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8 July 2015

TO:
President
Vice President
Heads of Delegation
All Contracting Parties

Reference: HOD 15/52

Proposed exploratory fisheries No.3 by the European Union – Notice of Intent

With reference to Recommendation 19:2014, please find attached a further letter from the EU regarding a proposal for exploratory bottom fishing in the NEAFC Regulatory Area (international waters of the Barents Sea), which I am sure you will find self-explanatory.

Please note that this is a separate proposal from those circulated on 1 April (HOD 15/32) and 19 June (HOD 15/46).

Yours sincerely

Stefán Ásmundsson

Stefán Ásmundsson
Secretary

Ref. Ares(2015)2871996 - 08/07/2015

EUROPEAN COMMISSION
DIRECTORATE-GENERAL FOR MARITIME AFFAIRS AND FISHERIES

ATLANTIC, OUTERMOST REGIONS AND ARCTIC
ADVISER NORWAY AND NEAFC

Brussels,
MARE C/AT

Mr Stefan Asmundsson
Secretary
North-East Atlantic Fisheries
Commission
22 Berners Street
London
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UNITED KINGDOM

Subject: **Proposed exploratory fisheries No. 3 by the European Union – Notice of Intent**

Dear Mr Asmundsson,

Please find enclosed a copy of an assessment report on a proposal for exploratory bottom pot fishing in the NEAFC Regulatory Area (international waters of the Barents Sea – Loophole).

This proposal is submitted in line with Articles 6 and 7 of Recommendation 19:2014 and should be submitted to Contracting Parties, as well as to PECMAS, for review. Following this assessment, and should the Commission approve the project, it is the intention that exploratory bottom fisheries would start later in 2015.

In view of the fact that no PECMAS meeting is foreseen to take place before October 2015, and in accordance with Article 7 (3) of the Recommendation, the Union would request that PECMAS should undertake its evaluation of the submitted documentation through correspondence. In any case, this evaluation by PECMAS should be carried out within three months of the submission of the Notice of Intent and the Commission should either give or withhold its approval within 30 days of the subsequent advice from PECMAS.

Please let me know if there is any need for further clarification.

John Spencer
Head of Delegation
of the European Union

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Proposal of Exploratory bottom pot fishing of Snow crab (*Chionoecetes opilio)* in the international waters of the Barents Sea (NEAFC Regulatory Area 3 Loophole) and preliminary assessment of impact to the vulnerable marine ecosystem

Riga, 2015

Contents

1. Introduction

This Proposal of Exploratory bottom pot fishing was prepared according to the Recommendation on the protection of vulnerable marine ecosystems in the NEAFC Regulatory Area **(***Recommendation 19 2014: Protection of VMEs in NEAFC Regulatory Areas as Amended by Recommendation 09:2015).*

According to the Article 7 of the Recommendation 09:2015 the preliminary Assessment of impact to the vulnerable marine ecosystem by the bottom pot fishing in the international waters of the Barents Sea (Loophole) has been made for the submission to the Secretary.

Relevant general information on the bottom topography, water mass circulation, seabed type and composition of sediments were gathered. Based on the available scientific information the benthic communities in the proposed fishing area are described and potentially vulnerable taxa are noted.

Information on Latvian snow crab catches in the existing bottom fishing area, fishing fleet capacity, description of fishing gears and setting/hauling procedure are presented in the Proposal.

In line with Article 6 of Recommendation 09:2015 the following plans of respective exploratory bottom fishing activities are proposed: harvesting plan; mitigation plan; catch monitoring plan; data collection plan.

2. Review of the Barents Sea Ecosystem

2.1. General Information

The Barents Sea is one of the continental shelf-seas surrounding the Arctic Ocean. It is situated between 70° and 80° N and bordered by the Norwegian Sea to the west, the Norwegian and Russian mainland to the south and Novaya Zemlya to the east (Ozhigin *et al*., 2011). The average depth is 230 m. There is a gradual increase in depth toward the Norwegian Sea and the Arctic Ocean, and a maximum depth at the western entrance is about 500 m. There are several shallow banks, with depths between 50–200 m, which make up more than one-third of the area of the Barents Sea. The Central Bank, one of the most widespread banks, lies in the centre of the Barents Sea; its depth varies from 150 to about 300 m.

The general pattern of water mass circulation in the Barents Sea is influenced by the bottom topography and dynamic interaction between warm Atlantic water from west and cold Arctic water penetration from north and northeast. The border area between the Atlantic and Arctic water masses forms the oceanographic Polar Front, which is characterized by strong gradients, in both temperature and salinity. Polar Front separates the western Barents Sea, where the front position is relatively stable, and the eastern part where the front position has large seasonal and interannual fluctuations (ICES, 2008).

In turn currents and topography to a large degree determine the seabed type and composition of sediments (Loeng, 1991*;* Ozhigin *et al.,* 2011, Jørgensen *et al.,* 2015a). The bottom sediments change with water depth and relief (slope) of the seabed. Finer mud substrates predominate in deeper areas with slow bottom-water movement, whereas sandy to stony substrates are common on shallower banks with stronger currents (Vinogradova and Litvin, 1960).

2.1.1. Exploratory fishing area

The proposed exploratory fishing area lies in the central part of the Barents Sea outside of the existing bottom fishing grounds of the NEAFC Regulatory Area 3 Loophole (Fig. 1). The area is partly situated on the east and south-east slopes of the Central Bank at the depth of 150-200 m and spreads toward the northeast and southeast till the depths of about 300 m.

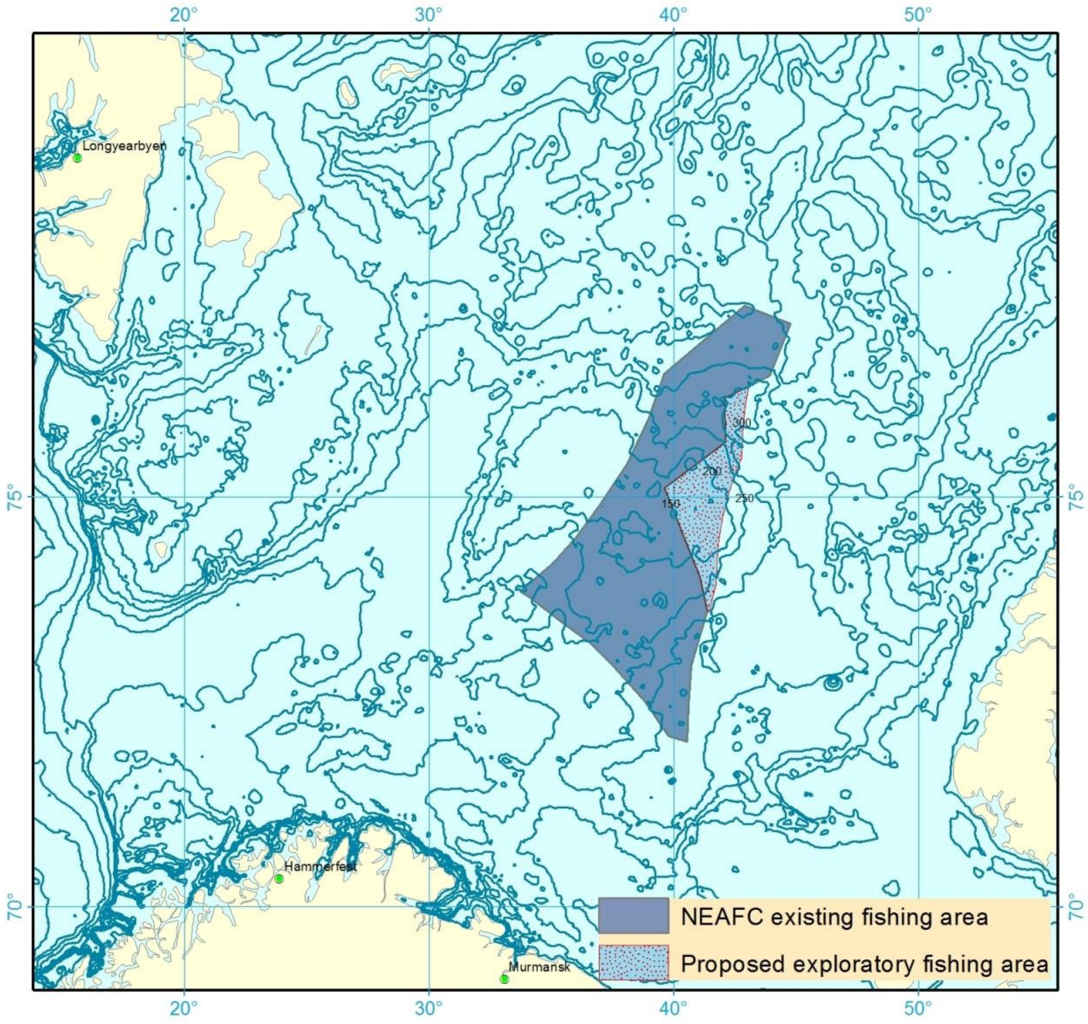

Figure 1. Location of the proposed exploratory fishing area. This map was prepared with ArcMap 10.3.1 (GCS_WGS_1984). Bathymetry (IOC, IHO and BODC, 2003).

The detailed information on the seabed in the central part of the Barents Sea, based on high-resolution imagery, is not available. The information on spatial distribution of surface sediments according to Lepland *et al*. (2014) was used to characterize the proposed exploratory area. Accordingly this basic map published on

Barents Portal, the seabed in the largest part of the area is mostly covered by gravelly sandy mud. The shallowest small part in the west is dominated by gravelly and sand, or gravelly muddy sand; whereas the northern part is covered by mud and sandy mud (Fig. 2).

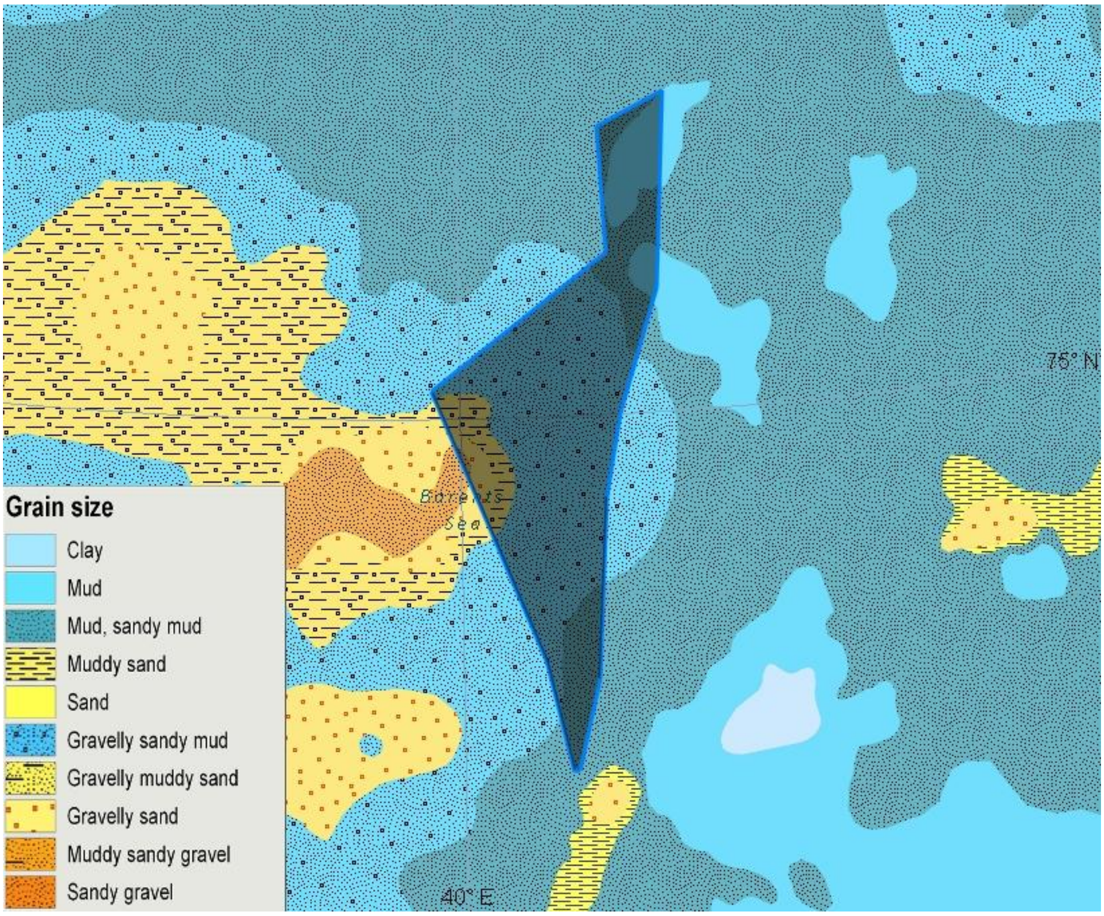

Figure 2. Seabed sediments of the Barents Sea. Blue line shows the contour of the proposed exploratory fishing area. Source for base sediment map: http://geodata.npolar.no/barentsportal

Source for grain size labels: Lepland, A., Rybalko A. and Lepland A.(2014) Seabed Sediments of the Barents Sea. Scale 1:3000000. Geological Survey of Norway (Trondheim) and SEVMORGEO (St. Petersburg).

2.2. Benthic fauna of the Barents Sea

The majority of benthos species in the Barents Sea belongs to widely distributed Arctic boreal and Arctic high-boreal biogeographic groups. The taxonomic groups with highest species numbers are *Polychaeta*, *Hydroidea*, *Mollusca*, *Crustacea* and *Bryozoa* (GIWA, 2004). Faunal groups' distribution, abundance and structure of benthic communities are to be influenced by three main environmental factors – current, type of seabed and spatial distribution of Arctic/Atlantic water boundary. Most of the shallow banks are characterized by rich and diverse epifaunal communities compared to the deeper areas. The highest benthos biomasses in the

Barents Sea are generally found around Bear Island, and on the banks such as Spitsbergen and Central Bank (Gulliksen *et al.*, 2009).

Investigation of benthic macrofauna and productivity regimes in the central and southern parts of the Barents Sea identified three faunal complexes – northern, southern and Hopen (Cochrane *et al.*, 2009) and showed that the northern and southern faunal groups are separated by the northern-most penetration of Atlantic Water in the bottom water. The northern group was reported to be dominated in biomass by *echinoderms*, followed by *molluscs*, and with a lesser representation of *annelids* and other taxa. The southern biocenosis was dominated in almost equal proportions by *molluscs*, *annelids* and *echinoderms*, with lower amounts of *crustaceans* and other taxa (Cochrane *et al*., 2009).

Based on the analysis of joint Norwegian–Russian Ecosystem Survey data, the geographical distribution pattern of benthic megafauna in the Barents Sea in 2011 was presented as a baseline mapping for long-term monitoring possible future changes (Jørgensen *et al*, 2015a), including increasing of snow and red crab populations. The 2011 dataset included the analysis of 354 taxa (218 were identified to species level). The four main megafaunal subregions were detected in relation to depth, temperature, salinity, and number of ice-days: the southwestern (SW), southeast and west (SEW), northwestern (NW) and northeastern (NE) subregions. The SW subregion is dominated by filter-feeders (sponges). Banks/slopes in SEW subregion are dominated by predators (sea stars, anemones and snow crabs) together with filtrating species (sea cucumber and bivalves). Plankton-feeding brittlestars are common in the NW and NE subregions, with increasing snow crab population in NE (Jørgensen *et al*, 2015a). These large subregions were further divided into 19 local areas totally according to the similarity levels of 42-62 %.

2.2.1. Benthic fauna in the proposed exploratory fishing area

There is no detailed information on benthic fauna composition especially for exploratory fishing area. However, based on the mapping of benthic megafauna (Jørgensen et al., 2015a, 2015b) it is possible to give some overall estimation of benthic assemblages in the area. The area is located on an approximate border between NW and NE megafaunal regions. Consequently, benthic megafauna of the proposed fishing area can be characterised by both NW and NE faunal groups of benthic organisms.

Relatively shallow depths, mainly east slopes of the Central bank (92-226 m) are covered by Arctic or modified Atlantic waters and coarser sediments than the deeper zones. These areas have the highest number of species and moderate biomass.

The dominating taxa are the following:

sea urchins *Strongylocentrotus spp. (Strongylocentrotidae*);
brittle stars *Gorgonocephalus spp. (Gorgonocephalidae);*
shrimp *Sabinea septemcarinata*;
sea lily *Heliometra glacialis (Antedonidae)*;
sea stars *Urasterias linckii (Asteriidae), Ctenodiscus crispatus (Ctenodiscidae*);

sea cucumber *Molpadia borealis (Molpadiidae);*
bryozoan *Alcyonidium spp.* ***(Alcyonidiidae)****;*
soft corals *Drifa glomerata, Duva florida, Gersemia spp. (****Nephtheidae****).*

Among all mentioned taxa, *Alcyonidiidae* (*Bryozoa*) and soft corals *Nephtheidae* are considered as VME indicators for Habitat type of Cauliflower coral fields and Bryozoan patches. Sea lily *Heliometra glacialis (Antedonidae*) is not included to the list of VME indicators but considered as vulnerable benthic species with high risk at least to trawling in the Barents Sea (Jørgensen, 2015b).

The largest and deeper part of the area with depths of 200-300 m influenced by Arctic or modified Atlantic waters are covered mostly by mud and sandy mud. Number of species is moderate, but biomass - from moderate to high.

The dominating taxa are the following:

polychaete *Spiochaetopterus arcticus (Polychaeta/Sedentaria)*;
sponges *Radiella grimaldi (Polymastiidae)* and *Tetilla polyuria (Tetillidae);*
snow crab *Chionoecetes opilio;*
sea cucumber *Molpadia borealis (Molpadiidae)*;
shrimp *Sabinea septemcarinata*;
brittle stars *Ophiacanthidae, Gorgonocephalidae, Ophiuridae.*

Among sponges *Radiella grimaldi* and *Tetilla polyura* can be considered as representatives of families included in the list of VME indicators (Annex 5 of Rec. 9 2015).

2.3. Identification and description of VMEs known or likely to occur in the proposed exploratory fishing area

ICES advises that in the NEAFC RA, VME indicators should be considered by habitat type and/or at the taxonomic level of family rather than by an exhaustive list of all likely species that could be indicators of VMEs. This approach avoids the risk of excluding or misidentifying any potential species, while ensuring that VMEs are appropriately recognised (*ICES, 2013).*

According to the *Recommendation 09:2015* (NEAFC, 2015) the list of VME indicator species by habitat types with the taxa most likely to be found (*Annex 5 of Recommendation 09:2015*) is used to evaluate the possibility of VME indicators occurrence in the proposed exploratory fishing area. Based on integrated information, including supplementary data from the reports of Russian-Norwegian surveys and publications (Anisimova *et al.*, 2010; Eriksen, 2012; Lubin and Mashnin, 2013; Jørgensen et al., 2015a, 2015b) it may be concluded that totally 10 taxa (on the family level) correspond to the List of VME indicators (Table 1). Some of them could potentially be found in the proposed fishing area. For several taxa listed in the table the likelihood of their occurrence is rather low or negligible.

Table 1. List of benthic taxa (families) and their Habitat types (VME indicators) that could potentially be found in proposed exploratory fishing area.

VME Habitat type	Representative taxa
Cup-coral fields	*Flabellidae*
Cauliflower coral fields	*Nephtheidae*
Deep-sea sponge aggregations	*Geodiidae, Ancorinidae, Pachastrellidae, Axinellidae, Mycalidae, Polymastiidae, Tetillidae*
Bryozoan patches	*Bryozoa*

2.4.Preliminary assessment of potential impact on benthic communities in the proposed fishing area

In comparison with other fishing gears pot fishing is assumed to cause little or moderate damage to seafloor and its living structures (Chuenpagdee *et al*., 2003; Donaldson *et al.*, 2010). Pots may physically damage bottom habitats during setting and hauling or flatten structural components of corals and seagrasses, while fishing. Habitat damage by pots depends on size, weight and pot material, as well as hauling depth and speed and ocean conditions (Donaldson *et al.*, 2010). The most damage occurs when pots and pot lines are dragged along the seafloor during storms.

The available information on direct impact of potting activities is known mostly from the other fishing grounds at shallower depths (Johnson, 2002). These studies show that pot fishing on hard bottoms or reefs have some adverse impact on sensitive habitats and may strongly affect stony corals, gorgonians and sponge aggregations. The size of damage may be reduced through implementation of appropriate mitigation measures. Furthermore, some observations demonstrated a recovery of several benthic organisms (gorgonians and sea pens) from pot impact (Johnson, 2002).

Information on the response of benthic communities to the impact of pot fishing in deep waters is currently limited. Generally, in deep water, pots have smaller impact on the seafloor and non-target benthic species (Donaldson *et al.*, 2010). Deep water pots are significantly less affected by wave action as well as biological fouling.

There is no information on the impact of pots to bottom habitats and benthic communities in the Barents Sea, while the damage from trawl fishery is discussed quite widely. The latest study relevant to vulnerability of the Barents Sea benthic species to trawling has assessed the risk of being caught or damage by bottom trawl (Jørgensen, 2015b). The authors have estimated different taxa by their morphological traits, mainly body size, shape, sediment position and identified 23 species with large body weight and upraised, which are consequently “easily caught” by a bottom trawl. Some observations of crustacean pot fishing revealed that the habitats and their communities appeared relatively unaffected by potting, but also emphasised that some erect and delicate organisms might be injured or become permanently detached on contact with pots and traps (Eno *et al*, 2001).

The seabed in the largest deeper part of the proposed fishing area is dominated by mud or sandy mud sediments (Fig. 2). The most abundant benthic taxa (polychaetes, sponges, crustaceans and echinoderms) in this part of the area are mentioned above (Chapter 2.2.1.).

The shallower smaller part of the area is covered by gravelly muddy sand and dominated by echinoderms, bryozoans and cnidarians (soft corals). This type of seabed rather makes the presence of the Nephteidae family (Anisimova *et al*., 2010), which is considered as VME indicator (*NEAFC, 2015*).

Based on the estimation of species vulnerability (Jørgensen et al., 2015b) the representatives of genus *Gorgonocephalus spp.(Gorgonocephalidae)* as well as sea lily *Heliometra glacialis (Antedonidae*), *Molpadia borealis (Molpadiidae)* and two species of sponges *Radiella grimaldi* and *Tetilla polyura* have the high-risk to be damaged by bottom trawling, while the species of *Bryozoa* are less sensitive (low- and medium risk). It can be assumed that pots also might cause certain damage to these sensitive benthic species.

On the base of available information the possible impact of exploratory pot fishing on bottom habitats is initially considered to be moderate. More detailed studies on benthic fauna in actual and proposed fishing zones, including spatial distribution of VME species and habitats, are needed.

It is expected that implementation of measures described in the mitigation plan (Chapter 5.2.) will prevent the potential Significant Adverse Impacts (SAI) of the pot fishery on the most sensitive benthic habitats and species. In addition, the exploratory fishing will obviously expand the existing knowledge of benthofauna vulnerability in this area and possible impact of bottom pot fishing.

3. Description of the target species Snow Crab

The snow crab *Chionoecetes opilio* (O. Frabricius, 1788) (Brachyura, Oregoniidae) is widely distributed in subarctic and arctic regions, including the north Pacific and the northwest Atlantic. It is a benthic shelf and upper slope species, inhabiting sand or muddy bottoms over wide range of depths. Males and females are segregated over most of the year, males occurring on mud bottoms in deeper waters whereas females occur on shallower sand-gravel or rocky bottoms (FAO). Snow crab females undergo a terminal molt to maturity and reach a maximum size of 44-95 mm carapace width (CW). Males are much larger than females; they continue to molt after attaining maturity at 51-80 mm CW and can reach a size of approximately 160 mm (Davidson *et al*., 1985).

The snow crab is the most recent large-bodied decapod that has become invasive to the Barents Sea in addition to the red king crab *Paralithodes camtschaticus*.

The snow crabs in the Barents Sea were found at depths of 40 - 380 m, mostly at 100 - 300 m (Agnalt *et al*., 2010), in water temperature range from -0, 6 °C to +5, 9°C (Pavlov & Sokolov, 2003).

The recent studies show the snow crab adaptation to the northeast Atlantic and clearly recognize the establishment of its self-recruiting population in the Barents Sea (Alvsvag *et al.*, 2009).

The ecological role of snow crab in the Barents Sea is a subject of a number of studies and future impact of this new species on the existing Barents Sea ecosystem is discussed (Jørgensen & Spiridonov, 2013). The snow crabs feed on diverse benthic prey - polychaetes, crustaceans, molluscs, echinoderms, fishes, etc. (Sundet**,** 2014).

The investigations demonstrate that its distribution area in the Barents Sea is continually increasing (Kuzmin, 2001; Pavlov & Sokolov, 2003; Agnalt *et al*., 2010). Based on the data from the joint annual Norwegian – Russian Ecosystem survey covering almost the entire Barents Sea, the distribution of the crab has increased rapidly since 2004 (Sundet**,** 2014). The snow crab in the Barents Sea is expected to spread further north and west (ICES, 2014). The extent of distribution and crab density indices reveals that the total stock must be considerable (ICES, 2014) and has potential for its commercial fishery in the Barents Sea.

4. The snow crab fishery in the Barents Sea in 2013-2015

4.1. International bottom pot fishing

The snow crab has recently become the object of commercial fishing in the Barents Sea. Fishery of snow crab was started by Norway, Russia and Spain and 563 tons of snow crab were landed by five fishing vessels in 2013. These countries were joined by Lithuania and Latvia in 2014. In total 21 fishing vessels from five countries were already involved to the fishing and 8004 tons of snow crabs were landed by the end of 2014. High level of snow crab stock and the commercial success of snow crab fishery in the Barents Sea increase the interest in this type of fishing and guarantee the tendency to growth for 2015 and coming years.

The latest data on catches and number of fishing vessels by country are shown in the tables 2 and 3.

Table 2. Landing of snow crab in the Barents Sea in 2013-2014 (PINRO data, Bakanev and Pavlov, 2015)

Year	Russia	Norway	Other countries	Total
2013	62	189	312*	563
2014	4104	1650*	2250*	8004

* Expert assessment of catches

Table 3. Number of vessels involved in the snow crab fishery in the NEAFC RA3 in the Barents Sea in 2013-2014

Year	Russia	Norway	Spain	Lithuania	Latvia	Total
2013	2	2	1	-	-	5
2014	12*	4	1	2	2**	21

Sources: Bakanev, 2014; * PINRO data, Bakanev and Pavlov, 2015;** Latvian national data

4.2. Latvian bottom pot fishing

Latvian fishing vessels started snow crab fishing in the Barents Sea (in the NEAFC Regulatory Area 3 Loophole) in July 2014. Two Latvian fishing vessels caught 229 tons in 2014. There were 8 vessels involved in the snow crab fishery in 2015 and their total catch reached around 870 tons (provisional data by the end of June).

4.2.1. Fleet description

Latvian crab fishing fleet is dominated by 25-30 year old vessels (LOA 54 - 61 m, EC tonnage 622 -1211, kW 736 - 2207) with the total main engine power 8397 kW and the total tonnage 5926 GT. All technical parameters are listed in the table below.

Table 4. Capacity of the Latvian fishing vessels involved in the snow crab fishery in the NEAFC RA 3 in the Barents Sea. (on 01.07.2015).

Registration number	Vessel name	Total Length, m	Main Engine Power, KW	Tonnage EC, t	Year of Construction	Echosounder	Number of pots
LVR0834	SENATOR	61.17	2207	1211	1968	1.Simrad E160 (Fishery Echo sounder) 2.Echosouder JMC V-144	6000
LVR0847	SOLVITA	54.82	852	734	1986	Furuno	2667
LVR0848	SALDUS	54.82	853	723	1985	Furuno CV-295	2160
LVR0849	SOLVEIGA	55.75	1103	667	1986	Furuno FCV-1100L	4004
LVL2149	KALMAR	56.39	736	704	1990	SAMYUNG SDF-310	3750
LVL2150	VALKA	56.07	882	622	1988	Furuno 1150	4074
LVL2151	MEMELE	56.07	882	643	1989	SAMYUNG SDF-310	4500
LVL2152	DUBNA	56.07	882	622	1989	FURUNO FCV-1100L	4500
Total			**8397**	**5926**	**Average age 30**		**31655**

Figure 3. The Latvian crab fishing vessel SOLVEIGA.

Figure 4. The Latvian crab fishing vessel SENATOR.

Figure 5. The Latvian crab fishing vessel SALDUS.

Figure 6. The Latvian crab fishing vessel SOLVITA.

Figure 7. The Latvian crab fishing vessel DUBNA.

All Latvian vessels have navigational equipment and sonar (Table 4), and are connected to the VMS. The equipment provides early detection of lines of pots to prevent problem with lost pots.

4.2.2. Gear description

Latvian vessels use conical pots manufactured by Korea (the height of the pot is 650mm, diameter of the lower base - 1500mm, the upper entrance part with diameter of 750mm and with the selective window used to grand passage to non-commercial size crab). The upper entrance has a diameter of 550 - 350 mm, and the selective window for juveniles and females – 30 x 45mm. The pot is fitted by the net (60 - 120mm), thickness of thread is 2, 5 - 3 mm. Weight of the pot ~ 18 kg. The impact field of one pot is ~ 1, 77 m².

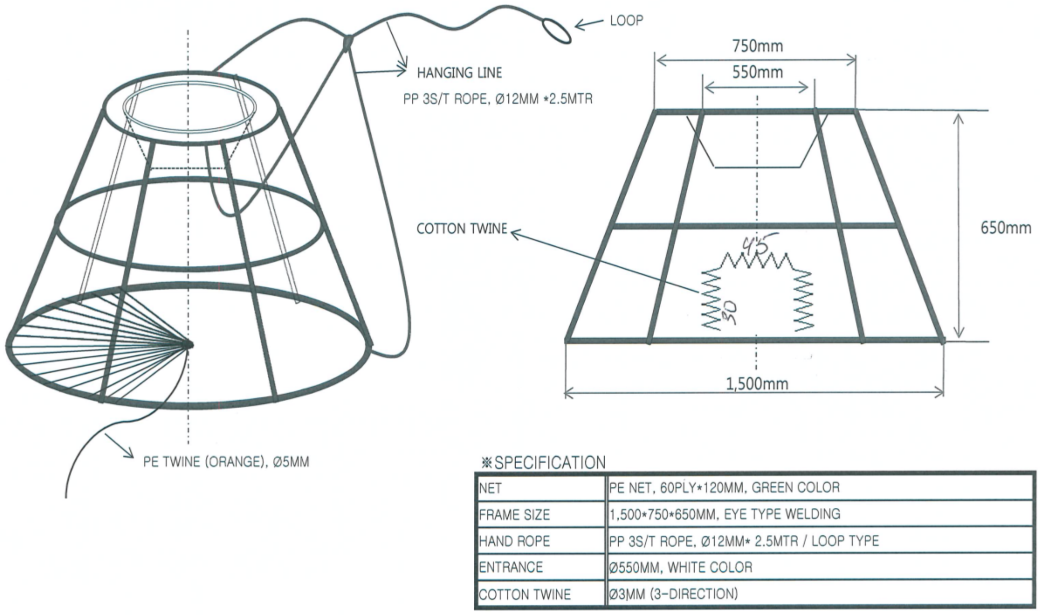

Figure 8. Scheme and specification of the conical pot.

The bait is placed inside the pot. The pots are set at a distance approximately 26m from each other and there are 108 to 200 pieces per line. Anchors (35 kg) are placed on both sides of the line.

Figure 9. The conical pot.

Figure 10. Setting the line of the crab pots.

Figure 11. Hauling the line of the crab pots.

The number of lines per vessel is from 20 to 30, the number of pots in the line - from 108 to 200. Positioning time is from 3 to 7 days, an average of 5 days. Setting procedure takes 20 - 30 minutes per line, hauling - from 1 hour 20 minutes to 2 hours per line.

The impact field of one line is about 191 – 354 m², respectively it is 3823 - 10620 m² per vessel, excluding anchors.

4.2.3. Fishing effort and catch processing

The average catch per one fishing day was 5.2 tonnes and 6.4 kg per one pot for the period of July 2014 – June 2015 (Table 5).

Processing and sorting of the catch is made manually, and by-catch is immediately discarded into water in the most gentle way.

Table 5. Catch and effort data for the Latvian fishing fleet involved in the snow crab fishery in the Barents Sea for the period July 2014 – June 2015

Catch, ton	Fishing day	CPUE (t/days)	CPUE (kg/pots)
1100	211*	5.2	6.4

*the days when hauling took place

Figure 12. The catch processing.

The by-catches in the reference period were negligible or completely absent and dominated by flounder and starfish. The VME species in the catches were not recorded.

Figure 13. The typical by-catch.

5. Proposal for the exploratory fishing activities

5.1. Harvesting plan

5.1.1. **Target species:** Snow crab (Chionoecetes opilio)

Figure 14. The snow crabs.

5.1.2. **<u>Type of bottom fishing gear:</u>** Conical pots (Figure 8, 9 and 15).

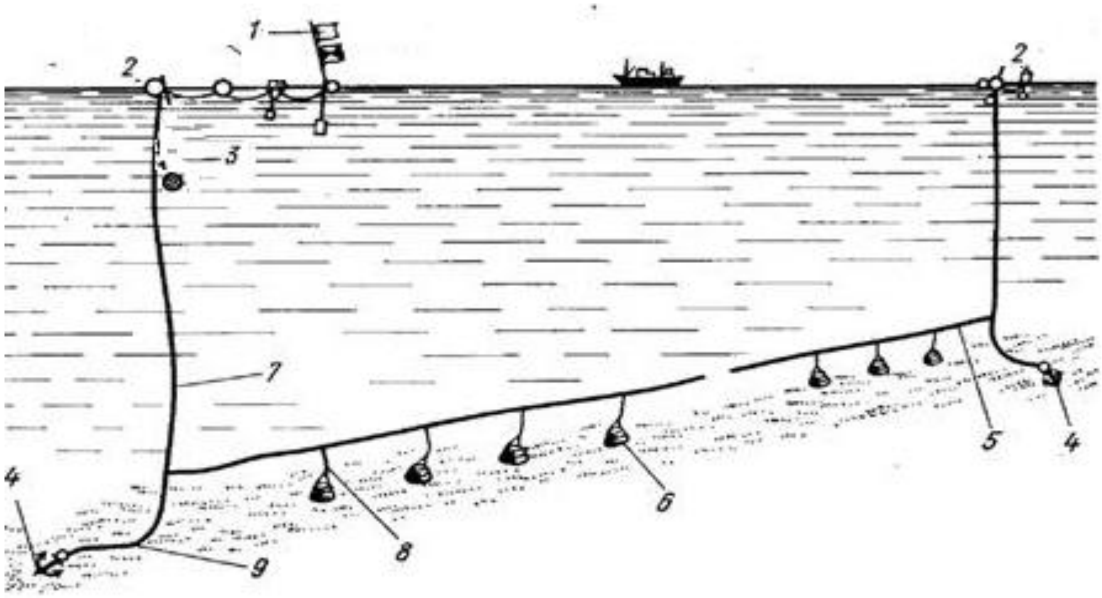

Figure 15. The line of the crab pots.

1 - a stake with a flag and a beacon; 2 - an inflatable buoy; 3 - load (3-4 kg); 4 - anchor (35 kg, for large flows – up to 80 kg); 5 - 24 mm mainline PP Rope; 6 - the pot; 7 - buoy line; 8 streamer of the pot (PP rope 12 mm); 9 - anchor chain.

5.1.3. **Proposed dates and areas:**

Exploratory fishing is supposed to be conducted by four vessels with a reduced amount of lines (no more than 10) and reduced number of pots (up to 100 per line) during the period of 12 months, to study the dynamics of the annual catch and possible by-catch of VME species. Fishing will be carried out across the water area indicated on the map (Figure 16).

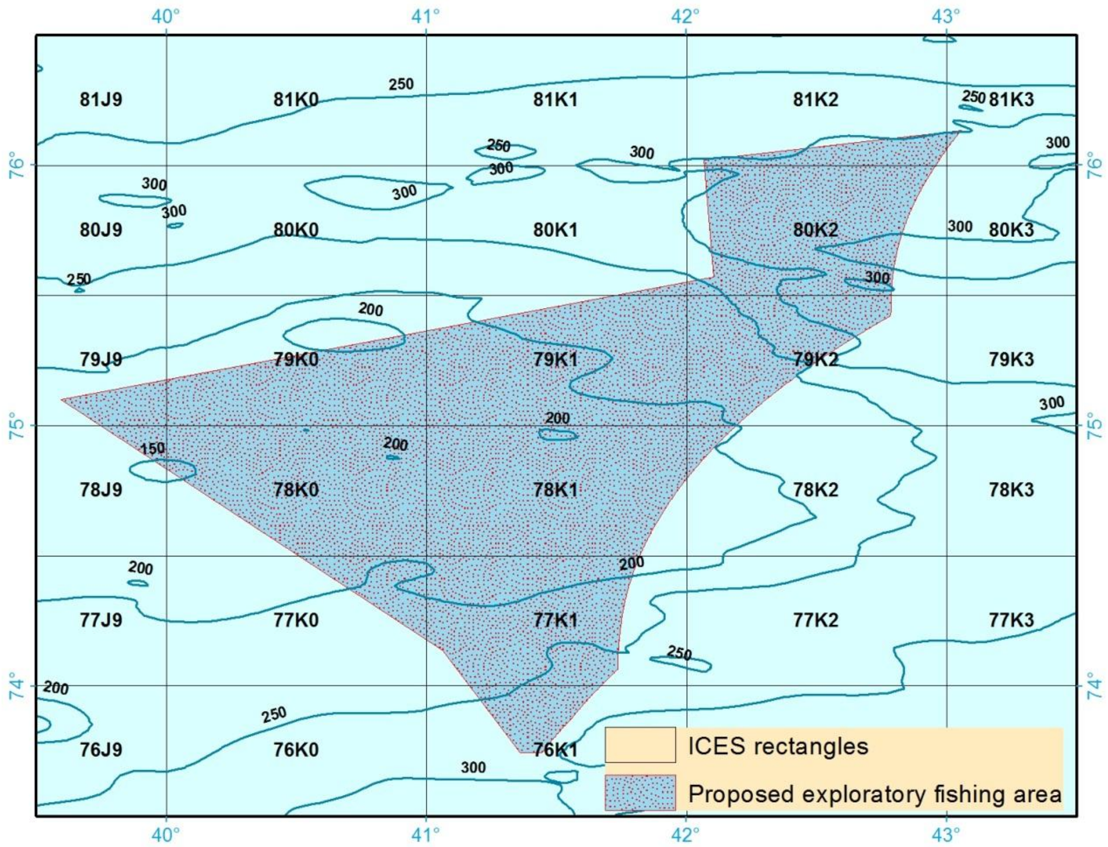

Figure 16. Proposed exploratory fishing area. This map was prepared with ArcMap 10.3.1 (GCS_WGS_1984). Bathymetry (IOC, IHO and BODC, 2003).

5.1.4. **Proposed vessels:**

Table 6. Proposed Latvian vessels for exploratory fishing

Name of vessel	SOLVEIGA	SENATOR	MEMELE	DUBNA
Registered Nr.	LVR0849	LVR0834	LVL2151	LVL2152
Call sign	YL2892	YLAC	YL2878	YL2879
Flag	Latvia	Latvia	Latvia	Latvia
Registered port	Rīga	Rīga	Liepāja	Liepāja
Owner	North Star LTD	North Star LTD	SIA ”Baltjura-Serviss”	SIA ”Baltjura-Serviss”
LOA	55.75	61.17	56.07	56.07
Tonnage EC, t	667	1211	643	622
Power	1103	2207	882	882
Year of construction	1986	1968	1989	1989
Echo-sounder	FURUNO FCV-1100L	1.Simrad E160 2.Echosouder JMC V-144	SAMYUNG SDF - 310	FURUNO FCV - 1100L

5.2.Proposals for mitigating the effects of the exploratory fishing

Exploratory fishing is a compromise between the need to obtain maximum information about the crab fishery and the need to prevent possible damage to sensitive bottom habitats (and especially sensitive VME species).

The primary measures for mitigating the effects of the exploratory fishing are proposed as follows: reducing the duration of line positioning (3-4 days) and the number of pots per vessel (up to 1000 pots for one fishing act); possibility of leaving the pots for juveniles and females of snow crab (a special hole - 30 x 45mm); the sorting of the catch with immediate release of non-commercial by-catch species and VME species.

The area of impact of the exploratory fishing on the bottom fauna in one fishing act will be 1770 m² per vessel only. Within 12 months (approximately 200 fishing days or 50 - 67 fishing acts) the area will be 88 500 – 118 590 m² per vessel, or 354 000 – 474 360 m² for 4 vessels, which is not more 0, 0053 % of the total area of exploratory fishing.

It should also be a uniform distribution of fishing effort throughout the area of exploratory fishing.

To implement the mitigation plan, the use of VMS and the obligatory presence of a qualified independent observer on board of a vessel participating in the exploratory fishing are necessary. The observer should be provided with relevant workplace, necessary materials and technologies (catch and by-catch fixation, key-books, visual material, access to Internet and VMS). It is also necessary to provide preliminary crew training for adequate recording of fishing parameters. Crew members should help the observer to sort the catch and release non-commercial species and VME species.

The vessel should also avoid areas with a high concentration of VME species if the observer indicates it.

5.3.Fishing, effort, catch and by-catch monitoring

The following activities are necessary to implement the monitoring of fishing, effort, catch and by-catch:

- the mandatory presence of an observer on board of each vessel during the entire exploratory fishing;
- complete recording of fishing locations (coordinates, depth), fishing gear, catch and fishing effort in the electronic logbook (Latvian ERS system) under the supervision of an observer;
- recording of environmental parameters by fishery observer;
- regular reporting of information (every 10 days) to the Latvian Institute BIOR for regulation of fishing and evaluation of the target species stock, as well as assessing the impact of the experimental fishery on VME species (BIOR Institute provides further disclosure NEAFC and ICES).

Table 7.1. Catch and Effort Information by Haul

Haul #	Gear #	Date (YYYYMMDD)	ICES Division	Information by Haul				Species (FAO 3-alphaSpecies Code)	Directed Species? (yes or no)	Product Form	Conversion Factor Used	Retained (kg)	Discarded (kg)
				Latitude (decimal)	Longitude (decimal)	Depth (m)	Time (UTC) (HHMM)						

Table 7.2. Effort Summary Table

ICES Division	Gear #	Directed Species	Date		# of hauls	Depth (m)		# Hours fished	# Fishing Days
			Start	Finish		Minimum	Maximum		

Table 7.3. Trip Catch Summary

ICES Division	Species	Catch		
		Retained	Discarded	Total

Table 7.4. Non-commercial and VME species data collection form by Haul

Haul #	Gear #	Date (YYYYMMDD)	ICES Division	Information by Haul				Non-commercial and VME species	Quantity in the one line
				Latitude (decimal)	Longitude (decimal)	Depth (m)	Time (UTC) (HHMM)		
1									
2									
3									

6. References

Agnalt, A.L., Jørstad, K.E., Pavlov, V.A. and Olsen, E. (2010) Recent Trends in Distribution and Abundance of the Snow Crab (*Chionoecetes opilio*) Population in the Barents Sea. In: Kruse, G.H., et al. (ed.) *Biology and management of exploited crab populations under climate change*. Fairbanks, Alaska, Alaska Sea Grant College Program, 2010, 317-326.

Alvsvag, J., Agnalt, A. L., and Jørstad, K. E. (2009) Evidence for a permanent establishment of the snow crab (*Chionoecetes opilio*) in the Barents Sea. *Biological Invasions* 11, 587–595.

Anisimova, N.A., Jørgensen, L.L., Lyubin, P.A. and Manushin, I.E. (2010) Mapping and monitoring of benthos in the Barents Sea and Svalbard waters: Results from the joint Russian - Norwegian benthic programme 2006-2008. IMR-PINRO Joint Report Series 1-2010, 114 pp.

Bakanev, S. (2014) Assessment and management of invasive crab stocks in the Barenst Sea. Workshop on Spatial issues in Arctic Marine Resource Governance. Stockholm, 3-6 September 2014.

Bakanev, S. and Pavlov V. (2015) The Snow crab (*Chionoecetes opilio*). In: Materials substantiating the volume of total allowable catch of invertebrates of the Northern fishery basin in 2016. Polar Research Institute of Marine Fisheries and Oceanography, 15-27 (in Russian).

Chuenpagdee, R., Morgan, L.E., Maxwell, S.M., Norse, E.A. and Pauly, D. (2003) Shifting gears: assessing collateral impacts of fishing methods in US waters. *Frontiers in Ecology and the Environment* 1(10), 517-524.

Cochrane, S.K. J., Denisenko, S. G.,Renaud,P. E.,Emblow, C. S.,Ambrose, W. G., Jr, Ellingsen, I.H. and Skarðhamar, J. (2009) Benthic macrofauna and productivity regimes in the Barents Sea -ecological implications in a changing Arctic. Journal of Sea Research, 61: 222–233.

Davidson, K., Roff, J.C., Elner, W. (1985) Morphological, Electrophoretic, and Fecundity Characteristics of Atlantic Snow Crab, *Chionoecetes opilio*, and Implications for Fisheries Management. Canadian Journal of Fisheries and Aquatic Sciences, vol. 42, 3, 474-482.

Donaldson, A., Gabriel, C., Harvey, BJ, and Carolsfeld, J. (2010) Impacts of Fishing Gears other than Bottom Trawls, Dredges, Gillnets and Longlines on Aquatic Biodiversity and Vulnerable Marine Ecosystems. DFO Canadian Science Advisory Secretariat Research Document. 2010/011, vi +84 pp.

Eno, N.C., MacDonald, D.S, Kinnear, J.A.M., Amos, S.C., Chapman, C.J., Clark, R.A., Bunker, F.St.P.D., and Munro, C. (2001) Effects of crustacean traps on benthic fauna. *ICES Journal of Marine Science* 58,11–20.

Eriksen, E. (Ed.) (2012) Survey report from the joint Norwegian/Russian ecosystem survey in the Barents Sea August-October 2012. IMR/PINRO Joint Report Series, No. 2/2012, 139 pp.

FAO Species Fact Sheets http://www.fao.org/fishery/species/2644/en

GIWA Regional assessment 11 (2004) Global International Waters Assessment Barents Sea (http://www.unep.org/dewa/giwa)

Gulliksen, B. Hop, H. and Nilsen, M. (2009) Benthic Life. In: Sakshaug, E, Johnsen, G. and Kovaccs, K. (eds.) *Ecosystem Barents Sea.* Academic Press, Trondheim, Norway, 339-372.

ICES (2008) ICES Advice 2008, Book 3. 3 The Barents Sea and the Norwegian Sea 3.1 Ecosystem Overview. 3.1.1 Ecosystem components. Copenhagen: *International Council for the Exploration of the Sea* (CM papers and reports), 14 pp.

ICES (2013) ICES Advice 2013, Book 1. General advice. Assessment of the list of VME indicator species and elements. 1.5.5.3 Special request, Advice, June 2013.

ICES (2014) Interim Report of the Working Group on the Biology and Life History of Crabs (WGCRAB). *International Council for the Exploration of the Sea* (CM papers and reports), ICES CM 2014/SSGEF: 12 REF. SCICOM

Johnson, K.A. (2002) A Review of National and International Literature on the Effects of fishing on Benthic Habitats U.S. Department of Commerce. National Oceanic and Atmospheric Administration. National Marine Fisheries Service. NOAA Technical memorandum NMFS-F/SPO-57, 77 pp.

Jørgensen, L.L. and Spiridonov V. (2013) Effect from the king- and snow crab on Barents Sea benthos. Results and conclusions from the Norwegian-Russian Workshop in Tromsø 2010. Fisken og Havet nr. 8/2013. Institute of Marine Research, Bergen, Norway, 41 pp.

Jørgensen, L. L., Ljubin, P., Skjoldal, H. R., Ingvaldsen, R. B., Anisimova, N., and Manushin, I. (2015a) Distribution of benthic megafauna in the Barents Sea: baseline for an ecosystem approach to management. ICES Journal of Marine Science, 72(2): 595–613.

Jørgensen, L. L., Planque, B., Thangstad, T. H., and Certain, G. (2015b) Vulnerability of megabenthic species to trawling in the Barents Sea. ICES Journal of Marine Science, doi: 10.1093/icesjms/fsv107.

Kuzmin, S.A. (2001) New data on snow crab, Chionecetes opilio (Fabricius), distribution in the Barents Sea. In: Ivanov BG (ed) Study of biology of commercial crustaceans and algae of Russia seas. *Collected papers.* VNIRO Publishing, Moscow, 94–97. (in Russian)

Lepland A., Rybalko A. and Lepland A. (2014) Seabed Sediments of the Barents Sea. Scale 1:3000000. Geological Survey of Norway (Trondheim) and SEVMORGEO (St. Petersburg).

Loeng, H. 1991. Features of the physical oceanographic conditions of the Barents Sea. Polar Research, 10, 5–18.

Lubin, P. and Mashnin A. (2013) Appendix 3. Invertebrate sampling in ecosystem survey 2013. In: Prokhorova, T. (Ed.) Survey report from the joint Norwegian/Russian ecosystem survey in the Barents Sea and adjacent waters, August-October 2013. IMR/PINRO Joint Report Series.

NEAFC (2015) *Recommendation 19 2014: Protection of VMEs in NEAFC Regulatory Areas as Amended byRecommendation 09:2015.* London: North East Atlantic Fisheries Commission.

Ozhigin, V.K., Ingvaldsen, R.B., Loeng, H., Boitsov, V.D. and Karsakov, A.L.. (2011) 2 The Barents Sea 2.1 Introduction to the Barents Sea. In: Jakobsen, T. and. Ozhigin V.K. (eds.) *The Barents Sea. Ecosystem, resources,management. Half a century of Russian – Norwegian cooperation*. Tapir Academic Press, Trondheim, Norway, 44-76.

Pavlov, V.A., Sokolov, A.M. (2003) On the biology of snow crab Chionoecetes opilio (Fabricius, 1788) in the Barents Sea. *Collected papers.* VNIRO Publishing, Moscow, 94–97. (in Russian).

Sundet, H.J. (2014) The Snow crab (*Chionoecetes opilio*) in the Barents Sea. In: Hjelset, A.M. (ed.) *Report from the Workshop: Workshop on King – and snow crabs in the Barens Sea*. Tromso, 11-12 March, 2014. Institute of Marine Research.

Vinogradova, P. S., and Litvin, V. M. (1960) Study of the topography and sediments in the Barents and Norwegian seas. In: Soviet Fisheries Investigations in north European Seas, 101-110. Ed. by J. J. Marty. PINRO-VNIRO Press, Moscow (In Russian).