the history of snow crab exploitation in Russian waters is short, there is some evidence that the management tools in place in the Russian fishery are effective in controlling exploitation rate. Annual stock assessments, TAC setting according to the stock status and HCR, effective control of the catch, real time monitoring of the removals, strict enforcement, area and seasonal closures and other measures lead to significant stock growth and stabilization at the level above the Bmsy (PINRO 2020). Furthermore, accumulated experience in other crab fisheries indicate that the HCR based on limit and target reference points and a target exploitation rate is appropriate and effective in controlling exploitation (Siddeek, 2002; Siddeek and Zheng, 2007; Szuwalsky and Punt, 2013; Punt et al.,2020). SG60 is met.

There is clearly considerable scope for the snow crab population to expand geographically and for significant increases in stock biomass, and the current tools of limiting fishing effort, and setting highly-precautionary TACs (the TAC for 2020 of 13,250 tonnes is much less than a TAC of 76,000 tons that corresponds to the target exploitation rate of 0.15) are effective. SG80 is met.

The HCRs are newly-implemented and scientists are only beginning to understand snow crab stock dynamics in the Barents Sea and so it is too early in the development of the snow crab stock to conclude that there is clear evidence that the tools are effective in achieving the exploitation levels required under the HCRs. SG100 is not met.

References

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Bizikov, V. A. editor. Harvest control rules for priority species of crabs. FSBSI “VNIRO”

Russian Federal Act 2004 (law No.166-FZ)

Punt, A.E., Dalton, M.G. and Foy, R.J., 2020. Multispecies yield and profit when exploitation rates vary spatially including the impact on mortality of ocean acidification on North Pacific crab stocks. Fisheries Research, 225, p.105481.

Szuwalski, C.S. and Punt, A.E., 2013. Fisheries management for regime-based ecosystems: a management strategy evaluation for the snow crab fishery in the eastern Bering Sea. ICES Journal of Marine Science, 70(5), pp.955-967.

Siddeek, M.S.M. and Zheng, J., 2007. Evaluating the parameters of a MSY control rule for the Bristol Bay, Alaska, stock of red king crabs. ICES Journal of Marine Science, 64(5), pp.995-1005.

Siddeek, M.S.M., 2002. Review of biological reference points used in Bering Sea and Aleutian Islands (king and Tanner) crab management. Alaska Department of Fish and Game, Division of Commercial Fisheries.

| **Draft scoring range** | **≥80** |
|---|---|
| Information gap indicator | **Information sufficient to score PI** |

**Overall Performance Indicator scores added from Client and Peer Review Draft Report stage**

| | |
|---|---|
| Overall Performance Indicator score | |
| Condition number (if relevant) | |

## PI 1.2.3 – Information and monitoring

| PI 1.2.3 | | Relevant information is collected to support the harvest strategy | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| **a** | Range of information | | | |
| | Guide post | **Some** relevant information related to stock structure, stock productivity and fleet composition is available to support the harvest strategy. | **Sufficient** relevant information related to stock structure, stock productivity, fleet composition and other data are available to support the harvest strategy. | A **comprehensive range** of information (on stock structure, stock productivity, fleet composition, stock abundance, UoA removals and other information such as environmental information), including some that may not be directly related to the current harvest strategy, is available. |
| | Met? | **Yes** | **Yes** | **No** |

There is good information available from the annual Joint Russian-Norwegian ecosystem surveys on stock structure, stock productivity and distribution of the stock. There are about 16 vessels in the Russian snow crab fishery and fleet composition is well understood. The SG60 is therefore met.

All vessels are currently equipped with an automatic vessel monitoring system (VMS) which provides records of fishing position on all fishing trips, and vessels are required to complete log books describing their fishing activity in terms of catch and fishing effort which requires recording of both undersized and commercial crabs, and landings declarations are required. There is an observer program (with a target coverage of 20%) which records size and sex composition of the catch in addition to catch numbers. The snow crab population within the Barents Sea is considered to be a single stock. There is enough information available from both fishery-dependent and fishery-independent sources to meet the SG80.

Whilst there is additional environmental and community information available from the annual ecosystem surveys, and modelling work has provided predictions on likely snow crab stock abundance and distribution in future years, there are uncertainties in sampling variability in the ecosystem surveys relating to snow crab catchability and stock structure which provide some uncertainties surrounding estimates of stock abundance, so it cannot be concluded that the information for this fishery is comprehensive. The SG100 is not met

| | | | | |
|---|---|---|---|---|
| **b** | Monitoring | | | |
| | Guide post | Stock abundance and UoA removals are monitored and **at least one indicator** is available and monitored with sufficient frequency to support the harvest control rule. | Stock abundance and UoA removals are **regularly monitored at a level of accuracy and coverage consistent with the harvest control rule**, and **one or more indicators** are available and monitored with sufficient frequency to support the harvest control rule. | **All information** required by the harvest control rule is monitored with high frequency and a high degree of certainty, and there is a good understanding of inherent **uncertainties** in the information [data] and the robustness of assessment and management to this uncertainty. |

| | | | | |
|---|---|---|---|---|
| | Met? | **Yes** | **Yes** | **No** |

Rationale

Unit of assessment removals and catch rates are monitored in real time using daily and cumulative catch information that is a subject to mandatory submission by fishing vessels via the national Fisheries Monitoring System. Stock abundance is monitored through the joint Russian Norvegian annual ecosystem survey. SG60 is met.

Whilst snow crab removals are rigorously monitored, there are some uncertainties surrounding the estimates of stock abundance which are used to assess the status of the stock in relation to the biomass reference points. However, by using the lower 95% confidence limit of the estimated stock biomass (Figure 26) within the HCR to calculate the TAC, it can be concluded that the stock biomass estimates are monitored at a level of accuracy that is sufficient to support the HCR. In 2020 (and prior to that), the management authorities set the TAC at a significantly lower level than that required at the target exploitation rate used in the HCR. The SG80 is met.

Fishery removals and survey indices required for the assessment are collected annually at sufficient level of accuracy to serve as a model input. Although the surplus production model is well suited for stocks that do not have age structure information, it describes the stock dynamics only in terms of biomass, ignoring finer processes related to the stock size and age structure, maturity and fecundity. Therefore, there is not a high degree of certainty on how appropriately the model describes they dynamics of the stock (process error), and there is not a good understanding of the inherent uncertainties in the information (or the robustness of the assessment and management to those uncertainties. More years of stock observation are required to reduce some uncertainties. SG100 is not met.

| | | | | |
|---|---|---|---|---|
| **c** | Comprehensiveness of information | | | |
| | Guide post | | There is good information on all other fishery removals from the stock. | |
| | Met? | | **No** | |

Rationale

There are less than twenty registered snow crab fishing vessels in the UoA for which there is very good information on all catches of commercial-sized and undersized snow crab, and there are no other crab catching vessels in the Barents Sea. As the entire fishery is conducted outside the 12nm limit, there is no recreational fishing. There is some bycatch of snow crab in the trawl fisheries for haddock, cod and halibut in the Barents Sea and in the shrimp fishery. Due to its wide distribution, snow crab has become one of important by-catch items in bottom trawl fisheries in the Barents Sea. This applies especially to the eastern areas of the sea where domestic and foreign northern shrimp fisheries traditionally operate. These bycaught snow crabs are generally damaged by the trawl and therefore not landed. Any such damaged and discarded snow crabs caught in the trawls are recorded by the observers. There is also detailed information on proportion of snow crab in the research survey trawls. Estimates of the by-catch of snow were recently developed (PINRO 2020c) for 2008 - 2019 by expanding snow crab catch rates recorded by the observers onboard commercial vessels or in scientific surveys to the total yield of finfish and shellfish in the area. Estimated snow crab bycatch in bottom trawl fisheries varied from 0.7 to 4.7 thousand tons. These estimates include males and females of all sizes. When compared to the exploitable stock of legal size males, snow crab by-catches in the demersal fish and shrimp bottom fisheries account for about 0.5–0.9% of its exploitable stock. (PINRO 2020c). In summary, direct catch of snow crab is well monitored and reported and newly developed estimates of bycatch in bottom trawls appear to be reasonably well estimated. Bycatch of snow crab in other fisheries is considered to be small, but no estimates have been presented yet. However, dead discards are not calculated and used as input in the assessment due to presumed low discard mortality losses and therefore, lack of influence on the assessment results. SG80 is not met.

References

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Bakanev, S.V. 2019. Evaluation of biological reference points and HCR for snow crab stock in the Russian EEZ of the Barents Sea, unpublished.

Bakanev, S., Sokolov, K. and Pavlov, V. 2018. Prospects for a Russian snow crab (*Chionoecetes opilio*) fishery in the Barents Sea. Submission to 18th Russian-Norwegian Symposium, 24pp.

Results of the annual joint Norwegian-Russian ecosystem survey in the Barents Sea.

| **Draft scoring range** | **60-79** |
|---|---|
| Information gap indicator | **More information sought** - More information sought on estimates of dead discards or evidence of their negligible effect. |

**Overall Performance Indicator scores added from Client and Peer Review Draft Report stage**

| | |
|---|---|
| Overall Performance Indicator score | |
| Condition number (if relevant) | |

## PI 1.2.4 – Assessment of stock status

| PI 1.2.4 | | There is an adequate assessment of the stock status | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| **a** | Appropriateness of assessment to stock under consideration | | | |
| | Guide post | | The assessment is appropriate for the stock and for the harvest control rule. | The assessment takes into account the major features relevant to the biology of the species and the nature of the UoA. |
| | Met? | | **Yes** | **No** |
| Rationale | | | | |

Prior to 2020, snow crab stock assessment was based on swept area method with the data from the fishery-independent annual joint Norwegian-Russian ecosystem survey. The biomass density estimates were calibrated using snow crab catchability estimates derived from Leslie depletion analysis applied to commercial fishing data collected in previous years in the snow crab fishery. Since 2020 the assessment of the snow crab stock is based on the Bayesian surplus production model that utilizes both fishery-dependent and fishery-independent information. The model is appropriate given the type the information available and is specified as recommended assessment approach for category 2 type of data according to the FFA executive Ordrer #104 which defines three levels of required type of analysis based on the structure and quality of available information: “”Level II. The available information provides for a limited analytical assessment of the state of the stock and TAC using production models of the exploited stock. The minimum information requirements at this level are historical catch and catch series per unit of fishing effort or effort” (FFA Order #104 http://docs.cntd.ru/document/553957543).The assessment provides annual estimates of stock biomass which are compared with both limit and target reference points estimated internally within the Bayesian stock production model, making them more consistent and directly comparable. Furthermore, the model provides the posterior distribution of estimated parameters, thus making it possible to evaluate the results in probabilistic way. TACs are then set based on exploitation rates determined within the HCR and whether the stock status is within the healthy, cautious or critical zones. Probability distribution of the terminal year estimate of stock biomass allows for the quantitative determination of the likelihood for the stock below PRI or the target biomass. The assessment method is therefore appropriate to the stock and for the HCR. The SG80 is met.

Due to the simplicity of the surplus production model, designed to work with limited input data (catch and indices of biomass) and utilize the assumption of the logistic growth of population, this assessment method does not account explicitly for the major features of the biology of snow crab. Surplus production model represents population dynamics only in the form of biomass, thus potentially missing the changes in certain population parameters such as changes in recruitment, growth rates, changes in size structure, etc. There is sufficient uncertainty in snow crab dynamics in the Barents Sea as described by the surplus production model due to potential process error. There are uncertainties underlying the method of estimating stock biomass with the surplus production model that preclude us for the conclusion that the assessment takes into all the major features of the UoA. The SG100 is not met.

| | | | | |
|---|---|---|---|---|
| **b** | Assessment approach | | | |
| | Guide post | The assessment estimates stock status relative to generic reference points appropriate to the species category. | The assessment estimates stock status relative to reference points that are appropriate to the stock and can be estimated. | |

| | | | | |
|---|---|---|---|---|
| | Met? | **Yes** | **Yes** | |
| Rationale | | | | |

The reference points were developed based on a Bayesian surplus production model fitted to a multiple time series of abundance and expert knowledge. The production model was used to estimateB0 and $B_{MSY}$. A $B_{lim}$ set at 30% of $B_{MSY}$ is appropriate given the measures in place to protect spawning stock. Reference points ($B_{lim}$ and $B_{tr}$, set at $B_{MSY}$) are in place and stock biomass can be estimated in relation to these reference points. They are appropriate to the stock. The assessment estimates stock status relative to reference points appropriate to the species category.SG60 is met.

The assessment of the snow crab stock is based on the Bayesian surplus production model that utilizes both fishery-dependent and fishery-independent information. The model is appropriate given the structure and quality of available information. For the stocks that have historical catch and catch series per unit of fishing effort (or effort), the use of surplus production models is recommended. The assessment provides annual estimates of stock biomass which are compared with both limit and target reference points estimated internally within the same Bayesian stock production model. The target reference point is the Bmsy estimate and the limit reference point is a derivative of the Bmsy (0.3Bmsy). Reference points and year specific estimates are estimated within the same model making them consistent and directly comparable. SG80 is met.

| | | | | |
|---|---|---|---|---|
| **c** | Uncertainty in the assessment | | | |
| | Guide post | The assessment **identifies major sources** of uncertainty. | The assessment **takes uncertainty into account**. | The assessment takes into account uncertainty and is evaluating stock status relative to reference points in a **probabilistic** way. |
| | Met? | **Yes** | **Yes** | **Yes** |
| Rationale | | | | |

The stock assessment has identified the major sources of uncertainty – estimates of stock biomass from the ecosystem survey need calibrating for snow crab catchability and snow crab distribution is expanding. The SG60 is met.

Uncertainty is accounted for in the assessment by treating the input data as measured with some error. Uncertainty is accounted for in the output of the Bayesian surplus production model estimates by providing confidence intervals that are based on probability density distribution of estimated parameters. Uncertainty was accounted for in the development of reference points within the Bayesian stock production model which inherently takes into account uncertainty in the initial stock size, carrying capacity and the estimate of MSY. In addition to taking into account uncertainties in the assessment, uncertainty is accounted for through the setting of precautionary TACs which are much lower than those required under the HCRs. SG80 is met.

The assessment evaluates stock status relative to reference points in a probabilistic way by providing a median estimate with 50% and 95% confidence limits for future biomass under different recruitment scenarios. The assessment also conducted simulations that show the risk of legal stock falling below the limit reference point $B_{lim}$. SG100 is met.

| | | | | |
|---|---|---|---|---|
| **d** | Evaluation of assessment | | | |
| | Guide post | | | The assessment has been tested and shown to be robust. Alternative hypotheses and assessment approaches have been rigorously explored. |

| | | | | |
|---|---|---|---|---|
| | Met? | | | **Yes** |

Rationale

The stock assessment approach using surplus production model has not been fully tested and has yet to be shown to be robust. Various stock assessment methodologies have been trialled for this newly developed fishery based on a recently introduced species, but it cannot be concluded that the methodologies have been rigorously explored. The SG100 is not met**.**

| | | | | |
|---|---|---|---|---|
| e | Peer review of assessment | | | |
| | Guide post | | The assessment of stock status is subject to peer review. | The assessment has been **internally and externally** peer reviewed. |
| | Met? | | **Yes** | **Yes** |

Rationale

Stock assessments are generally reviewed internally and externally following the multistage process, beginning with the internal PINRO review, followed by the scientific council review at the head VNIRO institute in Moscow and externally by the Ecological Council of the Ministry of Nature. The 2020 snow crab assessment was subject to all steps of this process and therefore, has been reviewed by the independent experts both internally and externally. SG80 is met.

VNIRO scientists review the material they receive on the TAC for the Barents Sea snow crab and make their comments and proposals at an extended meeting of PINRO's Scientific Council with participation of scientists from VNIRO and industry representatives. PINRO then revises the draft advice in response to the VNIRO comments. The final TAC recommendations are further reviewed by the independent Ecological Council of the Ministry of Nature comprised of independent scientists representing Academy of Science and universities. The VNIRO and the Ministry of Nature Ecological Councils' peer reviews are external. There is no evidence of independent international review, but such a review is not among MSC requirements. SG100 is met.

References

Bakanev, S.V. 2015. Stock assessment of the red king crab in the Russian EEZ of the Barents Sea by using depletion models. Voprosy rybolovstva, vol. 16, *No.* 4: 465–476 (in Russian).

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Hvingel, C. and Kingsley, M.C.S. 2006. A framework to model shrimp (*Pandalus borealis*) stock dynamics and to quantify the risk associated with alternative management options, using Bayesian methods. ICES Journal of Marine Science, 63: 68-82.

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Results of the annual joint Norwegian-Russian ecosystem survey in the Barents Sea.

The CAB shall list any references here, including hyperlinks to publicly-available documents.

| | |
|---|---|
| **Draft scoring range** | **≥80** |

| Information gap indicator | **Information sufficient to score PI** |
|---|---|

**Overall Performance Indicator scores added from Client and Peer Review Draft Report stage**

| Overall Performance Indicator score | |
|---|---|
| Condition number (if relevant) | |

### 7.2.7 P1 references

General Introductory text

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- АНАЛИЗ ДЕЙСТВУЮЩИХ МЕР УПРАВЛЕНИЯ РЫБОЛОВСТВОМ ПРИОРИТЕТНЫХ ВИДОВ КРАБОВ И КРАБОИДОВ С РЕКОМЕНДАЦИЯМИ ПО ИХ ДОРАБОТКЕ И СОВЕРШЕНСТВОВАНИЮ
- ПРАВИЛА РЕГУЛИРОВАНИЯ ПРОМЫСЛА ПРИОРИТЕТНЫХ ВИДОВ КРАБОВ И КРАБОИДОВ
- СВОДНЫЕ ДАННЫЕ ПО ИНФОРМАЦИОННОЙ ОБЕСПЕЧЕННОСТИ ПРОГНОЗНЫХ МАТЕРИАЛОВ ПРИОРИТЕТНЫХ ВИДОВ КРАБОВ И КРАБОИДОВ В МОРЯХ РОССИЙСКОЙ ФЕДЕРАЦИИ С ОПРЕДЕЛЕНИЕМ СТАТУСА И ОРИЕНТИРОВ УПРАВЛЕНИЯ ЗАПАСОМ
- ХАРАКТЕРИСТИКА ИССЛЕДОВАНИЙ, ЗНАЧЕНИЕ И СТАТИСТИКА ОСВОЕНИЯ ОДУ. А ТАКЖЕ РЯД ХАРАКТЕРИСТИК, ИСПОЛЬЗУЕМЫХ В РАСЧЕТЕ ЗАПАСА ДЛЯ ПРИОРИТЕТНЫХ ВИДОВ КРАБОВ И КРАБОИДОВ ЗА 2005-2014 ГГ.

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# 8 Scoring Principle 2

The two UoAs, Red King Crab and Opilio are not fished in the same area in the Barents Sea, and are not fished at the same time. Hence they are being evaluated separately. However, there are two components which overlap, Habitat (as part of 'managed area') and ecosystems.

In order to avoid repletion, the background to Habitat and Ecosystem is only given once, under UoA1, and then for UoA2 only the differences are evaluated and highlighted, as the rest is the same. The scoring tables are fully presented for each UoA.

## 8.1 UoA 1 Red King Crab

### 8.1.1 Red King Crab – background

The distribution expansion of RK crab is restricted within a certain area to the SE of the Barents Sea. Expansion westward (along the north western Norwegian coast) of the species is monitored and controlled by Norwegian fisheries regulations, whereby the fishers are encouraged to fish-out along the edges of the managed stock; expansion eastwards of the species is prevented by natural oceanographic limits, such as salinity and water temperature. Consequently, this limits the fishery within a certain contained area.

### 8.1.2 Catch profile

Catch composition data provided by the client was used to separate the species into Primary or Secondary species, as well as ETP species. Primary species are those which are managed (MSC Fisheries Standard v2.01 GSA3.1), i.e. species of commercial value with management tools controlling exploitation. Furthermore, Primary species are divided into 'main' and 'minor' groups. 'Main' are those species where the catch of that species comprises 5% or more by weight of the total catch of all species by the UoA; it is also 'Main' if the species is classified as 'less resilient' and the catch of that species comprises 2% or more by weight of the total catch of all species. Therefore, it is important that the total catch of all species by the UoA is known. All other primary species not considered 'main' shall be considered 'minor' species.

Secondary species include fish that are not managed according to reference points and all species that are out of scope of the standard (birds/ mammals/ reptiles/ amphibians). These 'out of scope' species, if they are not ETPs, are considered 'main' (whereby percentage thresholds apply – see MSC Fisheries Standard v2.01 SA3.4.1-5), unless they can be released alive (MSC Fisheries Standard v2.01 SA3.4.3). Once that has been established, those Secondary species within scope are assessed as to whether they are 'main' (catch percentage thresholds apply) or not.

Demersal fish by-catches in Russian king crab fisheries were evaluated from results obtained by scientific observers based on board Russian fishing vessels harvesting king crab in 2009, 2016, 2018 and 2019 in the Barents Sea. Species composition was analysed in 12,148 bottom trap catches in the king crab fishery. The work was carried out by researchers from PINRO (VNIRO/ PINRO, 2020)[12].

The algorithm for calculating the amount of demersal fish by-catch is straightforward and was previously used for the correction of Russian statistics on cod and haddock fisheries in the Barents Sea in 1990s (Shevelev et al., 1996 in VINRO/PINRO 2020). Using observers' data, the weight of demersal fish by-catch per trap in the king crab fishery was determined and the resulting value was extrapolated to the total number of traps deployed in the course of fishing.

All by-caught fish in the trap fisheries in 2009–2019 are demersal species, 14 demersal fish species were registered in by-catches of crustacean fisheries in 2009–2019, of which 11 ones are commercial species (Table 26). All by-caught fishes are abundant and their fishable stocks are in a satisfactory condition (VNIRO/PINRO 2020).

**Table 26: Bycatch presence / absence for demersal fish species in both crab fisheries from 2009-2019 (VNIRO/ PINRO 2020)**

| Species | Red King crab fishery | Snow crab fishery |
|---|---|---|
| Cod *Gadus morhua* | + | + |
| Haddock *Melanogrammus aeglefinus* | + | - |
| Deepwater redfish *Sebastes mentella* | + | - |
| Atlantic wolffish *Anarhichas lupus* | + | - |
| Spotted wolffish *Anarhichas minor* | + | + |
| Northern wolffish *Anarhichas denticulatus* | + | + |
| Greenland halibut *Reinhardtius Hippoglossoides* | + | + |
| American plaice *Hippoglossoides Platessoides* | - | + |
| European plaice *Pleuronectes platessa* | + | - |
| Thorny/starry ray *Amblyraja radiata* | + | + |
| Arctic skate *Amblyraja hyperborean* | - | + |
| Lumpfish *Cyclopterus lumpus* | + | - |
| Eelpout Lycodes sp. | - | + |
| Snailfish Careproctus sp. | - | + |

**Table 27: Demersal fish by-catches in the Russian king crab trap fishery in the Barents Sea in 2015–2020, tonnes; *up to 20th Sept 2020 (VNIRO/ PINRO 2020)**

| | 2015 | 2016 | 2017 | 2018 | 2019 | 2020* |
|---|---|---|---|---|---|---|
| RKC** | 6.381 | 8.300 | 9.285 | 9.187 | 9.836 | |
| Cod | 0.2 | 0.4 | 0.9 | 0.3 | 0.3 | 0.3 |
| Haddock | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Deepwater redfish | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Atlantic wolffish | <0.1 | 0.1 | 0.1 | <0.1 | <0.1 | <0.1 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Spotted wolffish | 0.4 | 0.8 | 1.9 | 0.5 | 0.6 | 0.6 |
| Northern Wolffish | <0.1 | 0.1 | 0.1 | <0.1 | <0.1 | <0.1 |
| Greenland halibut | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| European plaice | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Thorny/ starry ray | 0.1 | 0.1 | 0.3 | 0.1 | 0.1 | 0.1 |
| Lumpfish | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Total | 0.7 | 1.5 | 3.4 | 1.0 | 1.2 | 1.0 |

**The total catches (in tonnes) of Red King crab for the years 2015 to 2019 (2020 was not available), taken from report by Bakanev and Stesko, 2020 on the Red King crab for VNIRO. Internal report provided by Client as part of client information pack, Sept 2020.

From this it can be seen that the percentage bycatch of each of these species is minute, between 0.002% - 0.009%. According to the client (interview 14th Sept 2020), the catch composition in the Russian red king crab fishery is "practically 100% crab". Some bycatch, besides juvenile and female crabs (this is dealt with under the target species evaluation) does occur, however, and has been quantified to some extent by the client, in preparation for this assessment (and as provided in the VNIRO/PINRO 2020 report). The traps are positioned on the benthos beyond a depth of 100m, baited and thus attract those species which live near the benthos, commonly predatory species such as cod.

The catch profile information provided by the fishery under assessment did not give any information on non-fish bycatch. However, A study by PINRO (2015)[13] showed the kinds of species that may be attracted to the traps and brought up (Table 28). All are immediately released back into the sea.

**Table 28: Non-fish bycatch in the Red King crab fishery as part of a research project by PINRO (PINRO 2015)**

| **Species** | Quantity | Primary/ Secondary | Main/ minor |
|---|---|---|---|
| **Invertebrates:** | | | |
| Barents Sea Northern stone crab (*Lithodes maja*), | Occasional | Secondary | Minor |
| Lyre crabs (*Hyas areneus* and *Hyas coarctatus*) | 0.1 indiv / trap | Secondary | Minor |
| Iceland scallop (*Chlamys islandica*), | Occasional | Secondary | Minor |
| Sea urchin (*Strongylocentrotus droebachiensis*) | Occasional | Secondary | Minor |
| Sea anemone (*Hormathia digitata*). | NA | Not applicable | Not applicable |

### 8.1.3 Primary and Secondary species

The presence/absence and catch composition tables provided by the fishery under assessment were used to categorise the bycaught species into Primary, Secondary (Table 29).

**Table 29: Categorisation of catch composition data into Primary and Secondary Species**

| Species | Primary/ Secondary | Main/ Minor |
|---|---|---|
| Cod *Gadus morhua* | Primary | Minor |
| Haddock *Melanogrammus aeglefinus* | Primary | Minor |
| Deepwater redfish *Sebastes mentella* | Primary | Minor |
| Atlantic wolffish *Anarhichas lupus* | Secondary | Minor |
| Spotted wolffish *Anarhichas minor* | Secondary | Minor |
| Northern wolffish *Anarhichas denticulatus* | Secondary | Minor |
| Greenland halibut *Reinhardtius Hippoglossoides* | Primary | Minor |
| European plaice *Pleuronectes platessa* | Primary | Minor |
| Thorny/ Starry ray *Amblyraja radiata* | Secondary | Minor |
| Lumpfish *Cyclopterus lumpus* | Secondary | Minor |
| Herring *Clupea harengus* (bait) | Primary | Minor |
| Squid (bait) | Secondary | Minor |
| Cod (heads - bait) | Primary | Minor |

#### 8.1.3.1 Primary species information

**Table 30: ICES Advice for Primary Species (ICES.dk)**

| Species | Assessment Unit<br>ICES Area | $B_{lim}$ | MSY | Advisory Category | Stock status | ICES Advice<br>Year/ section |
|---|---|---|---|---|---|---|
| **Cod**<br>*Gadus morhua* | I + II | Y | Y | Analytical assessment | F above $F_{MSY}$; Full reproductive capacity | June 2020[14] |
| **Haddock**<br>*Melanogrammus aeglefinus* | I + II | Y | Y | Analytical assessment | F above $F_{MSY}$; Full reproductive capacity | June 2020[15] |
| **Beaked redfish**<br>*Sebastes mentella* | I + II | Y | Y | Analytical assessment | Full reproductive capacity | June 2020[16] |
| **Greenland halibut**<br>*Reinhardtius hippoglossoides* | I + II | Y | NA | Age length Gadget model | Stock at full reproductive capacity; no reference points for F; quota advice given | June 2019/<br>No update |
| **European Plaice**<br>*Pleuronectes platessa* | No stock assessment for I + II, as this is outside the range for plaice;<br>For North Sea, IV | Y | Y | Analytical assessment | The stock is harvested sustainably; it is at full reproductive capacity | June 2020[17] |
| **Herring** (bait)<br>*Clupea harengus* | NE Atlantic<br>Norwegian spring-spawning | Y | Y | Analytical assessment | The stock is at full reproductive capacity; F above MSY | Sept 2020[18] |

A small amount of European plaice (*Pleuronectes platessa*) was caught, however, the main distribution of this species is further south, there is limited distribution information of this species in the BS (IMR/PINRO ecosystem survey 2018). No stock defined in the BS. At this stage it is argued that European plaice is a Primary species following the analytical stock assessment in the North Sea, as an extension along the Norwegian coastline northwards. Although there is currently no stock structure for plaice in the Barents Sea (no ageing is done), they are recorded as part of the regular ecosystem surveys, and distribution maps and size distribution is available from these surveys (Bogstad pers comm. Site visit March 2020, on MSC Arkhangelsk Trawl fishery)

Herring and cod heads are used as bait (see detailed description of 'bait' in section 5.2.2.5). The bait species are assessed under 'Primary' species, as both herring and cod are managed species. Whether they are considered 'main' or 'minor' depends on the amount of bait used in relation to the overall catch of crab. The company estimates that about 450–500 tons of bait will be required to catch its quota of crabs in the Barents Sea for 2020, and this is combined for both crab species. Based on similar crab fisheries in the Barents Sea (Hønneland et al 2018) it is thought that the bait will be evaluated under the Primary 'minor' scoring issues.

Updated information (8$^{th}$ Dec 2020) from the client showed that bait use for the 2020 season was lower than anticipated:

| | Herring | Squid | Cod heads |
|---|---|---|---|
| Opilio fishery 2020 | 43.12t | 6.84t | - |
| Red King crab fishery | 77.55t | 27.39t | 5.63t |

Considering the small amounts of bait used compared to the overall crab catch (for either crab species), herring and cod-head bait are considered Primary minor.

#### 8.1.3.2 Secondary species

<u>Three species of wolffish</u>

Atlantic wolffish (*Anarhichas lupus*), Spotted wolffish (*Anarhichas minor*), and Northern wolffish (*Anarhichas denticulatus*) — are resident in the Barents Sea. The abundance and biomass of all three species is relatively low but they are all widely distributed throughout the Sea. Wolffish species may be regarded as vulnerable to over-exploitation. They are slow growing and long-lived fish that spawn late in life (5-8 yrs – fishbase.org). The relationship between recruitment and stock size index is poor. Furthermore, the male guards' large clusters of eggs deposited on the bottom until they hatch, which makes them vulnerable to bottom trawling. Data from the 2018 Ecosystem Survey of the Barents Sea (IMR-PINRO joint report series 2019) suggest that Atlantic and Spotted wolffish are most abundant in shallower waters (50-150m) while Northern wolffish is found between 200 and 400m.

*Status*. There is no ICES assessment for Northern wolffish (nor for the other two wolffish species found in the Barents Sea. Biomass trends are available, up to 2017 (Figure 27 and Table 31), with more recent distribution patterns (Figure 28) provided by the IMR/PINRO ecosystem survey 2018.

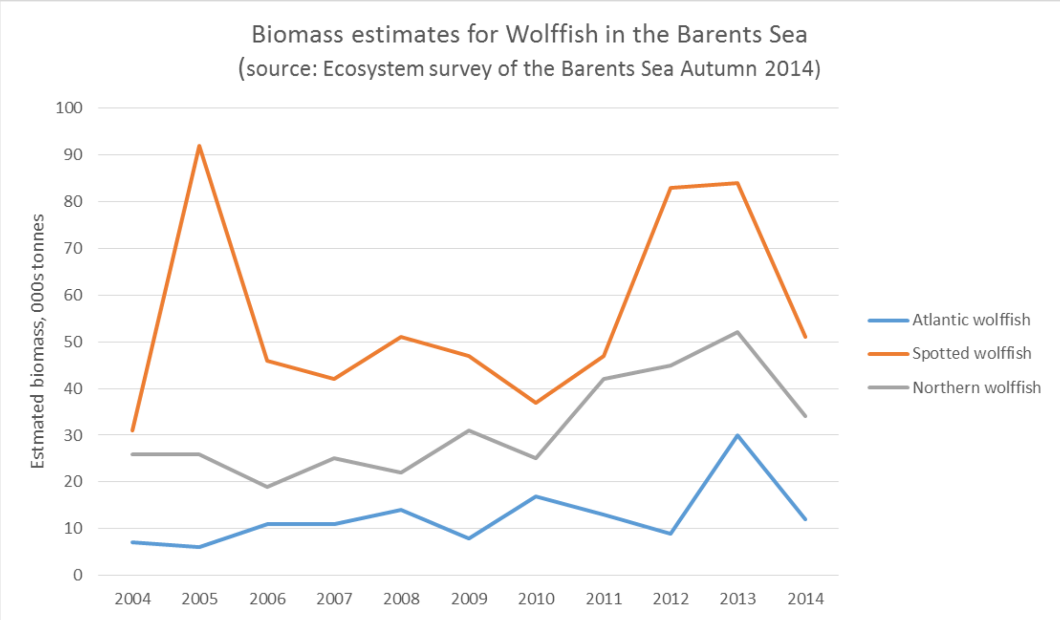



**Figure 27: Biomass estimates for Wolffish in the Barents Sea (IMR/PINRO 2014)**

**Table 31: Extract from IMR/PINRO ecosystem survey 2018: *Abundance (N, million individuals) and biomass (B, thousand tonnes) of the main demersal fish species in the Barents Sea (not including 0-group) – just showing wolffish species here***

| Species | | Year | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016* | 2017 |
| Atlantic wolffish | N | 26 | 42 | 25 | 20 | 17 | 20 | 22 | 27 | 12 | 33 | 40 | 30 |
| | B | 11 | 11 | 14 | 8 | 17 | 13 | 9 | 30 | 12 | 37 | 24 | 29 |
| Spotted wolffish | N | 12 | 12 | 13 | 9 | 7 | 9 | 13 | 13 | 8 | 12 | 13 | 14 |
| | B | 46 | 42 | 51 | 47 | 37 | 47 | 83 | 84 | 51 | 86 | 40 | 63 |
| Northern wolffish | N | 2 | 3 | 3 | 3 | 3 | 6 | 8 | 12 | 6 | 9 | 8 | 8 |
| | B | 19 | 25 | 22 | 31 | 25 | 42 | 45 | 52 | 34 | 63 | 51 | 63 |

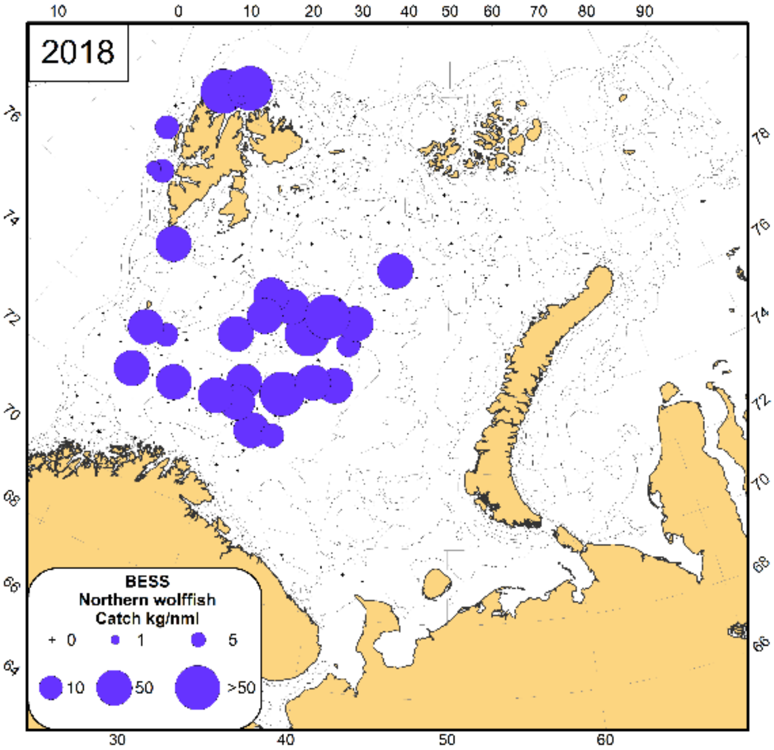



**Figure 28:** **Distribution of northern wolffish (*Anarhichas denticulatus),* August-October 2018 (Source: IMR/PINRO 2018)**

The ecosystem survey (IMR/ PINRO 2018) concluded that the distribution and biomass of Northern Wolffish has changed little over the last few years.

Management of wolffish species at regional level is limited. Russian fishing regulations for the Northern Basin (RUS EEZ/ Barents Sea) stipulate by-catch limits of 45% of total catch in 1 haul, and max. 45% of landed catch. Given the availability of high-quality catch data, it should be possible to improve the understanding of the interactions between the trawl fleet and these wolffish species, including improved stock assessments (ICES WGIBAR 2018).

Lumpfish *Cyclopterus lumpus*: Information on the stock in the Barents Sea is available from long-term monitoring surveys conducted between August and September since 1980. Investigations show that lumpfish is widely distributed in the pelagic waters of the Barents Sea. Relative biomass and abundance indices were calculated for the period 1980–2012. In the Barents Sea, mature fish migrate from offshore areas to spawning areas along the coast during late winter and early spring (February– May). Lumpfish spawn in shallow water, mainly along the Nordland, Troms and Finnmark, and Murman coasts. After fertilization, eggs are guarded and cared for by males until hatching. The incubation period decreases when temperature increases. A commercial fishery for lumpfish in the northern part of Norway has existed since the 1950s. Mature females are mainly caught in the spawning grounds with gillnets and small vessels. The fishery is based on the catch of pre-spawned fish and is, therefore, highly seasonal: generally, 5–6 weeks from April to mid-June. Today, the Russian coastal fishery in the Barents Sea and the White Sea is relatively low, with the total amount usually lower than 15–50 t annually (Eriksen et al 2014[19]).

Thorny Skate (*Amblyraja radiata*): The IUCN Red list European regional assessment (Dec 2014) for Thorny skate gives it a Least Concern (LC) status. Thorny (or Starry) skate is found in the Northeast Atlantic at depths of 18–1,400 m, but is most common from 27–439 m. This species is common in the northern region of the Northeast Atlantic. It is the most abundant skate species in the Barents Sea, where it is a common bycatch species of demersal fisheries. It reaches first maturity at a relatively small size (44 cm total length) and demographic modelling suggests it is less susceptible to fishing mortality in this region than larger skate species. For these reasons Thorny Skate is assessed as Least Concern in European waters (https://www.iucnredlist.org/species/161542/48945123#assessment-information; accessed 10th Nov 2020).

The IMR-PINRO Barents Sea ecosystem survey conducted in 2018 (IMR-PINRO 2019) presented a distribution map of the species (Figure 29).

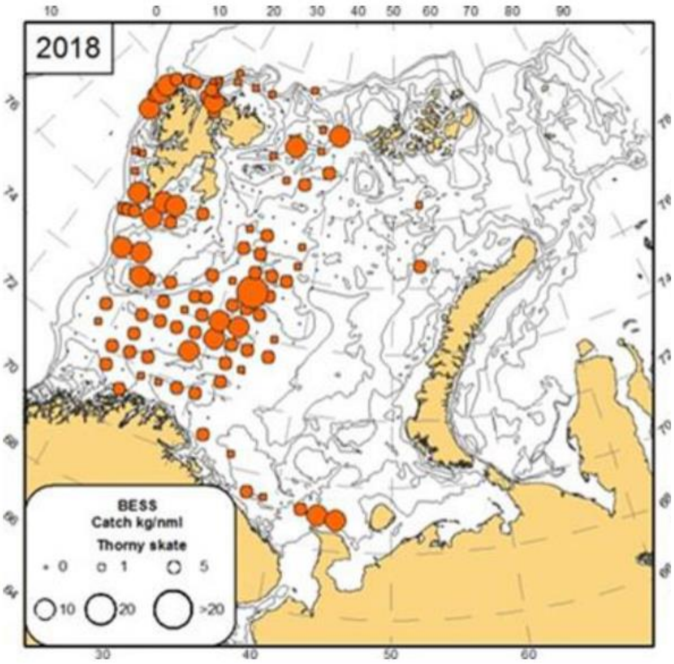



**Figure 29: Distribution of thorny skate (*Amblyraja radiata*) and Arctic skate (*Amblyraja hyperborea*), August-October 2018 (IMR-PINRO ecosystem survey report 2019)**

In the survey, Thorny skate was widely distributed in the Norwegian Zone, from the southwest to the northwest where warm Atlantic and Coastal waters dominate. According to ICES WGEF (2017) it is widely distributed and the most common skate species in Barents Sea.

<u>Squid</u>: the squid is used as bait. It is purchased from Norway and Chile via a supplier.

There are records of invertebrate bycatch in the report produced by VNIRO/PINRO 2020. The following is information taken from a previous PINRO (2015) study on RKC bycatch (see also Table 28)

<u>Lyre crabs</u>: According to PINRO (2015), bycatch of *Hyas* sp. in the red king crab fishery does not exceed 0.1 crabs per trap. This crab species is considerably smaller than red king crabs and can thus escape the traps, which have a standard mesh size of 70mm. They are also washed through the mesh when the trap is lifted. Large individuals with a carapace width of 50-70mm are found more frequently in the bycatch. Catches of *Hyas* sp are reported to increase when catches of red king crab decrease. Lyre crabs are harvested at depths of 50-80m throughout the entire fishing period.

Other bycatch species are sporadically and occasionally recorded in the trap catches, see listing in Table 28. It should be noted here, that bycatch species and red king crab captured in the same trap are capable of inflicting injuries on each other. Greenland halibut and tusk were reported to be greatly injured by red king crabs. Wolffishes, by contrast, injure crabs that have been already captured in the trap and prevent new crabs from entering the trap. During the fishing process the bycatch is brought aboard the vessel alive. Generally, the fish bycatch captured by traps is either consumed by the crew or returned to the sea, after having been recorded in the case of commercial species. All by-caught benthic organisms, which are not attractive in terms of consumption for the crew, are returned alive to the sea. Due to the short exposure time onboard the fishing vessel during trap catch sorting operations, benthic organisms generally tend to fully maintain their vitality, and, once returned to the sea, survive (PINRO, 2017).

### 8.1.4 ETP

Endangered, Threatened or Protected species are classified based on the following criteria:

- Species that are recognised by national ETP legislation

- Species listed in the binding international agreements given below:

- Appendix 1 of the Convention on International Trade in Endangered Species (CITES), unless it can be shown that the particular stock of the CITES listed species impacted by the UoA under assessment is not endangered.

- Binding agreements concluded under the Convention on Migratory Species (CMS), including:

  i. Annex 1 of the Agreement on Conservation of Albatross and Petrels (ACAP);

  ii. Table 1 Column A of the African-Eurasian Migratory Waterbird Agreement (AEWA);

  iii. Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas (ASCOBANS);

  iv. Annex 1, Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area (ACCOBAMS);

  v. Wadden Sea Seals Agreement;

  vi. Any other binding agreements that list relevant ETP species concluded under this Convention.

- Species classified as ‘out-of scope’ (amphibians, reptiles, birds and mammals) that are listed in the IUCN Redlist as vulnerable (VU), endangered (EN) or critically endangered (CE).

Specifically, to this RKcrab fishery, ETP are species recognised by national legislation and/or binding international agreements to which Russia is a party to. Russia is a signatory to a number of conventions on species protection and management, notably the Convention on Biological Diversity and the Convention on International Trade in Endangered Species (CITES). Russia has compiled a “red-list” based on IUCN criteria, with 5 status levels ranging from regionally extinct to near threatened, plus a “data deficient” category. The existing Russian Red Data Book is used in parallel with the IUCN system (see outcome of workshop in the autumn of 2014: An international workshop on Methods of Assessment of Status of the Threatened species for the Barents Region Red Data books based on IUCN criteria[20]). The following section outlines the evaluation on what kinds of ETP species may be encountered in the Barents Sea, and interacting with the fishery, if at all.

#### 8.1.4.1 Marine mammals

The Barents Sea is an important area for Marine mammals. The PINRO / IMR Joint Ecosystem work (IMR-PINRO joint ecosystem report 2019) concludes that the most common marine mammal in the Barents Sea is the white-beaked dolphin (*Lagenorhynchus albirostris* – IUCN Least Concern). The following two figures provide a broad distribution overview of toothed and baleen whales as mapped out by the IMR-PINRO 2018 ecosystem survey.

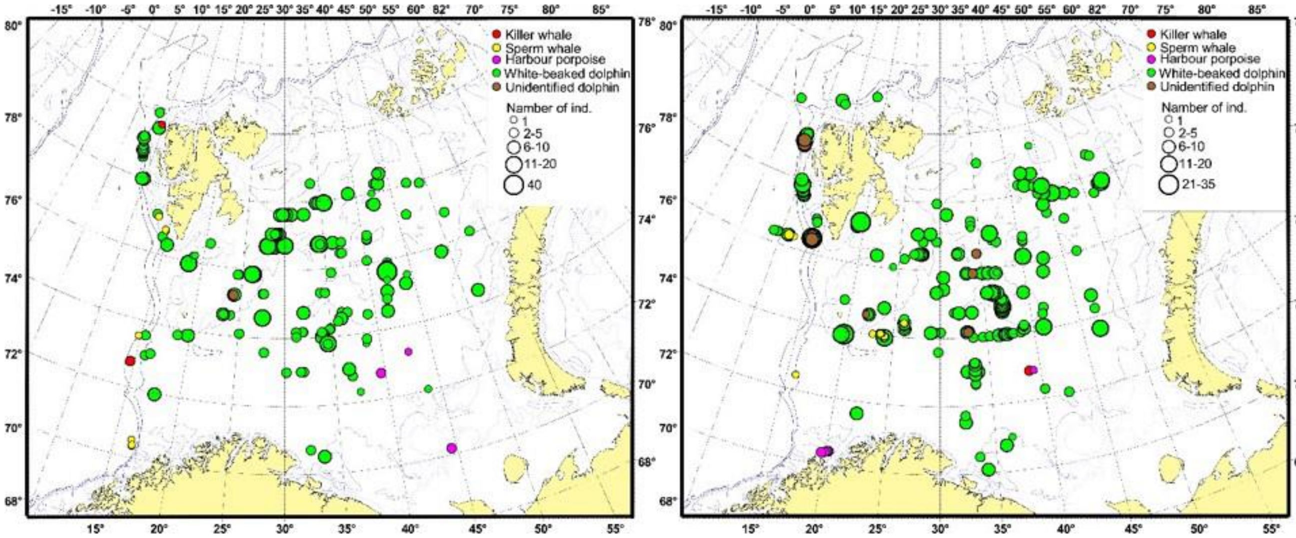



**Figure 30: Distribution of toothed whales in August-October: 2017 (left) and 2018 (right). (Source IMR-PINRO ecosystem survey 2019[21])**

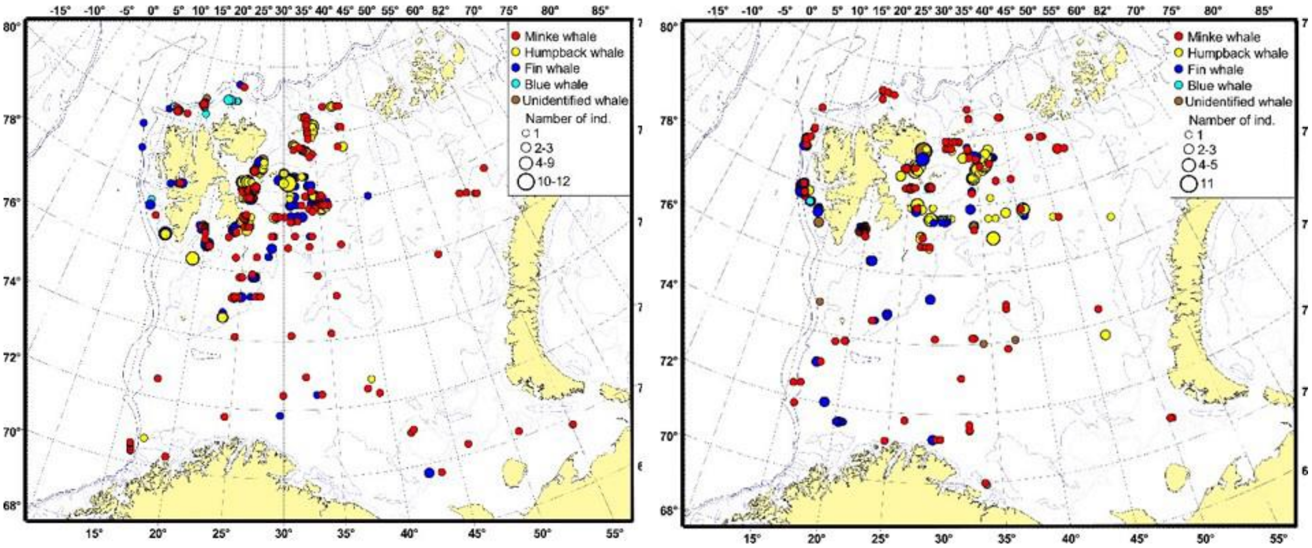



**Figure 31: Distribution of baleen whales in August-October: 2017 (left) and 2018 (right). (Source IMR-PINRO ecosystem survey 2019)**

The following table (Table 32) provides an overview of the relevant marine mammals discussed in that ecosystem report. It should be noted, however, that there is a broad range of uncertainty levels in the assessments of abundance of marine mammal population in the Barents Region: some populations have been assessed recently and completely (E); while many estimates represent partial estimates by region that have been extrapolated to the whole Barents Sea (providing a reasonable estimate); in some cases there is little or no available abundance data – so the numbers presented represent educated guesses based on sighting records or other non-quantitative estimators. Harp and hooded seals “step-out” of the Barents Sea for breeding, and in the case of the latter species, some post-breeding, pre-moulting foraging expeditions as well – but some of the population(s) spend much of the year in the Barents Region.

**Table 32:** **Residency status and abundance of marine mammals in the Barents Sea Region (Source: Barentsportal webpage, Marine Mammals of the Barents Sea (2017)[22]; (**E=assessed recently and completely; reasonable =?; somewhat uncertain=??; best guess, little or no abundance data = ???)

| Common Name *Genus species* | Residency status | Abundance | Uncertainty* level |
|---|---|---|---|
| Polar bear *Ursus maritimus* | Year-round resident | 2650 (95% CI: 1900–3600)[1] | E |
| Walrus *Odobenus rosmarus* | Year-round resident | 12000 (Sval. – 3886 - 95% CI: 3553-4262)[2a] Franz Josef Land thought to be similar to Svalbard (not surveyed). (Pechora Sea – 3943 – CI 3605-4325)[2b] | ? |
| Ringed seal *Pusa hispida* | Year-round resident | 100000 (Sval. partial - 7585 - 95% CI: 6332–9085)[3a] White Sea 20000[3b] | ?? |
| Bearded seal *Erignathus barbatus* | Year-round resident | Northern Barents Sea ~10,000 White Sea ~ 6000 | ?? |
| Harp seal *Pagophilus groenlandicus* | Year-round resident* | 1368200 (95% CO: 1226300-1509378 - Barents Sea stock)[4a] 627410 (95% CI: 470540-786280; Greenland Sea stock)[4b] | E |
| Hooded seal *Cystophora cristata* | Year-round resident* | 84020 (95% CI: 68060-99980)[4c] | E |
| Grey seal *Halichoerus grypus* | Year-round resident | 2000 Troms-Finnmark[5] 3500 Murman coast[5] | E |
| Harbour seal *Phoca vitulina* | Year-round resident | 3,500 (Sval. ~1800, CI range 1300-4418[6], Troms & Finmark 1967[7], 400-500 Murman Coast [8a], White Sea - unknown numbers[8b]) | E/? |
| Bowhead whale *Balaenoptera acutorostra* | Year-round resident | Some hundreds[11] | ?? |
| White whale (beluga) *Delphinapterus leucas* | Year-round resident | 10000 | ??? |
| Narwhal *Monodon monoceros* | Year-round resident | 1000 | ??? |
| White-beaked dolphin | Year-round resident | 60000-70000[15] | ?? |

The North Atlantic Marine Mammal Commission (NAMMCO) provides a mechanism for cooperation on conservation and management for all species of cetaceans (whales and dolphins) and pinnipeds (seals and walruses) in the region, many of which have not before been covered by such an international agreement. Although Russia is not a member of NAMMCO it does cooperate as a partner on projects and is an observer at the annual meetings. PINRO is actively involved in the Trans - North Atlantic Sightings Survey (TNASS), to estimate the summer distribution and absolute abundance of cetacean populations in the North Atlantic.

### 8.1.4.2 Protection Status of Marine Mammals

According to the IUCN Red List, several marine mammal species in the Barents Sea are threatened (Table 33). The Red Book of the Russian Federation, Murmansk region[23] (as accessed 18 Oct 2020), lists 3 marine mammal species – Harbour Seal (LC), Grey Seal (LC) and Walrus (VU).

**Table 33: Protection status of marine mammals resident in Barents Sea (Source PINRO/IMR Joint Ecosystem report 2014, IUCN site accessed 10 Nov 2020; CITES site accessed 10 Nov 2020)**

| Species | IUCN status | CITES | Comment |
|---|---|---|---|
| White-beaked dolphin *Lagenorhynchus albirostris* | LC | | Most common in Barents Sea |
| Harbour porpoise *Phocoena phocoena* | LC | | |
| Minke *Balaenoptera acutorostrata* | LC | Appendix I | Numerous |
| Fin whales *Balaenoptera physalus* | EN | Appendix I | Numerous |
| Sei whale *Balaenoptera borealis* | EN | Appendix I | Rare |
| Blue whale *Balaenoptera musculus* | EN | Appendix I | Rare - visitor |
| Bowhead whale *Balaena mysticetus* | LC | Appendix I | |
| Narwhal *Monodon monoceros* | LC | | |
| Beluga whale *Delphinapterus leucas* | LC | | |
| Harp seal *Pagophilus groenlandicus* | LC | | |
| Ringed Seal *Pusa hispida* | LC | | |
| Walrus *Odobenus rosmarus* | VU | | Red List VU |
| Bearded Seal *Erignathus barbatus* | LC | | |
| Hooded Seal *Cystophora cristata* | VU | | |
| Grey Seal *Halichoerus grypus* | LC | | Red List LC |
| Harbour Seal *Phoca vitulina* | LC | | Red List LC |
| Polar Bear *Ursus maritimus* | VU | | |

The anthropogenic factors that are thought to be most harmful for marine mammals are fisheries interactions, pollution and climate warming. The latter phenomenon is a particularly acute problem in the Arctic, and it is a serious threat factor for all ice-associated marine mammals[24].

Although Harp seals are sometimes taken in Barents Sea trawl fisheries, encounters with other fisheries are thought to be rare, and no interactions have been recorded for trap fisheries. Specifically, no interactions have been recorded for the trap fisheries under assessment, and no reports of interactions of this fishery with marine mammals have been noted. For the 2020 observer season, the fishery under assessment specifically requested the PINRO/ VNIRO observers to record any interaction with marine mammals. No interactions were registered (Client information, 8th Dec 2020).

#### 8.1.4.3 Elasmobranchs

According to the ICES Barents Sea ecosystem survey (ICES BS ecosystem 2019[25]) elasmobranchs may occur as bycatch in demersal fisheries, but rarely in trap fisheries. The most abundant skate in the area is the starry ray (also known as thorny skate), which is widespread in the Barents Sea and adjacent waters. Since 2010, all dead or dying skates and other fish in the catches should be landed, whereas live specimens can be discarded as they may survive. Sharks can also be taken as bycatch in the demersal fisheries, but no official records were available for trap fisheries (ICES BS ecosystem survey 2019).

None of the elasmobranchs species occurring in the Barents Sea are protected by CITES. IUCN status is available for several species occurring in the Barents Sea (Table 34). However, IUCN status alone does not qualify as ETP status (see MSC Fisheries Standard v2.01 SA3.1.5), but can be used as an indicator regarding the Russian red list, where the IUCN system is applied.

According to client information (8th Dec 2020) skates by-catch is rarely recorded in the crab fisheries. It is mandatory, as part of the fishing rules, that any bycaught rays and skates have to be returned to the sea immediately.

**Table 34: Elasmobranchs occurring in the Barents Sea with possible interaction with the fishery (IUCN site accessed 10 Nov 2020). Blue boxed species found in catch composition 2019 based on observer report.**

| Species | IUCN status | Comment |
|---|---|---|
| Flapper / blue skate<br>*Dipturus batis* | CR | Norwegian and Russian Red List<br>the Barents Sea is at the edge of its range |
| Porbeagle<br>*Lamna nasus* | CR[26] | Norwegian and Russian Red List<br>CITES App II<br>CMS App II, migratory species conserved through agreements |
| Spiny dogfish<br>*Squalus acanthias* | VU | Russian Red List VU |

Elasmobranchs **not** designated as ETPs, based on MSC criteria:

| | | |
|---|---|---|
| Arctic skate<br>*Amblyraja hyperborea* | LC | |
| Spinytail skate<br>*Bathyraja spinicauda* | NT | Listed in catch composition 2018; Generally, the stock appears to be relatively stable in terms of biomass and number of individuals, ICES WGEF 2018 |
| Starry/Thorny skate<br>*Amblyraja radiata* | LC | According to ICES WGEF (2017) widely distributed and most common skate species in BS (see Section 8.1.3.2 for detail); LC for Europe, assessed 2014 |
| Greenland shark<br>*Somniosus microcephalus* | NT[27] | Listed in catch composition 2019, recorded and released live. Norwegian Red List – Data Deficient [28]; it is not listed on the Russian Red List |

The IUCN system is used in parallel with the existing Russian Red Data Book (see outcome of workshop in the autumn of 2014: An international workshop on Methods of Assessment of Status of the Threatened species for the Barents Region Red Data books based on IUCN criteria[29]).

#### 8.1.4.4 Seabirds

Barents portal Status reports provide regular updates on seabird surveys (barentsportal.org) Several of the seabird populations in the Barents Sea region are of international importance. The summer population comprises around 20-25 million seabirds (more than 40 species) that harvest approximately 1.2 million tonnes of biomass annually. Major concentrations of breeding seabirds (more than 80%) are located on the Norwegian mainland, Novaya Zemlya and Svalbard. The most numerous species are the Brünnich´s guillemot *Uria lomvia*, little auk *Alle alle*, Atlantic puffin *Fratercula arctica*, black-legged kittiwake *Rissa tridactyla*, northern fulmar *Fulmarus glacialis* and common eider *Somateria mollissima*. An important part of the global breeding population of the rare Ivory gull *Pagophila eburnea* is found within the northern part of the region - in Svalbard and Franz Josef Land. Among more than 30 seabird species breeding and wintering in the Barents Sea region, there are seven Red-listed species. Major threats likely limiting population development of the Red-listed seabird species are: (i) - fisheries (competition for the resources and by-catch in gill-nets); (ii) - environmental deterioration (pollution, habitat destruction and disturbance); (iii) - climate change.[30]

Seabirds play a significant role in transferring nutrients from sea to land and from North to South. Fisheries may impact seabird populations directly through bycatch of seabirds in fishing equipment; or indirectly, through competition for the same food sources. According to regular Barents Sea status updates (see barentportal.com) many species are currently in decline, especially in the south of the Barents Sea, for reasons which are unclear. Decline is especially serious in the case of common guillemot and black-legged kittiwake in the Southern Parts of the Barents Sea and Brünnich's guillemot and kittiwake in the north. The trap fisheries are not implicated in this decline, though historic coastal gill-netting may have been a problem (barentsportal.com Status report 2019).

Several types of interaction with red-listed seabirds may take place:

- Aggregations of seabirds exploiting fish waste
- Capture of diving seabirds during hauling of traps
- Indirect impacts through reduction of food resources

Although birds could become entrapped in traps, such encounters have not been recorded, and even for deep water trawling operations this is now considered to be relatively rare (Grekov and Pavlenko 2011; ICES AFWG 2012). The seabirds could interact with trap fishers during recovery at water surface, but are more likely to benefit from spilled or waste fish than be adversely affected. Research by the Norwegian Institute for Nature Research (NINA) and the Institute of Marine Research in Norway suggests that most of the fisheries have a minor impact on bird mortality (ICES AFWG 2014), and those impacts that do occur are primarily attributable to gillnet fisheries. Furthermore, there are significant monitoring initiatives related to seabirds and it is likely that any emerging and significant negative interactions with fisheries will be flagged. For example, SEAPOP[31] is a mapping and monitoring programme for seabird populations in Norwegian waters. It focuses particularly on the collection of data that make it possible to model the effects of human activity and distinguish between these and natural variations.

No evidence or reports were provided to the assessment team that the red crab fishery has an impact on seabird ETP species. The fishery is conducted 12nm offshore, and at a depth below 100m, thus out of reach of diving seabirds.

It should also be pointed out that none of the invertebrates recorded in the red king crab catch composition compiled by PINRO (2015) (Table 28) are listed on any of the lists / Red Data Books mentioned above.

## 8.1.5 Habitat

When assessing the status of habitats and the impacts of fishing, teams are required to consider the full area managed by the local, regional, national, or international governance body(s) responsible for fisheries management in the area(s) where the UoA operates (the "managed area" for short) (SA3.13.5, MSC 2014). The MSC also specifies that the team shall use available information (e.g. bioregional information) to determine the range and distribution of the habitat under consideration, and whether this distribution is entirely within the 'managed area' or extends beyond the 'managed area' (SA3.13.5.1, MSC 2014). The UoA fishing area is restricted to the SE part of the Barents Sea, entirely within the Russian EEZ. Using the MSC definition of "the managed area" it would be expected that the audit team considers all habitats within the Barents Sea. It is not reasonable to consider the entire range of habitat(s) across the total area; therefore, the audit team have scaled down the "managed area" and in this assessment only consider habitats within the SE Barents Sea. The habitats elements scored are described below and summarised in Section 8.1.5.

### 8.1.5.1 Benthic habitats maps

Mapping of the benthic habitats in the Barents Sea has been undertaken over many years and is on-going under several national and international programmes (MAREANO programme; Joint Russian Norwegian Ecosystem Assessment – Barents Portal; Spiridinov et al 2011; Larsen et al 2003; ICES WGIBAR 2017; PINRO 2018). There is an increasing body of information available, of high enough resolution, to allow better decision-making regarding where to fish and where to protect vulnerable habitats. Areas of high biodiversity value/vulnerability continue to be identified (PINRO 2018 - sponge and coral surveys; ICES WGIBAR 2017) as part of ongoing collaborative work between PINRO and IMR (IMR/PINRO 2019[32]).

Although the MAREANO program was established initially (in 2005) to map the Norwegian EEZ seafloor along the coast of the Norwegian mainland, in recent years the program has been extended to transects northwards from the Norwegian coastline and to areas around Svalbard (Figure 32). More information on the MAREANO program and details of the sampling stations can be found on the MAREANO website (http://www.mareano.no/kart/mareano_en.html#maps/4050).

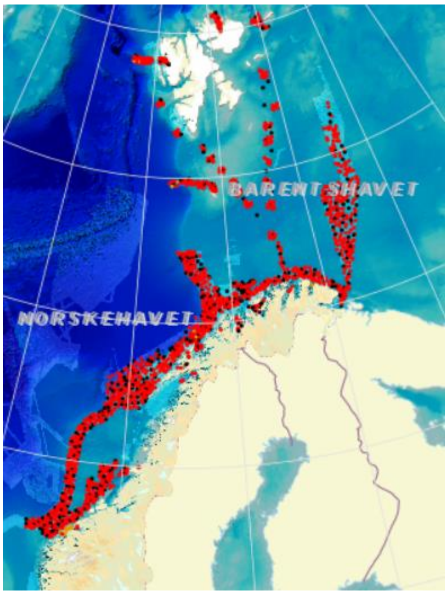



**Figure 32:** **Survey reference stations of the MAREANO program** (Source: http://www.mareano.no/kart/mareano_en.html#maps/4050)

A detailed sediment map of the Barents Sea provides an understanding of the underlying substrate of any benthic community encountered (Figure 33).

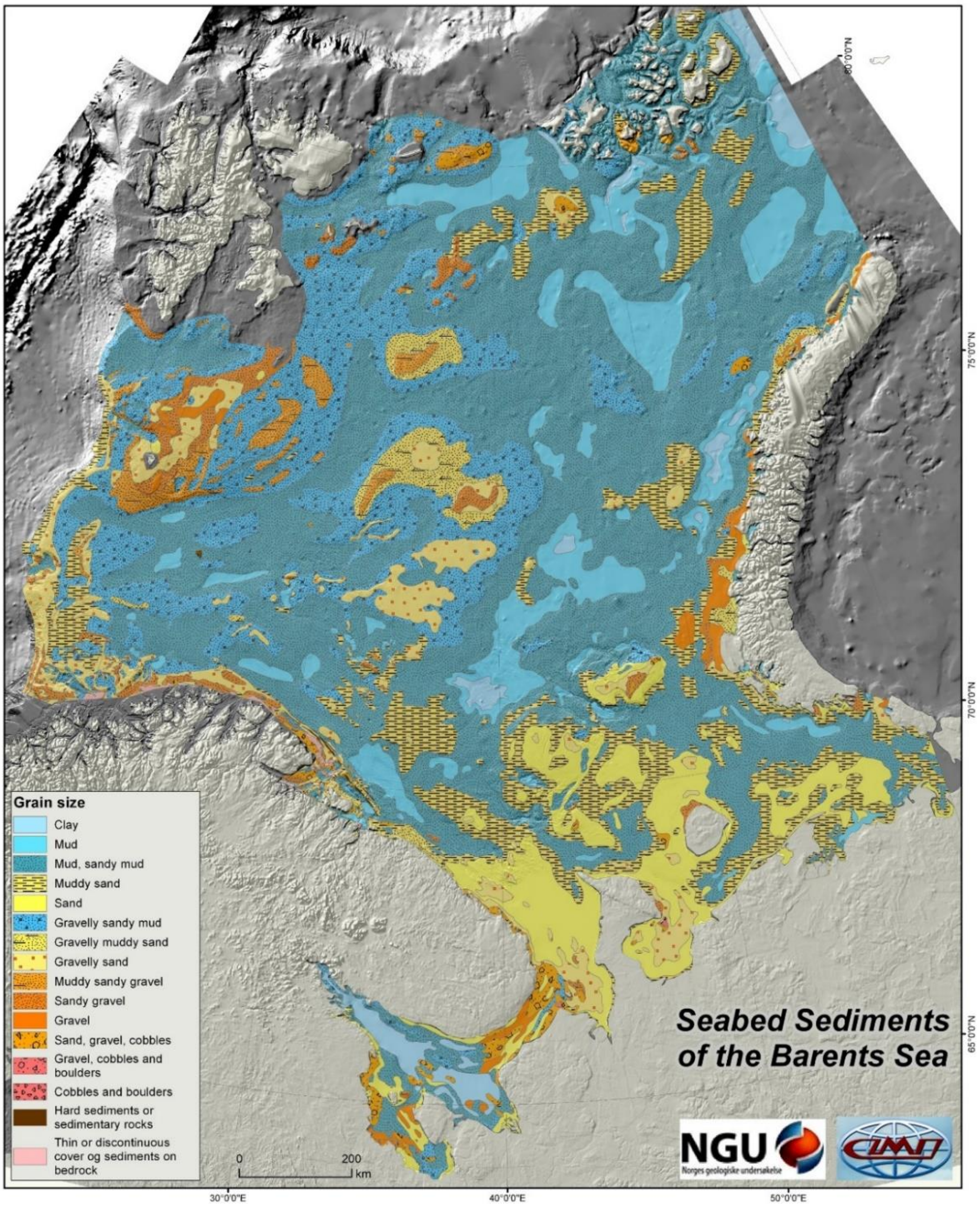



**Figure 33: Seabed sediments of the Barents Sea (Source: https://www.ngu.no/en/news/new-seabed-sediment-map-barents-sea, published 2019)**

As more detail on the benthos becomes available, areas can be mapped into broad biotopes. Biotopes are characteristic combinations of species and environment and are one component of seabed habitat mapping. Biological sampling stations across the Barents Sea have been surveyed annually by IMR and PINRO on the joint Norwegian-Russian Ecosystem Survey (IMR/PINRO 2019). Benthic fauna biomass data from bottom-trawl samples were arranged into faunal groups and a set of these groups was used as the basis for the biotope classes used here in predictive modelling (see Figure 34)**.** The relationship of these biotope classes to the physical environment was analysed and selected full coverage physical data (sediment grain size, bathymetry and oceanographic parameters) were used to create a model and to predict the distribution of biotopes across the entire study area. This biotope map, covering the entire Barents Sea, has been compiled in collaboration between the Geological Survey of Norway, the Norwegian Institute of Marine

Research (IMR) and the Russian Polar Research Institute of Marine Fisheries and Oceanography (PINRO) in the frame of the Norwegian-Russian Environmental Commission Workplan for 2011-2013 and 2013-2015 (Dolan et al 2015).

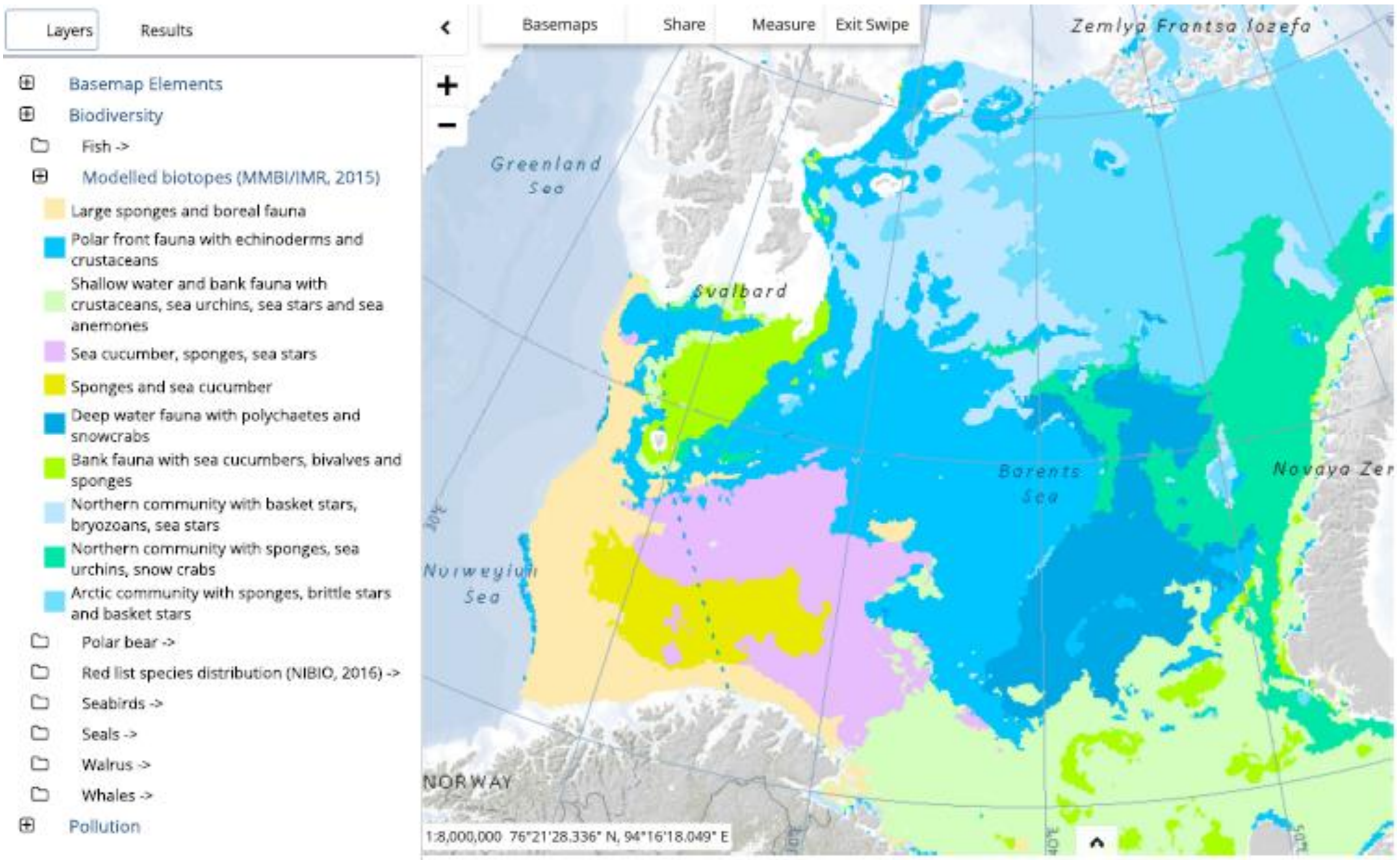
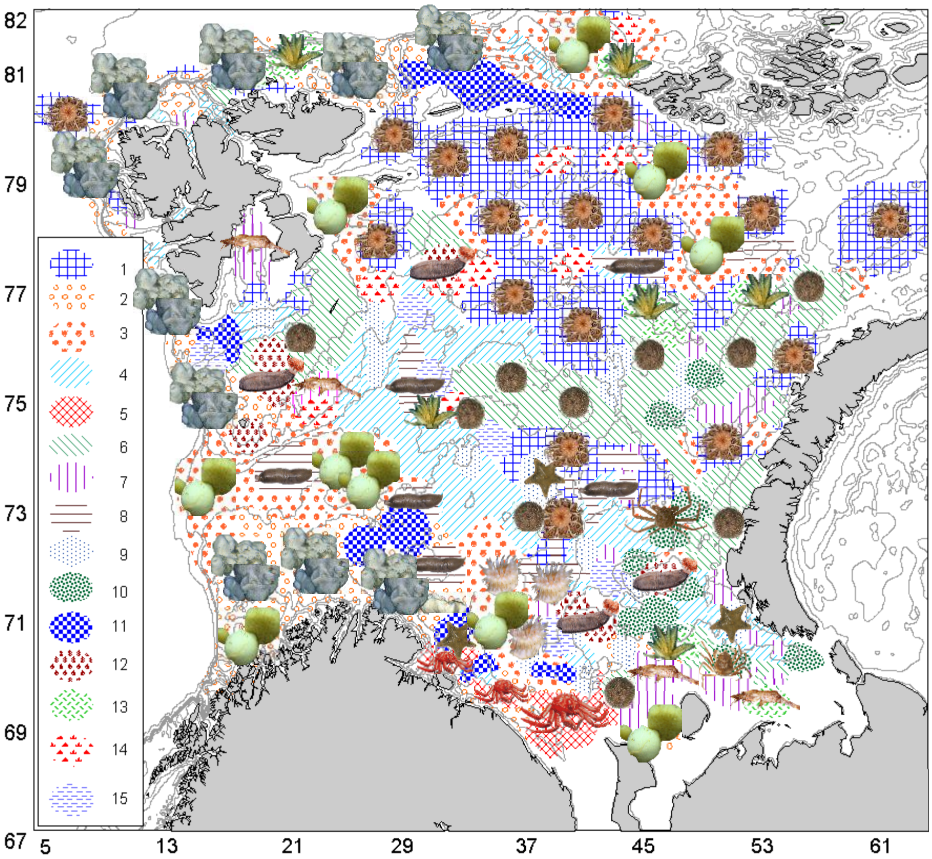



**Figure 34:** **Barents portal map showing the broad scale distribution of Barents Sea biotopes (Source: Dolan et al 2015)**

The biotope maps (Figure 34 and Figure 35) build on surveys of habitat types in the Barents Sea; it illustrates in visual detail that there are aggregations of large, non-mobile, long-living habitat-forming species, in particular large deep sea sponges (*Geodia* spp & *Stelletta* spp, *Tethya citrina*, *Thenea muricata*), mussel beds (*Modiolus modiolus*) and some reef species such as Zooanthidae and *Drifa glomerata*. Such deepsea communities serve as breeding, spawning and nursery areas for many fish species, and provide vital habitat for a variety of species (Anisimova et al 2010).




Legend: 1 - *Gorgonocephalus* spp., 2 - *Geodia* spp., 3 - *Spongia* g. Spp., 4 - *Ctenodiscus crispatus*, 5 - *Paralithodes camtschaticus*, 6 - *Strongylocentrotus* spp., 7 - *Sabinea septemcarinata*, 8 -*Molpadia* spp., 9 - *Urasterias linckii*, 10 - *Chionoecetes opilio*, 11 - *Hippasteria phrygiana*, 12 - *Cucumaria frondosa*, 13 - Sclerocrangon spp., 14 - Crinoidea g. spp., 15 -*Icasteriaspanopla*

**Figure 35: Areas with various dominant representatives of mega-zoobenthos in the Barents Sea in 2006-2011 (Source: Anisimova et al., 2010)**

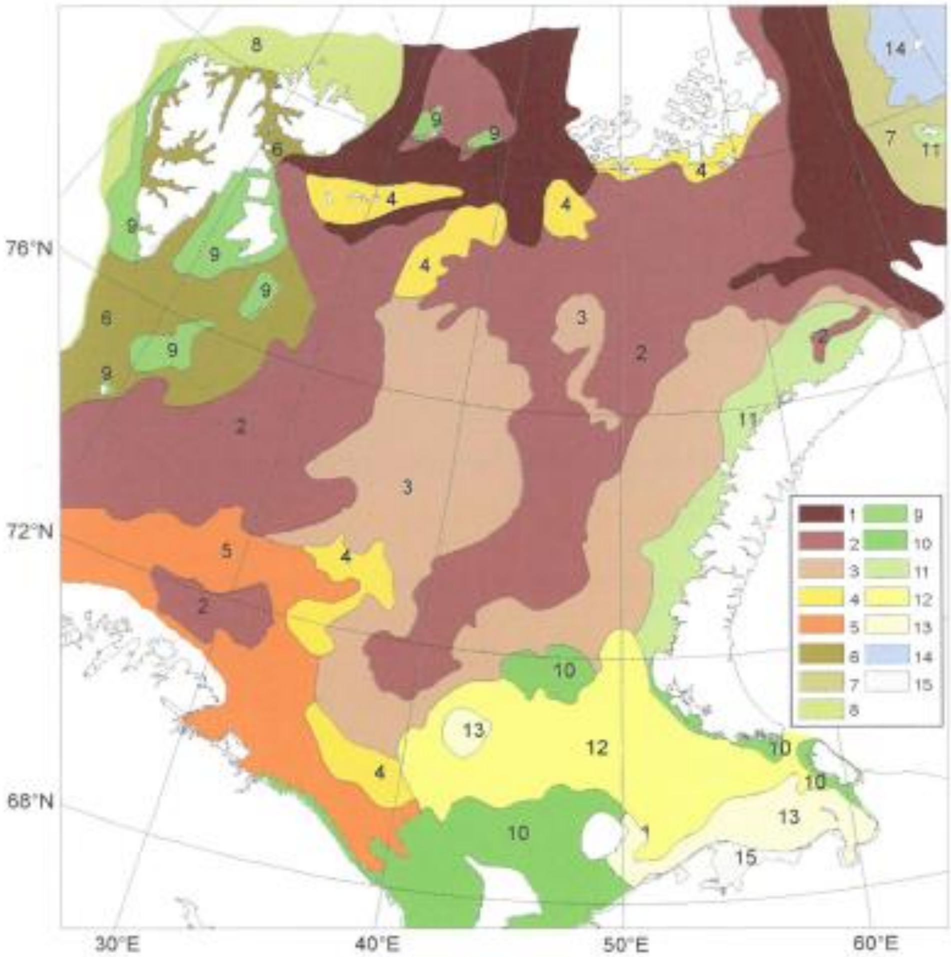



**Figure 4.1.8.** Distribution of benthic communities in the Barents Sea based on data from grab samples in 1991–1994 (after Kulakov *et al.* 2005). Community: 1 – *Ophiopleura borealis* + *Hormosina globulifera*; 2 – Polychaeta + Sipunculoidea (*Golfingia* spp.); 3 – *Trochostoma* spp.; 4 – *Elliptica elliptica* + *Astarte crenata*; 5 – *Brisaster fragilis*; 6 – soft-bottom community adjacent to Svalbard (Spitsbergen); 7 – community of St. Anna Trough slopes; 8 – *Strongylocentrotus* spp. + *Ophiopholis aculeata*; 9 – shallow-water coastal community of sessile filter-feeders adjacent to Svalbard (Spitsbergen); 10 – shallow-water coastal community of sessile filter-feeders on *Lithothamnion* spp.; 11 – shallow-water coastal community adjacent to western coast of Novaya Zemlya and Vise Island; 12 – *Astarte borealis*; 13 – *Clinocardium ciliatum* + *Macoma calcarea* + *Serripes groenlandicus*; 14 – community of bivalves adjacent to Ushakov Island; 15 – *Macoma balthica*.

**Figure 36: Distribution of benthos communities in the Barents Sea (Source: Jakobsen T., Ozhigin V., 2011)**

The IMR/PINRO ecosystem survey conducted in 2018 (IMR/PINRO 2019) recorded a total of 574 invertebrate taxa (404 identified to species level). The most diverse groups in the scientific survey trawl catches in 2018 were Mollusca (132 taxa), Arthropoda (98 taxa) and Cnidaria (81 taxa) (Figure 37).

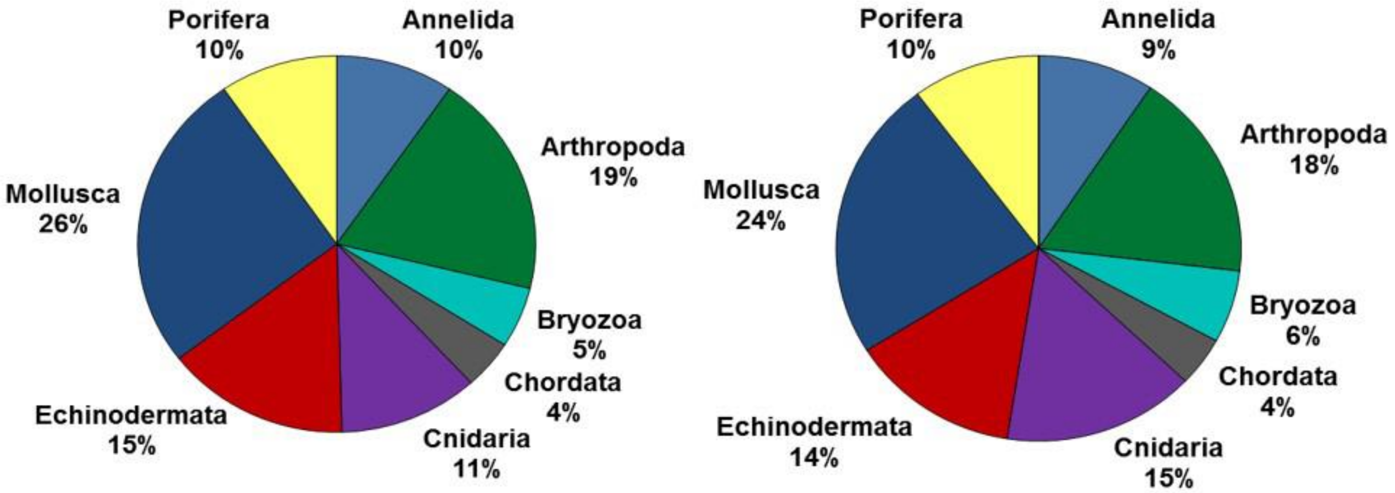



**Figure 37:** **The number of main taxa per megabenthic groups (%) in the Barents Sea, August-October 2017(left) and 2018 (right). (Source IMR/PINRO 2019)**

The survey also analysed the data with respect to species density, thus showing that greatest taxonomic diversity was observed around of the Spitsbergen archipelago (Figure 38). In general, a reduction of taxonomic diversity occurred in an easterly direction, whereby the lowest values on some stations (less 10 taxa/trawl) were recorded in the area of Kola Peninsula (IMR/PINRO 2019).

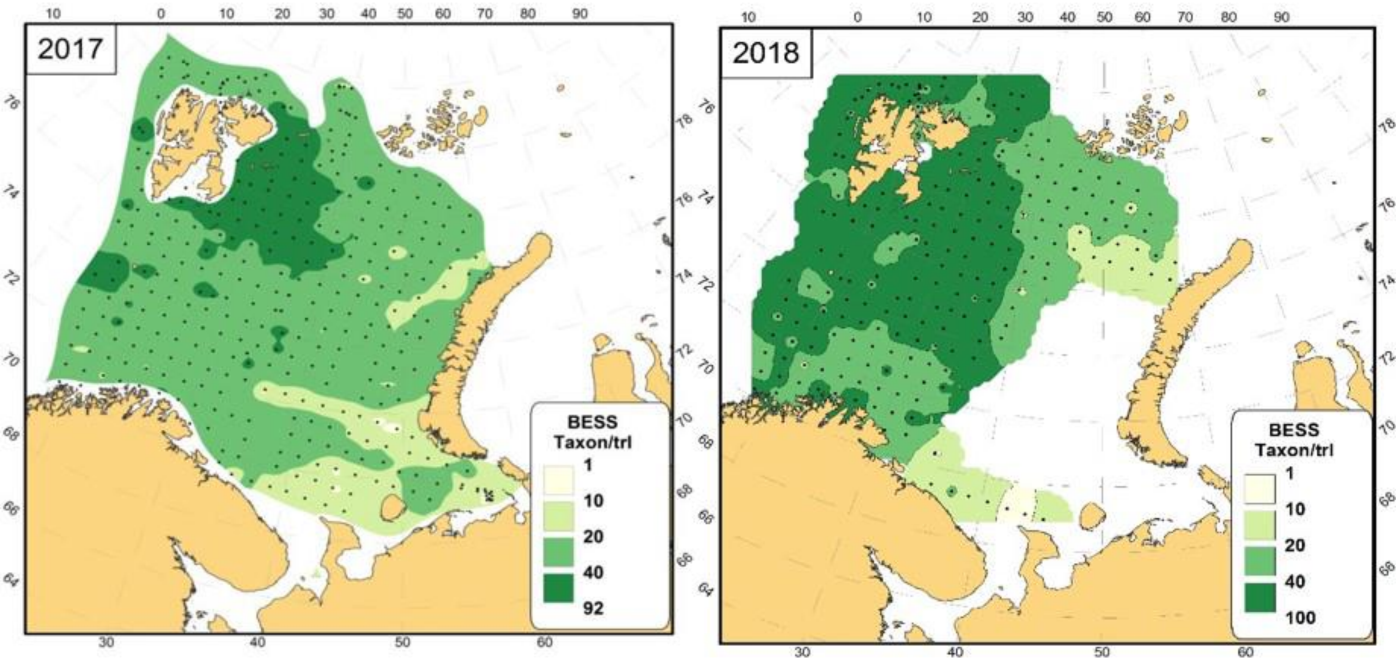



**Figure 38:** **The number of megabenthic taxa per trawl-catch in the Barents Sea, August-October 2017-2018. (Source: IMR/PINRO 2019)**

Grabs and trawl sampling continue to be used for surveys of the benthos. Since 2006, the ‘Russian – Norwegian Joint Annual Ecosystem surveys’ provide both spatial and temporal data of benthic fauna for more than 400 stations annually[33]. Analysis of these extensive samples has so far identified a total of 476 invertebrate taxa, of which 337 have been identified to species level. The highest number of taxa (77) have been recorded from the Spitzbergen Bank area and the lowest (3) outside Kola Bay.

The IMR/PINRO survey analysis showed that the northern central part of the Barents Sea is dominated by echinoderms (predominantly brittle stars) and the south western part by sponges. The maximum bycatch of mega-benthos in the southwestern part of the Barents Sea occurred at a depth of 331 m and was dominated by two species of *Geodia* sponges (*G. barretti* and *G. macandrewii*) (IMR/PINRO 2019). Overall, detailed surveys by Jørgensen et al 2019[34] on the distribution of large benthos groups show that Porifera (mainly the *Geodia* group) dominate biomass in the west, while Echinodermata (mainly brittle stars) dominate in the east. In the Northeast, Cnidaria (soft corals, such as the sea pen *Umbellula encrinus*, and sea anemones) dominates along with Echinodermata, while Crustacea dominates along with the Echinodermata in the Southeast (Figure 39).

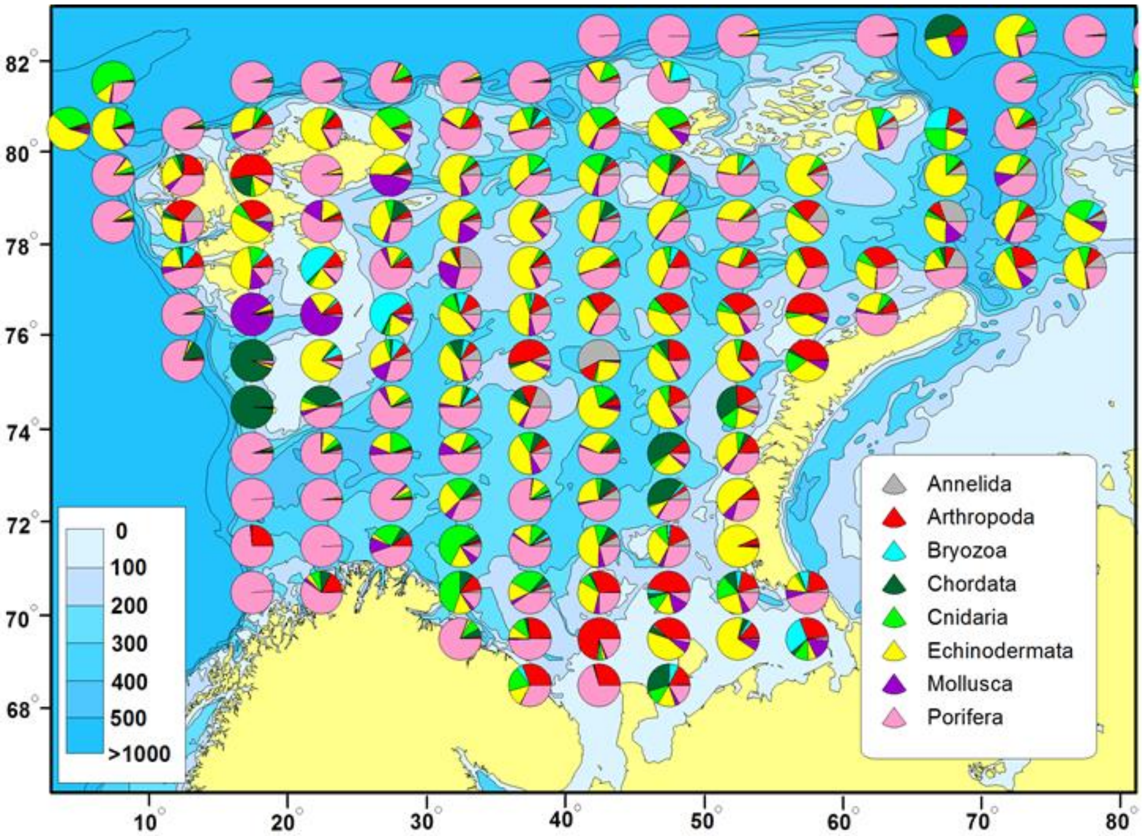



**Figure 39: The main benthos group distribution (in biomass). The data are the integrated mean for the period 2012-2017 (Source: Jørgensen et al 2019, in: http://www.barentsportal.com/barentsportal/index.php/en/status-2019/264-biotic-ecosystem-components-data-from-2018/benthos-and-shellfish-2018/938-benthos-and-shellfish; accessed 15th Nov 2020)**

There is an increasing body of information available, of good enough resolution, to allow better decision-making regarding where to fish and where to protect vulnerable habitats. Areas of high biodiversity value/vulnerability continue to be identified (IMR/PINRO 2019; Jørgensen et al 2019; Buhl-Mortensen et al 2019).

### 8.1.5.2 Commonly encountered habitats

The distribution of Red King crab is restricted to a certain area (Figure 40). Figure 41 shows the current distribution of the RKC within the Russian EEZ.

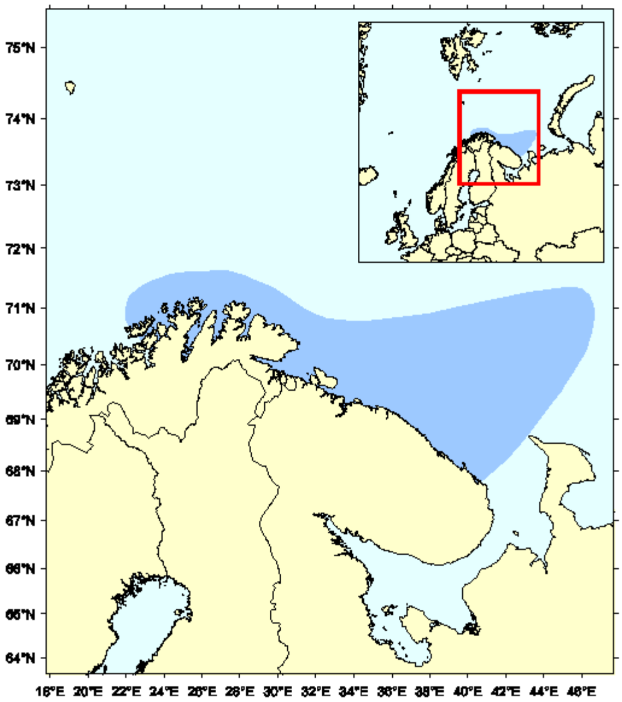



**Figure 40: Broadscale distribution of Red King crab in the Barents Sea. Source: Institute of Marine Research[35]**

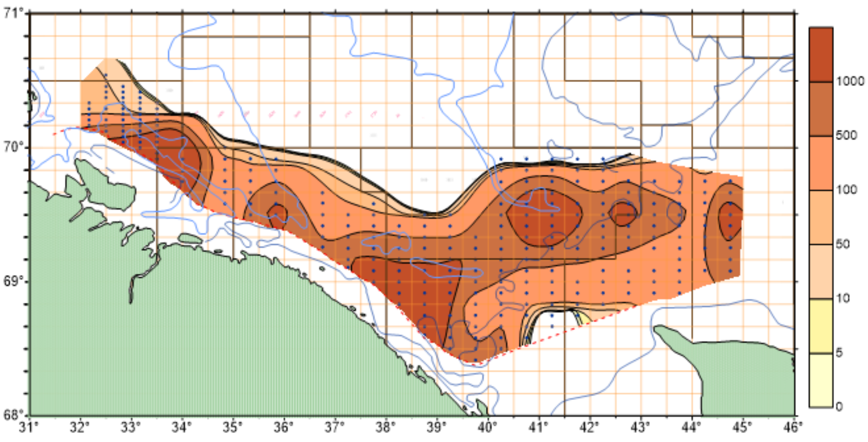



**Figure 41: Distribution of the commercial stock of Red King crab in the Russian EEZ (commercial males indiv/km²). Source: Barents Sea Status report 2019; http://www.barentsportal.com/barentsportal/index.php/en/status-**

**2019/272-human-activity-data-from-2018/fisheries-and-other-harvesting-2018/959-anthropogenic-impact-catches-of-shellfish**

Within the context of distribution of the stock, the current RKC fishery is distributed as illustrated in Figure 40.

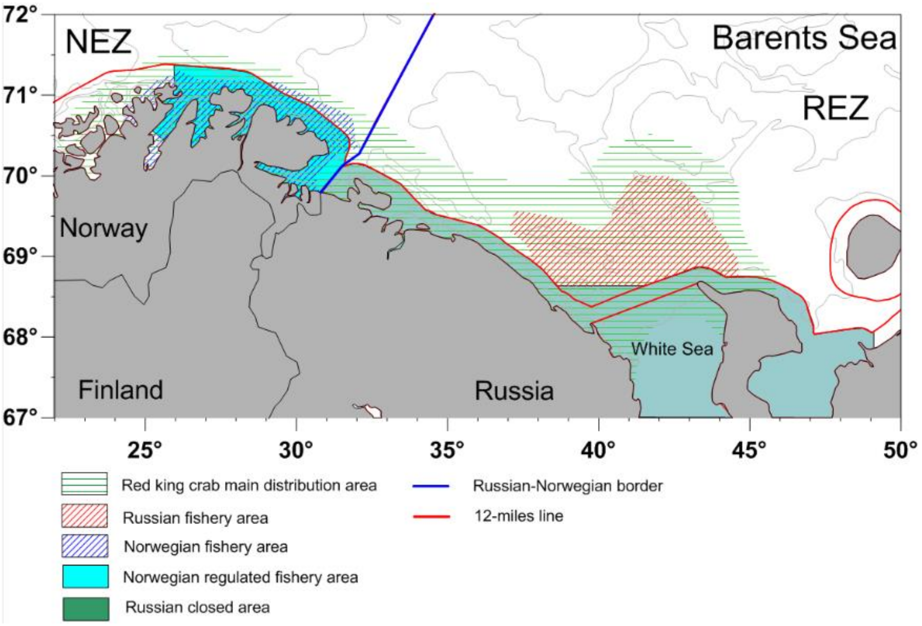



**Figure 42: RKC fishery area, operating outwith 12nm in Russian EEZ (Source: Bakanev, 2014)**

Figure 34, Figure 35, Figure 36 and Figure 39 are illustrations of the benthic communities as defined by statistical analysis and illustrated by dominant species. From these figures it can be seen, that the benthic area, where Red King crab is being fished, is dominated by the carnivorous sea anemone *Hormathia digitata* (which lives offshore down to about 200m, in sandy areas and usually attached to the shells of large whelks for example[36]), starfish such as *Hippasteria phrygiana* (which live on sedimentary bottoms[37], and feed on other echinoderms, bivalves and cnidarians [sea anemones, hydroids, etc]), the mud star[38] *Ctenodiscus crispatus*, which as the name implies lives on sedimentary bottom, Spongia spp. (only given to genus level), and sea cucumbers (*Cucumaria frondosa*[39]), another member of the Echinodermata phylum (just as the starfish species) genus.

As can be extrapolated from the sediment map (Figure 33), Red King crab are found in soft sediment areas; sand, mud, clay. Therefore, the main benthic communities encountered by the RKC fishery reflect the underlying sediment composition. These benthic communities include the following (derived primarily from Jakobsen and Ozhigen 2011, Denisenko and Zgurovsky 2013, and various publications related to the joint PINRO/IMR ecosystem surveys:

**Sea cucumber/starfish communities:** At depths below 300 m on muddy grounds in the Bear Island Trough, Hopen Deep and deep Eastern Basin, the benthic communities are dominated by sea cucumbers (*Molpadia spp)* and the starfish *Ctenodiscus crispatus.* The starfish *Pontaster tenuispinus*, the shrimp *Sabinea septemcarinata*, the brittle star *Ophiacantha bidentata* and soft corals of the Nephteidae family are also commonly found in these communities.

**Crab, shrimp and sea anemone communities:** Predators and scavengers (small mobile crustaceans as well as larger gastropods such as *Colus sabini*) concentrate in areas with high availability of organic debris (such as fishing grounds) and may also be associated with sea anemones such as *Hormathia digitata*. These communities form a belt that extends from the Murman coastal area through all eastern fishing banks up to the Moller Table near the south island of the Novaya Zemlya archipelago. Red king crab (*Paralithodes camtschaticus*) and snow crab (*Chionoecetes opilio*) dominate the south-eastern part of the sea.

A variety of other groups including Annelids (mainly polychaetes), nemaltelmintes, bryozoans, foraminiferans, and cnidarians also contribute a substantial biomass and numbers of species.

**Sponge communities:** Sponges (Porifera) are often associated with bryozoans and sea anemones. They make up the largest part of the communities in weight along the continental slope in depths of 50 to 300m from the Tromsø Plateau north along the west coast of Svalbard, north of Svalbard and east to Franz Joseph Land. Within the Barents Sea itself, they are found in high concentrations to the north of the Finnmark coast, in the Bear Island Channel, and more widely on the slopes of trenches and banks in the southern Barents Sea (Jakobsen and Ozhigin 2011). They can be broadly divided into soft bottom sponge communities comprising a variety of large sponge species *Geodiaspp., Aplysilla sulfurea, Stryphnus ponderosus and Steletta sp*.), and hard bottom sponge communities**,** including medium sized sponges such as *Phakellia spp., Axinella infundibulum, and Antho dichotoma*. This biotope is generally home to more species, but lower density than the soft bottom sponge community.

From the information available it can be deduced that Red King crab lives primarily on soft substrate areas. In other words, the RKC fishery's 'commonly encountered habitat' in the red king crab fishing area (which is 12nm offshore) is mainly soft sedimentary bottom, dominated by specific species of starfish, sea cucumber, sponges and burrowing bivalves (*Astarte borealis*).

#### 8.1.5.3 VMEs (Vulnerable marine ecosystems)

Following the guidance produced by FAO[40], there has been increasing activity on the parts of governments and RFMOs to define and manage "vulnerable marine ecosystems". These are typically interpreted as significant aggregations of benthic organisms that create benthic habitats of importance in their own right and as habitat for other organisms. These areas may high structural diversity, biodiversity and productivity and may in turn be important for the long term health of commercial fish and shellfish stocks. In its advice to NEAFC and NAFO, ICES list seven VME habitat types for the Northeast Atlantic and the taxa and species that are most likely to be found in these habitats[41]. Criteria for a VME indicator are based on traits related to functional significance, fragility, and the life-history traits of component species that show slow recovery to disturbance. For each group, it is the dense aggregations (beds/fields) that are considered to be VME in order to establish functional significance. Indicators include for example various species of crinoids, erect bryozoans, large sea squirts, sponges and corals.

NEAFC VME habitat types include:

1 - Cold water coral reef:

*Lophelia pertusa* reef

*Solenosmilia variabilis* reef

2 - Coral garden:
a) Hard-bottom coral garden
- Hard-bottom gorgonian and black coral gardens
- Colonial scleractinians on rocky outcrops (incl. *L.petusa*)

- Non-reefal scleractinian aggregations

b) Soft bottom coral gardens

3 - Deep sea sponge aggregations

4 - Seapen fields

5 - Tube dwelling anemone patches

6 - Mud and sand emergent fauna

7 - Bryozoan patches

FAO also offers guidance as the meaning of "significant adverse effects" on VMEs: They are those that compromise ecosystem integrity (i.e. ecosystem structure or function) in a manner that:

- impairs the ability of affected populations to replace themselves,
- degrades the long-term natural productivity of habitats, or
- causes, on more than a temporary basis, significant loss of species richness, habitat or community types

OSPAR (to which Norway is party, but not (as yet) Russia) also lists threatened and/or declining species and habitats (OSPAR agreement 2008-6) in sub-areas I&II and of relevance to these fisheries, including for example Coral gardens, Deep sea sponge aggregations, *Lophelia pertusa* reefs *Modiolus modiolus* beds, Seapen and burrowing megafauna communities.

Both NEAFC and NAFO have obligations to contribute to the key objectives of the UN General Assembly Resolutions on the protection of vulnerable marine ecosystems and to ensure the long-term sustainability of deep sea fish stocks and non-target species. They have therefore responded by seeking guidance from ICES[42] on implementing the FAO guidance at regional level, and subsequently issued a recommendation on the Protection of Vulnerable Marine Ecosystems in the NEAFC Regulatory Area (which encompasses most of the Barents and all the Norwegian Sea) (NEAFC 2014).

While some protection is now in place for the less common and more delicate VMEs such as corals (and biogenic reefs more generally), protection remains very limited for more widespread but ecologically important habitats. It is notable that ICES (2009) has developed a list of 25 sponge species which are habitat-forming and can be considered indicators of sponge VMEs in the North Atlantic. These are species that form the sponge grounds, and host a variety of associated smaller sponge species that contribute to the biodiversity of the habitat.

Russia has been party to the process of developing VME advice and the NEAFC recommendation, but application of the rules and protocols has not been formalized in Russian regulations. According to a report by VNIRO/PINRO 2020[43] there are currently no recognized areas with a Vulnerable Marine Ecosystem status in the Barents Sea. Of all the taxonomic groups of benthos present in the Barents Sea, tentatively considered as candidates to VME indicators are sponges, sea pens, soft corals, moss animals *Eucratea loricata* and stemmed crinoids (VNIRO/PINRO 2020). With regards to the distribution features and quantitative characteristics of the species that may be considered as VME indicators, the crab fisheries do not pose any serious threat (VNIRO/PINRO 2020).

In addition to the soft bottom community type described above in Section 8.1.5.2 the following hard- bottom community types can be found in the Barents Sea. However, it should be noted that considering where the crab fishery is located, hard bottom and reef communities, and basket star and soft coral communities, are unlikely to be encountered, and therefore the following summary of this habitat is included for information only:

**Bivalve beds:** Generally, more common in the east (especially coasts of Novaya Zemlya) and bivalves and gastropods also dominate offshore parts of south-western Barents Sea, and parts of the west coast of Svalbard**.**

**Feather star communities:** The sea lily (*Heliometra glacialis*) – a species of crinoid - is common in water depths of 105-292 m on the slopes of the Spitsbergen Bank, the Central Bank and the Great Bank.

**Hardbottom and reef communities.** The richest communities of benthic animals (including sponges, bryozoans, *Balanus* spp, brachiopods, mussels, soft and hard corals) are associated with hard substrates and strong currents or turbulence, especially along the Norwegian coast and the coast of Svalbard. These animals create structural habitat diversity and are often species-rich and associated with high biomass.

» Reefs of the hard coral *Lophelia pertusa* are found along the continental slope in Norwegian waters.

» Massive settlements of barnacles, bryozoans, hydroids, and sea urchins (*Strongylocentrotus)* are found in the shallow rocky waters of the Novaya Zemlya bank.

» Aggregations of different large, non-mobile, long-living habitat-forming species such as large deep sea sponges (*Geodia spp, Stelletta spp, Tethya citrina, Thenea muricata*) mussel beds (*Modiolus modiolus*) and some reef species such as Zooanthidae and the soft coral *Drifa glomerata*, are found along the southern coast of Spitzbergen/Svalbaard, and Bear Island.

**Basket star and soft coral communities:** Further north and west and at the eastern slope of the Eastern Basin at depths between 200 and 300m, communities are dominated by the basket star *Gorgonocephalus spp.* These creatures thrive where there are high concentrations of zooplankton close to the sediment surface. Settlements of soft corals and crinoids are also found alongside basket stars on soft substrates in the Northern Barents Sea on the slopes of deep-water trenches and uplands.

#### 8.1.5.4 Protected areas

Russia has signed several international agreements and conventions on species protection and management of relevance to the Barents Sea Fisheries:

» the Convention on Biological Diversity (CBD),

» the Convention on Trade in Endangered Species of Wild Animals (CITES)

» the Convention on the Conservation of Migratory Species of Wild Animals (CMS),

» the Agreement on North Atlantic Marine Mammal Commission (NAMMCO)

In addition to these, and of relevance to the Barents Sea, Norway is also subject to its agreements under OSPAR Annex V (“on the protection and conservation of the ecosystems and Biological Diversity in the maritime area”). The Norwegian Government has established a set of objectives for species management in the Barents Sea – Lofoten area (Report No. 8 (2005-2006) to the Storting [=Norwegian parliament]). These relate to population viability, genetic diversity, safe biological limits (for harvested species), management of key species in the ecosystem, endangered species for which Norway has special responsibility.

Under the biodiversity assessment of the Barents Sea (Larson et al 2003), experts nominated areas of high conservation value for plankton, benthos, fish, seabirds and marine mammals. In the Norwegian sector this work was taken forward under the Barents Sea Integrated Management Plan, using criteria including productivity, number of species, endangered or vulnerable habitats, important/ETP species. As a consequence, several areas were selected as closed areas designed mainly to protect cold water corals and fish nursery areas. At present, in Norwegian waters, the management of habitat impacts includes the closure to bottom fishing of five marine protected areas, established under the fisheries legislation to specifically protect coral reefs: Sula Reef (Sularevet, 1999), Iverryggen Reef (2000), Røst Reef (Røstrevet, 2003), Tisler and Fjellknausene Reefs (2003)

The Norwegian Government has set a target for at least 10% of coastal and marine areas to be protected by 2020. Four areas have been established just inside the Barents Sea–Lofoten area (see list in previous paragraph), and four more are likely to be designated in coming years. Furthermore, the Norwegian government is committed to cooperate with Russia on “the establishment of an integrated Norwegian-Russian monitoring programme for the Barents Sea, particularly with the aim of assisting in the development of a Russian management plan for the Russian part of the Barents Sea"[44].

In Russian waters, although closed areas - both seasonal and permanent - are a regularly applied fisheries management tool, the focus for the majority of these closures is to protect spawning and nursery areas of certain commercial species (e.g. red king crab). The protected areas in the map below (Figure 43) are primarily situated around land masses[45]. As yet there are no areas designated to protect vulnerable habitats outright, although some voluntary agreements have recently been implemented with relevant trawl fisheries (in areas of the Barents Sea outside the area fished by the UoAs under assessment here and therefore not relevant to the fishery under assessment).

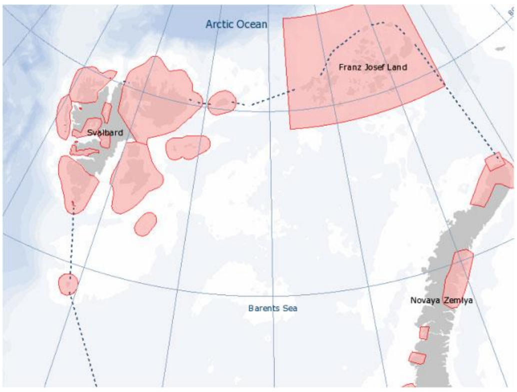



**Figure 43: Protected areas in the Barents Sea Source: barentsportal.com- from IUCN/UNEP**

Fishery control practices in the Barents Sea also include areas of prohibited use of bottom trawl fishing gear. Thus, use of trawls and dredges is prohibited year-round in the area limited by straight lines connecting points with the following coordinates (in the area of the Red King crab fishery):

68°55' N – 37°00' E;
69°25' N – 37°00' E;
69°25' N – 39°00' E;
69°50' N – 39°00' E;
69°50' N – 43°00' E;
69°10' N – 43°00' E;
69°10' N – 40°30' E;
68°40' N – 40°30' E;
68°40' N – 39°00' E;
68°30' N – 39°00' E;
68°30' N – 38°15' E and farther to the initial point

A year-round ban on use of trawling fishing gear is also applicable in the territorial waters of the Russian Federation and internal sea waters of the Russian Federation along the Kola Peninsula coast from the border with Norway in the west and towards longitude 37°00' E in the east. Such a ban on bottom trawl use in limited areas has been introduced into fishery control practices due to need for conservation of commercial fish juveniles (primarily cod and haddock) abundant here. At the same time, this fish protection measure has a positive effect on the conservation of red king crab (particularly its juveniles and females) distributed in large quantities in these areas. Elsewhere, seasonal restrictions on use of bottom trawls in certain areas of the Barents Sea are aimed at the reduction of red king crab by-catches. Thus, use of trawls and dredges is prohibited during January 1 – June 30 in the area limited by straight lines connecting points with the following coordinates:

68°35' N – 38°00' E;
69°30' N – 38°00' E;
69°30' N – 44°00' E;
68°35' N – 44°00' E and farther to the initial point.

Furthermore, the Fishing Rules impose restrictive measures in respect of the red king crab fishery period and its minimum commercial size. Thus, red king crab fishing is prohibited between January 1 – August 15, because of breeding activities combined with moulting, as well as migration to feeding areas.

On the 14th July 2020 it was announced by the participating parties that a series of voluntary closed areas have been agreed on in the Barents Sea (Figure 44**Error! Reference source not found.**). The Agreement came into force on 1st August 2020 (Press release Murmansk 14th July 2020[46]). The agreement currently only deals with trawl fisheries, but mention of it has been included in this report, in order to demonstrate that such voluntary arrangements can be negotiated. The four largest Russian fishing groups[47] have signed this Agreement on the conservation of benthic vulnerable biotopes, such as sponges and coral "gardens" in the Barents Sea. The agreement is a result of the successful long-term cooperation of fishing companies, WWF Russia and scientific organizations in order to develop possible measures to reduce the impact of bottom fishing on the marine environment, and to develop measures to preserve the ecosystem of the Barents Sea. The sustainable exploitation of the marine biological resources stocks in accordance with the principles of precautionary approach is part of this Agreement. However, none of these areas are relevant to the crab fisheries under assessment.

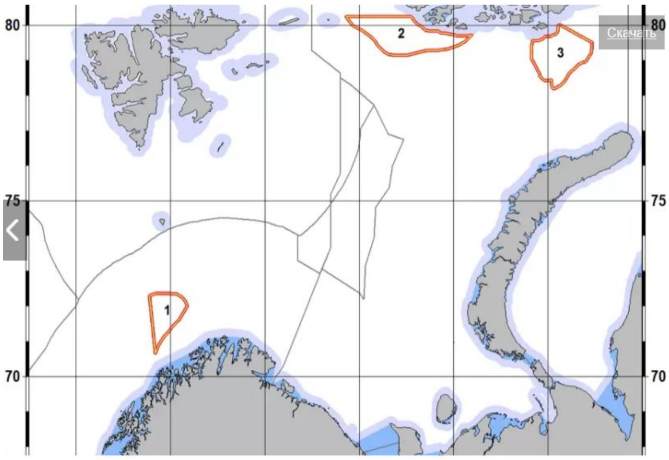



**Figure 44: Newly created (14th July 2020) voluntary closed areas to demersal fisheries in the Barents Sea (Source:** https://wwf.ru/en/resources/news/barents/morskie-lesa-barentseva-morya-zashchityat-rossiyskie-rybaki-/

### 8.1.5.5 Impact of pots/trap gear

Repeated use of mobile fishing gear can degrade habitat complexity by: (1) directly removing or damaging epifauna; (2) smoothing sedimentary bedforms and reducing rugosity; and (3) eliminating taxa that produce structure where fish aggregate (Auster & Langton, 1999). Disturbance to benthic habitat as a result of fishing with passive gear, such as traps, can create impacts similar in scope to that of mobile gear (Auster & Langton, 1999). Despite the widespread use of passive fishing gear, there appear to be few studies on the impacts of traps on benthos. A study by Schweitzer et al (2018) indicated that all traps in the line (here a 384m long line of 20 fish traps, for lobster and bass) were dragged along the bottom and damaged living epifauna, suggesting that the real impacts of trap lines may have been underestimated.

The extent of bottom impacts from pots depends on the type of bottom habitat where the setting and retrieval of pots occurs (NMFS 2004[48]). Similarly, to the Alaskan red king crab fishery studied in NMFS (2004), the Russian red king crab fishery takes place in predominantly sandy or silty bottom areas, at depths of down to 300m. Pots are considered less damaging compared to trawls or dredges because pots are predominantly static gears (NOAA 2017[49]). Although they are a bottom gear, they have contact with a substantially smaller area of the seafloor than dredges or trawls. Pots can affect habitat, however, because they do not always remain entirely stable on the seafloor. In the case of this fishery, they can get dragged across the seafloor when being removed, especially during a storm or when pots are stuck in the sand (Morgan and Chuenpagdee 2003). Morgan and Chuenpagdee (2003) conducted a study to gauge the relative severity of impacts associated with all commercial fishing gears and compare and rank the overall ecological impact of each gear type. They found that pots (including the kind used in the red king crab fishery) generally have a “medium impact” on physical structure and a “low impact” on biological habitat (seafloor organisms).

Eno et al. (2001) studied the effects of pots set over a wide range of sediment types in Scottish waters, albeit the traps and pots were light compared to those used by the red king crab fishery. They observed that mud communities fully recovered from pot impact within 72–144 hours of pot removal. Hauling the pots along the ocean bottom during pot removal left a track in the sediments, but biological abundance within the area was not affected. Soft sediments, where red king crabs occur, are less likely to be impacted than hard structures that rise above the seafloor (Quandt 1999). The impact of fishing gear on habitat also depends on the spatial scale of the fishery, because although each pot may have a small impact, the cumulative effect of thousands of pots can be larger (Morgan and Chuenpagdee 2003), although this is less of an issue in the soft sediments of Barents Sea red king crab fishery. The fishery occurs within a specific limited area, where the crabs are found, rather than across the whole of the basin, and the fishery is limited to a short season (autumn and early winter, when the crabs are of optimal commercial quality, and they are neither moulting nor mating).

With regards to assessing the impact of the trap fishing gear, the assessment team has interpreted “serious or irreversible harm” for commonly encountered habitats as reductions in habitat structure and function (as defined in MSC fisheries standard v2.01 SA3.13.4) such that the habitat would be unable to recover at least 80% of its structure and function within 5-20 years if fishing on the habitat were to cease entirely. For VMEs “serious or irreversible harm” is defined as reductions in habitat structure and function below 80% of the unimpacted level.

### 8.1.6 Ecosystem

Please note that the Ecosystem component also directly applies to UoA2 – Opilio, although the Opilio fishery operates further North, to the West of Novaya Zemlya

#### 8.1.6.1 Broad overview

According to the UoA, the Red King crab fishery operates within the Barents Sea ecoregion, and more specifically, solely within the SE part of it.

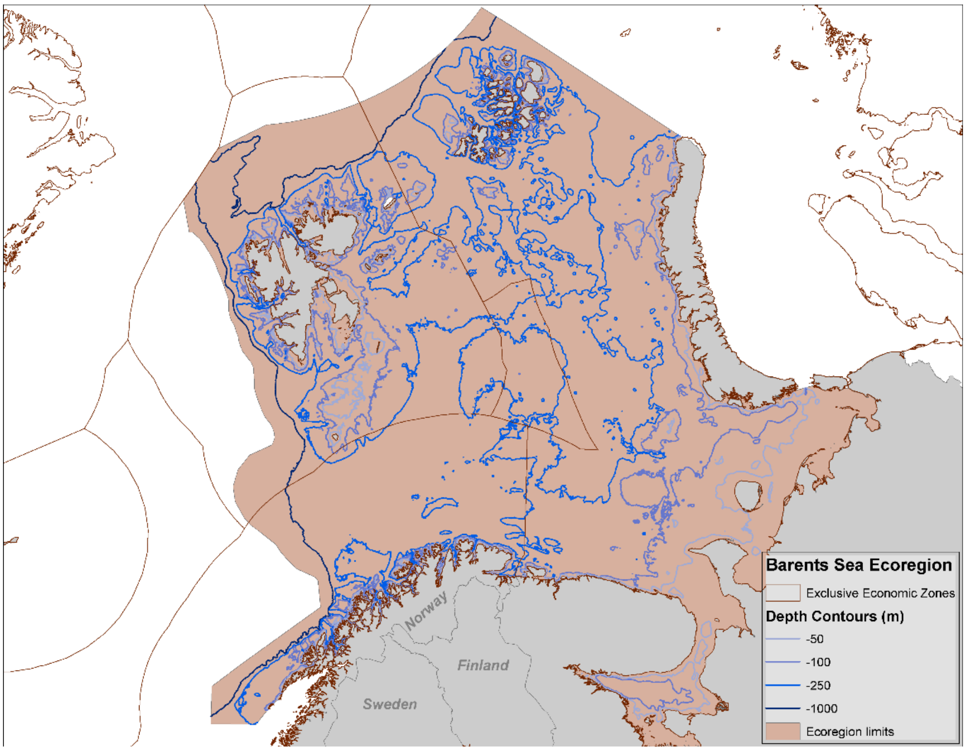



**Figure 45: The Barents Sea ecoregion (Source: ICES Advice 2019 https://doi.org/10.17895/ices.advice.5747**

The Barents Sea is divided into the Russian Exclusive Economic Zone (EEZ) and the Norwegian EEZ (agreed since 2010). An EEZ around Svalbard was claimed by Norway in 1977 and is disputed by Russia (ICES Advice 2019 Barents Sea ecoregion overview).

The Barents Sea ecoregion has been described in a number of recent MSC full assessments of fisheries located in that area[50]. There is ongoing detailed research into the Barents Sea ecosystem conducted by Russian and Norwegian scientists, as part of the joint research and marine surveys conducted by these countries[51], and the latest report, 2018, can be found on-line[52], as well as regular on-line updates. ICES Ecosystem overviews produce regular updates of the Barents Sea[53] as well as the ICES WG on integrated assessment of the Barents Sea WGIBAR 2019[54]), and the Working Group on Arctic Fisheries regularly updates fisheries species related information on the Barents Sea with reference to the ecosystem[55].

Since the 1980s, the Barents Sea has gone from a situation with high fishing pressure, cold conditions and low demersal fish stock levels, to the current situation with high levels of demersal fish stocks, and warm conditions (ICES WGIBAR 2019)

Key features of the Barents Sea ecosystem may be summarized as follows (McBride et al 2014; ICES WGIBAR 2019), and added to by studies since:

- High productivity and biodiversity associated with polar front, sea ice edge, and continental slope;
- Relatively low pollution, although this is monitored regularly in seabirds, mammals and sediments (see individual studies updated on barentsportal.com[56]);
- Large inter-annual variations in productivity related to variations in the inflow of Atlantic water and/or other oceanographic changes;
- Average water temperature in Barents Sea has increased , and also higher than the long-term average (see IMR/ PINRO Joint Report Series 2014, 2018, 2019; ICES WGIBAR 2019); The warming was also associated with increased primary and secondary (macro zooplankton such as krill and jellyfish) production, increased fish recruitment (age 0) which trigger positive development of fish stocks (cod, haddock, deep water redfish, capelin and herring) Cooling favours capelin; warming favours cod and herring;
- More than 2,500 benthic invertebrate species recorded, with decreasing biodiversity from West to East;
- Benthos composition highly variable dependent on overlying (Arctic or Atlantic) water;
- Knowledge of distribution of benthic animals improving through regular joint Russian – Norwegian surveys (Jakobsen & Ozhigin, 2011; Dolan et al 2015), as well as ongoing research and surveys undertaken by PINRO (PINRO 2018; IMR/PINRO 2019) and individual research projects (Jørgensen et al 2019; Buhl-Mortensen et al 2015, 2019);
- Benthos dominated by sponges in certain areas;
- Deep water coral reefs along the Norwegian coast including the Røst Reef, the world's largest cold-water coral reef, located off Loføten;
- Relatively short and simple food chains, but complex relationships/feedback between major fish species (cod, haddock, herring, capelin and polar cod) with predator-prey relationships shifting according to opportunity and life cycle stage;
- Capelin is a key species serving as major predator of zooplankton and major prey species of other fish, birds and mammals. It has suffered three major collapses in the last 25 years, though the causes are poorly understood;
- Important nursery areas for Norwegian spring spawning herring;
- Presence of several alien species, including Red king crab (deliberately introduced in the 1960's) and Snow crab (first found on Goose Bank in 1996, suggested to have come into the Barents Sea in ballast water (Sundet and Bakanev, 2014);
- Highly concentrated fishing pressure based on known movement and aggregation of cod and haddock;
- Summer population of around 20-25 million seabirds (more than 40 species) that harvest approximately 1.2 million tonnes of biomass annually. Main concentrations of breeding seabirds (more than 80%) are located on the Norwegian mainland, Novaya Zemlya and Svalbard. Several seabirds populations from coastal colonies stay or migrate into the Barents Sea to feed and moult, possibly increased in total number ICES WGIBAR 2019).
- Seabirds play a significant role in transferring nutrients from sea to land and from North to South

- Significant marine mammal populations (minke, humpback and fin whale (which breed further south and forage in the sea) beluga and narwhal (which breed in the area), harp, common, grey, bearded, hooded and ringed seals; The number of whales, which use the Barents Sea as summer feeding area, increased or stabilized in last decades (ICES WGIBAR 2019).
- Minke whale, and some seal species are hunted and subject to a quota;
- The effect on the marine ecosystem of the increased tourist traffic (in particular to Svalbard) is not known, but the possibility for more littering is a potential risk. Large-scale monitoring of marine litter since the 2010, showed that plastic dominated number of observations with marine litter, while textile, paper, rubber and metal was observed occasionally (ICES WGIBAR 2019).
- Expected changes in the coming years: Oceanic systems have a “longer memory” than atmospheric ones. According to the expert evaluation, the Atlantic water temperature in the Murman Current is expected to decline slightly but remain typical of warm years. Due to high temperatures and low sea-ice extent in recent years, the ice coverage of the Barents Sea is expected to remain below normal (ICES WGIBAR 2019).
- Gas and oil activities are increasing with drop in extent of sea ice (McBride et al 2016)

Atlantic and Arctic water masses are two major hydrographical domains in the Barents Sea, which determine the zoogeographical species composition in the ecosystem (Figure 46). The zoogeographical groups may be represented as “Mainly Arctic”, “boreal” or “Arctic-boreal”. Due to variability in distribution of Arctic and Atlantic waters in the Barents Sea alterations in distribution and relative abundance of arctic and boreal species are typical for the ecosystem.

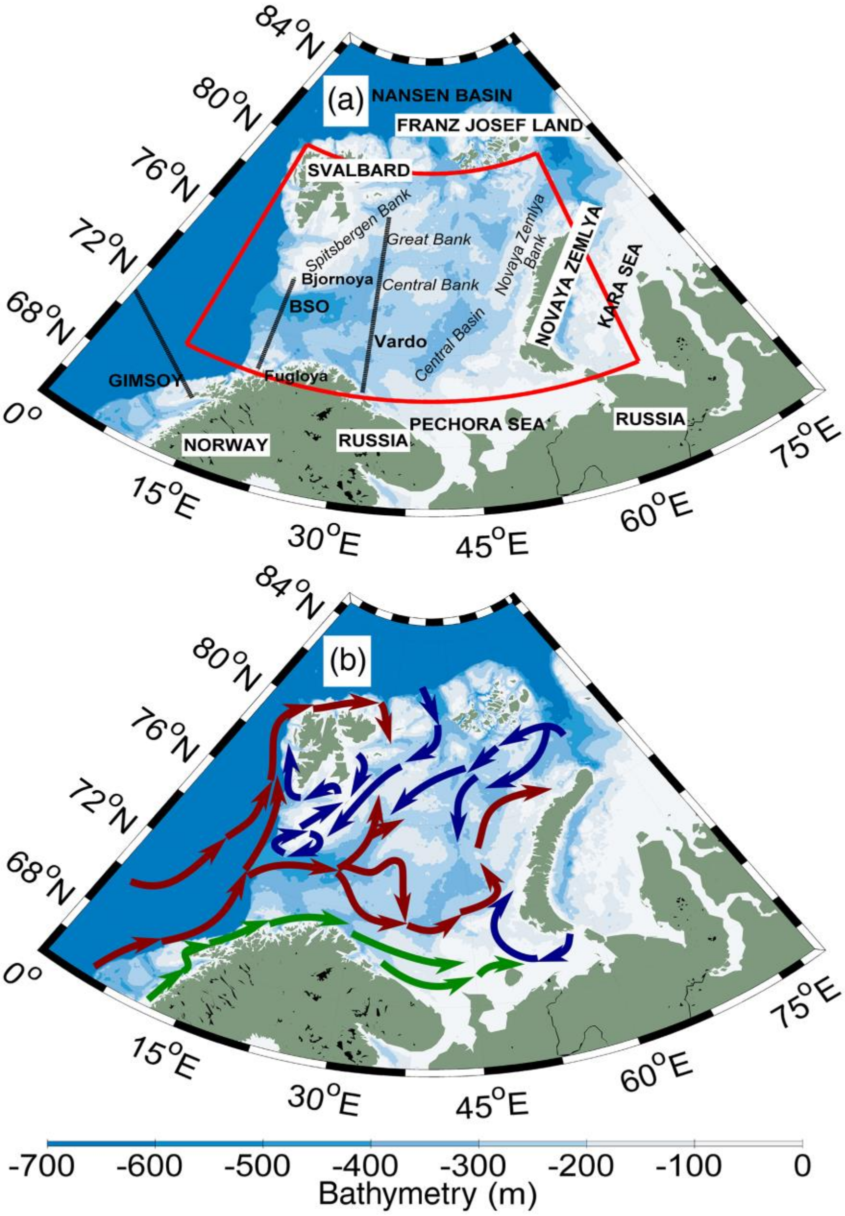



**Figure 46:** **Detail of bathymetry and a schematic of the surface circulation of the main water masses (Atlantic Water: red arrows; Arctic Water: blue arrows; Norwegian Coastal Current: green arrows) including coastal currents (Source: Oziel et al 2016)**

Climate has an important effect on the amount of energy entering the system, both directly through affecting the production and indirectly through affecting the inflow to the Barents Sea. Climate variability also impacts fish stocks by altering recruitment, growth and migration patterns. The formation, melt and retreat of sea-ice in the Barents Sea provide physical conditions that influence the structure and function of pelagic and benthic communities. Due to high temperatures and the extreme minimum in sea-ice extent in recent years, ice cover is expected to remain well below the long-term average[57].

Seasonal primary production is governed by nutrients and light, which again are modified by ice cover and vertical mixing of the water column. The Barents Sea is a high-latitude sea, characterized by increasing hours of daylight towards summer and decreasing hours of daylight towards winter. The length of daylight is also determined by latitude and hence modifies the length of the growing season of the primary production in the north-south axis. The 2015 meeting of the ICES (ICES 2016) [58] working group on integrated assessments of the Barents Sea concluded that since the 1980s, the Barents Sea has gone from a situation with high fishing pressure, cold conditions and low demersal stock levels to the current situation with high levels of demersal stocks, reduced fishing pressure, and warm conditions. The current situation is unprecedented and the Barents Sea appears to be changing rapidly.

Such changes are also being monitored through ongoing benthos monitoring studies. Benthos is one of the main components of marine ecosystems. It is stable in time, characterizes local situation, and is able to show the ecosystem dynamics in retrospective. The changes in community structure and composition reflect natural and anthropogenic factors, see Figure 47 (Korneev et al, 2017[59]).

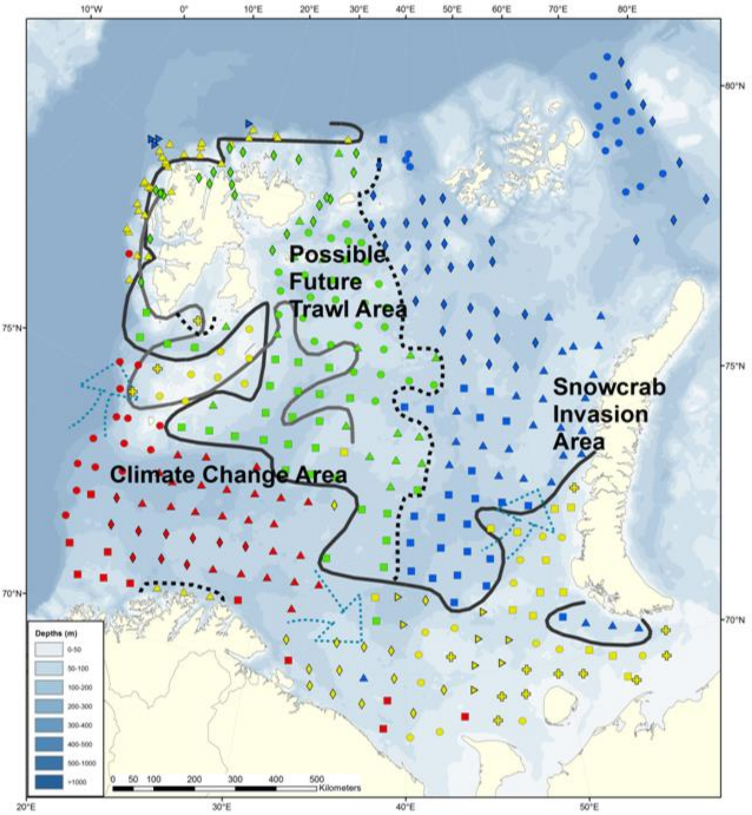



**Figure 47: Baseline map of the Barents Sea mega-benthic communities in 2011(Source: Korneev et al 2017[60])**

The baseline map based on fauna similarity (Figure 47; see Jørgensen et al 2014 for methodology, results and discussion) with the northern (green and blue) and southern (yellow and red) region where the black full line is illustrating the “benthic polar front” in 2011. The grey full line is the approximately oceanographic Polar Front. Dotted line: Is partly illustrating a west-east division. Red: South West sub-region (SW) Yellow: Southeast, banks and Svalbard coast (SEW). Green: North West and Svalbard fjords (NW). Blue: North East (NE). Source: Institute of Marine Research[61],

A further impact of climate changes has been summarised in one of the main conclusions of recent ICES WGCRAB reports (2017[62] and 2015), in that increasing ocean acidification might not be favourable for crustaceans in general. There is a growing concern in the WG about the consequences of future climate change for important crab species in the NE Atlantic region. Observed increases in sea water temperatures have already entailed expanded distribution areas of some species in the northeast Atlantic. However, a rise in the seawater pH would probably be the most serious.

Commercially exploited species (fish, invertebrates, mammals) are part of the marine food web and interact in various ways, including through predation and competition. The main top predators in the ecosystem are cod, harp seal, and minke whale. They all feed on young cod as well as on capelin, herring, and the krill and amphipod prey of these species (Figure 48). Since fishing and hunting mortality rates have been reduced on most species over the last two decades, natural mortality, including cannibalism, has the potential to change; this influences the abundance and yield of other stocks. The abundance of some mammal species has increased in parts of the ecoregion, although more slowly than in fish stocks (ICES Nov 2019 – Barents Sea ecosystem fisheries overview[63]).

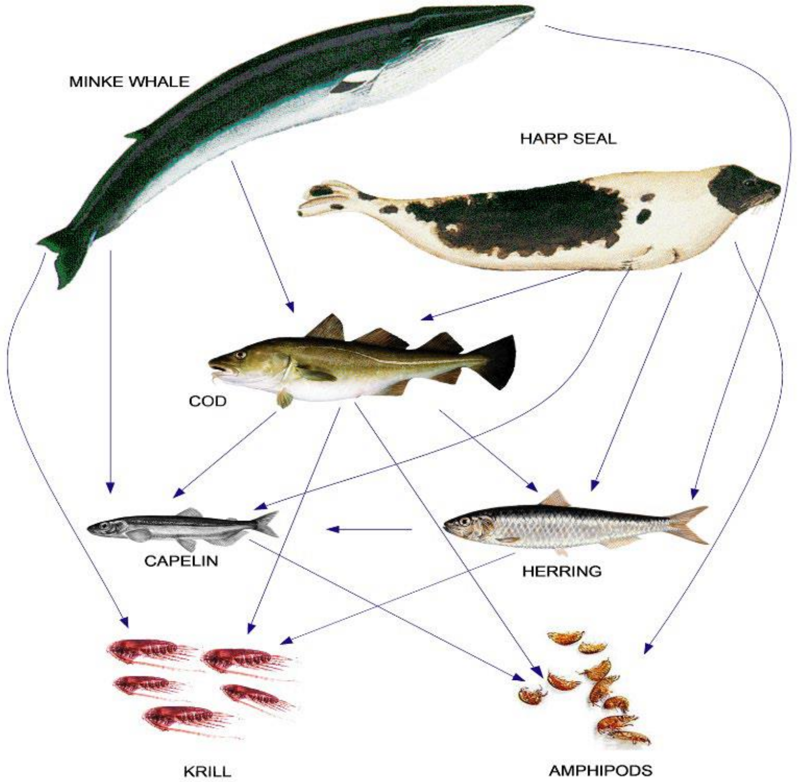



**Figure 48** **Interactions between commercial species and their prey in the Barents Sea foodweb. The arrows indicate central predator–prey relationships, with the arrows pointing from predator to prey (Source: ICES Nov 2019, Barents Sea fisheries overview)**

The ICES Barents Sea ecosystem overview (Nov 2019) showed that demersal trawlers account for the majority of landings and fishing effort, targeting cod, haddock, Greenland halibut, and northern shrimp at the southern and central fishing banks and along the shelf break into the Norwegian Sea (Figure 49). The map also clearly shows the spatial distribution of crab fishing, with Red King crab in the SE of the Barents Sea, and Opilio off Novaya Zemlya (Figure 49).

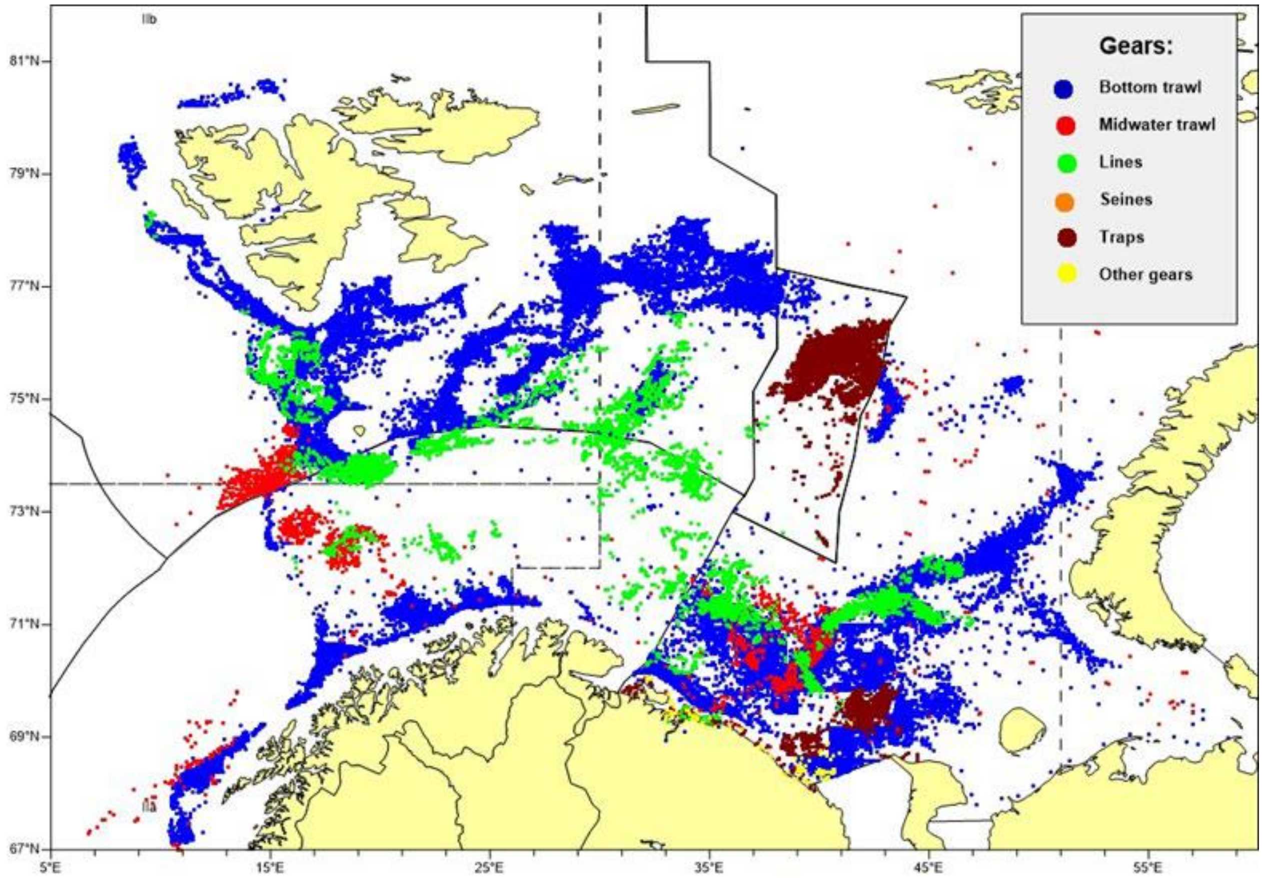



**Figure 49: Location of Russian fishing activity in all waters, and of non-Russian fishing activity within the Russian EEZ in 2014 as reported (VMS) to Russian authorities (Source: ICES BS ecosystem overview 2019)**

Only looking at the crab fisheries, as this is of relevance to this assessment, the distribution of red king crab is constrained to coastal areas in the south eastern part of the ecoregion, where almost all red king crab catches occur. In Norwegian waters, most of the red king crab landings originate in the fjords in the Finnmark area. Snow crab is mainly caught in the central Barents Sea, in Norwegian and Russian waters.

According to the ICES 2019 BS ecosystem overview, Red king crabs are well established along the mainland Russian and Norwegian coast. The abundance and reproduction rates have declined in recent years, due to a decrease in recruitment rate and high fishing mortality.

The snow crab stock is increasing in the central and eastern Barents Sea, and the biomass is calculated to be ten times higher than the biomass of red king crabs and close to half the biomass of the deep-water shrimp. A commercial fishery has been launched for the species. A further expansion in range westwards towards Svalbard is expected.

The Norwegian hunt of harp seals is directed towards weaned pups (beaters) or older animals on their moulting grounds in the south eastern Barents Sea. Hunting takes place in the Russian EEZ, but Norwegian vessels are not permitted to access areas inside the Russian 12 nautical mile line. Russian hunting also targets weaned pups, and occurs on the whelping grounds in the White Sea.

The Norwegian minke whale hunt targets whales while they are at feeding grounds at high latitudes. Currently, most minke whales are caught along the coasts of northern Norway, further out in the Barents Sea, and off the west coast of

Spitsbergen. Prior to 1987 whaling occurred in the entire Barents Sea, but Norwegian whalers have not had access to the EEZ of Russia since the hunt was resumed in 1993. Russia has never hunted whales in the Barents Sea.

Other ecosystem impacts of the fishery under assessment, besides direct fishing, have also been considered – these include unintended consequences of the fishing operation such as lost gear, fuel and oil pollution, waste and litter. Russia has been a member of the MARPOL Convention[64] since 1958. Amongst other issues, the Convention deals with different types of garbage and specifies the distances from land and the manner in which they may be disposed of; the most important feature of the Annex (V) is the complete ban imposed on the disposal into the sea of all forms of plastics. Annex IV contains requirements to control pollution of the sea by sewage. The fishery under assessment has implemented the MARPOL requirements into company policy and is thus complying with the regulation for dealing with any pollution issues. Organic / food waste is kept on board and delivered to the port, where an agent picks it up, and the whole process of the transfer is documented. Wastewater and sewage is kept on board in special tanks, and delivered to a dedicated service at the port, or a special vessel at sea. No waste from the vessel goes into the sea, the captain of the vessel is responsible for implementing MARPOL requirements (Client information 8th Dec 2020)

Increasingly ecosystem reports include sections on pollution (IMR/PINRO Barents Sea ecosystem report 2019), providing quantitative information on the extent of plastic pollution across the area, for example. This is in addition to the regular and ongoing surveys on chemical pollutants in the Barents Sea (see live updates on barentsportal.com), as well as sampling of stations (IMR/PINRO BS ecosystem survey 2019). The ecosystem survey provides a summary of the findings on pollution sampling in the Barents Sea, with plastic being the most common anthropogenic pollutant, found in both demersal trawl gear and pelagic gear. It also gives an indication of how much of this plastic comes from fishing gears. It should be noted that some of the trawled up plastic litter may be historical, awareness is rising globally as to the detrimental impact of litter pollution and harbours increasingly install disposal facilities for litter collected at sea and brought in by vessels. Currents move lighter and floating litter, and it eventually collects and is deposited in certain hot-spots.

#### 8.1.6.2 Ecosystem impact of red king crab on the Barents Sea

The impact of red king crab on Barents Sea benthic fauna was a significant theme in two three-year Joint Russian-Norwegian research programs on this species during 2002-2004 and 2005-2007. This species was studied both in terms of its population expansion and its impact on benthic communities. Central topics were the effects of red king crab feeding activity on the benthos, and the interspecies relationships between the crab and other commercial species with emphasis on red king crab both as both a predator and as a competitor for available food resources (Tsyganova et al 2015)[65].

Motovsky Bay in the Russian portion of the southern Barents Sea was the main area for these studies. This area was chosen because red king crab has been abundant there since its introduction to the Barents Sea. In addition, published results from studies conducted — during 1931-1932 and 1996-2003 — on the benthos in this Bay were available. The red king crab has inhabited this area for more than four decades, and appears to have successfully adapted to its new environment. The benthic community in this area is dominated by the sedentary polychaete *Maldane sarsi*. Results indicate that red king crab has not had a significant impact on either indices of species abundance or species diversity for the benthic community in the deep-water of the Bay. The local variations in total biomass and the structure of the community recorded in the open part of the bay was probably due to fishing activities which was mainly carried out in the open north-eastern part of the Bay. It is believed that observed changes within benthic communities in this area were more likely caused by the fishing activities than by an abundant king crab stock feeding in the area (Tsyganova et al 2015).

Zoobenthic monitoring in the Kola section is one of the most published and extensive monitoring programs in the Russian Arctic. Data collection was initiated in the early 20th century by the Marine Biological Station, in Alexander Harbor of Kola Bay. Since 1995 benthic investigations and regular annual surveys in the Kola Section have been conducted by the Murmansk Marine Biological Institute (MMBI), PINRO joined the monitoring program in 2003 using methods comparable to the existing long-term monitoring series. Since 2010, PINRO and MMBI have been collaborating to ensure increased sampling regularity, greater speed in data processing, and more accurate taxonomic identification (Lyubina et al 2015)[66].

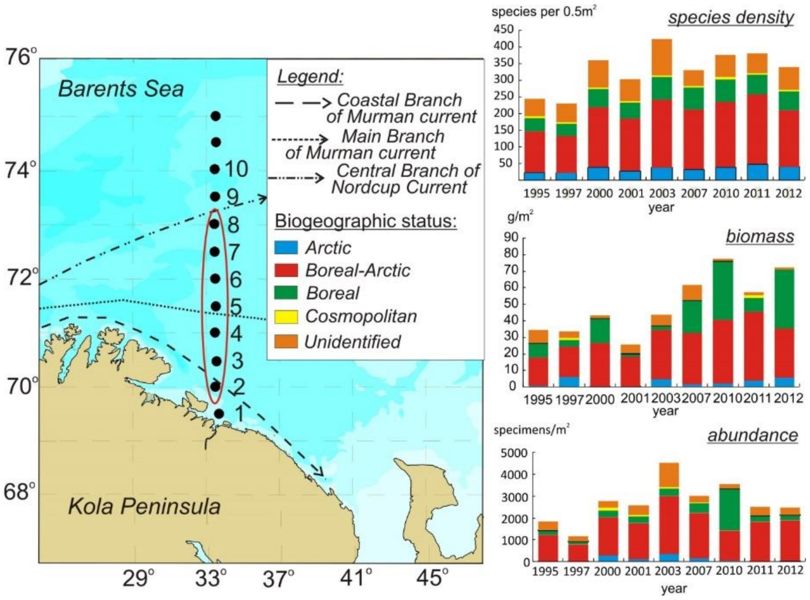



**Figure 50:** **Zoobenthic survey location near the Kola Peninsula in the south eastern Barents Sea; the change in average species density, biomass, and abundance of zoobenthos in different years of monitoring (Source: Lyubina et al 2015)**

Monitoring results indicate that since 2000, the number of species (species density) has remained stable with a maximum of 15 species/0.5 m$^2$ inter-annually. The ratio of biogeographic groups of zooplankton (Arctic, Boreal-Arctic, Boreal, and Cosmopolitan) along the entire Kola section has also been fairly stable since 2000. In 2007, however, an increase was indicated in the relative number of boreal species (Figure 50). This increase followed the historical maximum temperature anomaly recorded in 2006. The "maximum biodiversity indicator" (i.e. total number of species/species density) was recorded in 2003 with temperatures close to the long-term mean.

Both abiotic (e.g., temperature and substrate) and biotic factors influence species composition and abundance of zoobenthic communities. Predation pressure is the most important biotic factor regulating zoobenthos (in Lyubina et al 2015).The most important benthic predators are demersal fish, primarily cod and haddock (Bohanov et al., 2013). With changing temperatures, cod follow different migration routes. In "cold" years, cod feeding migration occur mainly along the coast of the Kola Peninsula; this increases the pressure on the benthic community that is already impacted by lower temperatures. In "warm" years, cod feeding grounds are found in northern and eastern regions of the Barents Sea (in Lyubina et al 2015), reducing pressure on zoobenthos in the southern region. It can therefore be assumed that a high impact on zoobenthos from predatory demersal cod correlates with low temperatures.

The red king crab is a significant benthic predator that has an impact on the benthic community near the shores of Western Murman (Stations 1 and 2, Kola section) (in Lyubina et al 2015). The red king crab prefers mostly large specimens of bivalves, sea urchins, sea stars, and brittle stars (in Lyubina et al 2015). The benthic community at Station 2 of the Kola section differs from others in having high species diversity and abundance, and generally organisms with relatively smaller body size. It can be assumed that the predatory impact from the red king crab on the zoobenthos of southern stations has been ongoing since the early 2000s. Previous studies of the red king crab's impact on the benthos in Motovskyi Bay indicated significant changes in the structure of benthic communities. Similar changes were observed at the stations mentioned above.

In the Varangerfjord, close to the Russian-Norwegian border, detailed studies of the benthic community were conducted at two locations in 1994, just prior to the invasion of the red king crab. In 2008 the sites were revisited and large changes in the benthic communities were found. In one of the locations, the most striking observations were a total absence of the mud sea star (*Ctenodiscus crispatus*) and a significant reduction of brittle stars (Ophiuroidea). In 1994 *Ctenodiscus* was present in a density of 10-15 ind./$m^2$ here. In addition, several species of bristle worms and bivalves were reduced or absent. In the other location, a similar reduction or absence of large specimens of biologically important taxa was observed. For example, no brittle stars of any species were observed in 2008, and very few specimens of the sea urchin (*Strongylocentrotus droebachiensis*) — which were common in 1994 — were observed in 2008. The bivalves *Mya truncata* and *Macoma calcarea* were highly reduced, and only a few larger specimens were found. It also appeared that the smaller bivalve species were reduced or absent. Among the bristle worms, *Harmothoe imbricata*, which were abundant at the shallowest station (10m depth) in 1994, seemed to be totally absent in 2008. The same holds for *Nothria conchylega*, which were common at the two deepest stations in 1994 and not recorded in 2008. The authors of the study concluded that the observed changes are likely to be caused by feeding activities from the king crab (Sundet et al, 2008).

The red king crab is an active predator on benthic fauna, especially feeding in deep soft-bottom environments. A study by Oug et al (2011), carried out in the Varanger area close to the Russian border in 2007-2009, indicated that soft-bottom epifauna and infauna have become markedly reduced in crab-invaded areas. For infauna, quantitative data from 1994 were used as a basis to compare faunal composition before and after the crab became abundant in the area. It appeared that echinoderms, non-moving burrowing and tube-dwelling polychaetes, and most bivalves were reduced, whereas some small-sized polychaetes and small bivalves had increased. In situ sediment profile imagery (SPI) was used to examine sediment structure and biogenic activity. At several locations, the sediment habitat quality was degraded due to hypoxic conditions and low biological activity below surface layers. It is suggested that the crab has removed organisms performing important functions such as bio-irrigation and sediment reworking. Hence, it appears that the crab may reduce the functional diversity of the resident species assemblages, which may have overall implications for ecosystem function, production and responses to other environmental stressors.

Several publications report that although red king crab have had an effect, it is not significant to the Barents Sea ecosystem. Bakanev and Anisimova (2013) concluded that the results of studies on the impact of red king crab showed that consumption of benthos by red king crab represents a small part of the total estimated benthic production and that although structural changes to the benthos have been demonstrated, these changes have not affected the total biomass and biodiversity of the benthos. A study comparing changes in benthic communities resulting from the introduction of red king crab to several bays in Russia (Britayev et al. 2010) showed a decrease in the diversity of soft bottom communities as well as in species richness, density and biomass of bivalves. Since no evidence was found that predation by red king crab resulted in species elimination, or a drastic decrease in food resources for commercially important organisms, they concluded that the impact of red king crab on the bottom communities of the Barents Sea was not as dramatic as expected, possibly because red king crab predation pressure is distributed across various groups, preventing elimination of particular species or taxa (Britayev et al. 2010).

As the red king crab is preying on all sessile benthic species, with a dominance of soft bottom species, investigations have shown that large specimens of echinoderms, bivalves and siphunculids disappear in areas with high abundances of crabs. In addition, there is a reduction in the number of dominating species, while the number of species has increased after the crab introduction.[67] A study by Fuhrmann et al (2015), located in a fjord in Northern Norway, showed that the low biomass and the sparseness of large taxa in the outer and middle fjord may be a result of predation by the invasive red king crab, resulting in an overall lower macrobenthic production regime.

Feeding of the crab on fish eggs during spring has been documented (Tsyganova et al 2015)[68]. However, the long-term observations showed that, on the average, in spring, the frequency of occurrence of fish eggs in crab stomachs was less than 6% and the weight portion in the crab diet less than 2%. The highest frequency of occurrence of fish eggs (mainly capelin eggs) in crab stomachs was registered in 2001 (19.4%). Preliminary estimations indicate that in this particular year about 37 tonnes of capelin eggs were eaten by red king crabs in Western Murman waters. In the Russian Economic Exclusion Zone, the capelin spawning stock accounts for the one third of the total spawning stock and was estimated to be 99.5 billion individuals in 2001. The weight of an egg clutch from one female capelin is on the average 8 gram. Thus, the total amount of eggs spawned by the capelin stock in 2001 in Russian waters is estimated to 130 thousand tonnes. The simple calculations therefore show that, in 2001, the red king crab ate about 0.03% of the weight of all capelin eggs spawned. It is therefore reasonable to believe that red king crab feeding on eggs does not influence the capelin spawning stock significantly.

Long-term studies indicate that the main food items for red king crabs in the Barents Sea — echinoderms, molluscs, and worms — are also major prey species for the haddock. Therefore, any food competition between the red king crab and haddock should result in lower frequency of occurrence in haddock stomachs. A comparative analysis of haddock stomach content during a period (1971-1977) of low red king crab abundance with a period of increased red king crab abundance (1995-2002) was conducted; this analysis did not indicate any direct food competition between these two species in the Russian part of the Barents Sea[69].

A project on temperature tolerances of the king crab larvae has revealed tolerance limits for survival between –1.5 and 14°C, which may indicate a much wider geographical area for potential spreading of the crab than earlier anticipated.[70]

A study by Dvoretsky and Dvoretsky (2015), on whether the introduction of red king crab has affected the population trajectory of commercial fish species in the Barents Sea, has shown that the introduction of the red king crab species has had no apparent detrimental effects on fish stocks while resulting in positive economic benefits. The authors inferred that the high overall productivity of the Barents Sea in recent years, as evidenced by high abundances of major fish stocks, is more likely associated with warming in the Arctic region.

A literature review on the establishment and ecosystem effects of the introduced red king crab species into the Barents Sea, was conducted by Falk-Pedersen et al (2011). The study identified factors contributing to the success of the red king crab as well as its interactions with native biota. Characteristics of the Barents Sea and the red king crab itself that may explain its success were shown to include suitable habitat for settlement and growth of the larvae; the wide range of habitats occupied throughout its life history, high mobility, generalist prey choice, low fishing pressure during establishment, and the lack of parasites. Being a large, bottom-feeding omnivore of great mobility, the red king crab would therefore significantly impact the ecosystem. Reduced benthic diversity and biomass have been registered in invaded areas. Important prey items include large epibenthic organisms. Impacts on commercial and non-commercial fish species, through egg predation or indirect interactions, were difficult to detect and predict.

It is clear that red king crab is now an established species in the Barents Sea, and that it has had a demonstrable impact on the benthic ecosystem. From the studies conducted so far, and the results available, it is unclear whether this is significant in terms of ongoing change within the total benthic ecosystem, and in comparison to such drivers as climate change.

No records and/or research has been found on trap gear interactions with marine mammals. Such interactions might for example be in the form of entanglement with the buoy lines. PINRO (2015) explicitly stated that no such interactions have been recorded by the crab fishing vessels.

#### 8.1.6.3 Lost fishing gear, Ghost fishing

More than 640,000 tonnes of nets, lines, pots and traps used in commercial fishing are dumped and discarded in the seas every year, the same weight as 55,000 double-decker buses (The Guardian 6th Nov 2019[71]; Thomas et al 2019[72]).

Abandoned, lost, or discarded fishing gear is a significant problem in all fisheries. These gears continue to catch or trap fish, birds, and mammals for a long time - ghost fishing. Ghost fishing is more problematic in deeper waters; because of lower rates of biofouling and tidal scouring, these gears continue to fish effectively. Investigations made by the Norwegian Institute of Marine Research has shown that the number of gillnets lost increases with depth, for example (ICES BS ecosystem overview Nov 2019). There are global initiatives to combat ghost fishing, such as the Global Ghost Gear alliance (https://www.ghostgear.org/) set up in 2015 and aimed at finding solutions in collaboration with fishing industry, research and policy and education.

The fishery under assessment has in place on-board measures to minimise losses of fishing gear, as well as taking direct action to retrieve lost gear, as prescribed in the fishing rules. Fishing gear is expensive equipment, and loss of gear can also be a reason for withdrawal of a vessel from fishing. Therefore, ship specialists are keen to prevent the loss of gear. The loss of gear and how this is dealt with, is described in detail in Section 5.2.2.4 of this report.

### 8.1.7 P2 – Red King crab Performance Indicator scores and rationales

## PI 2.1.1 – Primary species outcome

| PI 2.1.1 | | The UoA aims to maintain primary species above the point where recruitment would be impaired (PRI) and does not hinder recovery of primary species if they are below the PRI | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| **a** | Main primary species stock status | | | |
| | Guide post | Main primary species are **likely** to be above the PRI.<br>OR<br>If the species is below the PRI, the UoA has measures in place that are **expected** to ensure that the UoA does not hinder recovery and rebuilding. | Main primary species are **highly likely** to be above the PRI.<br>OR<br>If the species is below the PRI, there is either **evidence of recovery** or a demonstrably effective strategy in place **between all MSC UoAs which categorise this species as main**, to ensure that they collectively do not hinder recovery and rebuilding. | There is a **high degree of certainty** that main primary species are above the PRI **and are** fluctuating around a level consistent with MSY. |
| | Met? | **NA** | **NA** | **NA** |
| Rationale | | | | |

There are no 'main' Primary species in the red crab fishery. All Primary species are caught at less than 5% of the total catch. See Table 29 Section 8.1.3.1.

Because there are no 'main' species, scoring issue a) is not used.

| | | | | |
|---|---|---|---|---|
| **b** | Minor primary species stock status | | | |
| | Guide post | | | Minor primary species are highly likely to be above the PRI.<br>OR<br>If below the PRI, there is evidence that the UoA does not hinder the recovery and rebuilding of minor primary species. |
| | Met? | | | **All elements - Yes** |
| Rationale | | | | |

All 'minor' species automatically meet SG80. Each element (minor species) is assessed against scoring issue b). If it does not meet SG100, it is treated as though it still meets SG80 (which is blank), which is automatically met by virtue of being a minor species.

The Primary minor species identified are: Cod, haddock, Beaked redfish, Greenland halibut, European plaice and herring (bait). There is good information from ICES (see table below) that cod, haddock, herring, Greenland halibut are highly likely to be above the PRI, and for European plaice please see Section 8.1.3.1 why it is considered a Primary minor species, and furthermore, the UoA catches so few individuals that it does not hinder the recovery and rebuilding of European plaice if there was a designated stock in the Barents Sea.

SG100 is met for those elements

For the redfish, for which there may be some uncertainty as it is not above the PRI, it is reasoned that the low level of catches, as calculated by VNIRO/PINRO (2020) do not hinder the recovery and rebuilding of this minor Primary species, SG100 is met.

Table showing ICES Advice for Primary Species (ICES.dk)

| Species | Assessment Unit<br>ICES Area | $B_{lim}$ | MSY | Advisory Category | Stock status | ICES Advice<br>Year/ section |
|---|---|---|---|---|---|---|
| **Cod**<br>*Gadus morhua* | I + II | Y | Y | Analytical assessment | F above $F_{MSY}$; Full reproductive capacity | June 2020 |
| **Haddock**<br>*Melanogrammus aeglefinus* | I + II | Y | Y | Analytical assessment | F above $F_{MSY}$; Full reproductive capacity | June 2020 |
| **Beaked redfish**<br>*Sebastes mentella* | I + II | Y | Y | Analytical assessment | Full reproductive capacity | June 2020 |
| **Greenland halibut**<br>*Reinhardtius hippoglossoides* | I + II | Y | NA | Age length Gadget model | Stock at full reproductive capacity; no reference points for F; quota advice given | June 2019/<br>No update |
| **European Plaice**<br>*Pleuronectes platessa* | No stock assessment for I + II, as this is outside the range for plaice;<br>For North Sea, IV | Y | Y | Analytical assessment | The stock is harvested sustainably; it is at full reproductive capacity | June 2020 |
| **Herring** (bait)<br>*Clupea harengus* | NE Atlantic<br>Norwegian spring-spawning | Y | Y | Analytical assessment | The stock is at full reproductive capacity; F above MSY | Sept 2020 |

## References

ICES Advice 2020 – cod.27.1-2 – https://doi.org/10.17895/ices.advice.5909

ICES Advice 2020 – had.27.1-2 – https://doi.org/10.17895/ices.advice.5948

ICES Advice 2020 –reb.27.1-2 – https://doi.org/10.17895/ices.advice.5826

ICES Advice 2020–ple.27.420–https://doi.org/10.17895/ices.advice.591

ICES Advice 2020 – her.27.1-24a514a – https://doi.org/10.17895/ices.advice.5876

VNIRO/ PINRO 2020 report

| | |
|---|---|
| **Draft scoring range** | **≥80** |
| Information gap indicator | **Information sufficient to score PI** |

**Overall Performance Indicator scores added from Client and Peer Review Draft Report stage**

| | |
|---|---|
| Overall Performance Indicator score | |
| Condition number (if relevant) | |

## PI 2.1.2 – Primary species management strategy

| PI 2.1.2 | | **There is a strategy in place that is designed to maintain or to not hinder rebuilding of primary species, and the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of unwanted catch** | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| **a** | Management strategy in place | | | |
| | Guide post | There are **measures** in place for the UoA, if necessary, that are expected to maintain or to not hinder rebuilding of the main primary species at/to levels which are likely to be above the PRI. | There is a **partial strategy** in place for the UoA, if necessary, that is expected to maintain or to not hinder rebuilding of the main primary species at/to levels which are highly likely to be above the PRI. | There is a **strategy** in place for the UoA for managing main and minor primary species. |
| | Met? | **Yes** | **Yes** | **Yes** |
| Rationale | | | | |

SG60 and SG80 is met, there are no main Primary species.

SG100 requires that there is a strategy in place to manage main and minor Primary species. 'Primary species are species of commercial value with management tools controlling exploitation. These tools, which comprise a strategy as they are regularly reviewed through the ICES process, Joint Russia and Norway Fisheries Commission, as well as by PINRO scientists, include: a requirement for accurate information on landings of bycaught species (via log book, landings notes and on-board checks by inspectors, all commercial species have to be retained and recorded), fishing season, technical measures for gear (mesh size and design of trap, including biodegradability and non-crab bycatch reduction design) and bycatch exclusion measures where possible. Bycatch data is available through a study by VNIRO/ PINRO (2020) which shows that bycatch of Primary species is low. SG100 is met.

| | | | | |
|---|---|---|---|---|
| **b** | Management strategy evaluation | | | |
| | Guide post | The measures are considered **likely** to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries/species). | There is some **objective basis for confidence** that the measures/partial strategy will work, based on some information directly about the fishery and/or species involved. | **Testing** supports **high confidence** that the partial strategy/strategy will work, based on information directly about the fishery and/or species involved. |
| | Met? | **Yes** | **Yes** | **No** |
| Rationale | | | | |

The measures/strategy will work because logbooks, registered landing ports and effectives monitoring, control and surveillance, as well as trap design research give objective basis for confidence that the measures designed to minimise the level of retention of non-target species are effective. The primary species involved are managed through stock management measures, gear design, and recording of all bycatch, whereby this data feeds into the relevant stock assessments.

The available toolbox (seasons, TACs, gear design) to reduce bycatch and experience with the system, including willingness to use the toolbox, provides confidence that the strategy will work. SG60 and SG80 is met.

'Testing' implies simulations of the strategy, and/or comparisons with its implementation elsewhere. There is no quantitative information available over a sufficient period of time, e.g. over several fishing seasons to allow testing. SG100 not met.

| | | | | |
|---|---|---|---|---|
| **c** | Management strategy implementation | | | |
| | Guide post | | There is **some evidence** that the measures/partial strategy is being **implemented successfully**. | There is **clear evidence** that the partial strategy/strategy is being **implemented successfully and is achieving its overall objective as set out in scoring issue (a).** |
| | Met? | | **Yes** | **Yes** |
| Rationale | | | | |

Given the low proportion of bycatch in this trap fishery, the partial strategy is working in practice for the client fleet, and the species in question are within biological limits, as regularly evaluated through stock specific ICES and JRNFC workshops. Evidence is in terms of logbooks where retained commercially important species are recorded (VNIRO/ PINRO 2020), compliance records, and VMS records, for example. SG80 is met.

Information on bycatch collected by the fleet, coupled with analysis by PINRO (VNIRO/ PINRO 2020), and ongoing scientific surveys of the stock status of the species involved, provide a basis for confidence that the strategy is working. Furthermore, there is good compliance with the regulations as implemented by the strategy. The bycatch is counted in numbers of individuals and is thus low. SG100 is met.

| | | | | |
|---|---|---|---|---|
| **d** | Shark finning | | | |
| | Guide post | It is **likely** that shark finning is not taking place. | It is **highly likely** that shark finning is not taking place. | There is a **high degree of certainty** that shark finning is not taking place. |
| | Met? | **NA** | **NA** | **NA** |
| Rationale | | | | |

There are no unwanted catches of shark as primary species.

| | | | | |
|---|---|---|---|---|
| **e** | Review of alternative measures | | | |
| | Guide post | There is a review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of main primary species. | There is a **regular** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of main primary species and they are implemented as appropriate. | There is a **biennial** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of all primary species, and they are implemented, as appropriate. |
| | Met? | **Yes** | **Yes** | **No** |

## Rationale

'Alternative measures' are to be interpreted as alternative fishing gear and /or practices that have been shown to minimise the rate of incidental mortality. 'Unwanted catch' is interpreted as the part of the catch that a fisher did not intend to catch but could not avoid, and did not want or chose not to use (SA3.1.6).

There are no main Primary species in the bycatch. SG80 is met.

There is very little bycatch, so researching into alternative measures seems not warranted or appropriate at this stage. There is no formal review process of this fishery regarding the gear and deployment, as traps have been traditionally used and are considered low impact. SG100 is not met.

## References

VNIRO/ PINRO 2020; client information; as under PI2.1.1

| **Draft scoring range** | **≥80** |
|---|---|
| Information gap indicator | **Information sufficient to score PI** |

**Overall Performance Indicator scores added from Client and Peer Review Draft Report stage**

| | |
|---|---|
| Overall Performance Indicator score | |
| Condition number (if relevant) | |

## PI 2.1.3 – Primary species information

| PI 2.1.3 | | Information on the nature and extent of primary species is adequate to determine the risk posed by the UoA and the effectiveness of the strategy to manage primary species | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| **a** | Information adequacy for assessment of impact on main primary species | | | |
| | Guide post | Qualitative information is **adequate to estimate** the impact of the UoA on the main primary species with respect to status.<br>**OR**<br>**If RBF is used to score PI 2.1.1 for the UoA:**<br>Qualitative information is adequate to estimate productivity and susceptibility attributes for main primary species. | Some quantitative information is available and is **adequate to assess** the impact of the UoA on the main primary species with respect to status.<br>**OR**<br>**If RBF is used to score PI 2.1.1 for the UoA:**<br>Some quantitative information is adequate to assess productivity and susceptibility attributes for main primary species. | Quantitative information is available and is **adequate to assess with a high degree of certainty** the impact of the UoA on main primary species with respect to status. |
| | Met? | **NA** | **NA** | **NA** |

Rationale

Given that there are no 'main' species Scoring Issue a) is not used.

| | | | | |
|---|---|---|---|---|
| **b** | Information adequacy for assessment of impact on minor primary species | | | |
| | Guide post | | | Some quantitative information is adequate to estimate the impact of the UoA on minor primary species with respect to status. |
| | Met? | | | **No** |

Rationale

Each element (minor species) is assessed against Scoring Issue b). If it does not meet SG100, it is treated as though it still meets SG80 (which is blank), which is automatically met by virtue of being a minor species.

Quantitative data is available on all Primary species (VNIRO/ PINRO 2020), at the point of capture and landing (recorded on board when emptying the traps). This is checked and verified through the scientific observer programme (via PINRO), inspections, and landings notes. Synthesis of data, analysis and checks are made by PINRO on an on-going basis. This is adequate to estimate the impact of the RKC fishery on the minor Primary species.

However, the fishery under assessment, UoA, has only just started in this fishery. There has been no observer report available directly from this UoA, which would complement the reports made for other RKC fisheries. The UoA itself does not appear to have initiated a bycatch data collection programme, similar to other certified crab fisheries in the Barents Sea, which have installed dedicated software, identification and training to collect and together with PINRO, analyse the bycatch information. SG100 is not met

| | | | | |
|---|---|---|---|---|
| c | **Information adequacy for management strategy** | | | |
| | Guide post | Information is adequate to support **measures** to manage **main** primary species. | Information is adequate to support a **partial strategy** to manage **main** primary species. | Information is adequate to support a **strategy** to manage **all** primary species, and evaluate with a **high degree of certainty** whether the strategy is achieving its objective. |
| | Met? | **Yes** | **Yes** | **No** |

Rationale

There are no main Primary species. SG60 and SG80 is met.

The amount of bycatch is low. This is a result of the type of gear used, and species targeted. However, quantitative information on Primary species bycaught is limited (VRINO/ PINRO 2020), and the analysis of available quantitative data does not make it possible to evaluate any trends. Therefore, it is not possible to say with a high degree of certainty that the strategy is achieving its objective. SG100 is not met.

References

VRINO/PINRO 2020

| | |
|---|---|
| **Draft scoring range** | ≥80 |
| Information gap indicator | **More information sought -** observer coverage and reports for 2020 fishing season. |

**Overall Performance Indicator scores added from Client and Peer Review Draft Report stage**

| | |
|---|---|
| Overall Performance Indicator score | |
| Condition number (if relevant) | |

## PI 2.2.1 – Secondary species outcome

| PI 2.2.1 | | The UoA aims to maintain secondary species above a biologically based limit and does not hinder recovery of secondary species if they are below a biological based limit | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| **a** | Main secondary species stock status | | | |
| | Guide post | Main secondary species are **likely** to be above biologically based limits.<br>OR<br>If below biologically based limits, there are **measures** in place expected to ensure that the UoA does not hinder recovery and rebuilding. | Main secondary species are **highly likely** to be above biologically based limits.<br>OR<br>If below biologically based limits, there is either **evidence of recovery** or a **demonstrably effective partial strategy** in place such that the UoA does not hinder recovery and rebuilding.<br>AND<br>Where catches of a main secondary species outside of biological limits are **considerable**, there is either **evidence of recovery** or a, **demonstrably effective strategy in place between those MSC UoAs that have considerable catches of the species**, to ensure that they collectively do not hinder recovery and rebuilding. | There is a **high degree of certainty** that main secondary species are above biologically based limits. |
| | Met? | **NA** | **NA** | **NA** |
| Rationale | | | | |

There are no main Secondary species in the red crab fishery. All Secondary species are caught at less than 5% of the total catch. See Table 27 in Section 8.1.3.2.

Because there are no 'main' species, scoring issue a) is not used. Each element (minor species) is therefore assessed against Scoring Issue b).

| | | | | |
|---|---|---|---|---|
| **b** | Minor secondary species stock status | | | |
| | Guide post | | | Minor secondary species are highly likely to be above biologically based limits.<br>OR<br>If below biologically based limits', there is evidence that |

| | | | | |
|---|---|---|---|---|
| | | | | the UoA does not hinder the recovery and rebuilding of secondary species |
| | Met? | | | **All elements - No** |

## Rationale

The nature of the classification into Secondary species indicates that these species are not managed, and in many cases do not have the necessary analytical assessment to determine the biologically based limits. There is little evidence available which shows that these species are highly likely to be above biologically based limits. Each Secondary species is an element and is assessed against Scoring Issue b), as they are all ‘minor’. If it does not meet SG100, it is treated as though it still meets SG80 (which is blank), which is automatically met by virtue of being a minor species.

The amount of Secondary species bycatch is small, as analysed by VNIRO/ PINRO 2020 from 2015-2020, evaluating the catches across a number of RKC fisheries (not the client fishery per se). The Secondary ‘minor’ species identified from the catch composition in 8.1.3.2are listed as the following elements: Spotted, Atlantic and Northern wolfish; lumpfish; Thorny (starry) ray; and the PINRO 2015 study identified a number of invertebrates, such as lyre crabs, sea urchins, Barents Sea stone crab, Iceland scallop.

Squid as bait was designated as a Secondary species, there was no stock information.

Although there are some biomass estimates and distribution information for the species of wolffish (see Section 8.1.3.2), the minor secondary species caught in this fishery should be considered as data-deficient as there are no stock status reference points available (MSC Fisheries Standard v2.01, 7.7.6, Table 3) Paragraph 7.7.6.5 requires that the Risk-Based Framework (RBF) should be used to evaluate scoring elements that are data-deficient. The secondary species identified should therefore be scored using the RBF. However, PF4.1.4 states that “The team may elect to conduct a PSA on “main” species only when evaluating PI 2.1.1 or 2.2.1”, and this is the approach taken in this assessment as all secondary species caught were designated as minor secondary species. PF 5.3.2 is therefore applied and the scores for this SI are capped at 80. SG80 is met. SG100 is not met.

Available information is summarised for each of the minor species in Section 8.1.3.2of this report.

## References

PINRO 2015; 2017; VNIRO/ PINRO 2020; IMR-PINRO joint report 2019, 2018, 2014; ICES WGIBAR 2018; ICES WGEF 2017; Eriksen et al 2014.

| **Draft scoring range** | **≥80** |
|---|---|
| Information gap indicator | **More information sought -** biological status of secondary minor species |

**Overall Performance Indicator scores added from Client and Peer Review Draft Report stage**

| | |
|---|---|
| Overall Performance Indicator score | |
| Condition number (if relevant) | |

# PI 2.2.2 – Secondary species management strategy

| PI 2.2.2 | | There is a strategy in place for managing secondary species that is designed to maintain or to not hinder rebuilding of secondary species and the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of unwanted catch | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| **a** | Management strategy in place | | | |
| | Guide post | There are **measures** in place, if necessary, which are expected to maintain or not hinder rebuilding of main secondary species at/to levels which are highly likely to be above biologically based limits or to ensure that the UoA does not hinder their recovery. | There is a **partial strategy** in place, if necessary, for the UoA that is expected to maintain or not hinder rebuilding of main secondary species at/to levels which are highly likely to be above biologically based limits or to ensure that the UoA does not hinder their recovery. | There is a **strategy** in place for the UoA for managing main and minor secondary species. |
| | Met? | **Yes** | **Yes** | **Yes** |
| Rationale | | | | |

There are no main Secondary species. SG80 is met.

The nature of the fishery is such, that there is little else bycaught besides the target species, Red king crab. This is confirmed by the catch composition data from observer reports of the RKC fishery as a whole (VNIRO/ PINRO 2020), which show little bycatch. The main strategy to reduce unwanted bycatch consists of trap design (mesh size and design of trap, including biodegradability of parts of the trap), special chutes to return bycatch to the sea as speedily as possible where appropriate, move on rules (which applies to target species juveniles and females as well as non-target species). SG100 is met

| | | | | |
|---|---|---|---|---|
| **b** | Management strategy evaluation | | | |
| | Guide post | The measures are considered **likely** to work, based on plausible argument (e.g. general experience, theory or comparison with similar UoAs/species). | There is **some objective basis for confidence** that the measures/partial strategy will work, based on some information directly about the UoA and/or species involved. | **Testing** supports **high confidence** that the partial strategy/strategy will work, based on information directly about the UoA and/or species involved. |
| | Met? | **Yes** | **Yes** | **No** |
| Rationale | | | | |

The measures/strategy will work because logbooks, registered landing ports and effective monitoring, control and surveillance, and catch composition data through an on-board observer regime, as well as trap design (mesh size, shape), give an objective basis for confidence that the measures designed to minimise the level of retention of non-target species are effective. Available observer data shows little secondary species bycatch (VNIRO/ PINRO 2020; PINRO 2015). SG80 is met.

'Testing' implies simulations of the strategy, and/or comparisons with its implementation elsewhere. There is no quantitative information available over a sufficient period of time, e.g. over several fishing seasons to allow testing. SG100 not met.

| | | | | |
|---|---|---|---|---|
| **c** | Management strategy implementation | | | |
| | Guide post | | There is **some evidence** that the measures/partial strategy is being **implemented successfully**. | There is **clear evidence** that the partial strategy/strategy is being **implemented successfully and is achieving its objective as set out in scoring issue (a).** |
| | Met? | | **Yes** | **No** |
| Rationale | | | | |

Given the low proportion of bycatch in the RKC fishery as analysed by VNIRO/ PINRO (2020), the partial strategy seems to be working in practice for the client fleet. SG80 is met.

This fishery under assessment has only recently started operating (2020), and bycatch information is based on VNIRO/PINRO studies of other RKC fisheries is the area. Although there is no reason to suppose that the fishery under assessment will perform any differently considering that the same rules and regulations have to be followed, there is little direct bycatch data collected to date by the fishery under assessment. Therefore, evidence is not clear. SG100 is not met.

| | | | | |
|---|---|---|---|---|
| **d** | Shark finning | | | |
| | Guide post | It is **likely** that shark finning is not taking place. | It is **highly likely** that shark finning is not taking place. | There is a **high degree of certainty** that shark finning is not taking place. |
| | Met? | **NA** | **NA** | **NA** |
| Rationale | | | | |

No Secondary species are sharks. This SI is not scored.

| | | | | |
|---|---|---|---|---|
| **e** | Review of alternative measures to minimise mortality of unwanted catch | | | |
| | Guide post | There is a review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of **unwanted** catch of main secondary species. | There is a **regular** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of **unwanted** catch of main secondary species and they are implemented as appropriate. | There is a **biennial** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of **unwanted** catch of all secondary species, and they are implemented, as appropriate. |
| | Met? | **Yes** | **Yes** | **No** |
| Rationale | | | | |

‘Alternative measures’ are to be interpreted as alternative fishing gear and /or practices that have been shown to minimise the rate of incidental mortality. ‘Unwanted catch’ is interpreted as the part of the catch that a fisher did not intend to catch but could not avoid, and did not want or chose not to use (SA3.1.6).

There are no main Secondary species in the bycatch. SG60 and SG80 is met.

There is very little bycatch, so researching into alternative measures seems not warranted or appropriate at this stage. There is no formal review process of this fishery regarding the gear and deployment, as traps have been traditionally used and are considered low impact. SG100 is not met.

| References |
|---|

As for PI 2.2.1

| **Draft scoring range** | **≥80** |
|---|---|
| Information gap indicator | **Information sufficient to score PI** |

**Overall Performance Indicator scores added from Client and Peer Review Draft Report stage**

| | |
|---|---|
| Overall Performance Indicator score | |
| Condition number (if relevant) | |

## PI 2.2.3 – Secondary species information

| PI 2.2.3 | | Information on the nature and amount of secondary species taken is adequate to determine the risk posed by the UoA and the effectiveness of the strategy to manage secondary species | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| **a** | Information adequacy for assessment of impacts on main secondary species | | | |
| | Guide post | Qualitative information is **adequate to estimate** the impact of the UoA on the main secondary species with respect to status.<br>OR<br>**If RBF is used to score PI 2.2.1 for the UoA:**<br>Qualitative information is adequate to estimate productivity and susceptibility attributes for main secondary species. | Some quantitative information is available and **adequate to assess** the impact of the UoA on main secondary species with respect to status.<br>OR<br>**If RBF is used to score PI 2.2.1 for the UoA:**<br>Some quantitative information is adequate to assess productivity and susceptibility attributes for main secondary species. | Quantitative information is available and **adequate to assess with a high degree of certainty** the impact of the UoA on main secondary species with respect to status. |
| | Met? | **NA** | **NA** | **NA** |
| Rationale | | | | |

There are no main Secondary species, Scoring Issue a) is not used. Each element (minor species) is assessed against Scoring Issue b)

| | | | | |
|---|---|---|---|---|
| **b** | Information adequacy for assessment of impacts on minor secondary species | | | |
| | Guide post | | | Some quantitative information is adequate to estimate the impact of the UoA on minor secondary species with respect to status. |
| | Met? | | | **No** |
| Rationale | | | | |

Some quantitative data is available on several of the minor Secondary species of fish (through the catch profile), based on VNIRO/PINRO data from 2015-2020. This research is based on RKC fisheries in the Barents Sea, and not necessarily particular to the fishery under assessment (as this has only started fishing for RKC in 2020). Some qualitative information on non-fish bycatch has also been collected and presented by PINRO (2015). The individual elements have been identified under PI 2.2.1. from observer reports. The data was collected at the point of capture and verified through the scientific observer programme of PINRO. In the Red King crab fishery, using pots, bycatch is limited to few species and few individuals of those species (PINRO 2015). Synthesis of data, analysis and checks are made by PINRO on an on-going basis. This information is adequate to estimate the impact of the red king crab fishery as a whole on the minor Secondary species.

However, the fishery under assessment, this UoA, has only just started in this fishery (2020). There has been no observer report available directly from this UoA, which would complement the reports made for other RKC fisheries. The UoA itself does not appear to have initiated a bycatch data collection programme, similar to other certified crab fisheries in the Barents Sea, which have installed dedicated software, identification and training to collect and together with PINRO, analyse the bycatch information. SG100 is not met

| | | | | |
|---|---|---|---|---|
| **c** | Information adequacy for management strategy | | | |
| | Guide post | Information is adequate to support **measures** to manage **main** secondary species. | Information is adequate to support a **partial strategy** to manage **main** secondary species. | Information is adequate to support a **strategy** to manage **all** secondary species, and **evaluate** with a **high degree of certainty** whether the strategy is **achieving its objective**. |
| | Met? | **Yes** | **Yes** | **No** |

Rationale

There are no main Secondary species, SG60 and SG80 is met.

The amount of bycatch is low, it is measured in numbers of individuals for the invertebrates, and small quantities for fish species. This is a result of the type of gear used, and species targeted. However, quantitative information on some of the Secondary species bycaught is limited (ie no regular collection of bycatch data on non-fish species as can be seen in VNIRO/PINRO 2020), and the analysis of available quantitative data does not make it possible to evaluate any trends. Therefore, it is not possible to say with a high degree of certainty that the strategy is achieving its objective. SG100 is not met.

References

As for PI 2.2.1

| | |
|---|---|
| **Draft scoring range** | **≥80** |
| Information gap indicator | **Information sufficient to score PI** |

**Overall Performance Indicator scores added from Client and Peer Review Draft Report stage**

| | |
|---|---|
| Overall Performance Indicator score | |
| Condition number (if relevant) | |

## PI 2.3.1 – ETP species outcome

| PI 2.3.1 | | The UoA meets national and international requirements for the protection of ETP species<br>The UoA does not hinder recovery of ETP species | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| **a** | Effects of the UoA on population/stock within national or international limits, where applicable | | | |
| | Guide post | Where national and/or international requirements set limits for ETP species, the **effects of the UoA** on the population/ stock are known and **likely** to be within these limits. | Where national and/or international requirements set limits for ETP species, the **combined effects of the MSC UoAs** on the population /stock are known and **highly likely** to be within these limits. | Where national and/or international requirements set limits for ETP species, there is a **high degree of certainty** that the **combined effects of the MSC UoAs** are within these limits. |
| | Met? | **NA** | **NA** | **NA** |
| Rationale | | | | |

No ETP species were recorded in the catch composition. The assessment team has not received any reports or documentation of the UoA affecting ETPs. The assessment team is not aware of any national and/or international requirements set limits for ETP species which may be encountered by the fishery under assessment. This SI is therefore not scored.

| | | | | |
|---|---|---|---|---|
| **b** | Direct effects | | | |
| | Guide post | Known direct effects of the UoA are likely to not **hinder recovery** of ETP species. | Direct effects of the UoA are **highly likely** to not **hinder recovery** of ETP species. | There is a **high degree of confidence** that there are no **significant detrimental direct effects** of the UoA on ETP species. |
| | Met? | **Yes** | **Yes** | **No** |
| Rationale | | | | |

The red king crab trap fishery has no known direct effects on ETP species. It is a passive gear, where benthic predators are attracted to the trap by the smell of the bait. The traps are designed in such a way that parts will decompose in case of lost traps, so that ghost fishing is not considered an issue (see also Section 5.2.2.4). Considering that no ETP species have been recorded in the catch composition (PINRO 2015; VNIRO/PINRO 2020), SG60 and SG80 are met.

The catch composition data comes from observer trips which cover only 1-2% of fishing trips (PINRO 2015; VNIRO/PINRO 2020). Furthermore, although the data covers several years (2015-20), the observer coverage is not extensive, and thus it is not possible to evaluate with a high degree of confidence that there are no significant detrimental effects of the UoA on ETP species. SG100 is not met

| | | | | |
|---|---|---|---|---|
| **c** | Indirect effects | | | |
| | Guide | | Indirect effects have been considered for the UoA and are thought to be **highly** | There is a **high degree of confidence** that there are no **significant detrimental** |

| | | | | |
|---|---|---|---|---|
| | post | | **likely** to not create unacceptable impacts. | **indirect effects** of the UoA on ETP species. |
| | Met? | | **Yes** | **No** |

Rationale

Indirect effects may include removal of prey and pollution, as well as for example disturbance/ interference of feeding or breeding behavior of ETP species.

The main determinants of whale and dolphin species abundance is zooplankton and capelin abundance in the Barents Sea, in this sense this fishery is unlikely to be of consequence. The fishery operates outwith the 12nm zone in open water, therefore away from any onshore bird breeding colonies. It operates in deeper waters (>100m) which reduces the likelihood of diving seabird interactions. No marine mammal and seabird interactions have been noted (Client information pack Nov 2020).

All vessels are fully MARPOL compliant, with detailed waste and oil handling protocols. Pollution from the to-be-certified vessels is therefore not likely to impact on ETP species.

In summary, it is highly unlikely that indirect effects create unacceptable impacts. SG80 is met.

There are currently no direct observations from observer reports on the fishery under assessment, all the information and bycatch data available is from science reports across RKC fishery in the Barents Sea. The vessels under assessment have an agreement with PINRO and VNIRO for allocating observers who collect biological information including by-catch and ETP interaction. However, this agreement is new, the fishery has started recently (2020 season), and existing bycatch information from observer reports on the RKC fishery as a whole cover only few years. Also, as bycatch is very low, trends would be difficult to show. The lack of time series data on bycatch/ ETP bycatch does not allow a high degree of confidence. SG100 is not met.

**References**

Barentsportal.org Status reports of the Barents Sea; VNIRO/PINRO 2020; PINRO 2015; Client information Oct 2020, 8th Dec 2020

| | |
|---|---|
| **Draft scoring range** | **≥80** |
| Information gap indicator | **More information sought -** Additional info on data collection relevant to the vessels |

**Overall Performance Indicator scores added from Client and Peer Review Draft Report stage**

| | |
|---|---|
| Overall Performance Indicator score | |
| Condition number (if relevant) | |

# PI 2.3.2 – ETP species management strategy

| PI 2.3.2 | The UoA has in place precautionary management strategies designed to:<br>- meet national and international requirements;<br>- ensure the UoA does not hinder recovery of ETP species.<br><br>Also, the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of ETP species | | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| **a** | Management strategy in place (national and international requirements) | | | |
| | Guide post | There are **measures** in place that minimise the UoA-related mortality of ETP species, and are expected to be **highly likely to achieve** national and international requirements for the protection of ETP species. | There is a **strategy** in place for managing the UoA's impact on ETP species, including measures to minimise mortality, which is designed to be **highly likely to achieve** national and international requirements for the protection of ETP species. | There is a **comprehensive strategy** in place for managing the UoA's impact on ETP species, including measures to minimise mortality, which is designed to **achieve above** national and international requirements for the protection of ETP species. |
| | Met? | **NA** | **NA** | **NA** |
| Rationale | | | | |

There were no ETP species recorded in the catch profile of the RKC fishery.

This SI is not scored (MSC Fisheries Standard SA3.11.2) as there are no requirements for protection and rebuilding provided through national/ international ETP legislation of relevant ETPs (relevant to this fishery under assessment). SIb is scored instead.

| | | | | |
|---|---|---|---|---|
| **b** | Management strategy in place (alternative) | | | |
| | Guide post | There are **measures** in place that are expected to ensure the UoA does not hinder the recovery of ETP species. | There is a **strategy** in place that is expected to ensure the UoA does not hinder the recovery of ETP species. | There is a **comprehensive strategy** in place for managing ETP species, to ensure the UoA does not hinder the recovery of ETP species. |
| | Met? | **Yes** | **Yes** | **No** |
| Rationale | | | | |

There are measures in place, amounting to a strategy, which is expected to ensure the UoA does not hinder the recovery of ETP species. This consists of keeping detailed records of catch composition of the trap fishery through observers, who are deployed throughout the RKC fishery and evaluating any trends in the data (PINRO 2015; VNIRO/PINRO 2020). Furthermore, bycatch reduction devices and trap design, including biodegradability of the gear, reduce the potential of catching ETP species, similar to Primary and Secondary species bycatch. Recording of bycatch and location of fishing, and the quick release of any bycatch not suitable for human consumption, are all expected to not hinder the recovery of possible ETPs. SG60 and SG80 are met.

A comprehensive strategy is defined by the MSC as "a complete and tested strategy made up of linked monitoring, analyses, and management measures and responses" (MSC Fisheries Standard v2.01). There does not appear to be such an ETP specific review. SG100 is not met.

| | | | | |
|---|---|---|---|---|
| **c** | Management strategy evaluation | | | |
| | Guide post | The measures are **considered likely** to work, based on **plausible argument** (e.g.,general experience, theory or comparison with similar fisheries/species). | There is an **objective basis for confidence** that the measures/strategy will work, based on **information** directly about the fishery and/or the species involved. | The strategy/comprehensive strategy is mainly based on information directly about the fishery and/or species involved, and a **quantitative analysis** supports **high confidence** that the strategy will work. |
| | Met? | **Yes** | **Yes** | **No** |
| Rationale | | | | |

The bycatch, including possible ETP species in this trap fishery is small and can be counted in individuals (PINRO 2017; VNIRO/PINRO 2020). The current measures in place, such as recording of bycatch through PINRO (2017) and gear deployment, provides an objective basis for confidence that measures will work. No ETPs have been recorded in the bycatch. SG 60 and SG80 are met.

Although quantitative information on and analysis of the catch composition (covering 5yrs, 2015-2020) from observer reports are available (VNIRO/PINRO 2020; PINRO 2015), the observer coverage is too low, 1-2% of the fishery per year, to support a high confidence that the strategy will work. Observers have been placed on two vessels of the fishery under assessment for during the 2020 season. The reports were not available in time for the ACDR. SG100 is not met

| | | | | |
|---|---|---|---|---|
| **d** | Management strategy implementation | | | |
| | Guide post | | There is some **evidence** that the measures/strategy is being implemented successfully. | There is **clear evidence** that the strategy/comprehensive strategy is being implemented successfully and **is achieving its objective as set out in scoring issue (a) or (b).** |
| | Met? | | **Yes** | **No** |
| Rationale | | | | |

There is some evidence that the strategy is being implemented successfully, as the observer report analysis on catch composition in the RKC fishery shows (VNIRO/PINRO 2020; PINRO 2015). The analysis indicates that no ETP species have been recorded in this fishery during the time frame of those reports. SG80 is met.

However, observer coverage is limited, and recording of bycatch is predominantly of finfish species, as this is a requirement, rather than recording of all bycatch. The evidence is not extensive,SG100 is not met.

| | | | | |
|---|---|---|---|---|
| **e** | Review of alternative measures to minimise mortality of ETP species | | | |
| | Guide | There is a review of the potential effectiveness and | There is a **regular** review of the potential effectiveness | There is a **biennial** review of the potential effectiveness |

| | | | | |
|---|---|---|---|---|
| | post | practicality of alternative measures to minimise UoA-related mortality of ETP species. | and practicality of alternative measures to minimise UoA-related mortality of ETP species and they are implemented as appropriate. | and practicality of alternative measures to minimise UoA-related mortality ETP species, and they are implemented, as appropriate. |
| | Met? | **NA** | **NA** | **NA** |

Rationale

This SI was not scored, as scientists' reports show (PINRO 2015; VNIRO/PINRO 2020) that any bycatch in this trap fishery is small, and no ETPs have been recorded. No publications have been found which would indicate otherwise for this trap fishery, and this suggests that reviews and research on alternative measures to minimise ETP mortality are not relevant.

References

PINRO 2015; VNIRO/PINRO 2020; http://www.barentsportal.com/barentsportal/index.php/en/status-2019

| | |
|---|---|
| Draft scoring range | **≥80** |
| Information gap indicator | **Information sufficient to score PI** |

**Overall Performance Indicator scores added from Client and Peer Review Draft Report stage**

| | |
|---|---|
| Overall Performance Indicator score | |
| Condition number (if relevant) | |

## PI 2.3.3 – ETP species information

| PI 2.3.3 | Relevant information is collected to support the management of UoA impacts on ETP species, including:<br>- Information for the development of the management strategy;<br>- Information to assess the effectiveness of the management strategy; and<br>- Information to determine the outcome status of ETP species | | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| **a** | Information adequacy for assessment of impacts | | | |
| | Guide post | Qualitative information is **adequate to estimate** the UoA related mortality on ETP species.<br>**OR**<br>**If RBF is used to score PI 2.3.1 for the UoA:**<br>Qualitative information is **adequate to estimate productivity and susceptibility** attributes for ETP species. | Some quantitative information is **adequate to assess** the UoA related mortality and impact and to determine whether the UoA may be a threat to protection and recovery of the ETP species.<br>**OR**<br>**If RBF is used to score PI 2.3.1 for the UoA:**<br>Some quantitative information is **adequate to assess productivity and susceptibility attributes** for ETP species. | Quantitative information is available to assess with a high degree of certainty the **magnitude of UoA-related impacts, mortalities and injuries and the consequences for the status** of ETP species. |
| | Met? | **Yes** | **No** | **No** |

Rationale

The PINRO / IMR Reports (Jakobsen & Ozhigin, 2011; McBride et al 2014) on the State of the Barents Sea ecosystem offer an overview of the ETP species which occur in the Barents Sea including their spatial and temporal distribution and ecology. Species recording requirements of bycatch, by PINRO scientists, generate high quality data on the catch of a wide range of species, and the analysis presented in Table 27 and Table 28 suggests that encounters with ETP species are likely to be rare, as no ETP species were recorded in the RKC fisheries observed (PINRO 2015; PINRO 2017; VNIRO/PINRO 2020).

The information comes from observer trips which cover only 1-2% of fishing trips. Given the likely low abundance of ETP species and therefore the low likelihood of encountering ETP species on the few trips that are covered by the observer programme, the quantitative information available is not adequate to assess the magnitude of UoA-related impacts, mortalities and injuries and the consequences for the status of ETP species. SG60 is met, SG 80 is not met.

| | | | | |
|---|---|---|---|---|
| **b** | Information adequacy for management strategy | | | |
| | Guide post | Information is adequate to support **measures** to manage the impacts on ETP species. | Information is adequate to measure trends and support a **strategy** to manage impacts on ETP species. | Information is adequate to support a **comprehensive strategy** to manage impacts, minimise mortality and injury of ETP species, and evaluate with a **high degree of** |

| | | | | |
|---|---|---|---|---|
| | | | | **certainty** whether a strategy is achieving its objectives. |
| | Met? | **Yes** | **No** | **No** |

| Rationale |
|---|

The quantity of bycatch in the Red King crab trap fishery is small, primarily due to the specifics of the fishery (passive gear of baited traps of particular design, and species targeted). Information on bycatch is recorded and analysed in Observer reports (VNIRO/ PINRO 2020; PINRO 2015). The information is adequate to support measures to manage possible impacts on ETPs. SG60 is met.

The data collected and analysed is not detailed and frequent enough to measure trends, as well as the fact that bycatch is inherently small. Observer coverage is limited. The fishery under assessment is new to the fishery (2020). The fishery under assessment has not implemented a self-recoding of bycatch programme on board, which would complement observer information. Such self-recording could be in the form of dedicated software and analysis implemented on currently certified vessels in the Barents Sea. SG80 is not met

| References |
|---|

VNIRO/ PINRO 2020; PINRO 2015; barentsportal Status report 2019
http://www.barentsportal.com/barentsportal/index.php/en/status-2019

| **Draft scoring range** | **60-79** |
|---|---|
| Information gap indicator | **More information sought**<br>VMS data, Observer reports and information on the implementation of self-reporting system for bycatch. Also, Information should be sought on data in greater detail over a longer time period |

**Overall Performance Indicator scores added from Client and Peer Review Draft Report stage**

| | |
|---|---|
| Overall Performance Indicator score | |
| Condition number (if relevant) | |

## PI 2.4.1 – Habitats outcome

| PI 2.4.1 | | The UoA does not cause serious or irreversible harm to habitat structure and function, considered on the basis of the area covered by the governance body(s) responsible for fisheries management in the area(s) where the UoA operates | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| **a** | Commonly encountered habitat status | | | |
| | Guide post | The UoA is **unlikely** to reduce structure and function of the commonly encountered habitats to a point where there would be serious or irreversible harm. | The UoA is **highly unlikely** to reduce structure and function of the commonly encountered habitats to a point where there would be serious or irreversible harm. | There is **evidence** that the UoA is highly unlikely to reduce structure and function of the commonly encountered habitats to a point where there would be serious or irreversible harm. |
| | Met? | **Yes** | **Yes** | **Yes** |
| Rationale | | | | |

The nature and distribution of benthic habitats and their interaction with the client fleet has been described in detail in section 8.1.5. The section also described in detail the various types of habitats in the Barents Sea, which may be encountered by the fishery.

The commonly encountered habitat within the UoA fishing area is sedimentary soft substrate, clay/mud, sand and silty bottom (Figure 33), and associated benthos (for example Figure 35and Figure 36) and biotopes (Figure 34) as described in studies highlighted in Sections 8.1.5.1/2. The trap gear is a static gear, with a small footprint on the seafloor. It is highly unlikely that the UoA reduces structure and function of the sedimentary seafloor to a point where there is serious or irreversible harm (meaning, that the habitat can recover at least 80% of its structure and function within 5-20 years if fishing on the habitat were to cease entirely). SG60 and SG80 is met.

Studies have shown (Morgan and Chuenpagdee 2003; NMFS 2004; Eno et al 2001, see also Section 8.1.5.5) that the trap gear deployed on the sedimentary seafloor is highly unlikely to reduce structure and function of the commonly encountered habitat (sand and silt) to a point where there would be serious or irreversible harm. SG100 is met

| | | | | |
|---|---|---|---|---|
| **b** | VME habitat status | | | |
| | Guide post | The UoA is **unlikely** to reduce structure and function of the VME habitats to a point where there would be serious or irreversible harm. | The UoA is **highly unlikely** to reduce structure and function of the VME habitats to a point where there would be serious or irreversible harm. | There is **evidence** that the UoA is highly unlikely to reduce structure and function of the VME habitats to a point where there would be serious or irreversible harm. |
| | Met? | **Yes** | **Yes** | **No** |
| Rationale | | | | |

Criteria for a VME indicator are based on traits related to functional significance, fragility, and the life-history traits of component species that show slow recovery to disturbance. For each group, it is the dense aggregations (beds/fields) that are considered to be VME in order to establish functional significance. Indicators include for example various species of crinoids, erect bryozoans, large sea squirts, sponges and corals.

A search of the available literature and research did not show any officially defined VMEs in the red king crab fishing area. OSPAR did not show any MPAs in this area (see Section 8.1.5.4). The MAREANO project maps for benthic biotopes and vulnerable areas does not reach into the Russian sector of the Barents Sea. The latest sediment maps of the area published by the Norwegian Geological Institute in 2019 shows soft substrate for the area (Figure 33; see Section 8.1.5.1for maps). Russian literature on benthos surveys did not highlight hard substrate VME habitats, mainly showing soft bottom communities (See Section 8.1.5.1/ 2 for distribution maps of benthos, Figure 34, Figure 35, Figure 36).

From the zoobenthos distribution maps provided in Section 8.1.5.32it can be deduced that the main habitat type in the red king crab fishing area (which is 12nm offshore) is soft sedimentary bottom, such as mud, sandy mud, and muddy sand, dominated by specific species of starfish, sea cucumber, sponges and burrowing bivalves (*Astarte borealis*).

Based on the information on the passive gear type and deployment, the fact that red king crab lives on soft sediments, the fact that the RKC fishery operates within a limited area only (for physiological reasons the distribution of the crab is limited) and the specific substrate requirements of VME habitat types (such as coral gardens, reefs etc) which the latest sediment map (2019) does not indicate in the area under assessment, it can be stated that the fishery is highly unlikely to reduce structure and function of VME habitats to a point where there would be serious or irreversible harm (reductions in habitat structure and function below 80% of the unimpacted level), because there is low encounterability, and the likelihood of VMEs on these soft sediments is low.. SG60 and SG80 is met.

In order to meet SG100 evidence has to be provided in the form of higher resolution habitat maps, including species sampling, within the fishing area. SG100 is not met.

| | | | | |
|---|---|---|---|---|
| | Minor habitat status | | | |
| **c** | Guide post | | | There is **evidence** that the UoA is highly unlikely to reduce structure and function of the minor habitats to a point where there would be serious or irreversible harm. |
| | Met? | | | **Yes** |

Rationale

The minor habitats are those that are not commonly encountered by the gear (i.e. those not considered under SI(a), such as particular combinations of sediments, outcrops and gullies, etc. The sediment map of the area (Figure 33), as well as maps produced as part of several surveys of the megabenthos (see also Section 7.3.1d) showed that there appear to be no distinct minor habitats in the area where the UoA is fishing (outwith 12nm). The fishing area consists of fine substratum, as defined in MSC Fisheries Standard v2.01 Table GSA6, and associated biota, which studies show is not irreversibly harmed by the trap fishery (Morgan and Chuenpagdee 2003; Eno et al 2001). SG100 is met.

References

Morgan and Chuenpagdee 2003; Eno et al 2001; MAREANO programme; Joint Russian Norwegian Ecosystem Assessment – Barents Portal; Spiridinov et al 2011; Larsen et al 2003; ICES WGIBAR 2017; PINRO 2018; IMR/PINRO 2019; Dolan et al 2015; Anisimova et al 2010; Jakobsen T., Ozhigin V., 2011; Jørgensen et al 2019; Bakanev et al 2014; VNIRO 2020; NEAFC 2014; ICES 2009; NMFS 2004; NOAA 2017; Quandt 1999;

Barents Sea Status report 2019; http://www.barentsportal.com/barentsportal/index.php/en/status-2019/272-human-activity-data-from-2018/fisheries-and-other-harvesting-2018/959-anthropogenic-impact-catches-of-shellfish

http://www.mareano.no/kart/mareano_en.html#maps/4050;

https://www.ngu.no/en/news/new-seabed-sediment-map-barents-sea, published 2019

https://www.hi.no/en/hi/temasider/species/red-king-crab

http://www.fao.org/in-action/vulnerable-marine-ecosystems/criteria/en/

http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2013/Special%20requests/NEAFC_VME_%20indicator_%20species_%20and_elements.pdf

| **Draft scoring range** | **≥80** |
|---|---|
| Information gap indicator | **Information sufficient to score PI** |

**Overall Performance Indicator scores added from Client and Peer Review Draft Report stage**

| | |
|---|---|
| Overall Performance Indicator score | |
| Condition number (if relevant) | |

PI 2.4.2 – Habitats management strategy

| PI 2.4.2 | | There is a strategy in place that is designed to ensure the UoA does not pose a risk of serious or irreversible harm to the habitats | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| **a** | Management strategy in place | | | |
| | Guide post | There are **measures** in place, if necessary, that are expected to achieve the Habitat Outcome 80 level of performance. | There is a **partial strategy** in place, if necessary, that is expected to achieve the Habitat Outcome 80 level of performance or above. | There is a **strategy** in place for managing the impact of all MSC UoAs/non-MSC fisheries on habitats. |
| | Met? | **Yes** | **Yes** | **No** |

Rationale

The red king crab fishery occurs in soft sediment areas.

Measures in place to mitigate habitat impacts include on-going mapping programmes to improve access management. Grabs and trawl sampling continue to be used for surveys of the benthos. Since 2006, the 'Russian – Norwegian Joint Annual Ecosystem surveys' provide both spatial and temporal data of benthic fauna for more than 400 stations annually. There has been research into habitat impacts of gear types (interpretation from other studies, such as outlined in Section 8.1.5.5). Management measures, which specifically addresses habitat impact has largely focused on closing inshore waters, the crab fishery is not allowed within 12nm of the coast.

As a passive gear, the move on rule in relation to benthic organisms is not applicable. Although benthic organisms (such as echinoderms which have moved into the trap) have been brought up with trap gear retrieval, it may at this stage be considered inappropriate to apply threshold values of weight per species/genus, as this is a passive trap fishery. A move on rule is in place with regards to protecting juveniles of the target species (i.e. if too many juvenile crabs move into the trap, although observations have shown that when adult crabs are present, juveniles do not move in [client interview May 2019 for RKC fishery). Local knowledge by the crew is a further determinant as to where fishing occurs and avoidance of particular areas.

Scientific observers collect and analyse non-target species bycatch, including benthic species that have been attracted to the traps and brought on board (PINRO 2015; VNIRO 2020). Although such bycatch is in small amounts, it nonetheless can contribute towards the mapping of the benthos fished on. Local knowledge by the crew is a further determinant as to where fishing occurs and avoidance of particular areas. The vessels have habitat maps on board, provided by PINRO.

These measures amount to a partial strategy. SG60 and SG80 is met

Considering that the habitat in the crab fishery area is soft sedimentary bottom, and the bycatch of non-target benthic species is low there is as yet no specific strategy in place to manage impact of the UoA on habitat. SG100 is not met

| | | | | |
|---|---|---|---|---|
| **b** | Management strategy evaluation | | | |
| | Guide post | The measures are **considered likely** to work, based on plausible argument (e.g. general experience, theory or comparison with similar UoAs/habitats). | There is some **objective basis for confidence** that the measures/partial strategy will work, based on **information directly about the UoA and/or habitats** involved. | **Testing** supports **high confidence** that the partial strategy/strategy will work, based on **information directly about the UoA and/or habitats** involved. |

| | | | | |
|---|---|---|---|---|
| | Met? | **Yes** | **Yes** | **No** |

Rationale

The extensive and increasingly more sophisticated benthos mapping initiatives, and the fact that the fishery takes place 12nm offshore thus avoiding rocky inshore areas, the measures/ partial strategy are likely to work to help protect potential vulnerable habitats. The fleet-specific move-on rule is likely to work as the incentive is to improve the target catch rather than include quantities of unwanted benthic organisms such as other predatory mobile species. Although this is not directly related to habitat management, by deploying the gear in the habitat of the target species, which is soft sedimentary bottom, other potential habitats are thus avoided. As part of the work observers conduct on board, there is some information available on benthos bycatch, and this is shown to be low, which is to be expected, as this is a passive gear. SG60 and SG80 is met.

A time series of data necessary for testing and feeding back into a strategy is not available. Considering that the habitat in the crab fishery area is soft sedimentary bottom, and the bycatch of non-target benthic species is low there is as yet no specific strategy to be tested in place to manage impact of the UoA on habitat. SG100 is not met

| | | | | |
|---|---|---|---|---|
| **c** | Management strategy implementation | | | |
| | Guide post | | There is **some quantitative evidence** that the measures/partial strategy is being implemented successfully. | There is **clear quantitative evidence** that the partial strategy/strategy is being implemented successfully and is achieving its objective, as outlined in scoring issue (a). |
| | Met? | | **Yes** | **No** |

Rationale

Habitat maps, in the form of sediment distribution and pre-dominant benthic organisms, of the UoA fisheries area are available, and although no direct VMS tracks of the vessels are available, the vessels only operate within the limited area in which the target species occurs, and as that, only where the target species occurs in economically viable quantities. Research studies conducted by PINRO (2015) showed occasional bycatch of mobile non-target species. No benthic non-mobile species were recorded in the bycatch of the study, nor have there been any noted observations by observers of habitat interactions, other than sandy/ muddy silty sediments (PINRO 2015). SG80 is met.

Habitat maps and (by implication as to where the target species lives) vessel positions indicate that the vessels fish in the areas described by the maps as predominantly types of soft sediments and associated benthic species communities. The grab samples and surveys provide show the dominant benthic species (see Section 8.1.5.1), and these do not indicate VMEs as listed in Section 8.1.5.3for soft sediments. However, apart from the habitat maps not showing areas of VME indicator species, and no VMEs have been declared for that area, there is no specific information being regularly collected as part of the bycatch, thus there is no clear quantitative UoA-related evidence on benthos bycatch. SG100 is not met

| | | | | |
|---|---|---|---|---|
| **d** | Compliance with management requirements and other MSC UoAs'/non-MSC fisheries' measures to protect VMEs | | | |
| | Guide post | There is **qualitative evidence** that the UoA complies with its management requirements to protect VMEs. | There is **some quantitative evidence** that the UoA complies with both its management requirements and with protection measures afforded to VMEs by other | There is **clear quantitative evidence** that the UoA complies with both its management requirements and with protection measures afforded to VMEs by other |

| | | | | |
|---|---|---|---|---|
| | | | MSC UoAs/non-MSC fisheries, where relevant. | MSC UoAs/non-MSC fisheries, where relevant. |
| | Met? | **NA** | **NA** | **NA** |

Rationale

From the habitat surveys available to the assessment team, there are no VMEs in the red king crab fishery area under assessment, and none have been declared. Therefore, there are no associated management requirements.

References

PINRO 2015; see PI 2.4.1 ref list.

| | |
|---|---|
| **Draft scoring range** | **≥80** |
| Information gap indicator | **Information sufficient to score PI** |

**Overall Performance Indicator scores added from Client and Peer Review Draft Report stage**

| | |
|---|---|
| Overall Performance Indicator score | |
| Condition number (if relevant) | |

## PI 2.4.3 – Habitats information

| PI 2.4.3 | | Information is adequate to determine the risk posed to the habitat by the UoA and the effectiveness of the strategy to manage impacts on the habitat | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| **a** | Information quality | | | |
| | Guide post | The types and distribution of the main habitats are **broadly understood**.<br>**OR**<br>**If CSA is used to score PI 2.4.1 for the UoA:**<br>Qualitative information is adequate to estimate the types and distribution of the main habitats. | The nature, distribution and **vulnerability** of the main habitats in the UoA area are known at a level of detail relevant to the scale and intensity of the UoA.<br>**OR**<br>**If CSA is used to score PI 2.4.1 for the UoA:**<br>Some quantitative information is available and is adequate to estimate the types and distribution of the main habitats. | The distribution of all habitats is known over their range, with particular attention to the occurrence of vulnerable habitats. |
| | Met? | **Yes** | **Yes** | **No** |
| Rationale | | | | |

Detailed habitat maps of the Barents Sea are available (see also Section 8.1.5.1), and the distribution of benthos is updated through ongoing surveys in the Barents Sea (such as the annual IMR-PINRO ecosystem surveys). This means that the natures, distribution and vulnerability of the main habitats (soft sediments) are known at a level of detail relevant to the scale and intensity of the fishery under assessment. With regards to vulnerability, this is a passive gear (traps) on predominantly soft sediments and the impact of trap gear on soft sediments has been studied (see Section 8.1.5.5) SG80 is met.

Although benthic habitats and their distribution are being identified as part of these ecosystem surveys, including VME indicator species, it cannot yet be said that the distribution of all habitats with particular attention to the occurrence of VMEs is known. SG100 is not met

| | | | | |
|---|---|---|---|---|
| **b** | Information adequacy for assessment of impacts | | | |
| | Guide post | Information is adequate to broadly understand the nature of the main impacts of gear use on the main habitats, including spatial overlap of habitat with fishing gear.<br>OR<br>If CSA is used to score PI 2.4.1 for the UoA: | Information is adequate to allow for identification of the main impacts of the UoA on the main habitats, and there is reliable information on the spatial extent of interaction and on the timing and location of use of the fishing gear.<br>OR | The physical impacts of the gear on all habitats have been quantified fully. |

| | | | | |
|---|---|---|---|---|
| | | Qualitative information is adequate to estimate the consequence and spatial attributes of the main habitats. | If CSA is used to score PI 2.4.1 for the UoA:<br>Some quantitative information is available and is adequate to estimate the consequence and spatial attributes of the main habitats. | |
| | Met? | **Yes** | **Yes** | **No** |

Rationale

Several studies have been undertaken to assess the impact of the trap/pots gear on benthos. These studies can be extrapolated on benthic habitats of the Barents Sea (see background section 8.1.5.5). There is adequate information to allow the impact of the gear on the main habitats, which is soft sediment where the crabs are found. Traps are passive gear, stationary until hauled. The annual Joint Russian Norwegian ecosystem survey undertakes benthic sampling and generates benthic composition/distribution time series throughout the Barents Sea. The sediment map of the Barents Sea has been updated in 2019, giving finer detail than previous maps (ngu.no).

Information is available on spatial location of the crab fleet as it is limited to within the limited range of Red King crab occurrence, and this can be compared with the underlying habitat maps. Timing and location of the use of the gear is recorded at each trip, as a matter of course, as part of the everyday management of the fishery. Fishing is seasonally restricted.

The information is adequate to allow for identification of the main impacts of the UoA on the main habitats, and there is reliable information on the spatial extent of interaction and on the timing and location of use of the fishing gear. SG60 and SG80 is met.

The physical impact of the gear on all the habitats have not been quantified fully. SG100 is not met

A Recommendation is raised to improve on the information gathering when fishing for crab by setting up a recording system on board which allows the detailed collection of information on any benthic species being brought up. This information would include species identification, quantity and location, and all fed into a dedicated software programme which can be shared with relevant benthos mapping research based at PINRO. Such software and recording system is already in place and being used on other MSC certified fisheries in the Barents Sea.

| | | | | |
|---|---|---|---|---|
| **c** | Monitoring | | | |
| | Guide post | | Adequate information continues to be collected to detect any increase in risk to the main habitats. | Changes in all habitat distributions over time are measured. |
| | Met? | | **Yes** | **No** |

Rationale

Habitat mapping programmes continue to be rolled out with increasing detail, see also Joint Russian Norway Barents Sea surveys (see also Joint Russian Norway Barents Sea surveys; Jørgensen et al 2015/16/19), and the published information is updated regularly online (www.barentsportal.com). SG80 is met.

As the mapping programmes continue, it will increasingly become possible to measure changes in spatial distribution, once a relevant time series becomes available. This is not yet possible, SG100 is not met

References

https://www.ngu.no/en/news/new-seabed-sediment-map-barents-sea; Jørgensen et al 2015/16/19 see also PI 2.4.1 refs

| **Draft scoring range** | **≥80** |
|---|---|
| Information gap indicator | **Information sufficient to score PI** |

**Overall Performance Indicator scores added from Client and Peer Review Draft Report stage**

| | |
|---|---|
| Overall Performance Indicator score | |
| Condition number (if relevant) | |

## PI 2.5.1 – Ecosystem outcome

| PI 2.5.1 | | The UoA does not cause serious or irreversible harm to the key elements of ecosystem structure and function | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| a | Ecosystem status | | | |
| | Guide post | The UoA is **unlikely** to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm. | The UoA is **highly unlikely** to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm. | There is **evidence** that the UoA is highly unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm. |
| | Met? | **Yes** | **Yes** | **Partial** |
| Rationale | | | | |

Detailed information on the Barents Sea ecosystem has been provided in the background section 8.1.6. Studies on the effects of red king crab on the benthos have been described in detail in section 8.1.6.2.

Several ICES working groups provide annual assessments of the state of the Barents Sea Ecosystem: ICES Arctic Fisheries Working group; WG for Regional Ecosystem Description; WGIBAR - working group on integrated assessment in the Barents Sea. The ICES working group on crabs, WGCRAB, looks specifically, amongst other crab species, at the Red King crab in the context of the wider Barents Sea ecosystem. This information is supplemented by on-going data collected under the Joint Norwegian-Russian Environmental Status Report for the Barents Sea (which issues annual Barents Sea ecosystem status report, trends, highlights expected future situation, as well as on-line updates of research on barentsportal.com.

All these assessments suggest that broadly speaking, the Barents Sea Ecosystem is relatively healthy, and that current fishing activities are not disrupting ecosystem structure and function. There has been a decline in seabird populations (similar to that throughout the NE Atlantic), but the reasons for this are unclear (drivers are a combination of these: local food shortage; increased predation; historic bycatch in drift net and long-line fisheries, climate change – see barentsportal.com for updates) and are not attributed to current fishing activity of the snow crab fishery, the fishery under assessment. The stocks of key species at different trophic levels (cod/ haddock and capelin) suggest that the finfish related elements of the ecosystem are evaluated and researched. Significant distributional changes are however taking place, probably related to climate change causing oceanographic shifts (e.g. Jørgensen et al 2019).

These surveys and assessments are also supported by several ecosystem modelling studies related specifically to the Barents Sea, which have explored for example the trophic relations between fish species, and links between capelin, cod, seabirds, marine mammals. These include ecopath type studies by Blanchard *et al* 2002; EcoCod (which seeks to estimate cod MSY taking into account a range of ecosystem factors), Gadget (multispecies interactions between cod, herring, capelin, minke whale, krill) in the Barents Sea; Biofrost (multispecies model for Barents Sea – addressing primarily cod / capelin dynamics); STOCOBAR (Stock of cod in the Barents Sea). Broader ecosystem models include NORWECOM.E2E, which includes plankton and fish, and is under development and semi-operational, and both PINRO and IMR have developed hydrodynamic models that complement these mainly biologically based models.

SG80 is met.

Available studies on the trophic role of red king crab are discussed in Section 8.1.6.1. Some epibenthic population and diversity trends have been recorded in some of these studies (eg the Kola transect study). The possible predation of the red king crab on fish eggs of commercial fish species has yet to be studied, and the wider impacts are as yet little understood, as any potential trends in the data may be masked by wider oceanographic changes (temperature and currents). This aspect of non-biotic variable changes impacting on the Barents Sea ecosystem is further highlighted in a study by Nedreaas et al 2015, which aimed to tease out indirect effects of fisheries on the ecosystem.

There is some evidence, based on detailed quantitative ecological studies over time, that the UoA is highly unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be serious or irreversible harm. However, the overall understanding of the impact of the red king crab fishery on all ecosystem elements is limited. A partial score of SG 90 is met

## References

ICES. AFWG 2016; ICES Ecosystem overview 2019; ICES WGCRAB 2015; ICES WGIBAR 2014;

Arneberg, et al 2013; Blanchard et al 2002;

Ecosysten Survey of the Barents Sea Autumn 2014. 6. Monitoring the demersal community; Seabird observations; Marine Mammal and Seabirds Monitoring; Fish Biodiversity; invertebrate biodiversity. etc

IMR/PINRO Barents sea ecosystem 2014, 2019; Jakobsen, T. and Ozhigin, K (Eds) 2011; Johannesen, et al 2012; Tsyganova et al 2015.

Lyubina et al 2015. http://www.barentsportal.com/barentsportal/index.php/en/biotic-components/36-biotic-topics-1/benthos/327-

Sundet JH, Berenboim B (eds) (2008); Oug, et al 2011; Jørgensen et al 2019;

http://www.imr.no/temasider/skalldyr/kongekrabbe/en; updated 8.10.2013

Fuhrmann et al, 2015; Tsyganova et al 2015. Introduced species; red king crab and snow crab.
http://www.barentsportal.com/barentsportal/index.php/en/biotic-components/85-biotic-topics/introduced-species/564-

http://www.imr.no/temasider/skalldyr/kongekrabbe/en

Dvoretsky & Dvoretsky, 2015; Falk-Pedersen etal 2011; Nedreaas et al 2015;

| **Draft scoring range** | **≥80** |
|---|---|
| Information gap indicator | **Information sufficient to score PI** |

**Overall Performance Indicator scores added from Client and Peer Review Draft Report stage**

| | |
|---|---|
| Overall Performance Indicator score | |
| Condition number (if relevant) | |

## PI 2.5.2 – Ecosystem management strategy

The Default Assessment Tree was modified for P2, Ecosystem management (PI 2.5.2) in order to reflect the fact that the Red King crab is an introduced species. The introduction was deliberate and occurred at least 20 years prior to the date the application is made for assessment against the MSC standard (the introduction occurred in the 1960s). See Section 5.1.3 for more information.

| PI 2.5.2 | | There are measures in place to ensure the UoA does not pose a risk of serious or irreversible harm to ecosystem structure and function | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| **a** | Management strategy in place[73] | | | |
| | Guide post | There are **measures** in place, if necessary which take into account the potential impacts of the UoA on key elements of the ecosystem. | There is a **partial strategy** in place in the fishery to prevent further ecosystem impacts that may have occurred as a result of the introduction of the species | There is a **strategy** that consists of a **plan**, in place which contains measures to **address all main impacts of the UoA** on the ecosystem, and at least some of these measures are in place. |
| | Met? | **Yes** | **Yes** | **No** |
| Rationale | | | | |

There are specific measures and initiatives in place to address management of individual ecosystem elements:

- Measures described under P1 to ensure that the red king crab fishery is conducted within sustainability limits, which as a consequence thereof keeps the population within well-defined limits.
- Expansion westward (along the north western Norwegian coast) of the species is monitored and controlled by Norwegian fisheries regulations, whereby the fishers are encouraged to fish-out along the edges of the managed stock;
- Expansion eastwards of the species is prevented by natural oceanographic limits, such as salinity and water temperature. The expansion and distribution of the species is carefully monitored by Russian scientists along the eastern edge of the stock distribution (through sampling stations).
- A range of technical measures and protocols to minimize bycatch of other fish species (described under P2.2.1 and 2.2.2) that may play an important role in ecosystem structure and function
- No fishing within the 12nm zone, and seasonal fishery only.
- Protocols and gear design to reduce bycatch.

No interaction with marine mammals and seabirds has been recorded (PINRO 2015), therefore additional specific measures are not considered necessary at this stage.

The mix of planning initiatives, Russian-Norwegian research cooperation initiatives, ecosystem monitoring and assessments, seabed mapping, detailed benthos studies to specifically study any potential impact of the species on benthic ecology, fishing effort distribution monitoring, ICES advice, and the range of individual measures designed to protect different elements of the ecosystem, taken together may be regarded as comprising a partial strategy.

SG60 and SG80 is met.

There appears to be no strategy which consists of a plan to prevent possible further expansion of the species eastwards (if it were to occur with changing oceanographic conditions), apart from regular monitoring of survey stations and research. SG100 is not met

| | | | | |
|---|---|---|---|---|
| **b** | Management strategy evaluation | | | |
| | Guide post | The **measures** are considered likely to work, based on plausible argument (e.g., general experience, theory or comparison with similar UoAs/ ecosystems). | There is **some objective basis for confidence** that the measures/ partial strategy will work, based on some information directly about the UoA and/or the ecosystem involved. | **Testing** supports **high confidence** that the partial strategy/ strategy will work, based on information directly about the UoA and/or ecosystem involved. |
| | Met? | **Yes** | **Yes** | **No** |
| Rationale | | | | |

The measures are considered to work, in that the expansion of the crab stock northwestward is much reduced through the measures introduced by the Norwegian fishery regulations, and eastwards it is limited by natural oceanographic barriers. Research on the benthos and regular monitoring stations ensure that measures are likely to work. SG60 is met.

There is objective basis for confidence that the measures /partial strategy will work, as can be seen from the survey results, and extensive mapping exercises and ecosystem surveys of the Barents Sea as a whole. SG80 is met.

Testing would require testable models and scenarios, which were not available for this assessment. SG100 is not met

| | | | | |
|---|---|---|---|---|
| **c** | Management strategy implementation | | | |
| | Guide post | | There is **some evidence** that the measures/partial strategy is being **implemented successfully**. | There is **clear evidence** that the partial strategy/strategy is being **implemented successfully and is achieving its objective as set out in scoring issue (a).** |
| | Met? | | **Yes** | **No** |
| Rationale | | | | |

There is clear evidence of research cruises and resulting status reports at ecosystem and target species level, there is evidence of area closures (outside of the 12nm zone) and VMS tracking of the crab fishery as a whole to confirm compliance, and there is evidence of ecosystem elements being given key consideration at fisheries management level – both in the form of ICES advice and in the deliberations of PINRO research.

Evidence relating to successful implementation at the fleet level includes:

- VMS data relating to the spatial intensity of fishing fleet effort, and compliance with closed area restrictions;
- Catch records
- Vessel inspections
- Observer programme
- Review and analysis of fishing activity, species caught and habitats affected - by PINRO and the inspectorates.

SG 80 is met

The partial strategy consists of primarily monitoring and research, to understand the impact and distribution of red king crab on the ecosystem, as well as managing the fishery so that the activity of fishing per se has minimal impact on the ecosystem (gear design, bycatch). At this stage, no evidence was provided to show that prevention of further expansion of the species eastwards was addressed, apart from relying on natural barriers. SG100 is not met

| References |
|---|

See PI 2.5.1

| | |
|---|---|
| **Draft scoring range** | **>80** |
| Information gap indicator | **Information sufficient to score PI** |

**Overall Performance Indicator scores added from Client and Peer Review Draft Report stage**

| | |
|---|---|
| Overall Performance Indicator score | |
| Condition number (if relevant) | |

## PI 2.5.3 – Ecosystem information

| PI 2.5.3 | | There is adequate knowledge of the impacts of the UoA on the ecosystem | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| **a** | Information quality | | | |
| | Guide post | Information is adequate to **identify** the key elements of the ecosystem. | Information is adequate to **broadly understand** the key elements of the ecosystem. | |
| | Met? | **Yes** | **Yes** | |
| Rationale | | | | |

As described in detail in section 8.1.6and under PI 2.5.1 above, the Barents Sea food web and ecosystem are well researched, a range of models at different levels of complexity have been developed, and key relationships analysed. A good deal of biological diversity (location, migrations etc.) has been mapped. Key indicators and parameters as well as oceanographic features are monitored on a regular basis and trend data is collected.

These surveys and assessments are also supported by several ecosystem modelling studies (see ICES WGIBAR 2017) related specifically to the Barents Sea, which have explored for example the trophic relations between fish species, and links between capelin, cod, seabirds, marine mammals. These include ecopath type studies by Blanchard *et al* 2002; EcoCod (which seeks to estimate cod MSY taking into account a range of ecosystem factors), Gadget (multispecies interactions between cod, herring, capelin, minke whale, krill) in the Barents Sea; Biofrost (multispecies model for Barents Sea – addressing primarily cod / capelin dynamics); STOCOBAR (Stock of cod in the Barents Sea). Broader ecosystem models include NORWECOM.E2E, which includes plankton and fish, and is under development and semi-operational, and both PINRO and IMR have developed hydrodynamic models that complement these mainly biologically based models.

Information is adequate to broadly understand the key elements of the ecosystem. SG60 and SG80 is met.

| | | | | |
|---|---|---|---|---|
| **b** | Investigation of UoA impacts | | | |
| | Guide post | Main impacts of the UoA on these key ecosystem elements can be inferred from existing information, but **have not been investigated** in detail. | Main impacts of the UoA on these key ecosystem elements can be inferred from existing information, and **some have been investigated in detail**. | Main interactions between the UoA and these ecosystem elements can be inferred from existing information, and **have been investigated in detail**. |
| | Met? | **Yes** | **Yes** | **No** |
| Rationale | | | | |

As described in the background section 8.1.6and under PI2.5.1 main impacts of the fishery on key ecosystem elements can be inferred from existing information, and those of particular concern have been investigated in detail.

There is detailed information on catches of the target species under Principle 1. There is adequate information on non-target species bycatch through observer reports. This provides information about the impact of the assessed fishery on the populations of non-target species involved and would provide evidence of impact if any key ecosystem species were affected. The main impacts of the UoAs on bottom habitats and trophic structures can also be inferred from the existing information, including location (VMS), mapping, and gear-habitat interaction studies. Interactions between fisheries and key ecosystem elements have been investigated in detail, especially trophic interactions with key predator - prey relationships, and with bottom substrates. In particular, there is a high level of spatial and temporal information on this fishery and the gear used. SG60 and SG80 is met.

Although there is increasing spatial and temporal information on most forms of fishing and captures, it cannot be said that all the main interactions have been investigated in detail. SG 100 is not met.

| | | | | |
|---|---|---|---|---|
| **c** | Understanding of component functions | | | |
| | Guide post | | The main functions of the components (i.e., P1 target species, primary, secondary and ETP species and Habitats) in the ecosystem are **known**. | The impacts of the UoA on P1 target species, primary, secondary and ETP species and Habitats are identified and the main functions of these components in the ecosystem are **understood**. |
| | Met? | | **Yes** | **Yes** |
| Rationale | | | | |

There is a comprehensive understanding of the key elements of the ecosystems of the Barents Sea and the relationships between predators, prey and habitats are known (see regularly updated research on barentsportal, joint research between PINRO and IMR on the status of the Barents Sea – www.barentsportal.com). The biology and ecology of the Principle 1 species are well known (see fishbase.org) and are researched within the context of the ecosystem as part of the regularly updated stock assessments. The main functions of the relevant primary, secondary, and ETP species caught by the UoA as well as the habitats where fishing is taking place, the interactions and their impacts of the gear on the benthos have been investigated in some detail are known and understood. SG80 and SG100 is met

| | | | | |
|---|---|---|---|---|
| **d** | Information relevance | | | |
| | Guide post | | Adequate information is available on the impacts of the UoA on these components to allow some of the main consequences for the ecosystem to be inferred. | Adequate information is available on the impacts of the UoA on the components **and elements** to allow the main consequences for the ecosystem to be inferred. |
| | Met? | | **Yes** | **No** |
| Rationale | | | | |

Survey and monitoring as well as some modelling all support fishery impact assessment studies, and some of the consequences for the ecosystem have been inferred. Relations between the target species, red king crab, and benthic species are researched (see section 8.1.6.2) and time series of catches are available. The role of benthic species on the wider ecosystem, and the implications of the red king crab introduction and consequent crab fishery continue to be investigated, as it needs a long enough time series to detect trends. SG80 is met.

The level of research and understanding continues to grow, and more detail becomes available as mapping and monitoring continues. Although the information on the impacts of the UoA on the components is adequate, this cannot be said for some of the elements, as on-board self-reporting of bycatch is not yet in place. SG100 is not met

| | | | | |
|---|---|---|---|---|
| **e** | Monitoring | | | |
| | Guide post | | Adequate data continue to be collected to detect any increase in risk level. | Information is adequate to support the development of |

| | | | | |
|---|---|---|---|---|
| | | | | strategies to manage ecosystem impacts. |
| | Met? | | **Yes** | **Yes** |

Rationale

There is a relatively comprehensive monitoring programme in place related to the Joint Norwegian-Russian Barents Sea Ecosystem assessment and the Norwegian Integrated Management Plan for the Barents Sea - Loføten Area. A variety of other related initiatives monitor marine mammals and seabirds. PINRO and IMR collect comprehensive data related to the major commercial fisheries. Risks associated changing populations or relations between fisheries and various elements of the ecosystem will be picked up as part of the longer-term time series assessments. SG80 is met.

Although there are inevitably some gaps in our understanding, there is enough information available to support strategies to manage marine ecosystem impacts, especially if a precautionary approach were to be taken to avoid and/or reduce damage to benthic habitats. SG100 is met

References

As in PI 2.5.1

| | |
|---|---|
| **Draft scoring range** | **>800** |
| Information gap indicator | **Information sufficient to score PI** |

**Overall Performance Indicator scores added from Client and Peer Review Draft Report stage**

| | |
|---|---|
| Overall Performance Indicator score | |
| Condition number (if relevant) | |

## 8.2 UoA 2 – Opilio

### 8.2.1 Opilio - background

Both the Red King crab and Opilio (snow crab) fisheries take place in the Barents Sea ecoregion. Therefore, several of the component outcomes and management, as well as information will be the same or at least very similar. In order to avoid repetition, this background section on the Opilio UoA will highlight the differences to the Red King crab UoA described in Section 8.1.1, rather than repeat what both have in common.

The RK crab fishery and the opilio fishery are conducted in different areas of the Barents Sea. Although the dietary and physiological needs of the two crab species are similar, there are likely to be different habitat issues encountered in the Opilio fishery. Fishing in different areas of the Barents Sea will also likely result in different species in the bycatch, even though the gear and method of fishing is the same.

Whereas Red King crab has a distinct fishing season (16th August to 15th December), opilio has no formal season, although the species is fished when it is in peak condition (fattest – Client interview 14th Sept 2020), i.e. when the meat content is high, and this is between March and July.

Unlike Red King crab it appears that the expansion of Opilio is not hindered by water temperature/ salinity, opilio seems to be expanding NW-wards from its initial recorded point.

The snow crab (*Chionoecetes opilio*) is a non-indigenous species in the Barents Sea and was first recorded in 1996 on the Goose Bank area (Strelkova, 2016). Several theories about the cause of the arrival exist, and the introduction via ballast water is one of them. The introduction of the snow crab to the Barents Sea is believed to have occurred during 1996–1993. Regular annual monitoring of the snow crab population began with BESS[74] in 2004. This survey is, currently, the most important source of information on snow crab population status.

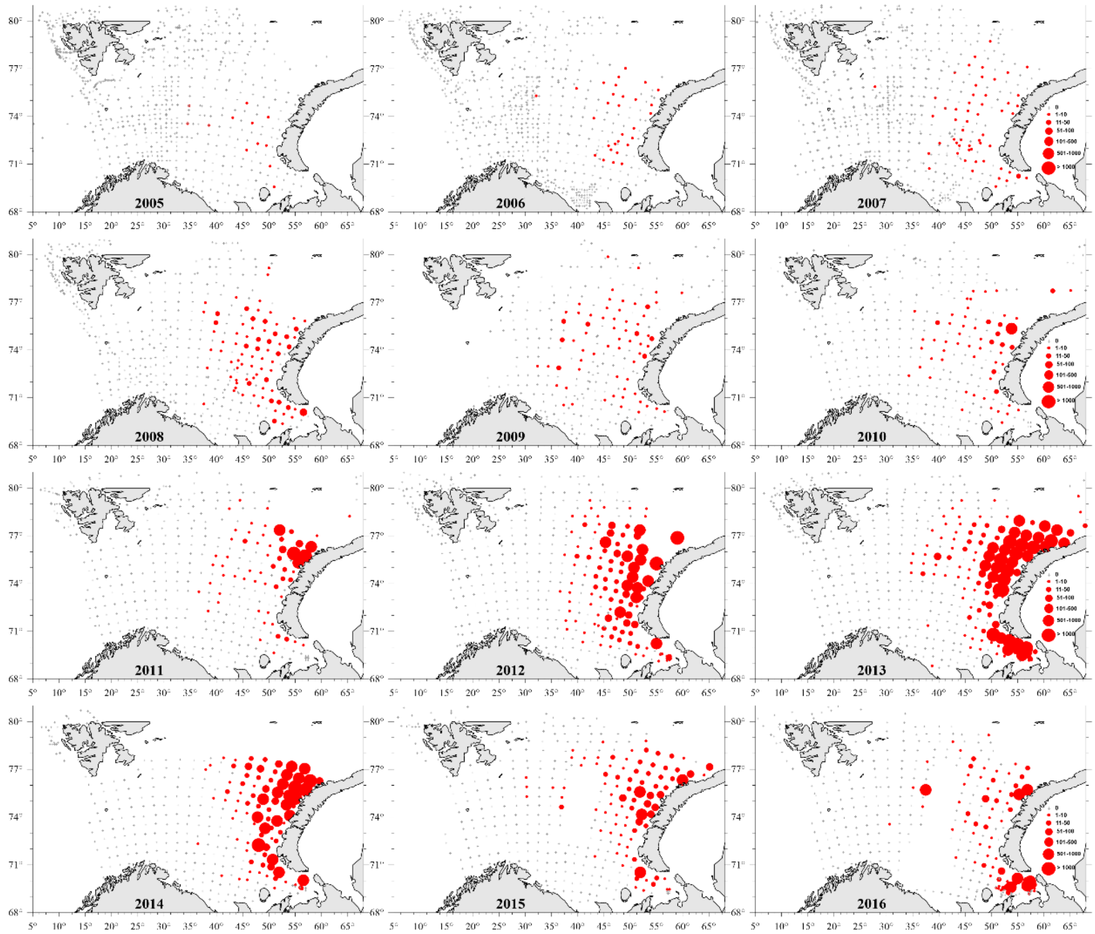



**Figure 51:** **The temporal distribution of the snow crab population in the Barents Sea (number of individuals/nm) according to BESS 2005-2016 (Source Zakharov, PINRO 2019, in IMR/PINRO Status report 2019; http://www.barentsportal.com/barentsportal/index.php/en/status-2019/264-biotic-ecosystem-components-data-from-2018/benthos-and-shellfish-2018/938-benthos-and-shellfish).**

## 8.2.2 Catch profile

Catch composition data provided by the client was used to separate the species into Primary or Secondary species, as well as ETP species. Primary species are those which are managed (MSC Fisheries Standard v2.01 GSA3.1), i.e. species of commercial value with management tools controlling exploitation. Furthermore, Primary species are divided into ‘main’ and ‘minor’ groups. ‘Main’ are those species where the catch of that species comprises 5% or more by weight of the total catch of all species by the UoA; it is also ‘Main’ if the species is classified as ‘less resilient’ and the catch of that species comprises 2% or more by weight of the total catch of all species. Therefore, it is important that the total catch of all species by the UoA is known. All other primary species not considered ‘main’ shall be considered ‘minor’ species.

Secondary species include fish that are not managed according to reference points and all species that are out of scope of the standard (birds/ mammals/ reptiles/ amphibians). These ‘out of scope’ species, if they are not ETPs, are considered ‘main’ (whereby percentage thresholds apply – see MSC Standard SA3.4.1-5), unless they can be released alive (SA3.4.3). Once that has been established, those Secondary species within scope are assessed as to whether they are ‘main’ (catch percentage thresholds apply) or not.

The demersal fish by-catches in Russian king crab and snow crab trap fisheries were evaluated by results obtained by scientific observers based on board Russian fishing vessels harvesting snow crab in 2016, 2017, 2018 and 2019 in the Barents Sea. Species composition was analysed in 18,103 trap catches in the snow crab fishery, and presented as part of a crab fishery report by VNIRI/PINRO 2020[75] (Table 35; please note that the snow crab fishery started in 2013, which is when observer reports for snow crab fishery started too).

**Table 35: Bycatch presence / absence for demersal fish species in the snow crab fishery from 2013-2019 (VNIRO/ PINRO 2020)**

| Species | Snow crab fishery |
|---|---|
| Cod *Gadus morhua* | + |
| Deepwater redfish *Sebastes mentella* | + |
| Spotted wolffish *Anarhichas minor* | + |
| Northern wolffish *Anarhichas denticulatus* | + |
| Greenland halibut *Reinhardtius hippoglossoides* | + |
| American plaice *Hippoglossoides Platessoides* | + |
| Thorny/starry skate *Amblyraja radiata* | + |
| Arctic skate *Amblyraja hyperborea* | + |
| Eelpout Lycodes sp. | + |
| Snailfsh Careproctus sp. | + |
| Ling *Molva molva** | + |
| Grey gurnard *Chelidonychthys gurnardus** | + |

*****these two species were also listed in the 2017 PINRO translated Opilio report

**Table 36: Demersal fish by-catches in the Russian snow crab trap fishery in the Barents Sea in 2015–2020, tonnes; *up to 20th Sept 2020 (VNIRO/ PINRO 2020).**

| Species | 2015 | 2016 | 2017 | 2018 | 2019 | 2020** |
|---|---|---|---|---|---|---|
| Opilio* | 8900 | 7700 | 7840 | 9730 | 9840 | - |
| Cod | 5.4 | 4.9 | 0.8 | 1.1 | 0.9 | 1.5 |
| Greenland halibut | 1.8 | 1.6 | 0.3 | 0.4 | 0.3 | 0.5 |
| Spotted wolffish | 42.9 | 38.2 | 6.2 | 8.6 | 7.4 | 11.8 |
| Northern wolffish | 19.5 | 17.4 | 2.8 | 3.9 | 3.4 | 5.3 |
| American plaice | 5.0 | 4.5 | 0.7 | 1.0 | 0.9 | 1.4 |
| Thorny ray | 1.6 | 1.4 | 0.2 | 0.3 | 0.3 | 0.4 |
| Others | 0.1 | 0.1 | >0.1 | >0.1 | >0.1 | >0.1 |

*the catch statistics for opilio was provided by PINRO as published in Hønneland et al 2020[76], the numbers have been rounded.

**until September 2020

From this it can be seen that the percentage bycatch of each of these species is small, the highest being 0.5%. According to the client (interview 14th Sept 2020), the catch composition in the Russian opilio fishery is "practically 100% crab". Some bycatch, besides juvenile and female crabs (this is dealt with under the target species evaluation) does occur, however, and has been quantified to some extent by the client, in preparation for this assessment (and as provided in the VNIRO/PINRO 2020 report). The traps are positioned on the benthos beyond a depth of 100m, baited and thus attract those species which live near the benthos, commonly predatory species such as cod.

An Observer report from 2019, sampling a snow crab fishery from April-July 2019, recorded the demersal fish bycatch in terms of numbers of individuals, it was that low (Table 37)

**Table 37: Bycatch of demersal fish April-July 2019 (Source: VNIRO opilio observer report 2019)[77]**

| Species | Number of individuals. |
|---|---|
| American plaice | 24 |
| Spotted wolffish | 23 |
| Northern wolffish | 8 |
| Cod | 4 |
| Arctic skate | 3 |
| Greenland halibut | 1 |

According to the observer report, there are no quotas for other aquatic organisms (except king crab), all bycatch was immediately released to their habitat after being measured. It should be noted that all skates and several small-size American plaice were already dead at the time of trap lifting and heavily gnawed by crabs and amphipods. Relatively few fish were captured in conical traps. In total, 63 demersal fish individuals (6 species) were found in the investigated trap arrays, Fish by-catch in the snow crab fishery using conical traps is assessed as insignificant (VNIRO 2019). The bycatch species listed in this observer report tally with those of the previous analysis listed above.

The bycatch is brought aboard the vessel alive. Generally, the fish bycatch captured by traps is either consumed by the crew or returned to the sea, after having been recorded in the case of commercial species. All by-caught benthic organisms, which are not attractive in terms of consumption for the crew, are returned alive to the sea. Due to the short exposure time onboard the fishing vessel during trap catch sorting operations, benthic organisms generally tend to fully maintain their vitality, and, once returned to the sea, survive (PINRO, 2017; Client interview Sept 2020).

Results of surveys carried out by FSBSI PINRO specialists in 2013–2016 showed that by-catches in the snow crab trap fishery in the Barents Sea included demersal fishes, crustaceans, echinoderms, mollusks, and worms (Table 38). No cases of marine bird or mammal capture in crab bottom traps have been registered. Most of large animals attracted by the bait are capable of leaving the trap through its sufficiently wide entry openings (PINRO 2017, report translated by client). This information is used as part of the habitat component, but also mentioned here for completion sake.

**Table 38: Invertebrate bycatch observations 2013-2016. (Source: PINRO 2017, provided in translation by client)**

| Invertebrates | |
|---|---|
| Crustaceans | |
| Spider crab | *Hyas araneus* |
| Amphipods | *Paramphithoe hystrix* |
| Sponges | *Tetilla polyura* |
| | *Polymastia thielei* |
| | *Thenea muricata* |
| | *Stylocordyla borealis* |
| | *Tentorium semisuberites* |
| | *Phakellia sp.* |
| | *Asbestopluma sp.* |
| | *Hamacantha implicans* |
| | *Forcepia sp.* |
| | *Radiella grimaldiii* |
| Anthozoan polyps | *Nephteidae sp.* |
| | *Drifa glomerata* |
| | *Gersemia rubiformis* |
| | *Duva florida* |
| Bryozoans | *Hornera lichenoides* |
| | *Flustra sp.* |
| | *Flustridae g.sp.* |
| | *Porella sp.* |
| | *Leieschara sp.* |
| | *Bowerbankia sp.* |
| Echinoderms | *Strongylocentrotus pallidus* |
| | *Strongylocentrotidae g.* |
| | *Solaster endeca* |
| | *Ctenodiscus crispatus* |
| | *Urasterias linckii* |
| | *Icasterias panopla* |
| | *Pontasstertenuis pinus* |
| | *Lophaster furcifer* |
| | *Poraniomorphahus pida* |
| | *Thyonidium drummondi* |
| | *Molpadia arctica* |
| | *M. borealis* |
| | *Ophioscolex glacialis* |
| | *Ophiopholis aculeate* |
| | *Ophiacantha bidentate* |
| | *Ophiura sarsi* |
| | *O. robusta* |
| | *Ophiopleura borealis* |
| | *Gorgonocephalus arcticus* |
| | *Heliometra glacialis* |
| Worms | *Maldanidae g. sp.* |
| | *Terebellidae g. sp.* |
| | *Spiochaetopterus typicus* |
| | *Lumbrineris sp.* |
| | *Nemertina g. sp.* |
| | |
| | *Priapulus caudatus (Priapulida)* |
| Bivalves | *Clinocardium ciliatum* |
| | *Portlandia arctica* |
| | *Chlamys islandica* |
| Gastropods | *Colus sabini* |
| | *Turrisipho lachesis* |
| | *Buccinidae* |

## 8.2.3 Primary and Secondary species

The catch composition table is further analysed into primary and secondary species bycatch (Table 39), and the current stock status is given for the primary species in Table 39.

**Table 39: Primary and Secondary species bycatch**

| Common Name | Latin Name | Primary /Secondary | Main/ Minor |
|---|---|---|---|
| Atlantic cod | *Gadus morhua* | Primary | Minor |
| Cod as bait | *Gadus morhua* | Primary | Minor |
| Herring as bait | *Clupea harengus* | Primary | Minor |
| Beaked redfish | *Sebastes mentella* | Primary | Minor |
| Greenland halibut | *Reinhardtius hippoglossoides* | Primary | Minor |
| Ling | *Molva molva* | Primary | Minor |
| Spotted wolffish | *Anarhichas minor* | Secondary | Minor |
| Northern wolffish | *Anarhichas denticulatus* | Secondary | Minor |
| American plaice/ Long rough dab | *Hippoglosoides platessoides* | Secondary | Minor |
| Arctic eelpout | *Lycodes reticulatus* | Secondary | Minor |
| Grey gurnard | *Eutrigla gurnardus* | Secondary | Minor |
| Starry/Thorny skate | *Amblyraja radiata* | Secondary | Minor |
| Arctic skate* | *Amblyraja hyperborea* | Secondary | Minor |
| Spider crab | *Hyas araneus* | Secondary | Minor |
| Squid (bait)** | | | Minor |

*IUCN = LC (Least Concern; as assessed in 2015; fishbase.org)

**Squid is used as bait, the species information was not available, nor location where caught, thus it was not possible to determine whether it came from a managed stock. Squid bait quantity used (6.84t) determined this to be a minor species (0.17% of total catch of 3971t in 2020 – see Table 25)

#### 8.2.3.1 Primary species

**Table 40: ICES Advice for Primary species. (Source: ICES.dk)**

| Species | Assessment Unit<br>ICES Area | $B_{lim}$ | MSY | Advisory Category | Stock status | ICES Advice<br>Year/ section |
|---|---|---|---|---|---|---|
| **Cod**<br>*Gadus morhua* | I + II | Y | Y | Analytical assessment | F above $F_{MSY}$; Full reproductive capacity | June 2020[78] |
| **Beaked redfish**<br>*Sebastes Mentella* | I + II | Y | Y | Analytical assessment | Full reproductive capacity | June 2020[79] |
| **Greenland halibut**<br>*Reinhardtius hippoglossoides* | I + II | Y | NA | Age length Gadget model | Stock at full reproductive capacity; no reference points for F; quota advice given | June 2019[80]<br>No update |
| **Herring**<br>*Clupea harengus* | NE Atlantic<br>Norwegian spring-spawning | Y | Y | Analytical assessment | The stock is at full reproductive capacity; F above MSY | Sept 2020[81] |
| **Ling**<br>*Molva molva* | I + II | | proxy | Standardised CPUE | The status evaluation is based on the reference point proxy for FMSY using the length-based indicator model | ICES June 2019[82]<br>MSC certified[83] |

Herring and cod heads are used as bait (see detailed description of 'bait' in section 5.2.2.5). The bait species are assessed under 'Primary' species, as both herring and cod are managed species. Whether they are considered 'main' or 'minor' depends on the amount of bait used in relation to the overall catch of crab. The company estimates that about 450–500 tons of bait will be required to catch its quota of crabs in the Barents Sea for 2020. Based on similar crab fisheries in the Barents Sea (Hønneland et al 2020) it is thought that the bait will be evaluated under the Primary 'minor' scoring issues.

The actual use of bait during the 2020 season was lower than expected, 160t instead of 450t, see the following itemised table (Client information 8th Dec 2020).

| | Herring | Squid | Cod heads |
|---|---|---|---|
| Opilio fishery 2020 | 43.12t | 6.84t | - |
| Red King crab fishery | 77.55t | 27.39t | 5.63t |

#### 8.2.3.2 Secondary species

<u>Two species of wolffish</u>

Spotted wolffish (*Anarhichas minor*) and Northern wolffish (*Anarhichas denticulatus*) — are resident in the Barents Sea. The abundance and biomass of all three species is relatively low but they are all widely distributed throughout the Sea. Wolffish species may be regarded as vulnerable to over-exploitation. They are slow growing and long-lived fish that spawn late in life (5-8 yrs – fishbase.org). The relationship between recruitment and stock size index is poor. Furthermore, the male guards' large clusters of eggs deposited on the bottom until they hatch, which makes them vulnerable to bottom trawling. Data from the 2018 Ecosystem Survey of the Barents Sea (IMR-PINRO joint report series 2019) suggest that Atlantic and Spotted wolffish are most abundant in shallower waters (50-150m) while Northern wolffish is found between 200 and 400m.

*Status*. There is no ICES assessment for Northern wolffish (nor for the other two wolffish species found in the Barents Sea). Biomass trends are available, up to 2017 (Figure 52 and Table 41), with more recent distribution patterns (Figure 53) provided by the IMR/PINRO ecosystem survey 2018:

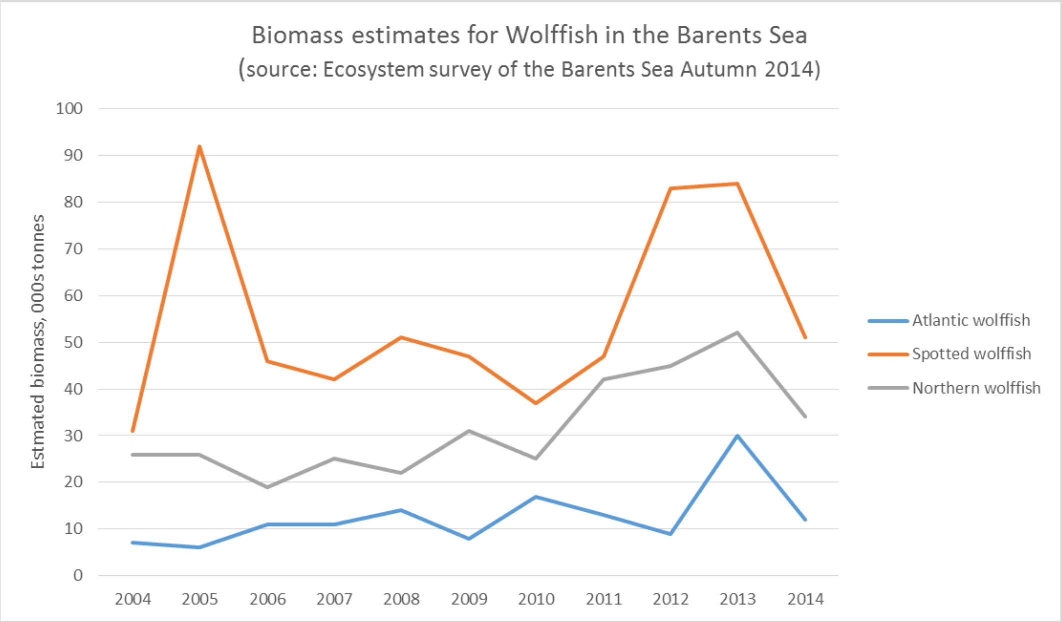


**Figure 52: Biomass estimates for Wolffish in the Barents Sea (IMR/PINRO 2014)**

**Table 41: Extract from IMR/PINRO ecosystem survey 2018: *Abundance (N, million individuals) and biomass (B, thousand tonnes) of the main demersal fish species in the Barents Sea (not including 0-group) – just showing wolffish species here***

| Species | | Year | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016* | 2017 |
| Atlantic wolffish | N | 26 | 42 | 25 | 20 | 17 | 20 | 22 | 27 | 12 | 33 | 40 | 30 |
| | B | 11 | 11 | 14 | 8 | 17 | 13 | 9 | 30 | 12 | 37 | 24 | 29 |
| Spotted wolffish | N | 12 | 12 | 13 | 9 | 7 | 9 | 13 | 13 | 8 | 12 | 13 | 14 |
| | B | 46 | 42 | 51 | 47 | 37 | 47 | 83 | 84 | 51 | 86 | 40 | 63 |
| Northern wolffish | N | 2 | 3 | 3 | 3 | 3 | 6 | 8 | 12 | 6 | 9 | 8 | 8 |
| | B | 19 | 25 | 22 | 31 | 25 | 42 | 45 | 52 | 34 | 63 | 51 | 63 |

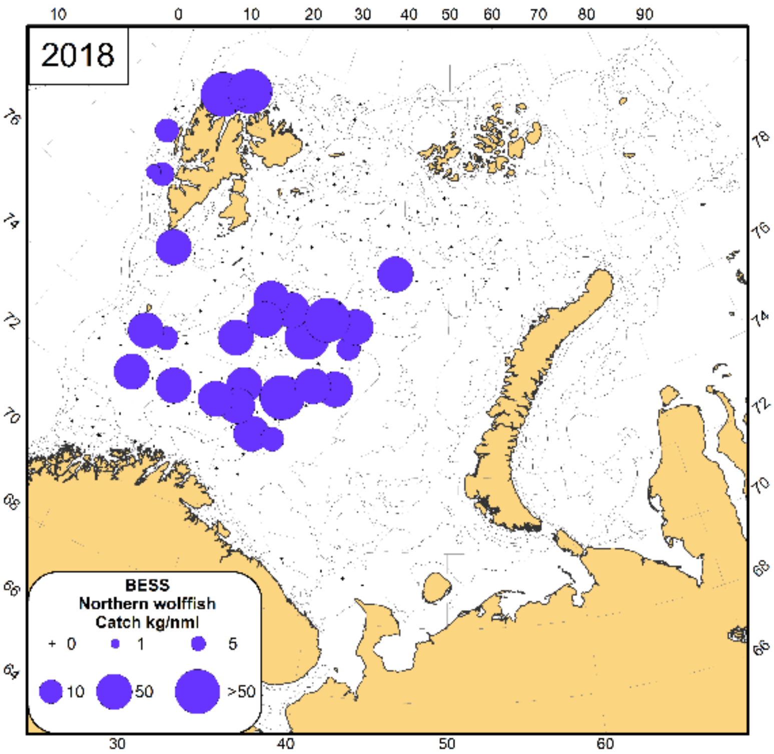



**Figure 53: Distribution of northern wolffish (*Anarhichas denticulatus),* August-October 2018 (Source: IMR/PINRO 2018)**

The ecosystem survey (IMR/ PINRO 2018) concluded that the distribution and biomass of Northern Wolffish has changed little over the last few years.

Management of wolffish species at regional level is limited. Russian fishing regulations for the Northern Basin (RUS EEZ/ Barents Sea) stipulate by-catch limits of 45% of total catch in 1 haul, and max. 45% of landed catch (in weight). Given the availability of high-quality catch data, it should be possible to improve the understanding of the interactions between the trawl fleet and these wolffish species, including improved stock assessments (ICES WGIBAR 2018).

Thorny Skate (*Amblyraja radiata*): The IUCN Red list European regional assessment (Dec 2014) for Thorny skate gives it a Least Concern (LC) status. Thorny (or Starry) skate is found in the Northeast Atlantic at depths of 18–1,400 m, but is most common from 27–439 m. This species is common in the northern region of the Northeast Atlantic. It is the most abundant skate species in the Barents Sea, where it is a common bycatch species of demersal fisheries. It reaches first maturity at a relatively small size (44 cm total length) and demographic modelling suggests it is less susceptible to fishing mortality in this region than larger skate species. For these reasons Thorny Skate is assessed as Least Concern in European waters (https://www.iucnredlist.org/species/161542/48945123#assessment-information; accessed 10th Nov 2020).

The IMR-PINRO Barents Sea ecosystem survey conducted in 2018 (IMR-PINRO 2019) presented a distribution map of the species (Figure 54).

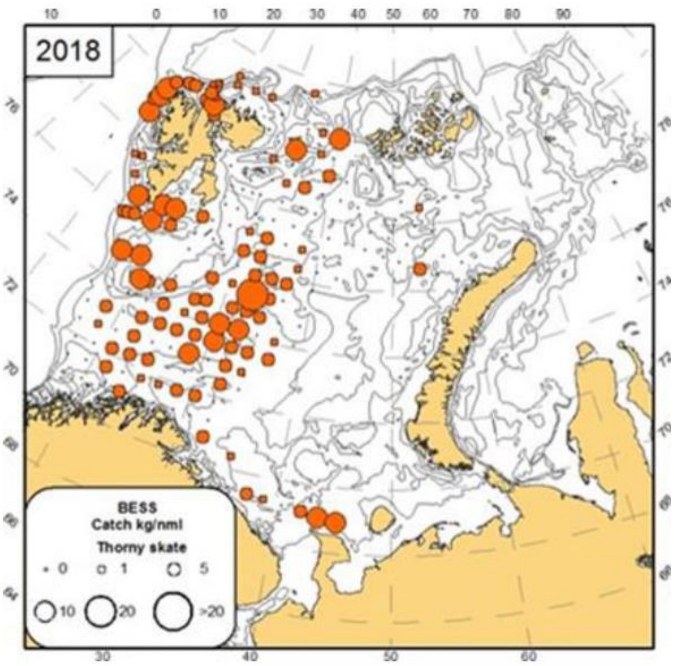



**Figure 54: Distribution of thorny skate (*Amblyraja radiata*) and Arctic skate (*Amblyraja hyperborea*), August-October 2018 (IMR-PINRO ecosystem survey report 2019)**

In the survey, Thorny skate was widely distributed in the Norwegian Zone, from the southwest to the northwest where warm Atlantic and Coastal waters dominate. According to ICES WGEF (2017) it is widely distributed and the most common skate species in Barents Sea.

Squid: the squid is used as bait. It is purchased from Norway and Chile via a supplier.

American plaice/Long rough dab: This species is widely distributed in the Barents Sea, and the biomass of long rough dab in the eco-system survey in 2014–2016 has been relatively stable (ICES WGIBAR 2017). No stock information was available for this species.

Arctic skate (*A.hyperborea*): The species was found in deeper waters along the shelf edge towards the Norwegian Sea and Polar basin, and in Arctic water in the deeper parts of the eastern Barents Sea. The stock increased in biomass and numbers between 2007 and 2014. For the recent years, the estimates have been on the same level as before 2007 (ICES WGEF, 2018).

Arctic eelpout and Grey gurnard, and Spider crab: No stock information is available for these species.

It should be noted here, that bycatch species and opilio captured in the same trap are capable of inflicting injuries on each other. Wolffishes injure crabs that have been already captured in the trap and prevent new crabs from entering the trap. During the fishing process the bycatch is brought aboard the vessel alive. Generally, the fish bycatch captured by traps is either consumed by the crew or returned to the sea, after having been recorded in the case of commercial species. All by-caught benthic organisms, which are not attractive in terms of consumption for the crew, are returned alive to the sea. Due to the short exposure time onboard the fishing vessel during trap catch sorting operations, benthic organisms generally tend to fully maintain their vitality, and, once returned to the sea, survive (PINRO, 2017).

### 8.2.4 ETP

The background information on ETP species provided for the Red King crab UoA applies also to Opilio, and is therefore not repeated here.

No endangered, threatened and protected (ETP) species were recorded in the by-catch in the snow crab trap fishery in the Barents Sea. None of the fish species recorded in the by-catch in the Barents Sea snow crab fishery are listed on the species specific in the IUCN Red List, the Red Data Book of the Russian Federation and the Red Data Book of the Murmansk Region of the Russian Federation. None of the invertebrates recorded in the catch composition table in Section 8.2.2are recorded on any of the lists / Red Data Books mentioned above. No evidence or reports were provided to the assessment team that the snow crab fishery has a direct impact on ETP species. The fishery is conducted beyond 12nm offshore, and at a depth below 100m, thus out of reach of diving seabirds.

### 8.2.5 Habitat

The Barents Sea Habitat background for the 'managed area' for opilio is the same as for the Red King crab fishery. However, there is opilio – specific information, which will be considered as part of the scoring.

When assessing the status of habitats and the impacts of fishing, teams are required to consider the full area managed by the local, regional, national, or international governance body(s) responsible for fisheries management in the area(s) where the UoA operates (the "managed area" for short) (SA3.13.5, MSC 2014). The MSC also specifies that the team shall use available information (e.g. bioregional information) to determine the range and distribution of the habitat under consideration, and whether this distribution is entirely within the 'managed area' or extends beyond the 'managed area' (SA3.13.5.1, MSC 2014). The opilio UoA fishing area is restricted to an area West of Novaya Zemlya entirely within the Russian EEZ, as this is where the opilio crab occurs. Using the MSC definition of "the managed area" it would be expected that the audit team considers all habitats within the Barents Sea. It is not reasonable to consider the entire range of habitat(s) across the total area; therefore, the audit team have scaled down the "managed area" and in this assessment only consider habitats within the range and vicinity of the opilio location in the eastern Barents Sea. The habitats elements scored are described below and summarised in Section 5.3.6

#### 8.2.5.1 Habitat background specific to Opilio

The opilio fishery occurs in a different location to the Red King crab fishery (Figure 55 and Figure 56, note that the latter is a snapshot of 2014)

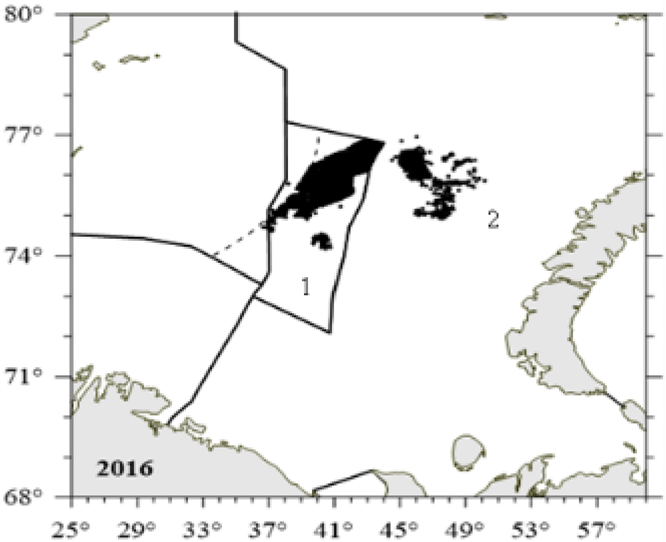



**Figure 55:** **Location of Russian fishery for Opilio, international waters (1) and Russian waters (2). (Source: barentsportal.com – Barents Sea Status report 2019**[84]

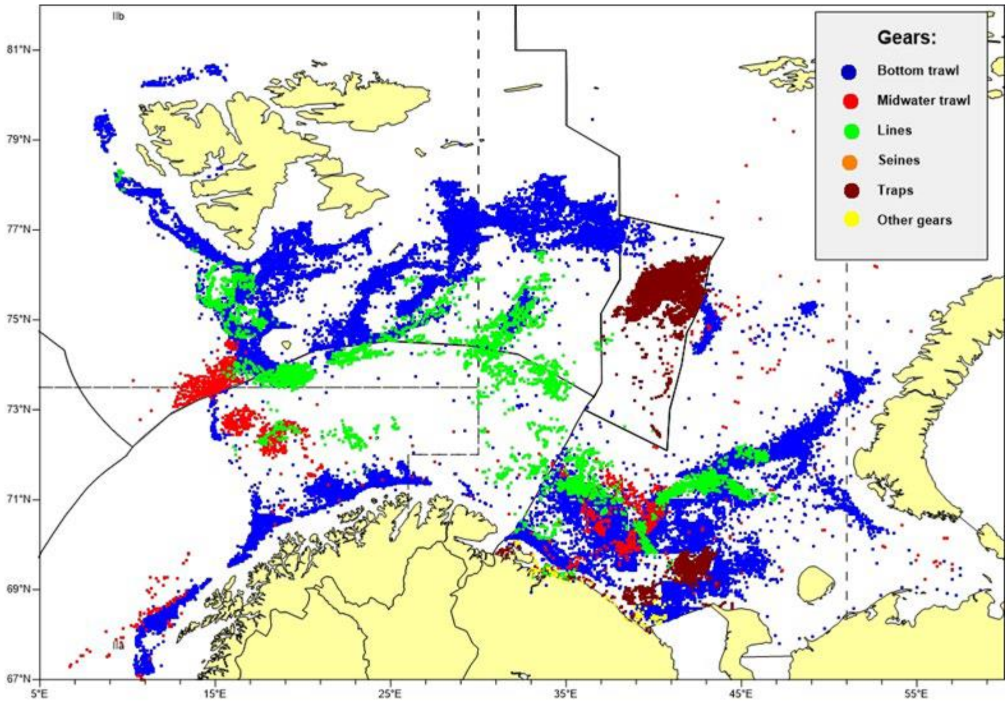



**Figure 56:** **Location of Russian fishing activity in all waters, and of non-Russian fishing activity within the Russian EEZ in 2014 as reported (VMS) to Russian authorities (Source: ICES Barents Sea ecosystem 2019)**

The general opilio fishery follows the location of the snow crab (Figure 57). The assessment team has not been provided with any vessel tracks (the fishery has only operated for one season so far, in 2020). The vessel tracks/ VMS would be important in this fishery, as it would show where the fishery is operating in relation to the International Waters area.

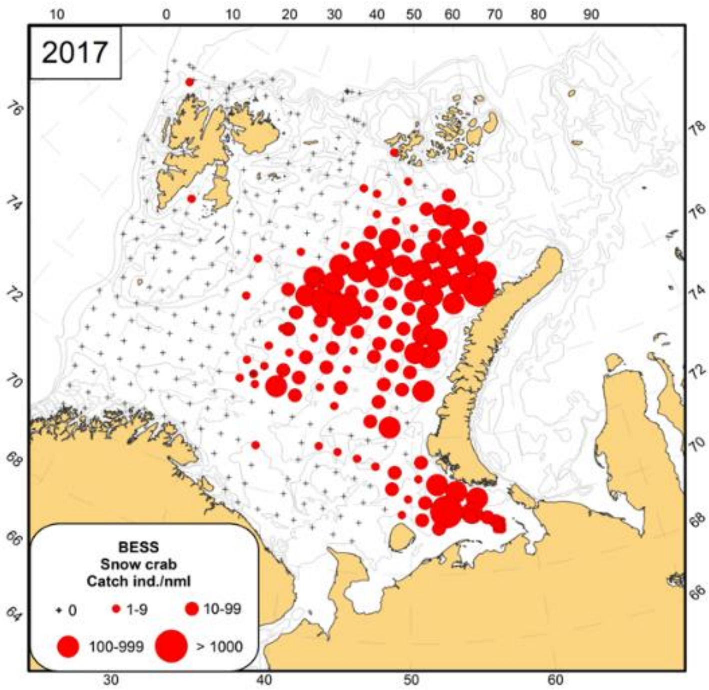



**Figure 57: Distribution of the snow crab (*Chionoecetes opilio*) in the Barents Sea in August-October 2017 (according to BESS data (Source IMR/PINRO ecosystem survey 2019)**

Snow crab are caught in a wide depth range from 40 m to 300 m with legal males showing preference for waters deeper than 150 m with temperatures close to 0°C and below. As the snow crab is a cold-water species, it has not spread to the relatively warmer waters of the southwestern Barents Sea where there are high concentrations of red king crab (*Paralithodes camtschaticus*). Figure 58, giving the depth contours in the Barents Sea, corresponds with where the majority of the fishery operates. Vessel tracks have not yet been provided by the fishery under assessment. Snow crab fishing primarily operates between March to July while the meat content is high.

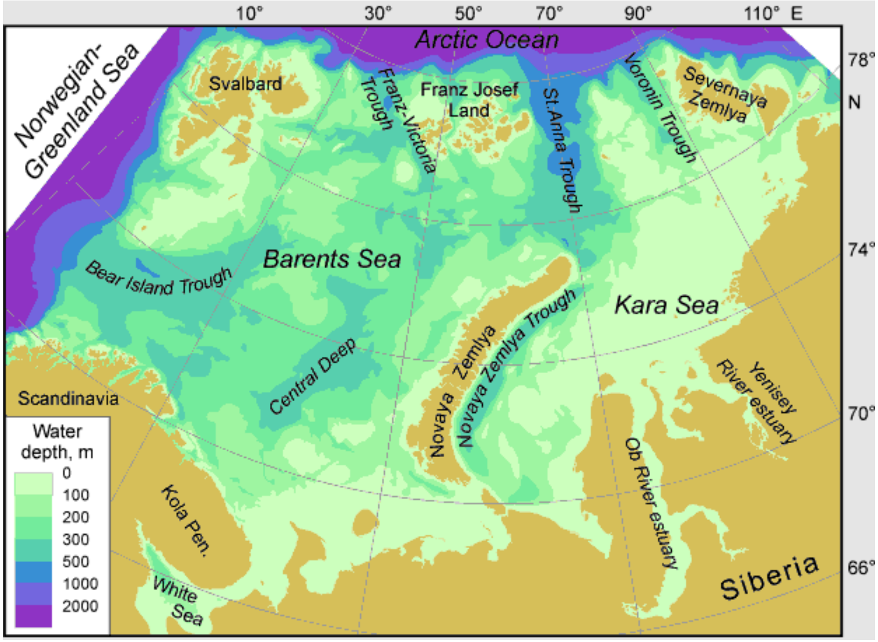



**Figure 58:** **Depth contours of Barents Sea, in relations to where the fishery operates. (Source:** http://research.bpcrc.osu.edu/foram/maps.htm**)**

The underlying sediment map (Figure 59) shows that the common habitat type is sedimentary, mud and sandy mud, gravelly sandy mud and various combinations of fine substratum with a flat geomorphology. The mapping programme also showed that there are no sensitive habitat types, such as hard or soft bottom sponge communities, coralline communities etc in the area where the snow crab fishery takes place, although several species groups have been identified.

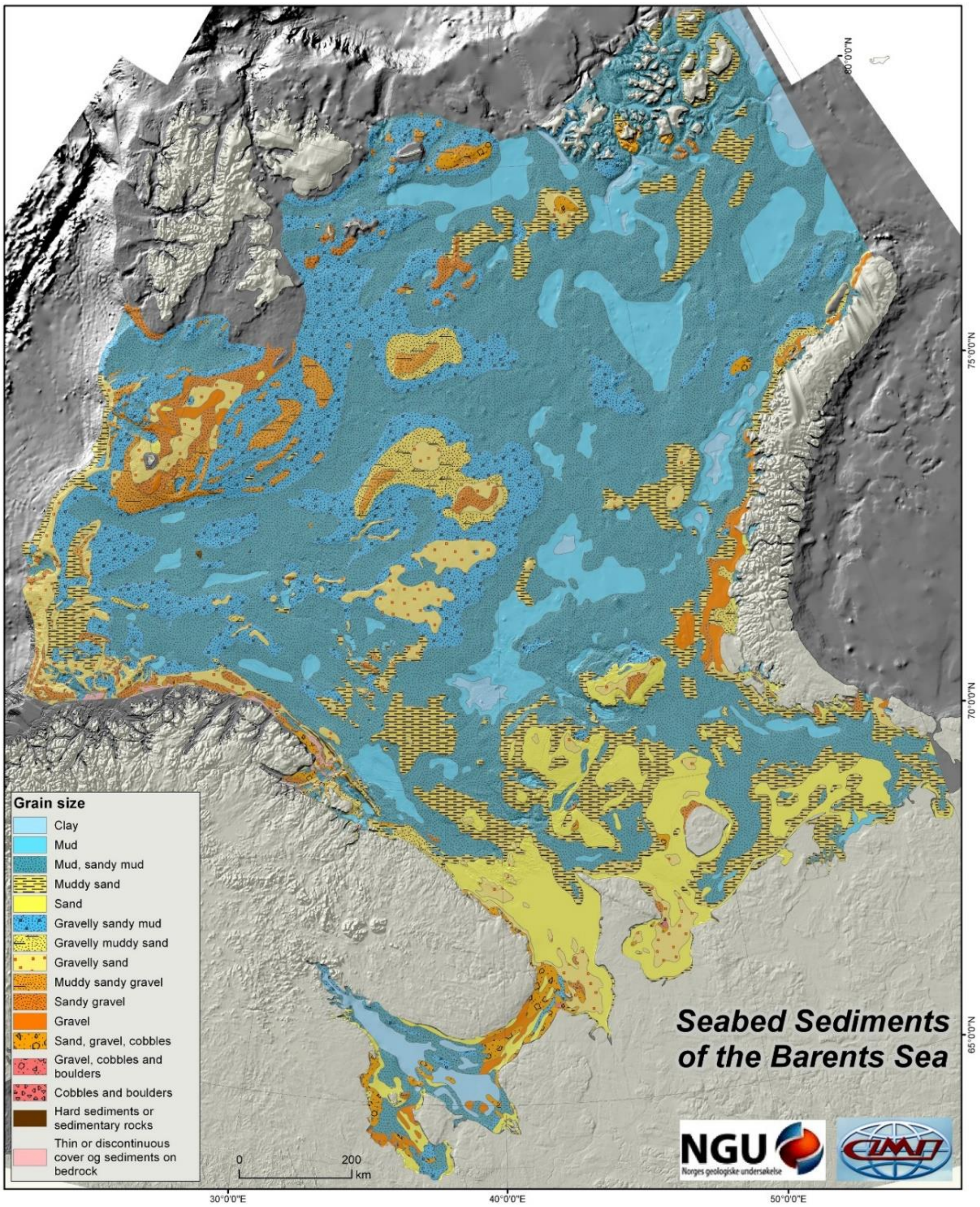



**Figure 59: Seabed sediments of the Barents Sea (Source: https://www.ngu.no/en/news/new-seabed-sediment-map-barents-sea, published 2019)**

The IMR/PINRO survey analysis showed that the northern central part of the Barents Sea is dominated by echinoderms (predominantly brittle stars) and the south western part by sponges. The maximum bycatch of megabenthos in the southwestern part of the Barents Sea occurred at a depth of 331 m and was dominated by two species of *Geodia* sponges (*G. barretti* and *G. macandrewii*) (IMR/PINRO 2019). Overall, detailed surveys by Jørgensen et al 2019[85] on the distribution of large benthos groups show that Porifera (mainly the *Geodia* group) dominate biomass in the west, while

Echinodermata (mainly brittle stars) dominate in the east. In the Northeast, Cnidaria (soft corals, such as the sea pen *Umbellula encrinus*, and sea anemones) dominates along with Echinodermata, while Crustacea dominates along with the Echinodermata in the Southeast (Figure 60).

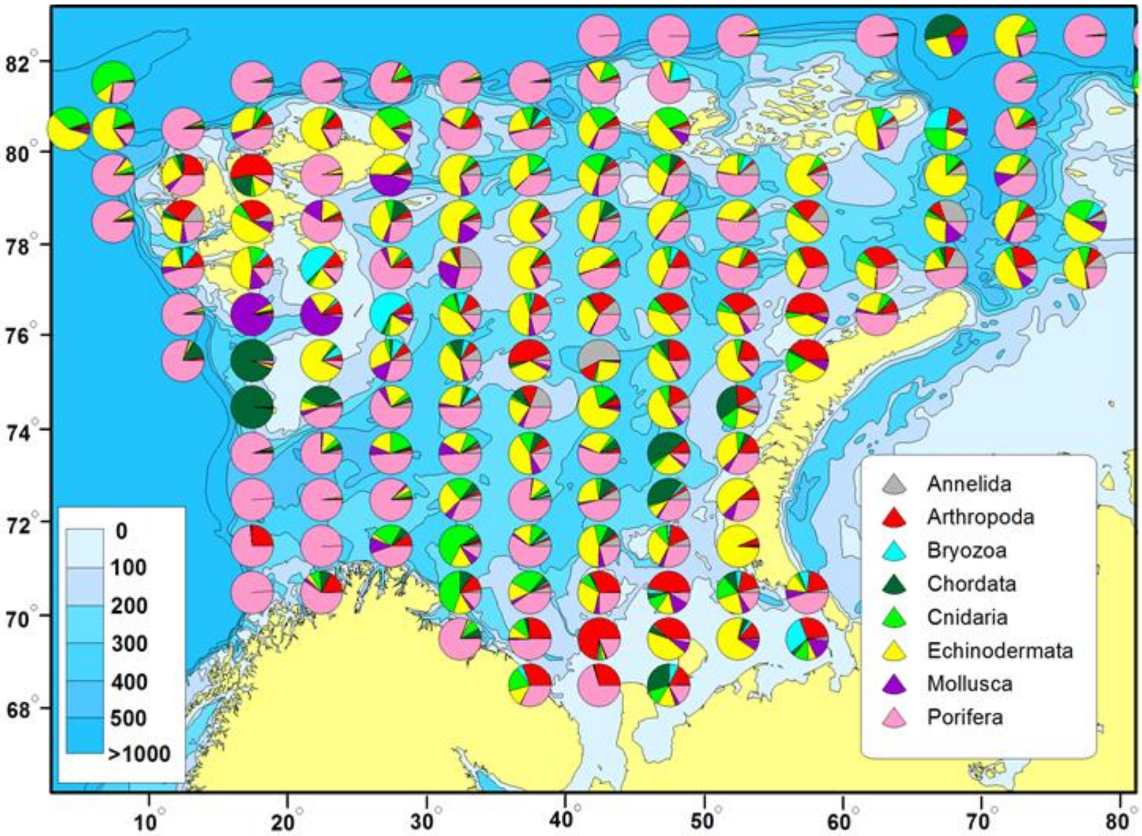



**Figure 60: The main benthos group distribution (in biomass). The data are the integrated mean for the period 2012-2017 (Source: Jørgensen et al 2019, in: http://www.barentsportal.com/barentsportal/index.php/en/status-2019/264-biotic-ecosystem-components-data-from-2018/benthos-and-shellfish-2018/938-benthos-and-shellfish; accessed 15th Nov 2020)**

A study by Jørgensen et al (2015) on the distribution of benthos revealed four main megafaunal regions: southwestern (SW), banks/slopes in southeast and west (SEW), north-western (NW), and north-eastern (NE). The distribution of this region-specific benthos was significantly related to depth, temperature, salinity, and number of ice-days. The SW region was dominated by filter-feeders (sponges) in the inflow area of warm Atlantic water while the deeper trenches had a detritivorous fauna (echinoderms). In the SEW region, predators (starfish, anemones and snow crabs) prevailed together with filtrating species (sea cucumber and bivalves) within a mosaic of banks and slopes. Plankton-feeding brittle stars were common in the NW and NE region, but with increasing snow crab population in NE. The study concluded that climate change, potentially expanding trawling activity, and increasing snow and king crab populations might all have an impact on the benthos. It suggested that benthos should therefore be a part of an integrated assessment of a changing sea, and national agencies might consider adding benthic taxonomic expertise on-board scientific research vessels to identify the invertebrate “bycatch” as part of routine trawl surveys. Indeed, this is an integral part of MSC certified fisheries.

Dependent on their sex and size, the diet of snow crabs consists of polychaetes, shrimps, crabs, smaller crustaceans, clams, brittle stars, gastropods, and sea urchins (Squires & Dawe 2003), which live in and on based on sedimentary habitat types. These prey species were common in the southeast, central, and north-western part of the Barents Sea (Jørgensen et al 2019), which is of relevance regarding the expansion NW-wards of snow crab. It can be summarised that for this fishery the commonly encountered habitat type is sedimentary, mud and sandy mud, in other words fine substratum and fairly flat geomorphology. The main community types that may be encountered by the snow crab fishery vessels, as derived primarily from Jakobsen & Ozhigen (2011) and Denisenko & Zgurovsky (2013), and various publications related to the joint PINRO/IMR ecosystem surveys, appears to be *Echinoid* communities, including *Strongylocentrotus* spp and *Gorgonocephalus* spp, *Crinoidea* spp. Considering where the snow crab fishery is located, and the dietary needs of the species, the fishery is unlikely to encounter hard bottom and reef communities. This is confirmed by the bycatch information available from scientific records 2013-2016 (PINRO 2017; PINRO/VNIRO 2020)

#### 8.2.5.2 Benthos species bycatch observations

The fishery occurs within a specific limited area, where the crabs are found, rather than across the whole of the Barents Sea. As vessels follow the target species, the areal footprint varies with the distribution of the snow crab and local sea conditions. Detailed observations on the presence of non-target species bycatch were conducted between 2013 to 2016 by PINRO scientists (PINRO 2017 report; VNIRO 2019 – opilio). The data collected is presence- absence data (Table 42), no weights or numbers of individuals were given, nor was the information broken down per trap line, for example. It shows a diversity of benthic species, both sessile and mobile. Some of the echinoderm species for example would be attracted to the trap because of the bait.

**Table 42: Invertebrate bycatch observations 2013-2016. (Source: PINRO 2017, provided in translation by client)**

| Invertebrates | |
|---|---|
| Crustaceans | |
| Spider crab | *Hyas araneus* |
| Amphipods | *Paramphithoe hystrix* |
| Sponges | *Tetilla polyura* |
| | *Polymastia thielei* |
| | *Thenea muricata* |
| | *Stylocordyla borealis* |
| | *Tentorium semisuberites* |
| | *Phakellia sp.* |
| | *Asbestopluma sp.* |
| | *Hamacantha implicans* |
| | *Forcepia sp.* |
| | *Radiella grimaldiii* |
| Anthozoan polyps | *Nephteidae sp.* |
| | *Drifa glomerata* |
| | *Gersemia rubiformis* |
| | *Duva florida* |
| Bryozoans | *Hornera lichenoides* |
| | *Flustra sp.* |
| | *Flustridae g.sp.* |
| | *Porella sp.* |
| | *Leieschara sp.* |
| | *Bowerbankia sp.* |
| Echinoderms | *Strongylocentrotus pallidus* |
| | *Strongylocentrotidae g.* |
| | *Solaster endeca* |
| | *Ctenodiscus crispatus* |
| | *Urasterias linckii* |
| | *Icasterias panopla* |
| | *Pontasstertenuis pinus* |
| | *Lophaster furcifer* |
| | *Poraniomorphahus pida* |
| | *Thyonidium drummondi* |
| | *Molpadia arctica* |
| | *M. borealis* |
| | *Ophioscolex glacialis* |
| | *Ophiopholis aculeate* |
| | *Ophiacantha bidentate* |
| | *Ophiura sarsi* |
| | *O. robusta* |
| | *Ophiopleura borealis* |
| | *Gorgonocephalus arcticus* |
| | *Heliometra glacialis* |
| Worms | *Maldanidae g. sp.* |
| | *Terebellidae g. sp.* |
| | *Spiochaetopterus typicus* |
| | *Lumbrineris sp.* |
| | *Nemertina g. sp.* |
| | |
| | *Priapulus caudatus (Priapulida)* |
| Bivalves | *Clinocardium ciliatum* |
| | *Portlandia arctica* |
| | *Chlamys islandica* |
| Gastropods | *Colus sabini* |
| | *Turrisipho lachesis* |
| | *Buccinidae* |

A detailed biological study[86] was conducted during an Opilio fishery in 2019 as located in Figure 61 presented further information on presence/absence benthos species (Table 43).

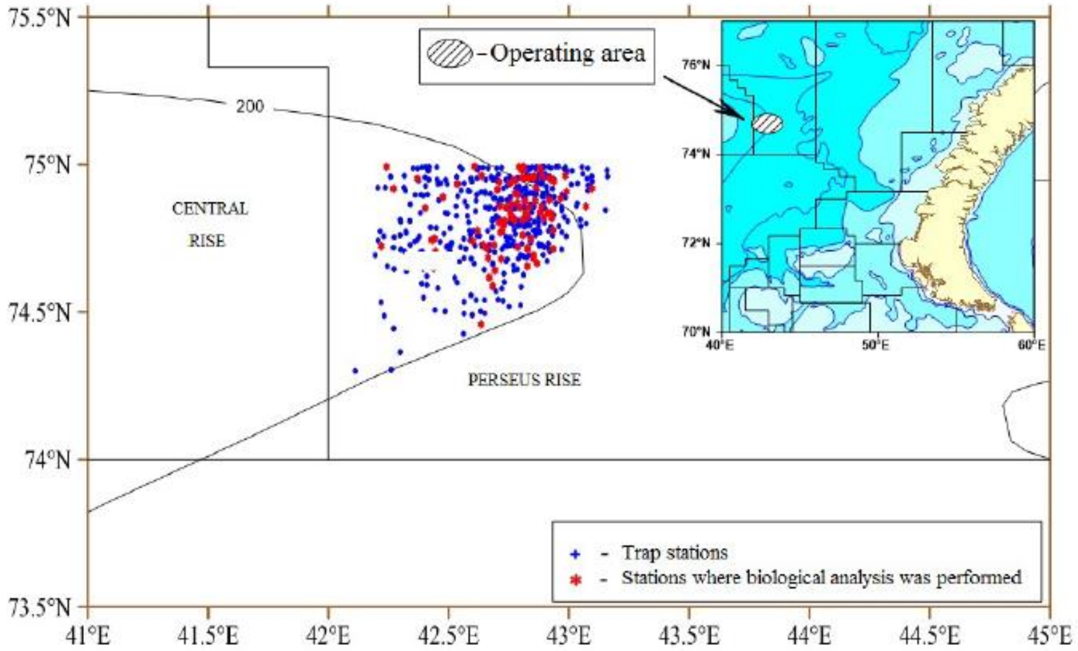



**Figure 61:** **Operating area of fishing voyage No. 11 during 29 March – 15 July 2019 (Source VNIRO 2019, opilio)**

**Table 43:** **Species composition of opilio trap catches in March–July 2019 (Source: VNIRO 2019 – opilio)**

| No. | Aquatic organism species | No. | Aquatic organism species |
|---|---|---|---|
| | Fishes | 14 | *Icasterias panopla* |
| 1 | Atlantic cod *(Gadus morhua)* | 15 | *Urasterias lincki* |
| 2 | Greenland halibut *(Reinhardtius hippoglossoides)* | 16 | Purple sunstar (*Solaster endeca)* |
| 3 | American plaice *(Hippoglossoides platessoides)* | | Brittle stars |
| 4 | Northern wolffish *(Anarchichas denticulatus)* | 17 | Crevice brittle star (*Ophiopholis aculeate)* |
| 5 | Spotted wolffish *(Anarchichas lupus)* | 18 | *Ophiacantha bidentata* |
| 6 | Arctic skate | 19 | *Ophioscolex glacialis* |
| | Crustaceans | 20 | *Gorgonocephalus arcticus* |
| 7 | King crab (*Paralithodes camtschaticus*) | 21 | Sea cucumber (*Molpadia borealis)* |
| 8 | Snow crab *(Chionoecetes opilio)* | 22 | Bivalve mollusks *(Clinocardium ciliatum)* |
| 9 | Great spider crab *(Hyas araneus)* | 23 | Gastropod mollusks (*Buccinidae* sp.) |
| 10 | Coral polyps (*Nephteidae* sp.) | | Sea anemomes |
| 11 | Sea strawberry (*Gersemia rubiformis)* | 24 | *Hormathia nodosa* |
| | Echinoderms | 25 | *Hormathia digitata* |
| 12 | Sea urchins (*Strongylocentrotidae* g.) | 26 | *Stomphia coccinea* |
| | Starfish | | Worms |
| 13 | *Ctenodiscus crispatus* | 27 | *Spiochaetopterus typicus* |

### 8.2.5.3 VME interaction

Regarding the fishery under assessment interacting with VMEs, the same information as provided for the Red King crab UoA applies to the snow crab fishery. There are no VMEs identified in the area of the opilio fishery. As mentioned above, considering the dietary needs of the crab, the fishery is unlikely to encounter hard bottom and reef communities. However, there is concern that with the expansion of the distribution of fisheries, primarily trawl fisheries but also less impactful trap fisheries, into formerly unfished areas would be impacted (Jørgensen et al 2019). The same study also highlighted that the expansion of snow crab would also impact those unimpacted areas. As mentioned below, under ecosystem, the study encouraged the identification of vulnerable areas that warrant special measures, including protection from trawling and reduction of the snow crab stock.

### 8.2.6 Ecosystem

The Barents Sea ecosystem background for opilio is the same as for the Red King crab fishery. However, there is opilio – specific information, which will be considered as part of the scoring.

The IMR/PINRO 2018 ecosystem survey report (Prozorkevich, et al 2018) stated that the snow crab distribution was expanding (Figure 62), which is relevant in the context of the ecosystem, as the fishery follows the snow crab, and with it associated fishery-related impacts.

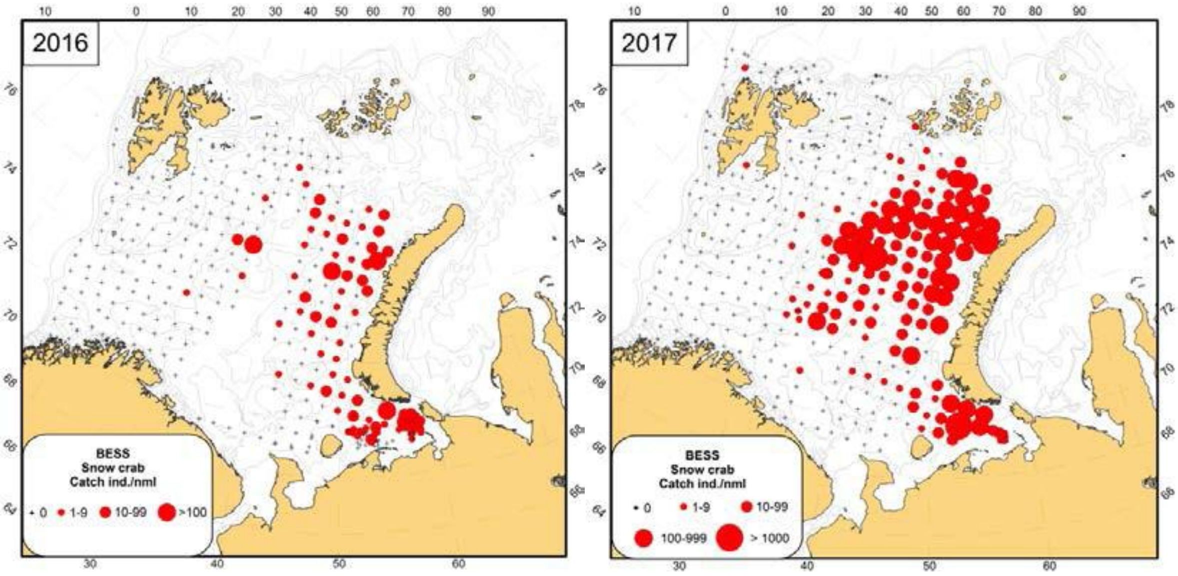



**Figure 62: Distribution of Snow Crab (*Chionecetes opilio)* in the Barents Sea, August-October 2016 and 2017. (Source: IMO/PINRO 2018 Ecosystem report)**

The snow crab stock is increasing in the central and eastern Barents Sea, and the biomass is calculated to be ten times higher than the biomass of red king crabs and close to half the biomass of the deep-water shrimp. In the past few years a commercial fishery has become viable for the species. A further expansion in range westwards towards Svalbard is expected (IMR/PINRO 2019 ecosystem report)

The distribution changes of opilio are also being monitored through ongoing benthos monitoring studies. Benthos is one of the main components of marine ecosystems. It is stable in time, characterizes local situation, and is able to show the ecosystem dynamics in retrospective. The changes in community structure and composition reflect natural and anthropogenic factors, see Figure 63 (Korneev et al, 2017[87]). Studies by Jørgensen et al (2019) show the expansion of snow crab with underlying changes of the benthos community composition.

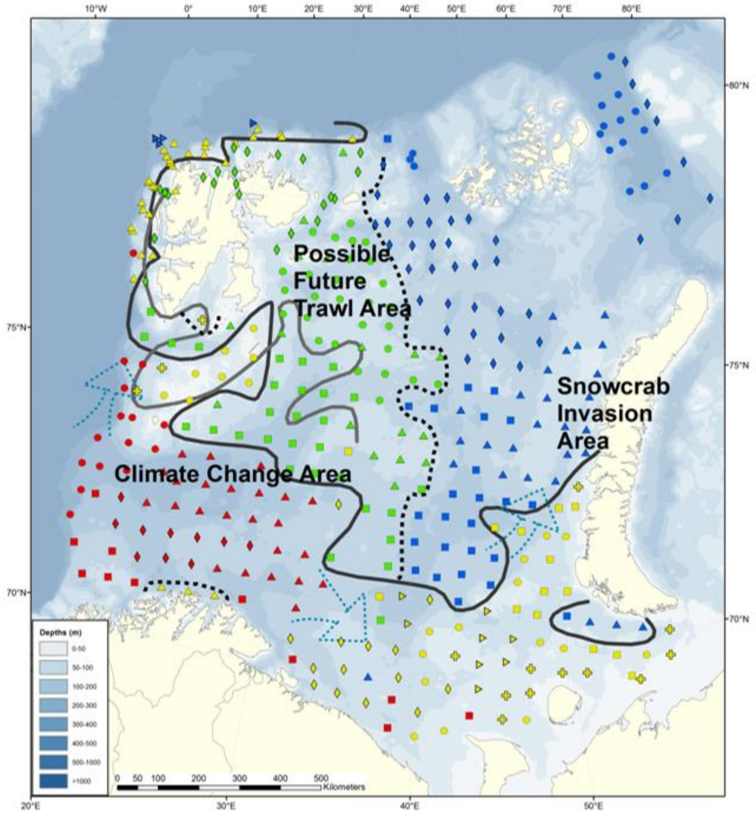



**Figure 63: Baseline map of the Barents Sea mega-benthic communities in 2011(Source: Korneev et al 2017[88])**

The baseline map based on fauna similarity (Figure 63; see Jørgensen et al 2014 for methodology, results and discussion) with the northern (green and blue) and southern (yellow and red) region where the black full line is illustrating the "benthic polar front" in 2011. The grey full line is the approximately oceanographic Polar Front. Dotted line: Is partly illustrating a west-east division. Red: South West sub-region (SW) Yellow: Southeast, banks and Svalbard coast (SEW). Green: North West and Svalbard fjords (NW). Blue: North East (NE). Source: Institute of Marine Research[89],

The Arctic Barents Sea is experiencing a record temperature increase, a poleward shift in the distributions of commercial fish stocks, and invasion by the snow crab, a new predator. Jørgensen et al (2019) evaluated benthic community vulnerability when exposed to seawater warming, bottom trawling, and predation from a new predator – the snow crab. The study showed a recent significant increase in community mean temperature ranks, indicating an increased importance of species with affinity for warmer waters and a reduced importance of coldwater species. Commercial fish stocks and snow crabs are expanding into the western part of the Barents Sea, thereby simultaneously increasing the exposure of large immobile species (currently untouched as there is no fishing in those areas yet, see Figure 63 for possible future trawl areas) to trawling and of small prey species to crab predation. The study encouraged the identification of vulnerable areas that warrant special measures, including protection from trawling and reduction of the snow crab stock.

Since 2003, snow crabs in the eastern part of the Barents Sea, have been recorded in stomachs of bottom fish species (cod, haddock, catfish, American dub, and starry ray). In recent years, snow crabs have become one of the most important prey species for cod. In 2011–2012 it made up about 2% of the cod stomachs examined, in 2013–2014 it made up 4–7%, and in 2015–2016 it made up 5–6%. All size categories of snow crab (up to 120 mm carapace width) are eaten by cod. Cod feeding on snow crabs was most intensive (up to a quarter of total stomach content) during autumn at Novaya Zemlya, Great Bank, Central Banks (IMR/ PINRO ecosystem survey 2019).

Impact of snow crab on benthos

Increasingly studies are being published which show the impact of the snow crab, an invasive species in the Barents Sea since first observed in grab surveys in 1996. The spatial impact on benthos biomass done by the snow crab predation (Manushin, 2016) shows that the highest impact is located west of Novaya Zemlya (Figure 49) and in an area dominated by the polychaete *Spiochaetopterus typicus* (deeper areas with adult snow crabs) and the bivalve *Macoma calcarea* (shallower areas with juvenile snow crabs) (Manushin, 2016 in ICES WGIBAR 2017).

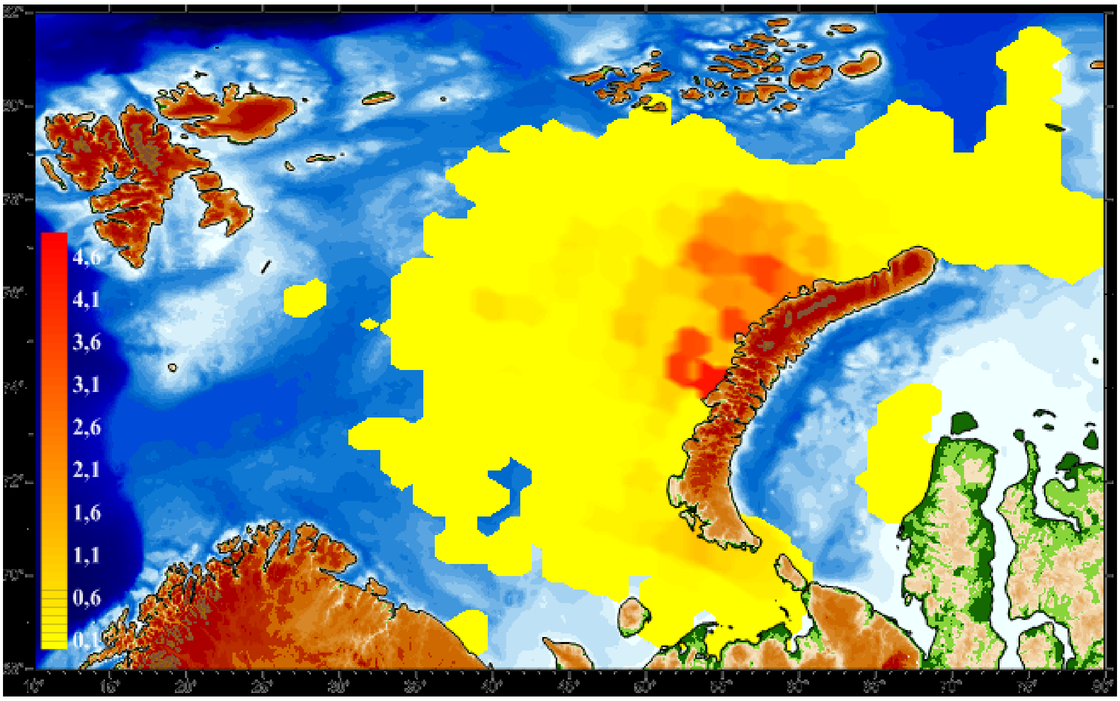



**Table 44: Total biomass (g/m$_2$) of the benthos consumed/ killed by the snow crab population during a nine-year period (2005-2014). (Source: Manushin, 2016 – in ICES WGIBAR 2017)**

### 8.2.7 Principle 2 Performance Indicator scores and rationales

## PI 2.1.1 – Primary species outcome

| PI 2.1.1 | | The UoA aims to maintain primary species above the point where recruitment would be impaired (PRI) and does not hinder recovery of primary species if they are below the PRI | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| **a** | Main primary species stock status | | | |
| | Guide post | Main primary species are **likely** to be above the PRI.<br>OR<br>If the species is below the PRI, the UoA has measures in place that are **expected** to ensure that the UoA does not hinder recovery and rebuilding. | Main primary species are **highly likely** to be above the PRI.<br>OR<br>If the species is below the PRI, there is either **evidence of recovery** or a demonstrably effective strategy in place **between all MSC UoAs which categorise this species as main**, to ensure that they collectively do not hinder recovery and rebuilding. | There is a **high degree of certainty** that main primary species are above the PRI **and are** fluctuating around a level consistent with MSY. |
| | Met? | **NA** | **NA** | **NA** |
| Rationale | | | | |

There are no main Primary species in this fishery.

| | | | | |
|---|---|---|---|---|
| **b** | Minor primary species stock status | | | |
| | Guide post | | | Minor primary species are highly likely to be above the PRI.<br>OR<br>If below the PRI, there is evidence that the UoA does not hinder the recovery and rebuilding of minor primary species. |
| | Met? | | | **All elements - Yes** |
| Rationale | | | | |

All 'minor' species automatically meet SG80.

Each element (minor species) is assessed against scoring issue b). If it does not meet SG100, it is treated as though it still meets SG80 (which is blank), which is automatically met by virtue of being a minor species. Thus, this SI will at least meet SG80 (if not more, depending on the status of the elements).

Bait species will be considered as elements here, depending on how much bait is used as a percentage of the total catch. There was quantitative information available on the bait species used, for herring and cod heads.

The catch composition table provided by the client fishery (based on PINRO 2017) lists the following Primary minor species, each being an element: Atlantic cod, Beaked redfish (*S.mentella*), Greenland halibut, herring (bait), ling. Recent stock status information is available on each of these species:

ICES advice for Primary minor species (ICES.dk)

| Species | Assessment Unit<br>ICES Area | $B_{lim}$ | MSY | Advisory Category | Stock status | ICES Advice<br>Year/ section |
|---|---|---|---|---|---|---|
| **Cod**<br>*Gadus morhua* | I + II | Y | Y | Analytical assessment | F above $F_{MSY}$; Full reproductive capacity | June 2020 |
| **Beaked redfish**<br>*Sebastes mentella* | I + II | Y | Y | Analytical assessment | Full reproductive capacity | June 2020 |
| **Greenland halibut**<br>*Reinhardtius hippoglossoides* | I + II | Y | NA | Age length Gadget model | Stock at full reproductive capacity; no reference points for F; quota advice given | June 2019<br>No update |
| **Herring**<br>*Clupea harengus* | NE Atlantic<br>Norwegian spring-spawning | Y | Y | Analytical assessment | The stock is at full reproductive capacity; F above MSY | Sept 2020 |
| **Ling**<br>*Molva molva* | I + II | | proxy | Standardised CPUE | The status evaluation is based on the reference point proxy for FMSY using the length-based indicator model | ICES June 2019<br>MSC certified |

The amount of bycatch recorded by PINRO (2017), was given in numbers of individuals and it is stated in the report that all bycatch is less than 10 tonnes per year for the opilio fishery (PINRO 2017). VNIRO/PINRO 2020 provided a quantitative catch profile.

These species listed above are managed with reference points and are highly likely to be above PRI. The amount of bait used per year is small compared with the catch of snow crab, indicating that all the bait species (herring, cod, squid) are 'minor'.

SG100 is met

## References

ICES Advice 2020 – cod.27.1-2 – https://doi.org/10.17895/ices.advice.5909

ICES Advice 2020 –reb.27.1-2 – https://doi.org/10.17895/ices.advice.5826

http://ices.dk/sites/pub/Publication%20Reports/Advice/2020/2020/ghl.27.1-2.pdf

ICES Advice 2020 – her.27.1-24a514a – https://doi.org/10.17895/ices.advice.5876 http://ices.dk/sites/pub/Publication%20Reports/Advice/2019/2019/lin.27.1-2.pdf

A number of ling fisheries in I + II are certified, eg: https://fisheries.msc.org/en/fisheries/nfa-norway-ling-tusk-and-nfa-norway-lumpfish/@@view; see MSC.org website for others

PINRO 2017. Federal Agency for Fisheries FEDERAL STATE BUDGETARY SCIENTIFIC INSTITUTION KNIPOVICH POLAR RESEARCH INSTITUTE OF MARINE FISHERIES AND OCEANOGRAPHY (FSBSI "PINRO"); REPORT ON RESEARCH WORKS; RESULTS FROM ANALYSIS OF SNOW CRAB *CHIONOECETES OPILIO* STOCK MANAGEMENT IN THE RUSSIAN PART OF THE BARENTS SEA AND STATUS OF ECOSYSTEM IN THESE WATERS IN LIGHT OF THE PROVISIONS IN THE CURRENT MARINE STEWARDSHIP COUNCIL (MSC) STANDARD ; Contract *No.*16/2017 dated 20.03.2017 with ZAO "Arktikservis"

VNIRO/PINRO 2020; PINRO 2019 observer report for opilio

| **Draft scoring range** | **≥80** |
|---|---|
| Information gap indicator | **Information sufficient to score PI** |

**Overall Performance Indicator scores added from Client and Peer Review Draft Report stage**

| | |
|---|---|
| Overall Performance Indicator score | |
| Condition number (if relevant) | |

## PI 2.1.2 – Primary species management strategy

| PI 2.1.2 | | There is a strategy in place that is designed to maintain or to not hinder rebuilding of primary species, and the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of unwanted catch | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| **a** | Management strategy in place | | | |
| | Guide post | There are **measures** in place for the UoA, if necessary, that are expected to maintain or to not hinder rebuilding of the main primary species at/to levels which are likely to be above the PRI. | There is a **partial strategy** in place for the UoA, if necessary, that is expected to maintain or to not hinder rebuilding of the main primary species at/to levels which are highly likely to be above the PRI. | There is a **strategy** in place for the UoA for managing main and minor primary species. |
| | Met? | **Yes** | **Yes** | **Yes** |
| Rationale | | | | |

There are no main Primary species. SG60 and SG80 is met.

SG100 requires that there is a strategy in place to manage main and minor Primary species. 'Primary species are species of commercial value with management tools controlling exploitation. These tools, which comprise a strategy as they are regularly reviewed through the ICES process, Joint Russia and Norway Fisheries Commission, as well as by PINRO scientists, include: a requirement for accurate information on landings of bycaught species (via log book, landings notes and on-board checks by inspectors, all commercial species have to be retained and recorded), fishing season, technical measures for gear (mesh size and design of trap) and bycatch exclusion measures where possible. Bycatch is low, >0.5% for most Primary species, which show that bycatch of Primary species is low. SG100 is met.

| | | | | |
|---|---|---|---|---|
| **b** | Management strategy evaluation | | | |
| | Guide post | The measures are considered **likely** to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries/species). | There is some **objective basis for confidence** that the measures/partial strategy will work, based on some information directly about the fishery and/or species involved. | **Testing** supports **high confidence** that the partial strategy/strategy will work, based on information directly about the fishery and/or species involved. |
| | Met? | **Yes** | **Yes** | **No** |
| Rationale | | | | |

SG60 and SG80 is met as there are no main primary species, and the SI relates to SIa at SG80.

The level of Primary species bycatch is small, given the passive gear involved (trap) and the species targeted (snow crab) and therefore it is highly likely that the low amount of Primary species caught will have little impact on the relevant stock.

There is no quantitative information available over a sufficient period of time, e.g. over several fishing seasons to allow testing. SG100 is not met

| | | | | |
|---|---|---|---|---|
| **c** | Management strategy implementation | | | |
| | Guide post | | There is **some evidence** that the measures/partial strategy is being **implemented successfully**. | There is **clear evidence** that the partial strategy/strategy is being **implemented successfully and is achieving its overall objective as set out in scoring issue (a).** |
| | Met? | | **Yes** | **Yes** |
| Rationale | | | | |

Given the low proportion of bycatch in this trap fishery, the partial strategy is working in practice for the client fleet, and the species in question are within biological limits, as regularly evaluated through stock specific ICES and JRNFC workshops. Evidence is in terms of logbooks where retained commercially important species are recorded (PINRO 2018, and Client interviews May 2019), compliance records, and VMS records, for example. SG80 is met.

Information on bycatch collected by observers, coupled with analysis by PINRO (PINRO 2017; VNIRO/PINRO 2020), and ongoing scientific surveys of the stock status of the species involved, provide a basis for confidence that the strategy is working. Furthermore, there is good compliance with the regulations as implemented by the strategy. The bycatch is low. SG100 is met.

| | | | | |
|---|---|---|---|---|
| **d** | Shark finning | | | |
| | Guide post | It is **likely** that shark finning is not taking place. | It is **highly likely** that shark finning is not taking place. | There is a **high degree of certainty** that shark finning is not taking place. |
| | Met? | **NA** | **NA** | **NA** |
| Rationale | | | | |

There are no unwanted catches of shark as primary species.

| | | | | |
|---|---|---|---|---|
| **e** | Review of alternative measures | | | |
| | Guide post | There is a review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of main primary species. | There is a **regular** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of main primary species and they are implemented as appropriate. | There is a **biennial** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of unwanted catch of all primary species, and they are implemented, as appropriate. |
| | Met? | **NA** | **NA** | **NA** |
| Rationale | | | | |

There is very little bycatch, so researching into alternative measures seems not warranted or appropriate at this stage. There is no formal review process of this fishery regarding the gear and deployment, as traps have been traditionally used and are considered low impact (Client interview, Sept 2020).

However, a Recommendation has been raised to consider possible increase of bycatch with an expanding fishery, and at what point a review would be triggered.

## References

As for PI 2.1.1

| | |
|---|---|
| **Draft scoring range** | **≥80** |
| Information gap indicator | **Information sufficient to score PI** |

**Overall Performance Indicator scores added from Client and Peer Review Draft Report stage**

| | |
|---|---|
| Overall Performance Indicator score | |
| Condition number (if relevant) | |

Recommendation for PI 2.1.1

Although the current low bycatch does not warrant a review of alternative measures it may well be that with this expanding fishery, bycatch could increase. There are currently no guidelines as to what level of bycatch should trigger a review of alternative measures. The fishery may need to address this in the fishery management plan

## PI 2.1.3 – Primary species information

| PI 2.1.3 | | Information on the nature and extent of primary species is adequate to determine the risk posed by the UoA and the effectiveness of the strategy to manage primary species | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| a | Information adequacy for assessment of impact on main primary species | | | |
| | Guide post | Qualitative information is **adequate to estimate** the impact of the UoA on the main primary species with respect to status.<br>**OR**<br>**If RBF is used to score PI 2.1.1 for the UoA:**<br>Qualitative information is adequate to estimate productivity and susceptibility attributes for main primary species. | Some quantitative information is available and is **adequate to assess** the impact of the UoA on the main primary species with respect to status.<br>**OR**<br>**If RBF is used to score PI 2.1.1 for the UoA:**<br>Some quantitative information is adequate to assess productivity and susceptibility attributes for main primary species. | Quantitative information is available and is **adequate to assess with a high degree of certainty** the impact of the UoA on main primary species with respect to status. |
| | Met? | **NA** | **NA** | **NA** |
| Rationale | | | | |

Given that there are no 'main' species Scoring Issue a) is not used.

| | | | | |
|---|---|---|---|---|
| b | Information adequacy for assessment of impact on minor primary species | | | |
| | Guide post | | | Some quantitative information is adequate to estimate the impact of the UoA on minor primary species with respect to status. |
| | Met? | | | **Bait Herring – No**<br>**Bait cod heads – No**<br>**Cod – Yes**<br>**Beaked Redfish – Yes**<br>**GL Halibut – Yes**<br>**Ling -Yes** |
| Rationale | | | | |

There is some quantitative information on bycatch. The bycatch information provided consists of numbers of individuals, observed in the traps at different times. This applies to all the Primary species elements, including the bait species for the 2020 season of the fishery under assessment.

<u>Bait:</u> herring SG80; cod heads SG80

Cod SG100; S.mentella, SG100; GL halibut, SG100

| | | | | |
|---|---|---|---|---|
| **c** | Information adequacy for management strategy | | | |
| | Guide post | Information is adequate to support **measures** to manage **main** primary species. | Information is adequate to support a **partial strategy** to manage **main** primary species. | Information is adequate to support a **strategy** to manage **all** primary species, and evaluate with a **high degree of certainty** whether the strategy is achieving its objective. |
| | Met? | **Yes** | **Yes** | **No** |

Rationale

There are no main Primary species. SG60 and SG80 is met.

The amount of bycatch is low, it is measured in numbers of individuals. This is a result of the type of gear used, and species targeted. However, quantitative information on Primary species bycaught is limited (PINRO 2017), and the analysis of available quantitative data does not make it possible to evaluate any trends. Therefore, it is not possible to say with a high degree of certainty that the strategy is achieving its objective. SG100 is not met.

A Recommendation is raised, to suggest that bycatch is recorded regularly, and the analysis of bycatch includes number/ amount for each species per season, so it is possible to calculate the proportion from the total each season. In other words, a more detailed catch profile each fishing year

References

PINRO 2017. Federal Agency for Fisheries FEDERAL STATE BUDGETARY SCIENTIFIC INSTITUTION KNIPOVICH POLAR RESEARCH INSTITUTE OF MARINE FISHERIES AND OCEANOGRAPHY (FSBSI “PINRO”); REPORT ON RESEARCH WORKS; RESULTS FROM ANALYSIS OF SNOW CRAB CHIONOECETES OPILIO STOCK MANAGEMENT IN THE RUSSIAN PART OF THE BARENTS SEA AND STATUS OF ECOSYSTEM IN THESE WATERS IN LIGHT OF THE PROVISIONS IN THE CURRENT MARINE STEWARDSHIP COUNCIL (MSC) STANDARD ; Contract No.16/2017 dated 20.03.2017 with ZAO “Arktikservis”

ICES Advice June 2019 for NE Atlantic cod 1-2; ICES Advice for Sebastes mentella Sept 2018, reb27.1-2; ICES Advice Greenland halibut Sept 2017 Ghl.27.1-2; ICES Advice herring October 2018 her.27.1-2

VNIRO 2019 – opilio

**Draft scoring range and information gap indicator added at Announcement Comment Draft Report stage**

| | |
|---|---|
| Draft scoring range | **≥80** |
| Information gap indicator | **More information sought -** on observer coverage and reports for 2020 fishing season |

**Overall Performance Indicator scores added from Client and Peer Review Draft Report stage**

| | |
|---|---|
| Overall Performance Indicator score | |
| Condition number (if relevant) | |

A Recommendation is raised, to suggest that bycatch is recorded regularly, either through increased observer coverage or through special designed software as used by other MSC certified fisheries in the BS, and the analysis of bycatch includes number/ amount for each species per season, so it is possible to calculate the proportion from the total each season. In other words, a more detailed catch profile each fishing year

## PI 2.2.1 – Secondary species outcome

| PI 2.2.1 | | **The UoA aims to maintain secondary species above a biologically based limit and does not hinder recovery of secondary species if they are below a biological based limit** | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| **a** | Main secondary species stock status | | | |
| | Guide post | Main secondary species are **likely** to be above biologically based limits.<br>OR<br>If below biologically based limits, there are **measures** in place expected to ensure that the UoA does not hinder recovery and rebuilding. | Main secondary species are **highly likely** to be above biologically based limits.<br>OR<br>If below biologically based limits, there is either **evidence of recovery** or a **demonstrably effective partial strategy** in place such that the UoA does not hinder recovery and rebuilding.<br>AND<br>Where catches of a main secondary species outside of biological limits are **considerable**, there is either **evidence of recovery** or a, **demonstrably effective strategy in place between those MSC UoAs that have considerable catches of the species**, to ensure that they collectively do not hinder recovery and rebuilding. | There is a **high degree of certainty** that main secondary species are above biologically based limits. |
| | Met? | **NA** | **NA** | **NA** |
| Rationale | | | | |
| There are no main Secondary species in the bycatch. Scoring issue a) is not used. | | | | |
| b | **Minor secondary species stock status** | | | |
| | Guide post | | | Minor secondary species are highly likely to be above biologically based limits.<br>OR<br>If below biologically based limits', there is evidence that the UoA does not hinder the recovery and rebuilding of secondary species |

| | Met? | All elements - No |
|---|---|---|

**Rationale**

The nature of the classification into Secondary species indicates that these species are not managed, and in many cases do not have the necessary analytical assessment to determine the biologically based limits. There is little evidence available which shows that these species are highly likely to be above biologically based limits. Each Secondary species is an element and is assessed against Scoring Issue b), as they are all 'minor'. If it does not meet SG100, it is treated as though it still meets SG80 (which is blank), which is automatically met by virtue of being a minor species.

The amount of Secondary species bycatch is small, recorded in numbers of individuals over a period of 3 seasons (2013 to 2016 – PINRO 2017), as well as part of the catch profile (VNIRO/PINRO 2020). The Secondary 'minor' species identified from the catch composition in Section 8.2.3.2are listed as the following elements: Spotted and Northern wolfish; Long rough dab; Thorny ray; Arctic skate; Arctic eelpout; Grey gurnard; Spider crab.

Squid as bait was designated as a Secondary species, there was no stock information.

The minor secondary species caught in this fishery should be considered as data-deficient as there are no stock status reference points available (MSC Fisheries Standard v2.01, 7.7.6, Table 3) Paragraph 7.7.6.5 requires that the Risk-Based Framework (RBF) should be used to evaluate scoring elements that are data-deficient. The secondary species identified should therefore be scored using the RBF. However, PF4.1.4 states that "The team may elect to conduct a PSA on "main" species only when evaluating PI 2.1.1 or 2.2.1", and this is the approach taken in this assessment as all Secondary species caught were designated as minor Secondary species. PF 5.3.2 is therefore applied and the scores for this SI are capped at 80.

Available information is summarised for each of the eight minor species in Section 8.2.3.2of this report

**References**

PINRO 2017; VNIRO/PINRO 2020

ICES Advice on *Amblyraja radiata* 2015 http://ices.dk/sites/pub/Publication%20Reports/Advice/2015/2015/rjr-234.pdf;

ICES WGEF 2018; ICES WGIBAR 2017

| **Draft scoring range** | **≥80** |
|---|---|
| Information gap indicator | **More information sought –** biological status of secondary minor species |

**Overall Performance Indicator scores added from Client and Peer Review Draft Report stage**

| | |
|---|---|
| Overall Performance Indicator score | |
| Condition number (if relevant) | |

## PI 2.2.2 – Secondary species management strategy

| PI 2.2.2 | | There is a strategy in place for managing secondary species that is designed to maintain or to not hinder rebuilding of secondary species and the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of unwanted catch | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| **a** | Management strategy in place | | | |
| | Guide post | There are **measures** in place, if necessary, which are expected to maintain or not hinder rebuilding of main secondary species at/to levels which are highly likely to be above biologically based limits or to ensure that the UoA does not hinder their recovery. | There is a **partial strategy** in place, if necessary, for the UoA that is expected to maintain or not hinder rebuilding of main secondary species at/to levels which are highly likely to be above biologically based limits or to ensure that the UoA does not hinder their recovery. | There is a **strategy** in place for the UoA for managing main and minor secondary species. |
| | Met? | **Yes** | **Yes** | **Yes** |
| Rationale | | | | |

There are no main Secondary species. SG60 and SG80 is met.

The nature of the fishery is such, that there is little else bycaught besides the target species, snow crab. This is confirmed by the catch composition data from observer reports (PINRO 2017; VNIRO 2019; VNIRO/PINRO 2020), which show little bycatch. The main strategy to reduce unwanted bycatch consists of trap design (mesh size and design of trap, including biodegradability) and location awareness. SG100 is met

| | | | | |
|---|---|---|---|---|
| **b** | Management strategy evaluation | | | |
| | Guide post | The measures are considered **likely** to work, based on plausible argument (e.g. general experience, theory or comparison with similar UoAs/species). | There is **some objective basis for confidence** that the measures/partial strategy will work, based on some information directly about the UoA and/or species involved. | **Testing** supports **high confidence** that the partial strategy/strategy will work, based on information directly about the UoA and/or species involved. |
| | Met? | **Yes** | **Yes** | **No** |
| Rationale | | | | |

The measures/strategy will work because logbooks, registered landing ports and effectives monitoring, control and surveillance, and catch composition data through an on-board observer and research, as well as trap design research (mesh size), give an objective basis for confidence that the measures designed to minimise the level of retention of non-target species are effective. Available observer data shows little secondary species bycatch (PINRO 2017; VNIRO 2019; VNIRO/PINRO 2020)

SG60 and SG80 is met.

‘Testing’ implies simulations of the strategy, and/or comparisons with its implementation elsewhere. No evidence for ‘testing’ was seen by the assessment team. SG100 not met

| | | | | |
|---|---|---|---|---|
| **c** | Management strategy implementation | | | |
| | Guide post | | There is **some evidence** that the measures/partial strategy is being **implemented successfully**. | There is **clear evidence** that the partial strategy/strategy is being **implemented successfully and is achieving its objective as set out in scoring issue (a).** |
| | Met? | | **Yes** | **Yes** |

Rationale

Given the low proportion of bycatch (see Section 8.2.3.2) as analysed by PINRO (2017; 2019) and VNIRO/PINRO 2020, the partial strategy seems to be working in practice for the client fleet. It is also in the nature of this fishery, passive trap gear, that there is little bycatch. SG80 is met.

Information on bycatch collected by scientists on board, and ongoing scientific surveys in the Barents Sea of the stock status of the species involved (e.g. ICES WGEF 2018; ICES WGIBAR 2017), provide clear evidence that the strategy is being implemented successfully, and that it meets the objective as outlined in a). SG100 is met

| | | | | |
|---|---|---|---|---|
| **d** | Shark finning | | | |
| | Guide post | It is **likely** that shark finning is not taking place. | It is **highly likely** that shark finning is not taking place. | There is a **high degree of certainty** that shark finning is not taking place. |
| | Met? | **NA** | **NA** | **NA** |

Rationale

None of the secondary species are sharks.

| | | | | |
|---|---|---|---|---|
| **e** | Review of alternative measures to minimise mortality of unwanted catch | | | |
| | Guide post | There is a review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of **unwanted** catch of main secondary species. | There is a **regular** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of **unwanted** catch of main secondary species and they are implemented as appropriate. | There is a **biennial** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of **unwanted** catch of all secondary species, and they are implemented, as appropriate. |
| | Met? | **NA** | **NA** | **NA** |

Rationale

There is very little bycatch, so researching into alternative measures seems not warranted or appropriate at this stage. There is no formal review process of this fishery regarding the gear and deployment, as traps have been traditionally used and are considered low impact (Client interview, Sept 2020).

References

As for PI 2.2.1 and 2.2.2; PINRO 2017, 2019, VNIRO/PINRO 2020; Bogstad et al 2015 – on barentsportal.com

ICES Advice on *Amblyraja radiata* 2015 http://ices.dk/sites/pub/Publication%20Reports/Advice/2015/2015/rjr-234.pdf;

ICES WGEF 2018; ICES WGIBAR 2017

**Draft scoring range and information gap indicator added at Announcement Comment Draft Report stage**

| | |
|---|---|
| Draft scoring range | **≥80** |
| Information gap indicator | **Information sufficient to score PI** |

**Overall Performance Indicator scores added from Client and Peer Review Draft Report stage**

| | |
|---|---|
| Overall Performance Indicator score | |
| Condition number (if relevant) | |

## PI 2.2.3 – Secondary species information

| PI 2.2.3 | | Information on the nature and amount of secondary species taken is adequate to determine the risk posed by the UoA and the effectiveness of the strategy to manage secondary species | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| a | | Information adequacy for assessment of impacts on main secondary species | | |
| | Guide post | Qualitative information is **adequate to estimate** the impact of the UoA on the main secondary species with respect to status.<br>OR<br>**If RBF is used to score PI 2.2.1 for the UoA:**<br>Qualitative information is adequate to estimate productivity and susceptibility attributes for main secondary species. | Some quantitative information is available and **adequate to assess** the impact of the UoA on main secondary species with respect to status.<br>OR<br>**If RBF is used to score PI 2.2.1 for the UoA:**<br>Some quantitative information is adequate to assess productivity and susceptibility attributes for main secondary species. | Quantitative information is available and **adequate to assess with a high degree of certainty** the impact of the UoA on main secondary species with respect to status. |
| | Met? | **NA** | **NA** | **NA** |
| Rationale | | | | |

Because there were no main Secondary species, SI a) was not used.

| b | | Information adequacy for assessment of impacts on minor secondary species | | |
|---|---|---|---|---|
| | Guide post | | | Some quantitative information is adequate to estimate the impact of the UoA on minor secondary species with respect to status. |
| | Met? | | | **Yes** |
| Rationale | | | | |

Each minor Secondary species automatically scores SG80.

There is some quantitative information on bycatch. The bycatch information provided consists of numbers of individuals, as well as catch composition, observed in the traps at different times of the fishing season, and was collected by scientists on board and analysed by PINRO (PINRO 2017, 2019), VNIRO/PINRO 2020. Individual species concerned, elements, have been identified from the bycatch (Section 7.3.3b). The bycatch was recorded between 2013-2019 and covers a period of fishing in each year. The quantitative information is adequate to estimate the impact of the UoA on minor secondary species with respect to status SG100 is met.

A Recommendation is made, similar to PI 2.1.3, as it concerns the collection and collation of bycatch data. The Recommendation suggests that bycatch is recorded regularly, and the analysis of bycatch includes number/ amount for each species per season, so it is possible to calculate the proportion from the total each season. In other words, a more detailed catch profile each fishing year

| | | | | |
|---|---|---|---|---|
| | Information adequacy for management strategy | | | |
| **c** | Guide post | Information is adequate to support **measures** to manage **main** secondary species. | Information is adequate to support a **partial strategy** to manage **main** secondary species. | Information is adequate to support a **strategy** to manage **all** secondary species, and **evaluate** with a **high degree of certainty** whether the strategy is **achieving its objective**. |
| | Met? | **Yes** | **Yes** | **No** |

Rationale

There are no main Secondary species – SG60 and SG80 is met

The amount of bycatch is low, it is measured in numbers of individuals. This is a result of the type of gear used, and species targeted. However, quantitative information on Secondary species bycaught is limited (PINRO 2017, 2019), VNIRO/PINRO 2020 and the analysis of available quantitative data does not make it possible to evaluate any trends. Therefore, it is not possible to say with a high degree of certainty that the strategy is achieving its objective. SG100 is not met

References

As in PI 2.2.1 and PI 2.2.2

**Draft scoring range and information gap indicator added at Announcement Comment Draft Report stage**

| | |
|---|---|
| Draft scoring range | **≥80** |
| Information gap indicator | **Information sufficient to score PI** |

**Overall Performance Indicator scores added from Client and Peer Review Draft Report stage**

| | |
|---|---|
| Overall Performance Indicator score | |
| Condition number (if relevant) | |

A Recommendation is made, similar to PI 2.1.3, as it concerns the collection and collation of bycatch data. The Recommendation suggests that bycatch is recorded regularly, and the analysis of bycatch includes number/ amount for each species per season, so it is possible to calculate the proportion from the total each season. In other words, a more detailed catch profile each fishing year

# PI 2.3.1 – ETP species outcome

| PI 2.3.1 | | The UoA meets national and international requirements for the protection of ETP species<br>The UoA does not hinder recovery of ETP species | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| a | Effects of the UoA on population/stock within national or international limits, where applicable | | | |
| | Guide post | Where national and/or international requirements set limits for ETP species, the **effects of the UoA** on the population/ stock are known and **likely** to be within these limits. | Where national and/or international requirements set limits for ETP species, the **combined effects of the MSC UoAs** on the population /stock are known and **highly likely** to be within these limits. | Where national and/or international requirements set limits for ETP species, there is a **high degree of certainty** that the **combined effects of the MSC UoAs** are within these limits. |
| | Met? | **NA** | **NA** | **NA** |
| Rationale | | | | |

No ETP species were recorded in the catch composition. The assessment team has not received any reports or documentation of the UoA affecting ETPs. The assessment team is not aware of any national and/or international requirements set limits for ETP species which may be encountered by the fishery under assessment. This SI is therefore not scored.

| | | | | |
|---|---|---|---|---|
| b | Direct effects | | | |
| | Guide post | Known direct effects of the UoA are likely to not **hinder recovery** of ETP species. | Direct effects of the UoA are **highly likely** to not **hinder recovery** of ETP species. | There is a **high degree of confidence** that there are no **significant detrimental direct effects** of the UoA on ETP species. |
| | Met? | **Yes** | **Yes** | **No** |
| Rationale | | | | |

The snow crab trap fishery under assessment has no known direct effects on ETP species. It is a passive gear, where benthic predators are attracted to the trap by the smell of the bait. Bycatch data analysed for a period from 2013-2016 showed that the bycatch consisted of a number of species, none of which were ETPs, which could be counted in numbers of individuals. The PINRO scientists also compiled a presence /absence list of species ( Table 35, Table 42, Table 43, in Section 8.2.2) encountered in the traps, and that list did not show any ETP species either. Considering that no ETP species have been recorded in the catch (PINRO 2017). SG60 and 80 are met.

The bycatch data is limited, based on observer data (PINRO 2017; VNIRO 2019 - opilio), and covers a short time series (2013-16 and one observer trip in 2019) during different seasons (thus each year is not directly comparable), due to the fact that fishery only started in 2013. It is not possible to evaluate with a high degree of confidence that there are no significant detrimental effects of the UoA on ETP species, as the way the data is collected does not allow the detection of any trends. SG100 is not met.

| | |
|---|---|
| | Indirect effects |

| | | | | |
|---|---|---|---|---|
| **c** | Guide post | | Indirect effects have been considered for the UoA and are thought to be **highly likely** to not create unacceptable impacts. | There is a **high degree of confidence** that there are no **significant detrimental indirect effects** of the UoA on ETP species. |
| | Met? | | **Yes** | **Yes** |

Rationale

Indirect effects would for example include the removal of the target species on the food source of ETP species in the locality, or the aggregation of seabirds during hauling of the traps, looking for possible fish waste (although this may not be counted as detrimental, as the birds would receive additional food). As snow crab was introduced into the area only recently, in 1996, there are few observations and studies on snow crab ecology and indirect effects of the fishery on ETP species. However, there are some studies which show a direct impact of snow crab on benthos, causing benthos biomass reduction (ICES WGIBAR 2017).

Other indirect effects include the impact of the deployment of the traps gear on ETP, such as entanglement by marine mammals. No observations to that effect have been recorded. (PINRO 2017)

There have been no records in the observer reports, or other reports made available to the assessment team, to indicate that ETP species are indirectly affected by this trap fishery, the fishery has only been in existence for few years (since 2013).

Indirect effects have been considered for this UoA and are thought to be highly unlikely to create unacceptable impact. SG80 is met.

Considering the type of gear, passive traps, the depth and area of deployment, and the high selectivity of the gear there is a high degree of confidence that there are no significant detrimental indirect effects of the UoA on ETP species. SG100 is met.

References

PINRO 2017 client information; VNIRO 2019 – opilio, ICES WGIBAR 2017; IMR/PINRO 2018; on-line updates on ecosystem components of the Barents Sea on barentsportal.com

McBride, M. M., Filin, A., Titov, O., and Stiansen, J. E. (Eds.) 2014. IMR/PINRO update of the “Joint Norwegian-Russian environmental status report on the Barents Sea Ecosystem” giving the current situation for climate, phytoplankton, zooplankton, fish, and fisheries during 2012-13. IMR/PINRO Joint Report Series 2014(1), 64 pp. ISSN 1502-8828.

Jakobsen T., Ozhigin V., 2011. The Barents Sea, ecosystem, resources, management. Half a century of Russian – Norwegian Co-operation. PINRO/ IMR. Tapir Academic Press, ISBN 978-82-519-2545-7

| **Draft scoring range** | **≥80** |
|---|---|
| Information gap indicator | **Information sufficient to score PI** |

**Overall Performance Indicator scores added from Client and Peer Review Draft Report stage**

| | |
|---|---|
| Overall Performance Indicator score | |
| Condition number (if relevant) | |

# PI 2.3.2 – ETP species management strategy

| PI 2.3.2 | The UoA has in place precautionary management strategies designed to:<br>- meet national and international requirements;<br>- ensure the UoA does not hinder recovery of ETP species.<br><br>Also, the UoA regularly reviews and implements measures, as appropriate, to minimise the mortality of ETP species | | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| **a** | Management strategy in place (national and international requirements) | | | |
| | Guide post | There are **measures** in place that minimise the UoA-related mortality of ETP species, and are expected to be **highly likely to achieve** national and international requirements for the protection of ETP species. | There is a **strategy** in place for managing the UoA's impact on ETP species, including measures to minimise mortality, which is designed to be **highly likely to achieve** national and international requirements for the protection of ETP species. | There is a **comprehensive strategy** in place for managing the UoA's impact on ETP species, including measures to minimise mortality, which is designed to **achieve above** national and international requirements for the protection of ETP species. |
| | Met? | **NA** | **NA** | **NA** |

Rationale

This SI is not scored (MSC Fisheries Standard SA3.11.2) as there are no requirements for protection and rebuilding provided through national/ international ETP legislation of relevant ETPs (relevant to this fishery under assessment). SIb is scored instead.

| | | | | |
|---|---|---|---|---|
| **b** | Management strategy in place (alternative) | | | |
| | Guide post | There are **measures** in place that are expected to ensure the UoA does not hinder the recovery of ETP species. | There is a **strategy** in place that is expected to ensure the UoA does not hinder the recovery of ETP species. | There is a **comprehensive strategy** in place for managing ETP species, to ensure the UoA does not hinder the recovery of ETP species. |
| | Met? | **Yes** | **Yes** | **No** |

Rationale

There are measures in place, amounting to a strategy, which are expected to ensure the UoA does not hinder the recovery of ETP species. This consists of keeping detailed records of all bycatch, including ETP species, by scientists in cooperation with PINRO(PINRO 2017; VNIRO 2019 – opilio). The amount of bycatch, including possible ETP species in this trap fishery is small and can be counted in individuals (PINRO 2017; VNIRO 2019 – opilio)). Trap design, including biodegradability of the gear, reduce the potential of catching ETP species. Recording of bycatch and location of fishing, and the quick release of any bycatch not suitable for human consumption, are all expected to not hinder the recovery of possible ETPs. SG60 and SG80 are met.

A comprehensive strategy entails a regular review of the catch composition in terms of ETP species, as well as the information being detailed enough to make it possible to see trends over time, not just on observations of actual bycatch but also observations on possible gear interactions with marine mammals and seabirds. There does not appear to be such an ETP specific review. SG100 is not met

| | | | | |
|---|---|---|---|---|
| **c** | Management strategy evaluation | | | |
| | Guide post | The measures are **considered likely** to work, based on **plausible argument** (e.g.,general experience, theory or comparison with similar fisheries/species). | There is an **objective basis for confidence** that the measures/strategy will work, based on **information** directly about the fishery and/or the species involved. | The strategy/comprehensive strategy is mainly based on information directly about the fishery and/or species involved, and a **quantitative analysis** supports **high confidence** that the strategy will work. |
| | Met? | **Yes** | **Yes** | **No** |
| Rationale | | | | |

The bycatch, including possible ETP species in this trap fishery, is small and can be counted in numbers of individuals (PINRO 2017; VNIRO 2019). The current measures in place, such as recording of bycatch through PINRO and VNIRO and gear deployment, provides an objective basis for confidence that measures will work. No ETPs have been recorded in the bycatch. The amount of bycatch is small and can be counted in individuals, any non-edible bycatch is released quickly back into the sea. SG 60 and SG80 are met.

As yet, there does not appear to be an ETP specific strategy in place, such as for example some degree of self-reporting, including on-board ID guides. SG100 is not met

| | | | | |
|---|---|---|---|---|
| **d** | Management strategy implementation | | | |
| | Guide post | | There is some **evidence** that the measures/strategy is being implemented successfully. | There is **clear evidence** that the strategy/comprehensive strategy is being implemented successfully and **is achieving its objective as set out in scoring issue (a) or (b).** |
| | Met? | | **Yes** | **No** |
| Rationale | | | | |

There is some evidence that the strategy is being implemented successfully, as the observer report analysis on catch composition in the opilio fishery shows (VNIRO 2019 - opilio; PINRO 2017). The analysis indicates that no ETP species have been recorded in this fishery during the time frame of those reports. SG80 is met.

However, observer coverage is limited, and recording of bycatch is predominantly of finfish species, as this is a requirement, rather than recording of all bycatch. So, the evidence is not extensive. SG100 is not met

| | | | | |
|---|---|---|---|---|
| **e** | Review of alternative measures to minimise mortality of ETP species | | | |
| | Guide post | There is a review of the potential effectiveness and practicality of alternative measures to minimise UoA- | There is a **regular** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality of ETP | There is a **biennial** review of the potential effectiveness and practicality of alternative measures to minimise UoA-related mortality ETP species, |

| | | | | |
|---|---|---|---|---|
| | | related mortality of ETP species. | species and they are implemented as appropriate. | and they are implemented, as appropriate. |
| | Met? | **NA** | **NA** | **NA** |

Rationale

This SI was not scored, as scientists' reports show (PINRO 2017; VNIRO 2019- opilio) that any bycatch in this trap fishery is small, and no ETPs have been caught in this UoA (between 2013-16; 2019). No publications have been found which would indicate otherwise for this fishery, and this suggests that reviews and research on alternative measures to minimise ETP mortality are not relevant

References

PINRO 2017; VNIRO 2019 - opilio See also for PI2.3.1

McBride, M. M., Filin, A., Titov, O., and Stiansen, J. E. (Eds.) 2014. IMR/PINRO update of the "Joint Norwegian-Russian environmental status report on the Barents Sea Ecosystem" giving the current situation for climate, phytoplankton, zooplankton, fish, and fisheries during 2012-13. IMR/PINRO Joint Report Series 2014(1), 64 pp. ISSN 1502-8828.

Jakobsen T., Ozhigin V., 2011. The Barents Sea, ecosystem, resources, management. Half a century of Russian – Norwegian Co-operation. PINRO/ IMR. Tapir Academic Press, ISBN 978-82-519-2545-7

| **Draft scoring range** | **≥80** |
|---|---|
| Information gap indicator | **Information sufficient to score PI** |

**Overall Performance Indicator scores added from Client and Peer Review Draft Report stage**

| | |
|---|---|
| Overall Performance Indicator score | |
| Condition number (if relevant) | |

# PI 2.3.3 – ETP species information

| PI 2.3.3 | | **Relevant information is collected to support the management of UoA impacts on ETP species, including:**<br>- **Information for the development of the management strategy;**<br>- **Information to assess the effectiveness of the management strategy; and**<br>- **Information to determine the outcome status of ETP species** | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| **a** | Information adequacy for assessment of impacts | | | |
| | Guide post | Qualitative information is **adequate to estimate** the UoA related mortality on ETP species.<br>**OR**<br>**If RBF is used to score PI 2.3.1 for the UoA:**<br>Qualitative information is **adequate to estimate productivity and susceptibility** attributes for ETP species. | Some quantitative information is **adequate to assess** the UoA related mortality and impact and to determine whether the UoA may be a threat to protection and recovery of the ETP species.<br>**OR**<br>**If RBF is used to score PI 2.3.1 for the UoA:**<br>Some quantitative information is **adequate to assess productivity and susceptibility attributes** for ETP species. | Quantitative information is available to assess with a high degree of certainty the **magnitude of UoA-related impacts, mortalities and injuries and the consequences for the status** of ETP species. |
| | Met? | **Yes** | **No** | **No** |

Rationale

The PINRO / IMR Reports (Jakobsen & Ozhigin, 2011; McBride et al 2014; IMR/PINRO 2018) on the State of the Barents Sea ecosystem offer an overview of the ETP species which occur in the Barents Sea including their spatial and temporal distribution and ecology. Species recording requirements of bycatch on opilio fishery vessels, by PINRO scientists, generate data on the catch of a wide range of species, and the analysis of the catch composition data (see Section 8.2.3.2) suggests that encounters with ETP species are likely to be rare, as no ETP species were recorded (PINRO 2017; VNIRO 2019 - opilio). Although there is some quantitative information available it is considered not to be adequate to assess the UoA related mortality and impact and to determine whether the UoA may be a threat to protection and recovery of the ETP species, because of the limited observer coverage across the opilio fishery. SG60 is met, SG80 is not met.

Recommendation:

The fishery is encouraged to record sightings and observations of marine mammals, giving species, location number of individuals, of sighting, in collaboration with PINRO scientists. PINRO, with IMP, is actively involved in such surveys (e.g. Transatlantic marine mammal surveys - TNASS), and the observations by the fishery would be a valuable contribution to ongoing marine mammal distribution studies.

Information adequacy for management strategy

| | | | | |
|---|---|---|---|---|
| **b** | Guide post | Information is adequate to support **measures** to manage the impacts on ETP species. | Information is adequate to measure trends and support a **strategy** to manage impacts on ETP species. | Information is adequate to support a **comprehensive strategy** to manage impacts, minimise mortality and injury of ETP species, and evaluate with a **high degree of certainty** whether a strategy is achieving its objectives. |
| | Met? | **Yes** | **No** | **No** |

Rationale

The quantity of bycatch in this trap fishery is small, primarily due to the specifics of the UoA (passive gear of baited traps of particular design, and species targeted). The information is adequate to support measures to manage possible impacts on ETPs. SG60 is met.

The data is based on records collected at different seasons over several years, and are thus not directly comparable, as well as presence / absence data of a number of different species encountered in the traps over that time period. The information is not adequate to measure trends. SG80 is not met

References

See PI 2.3.1 and 2.3.2

| | |
|---|---|
| **Draft scoring range** | **60-79** |
| Information gap indicator | **More information sought**<br>VMS data, Observer reports and information on the implementation of self-reporting system for bycatch. Also, Information should be sought on data in greater detail over a longer time period |

**Overall Performance Indicator scores added from Client and Peer Review Draft Report stage**

| | |
|---|---|
| Overall Performance Indicator score | |
| Condition number (if relevant) | |

Recommendation

The fishery is encouraged to record sightings and observations of marine mammals, giving species, location number of individuals, of sighting, in collaboration with PINRO scientists. PINRO, with IMP, is actively involved in such surveys (e.g. Transatlantic marine mammal surveys - TNASS), and the observations by the fishery would be a valuable contribution to ongoing marine mammal distribution studies.

## PI 2.4.1 – Habitats outcome

| PI 2.4.1 | | The UoA does not cause serious or irreversible harm to habitat structure and function, considered on the basis of the area covered by the governance body(s) responsible for fisheries management in the area(s) where the UoA operates | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| **a** | Commonly encountered habitat status | | | |
| | Guide post | The UoA is **unlikely** to reduce structure and function of the commonly encountered habitats to a point where there would be serious or irreversible harm. | The UoA is **highly unlikely** to reduce structure and function of the commonly encountered habitats to a point where there would be serious or irreversible harm. | There is **evidence** that the UoA is highly unlikely to reduce structure and function of the commonly encountered habitats to a point where there would be serious or irreversible harm. |
| | Met? | **Yes** | **Yes** | **No** |
| Rationale | | | | |

Based on the habitat requirements of the target species, the snow crab fishery occurs over soft sediment areas, which is thus the commonly encountered habitats.

The nature and distribution of benthic habitats and their interaction with the client fleet has been described in detail in background sections: section 8.1.5.1/2 (for wider Barents Sea) and Section 8.2.5.1 (for opilio in particular). These show details of where the fishery is operating, as well as habitat maps. The commonly encountered habitat within the UoA fishing area is sedimentary substrate, sand and silty, fine substrate bottom of geomorphological low profile. The trap gear is a static gear, with a small footprint on the seafloor, as described in Section 5.2.2 of the background section (which applies to both opilio and Red King crab).

Fishing location, showing where the whole opilio fishery operates, can be overlaid with habitat maps in that area (see also Section 7.3.3d). There are no fishing tracks available specific for the fishery under assessment. Studies have shown (Morgan and Chuenpagdee 2003; Eno et al 2001) that the trap gear deployed on the sedimentary seafloor is highly unlikely to reduce structure and function of the commonly encountered habitat (sand and silt, soft sediment) to a point where there would be serious or irreversible harm (meaning, that the habitat can recover at least 80% of its structure and function within 5-20 years if fishing on the habitat were to cease entirely). SG60 and SG80 is met.

Without more detailed habitat maps available for the area the fishery is operating in, fishery specific location (VMS tarcks), as well as improved detail on benthos bycatch over time for this fishery SG100 is not met.

| | | | | |
|---|---|---|---|---|
| **b** | VME habitat status | | | |
| | Guide post | The UoA is **unlikely** to reduce structure and function of the VME habitats to a point where there would be serious or irreversible harm. | The UoA is **highly unlikely** to reduce structure and function of the VME habitats to a point where there would be serious or irreversible harm. | There is **evidence** that the UoA is highly unlikely to reduce structure and function of the VME habitats to a point where there would be serious or irreversible harm. |
| | Met? | **Yes** | **Yes** | **No** |
| Rationale | | | | |

From the habitat maps available and fishing location it could be deduced that currently no actual VME habitats in the snow crab fishing area have been identified, nor designated. Scientific observations on bycatch (PINRO 2017; VNIRO/PINRO 2020) showed a list of benthos species brought up when retrieving the traps, and the list identified a number of genera which may be described as VME indicators (e.g. Alcyonaceans, Porifera), although only when occurring in aggregations of particular density and area would they form a VME habitat. There are ongoing benthic surveys, partly to monitor the spread of snow crabs and partly to improve on habitat mapping detail (Jørgensen et al 2019). From these surveys no potential VMEs have been highlighted. Based on the knowledge available of the gear type, the current areal footprint of the fishery (as calculated by the number of vessels, traps per vessel and practicalities of deployment), and the fact that snow crab lives on soft sediments, it can be stated that the fishery is unlikely to encounter VMEs and thus highly unlikely to reduce structure and function of VME habitats to a point where there would be serious or irreversible harm (reductions in habitat structure and function below 80% of the unimpacted level). SG60 and SG80 is met.

Habitat maps for the opilio fishing area are increasingly available (see Section 8.2.5.1), although not yet in enough detail/ resolution to show aggregations of VME indicator species, such as sponge aggregations, or soft coral aggregations, for example. No VMEs in the area have been officially declared. SG100 is not met

| | | | | |
|---|---|---|---|---|
| | Minor habitat status | | | |
| **c** | Guide post | | | There is **evidence** that the UoA is highly unlikely to reduce structure and function of the minor habitats to a point where there would be serious or irreversible harm. |
| | Met? | | | **Yes** |
| Rationale | | | | |

The minor habitats are those that are not commonly encountered by the gear (i.e. those not considered under SI(a), such as particular combinations of sediments, outcrops and gullies, etc. The sediment map of the area, as well as maps produced as part of several surveys of the mega-benthos (see also Section 7.3.1d) showed that there seemed to be no distinct minor habitats in the area where the UoA is fishing (outwith 12nm). The fishing area consists of fine substratum, as defined in MSC v2.01 Table GSA6, and associated biota, which studies show is not irreversibly harmed by the trap fishery (Morgan and Chuenpagdee 2003; Eno et al 2001). SG100 is met.

| References |
|---|

Morgan and Chuenpagdee 2003; NMFS 2004; Eno et al 2001; Anisimova et al., 2010; Jakobsen and Ozhigin 2011, Spiridinov et al 2011; Jørgensen et al 2019.

The “Mareano programme” http://www.mareano.no/__data/page/9235/Focus-Oceans_Mareano-Mai-2010.pdf; the Joint Russian/Norwegian Ecosystem Assessment (Barents Portal: http://barentsportal.com/barentsportal_v2.5/index.php/en/);

Larsen, T. Nagoda, D. and Andersen, J.R. (Eds) 2003. A biodiversity assessment of the Barents Sea Ecoregion WWF

PINRO 2017; VNIRO 2019 -opilio

| **Draft scoring range** | **≥80** |
|---|---|
| Information gap indicator | **Information sufficient to score PI** |

**Overall Performance Indicator scores added from Client and Peer Review Draft Report stage**

| | |
|---|---|
| Overall Performance Indicator score | |

| Condition number (if relevant) | |
|---|---|

PI 2.4.2 – Habitats management strategy

| PI 2.4.2 | | There is a strategy in place that is designed to ensure the UoA does not pose a risk of serious or irreversible harm to the habitats | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| **a** | Management strategy in place | | | |
| | Guide post | There are **measures** in place, if necessary, that are expected to achieve the Habitat Outcome 80 level of performance. | There is a **partial strategy** in place, if necessary, that is expected to achieve the Habitat Outcome 80 level of performance or above. | There is a **strategy** in place for managing the impact of all MSC UoAs/non-MSC fisheries on habitats. |
| | Met? | **Yes** | **Yes** | **No** |
| Rationale | | | | |

The snow crab fishery occurs in fine substratum areas.

Measures in place to mitigate habitat impacts include on-going mapping programmes to improve access management. Grabs and trawl sampling continue to be used for surveys of the benthos. Since 2006, the 'Russian – Norwegian Joint Annual Ecosystem surveys' provide both spatial and temporal data of benthic fauna for more than 400 stations annually. There has been research into habitat impacts of gear types (interpretation from other studies, such as outlined in Section 8.1.5.5). Management measures, which specifically addresses habitat impact has largely focused on closing inshore waters, the crab fishery is not allowed within 12nm of the coast.

As a passive gear, the move on rule in relation to benthic organisms is not applicable. Furthermore, it is also not applicable where the UoA does not interact with VMEs, this fishery under assessment does not interact with VMEs. Although benthic organisms (such as echinoderms which have moved into the trap) have been brought up with trap gear retrieval, it may at this stage be considered inappropriate to apply threshold values of weight per species/genus, as this is a passive trap fishery. A move on rule is in place with regards to protecting juveniles of the target species (i.e. if too many juvenile crabs move into the trap, although observations have shown that when adult crabs are present, juveniles do not move in. Local knowledge by the crew is a further determinant as to where fishing occurs and avoidance of particular areas.

Observer reports are available which record non-target species bycatch, although it has to be emphasised that such bycatch is small, and can be counted in individuals in some cases (see Section on catch profile, 8.2.2), PINRO 2017 (By-catch data in the snow crab fishery 2013-2016; PINRO 2017 report provided in translation by client which is analysed; VNIRO 2019 opilio observer report). The fishery under assessment does not self-report bycatch, as is currently being implemented on another MSC certified opilio fishery in the Barents Sea. There appear to be no on-board ID guides to help with self-reporting. The management of non-target species bycatch, including benthos species, is based on data recorded and analysed by observers from PINRO.

The measures in place amount to a partial strategy, expected to achieve SG80 for habitat outcome. SG60 and SG80 is met

Considering that the habitat in the crab fishery area is soft sedimentary bottom, and the bycatch of non-target benthic species is low there is as yet no specific strategy in place to manage impact of the UoA on habitat. SG100 is not met

A Recommendation is raised to suggest that the fishery under assessment initiates and implements an on-board system of self-reporting of non-target species, including benthos species.

| | | | | |
|---|---|---|---|---|
| **b** | Management strategy evaluation | | | |
| | Guide post | The measures are **considered likely** to work, based on plausible argument (e.g. general experience, theory or comparison with similar UoAs/habitats). | There is some **objective basis for confidence** that the measures/partial strategy will work, based on **information directly about the UoA and/or habitats** involved. | **Testing** supports **high confidence** that the partial strategy/strategy will work, based on **information directly about the UoA and/or habitats** involved. |
| | Met? | **Yes** | **Yes** | **No** |
| Rationale | | | | |

The extensive and increasingly more sophisticated benthos mapping initiatives, the habitat requirements of the target species (fine substratum), the passive gear used (traps), location of the fishery is verifiable (VMS) as being located within the opilio fishery area, and the fact that the fishery takes place 12nm offshore thus avoiding rocky inshore areas, provide some objective basis for confidence that the measures/ partial strategy are likely to work to help protect potential vulnerable habitats. SG60 and SG80 is met.

A time series of data necessary for testing and feeding back into a strategy is not available. Considering that the habitat in the crab fishery area is soft sedimentary bottom, and the bycatch of non-target benthic species is low there is as yet no specific strategy to be tested in place to manage impact of the UoA on habitat. SG100 is not met

| | | | | |
|---|---|---|---|---|
| **c** | Management strategy implementation | | | |
| | Guide post | | There is **some quantitative evidence** that the measures/partial strategy is being implemented successfully. | There is **clear quantitative evidence** that the partial strategy/strategy is being implemented successfully and is achieving its objective, as outlined in scoring issue (a). |
| | Met? | | **Yes** | **No** |
| Rationale | | | | |

Habitat maps and fishery location maps (based on VMS) indicate that the vessels fish in the areas described by the maps as predominantly types of soft sediments and associated fine substrate species communities. The grab samples and surveys conducted to date show the dominant benthic species (Section 8.1.5.1/2 applicable to both opilio and RKC and 8.2.5.1 opilio specific), and mapping of the benthic Barents Sea is an ongoing programme. Data on benthos bycatch, collected and analysed for 2013-2016 by PINRO scientists (PINRO 2017, translation provided by client; VNIRO 2019 opilio observer report) provides presence/ absence information on a list of benthos species found in the bycatch of the traps. SG80 is met.

The data on benthos by-catch species consists of presence / absence data. Some of the species identified in the mapping programmes may be VME indicator species and could possibly be used to designate VME areas, provided the aggregations are significant in extent. Detail of information, i.e. numbers of individuals/ or weight per species encountered per trip or per fishing season is not available to help formulate a strategy in these relevant benthic areas. SG100 is not met.

A Recommendation is raised to improve on the quantitative evidence:

The bycatch information currently available consists of presence/ absence data. It is highly recommended to improve on the detail of benthos bycatch data by recording numbers of individuals and /or weight per species/genus and to analyse this data for each season. Thus, it will be possible to build a picture of the type of benthos encountered in the fishing area. This information should be shared with ongoing habitat mapping programmes, for example as outlined by Jørgensen et al 2015 (which is a joint project between IMR and PINRO).

| | | | | |
|---|---|---|---|---|
| **d** | Compliance with management requirements and other MSC UoAs'/non-MSC fisheries' measures to protect VMEs | | | |
| | Guide post | There is **qualitative evidence** that the UoA complies with its management requirements to protect VMEs. | There is **some quantitative evidence** that the UoA complies with both its management requirements and with protection measures afforded to VMEs by other MSC UoAs/non-MSC fisheries, where relevant. | There is **clear quantitative evidence** that the UoA complies with both its management requirements and with protection measures afforded to VMEs by other MSC UoAs/non-MSC fisheries, where relevant. |
| | Met? | **NA** | **NA** | **NA** |
| Rationale | | | | |

From the habitat surveys available, there are no designated VMEs in the snow crab fishery area under assessment, and therefore there are no associated management requirements set. Surveys are ongoing to assess whether VME indicator species would constitute VMEs (based on extent of aggregation).

However, a Recommendation is raised regarding VMEs:

With the expansion of the distribution of snow crab further into the Barents Sea basin (northwest wards for example), the fishery will follow the snow crab. This will potentially mean that new areas will be exploited, hitherto not fished. (Jørgensen et al 2015). These areas will likely contain undisturbed benthic communities, with associated larger individuals (see observations in studies by Jørgensen et al 2015/16/19). Before fishing in new areas, it is highly recommended to conduct research (with PINRO/IMR) to establish what benthos is there, and if possible, actually close areas to fishing. The rationale being, that these closed areas will provide seed areas of benthic organisms, as fishing areas expand northwards, following changing fish community distribution patterns (not just for trap fishery but also trawl fishery)

References

PINRO 2017 By-catch data in the snow crab fishery 2013-2016; PINRO 2017 report provided in translation by client which is analysed; VNIRO 2019 – opilio observer report; as in PI 2.4.1; Jørgensen et al 2015/16/19

| | |
|---|---|
| **Draft scoring range** | **≥80** |
| Information gap indicator | **Information sufficient to score PI** |

**Overall Performance Indicator scores added from Client and Peer Review Draft Report stage**

| | |
|---|---|
| Overall Performance Indicator score | |
| Condition number (if relevant) | |

Recommendation PI 2.4.2

2.4.2a: A Recommendation is raised to suggest that the fishery under assessment initiates and implements an on-board system of self-reporting of non-target species, including benthos species.

Other MSC certified opilio fishery is implementing software is being implemented on their fishing vessels designed to create and maintain a database of any bycaught species including, which would also identify possible VME indicator species. The data recorded includes numbers of individuals, not just presence/absence data. This work is done in collaboration with PINRO and WWF Murmansk, and relevant ID guides have been created and distributed on the vessels. On the basis of these data, which will be analysed by scientists at PINRO, areas of VME indicator species and clusters will eventually be mapped. This software system is also being rolled out across a number of MSC certified trawl fisheries in the Barents Sea. This work is a joint effort of PINRO, WWF, and the fishing companies operating in the Barents and Norwegian seas. It is recommended for the fishery under assessment to consider participating in this self-reporting project.

2.4.2c: The bycatch information currently available consists of presence/ absence data. It is highly recommended to improve on the detail of benthos bycatch data by recording numbers of individuals and /or weight per species/genus and to analyse this data for each season. Thus, it will be possible to build a picture of the type of benthos encountered in the fishing area. This information should be shared with ongoing habitat mapping programmes, for example as outlined by Jørgensen et al 2015 (which is a joint project between IMR and PINRO).

2.4.2d: With the expansion of the distribution of snow crab further into the Barents Sea basin (northwest wards for example), the fishery will follow the snow crab. This will potentially mean that new areas will be exploited, hitherto not fished. (Jørgensen et al 2015). These areas will likely contain undisturbed benthic communities, with associated larger individuals (see observations in studies by Jørgensen et al 2015/16/19). Before fishing in new areas, it is highly recommended to conduct research (with PINRO/IMR) to establish what benthos is there, and if possible, actually close areas to fishing. The rationale being, that these closed areas will provide seed areas of benthic organisms, as fishing areas expand northwards, following changing fish community distribution patterns (not just for trap fishery but also trawl fishery)

# PI 2.4.3 – Habitats information

| PI 2.4.3 | | Information is adequate to determine the risk posed to the habitat by the UoA and the effectiveness of the strategy to manage impacts on the habitat | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| **a** | Information quality | | | |
| | Guide post | The types and distribution of the main habitats are **broadly understood**.<br><br>**OR**<br><br>**If CSA is used to score PI 2.4.1 for the UoA:**<br><br>Qualitative information is adequate to estimate the types and distribution of the main habitats. | The nature, distribution and **vulnerability** of the main habitats in the UoA area are known at a level of detail relevant to the scale and intensity of the UoA.<br><br>**OR**<br><br>**If CSA is used to score PI 2.4.1 for the UoA:**<br><br>Some quantitative information is available and is adequate to estimate the types and distribution of the main habitats. | The distribution of all habitats is known over their range, with particular attention to the occurrence of vulnerable habitats. |
| | Met? | **Yes** | **Yes** | **No** |

Rationale

Detailed habitat maps of the Barents Sea are available (Section 8.1.5.1/2; 8.2.5.1), and the distribution of benthos is updated through ongoing surveys in the Barents Sea (such as the annual IMR-PINRO ecosystem surveys). Information based on studies in other areas (not the Barents Sea) is available, which indicates the impact of the fishing gear, traps, on the benthos (Section d.v) (Eno et al 2001; Schweitzer et al 2018; Morgan & Chuenpagdee 2003; Auster & Langton 1999), and observer reports (PINRO 2017; VNIRO-opilio 2019). This means that the natures, distribution and vulnerability of the main habitats (soft sediments) are known at a level of detail relevant to the scale and intensity of the fishery under assessment. With regards to vulnerability, this is a passive gear (traps) on predominantly soft sediments and the impact of trap gear on soft sediments has been studied (see Section 8.1.5.5) ..

SG60 and SG80 is met.

Although vulnerable habitats and their distribution are being identified as part of these ecosystem surveys, it cannot yet be said that the distribution of all habitats with particular attention to the occurrence of VMEs is known. SG100 is not met.

| | | | | |
|---|---|---|---|---|
| **b** | Information adequacy for assessment of impacts | | | |
| | Guide post | Information is adequate to broadly understand the nature of the main impacts of gear use on the main habitats, including spatial overlap of habitat with fishing gear.<br><br>OR | Information is adequate to allow for identification of the main impacts of the UoA on the main habitats, and there is reliable information on the spatial extent of interaction and on the timing and | The physical impacts of the gear on all habitats have been quantified fully. |

| | | | | |
|---|---|---|---|---|
| | | **If CSA is used to score PI 2.4.1 for the UoA:**<br>Qualitative information is adequate to estimate the consequence and spatial attributes of the main habitats. | location of use of the fishing gear.<br>OR<br>**If CSA is used to score PI 2.4.1 for the UoA:**<br>Some quantitative information is available and is adequate to estimate the consequence and spatial attributes of the main habitats. | |
| | Met? | **Yes** | **Yes** | **No** |
| Rationale | | | | |

Several studies have been undertaken to assess the impact of the trap/pots gear on benthos (Eno et al 2001; Schweitzer et al 2018; Morgan & Chuenpagdee 2003; Auster & Langton 1999). These studies can be extrapolated for the benthic habitats of the Barents Sea. There is adequate information to allow the main impact of the gear on the main habitats, which is soft sediment where the target species (snow crabs) is found. The annual Joint Russian Norwegian ecosystem survey undertakes benthic sampling and generates broad-scale benthic composition/distribution time series throughout the Barents Sea. Information is available on spatial overlap from snow crab fleet VMS data and underlying common habitat types. The timing and location of the use of the gear is recorded at each trip, as a matter of course, as part of the everyday management of the fishery. The information is adequate to allow for the identification of impacts on the main habitats. SG60 and SG80 is met.

The physical impact of the gear on all the habitats have not been quantified fully. SG100 is not met

| | | | | |
|---|---|---|---|---|
| **c** | Monitoring | | | |
| | Guide post | | Adequate information continues to be collected to detect any increase in risk to the main habitats. | Changes in all habitat distributions over time are measured. |
| | Met? | | **Yes** | **No** |
| Rationale | | | | |

The main habitats concerning this fishery are fine substrate habitats, which is where the target species lives. Habitat mapping programmes continue to be rolled out across the Barents Sea with increasing detail (see also Joint Russian Norway Barents Sea surveys; Jørgensen et al 2015/16/19), and the published information is updated regularly online (www.barentsportal.com). SG80 is met.

As the mapping programmes continue, it will increasingly become possible to measure changes in spatial distribution of all habitat types, once a relevant time series becomes available. This is not yet possible, SG100 is not met**.**

| References |
|---|

PINRO 2017; VNIRO 2019 opilio observer; Jørgensen et al 2015/16/19; Eno et al 2001; Schweitzer et al 2018; Morgan & Chuenpagdee 2003; Auster & Langton 1999; PINRO 2017; VNIRO 2019 – opilio; as in PI 2.4.1

| | |
|---|---|
| **Draft scoring range** | **≥80** |

| | |
|---|---|
| Information gap indicator | **Information sufficient to score PI** |

**Overall Performance Indicator scores added from Client and Peer Review Draft Report stage**

| | |
|---|---|
| Overall Performance Indicator score | |
| Condition number (if relevant) | |

## PI 2.5.1 – Ecosystem outcome

| PI 2.5.1 | | The UoA does not cause serious or irreversible harm to the key elements of ecosystem structure and function | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| a | Ecosystem status | | | |
| | Guide post | The UoA is **unlikely** to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm. | The UoA is **highly unlikely** to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm. | There is **evidence** that the UoA is highly unlikely to disrupt the key elements underlying ecosystem structure and function to a point where there would be a serious or irreversible harm. |
| | Met? | **Yes** | **Yes** | **Partial** |

Rationale

Snow crab is an invasive species which recently expanded its range into the Barents Sea. After the first snow crab had been found on the Goose Bank in 1996 the number of reports on the snow crab by-catches in bottom trawl fishery has gradually increased (Pavlov, 2002). Since 2003 the snow crab has been observed in stomachs of cod, haddock, catfishes and thorny skate and thereby became a new food item for bottom fishes in the Barents Sea. In 2005, a snow crab was, for the first time, found during the ecosystem survey. Survey results indicate that the snow crab has adapted to the Barents Sea and it is assumed that the abundance of this crab will grow in the eastern Barents Sea in the nearest future. Due to this, the distribution and abundance of the crab is monitored, in order to estimate any impact on the native ecosystem (IMR/PINRO ecosystem report 2018, 2019).

Several ICES working groups provide annual assessments of the state of the Barents Sea Ecosystem: ICES Arctic Fisheries Working group; WG for Regional Ecosystem Description; WGIBAR - working group on integrated assessment in the Barents Sea. The ICES working group on crabs, WGCRAB, looks specifically, amongst other crab species, at the invasive snow crab species in the context of the wider Barents Sea ecosystem. This information is supplemented by on-going data collected under the Joint Norwegian-Russian Environmental Status Report for the Barents Sea (which issues annual Barents Sea ecosystem status report, trends, highlights expected future situation, as well as on-line updates of research on barentsportal.com.

All these assessments suggest that broadly speaking, the Barents Sea Ecosystem is relatively healthy, and that current fishing activities are not disrupting ecosystem structure and function. There has been a decline in seabird populations (similar to that throughout the NE Atlantic), but the reasons for this are unclear (drivers are a combination of these: local food shortage; increased predation; historic bycatch in drift net and long-line fisheries, climate change – see barentsportal.com for regular updates) and are not attributed to current fishing activity of the snow crab fishery, the fishery under assessment. The stocks of key species at different trophic levels (cod/ haddock and capelin) suggest that the finfish related elements of the ecosystem are evaluated and researched. Significant distributional changes of marine species are however taking place, probably related to climate change causing oceanographic shifts (e.g. Jørgensen et al 2019).

Considering that the snow crab is a ‘new’ species in the Barents Sea, and its impact on the Barents Sea ecosystem has yet to be quantified, the effect of the fishery on this species could be argued to ‘be evidence to be highly unlikely to be disrupting the key elements of ecosystem structure and function’, as the fishery is removing an ‘invasive’ species. In addition, the gear (traps) has comparatively little impact on habitats, as the crab fishery occurs in fine substrate areas, and the gear is target species specific with little bycatch. However, the overall understanding of the impact of the snow crab fishery on all ecosystem elements is limited. SG60 and SG80 is met and a partial score of SG 90 is met.

## References

ICES AFWG 2016 and 2919; ICES. WGIBAR. 2014. Working Group on Integrated Assessments of the Barents Sea (WGIBAR); ICES Ecosystem overview Barents Sea 2016; ICES WGCRAB 2015; Jørgensen et al 2019; Arneberg et al 2013; Blanchard et al 2002; Prozorkevich et al 2018 IMR/PINRO ecosystem survey 2018, 2019; IMR/PINRO 2014; Jakobsen, T. and Ozhigin, K (Eds) 2011; Johannesen et al 2017; Johannesen et al 2012;

| **Draft scoring range** | **≥80** |
|---|---|
| Information gap indicator | **Information sufficient to score PI** |

**Overall Performance Indicator scores added from Client and Peer Review Draft Report stage**

| | |
|---|---|
| Overall Performance Indicator score | |
| Condition number (if relevant) | |

## PI 2.5.2 – Ecosystem management strategy

The Default Assessment Tree was modified for P2, Ecosystem management (PI 2.5.2) in order to reflect the fact that the Snow crab is an introduced species. The introduction was non-deliberate and occurred at least 20 years prior to the date the application is made for assessment against the MSC standard (first found in benthos surveys grab samples 1996). See Section 5.1.3 for more information.

| PI 2.5.2 | | There are measures in place to ensure the UoA does not pose a risk of serious or irreversible harm to ecosystem structure and function | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| **a** | Management strategy in place[90] | | | |
| | Guide post | There are **measures** in place, if necessary which take into account the **potential impacts** of the UoA on key elements of the ecosystem. | There is a **partial strategy** in place, in the fishery, to prevent further ecosystem impacts that may have occurred as a result of the introduction of the species | There is a **strategy** that consists of a **plan**, in place which contains measures to **address all main impacts of the UoA** on the ecosystem, and at least some of these measures are in place. |
| | Met? | **Yes** | **Yes** | **No** |
| Rationale | | | | |

A range of technical measures and protocols leading to a partial strategy are in place to minimize bycatch of other fish species (described under PIs 2.1.2 and 2.2.2, and PI 2.3.2) that may play an important role in ecosystem structure and function. There is no fishing within the 12NM zone, and there are protocols and gear design to reduce bycatch. By default, due to the biology of the target species, gear deployment has limited impact on benthos (see Section 8.1.6.1under Red King Crab which also applies to opilio, for habitat descriptions and impact studies).

No interaction with marine mammals and seabirds has been recorded (PINRO 2017, VNIRO/PINRO 2020), therefore additional specific measures are not considered necessary at this stage. The mix of Russian-Norwegian research cooperation initiatives, ecosystem monitoring and assessments, seabed mapping, detailed benthos studies to specifically study any potential impact of the species on benthic ecology, fishing effort distribution monitoring, ICES advice, and the range of individual measures designed to protect different elements of the ecosystem, taken together may be regarded as comprising a partial strategy, and is expected to restrain impacts of the UoA on the ecosystem.

These surveys and assessments are also supported by several ecosystem modelling studies related specifically to the Barents Sea, which have explored for example the trophic relations between fish species, and links between capelin, cod, seabirds, marine mammals. These include ecopath type studies by Blanchard *et al* 2002; EcoCod (which seeks to estimate cod MSY taking into account a range of ecosystem factors), Gadget (multispecies interactions between cod, herring, capelin, minke whale, krill) in the Barents Sea; Biofrost (multispecies model for Barents Sea (Quilfeldt et al 2009) – addressing primarily cod / capelin dynamics); STOCOBAR (Stock of cod in the Barents Sea, Howell et al 2014). Broader ecosystem models include NORWECOM.E2E, which includes plankton and fish, and is under development and semi-operational, and both PINRO and IMR have developed hydrodynamic models that complement these mainly biologically based models.

Information is available on the number of lost traps for the 2020 season (Client information 8th Dec 2020), as the client fishery keeps detailed records (see Section 5.2.2.4). In order to prevent ghost fishing, biodegradable rope is used on one of the panels, which allows the trap to open within a season if lost.

The Russian Federation is a signatory of The Convention for the Prevention of Marine Pollution from ships (MARPOL, see also www.imo.org), and has ratified a number of relevant annexes: Annex IV – sewage from ships; Annex V: garbage from ships; Annex VI air pollution from ships to reduce greenhouse gas emissions. In particular annex IV and V have a direct impact on the marine ecosystem. The vessels of the fishery under assessment are in full compliance with MARPOL and ISM code (Client information 8th Dec 2020)

SG60 and SG80 is met.

While there is an overarching ecosystem management plan for the Norwegian Barents Sea and Lofoten Area, there is not yet an equivalent plan in the Russian Barents Sea. Although the fishery under assessment has implemented all necessary measures as per licence with regards to gear design, fishing practice, recording of catch etc, the fishery under assessment has not (yet?) implemented additional measures to support data collection on bycatch, for example (see other certified Opilio fishery in the Barents Sea). There appears to be no strategy which consists of a plan to prevent possible further expansion of the species (if it were to occur with changing oceanographic conditions), although there is regular monitoring of survey stations and research (e.g. stomach content research, in Jørgensen et al 2019) to evaluate the extend of the distribution and effect on the benthos. SG100 is not met.

| | | | | |
|---|---|---|---|---|
| **b** | Management strategy evaluation | | | |
| | Guide post | The **measures** are considered likely to work, based on plausible argument (e.g., general experience, theory or comparison with similar UoAs/ ecosystems). | There is **some objective basis for confidence** that the measures/ partial strategy will work, based on some information directly about the UoA and/or the ecosystem involved. | **Testing** supports **high confidence** that the partial strategy/ strategy will work, based on information directly about the UoA and/or ecosystem involved. |
| | Met? | **Yes** | **Yes** | **No** |
| Rationale | | | | |

There is some objective basis for confidence that the measures /partial strategy will work, as can be seen from the survey results, data collection by scientific studies (PINRO 2017; VNIRO/PINRO 2020; VNIRO 2020), and extensive mapping exercises and ecosystem surveys of the Barents Sea as a whole. The information provided indicates that the partial strategy employed by the fishery is expected to restrain impacts on the ecosystem. A fundamental part of the partial strategy is the process of Russian and Norwegian scientist collaborating annually on joint IMR / PINRO ecosystem research cruises, which result in annual status reports which specifically focus on ecosystem trends, threats and projections, and that this then directly contributes to both the work of ICES in producing advice for target species, and perhaps more importantly, the considerations of the Joint Norwegian Russian Fisheries Commission, when considering that advice and determining catch levels. SG60 and SG80 is met.

As noted under issue a), the lack of an overarching ecosystem management plan within the Russian zone, and the limited understanding of the wider effects of changes in benthic communities and benthic community functioning means this cannot be scored at SG100. SG100 is not met

| | | | | |
|---|---|---|---|---|
| **c** | Management strategy implementation | | | |
| | Guide post | | There is **some evidence** that the measures/partial strategy is being **implemented successfully**. | There is **clear evidence** that the partial strategy/strategy is being **implemented successfully and is achieving its objective as set out in scoring issue (a).** |
| | Met? | | **Yes** | **No** |

## Rationale

The partial strategy consists of monitoring and research, to understand the impact and distribution of snow crab on the ecosystem, as well as managing the fishery so that the activity of fishing per se has minimal impact on the ecosystem (gear design, bycatch). Evidence relating to successful implementation at the fleet level includes:

- VMS data relating to the spatial intensity of fishing effort (this is available for the whole opilio fishery, Figure 49 – showing the location of the opilio fishery)
- Catch records
- Vessel inspections
- Review and analysis of fishing activity, species caught and habitats affected - by PINRO and the inspectorates.

SG 80 is met.

Fishing for snow crab is a form of direct management of this species which was unintentionally introduced into the Barents Sea in the mid-1990s, thus slowing its expansion. At this stage, there is little information available to show the ecosystem impact of snow crab per se, apart from stomach contents studies of cod, where it opilio is recorded in increasing amounts (IMR/PINRO ecosystem survey 2019). SG100 is not met

## References

As in PI 2.5.1

IMR/PINRO ecosystem survey 2019; PINRO 2017; VNIRO 2020; VNIRO/PINRO 2020;

Howell, D., and Filin, A. A. 2014. Modelling the likely impacts of climate-driven changes in cod-capelin overlap in the Barents Sea. – ICES Journal of Marine Science, 71: 72–80. doi:10.1093/icesjms/fst172

NORWECOM.E2E http://bio.uib.no/te/papers/NORWECOMstrategy.pdf (accessed 20 Nov. 2020)

Hoel, et al 2009; Ottersen et al 2011; Quillfeldt,et al 2009; Blanchard et al 2002;

| | |
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| **Draft scoring range** | **≥80** |
| Information gap indicator | **Information sufficient to score PI** |

**Overall Performance Indicator scores added from Client and Peer Review Draft Report stage**

| | |
|---|---|
| Overall Performance Indicator score | |
| Condition number (if relevant) | |

# PI 2.5.3 – Ecosystem information

| PI 2.5.3 | | There is adequate knowledge of the impacts of the UoA on the ecosystem | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| **a** | Information quality | | | |
| | Guide post | Information is adequate to **identify** the key elements of the ecosystem. | Information is adequate to **broadly understand** the key elements of the ecosystem. | |
| | Met? | **Yes** | **Yes** | |
| Rationale | | | | |

The Barents Sea food web and ecosystem are well researched, a range of models at different levels of complexity have been developed, and key relationships analysed. A good deal of biodiversity (location, migrations etc.) is being mapped and monitored. Key indicators and parameters are monitored on a regular basis and trend data is collected.

These surveys and assessments are also supported by several ecosystem modelling studies (see ICES WGIBAR 2017) related specifically to the Barents Sea, which have explored for example the trophic relations between fish species, and links between capelin, cod, seabirds, marine mammals. These include ecopath type studies by Blanchard *et al* 2002; EcoCod (which seeks to estimate cod MSY taking into account a range of ecosystem factors), Gadget (multispecies interactions between cod, herring, capelin, minke whale, krill) in the Barents Sea; Biofrost (multispecies model for Barents Sea – addressing primarily cod / capelin dynamics); STOCOBAR (Stock of cod in the Barents Sea). Broader ecosystem models include NORWECOM.E2E, which includes plankton and fish, and is under development and semi-operational, and both PINRO and IMR have developed hydrodynamic models that complement these mainly biologically based models.

Information is adequate to broadly understand the key elements of the ecosystem. SG60 and SG80 is met.

| | | | | |
|---|---|---|---|---|
| **b** | Investigation of UoA impacts | | | |
| | Guide post | Main impacts of the UoA on these key ecosystem elements can be inferred from existing information, but **have not been investigated** in detail. | Main impacts of the UoA on these key ecosystem elements can be inferred from existing information, and **some have been investigated in detail**. | Main interactions between the UoA and these ecosystem elements can be inferred from existing information, and **have been investigated in detail**. |
| | Met? | **Yes** | **Yes** | **No** |
| Rationale | | | | |

As described in the background section 8.1.6and 8.2.6(specific to opilio) and under PI2.5.1 main impacts of the fishery on key ecosystem elements can be inferred from existing information, and those of particular concern have been investigated in detail.

There is detailed information on catches of the target species under Principle 1. There is adequate information on non-target species bycatch through observer reports. This provides information about the impact of the assessed fishery on the populations of non-target species involved and would provide evidence of impact if any key ecosystem species were affected. The main impacts of the UoAs on bottom habitats and trophic structures can also be inferred from the existing information, including location (VMS), mapping, and gear-habitat interaction studies. Interactions between fisheries and key ecosystem elements have been investigated in detail, especially trophic interactions with key predator - prey relationships, and with bottom substrates. In particular, there is a high level of spatial and temporal information on this fishery and the gear used. The exact impact of the snow crab fishery may not yet be fully quantifiable, as the species has only recently invaded the Barents Sea and its impact is under investigation. Ongoing research in the form of surveys being carried out by PINRO and research scientists in both Norway and Russia on the ecological spread of the snow crab is more than adequate to enable main impacts to be inferred - certainly sufficient for management purposes.SG60 and SG80 is met.

Although there is increasing spatial and temporal information on most forms of fishing and captures, it cannot be said that all the main interactions have been investigated in detail. Furthermore, Detailed information on the impact (both positive and negative) of the invasive species, snow crab, on the ecosystem is not yet available, and may anyhow be difficult to ascertain above the background noise of ecological variation and changes due to climate change. SG 100 is not met.

| | | | | |
|---|---|---|---|---|
| **c** | Understanding of component functions | | | |
| | Guide post | | The main functions of the components (i.e., P1 target species, primary, secondary and ETP species and Habitats) in the ecosystem are **known**. | The impacts of the UoA on P1 target species, primary, secondary and ETP species and Habitats are identified and the main functions of these components in the ecosystem are **understood**. |
| | Met? | | **Yes** | **Yes** |
| Rationale | | | | |

The main functions of Target, Primary and Secondary and ETP species are known (see background information provided in section 8.1.6 and 8.2.6). Ecosystem research, as listed in PI 2.5.2 above, has shown that the main functions of the components in the ecosystem are known. SG80 is met.

The impacts of the UoA (trap fishery for snow crab) on P1 target species (snow crab), bycatch species (Primary: cod, Greenland halibut, herring (bait), Beaked redfish, Blue ling) and Secondary: Spotted and Northern wolffish, long rough dab, Arctic eelpout, Grey gurnard, Thorny skate, Arctic skate), and potential ETP species (although none recorded as by-caught in this fishery, PINRO 2017), as well as habitats – are identified and the main functions of these components in the ecosystem are understood. Quantitative information is available on the amount of bycatch removal, and research has been conducted on the effects of the gear on the relevant habitat. SG100 is met.

| | | | | |
|---|---|---|---|---|
| **d** | Information relevance | | | |
| | Guide post | | Adequate information is available on the impacts of the UoA on these components to allow some of the main consequences for the ecosystem to be inferred. | Adequate information is available on the impacts of the UoA on the components **and elements** to allow the main consequences for the ecosystem to be inferred. |
| | Met? | | **Yes** | **No** |
| Rationale | | | | |

Survey and monitoring as well as some modelling all support fishery impact assessment studies, and some of the consequences for the ecosystem have been inferred, such as direct impact of the gear on benthos, and removal of bycatch species. Relations between the target species, snow crab, and benthic species are researched, as snow crab is a recently invasive species (mid- 1990s). The role of benthic species on the wider ecosystem, and the implications of the snow crab invasion and consequent crab fishery continue to be investigated. SG80 is met.

The level of research and understanding continues to grow, and more detail becomes available as mapping and monitoring continues. Although the information on the impacts of the UoA on the components is adequate, this cannot be said for some of the elements, as the time series data for by-catch is short and based on relatively few observations (due to this being a young fishery – started in 2013, and the fishery under assessment joined in 2020). SG100 is not met.

| | | | | |
|---|---|---|---|---|
| **e** | Monitoring | | | |
| | Guide post | | Adequate data continue to be collected to detect any increase in risk level. | Information is adequate to support the development of strategies to manage ecosystem impacts. |
| | Met? | | **Yes** | **No** |

Rationale

There is a relatively comprehensive monitoring programme in place related to the Joint Norwegian-Russian Barents Sea Ecosystem assessment, the MAREANO mapping programme, as well as long term benthos studies. Other related initiatives monitor marine mammals and seabirds. Survey results on biotic and abiotic components of the ecosystem are regularly and frequently updated on the barentsportal.com website. PINRO and IMR collect comprehensive data related to the major commercial fisheries. Risks associated with changing populations or relations between fisheries and various elements of the ecosystem should be picked up as part of the longer-term time series assessments. SG80 is met.

Although there are inevitably some gaps in our understanding, there is enough information available to support the development of strategies to manage marine ecosystem impacts, especially if a precautionary approach were to be taken to avoid and/or reduce damage to benthic habitats. Currently there are habitat mapping projects underway in the Barents Sea to improve the detail on benthic habitats. However, considering that detailed information on bycatch to species level and time series is not yet available, SG100 is not met.

References

Observer reports PINRO 2015, 2017, VNIRO 2020, PINRO/VNIRO 2020;

See 2.5.1

ICES WGIBAR 2017 for ecosystem models

| | |
|---|---|
| **Draft scoring range** | **≥80** |
| Information gap indicator | **Information sufficient to score PI** |

**Overall Performance Indicator scores added from Client and Peer Review Draft Report stage**

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|---|---|
| Overall Performance Indicator score | |
| Condition number (if relevant) | |

## 8.2.8 P2 References

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# 9 Scoring Principle 3

## 9.1 Principle 3 background

### 9.1.1 Jurisdiction

As sedentary species, crabs are managed under the continental shelf provisions of the United Nations Law of the Sea Convention (UNCLOS), and not under the Convention's EEZ regime. The crab fisheries in the Barents Sea are managed separately by Norway and Russia on their respective continental shelves. The UoA fishery takes place on the continental shelf of the Russian Federation by vessels carrying Russian flag.

### 9.1.2 Objectives

Russian fisheries law defines protection and rational use of aquatic biological resources as the main goal of the country's fisheries management. 'Protection and rational use' was an established concept in Soviet legislation on the protection of the environment and exploitation of natural resources and has remained so in the Russian Federation. 'Rational use' bears resemblance to the internationally recognized ideal of sustainability, insofar as the emphasis is on long-term and sustained use of the resource, supported by science for socio-economic purposes. The Federal Fisheries Act states that the protection of aquatic biological resources shall be given priority to their rational use. The precautionary approach is not mentioned explicitly, but the requirement to protect aquatic biological resources and take the best scientific knowledge into account equals the requirements of the precautionary approach, as defined in the FAO Code of Conduct and its technical guidelines. The Russian Federation has signed and ratified a number of international agreements which adopt the precautionary approach, including the 1995 UN Straddling Stocks Agreement, and works actively in international organizations or arrangements which explicitly adhere to the precautionary approach to fisheries management, such as ICES and NEAFC.

The rights of fishery-dependent communities are explicitly stated in the Federal Fisheries Act. The Act states that 'the small indigenous peoples of the North, Siberia and the Far East' (ethnic groups with a 'traditional' lifestyle consisting of less than 50,000 people) shall be given access to fish resources in order to secure their livelihood. It gives 'fisheries to protect the traditional lifestyle of small indigenous peoples of the North Siberia and the Far East' extended rights compared to the other types of fisheries listed in the Act (e.g., 'industrial fisheries', 'coastal fisheries' and 'fisheries for scientific and enforcement purposes'). In the Northern basin, a fixed quota of cod and haddock is given to the Saami, based on their traditional fishing rights in the region.

### 9.1.3 Legal basis and management set-up

The executive power in the Russian Federation is shared between the President and the Government, led by the Prime Minister. There are three main categories of federal bodies of governance: policy-making *ministries* (in Russian: *ministerstva*), implementing *agencies* (in Russian: *agentstva*) and *services* (in Russian: *sluzhby*), which often have a control function. The five most high-level ministries, among them the Ministry of Foreign Affairs and the Ministry of Defence, as well as a number of important agencies and services, are directly subordinate to the President. The remaining are under the purview of the Government (which, for all practical purposes, is appointed by the President as well). Some agencies and services under the Government (i.e. not directly under the President) are subordinate to a specific ministry while others report directly to the Prime Minister. Russia is a federative state consisting of 85 federal subjects ('regions'), some of which are ethnically defined, like republics and autonomous districts (in Russian: *okruga*) and some not, like counties (in Russian: *oblasti*) and territories (in Russian: *krai*).

Within the Russian Government, fisheries policy falls under the purview of the Ministry of Agriculture (Minselkhoz). The implementing body for fisheries management under the Ministry is the Federal Fisheries Agency (FFA – in Russian: Rosrybolovstvo), which is the successor of the former State Committee for Fisheries (abolished in 2004), and in turn the Soviet Ministry of Fisheries. The Federal Border Service (since 2003 part of the Federal Security Service, the FSB) is responsible for enforcement at sea. The Barents and White Sea Territorial Administration of the Federal Fisheries Agency (BBTA – in Russian: BBTU) was established in 2007 as the implementing body of the Federal Fisheries Agency in the Northern basin, located in Murmansk. Within the Russian Government, the Ministry of Agriculture interacts with other federal ministries, e.g. with the Ministry of Natural Resources and Environment (Minprirody) through its implementing Agency for Monitoring of Natural Resources (Rosprirodnadzor), which carries out environmental impact assessments of fisheries regulations.

The Russian Federation has signed and ratified relevant international agreements such as the 1982 Law of the Sea Convention and the 1995 Straddling Stocks Agreement. The Russian Constitution of 1993 stated that the provisions of international agreements entered by the Russian Federation stand above those of national law, but that provision was removed when the Constitution was revised in 2020. The Federal Fisheries Act of the Russian Federation was signed in 2004 and last revised in 2014. This is a framework law, and a number of supporting legal documents have been issued in recent years to implement the intensions behind the 2007 revision. Specific regulations are given at the level of fishery basins. Current regulations for Russia's Northern fishery basin (covering fisheries conducted by companies in Murmansk and Arkhangelsk Oblasts, the Republic of Karelia and Nenets Autonomous Okrug, i.e. not strictly a 'basin') were adopted in 2014 and last revised in 2017, providing, among other things, rules for closed areas, fishing gear (e.g. mesh size), by-catch and minimal allowable size of different species. There are also annual regulations for the fishery of each species.

### 9.1.4 Stakeholders and consultation processes

A number of bodies of governance, industry organizations and research institutions are involved in the management of Russian fisheries. The formal arena for interaction between the Russian fishing industry and the government are the advisory bodies, the so-called fishery councils, found at federal, basin and regional levels. At the federal level, the Public Fisheries Council was established in 2008 on the basis of the requirement in the Federal Public Chamber Act to have a public council for most federal bodies of governance. Basin-level and regional fishery councils have existed since Soviet times, and the 2004 Federal Fisheries Act makes them mandatory for all basins and regions located on their territory. The rules of procedures for 'basin scientific and fishery councils' in the Russian Federation were approved in 2008. They state that the councils shall advice on a wide range of fishery-related issues, including conduct of fisheries in the relevant region; control and surveillance; conservation; recovery and harvesting of aquatic biological resources; distribution of quotas and other issues of importance to ensure sustainable management of fisheries.

Russia has an extensive system of fisheries research in oceanography, biology of marine organisms, resource assessment, fishing gear and processing technology, among other things. Research institutes subordinate to the FFA are highly integrated in the management process and also participate in the fishery councils at different levels. As follows from the above, the FFA is the implementing body for fishery policies under the Ministry of Agriculture. The Federal Border Service (since 2003 part of the Federal Security Service, the FSB)/Coast Guard is responsible for enforcement at sea. The Barents and White Sea Territorial Administration of the Federal Fisheries Agency (the BBTA) was established in 2007 as the implementing body of the Federal Fisheries Agency in the Northern basin, located in Murmansk.

There is a strong Russian (and previously Soviet) tradition of stakeholder consultation in the management process. The fishery councils at different (referred to above) consist of representatives of the fishing industry, federal executive authorities, executive bodies of the Russian federal subjects (the regions), research institutions and non-governmental organizations (NGOs), including the indigenous people of the North, Siberia and the Far East. The current regulations of the Northern Basin Scientific and Fishery Council were given in 2002 and corresponding regulations for the Murmansk Territorial Fishery Council in 2005, stating, inter alia, that the council shall contribute to a harmonized fishery policy in the region, liaise between the fishing industry, fishery authorities, scientific institutions and NGOs. In addition, the Fishing Industry Union of the North (FIUN) has developed into an important lobbying organization in the Northern fishery basin, with direct access to the highest levels of federal authorities. At a more general level, all new federal regulations in Russia have to go through public hearings; i.e. all draft proposals for new regulations have to be published at the website https://regulation.gov.ru, administered by the Ministry of Economic Development, where the public are given 15–30 days to provide their comments. Further, the FFA has a dedicated 'Open Agency' initiative which is comprehensively detailed on their website. In addition to the use of the Public Chamber and consultation bodies at lower level, this includes the use of internet conferences with citizens, reference groups to discuss policy initiatives, and a general objective to increase public access to information.

### 9.1.5 Enforcement, sanctions and compliance

The FFA (in the northern basin: the BBTA as the Agency's regional branch) keeps track of how much crab each vessel and company has caught at any moment, based on daily reports from each fishing vessels and accumulated reports each 15th day from all fishing companies, as well as VMS data. The Inspection Service of the Russian Border Guard, which is part of the Federal Security Service (FSB), conducts inspections at sea and in port. Fish caught in the REZ must be taken to Murmansk for customs clearance, but some of it is subsequently transhipped for export. The Border Guard conducts random inspections at sea during fishing, with inspection of documentation, catch and gears. It also conducts physical inspections of all transhipments at sea (weather conditions allowing) and at the control points that all foreign vessels – and Russian vessels having fished outside the REZ – have to go through when entering and leaving the REZ. The inspectors have the authority to introduce real-time closure of fishing areas. When Russian vessels land in other European ports, they are subject to the NEAFC port state control scheme, which implies that the port state has to check with the flag state that the landed catch is counted towards a quota, inspect a fixed share of the catch physically, and inform the flag state of the landed volumes.

Sanctions to deal with non-compliance exist in the system for fisheries management as well as in the wider national governance system. The system makes wide use of administrative fines and refers only serious cases to the judicial system. The Russian Federal Fisheries Act requires the withdrawal of quota rights if a fishing company has committed two serious violations of the fisheries regulations within one calendar year, among other things. The Code of the Russian Federation on Administrative Infractions specifies the level of fines that can be issued administratively by enforcement bodies, e.g. up to RUR 5,000 for 'citizens', 50,000 for executive officers' and 200,000 for companies. The Criminal Code requires that illegal fishing such as causing 'large damage', conducted in spawning areas or migration ways leading to such areas, or in marine protected areas be penalized by either fines up to RUR 300,000 or an amount corresponding to 1-2 years' income for the violator, compulsory work of no less than 480 hours, corrective work for at least two years or arrest for at least 6 months.

According to a note provided by the fishery client, the Boarder Guard conducted 243 inspections of 14 crab fishing vessels (i.e. 17 inspections per vessel) in 2018 and 345 inspections of 21 vessels in 2019 (16 inspections per vessel). Five infringements were detected in 2018 and 13 in 2019. Hence, 2 % and 3.8 % of the inspections led to the detection of an infringement. The client started operating in the Barents Sea in March 2020 – by October that year, the four client vessels were inspected 2-3 times each. At nine inspections in total, infringements were revealed in two instances. One was a breach with a MARPOL regulation (hence not fishery-related) and one with the requirement to report juveniles of crab.

### 9.1.6 Review of the management system

There are various mechanisms in place to evaluate key parts of the fishery-specific management system, but at varied levels of ambition and coverage. At the fishery councils' meetings, found at federal, basin and regional levels (see SI 3.1.2 b) above), management authorities receive feedback on management practices from the industry and other interested stakeholders, including NGOs. The FFA and the Ministry of Agriculture report annually to the Government and the Presidential Administration about their work, with emphasis on achievements in the fishing industry. Other federal agencies also review parts of the fisheries management system. For instance, the Auditor General evaluates how allocated funds are spent, and the Anti-Monopoly Service how competition and investment rules are observed. Within FFA, there is regular review of the performance of the Agency's regional offices. In the establishment of TACs, the scientific advice from PINRO is peer reviewed by the federal fisheries research institute, VNIRO, and then forwarded to FFA and the federal natural resources monitoring agency Rosprirodnadzor for comments. It is also presented to the general public for discussion at public hearings, announced in the local press.

### 9.1.7 Principle 3 Performance Indicator scores and rationales

## PI 3.1.1 – Legal and/or customary framework

| PI 3.1.1 | The management system exists within an appropriate legal and/or customary framework which ensures that it:<br>- Is capable of delivering sustainability in the UoA(s);<br>- Observes the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood; and<br>- Incorporates an appropriate dispute resolution framework | | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| **a** | Compatibility of laws or standards with effective management | | | |
| | Guide post | There is an effective national legal system **and a framework for cooperation** with other parties, where necessary, to deliver management outcomes consistent with MSC Principles 1 and 2 | There is an effective national legal system and **organised and effective cooperation** with other parties, where necessary, to deliver management outcomes consistent with MSC Principles 1 and 2. | There is an effective national legal system and **binding procedures governing cooperation with other parties** which delivers management outcomes consistent with MSC Principles 1 and 2. |
| | Met? | **Yes** | **Yes** | **No** |
| Rationale | | | | |

As sedentary species, crabs are managed under the continental shelf provisions of the United Nations Law of the Sea Convention (UNCLOS), and not under the Convention's EEZ regime. The crab fisheries in the Barents Sea are managed separately by Norway and Russia on their respective continental shelves. The UoA fishery takes place on the continental shelf of the Russian Federation by vessels carrying Russian flag.

The executive power in the Russian Federation is shared between the President and the Government, led by the Prime Minister. There are three main categories of federal bodies of governance: policy-making *ministries* (in Russian: *ministerstva*), implementing *agencies* (in Russian: *agentstva*) and *services* (in Russian: *sluzhby*), which often have a control function. The five most high-level ministries, among them the Ministry of Foreign Affairs and the Ministry of Defence, as well as a number of important agencies and services, are directly subordinate to the President. The remaining are under the purview of the Government (which, for all practical purposes, is appointed by the President as well). Some agencies and services under the Government (i.e. not directly under the President) are subordinate to a specific ministry while others report directly to the Prime Minister. Russia is a federative state consisting of 85 federal subjects ('regions'), some of which are ethnically defined, like republics and autonomous districts (in Russian: *okruga*) and some not, like counties (in Russian: *oblasti*) and territories (in Russian: *krai*).

Within the Russian Government, fisheries policy falls under the purview of the Ministry of Agriculture (Minselkhoz). The implementing body for fisheries management under the Ministry is the Federal Fisheries Agency (FFA – in Russian: Rosrybolovstvo), which is the successor of the former State Committee for Fisheries (abolished in 2004), and in turn the Soviet Ministry of Fisheries. The Federal Border Service (since 2003 part of the Federal Security Service, the FSB) is responsible for enforcement at sea. The Barents and White Sea Territorial Administration of the Federal Fisheries Agency (BBTA – in Russian: BBTU) was established in 2007 as the implementing body of the Federal Fisheries Agency in the Northern basin, located in Murmansk. Within the Russian Government, the Ministry of Agriculture interacts with other federal ministries, e.g. with the Ministry of Natural Resources and Environment (Minprirody) through its implementing Agency for Monitoring of Natural Resources (Rosprirodnadzor), which carries out environmental impact assessments of fisheries regulations. In Murmansk Oblast (country), the Ministry of Fisheries and Agriculture (at the Governor's office, the executive branch of government at regional level in Russia) is responsible for inland fisheries, recreational fisheries and the distribution of the indigenous peoples' quota (see SI 3.1.1 c) below).

The Russian Federation has signed and ratified relevant international agreements such as the 1982 Law of the Sea Convention and the 1995 Straddling Stocks Agreement. The Russian Constitution of 1993 stated that the provisions of international agreements entered by the Russian Federation stand above those of national law, but that provision was removed when the Constitution was revised in 2020. The Federal Fisheries Act of the Russian Federation was signed in 2004 and last revised in 2014. This is a framework law, and a number of supporting legal documents have been issued in recent years to implement the intensions behind the 2007 revision. Specific regulations are given at the level of fishery basins. Current regulations for Russia's Northern fishery basin (covering fisheries conducted by companies in Murmansk and Arkhangelsk Oblasts, the Republic of Karelia and Nenets Autonomous Okrug, i.e. not strictly a 'basin') were adopted in 2014 and last revised in 2017, providing, among other things, rules for closed areas, fishing gear (e.g. mesh size), by-catch and minimal allowable size of different species. There are also annual regulations for the fishery of each species.

The management system is considered to be effective insofar as it constitutes a coherent set of binding rulemaking practices. Norway and Russia manage the crab stocks in the Barents Sea separately but inform and consult each other about management issues in the Joint Norwegian–Russian Fisheries Commission. SG 60 is met.

Through the national management regime and organized cooperation between the two coastal states appropriate to the scale and intensity of the fishery, considering that sedentary species according to the UNCLOS is not subject to the same requirement of joint management as species in the water column, the management system is capable of delivering management outcomes consistent with MSC Principles 1 and 2. SG 80 is met.

At ACDR state, it is too early to conclude that the system actually delivers such outcomes. SG 100 is not met.

| | | | | |
|---|---|---|---|---|
| **b** | Resolution of disputes | | | |
| | Guide post | The management system incorporates or is subject by law to a **mechanism** for the resolution of legal disputes arising within the system. | The management system incorporates or is subject by law to a **transparent mechanism** for the resolution of legal disputes which is **considered to be effective** in dealing with most issues and that is appropriate to the context of the UoA. | The management system incorporates or is subject by law to a **transparent mechanism** for the resolution of legal disputes that is appropriate to the context of the fishery and has been **tested and proven to be effective**. |
| | Met? | **Yes** | **Yes** | **No** |
| Rationale | | | | |

There are effective, transparent dispute resolution mechanisms in place, as fishers can take their case to court if they do not accept the rationale behind an infringement accusation by enforcement authorities or the fees levied against them. Verdicts at the lower court levels can be appealed to higher levels. However, most disputes are solved within the system for fisheries management, not requiring judicial treatment. There are well-established systems of consultation with user groups in place for the fishery (see PI 3.1.2 below), confirmed in federal and regional legislation and transparent for actors within the fishing industry.

Hence, the management system incorporates or is subject by law to a mechanism for the resolution of legal disputes. SG 60 is met.

These mechanisms are transparent and considered to be effective in dealing with most issues and is appropriate to the context of the UoA. SG 80 is met.

However, it cannot be concluded that the mechanisms have been tested and proven to be effective. SG 100 is not met.

| | | | | |
|---|---|---|---|---|
| | Respect for rights | | | |
| **c** | Guide post | The management system has a mechanism to **generally respect** the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood in a manner consistent with the objectives of MSC Principles 1 and 2. | The management system has a mechanism to **observe** the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood in a manner consistent with the objectives of MSC Principles 1 and 2. | The management system has a mechanism to **formally commit** to the legal rights created explicitly or established by custom of people dependent on fishing for food and livelihood in a manner consistent with the objectives of MSC Principles 1 and 2. |
| | Met? | **Yes** | **Yes** | **Yes** |

Rationale

The rights of fishery-dependent communities are explicitly stated in the Federal Fisheries Act. The Act states that 'the small indigenous peoples of the North, Siberia and the Far East' (ethnic groups with a 'traditional' lifestyle consisting of less than 50,000 people) shall be given access to fish resources in order to secure their livelihood. It gives 'fisheries to protect the traditional lifestyle of small indigenous peoples of the North Siberia and the Far East' extended rights compared to the other types of fisheries listed in the Act (e.g., 'industrial fisheries', 'coastal fisheries' and 'fisheries for scientific and enforcement purposes'). In the Northern basin, a fixed quota of cod and haddock is given to the Saami, based on their traditional fishing rights in the region.

Hence, the management system has a mechanism to generally respect the legal rights created explicitly or established by custom of people dependent on fishing for food or livelihood in a manner consistent with the objectives of MSC Principles 1 and 2. SG 60 is met.

The system has a mechanism to observe such rights, so SG 80 is also met.

Since it is founded in law, the mechanism formally commits to these rights, and SG 100 is met.

References

Алексеев, Д.О., А.И. Буяновский, В.А. Бизиков, 2017. ПРИНЦИПЫ ПОСТРОЕНИЯ ЕДИНОЙ СТРАТЕГИИ РЕГУЛИРОВАНИЯ ПРОМЫСЛА КРАБОВ И КРАБОИДОВ В МОРЯХ РОССИИ ('Principles for the establishment of a uniform strategy for regulation of crabs and craboids in Russian marine waters') © 2017 г., ВОПРОСЫ РЫБОЛОВСТВА, 2017, том 18, №1; с. 21–41/PROBLEMS OF FISHERIES, 2017, vol. 18, №1; pp. 21–41.

ФЕДЕРАЛЬНЫЙ ЗАКОН О РЫБОЛОВСТВЕ И СОХРАНЕНИИ ВОДНЫХ БИОЛОГИЧЕСКИХ РЕСУРСОВ ('Federal Act on fisheries and protection of aquatic biological resources' – Federal Fisheries Act), N 166-ФЗ, Federal Assembly of the Russian Federation, 2004 (last revised 2014).

Jørgensen, Anne-Kristin, 'Рыбное хозяйство и управление отраслью в России' ('The fishing industry and fisheries management in Russia'), in Anne-Kristin Jørgensen and Geir Hønneland, Общее море, общие задачи: Сравнительный анализ рамочных условий рыбной отрасли России и Норвегии ('Common sea, common challenges: a comparative analysis of the framework conditions for the fishing industries in Russia and Norway'), Lysaker: Fridtjof Nansen Institute, 2015.

ОБ УТВЕРЖДЕНИИ ПРАВИЛ РЫБОЛОВСТВА ДЛЯ СЕВЕРНОГО РЫБОХОЗЯЙСТВЕННОГО БАССЕЙНА ('On the confirmation of fisheries regulations for the Northern fishery basin'), N 414, Ministry of Agriculture, the Russian Federation, 2014 (last revised 2017).

ПРАВИЛА РЕГУЛИРОВАНИЯ ПРОМЫСЛА ПРИОРИТЕТНЫХ ВИДОВ КРАБОВ И КРАБОИДОВ ('Rules for the regulation of fishery for crabs and craboids'), Ministry of Agriculture/Federal Fisheries Agency, 2016.

Samy-Kamal, Mohamed, 2020. Overview of Fisheries Governance and Policy System in the Russian Federation: An Analysis against the Marine Stewardship Council (MSC) Standard, Ocean & Coastal Management, Volume 197, 2020, 105312, ISSN 0964-5691, https://doi.org/10.1016/j.ocecoaman.2020.105312.

| | |
|---|---|
| **Draft scoring range** | **≥80** |
| Information gap indicator | **Information sufficient to score PI** |

**Overall Performance Indicator scores added from Client and Peer Review Draft Report stage**

| | |
|---|---|
| Overall Performance Indicator score | |
| Condition number (if relevant) | |

## PI 3.1.2 – Consultation, roles and responsibilities

| PI 3.1.2 | | The management system has effective consultation processes that are open to interested and affected parties<br>The roles and responsibilities of organisations and individuals who are involved in the management process are clear and understood by all relevant parties | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| **a** | Roles and responsibilities | | | |
| | Guide post | Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are **generally understood**. | Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are **explicitly defined and well understood for key areas** of responsibility and interaction. | Organisations and individuals involved in the management process have been identified. Functions, roles and responsibilities are **explicitly defined and well understood for all areas** of responsibility and interaction. |
| | Met? | **Yes** | **Yes** | **No** |

Rationale

The functions, roles and responsibilities of the different organizations and individuals involved in the management of the fishery are explicitly defined in national and regional laws and regulations, as well as in long-standing practice; see SI 3.1.1 a) for an overview of the main state bodies engaged in the management of the fishery, and SI 3.1.2 b) for an overview of non-governmental organizations involved.

Organizations and individuals involved in the management process have been identified, and according to the submitted client checklist, their functions, roles and responsibilities are generally understood, according to interviews at the site visit. SG 60 is met.

The functions, roles and responsibilities are explicitly defined in legislation and long-standing practice and well understood for key areas of responsibility and interaction, as reflected in numerous other MSC assessments of North west Russian fisheries, including for red king crab and opilio. SG 80 is met.

Before the site visit, it is too early to conclude that functions, roles and responsibilities are well understood for *all* areas of responsibility and interaction. SG 100 is not met.

| **b** | Consultation processes | | | |
|---|---|---|---|---|
| | Guide post | The management system includes consultation processes that **obtain relevant information** from the main affected parties, including local knowledge, to inform the management system. | The management system includes consultation processes that **regularly seek and accept** relevant information, including local knowledge. The management system demonstrates consideration of the information obtained. | The management system includes consultation processes that **regularly seek and accept** relevant information, including local knowledge. The management system demonstrates consideration of the information and **explains how it is used or not used**. |
| | Met? | **Yes** | **Yes** | **No** |

## Rationale

There is a strong Russian (and previously Soviet) tradition of stakeholder consultation in fisheries management. A formal arena for interaction between the Russian fishing industry and the government are the advisory bodies, the so-called fishery councils, found at federal, basin and regional levels. At the federal level, the Public Fisheries Council was established in 2008 on the basis of the requirement in the Federal Public Chamber Act to have a public council for most federal bodies of governance. Basin-level and regional fishery councils have existed since Soviet times, and the 2004 Federal Fisheries Act makes them mandatory for all basins and regions located on their territory. Rules of procedures for 'basin scientific and fishery councils' in the Russian Federation were adopted in 2008. They state that the councils shall advice on a wide range of fishery-related issues, including conduct of fisheries in the relevant region; control and surveillance; conservation; recovery and harvesting of aquatic biological resources; distribution of quotas and other issues of importance to ensure sustainable management of fisheries. The fishery councils consist of representatives of the fishing industry, federal executive authorities, executive bodies of the Russian federal subjects (the regions), research institutions and non-governmental organizations (NGOs), including the indigenous people of the North, Siberia and the Far East. Hence, in the Northern basin (covering the counties of Murmansk and Arkhangelsk, the Republic of Karelia and Nenets Autonomous Region) both federal authorities (the FFA through its representation in Murmansk, the BBTA) and regional authorities (the Ministry of Fisheries and Agriculture under the Governor) meet regularly with representatives of the fishing industry (individual companies and associations such as the Fishing Industry Union of the North (FIUN) and the Association of coastal fisheries in Murmansk Oblast), and other stakeholders that have taken an interest in fisheries management in the region, notably WWF-Murmansk.

The current regulations of the Northern Basin Scientific and Fishery Council were given in 2002 and corresponding regulations for the Murmansk Territorial Fishery Council in 2005, stating, inter alia, that the council shall contribute to a harmonized fishery policy in the region, liaise between the fishing industry, fishery authorities, scientific institutions and NGOs. At a more general level, all new federal regulations in Russia have to go through public hearings; i.e. all draft proposals for new regulations have to be published at the website https://regulation.gov.ru, administered by the Ministry of Economic Development, where the public are given 15–30 days to provide their comments. (For public hearings in the fishery-specific management system, see PI 3.2.4 below.) Further, the FFA has a dedicated 'Open Agency' initiative which is comprehensively detailed on their website. In addition to the use of the Public Chamber and consultation bodies at lower level, this includes the use of internet conferences with citizens, reference groups to discuss policy initiatives, and a general objective to increase public access to information. User groups from both countries also participate in the respective national delegations to the JNRFC and regular fishery consultations with third countries. Management authorities actively seek advice from user groups in preparation for the international consultations and negotiations.

Hence, the management system includes consultation processes that obtain relevant information from the main affected parties, including local knowledge, to inform the management system. SG 60 is met.

The processes regularly seek and accept relevant information, and the management system demonstrates consideration of the information obtained. SG 80 is met.

Before the site visit, it cannot be concluded that the authorities always provide adequate explanations of how stakeholder input is used or not used, so SG 100 is not met.

| | | | | |
|---|---|---|---|---|
| **c** | Participation | | | |
| | Guide post | | The consultation process **provides opportunity** for all interested and affected parties to be involved. | The consultation process provides **opportunity and encouragement** for all interested and affected parties to be involved, and **facilitates** their effective engagement. |
| | Met? | | **Yes** | **No** |

## Rationale

As follows from SI 3.1.2 b) above, the consultation processes provide opportunity for all interested and affected parties to be involved at both national and international level. Meetings are publicly announced, and authorities encourage all interested parties, including NGOs and the media, to attend. The various hearing opportunities available online also contribute to encouraging and facilitating public involvement.

Hence, the consultation process provides opportunity for all interested and affected parties to be involved. SG 80 is met.

At ACDR stage, it has not been documented that the authorities do not only provide opportunity, but actively encourage all parties to be involved and facilitate their effective engagement. SG 100 is not met.

## References

ФЕДЕРАЛЬНЫЙ ЗАКОН О РЫБОЛОВСТВЕ И СОХРАНЕНИИ ВОДНЫХ БИОЛОГИЧЕСКИХ РЕСУРСОВ ('Federal Act on fisheries and protection of aquatic biological resources' – Federal Fisheries Act), N 166-ФЗ, Federal Assembly of the Russian Federation, 2004 (last revised 2014).

Jørgensen, Anne-Kristin, 'Рыбное хозяйство и управление отраслью в России' ('The fishing industry and fisheries management in Russia'), in Anne-Kristin Jørgensen and Geir Hønneland, Общее море, общие задачи: Сравнительный анализ рамочных условий рыбной отрасли России и Норвегии ('Common sea, common challenges: a comparative analysis of the framework conditions for the fishing industries in Russia and Norway'), Lysaker: Fridtjof Nansen Institute, 2015.

Об образовании Общественного совета при Федеральном агентстве по рыболовству ('On the formation of a public chamber under the Federal Fisheries Agency'), N 301, Federal Fisheries Agency, Russian Federation, 2008.

Об утверждении Положения о Северном научно-промысловом совете и Положения о Рабочей группе Северного научно-промыслового совета ('On the confirmation of the Order of a Northern scientific and fishery council and the Order of a working group of the Northern scientific and fishery council'), Federal Fisheries Agency, Russian Federation, 2002.

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ОБ УТВЕРЖДЕНИИ ПОЛОЖЕНИЯ О ПОРЯДКЕ ДЕЯТЕЛЬНОСТИ ТЕРРИТОРИАЛЬНОГО РЫБОХОЗЯЙСТВЕННОГО СОВЕТА МУРМАНСКОЙ ОБЛАСТИ И ЕГО СОСТАВА ('On the confirmation of arrangements for the territorial fishery council of Murmansk Oblast and its composition'), N 239-ПП/8, the Government of Murmansk Oblast, Russian Federation, 2005 (last revised 2016).

ОБ УТВЕРЖДЕНИИ ПРАВИЛ РЫБОЛОВСТВА ДЛЯ СЕВЕРНОГО РЫБОХОЗЯЙСТВЕННОГО БАССЕЙНА ('On the confirmation of fisheries regulations for the Northern fishery basin'), N 414, Ministry of Agriculture, Russian Federation, 2014 (last revised 2017).

ПОЛОЖЕНИЕ об Общественном совете при Баренцево-Беломорском территориальном управлении Федерального агентства по рыболовству ('Regulation on the Fishery Council at the Barents and White Sea Territorial Administration of the Federal Fisheries Agency'), N 61, Federal Fisheries Agency, Russian Federation, 2014.

| | |
|---|---|
| **Draft scoring range** | **≥80** |
| Information gap indicator | **More information sought**<br>*Information must be sought on whether i) functions, roles and responsibilities are well understood for all areas of responsibility and interaction; ii) the authorities provide adequate explanations of how stakeholder input is used or not used; and iii) the authorities actively encourage all parties to be involved and facilitate their effective engagement.* |

**Overall Performance Indicator scores added from Client and Peer Review Draft Report stage**

| | |
|---|---|
| Overall Performance Indicator score | |
| Condition number (if relevant) | |

Lloyd's Register

## PI 3.1.3 – Long term objectives

| PI 3.1.3 | | The management policy has clear long-term objectives to guide decision-making that are consistent with MSC Fisheries Standard, and incorporates the precautionary approach | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| **a** | Objectives | | | |
| | Guide post | Long-term decision-ma with the MS | **Clear** long-term objectiv that guide decision-mak consistent with MSC | **Clear** long-term objectives that guide decision-making, consistent with MSC |
| | Met? | **Yes** | **Yes** | **No** |

### Rationale

Russian fisheries law defines protection and rational use of aquatic biological resources as the main goal of the country's fisheries management. 'Protection and rational use' was an established concept in Soviet legislation on the protection of the environment and exploitation of natural resources and has remained so in the Russian Federation. 'Rational use' bears resemblance to the internationally recognized ideal of sustainability, insofar as the emphasis is on long-term and sustained use of the resource, supported by science for socio-economic purposes. The Federal Fisheries Act states that the protection of aquatic biological resources shall be given priority to their rational use. The precautionary approach is not mentioned explicitly, but the requirement to protect aquatic biological resources and take the best scientific knowledge into account equals the requirements of the precautionary approach, as defined in the FAO Code of Conduct and its technical guidelines. The Russian Federation has signed and ratified a number of international agreements which adopt the precautionary approach, including the 1995 UN Straddling Stocks Agreement, and works actively in international organizations or arrangements which explicitly adhere to the precautionary approach to fisheries management, such as ICES and NEAFC.

Hence, clear long-term objectives that guide decision-making, consistent with MSC Principles and Criteria and the precautionary approach, are explicit within management policy. SG 60 and SG 80 are met.

However, such objectives are not made mandatory for lower-level regulations and policy implementation at national level. SG 100 is not met.

### References

Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (Fish Stocks Agreement), New York, 4 August 1995.

Code of Conduct for Responsible Fisheries, FAO, Rome, 31 October 1995.

ФЕДЕРАЛЬНЫЙ ЗАКОН О РЫБОЛОВСТВЕ И СОХРАНЕНИИ ВОДНЫХ БИОЛОГИЧЕСКИХ РЕСУРСОВ ('Federal Act on fisheries and protection of aquatic biological resources' – Federal Fisheries Act), N 166-ФЗ, Federal Assembly of the Russian Federation, 2004 (last revised 2014).

ОБ УТВЕРЖДЕНИИ ПРАВИЛ РЫБОЛОВСТВА ДЛЯ СЕВЕРНОГО РЫБОХОЗЯЙСТВЕННОГО БАССЕЙНА ('On the confirmation of fisheries regulations for the Northern fishery basin'), N 414, Ministry of Agriculture, Russian Federation, 2014 (last revised 2017).

ПРАВИЛА РЕГУЛИРОВАНИЯ ПРОМЫСЛА ПРИОРИТЕТНЫХ ВИДОВ КРАБОВ И КРАБОИДОВ ('Rules for the regulation of fishery for crabs and craboids'), Ministry of Agriculture/Federal Fisheries Agency, 2016.

Precautionary Approach to Capture Fisheries and Species Introductions, FAO Technical Guidelines for Responsible Fisheries, No. 2, FAO, Rome, 1996.

| | |
|---|---|
| **Draft scoring range** | **≥80** |
| Information gap indicator | **Information sufficient to score PI** |

**Overall Performance Indicator scores added from Client and Peer Review Draft Report stage**

| | |
|---|---|
| Overall Performance Indicator score | |
| Condition number (if relevant) | |

## PI 3.2.1 – Fishery-specific objectives

| PI 3.2.1 | | The fishery-specific management system has clear, specific objectives designed to achieve the outcomes expressed by MSC's Principles 1 and 2 | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| **a** | Objectives | | | |
| | Guide post | **Objectives**, which are broadly consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are **implicit** within the fishery-specific management system. | **Short and long-term objectives**, which are consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are **explicit** within the fishery-specific management system. | **Well defined and measurable short and long-term objectives**, which are demonstrably consistent with achieving the outcomes expressed by MSC's Principles 1 and 2, are **explicit** within the fishery-specific management system. |
| | Met? | **Yes** | **Yes** | **Partial** |

Rationale

Objectives broadly consistent with achieving the outcomes expressed by MSC's Principles 1 and 2 are explicit in the Russian regulations of snow crab fisheries, including to maintain the stocks at sustainable levels (both target stocks and other retained species) and protect other parts of the ecosystem, such as habitats. SG 60 is met.

These objectives are short- and long-term, so SG 80 is also met.

P1 objectives are well defined and measurable in the sense that performance against them can be measured through the enforcement bodies' recording and inspection routines (see SI 3.2.3 a) below). However, P2 objectives are less well defined and measurable, warranting a partial score at SG 100.

References

ФЕДЕРАЛЬНЫЙ ЗАКОН О РЫБОЛОВСТВЕ И СОХРАНЕНИИ ВОДНЫХ БИОЛОГИЧЕСКИХ РЕСУРСОВ ('Federal Act on fisheries and protection of aquatic biological resources' – Federal Fisheries Act), N 166-ФЗ, Federal Assembly of the Russian Federation, 2004 (last revised 2014).

ОБ УТВЕРЖДЕНИИ ПРАВИЛ РЫБОЛОВСТВА ДЛЯ СЕВЕРНОГО РЫБОХОЗЯЙСТВЕННОГО БАССЕЙНА ('On the confirmation of fisheries regulations for the Northern fishery basin'), N 414, Ministry of Agriculture, Russian Federation, 2014 (last revised 2017).

ПРАВИЛА РЕГУЛИРОВАНИЯ ПРОМЫСЛА ПРИОРИТЕТНЫХ ВИДОВ КРАБОВ И КРАБОИДОВ ('Rules for the regulation of fishery for crabs and craboids'), Ministry of Agriculture/Federal Fisheries Agency, 2016.

| | |
|---|---|
| **Draft scoring range** | **≥80** |
| Information gap indicator | **Information sufficient to score PI** |

**Overall Performance Indicator scores added from Client and Peer Review Draft Report stage**

| | |
|---|---|
| Overall Performance Indicator score | |
| Condition number (if relevant) | |

## PI 3.2.2 – Decision-making processes

| PI 3.2.2 | | **The fishery-specific management system includes effective decision-making processes that result in measures and strategies to achieve the objectives, and has an appropriate approach to actual disputes in the fishery** | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| **a** | Decision-making processes | | | |
| | Guide post | There are **some** decision-making processes in place that result in measures and strategies to achieve the fishery-specific objectives. | There are **established** decision-making processes that result in measures and strategies to achieve the fishery-specific objectives. | |
| | Met? | **Yes** | **Yes** | |
| Rationale | | | | |

Established decision-making procedures at federal and regional levels have evolved over several decades and are now codified in the Fisheries Act, general provisions for fishery in the Barents Sea and specific regulations for the crab fisheries. The Ministry of Agriculture decides on policy and regulatory schemes, while the Federal Fisheries Agency acts as an implementing body under the Ministry, with a main responsibility for secondary legislation (see SI 3.1.1 a) above). The Federal Fisheries Agency through its regional offices, and the Fishery Inspection Service under the Federal Security Service, perform compliance control on shore and at sea respectively. The decision-making processes include the allocation of quotas based on scientific advice and corroborated in stakeholder bodies, public hearings and environmental impact assessments. Further, technical regulations are defined by the Federal Fisheries Agency, after consultations with user groups and other stakeholders (see SI 3.1.2 b) above). The enforcement system is further described in PI 3.2.3 a) below.

Hence, there are decision-making processes in place that result in measures and strategies to achieve the fishery-specific objectives. This applies to the UoA fishery as it does to Russian fisheries in general; see PIs 3.1.1 and 3.1.2 above. SG 60 is met.

These processes are established – evolved over several decades and now codified in the 2004 Federal Fisheries Act and secondary legislation – so SG 80 is also met.

| | | | | |
|---|---|---|---|---|
| **b** | Responsiveness of decision-making processes | | | |
| | Guide post | Decision-making processes respond to **serious issues** identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take some account of the wider implications of decisions. | Decision-making processes respond to **serious and other important issues** identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions. | Decision-making processes respond to **all issues** identified in relevant research, monitoring, evaluation and consultation, in a transparent, timely and adaptive manner and take account of the wider implications of decisions. |
| | Met? | **Yes** | **Yes** | **No** |

| | | | | |
|---|---|---|---|---|
| Rationale | | | | |

The well-established decision-making procedures at national level in Russia respond to issues identified in research, monitoring, evaluation or by groups with an interest in the fishery through the arenas for regular consultations between governmental agencies and the public. This happens first and foremost in the fishery councils at basin level, further through ad hoc consultation with the industry and other stakeholders (see PI 3.1.2 above). In addition, there is close contact between authorities and scientific research institutions, primarily between the FFA and PINRO. SGs 60 and 80 are met.

It is not clear at ACDR stage that *all* issues are responded to. SG 100 is not met.

| | | | | |
|---|---|---|---|---|
| **c** | Use of precautionary approach | | | |
| | Guide post | | Decision-making processes use the precautionary approach and are based on best available information. | |
| | Met? | | **Yes** | |
| Rationale | | | | |

Decision-making processes at the national level in Russia are based on scientific recommendations from PINRO. The Federal Fisheries Act, defines the precautionary approach, as defined in the FAO Code of Conduct and its technical guidelines, as the overarching objective in Russian fisheries management (see PI 3.1.3 above). SG 80 is met.

| | | | | |
|---|---|---|---|---|
| **d** | Accountability and transparency of management system and decision-making process | | | |
| | Guide post | Some information on the fishery's performance and management action is generally available on request to stakeholders. | **Information on the fishery's performance and management action is available on request**, and explanations are provided for any actions or lack of action associated with findings and relevant recommendations emerging from research, monitoring, evaluation and review activity. | Formal reporting to all interested stakeholders **provides comprehensive information on the fishery's performance and management actions** and describes how the management system responded to findings and relevant recommendations emerging from research, monitoring, evaluation and review activity. |
| | Met? | **Yes** | **Yes** | **No** |
| Rationale | | | | |

Information is available on the fishery's performance and management action on the websites of the Russian Federal Fisheries Agency and its regional office in the Northern basin, BBTA. SG 60 is met.

Since explanations are provided for actions or lack of action associated with findings and relevant recommendations emerging from research, monitoring, evaluation and review activity, SG 80 is also met.

However, no formal reporting to all interested stakeholders takes place, so SG 100 is not met.

| | |
|---|---|
| | Approach to disputes |

| | | | | |
|---|---|---|---|---|
| **e** | Guide post | Although the management authority or fishery may be subject to continuing court challenges, it is not indicating a disrespect or defiance of the law by repeatedly violating the same law or regulation necessary for the sustainability for the fishery. | The management system or fishery is attempting to comply in a timely fashion with judicial decisions arising from any legal challenges. | The management system or fishery acts proactively to avoid legal disputes or rapidly implements judicial decisions arising from legal challenges. |
| | Met? | **Yes** | **Yes** | **Yes** |

Rationale

The Russian system for fisheries management is not subject to continuing court challenges or indicating a disrespect or defiance of the law by repeatedly violating the same law or regulation necessary for the sustainability for the fishery. SG 60 is met.

When occasionally taken to court by fishing companies, the management authority complies with the judicial decision in a timely manner. SG 80 is met.

The management authority works proactively to avoid legal disputes. This is done partly through the tight cooperation with user groups at the regulatory level (see PI 3.1.2 above), ensuring as high legitimacy as possible for regulations and other management decisions. Regulatory and enforcement authorities offer advice to the fleet on how to avoid infringements, keeping them updated on changes in the regulations. They also have the authority to issue administrative penalties for minor infringements (serious enough to be met by a reaction above a written warning), thus referring only the more serious cases to prosecution by the police and possible transfer to the court system. Since the management system acts proactively to avoid legal disputes and rapidly implements judicial decisions, SG 100 is met.

References

ОБ УТВЕРЖДЕНИИ ПРАВИЛ РЫБОЛОВСТВА ДЛЯ СЕВЕРНОГО РЫБОХОЗЯЙСТВЕННОГО БАССЕЙНА (‘On the confirmation of fisheries regulations for the Northern fishery basin’), N 414, Ministry of Agriculture, the Russian Federation, 2014 (last revised 2017).

ПРАВИЛА РЕГУЛИРОВАНИЯ ПРОМЫСЛА ПРИОРИТЕТНЫХ ВИДОВ КРАБОВ И КРАБОИДОВ (‘Rules for the regulation of fishery for crabs and craboids’), Ministry of Agriculture/Federal Fisheries Agency, 2016.

Websites of the Russian Federal Fisheries Agency (www.fish.gov.ru) and its regional office in the Northern basin, BBTA (www.bbtu.ru).

| | |
|---|---|
| **Draft scoring range** | **≥80** |
| Information gap indicator | **Information sufficient to score PI** |

**Overall Performance Indicator scores added from Client and Peer Review Draft Report stage**

| | |
|---|---|
| Overall Performance Indicator score | |
| Condition number (if relevant) | |

## PI 3.2.3 – Compliance and enforcement

| PI 3.2.3 | | Monitoring, control and surveillance mechanisms ensure the management measures in the fishery are enforced and complied with | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| **a** | MCS implementation | | | |
| | Guide post | Monitoring, control and surveillance **mechanisms** exist, and are implemented in the fishery and there is a reasonable expectation that they are effective. | A monitoring, control and surveillance **system** has been implemented in the fishery and has demonstrated an ability to enforce relevant management measures, strategies and/or rules. | A **comprehensive** monitoring, control and surveillance system has been implemented in the fishery and has demonstrated a consistent ability to enforce relevant management measures, strategies and/or rules. |
| | Met? | **Yes** | **Yes** | **No** |
| Rationale | | | | |

The FFA (in the northern basin: the BBTA as the Agency's regional branch) keeps track of how much crab each vessel and company has caught at any moment, based on daily reports from each fishing vessels and accumulated reports each 15th day from all fishing companies, as well as VMS data. The Inspection Service of the Russian Border Guard, which is part of the Federal Security Service (FSB), conducts inspections at sea and in port. Fish caught in the REZ must be taken to Murmansk for customs clearance, but some of it is subsequently transhipped for export. The Border Guard conducts random inspections at sea during fishing, with inspection of documentation, catch and gears. It also conducts physical inspections of all transhipments at sea (weather conditions allowing) and at the control points that all foreign vessels – and Russian vessels having fished outside the REZ – have to go through when entering and leaving the REZ. The inspectors have the authority to introduce real-time closure of fishing areas. When Russian vessels land in other European ports, they are subject to the NEAFC port state control scheme, which implies that the port state has to check with the flag state that the landed catch is counted towards a quota, inspect a fixed share of the catch physically, and inform the flag state of the landed volumes.

According to a note provided by the fishery client, the Boarder Guard conducted 243 inspections of 14 crab fishing vessels (i.e. 17 inspections per vessel) in 2018 and 345 inspections of 21 vessels in 2019 (16 inspections per vessel). See SI 3.2.3 c) for information about infringements and compliance.

Hence, monitoring, control and surveillance mechanisms exist and are implemented in the fishery, and there is a reasonable expectation that they are effective. SG 60 is met.

These measures qualify as a system and have demonstrated an ability to enforce relevant management measures, strategies and rules; see SI 3.2.3 c) below on compliance. SG 80 is met.

The system qualifies as comprehensive relative to the scope and intensity of the fishery, but it cannot at this stage be concluded that it has demonstrated a *consistent* ability to enforce relevant regulations; see SI 3.2.3 c) on compliance below. SG 100 is not met.

| | | | | |
|---|---|---|---|---|
| **b** | Sanctions | | | |
| | Guide post | Sanctions to deal with non-compliance exist and there is some evidence that they are applied. | Sanctions to deal with non-compliance exist, **are consistently applied** and | Sanctions to deal with non-compliance exist, are consistently applied and |

| | | | | |
|---|---|---|---|---|
| | | | thought to provide effective deterrence. | **demonstrably** provide effective deterrence. |
| | Met? | **Yes** | **Yes** | **No** |
| Rationale | | | | |

Sanctions to deal with non-compliance exist in the system for fisheries management as well as in the wider national governance system. The system makes wide use of administrative fines and refers only serious cases to the judicial system. The Russian Federal Fisheries Act requires the withdrawal of quota rights if a fishing company has committed two serious violations of the fisheries regulations within one calendar year, among other things. The Code of the Russian Federation on Administrative Infractions specifies the level of fines that can be issued administratively by enforcement bodies, e.g. up to RUR 5,000 for 'citizens', 50,000 for executive officers' and 200,000 for companies. The Criminal Code requires that illegal fishing such as causing 'large damage', conducted in spawning areas or migration ways leading to such areas, or in marine protected areas be penalized by either fines up to RUR 300,000 or an amount corresponding to 1-2 years' income for the violator, compulsory work of no less than 480 hours, corrective work for at least two years or arrest for at least 6 months.

Hence, sanctions to deal with non-compliance exist and there is evidence that they are applied. SG 60 is met.

Sanctions are consistently applied and thought to provide effective deterrence; see SI 3.2.3 c) below on compliance. SG 80 is met.

It cannot be concluded that sanctions demonstrably provide effective deterrence; see SI 3.2.3 c) below on compliance. SG 100 is not met.

| | | | | |
|---|---|---|---|---|
| **c** | Compliance | | | |
| | Guide post | Fishers are **generally thought** to comply with the management system for the fishery under assessment, including, when required, providing information of importance to the effective management of the fishery. | **Some evidence exists** to demonstrate fishers comply with the management system under assessment, including, when required, providing information of importance to the effective management of the fishery. | There is a **high degree of confidence** that fishers comply with the management system under assessment, including, providing information of importance to the effective management of the fishery. |
| | Met? | **Yes** | **Yes** | **No** |
| Rationale | | | | |

As mentioned under SI 3.2.3 a) above, the Boarder Guard conducted 243 inspections of 14 crab fishing vessels (i.e. 17 inspections per vessel) in 2018 and 345 inspections of 21 vessels in 2019 (16 inspections per vessel). Five infringements were detected in 2018 and 13 in 2019. Hence, 2 % and 3.8 % of the inspections led to the detection of an infringement. The client started operating in the Barents Sea in March 2020 – by October that year, the four client vessels were inspected 2-3 times each. At nine inspections in total, infringements were revealed in two instances. One was a breach with a MARPOL regulation (hence not fishery-related) and one with the requirement to report juveniles of crab.

Hence, fishers are generally thought to comply with the requirements of the management system, including, when required, providing information of importance to the effective management of the fishery. SG 60 is met.

Some evidence exists, in the overview of inspections, that fishers comply, so SG 80 is met.

The numbers above are provided by the fishery client and have not been corroborated by Russian authorities. Hence, it cannot be concluded that there is a high degree of certainty that fishers comply. SG 100 is not met.

| | |
|---|---|
| | Systematic non-compliance |

| | | | | |
|---|---|---|---|---|
| **d** | Guide post | | There is no evidence of systematic non-compliance. | |
| | Met? | | **Yes** | |

| |
|---|
| Rationale |

Based on information collected at ACDR stage, there is no evidence of systematic non-compliance in the fishery. SG 80 is met.

| |
|---|
| References |

ФЕДЕРАЛЬНЫЙ ЗАКОН О РЫБОЛОВСТВЕ И СОХРАНЕНИИ ВОДНЫХ БИОЛОГИЧЕСКИХ РЕСУРСОВ (‘Federal Act on fisheries and protection of aquatic biological resources’ – Federal Fisheries Act), N 166-ФЗ, Federal Assembly of the Russian Federation, 2004 (last revised 2014).

КОДЕКС РОССИЙСКОЙ ФЕДЕРАЦИИ ОБ АДМИНИСТРАТИВНЫХ ПРАВОНАРУШЕНИЯХ (‘Code of the Russian Federation on administrative offences‘), N 195-ФЗ, Federal Assembly of the Russian Federation, 2001 (last revised 2017).

Note on inspections and infringements in 2018 and 2019, provided by the client.

ОБ УТВЕРЖДЕНИИ ПРАВИЛ РЫБОЛОВСТВА ДЛЯ СЕВЕРНОГО РЫБОХОЗЯЙСТВЕННОГО БАССЕЙНА (‘On the confirmation of fisheries regulations for the Northern fishery basin’), N 414, Ministry of Agriculture, the Russian Federation, 2014 (last revised 2017).

Websites of the Federal Fisheries Agency (www.fish.gov.ru) and its regional office in the Northern basin, BBTA (www.bbtu.ru).

| | |
|---|---|
| **Draft scoring range** | **≥80** |
| Information gap indicator | **More information sought**<br>*Confirmation of inspection and compliance levels should be sought from enforcement authorities.* |

**Overall Performance Indicator scores added from Client and Peer Review Draft Report stage**

| | |
|---|---|
| Overall Performance Indicator score | |
| Condition number (if relevant) | |

## PI 3.2.4 – Monitoring and management performance evaluation

| PI 3.2.4 | | There is a system of monitoring and evaluating the performance of the fishery-specific management system against its objectives<br>There is effective and timely review of the fishery-specific management system | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| **a** | Evaluation coverage | | | |
| | Guide post | There are mechanisms in place to evaluate **some** parts of the fishery-specific management system. | There are mechanisms in place to evaluate **key** parts of the fishery-specific management system. | There are mechanisms in place to evaluate **all** parts of the fishery-specific management system. |
| | Met? | **Yes** | **Yes** | **No** |
| Rationale | | | | |

There are various mechanisms in place to evaluate key parts of the fishery-specific management system, but at varied levels of ambition and coverage. At the fishery council meetings, found at federal, basin and regional levels (see SI 3.1.2 b) above), management authorities receive feedback on management practices from the industry and other interested stakeholders, including NGOs. The FFA and the Ministry of Agriculture report annually to the Government and the Presidential Administration about their work, with emphasis on achievements in the fishing industry. Other federal agencies also review parts of the fisheries management system. For instance, the Auditor General evaluates how allocated funds are spent, and the Anti-Monopoly Service how competition and investment rules are observed. Within FFA, there is regular review of the performance of the Agency's regional offices. In the establishment of TACs, the scientific advice from PINRO is peer reviewed by the federal fisheries research institute, VNIRO, and then forwarded to FFA and the federal natural resources monitoring agency Rosprirodnadzor for comments. It is also presented to the general public for discussion at public hearings, announced in the local press.

Hence, there are mechanisms in place to evaluate some parts of the fishery-specific management system. SG 60 is met.

These include key parts of the management system, so SG 80 is also met.

It is a principal challenge to claim that 'all' parts of a fisheries management system are subject to review, but it seems reasonable to expect some sort of a holistic evaluation of the system as such, which does not seem to be the case for the national management system for crabs in Russia. SG 100 is not met.

| | | | | |
|---|---|---|---|---|
| **b** | Internal and/or external review | | | |
| | Guide post | The fishery-specific management system is subject to **occasional internal** review. | The fishery-specific management system is subject to **regular internal** and **occasional external** review. | The fishery-specific management system is subject to **regular internal and external** review. |
| | Met? | **Yes** | **No** | **No** |
| Rationale | | | | |

Regular internal review of the fishery-specific management system is performed through FFA's continuous evaluation of the performance of regional management in the Northern basin, and other forms of review listed under SI 3.2.4 a) above. SG 60 is met.

However, the assessment team has not been provided evidence at this stage that the fishery-specific management system is subject to external review. The MSC Fisheries Standard specifies that external here means 'external to the fishery', but not necessarily international. It is a matter of definition where the line goes between internal and external reviews. In some MSC assessments, reviews of the fishery-specific management system by a state's Auditor General, on behalf of the Parliament, has been accepted as external since it is the legislative branch of government that evaluates the performance of the executive branch. Such review does take place in Russia (see SI 3.2.4 a) above), but only of peripheral aspects of the management system, primarily its financial components. In the opinion of the assessment team, this does not qualify as an external review of the fishery-specific management system as such, i.e. the management of the Russian Barents Sea crab fisheries. Nor have we come across any other such reviews, so SG 80 is not met.

References

ФЕДЕРАЛЬНЫЙ ЗАКОН О РЫБОЛОВСТВЕ И СОХРАНЕНИИ ВОДНЫХ БИОЛОГИЧЕСКИХ РЕСУРСОВ ('Federal Act on fisheries and protection of aquatic biological resources' – Federal Fisheries Act), N 166-ФЗ, Federal Assembly of the Russian Federation, 2004 (last revised 2014).

ОБ УТВЕРЖДЕНИИ ПРАВИЛ РЫБОЛОВСТВА ДЛЯ СЕВЕРНОГО РЫБОХОЗЯЙСТВЕННОГО БАССЕЙНА ('On the confirmation of fisheries regulations for the Northern fishery basin'), N 414, Ministry of Agriculture, the Russian Federation, 2014 (last revised 2017).

ПРАВИЛА РЕГУЛИРОВАНИЯ ПРОМЫСЛА ПРИОРИТЕТНЫХ ВИДОВ КРАБОВ И КРАБОИДОВ ('Rules for the regulation of fishery for crabs and craboids'), Ministry of Agriculture/Federal Fisheries Agency, 2016.

Websites of the Federal Fisheries Agency (www.fish.gov.ru) and its regional office in the Northern basin, BBTA (www.bbtu.ru).

| **Draft scoring range** | **60-79** |
|---|---|
| Information gap indicator | **More information sought**<br>*More information must be sought on external reviews of the fishery-specific management system* |

**Overall Performance Indicator scores added from Client and Peer Review Draft Report stage**

| | |
|---|---|
| Overall Performance Indicator score | |
| Condition number (if relevant) | |

### 9.1.8 P3 references

Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (Fish Stocks Agreement), New York, 4 August 1995.

Алексеев, Д.О., А.И. Буяновский, В.А. Бизиков, 2017. ПРИНЦИПЫ ПОСТРОЕНИЯ ЕДИНОЙ СТРАТЕГИИ РЕГУЛИРОВАНИЯ ПРОМЫСЛА КРАБОВ И КРАБОИДОВ В МОРЯХ РОССИИ ('Principles for the establishment of a uniform strategy for regulation of crabs and craboids in Russian marine waters') © 2017 г., ВОПРОСЫ РЫБОЛОВСТВА, 2017, том 18, №1; с. 21–41/PROBLEMS OF FISHERIES, 2017, vol. 18, №1; pp. 21–41.

Code of Conduct for Responsible Fisheries, FAO, Rome, 31 October 1995.

ФЕДЕРАЛЬНЫЙ ЗАКОН О РЫБОЛОВСТВЕ И СОХРАНЕНИИ ВОДНЫХ БИОЛОГИЧЕСКИХ РЕСУРСОВ ('Federal Act on fisheries and protection of aquatic biological resources' – Federal Fisheries Act), N 166-ФЗ, Federal Assembly of the Russian Federation, 2004 (last revised 2014).

Jørgensen, Anne-Kristin, 'Рыбное хозяйство и управление отраслью в России' ('The fishing industry and fisheries management in Russia'), in Anne-Kristin Jørgensen and Geir Hønneland, Общее море, общие задачи: Сравнительный анализ рамочных условий рыбной отрасли России и Норвегии ('Common sea, common challenges: a comparative analysis of the framework conditions for the fishing industries in Russia and Norway'), Lysaker: Fridtjof Nansen Institute, 2015.

КОДЕКС РОССИЙСКОЙ ФЕДЕРАЦИИ ОБ АДМИНИСТРАТИВНЫХ ПРАВОНАРУШЕНИЯХ ('Code of the Russian Federation on administrative offences'), N 195-ФЗ, Federal Assembly of the Russian Federation, 2001 (last revised 2017).

Об образовании Общественного совета при Федеральном агентстве по рыболовству ('On the formation of a public chamber under the Federal Fisheries Agency'), N 301, Federal Fisheries Agency, Russian Federation, 2008.

ОБ УТВЕРЖДЕНИИ ПОЛОЖЕНИЯ О ПОРЯДКЕ ДЕЯТЕЛЬНОСТИ ТЕРРИТОРИАЛЬНОГО РЫБОХОЗЯЙСТВЕННОГО СОВЕТА МУРМАНСКОЙ ОБЛАСТИ И ЕГО СОСТАВА ('On the confirmation of arrangements for the territorial fishery council of Murmansk Oblast and its composition'), N 239-ПП/8, the Government of Murmansk Oblast, Russian Federation, 2005 (last revised 2016).

Об утверждении Положения о Северном научно-промысловом совете и Положения о Рабочей группе Северного научно-промыслового совета ('On the confirmation of the Order of a Northern scientific and fishery council and the Order of a working group of the Northern scientific and fishery council'), Federal Fisheries Agency, Russian Federation, 2002.

ОБ УТВЕРЖДЕНИИ ПОРЯДКА ДЕЯТЕЛЬНОСТИ БАССЕЙНОВЫХ НАУЧНО-ПРОМЫСЛОВЫХ СОВЕТОВ ('On the confirmation of arrangements for basin scientific and fishery councils'), Federal Fisheries Agency, Russian Federation, 2008.

ОБ УТВЕРЖДЕНИИ ПРАВИЛ РЫБОЛОВСТВА ДЛЯ СЕВЕРНОГО РЫБОХОЗЯЙСТВЕННОГО БАССЕЙНА ('On the confirmation of fisheries regulations for the Northern fishery basin'), N 414, Ministry of Agriculture, the Russian Federation, 2014 (last revised 2017).

ПОЛОЖЕНИЕ об Общественном совете при Баренцево-Беломорском территориальном управлении Федерального агентства по рыболовству ('Regulation on the Fishery Council at the Barents and White Sea Territorial Administration of the Federal Fisheries Agency'), N 61, Federal Fisheries Agency, Russian Federation, 2014.

ПРАВИЛА РЕГУЛИРОВАНИЯ ПРОМЫСЛА ПРИОРИТЕТНЫХ ВИДОВ КРАБОВ И КРАБОИДОВ ('Rules for the regulation of fishery for crabs and craboids'), Ministry of Agriculture/Federal Fisheries Agency, 2016.

Precautionary Approach to Capture Fisheries and Species Introductions, FAO Technical Guidelines for Responsible Fisheries, No. 2, FAO, Rome, 1996.

Samy-Kamal, Mohamed, 2020. Overview of Fisheries Governance and Policy System in the Russian Federation: An Analysis against the Marine Stewardship Council (MSC) Standard, Ocean & Coastal Management, Volume 197, 2020, 105312, ISSN 0964-5691, https://doi.org/10.1016/j.ocecoaman.2020.105312.

# 10 Appendices

## 10.1 Assessment information

### 10.1.1 Small-scale fisheries

Information will be gathered at the site visit.

**Table 45: Small-scale fisheries**

| Unit of Assessment (UoA) | Percentage of vessels with length <15m | Percentage of fishing activity completed within 12 nautical miles of shore |
|---|---|---|
| tbc | tbc | tbc |

## 10.2 Evaluation processes and techniques

### 10.2.1 Site visits

The CAB shall include in the report:

- An itinerary of site visit activities with dates.
- A description of site visit activities, including any locations that were inspected.
- Names of individuals contacted.

Reference(s): FCP v2.2 Section 7.16

The assessment was announced on the MSC website and stakeholders that were identified by the client and also by Lloyd's Register, using stakeholder list from other MSC assessments within the region, were contacted directly by Lloyd's Register.

A Variation Request was accepted by the MSC to conduct the initial site visit for the full assessment remotely, a remote site visit will take place in the week commencing 15th February 2021 and will last approximately 7 days, or as long as needed. Audit plan will be communicated to all participants. The assessment team prepared an audit itinerary prior to the site visit, and meetings were conducted with the following individuals & organisations: -

[list all stakeholders / clients / etc.]

**Note**

* Where observers attended meetings, stakeholders and the client will be informed of their role and asked if they were happy with their attendance prior to starting the meeting.

### 10.2.2 Stakeholder participation

The CAB shall include in the report:

- Details of people interviewed: local residents, representatives of stakeholder organisations including contacts with any regional MSC representatives.
- A description of stakeholder engagement strategy and opportunities available.

Reference(s): FCP v2.2 Section 7.16

A total of 44 stakeholder organisations and individuals having relevant interest in the assessment were identified and notified, via e-mail, of the surveillance process. This highlighted the potential process for engagement in the surveillance, if desired. In addition, the interest of others not appearing on this list was solicited through the postings on the MSC website.

### 10.2.3 Evaluation techniques

At Announcement Comment Draft report stage, if the use of the RBF is triggered for this assessment, the CAB shall include in the report:

- The plan for RBF activities that the team will undertake at the site visit.
- The justification for using the RBF, which can be copied from previous RBF announcements, and stakeholder comments on its use.
- The RBF stakeholder consultation strategy to ensure effective participation from a range of stakeholders including any participatory tools used.
- The full list of activities and components to be discussed or evaluated in the assessment.

At Client Draft Report stage, if the RBF was used for this assessment, the CAB shall include in the report:

- A summary of the information obtained from the stakeholder meetings including the range of opinions.
- The full list of activities and components that have been discussed or evaluated in the assessment, regardless of the final risk-based outcome.

The stakeholder input should be reported in the stakeholder input appendix and incorporated in the rationales directly in the scoring tables.

Reference(s): FCP v2.2 Section 7.16, FCP v2.2 Annex PF Section PF2.1

### 1. Public Announcements

The full assessment was publicly announced on the the MSC website as well as sent by email in the MSC Fishery Announcements newsletter to all registered stakeholders. The announcement was also distributed to all LR stakeholders via the LR Mailchimp system (see Section 10.2.2). This was also the method used for consultation on subsequent steps (e.g. peer reviewers announcement, new UoA, etc.). See Section 10.4 for a detailed list of all consultations that took place at different stages along the process. At this time, LR also announced the assessment site visit dates, as well as the assessment team. This was done according to the process requirements in MSC's Fisheries Certification Process v2.2, and in the MSC Fisheries Standard v2.01. Together, these media presented the announcement to a wide audience representing industry, agencies, and other stakeholders. Meetings and conference calls held during the site visit constituted the main tool in guaranteeing the participation of relevant stakeholders.

### 2. Information gathering

The assessment team reviewed documents sent by the client ahead of the onsite visit. See section 7.2.7 and 8.2.8 and 9.1.8 for a detailed list of references used. Discussions with the clients and management agencies will be centred on the content within the provided documentation. In cases where relevant documentation was not provided in advance of the meeting, it will be requested by the assessment team and subsequently supplied during, or shortly after the meeting.

### 3. Scoring

Scoring was performed according to the procedure established in MSC FCP v2.2. The Fisheries Standard v2.01 default assessment tree used for this assessment, the MSC has 28 PIs, six in Principle 1, 15 in Principle 2, and seven in Principle 3. Please note however the default assessment tree was modified for both UoAs on PI 2.5.2 see Section 10.2.4. The PIs are grouped in each principle by 'component.' Principle 1 has two components, Principle 2 has five, and Principle 3 has two. Each PI consists of one or more 'scoring issues;' a scoring issue is a specific topic for evaluation. 'Scoring Guideposts' define the requirements for meeting each scoring issue at the 60 (conditional pass), 80 (full pass), and 100 (state of the art) levels.

Note that some scoring issue may not have a scoring guidepost at each of the 60, 80, and 100 levels; in the case of the example above, scoring issue (b) does not have a scoring issue at the SG60 level. The scoring issues and scoring guideposts are cumulative; this means that a PI is scored first at the SG60 levels. If not all of the SG scoring issues meet the 60 requirements, the fishery fails, and no further scoring occurs. If all of the SG60 scoring issues are met, the fishery meets the 60 level, and the scoring moves to SG80 scoring issues. If no scoring issues meet the requirements at the SG80 level, the fishery receives a score of 60. As the fishery meets increasing numbers of SG80 scoring issues, the score increases above 60 in proportion to the number of scoring issues met; PI scoring occurs at 5-point intervals. If the fishery meets half the scoring issues at the 80 level, the PI would score 70; if it meets a quarter, then it would score 65; and it would score 75 by meeting three-quarters of the scoring issues. If the fishery meets all of the SG80 scoring issues, the scoring moves to the SG100 level. Scoring at the SG100 level follows the same pattern as for SG80. Principle scores result from averaging the scores within each component, and then from averaging the component scores within each Principle. If a Principle averages less than 80, the fishery fails. Scoring for this fishery followed a consensus process in which the assessment team discussed the information available for evaluating PIs to develop a broad opinion of performance of the fishery against each PI.

After the site visit, each team member will be assigned their relevant section in the report to complete before proceeding to a joint evaluation of every PI and the pertaining scoring systems and rationales through scoring meetings which will take place via conference calls. Team members are responsible for completely their relevant scoring tables and providing a provisional score. The necessary harmonisation procedure was already described in section 10.8. PI scores were entered into MSC's Fishery Assessment Scoring Worksheet to arrive at Principle-level scores.

The team agrees that none of the scoring issues assessed for the Barents Sea Red King and Opilio Crab fishery fails to meet at the SG60 level, and a weighted average score of 80 or more was is likely to be achieved for each of the 3 MSC Principles. Scores allocated to the default performance indicators are summarised in Section 5.3.3

The Barents Sea Red King and Opilio Crab fishery complies with MSC Fisheries Certification Requirements v2.01.

To be drafted at CPRDR stage

The team has set X binding conditions for certification and X non-binding management recommendations (see sections 0 and 5.3.5 for more details).

## 4. Scoring elements

A complete list of the different scoring elements as used in the scoring tables is presented in Section 5.3.6.

## 5. Use of the RBF

The RBF was announced for this assessment, based on the following rationale:

The team concluded that, in accordance with the MSC's FCP v2.2, Annex PF, Table PF1, Principle 2 may need to be scored and consequently RFB has been announced on PI 2.2.1.

| | | | |
|---|---|---|---|
| 2.1.1 Primary species outcome and 2.2.1 Secondary species outcome | Biologically based limits are available, derived either from analytical stock assessment or using empirical approaches. | Yes | Use default Performance Indicator Scoring Guideposts within default assessment tree for this PI. |
| | | No | Use Annex PF (RBF) for this PI. |

RBF has not been announced for P 1 and 3

The use of the RBF was announced followed the MSC's procedure outlined in the FCP v2.2, Annex PF, Section PF2.1.

A key purpose of the site visit is to collect information and speak to stakeholders with an interest in the fishery. For those parts of the assessment involving the MSC's Risk Based Framework (RBF, see msc.org), we will be using a stakeholderdriven, qualitative and semi-quantitative analysis during the site visit. To achieve a robust outcome from this consultative approach, we rely heavily on participation of a broad range of stakeholders with a balance of knowledge of the fishery. We encourage any stakeholders with experience or knowledge of the fishery to participate in these meetings.

### 10.2.4 Modified assessment tree

A variation request was accepted by the MSC to modify the Default Assessment Tree for P2, Ecosystem management (PI 2.5.2) in order to reflect the fact that the Red King Crab and Opilio Snow crab is an introduced species.

Red King Crab (UoA 1) – The introduction was deliberate and occurred at least 20 years prior to the date the application is made for assessment against the MSC standard (the introduction occurred in the 1960s).

Opilio Snow Crab (UoA 2) -The introduction was non-deliberate and occurred at least 20 years prior to the date the application is made for assessment against the MSC standard (first found in benthos surveys grab samples 1996).

Modified text is marked in highlighted green.

| PI 2.5.2 | | There are measures in place to ensure the UoA does not pose a risk of serious or irreversible harm to ecosystem structure and function. | | |
|---|---|---|---|---|
| Scoring Issue | | SG 60 | SG 80 | SG 100 |
| a | Management strategy in place91 | | | |
| | Guidepost | There are measures in place in the fishery to prevent further ecosystem impacts that may have occurred as a result of the introduction of the species. | There is a partial strategy in place in the fishery to prevent further ecosystem impacts that may have occurred as a result of the introduction of the species. | There is a strategy that consists of a plan, in place in the fishery to prevent further ecosystem impacts that may have occurred as a result of the introduction of the species. |
| | Met? | | | |
| | Justification | | | |
| b | Management strategy evaluation | | | |
| | Guidepost | The **measures** are considered likely to work, based on plausible argument (e.g., general experience, theory or comparison with similar fisheries/ ecosystems). | There is **some objective basis for confidence** that the measures/partial strategy will work, based on some information directly about the UoA and/or the ecosystem involved | **Testing** supports **high confidence** that the partial strategy/strategy will work, based on information directly about the UoA and/or ecosystem involved |
| | Met? | | | |
| | Justification | | | |
| c | **Management strategy implementation** | | | |

| | | | | |
|---|---|---|---|---|
| PI 2.5.2 | | There are measures in place to ensure the UoA does not pose a risk of serious or irreversible harm to ecosystem structure and function. | | |
| | Guidepost | | There is **some evidence** that the measures/partial strategy is being **implemented successfully**. | There is clear evidence that the partial strategy/strategy is being implemented successfully and is achieving its objective as set out in scoring issue (a). |
| | Met? | | | |
| | Justification | | | |
| References | | | | |
| OVERALL PERFORMANCE INDICATOR SCORE: | | | | |
| CONDITION NUMBER (if relevant): | | | | |

## 10.3 Peer Review reports

**To be drafted at Public Comment Draft Report stage**

The CAB shall include in the report unattributed reports of the Peer Reviewers in full using the relevant templates. The CAB shall include in the report explicit responses of the team that include:

- Identification of specifically what (if any) changes to scoring, rationales, or conditions have been made; and,
- A substantiated justification for not making changes where Peer Reviewers suggest changes, but the team disagrees.

Reference(s): FCP v2.2 Section 7.14

## 10.4 Stakeholder input

**To be drafted at Client and Peer Review Draft Report stage**

The CAB shall use the 'MSC Template for Stakeholder Input into Fishery Assessments' to include all written stakeholder input during the stakeholder input opportunities (Announcement Comment Draft Report, site visit and Public Comment Draft Report). Using the 'MSC Template for Stakeholder Input into Fishery Assessments', the team shall respond to all written stakeholder input identifying what changes to scoring, rationales and conditions have been made in response, where the changes have been made, and assigning a 'CAB response code'.

The 'MSC Template for Stakeholder Input into Fishery Assessments' shall also be used to provide a summary of verbal submissions received during the site visit likely to cause a material difference to the outcome of the assessment. Using the 'MSC Template for Stakeholder Input into Fishery Assessments' the team shall respond to the summary of verbal submissions identifying what changes to scoring, rationales and conditions have been made in response, where the changes have been made, and assigning a 'CAB response code'.

Reference(s): FCP v2.2 Sections 7.15, 7.20.5 and 7.22.3

## 10.5 MSC Technical Oversight

**To be drafted at Public Comment Draft Report**

## 10.6 Conditions – delete if not applicable

**To be drafted at Client and Peer Review Draft Report stage**

The CAB shall document in the report all conditions in separate tables.

Reference(s): FCP v2.2 Section 7.18, 7.30.5 and 7.30.6

**Table 46: Condition 1**

| | |
|---|---|
| Performance Indicator | |
| Score | *State score for Performance Indicator.* |
| Justification | *Cross reference to page number containing scoring template table or copy justification text here.* |
| Condition | *State condition.* |
| Condition deadline | *State deadline for the condition.* |
| Exceptional circumstances ☐ | *Check the box if exceptional circumstances apply and condition deadline is longer than the period of certification (FCP v2.2 7.18.1.6). Provide a justification.* |
| Milestones | *State milestones and resulting scores where applicable.* |
| Verification with other entities | *Include details of any verification required to meet requirements in FCP v2.2 7.19.8.* |
| *Complete the following rows for reassessments.* | |
| Carried over condition ☐ | *Check the box if the condition is being carried over from a previous certificate and include a justification for carrying over the condition (FCP v2.2 7.30.5.1.a).*<br><br>*Include a justification that progress against the condition and milestones is adequate (FCP v2.2 7.30.5.2). The CAB shall base its justification on information from the reassessment site visit.* |
| Related condition ☐ | *Check the box if the condition relates to a previous condition that was closed during a previous certification period but where a new condition on the same Performance Indicator or Scoring Issue is set.*<br><br>*Include a justification – why is a related condition being raised? (FCP v2.2 7.30.6 & G7.30.6).* |

| | |
|---|---|
| Condition rewritten ☐ | *Check the box if the condition has been rewritten. Include a justification (FCP v2.2 7.30.5.3).* |

### 10.6.1 Client Action Plan

**To be drafted at Public Comment Draft Report stage**

The CAB shall include in the report the Client Action Plan from the fishery client to address conditions.

Reference(s): FCP v2.2 Section 7.19

## 10.7 Surveillance

**To be drafted at Client and Peer Review Draft Report stage**

The CAB shall include in the report the program for surveillance, timing of surveillance audits and a supporting justification.

Reference(s): FCP v2.2 Section 7.28

**Table 47: Fishery surveillance program**

| Surveillance level | Year 1 | Year 2 | Year 3 | Year 4 |
|---|---|---|---|---|
| e.g. Level 5 | e.g. On-site surveillance audit | e.g. On-site surveillance audit | e.g. On-site surveillance audit | e.g. On-site surveillance audit & re-certification site visit |
| | | | | |

**Table 48: Timing of surveillance audit**

| Year | Anniversary date of certificate | Proposed date of surveillance audit | Rationale |
|---|---|---|---|
| e.g. 1 | e.g. May 2018 | e.g. July 2018 | e.g. Scientific advice to be released in June 2018, proposal to postpone audit to include findings of scientific advice |
| | | | |

**Table 49: Surveillance level justification**

| Year | Surveillance activity | Number of auditors | Rationale |
|---|---|---|---|

| | | | |
|---|---|---|---|
| e.g.3 | e.g. On-site audit | e.g. 1 auditor on-site with remote support from 1 auditor | e.g. From client action plan it can be deduced that information needed to verify progress towards conditions 1.2.1, 2.2.3 and 3.2.3 can be provided remotely in year 3. Considering that milestones indicate that most conditions will be closed out in year 3, the CAB proposes to have an on-site audit with 1 auditor on-site with remote support – this is to ensure that all information is collected and because the information can be provided remotely. |
| | | | |

## 10.8 Harmonised fishery assessments

The MSC Fisheries Certification Process v2.2 (FCP) sets out procedures for ensuring consistency of outcomes in overlapping fisheries (see Annex PB of the FCP). The intention of this process is to maintain the integrity of MSC fishery assessments.

The audit team have consulted the guidance issued on the MSC's interpretation log to identify the harmonisation requirements for this fishery (see https://mscportal.force.com/interpret/s/article/What-are-the-MSC-requirements-on-harmonisation-multiple-questions-1527586957701). For each overlapping fishery, LR have considered harmonisation requirements for each PI using the table below.

### 10.8.1 MSC Directions for harmonisation between overlapping MSC fisheries

**Table 50: MSC directions for harmonisation between overlapping MSC fisheries**

| PIs / SIs | Harmonise? | Comments |
|---|---|---|
| All P1 PIs | Yes | P1 always considers the impacts of all fisheries on a stock, so any fisheries which have the same P1 species (stocks) should be harmonised. |
| PI 2.1.1a | Partially | For stocks that are 'main' in both UoAs, harmonise status relative to PRI (at SG60, 80 and 100), and if below PRI, harmonise cumulative impacts at SG80 (not at SG60). |
| PI 2.2.1a | Partially | For stocks that are 'main' in both UoAs, harmonise status relative to BBL (at SG60, 80 and 100), and if below BBL, harmonise cumulative impacts at SG80 (not at SG60). |
| PI 2.3.1a | Partially | Harmonise recognition of any limits applicable to both UoAs (at SG60, 80 and 100), and cumulative effects of the UoAs at SG80 and SG100 (not at SG60). |
| PI 2.4.1b | Partially | Harmonise recognition of VMEs where both UoAs operate in the same 'managed area/s' (as in SA3.13.5). |
| PI 2.4.2a,c | Partially | Harmonise scoring at SG100, since all fishery impacts are considered (not at SG60 or 80). |
| All P2 PIs | Yes, if -> | Two UoAs are identical in scope, even if the UoCs are different (e.g. separate clients). |
| PIs 3.1.1-3 | Yes, if -> | Both UoAs are part of the same larger fishery or fleet, or have stocks in either P1 or P2 which are at least partially managed by the same jurisdiction/s (nation states, RFMOs or others) or under the same agreements. Harmonisation may sometimes be possible for those management arrangements that apply to both UoAs (noting the limitations accepted in GPB3). |
| PIs 3.2.1-4 | Yes, if -> | Both UoAs have stocks within either P1 or P2 which are at least partially managed by the same jurisdiction/s (nation states, RFMOs or others) or under the same agreements. Harmonisation is needed for those management arrangements that apply to both UoAs, e.g. at the RFMO level but not the national level in the case of two separate national fleets both fishing the same regional stock. |

MSC fisheries overlapping fisheries have been identified as fisheries operating within scaled down managed area.. MSC Fisheries with overlapping UoCs to the UoAs under assessment here are detailed below in Table 51 and the relevant PIs which require harmonisation are shown. Please note only MSC Fisheries using the same version of the assessment tree (v2.0 or v.201) have been harmonised (MSC FCP v2.2 Annex PB 1.2.1). The scores awarded for the MSC fisheries were analysed during this re-assessment audit (see Table 53) and any differences in scoring is explained in Table 54.

**Table 51: Overlapping fisheries**

| Fishery name | Certification status and date | Performance Indicators to harmonise |
|---|---|---|
| Antey Sever Barents Sea Crab | In assessment – MSC V2.01 | All P1 PIs<br>P2 TBC<br>All P3 PIs |
| Russia Barents Sea Opilio Trap | Certified – 7th April 2020 (MSC V2.01) | All P1 PIs for UoA 2<br>P2 TBC<br>All P3 PIs |
| Russia Barents Sea Red King Crab Fishery | Certified – 22nd February 2018 (MSC V2.0) | All P1 PIs for UoA 1<br>P2 TBC<br>All P3 PIs |

**Table 52: Overlapping fisheries information**

Supporting information

| PI / SIs | Required to harmonise |
|---|---|
| **All P1 PIs** | The P1 target species for the Antey Severy Barents Sea Crab fishery should be harmonised with the two existing MSC certified fisheries on the overlapping UoAs. |
| **PI 2.1.1a** | There are no Primary Mains in the Antey Severy Barents Sea Crab fishery. |
| **PI 2.2.1a** | There are no Secondary Mains in the Antey Severy Barents Sea Crab fishery. |
| **PI 2.3.1a** | There are no ETP species identified to be interacting with any of the MSC certified fisheries listed. |
| **PI 2.4.1b** | Recognition of VMEs in the scaled down managed area – there are no VMEs, as defined by the MSC standard, recognized in the area. |
| **PI 2.4.2 a, d** | PI 2.4.2 (a) for all overlapping fisheries are not scored at SG 100 where all impacts of MSC UoAs are considered.<br>PI 2.4.2 (d) for all overlapping fisheries is scored as NA. LR note however that with the potential range expansion of Snow Crab there is potential for UoA 2 to overlap with other MSC or non-MSC fisheries in the future. If so the fishery would have to comply with other MSC or non-MSC specific protection measures i.e the voluntary closed area mentioned in Section 8.2.5.3. In which case this SI would need to be scored. |
| **All P2 PIs** | Overlap will be confirmed at the site visit and if appropriate all P2 PIs will be harmonised. |
| **PIs 3.1.1 – 3.1.3** | All overlapping MSC fisheries should be harmonised. |

| PI 3.2.1 – 3.2.4 | All overlapping MSC fisheries should be harmonised. |
|---|---|
| Was either FCP v2.2 Annex PB1.3.3.4 or PB1.3.4.5 applied when harmonising? | **Yes / No** |
| Date of harmonisation meeting | **DD / MM / YY** |
| If applicable, describe the meeting outcome | |
| - e.g. Agreement found among teams or lowest score adopted. | |
| | |

**Table 53: Scoring differences**

| Principle | Performance Indicators | | Russia Barents Sea Opilio Trap | Russia Barents Sea Red King Crab | Antey Sever Barents Sea Crab UoA 1 (RCK) | Antey Sever Barents Sea Crab UoA 2 (Opilio) |
|---|---|---|---|---|---|---|
| 1 | 1.1.1 | Stock status | 90 | 90 | ≥ 80 | ≥ 80 |
| | 1.1.2 | Stock rebuilding | N/A | N/A | N/A | N/A |
| | 1.2.1 | Harvest strategy | 80 | 85 | ≥ 80 | ≥ 80 |
| | 1.2.2 | Harvest control rules & tools | 80 | 80 | ≥ 80 | ≥ 80 |
| | 1.2.3 | Information & monitoring | 75 | 80 | 60 - 80 | 60 - 80 |
| | 1.2.4 | Assessment of stock status | 75 | 90 | ≥ 80 | ≥ 80 |
| 2 | 2.1.1 | Outcome | 100 | 100 | ≥ 80 | ≥ 80 |
| | 2.1.2 | Management | 90 | 90 | ≥ 80 | ≥ 80 |
| | 2.1.3 | Information | 85 | 90 | ≥ 80 | ≥ 80 |
| | 2.2.1 | Outcome | 80 | 85 | ≥ 80 | ≥ 80 |
| | 2.2.2 | Management | 90 | 90 | ≥ 80 | ≥ 80 |
| | 2.2.3 | Information | 90 | 90 | ≥ 80 | ≥ 80 |
| | 2.3.1 | Outcome | 90 | 100 | ≥ 80 | ≥ 80 |
| | 2.3.2 | Management | 85 | 100 | ≥ 80 | ≥ 80 |
| | 2.3.3 | Information | 70 | 90 | 60 - 80 | 60 - 80 |
| | 2.4.1 | Outcome | 85 | 100 | ≥ 80 | ≥ 80 |
| | 2.4.2 | Management | 80 | 85 | ≥ 80 | ≥ 80 |
| | 2.4.3 | Information | 80 | 85 | ≥ 80 | ≥ 80 |

| Principle | Performance Indicators | | Russia Barents Sea Opilio Trap | Russia Barents Sea Red King Crab | Antey Sever Barents Sea Crab UoA 1 (RCK) | Antey Sever Barents Sea Crab UoA 2 (Opilio) |
|---|---|---|---|---|---|---|
| | 2.5.1 | Outcome | 90 | 90 | ≥ 80 | ≥ 80 |
| | 2.5.2 | Management | 80 | 80 | ≥ 80 | ≥ 80 |
| | 2.5.3 | Information | 85 | 90 | ≥ 80 | ≥ 80 |
| 3 | 3.1.1 | Legal & customary framework | 95 | 95 | ≥ 80 | ≥ 80 |
| | 3.1.2 | Consultation, roles & responsibilities | 85 | 100 | ≥ 80 | ≥ 80 |
| | 3.1.3 | Long term objectives | 80 | 100 | ≥ 80 | ≥ 80 |
| | 3.2.1 | Fishery specific objectives | 90 | 90 | ≥ 80 | ≥ 80 |
| | 3.2.2 | Decision making processes | 95 | 95 | ≥ 80 | ≥ 80 |
| | 3.2.3 | Compliance & enforcement | 80 | 80 | ≥ 80 | ≥ 80 |
| | 3.2.4 | Monitoring & management performance evaluation | 70 | 70 | 60 - 80 | 60 - 80 |

**Table 54: Rationale for scoring differences**

| |
|---|
| If applicable, explain and justify any difference in scoring and rationale for the relevant Performance Indicators (FCP v2.2 Annex PB1.3.6). |
| The only material scoring difference is on PI 1.2.4, where Russia Barents Sea Opilio trap fishery scored at 75 and had a condition attached to it, while the Russia Barents Sea Red King Crab fishery, as well as the two UoAs of the present assessment, scored at 90. At the time of the assessment of the Russia Barents Sea Opilio trap fishery, the application of the Bayesian stock production model to the Barents Sea stock was a newly developed approach. Model results were presented between the publication of the ACDR and the site visit. There has not yet been sufficient time for a formal internal or external peer review of this latest stock assessment approach. Consequently, the assessment team was unable to award 80 points to SG 1.2.4e. However, by this date, the assessment went through the path of standard review process, which includes internal review by the Scientific Council of PINRO, the Scientific Council of the head institute VNIRO of the FFA research institutes network and the Ecological Council of the Ministry of Nature, as a part of regular annual stock assessment and TAC evaluation and approval. Based on this information, the LR assessment team believed that SG80 was met for P1.2.4.e (Peer review of the assessment) at the time of evaluation in November 2020, resulting in the overall score of 90 for P1.2.4 .<br><br>Some PIs for P2 also score differently within the 80-100 range. It is to be expected that these gaps will be tightened as more information is gathered at the site visit. Some guideposts explicitly ask about perceptions that can only be checked in direct interviews with stakeholders. |
| If exceptional circumstances apply, outline the situation and whether there is agreement between or among teams on this determination. |

## 10.9 Objection Procedure – delete if not applicable

### To be added at Public Certification Report stage

The CAB shall include in the report all written decisions arising from the Objection Procedure.

Reference(s): MSC Disputes Process v1.0, FCP v2.2 Annex PD Objection Procedure

# 11 Template information and copyright

This document was drafted using the 'MSC Reporting Template v1.2'.



**Template version control**

| Version | Date of publication | Description of amendment |
|---|---|---|
| 1.0 | 17 December 2018 | Date of first release |
| 1.1 | 29 March 2019 | Minor document changes for usability |
| 1.2 | 25 March 2020 | Release alongside Fisheries Certification Process v2.2 |

A controlled document list of MSC program documents is available on the MSC website (msc.org).

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