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Implementation of the Ecosystem Approach to Fisheries in the North-East Atlantic

A case study of how the Joint Norwegian-Russian Fishery Commission has worked with the EAF

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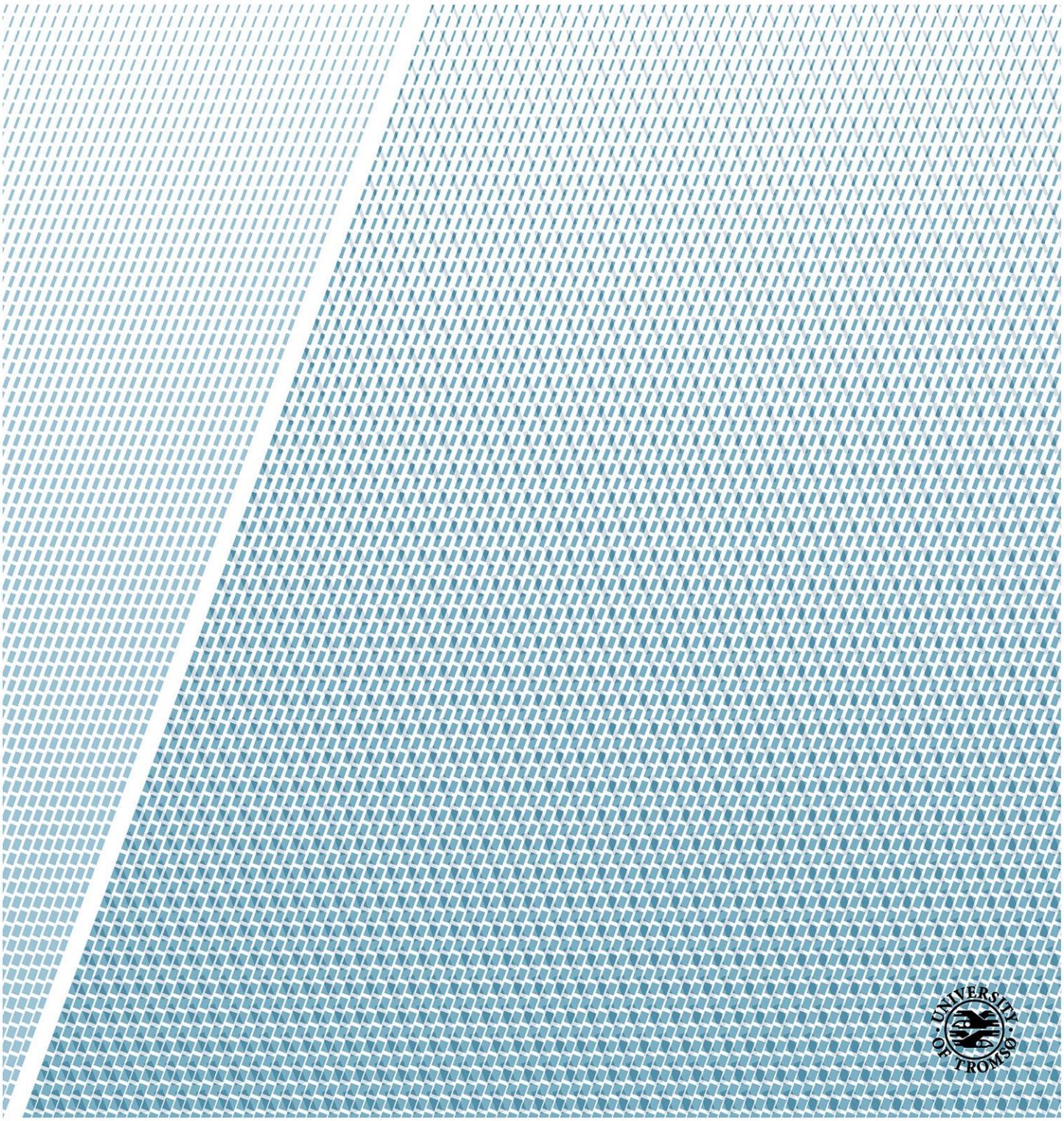

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Abstract

The Ecosystem Approach in Fisheries became a worldwide trend. More and more countries are adopting and developing this in management framework with different rate of success. There is a widespread agreement about the necessity of a new fisheries management strategy, which is taking into account food web linkages and human activity, which may affect sustainability of ecosystem.

However, there is no precise instructions for implementation of the regime. Therefore, the main issue for fisheries managing authorities is to transfer the general guidelines into specific tools for managing resources, The North-East Atlantic always has been productive area, and well established management system. The Norwegian-Russian Commission has long-lasting history of successful cooperation. This case-study investigate, how it will function within ecosystem framework, and how implementation process changing well-established management framework.

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List of abbreviations

COFI – Committee of Fisheries

EEZs – Exclusive Economic Zones

EAF – Ecosystem Approach to Fisheries

EBFM – Ecosystem Based Fisheries Management

EBM – Ecosystem Based Management

EM – Ecosystem Management

EU – European Union

FAO – The Food and Agriculture Organization of the United Nations

GI – Governing Interactions

GS- Governing System

HCI – Harvest Control Rules

ICES – International Council for the Exploration of the Sea

IMR – Institute of Marine Research

IUU – Illegal Unregulated Unreported Fisheries

NRC – Norwegian Russian Commission

PINRO – Polar Research Institute of Marine Fisheries and Oceanography

TAC – Total allowable catch

UNCLOS – United Nations Convention on Law of the Sea

1. Introduction

1.1 The Ecosystem Approach in Fisheries Management

Due to the fact that conventional single species fisheries management has a number of apparent shortcomings, it is commonly accepted that there is a need for an alternative management strategy that could take into account and focus on food web relations and human activity that affect ecosystem sustainability (Pitcher, et al. 2009). Hence, many countries have started adopting and developing strategies influenced by the Ecosystem Approach to Fisheries Management (EAF)[1].

The EAF has been adopted by the FAO Committee on Fisheries (COFI) as an appropriate and practical way to fully implement the Code of Conduct for Responsible Fisheries.

According to FAO, it is supposed to

> "*balance diverse societal objectives, by taking into account the knowledge and uncertainties about biotic, abiotic, and human components in ecosystems and their interaction and applying an integrated approach to fisheries within ecologically meaningful boundaries*" (FAO, FAO Technical Guidelines for Responsible Fisheries 2003).

However, FAO does not abandon the existing fisheries management approaches. Instead, it recommends that implementation of the EAF should take existing fisheries management strategies as a starting point and seek to strengthen them so that ecosystem effects are taken into considerations to a larger extent.

The shift from the conventional single species approaches to the EAF may not be an easy task, and there may be important lessons to learn from the attempts to implement EAF in existing fisheries management systems. These lessons may ease the implementation in the future This thesis seeks to explore how the EAF is implemented in a specific setting, namely in the Joint Russian-Norwegian fisheries management collaboration in the Barents Sea, with

[1] There are some mismatches in scientific literature with using definite article, however mostly the EAF is used with definite article, so I chose this option in my work.

an attempt to identify challenges and opportunities of EAF implementation in a well-established management system.

1.2 The need for EAF in the Barents Sea Ecosystem and Fisheries

According to First update of the Integrated Management Plan for the Marine Environment of the Barents Sea-Lofoten Area (White paper 2010-2011), the main fish stocks of the region such as cod (*Gadus morhua*), haddock (*Melanogrammus aeglefiinus*) and saithe (*Pollachius virens*) are in a very good condition. Capelin (*Mallotus villosus*), herring (*Clupea harengus*), and cod play a key role in ecosystem dynamics together with Greenland halibut (*Reinhardtius hippoglossoides*), golden redfish (*Sebastes marinus***),** beaked redfish (*Sebastes mentella*), and blue whiting (*Micromesistius poutassou*). Those species are chosen to be indicator species for monitoring ecosystem state and condition in the Barents Sea and Lofoten area. The annual ecosystem survey carried out by the Institute of Marine Research (IMR) together with Polar Research Institute of Marine Fisheries and Oceanography (PINRO) provides substantial information about commercially important species, although very little information is available when it comes to non-commercial species. It is recognized that large commercial stocks are in a good and healthy condition at the moment. Hence, the main focus will be on rebuilding smaller stocks, such as those of redfish species and Green halibut.

Besides that, invasion of such alien species as red king crab and snow crab might damage important elements of the ecosystem. Closer monitoring of distribution of those species should help to find a way to manage them.

Moreover, several coral reefs are found in this area. They have been mapped as part of the MARENO programme and were found to be damaged. It considered being endangered and vulnerable habitat type.

The most important industries in the Barents Sea-Lofoten area include fisheries, maritime transport, and petroleum activities. Travel and tourism industries are present too, while offshore energy and extraction of minerals from the seabed are also discussed as a promising direction. Petroleum activities have been carried out mainly in the southern Barents Sea, starting from 1980. The oil and gas sector today includes oil companies, the supplier industry

as well as petroleum-related research and education institutions. As part of oil and gas development, seismic surveys are conducted in the area, which results in significant conflicts between the petroleum and fisheries industries. Besides that, a high risk of pollution (such as oil spill) makes it even harder for the industries to co-exist.

As it has already been mentioned, this thesis examines fisheries management arrangements, and other important industries are intentionally left out beyond the scope of this work. My main focus will be on how the EAF is implemented within the framework of the Russian-Norwegian fisheries management collaboration.

1.3 Russian- Norwegian Fisheries Management Collaboration

The first steps towards international cooperation in managing natural resources of North-East Atlantic were taken in 1902 when The International Council for the Exploration of the Sea (ICES) was created. By the year 1959, 14 countries including the USSR and Norway had signed the fisheries convention in North-East Atlantic. However, this document did not have any power and only contained some basic recommendation to countries concerning fisheries regulations (G. Hønneland 2007).

Since the principle of a 200-mile exclusive economic zone (EEZ) was adopted at the beginning of the third UN Conference on the Law of the Sea (UNCLOS) in 1975 the situation in fisheries management changed. The right and responsibility to manage marine resources within an area of 200 nautical miles from the shore was given under control of the states. This led to a shift from multilateral negotiations for the Barents Sea fisheries under the auspices of the Northeast Atlantic Fisheries Commission (NEAFC) to bilateral negotiations between coastal states respecting transboundary fish stocks, in given case between Russia and Norway (G. Hønneland 2014).

In 1974, the parties came into an agreement concerning on cooperation in fisheries. The agreement in paper was signed in Moscow in 1975. It says that parties agreed to promote cooperation on practical issues of fisheries within the framework of the national legislations. The parties also agreed to consult with each other on some issues and pay particular attention to measures for conservation and management of living marine resources and coordination of research in the Barents Sea. In order to facilitate the implementation of the Agreement, the

parties decided to establish the Joint Russian-Norwegian Fisheries Commission (NRC), with representatives from both parties. The Commission meets at least once a year, alternately in the territory of each party (G. Hønneland 2007). The NRC is the central institution for fisheries management in the Barents Sea and a study of the EAF implementation in the area will therefore be a study of processes taking place within the NRC.

1.4 Problem definition, research questions and objectives of the thesis

FAO's framework on the EAF (presented in chapter 2.3) does not give precise instructions for implementation of the regime. Therefore, the main issue for fisheries managing authorities is to transfer the general guidelines into specific tools for managing resources, which, at least to some extent, take into account ecosystem interactions. Recent estimates of spawning stock biomass the cod stock in the Barents Sea has sustainable current harvest level now and is fully recovered after the collapse in 1990. The total stock biomass is at a level not seen since the early 1950s (IMR/PINRO 2014). The crucial question, however, is if this positive development is mainly a result of favourable natural conditions, pure luck or the dominant single species approach or if the EAF-inspired solutions may have had some impact as well. In order to investigate implementation of Ecosystem Approach to Fisheries in North-East Atlantic, I will attempt to answer the following research questions:

1. How does NRC contribute to make the Barents Sea governable?
2. What kind of changes can we see in NRC's management approach that indicate moving towards implementation of the EAF has contributed to make the Barents Sea even more governable?
3. What lessons can be learnt from the implementation of the EAF in the NRC

These questions will be answered through a governability assessment of the Barents Sea with emphasis on the NRC and its work to of implement the EAF.

1.5 Structure of the thesis

The structure of the thesis is as follows:

In the next chapter, I will describe the conceptual framework of the thesis. It includes overview of the EAF concept, the management system history as well as description of regional fisheries policy. Next, I will give a short description of the ecosystem of this area. I will also describe main commercial species and interactions within the ecosystem and give brief overview of the fisheries and other activities in the area before I present the NRC. Further, I will investigate the status of the EAF implementation in North-East Atlantic and how it is embedded in the decision-making process and give a governability assessment of the implementation. I will present the findings obtained from analysis of the reports and interviews, which contributes to drawing conclusions about the impact of the EAF implementation. In the last chapter, I will write about lessons that could be learnt from the work experience of the NRC.

2. Theoretical and Methodological Framework

2.1 How institution ns contribute to increased governability

The absence of adequate governance cause such crucial problems as transboundary pollution, overfishing, climate change. "The global ocean has lost more than 90% of large predatory fishes with an 80% decline typically occurring within 15 years of industrialized exploitation" (Myers og Worm 2003). G. Hardin in "Tragedy of the Commons" (1968) drew attention to the problem of common use of natural resources and it became the most referenced work.

He suggests two human factors that drive the environmental change:

1. An increasing demand for natural resources and environmental services, stemming from human population growth and increase of per capita resource consumption;
2. The way people organize themselves to extract resources from the environment and eject effluents back into it - institutional arrangements.

The resource users themselves were trapped in a tragic overuse of the natural resource and solutions had to be imposed on them from the outside to prevent further overharvesting.

G. Hardin sees two solutions for the governing common resource: private property and state control.

Hardin's model has often been formalized as a prisoner's dilemma game (Dawes 1975).

The Prisoner's dilemma is a concept used to describe relations between two parties, which use the same natural resource.

> *"It is conceptualized as a noncooperative game in which all players possess complete information. Communication among the players is forbidden or impossible or irrelevant as long as it is not explicitly modelled as a part of the game. During the game players choose strategy and produce an equilibrium that considered as a third best result for both"* (Ostrom, 1990, pp 4)

Ostrom, however, consider Hardin's solutions to be oversimplified. The simple structure of the Prisoner's Dilemma game is a useful devise for demonstrating the conflict between individual rationality and group rationality. When individuals withdraw scarce resource units from the same common pool resource, when they cannot communicate and establish agreed-upon rules and strategies, and when anther authority has established and enforced effective rules, predictions of suboptimal use of the resource are likely to be correct. The problems of governing natural resources used by many individuals in common are no more settled in academia than in the world of politics, according to Ostrom (1990) . Over time, neither state nor private rights turned out to be a universal solution for tackling with overexploitation of natural resources. Many case studies proved the point that a centralized government will not necessarily sustain common resources over the long run. Another flaw in this concept concern not taking into account the human ability to create self-governing institutions. Case studies have shown that a number of strategies to manage resources have been developed. Hardin's theoretical example is, in fact, leaving out opportunities of creating a dialog between users, managers, and scientists that actually contribute to make the system governable. Moreover, Hardin does not take into account the existence of the many complex, redundant, and layered institutions. In the real world, we find a mix of institutional types and designs that facilitate experimentation, learning and change. Hardin does not see institutions as ways of organizing activities that affect the resilience of the environment (Dietz, Ostrom og Stern 2003)

2.2 What characterize successful institutions?

An attempt to find out what makes institutions successful was undertaken by Ostrom who developed 8 principles of successful governing of the common pool resources (Ostrom, 1990) which will be described below.

Well-Defined Boundaries

First principle claims that boundaries of the resource system should be well defined. At this point, appropriators already know their field of work, Moreover a clear definition of the system could facilitate identifying its specific characteristics. That can also help to answer the question how to manage specific natural resource. In addition, defined boundaries close the access to common resource to "outsiders", who do not contribute to sustain resource, but may try to benefit from it. This way, the problem of so-called free riders can be either avoided or minimized. The boundary rules related to who can enter, harvest, manage, and potentially exclude others, impacts on the presumption that a participant has about the likely levels of trustworthiness and cooperation of the others involved.

Congruence between appropriation and provision rules and local conditions.

A rule defines time, place, technology, and quantity of resource units in accordance with conditions, requiring labor, materials, and money. In other words, it allocates benefits proportional to required inputs.

It is necessary to have rules, which define a proportion between input and benefits from harvesting a resource. In this matter, a group of users can assess the costs of developing this very resource. This rule also secures the equality of users in terms of harvesting: everyone gets the same opportunity to access and develop resources. Rules should also be created in a way to make participants not refuse to abide the rules because they are unfair. This, leads to the next principle:

Collective-Choice Arrangements

Individuals who are affected by a regime, which defines the use of resources, should be able to participate in creating and modifying the operational rules.

Monitoring

For a system to function, it is important to have accountable monitors, who actively audit resource conditions and make sure that rules are followed. To keep the rule-breaking level down among appropriators is one of the main conditions to explore resources in a sustainable way. Most self-organized resource regimes select their own monitors.

Graduated Sanctions

In many self-organized systems, the first sanction imposed by a local monitor is so low as it has *no* impact on the expected benefit-cost ratio of breaking local rules (given the high payoffs that could be achieved by harvesting illegally, for example).

Conflict-Resolution Mechanisms

The sixth principle is that there are rapid, low-cost, local arenas present to resolve conflict among users or between users and authorities.

Minimal Recognition of Rights to Organize

Whether local users can develop regimes that are more effective *over time* is affected by whether they have at least a minimal recognition of the right to be governed by a national or local government.

Nested Enterprises

When common-pool resources that are being managed by a group are large, an eighth design principle may be present in robust systems. The nested enterprise principle is that governance activities are organized in multiple layers of nested enterprises.

These principles can be seen as a model for analysis of specific institutions. Institutions contain certain rules and norms to sustain social order and shape human behavior (Ostrom 1990). I will analyze the NRC according to these principles and discuss if it has the characteristic of a successful institution. Taken the success of the institution into account it should have, but there can also be other important elements that are relevant. A variety of institutions can be created to achieve a certain goal, envisioned under ecosystem-based fisheries management (Rudd 2004). If the EAF shall be successfully implemented, the EAF principles and guidelines must comply with the institutional design principles. If they break

with or are inconsistent with the institutional characteristics, it implies that the institution must be redesigned or that the EAF has to be redefined or adapted to the existing design.

Institutions are in fact the thing that makes a complex world governable. Institutions help people understand their roles in the world and organize themselves. They provide us with rights, norms, guidance, and certain standards. They tie individuals to society, thus an organized society becomes much easier to govern (S. Jentoft 2004). By creating consensus on the rules of the game, institutions become tools to handle both natural and social complexity, by establishing a set of procedures that makes resource management and governance possible.

The NRC (as I will describe in chapter 3.3) is an institution that may reduce the social complexity that exist in Russia and Norway and that contributes to making the Barents Sea governable. Governance of ecosystem is complicated task, because of uncertainties related to both natural environment and society. Governance is the generic category; management is the more specific procedures. The NRC is a management arrangement can be considered as a part of the governance in the Barents Sea. So management addressing particular tasks, while governance is more holistic term, which includes management.

2.3 Governability

Governability is defined as the overall capacity for governance of any societal entity or system as a whole (Kooiman 2008). To assess governability "we need to be concerned with the relationship and the interaction between the natural and the social system-to-be-governed, and how the governing system interferes in that interaction" (S. Jentoft 2006, :pp360)

In order to obtain balance between natural and social system, issues of governance and governability arise. Current thinking on governance is largely about interactions among stakeholders, the institutions, whether formal or informal, that shape these interactions, and the visions and principles that guide these institutions and interactions (Kooiman, Bavinck, et al. 2005). This is also consistent with the Marine Governance perspective that

> *"the sharing of policy making competences in a system of negotiation between nested governmental institutions at several levels (international, supranational, national, regional and local) on the one hand, and state actors, market parties, and civil society*

organizations on the other in order to govern activities at seas and their consequences." (van Tatenhove 2011, :pp 87).

Governance systems designed to deal with complexity, often rely on multi-level arrangements where authority has been reallocated upward, downward and sideways away from central states (van Kersbergen og van Waarden 2004). It has been proposed that such diverse structures can address environmental problems at multiple scales and nurture diversity for dynamic responses, thereby complementing top down, command and control management arrangements (Ostrom , et al. 1999). In the next section, I will describe the EAF.

2.4 The Ecosystem Approach to Fisheries Management

The commitment to the EAF follows from a number of conventions (Figure 1.), what eventually matured in integrated framework in the 1995 FAO Code of Conduct for responsible Fisheries, addressing practically all the ecosystem considerations, principles, and conceptual goals needed for EAF (Garcia og Cochrance 2003).

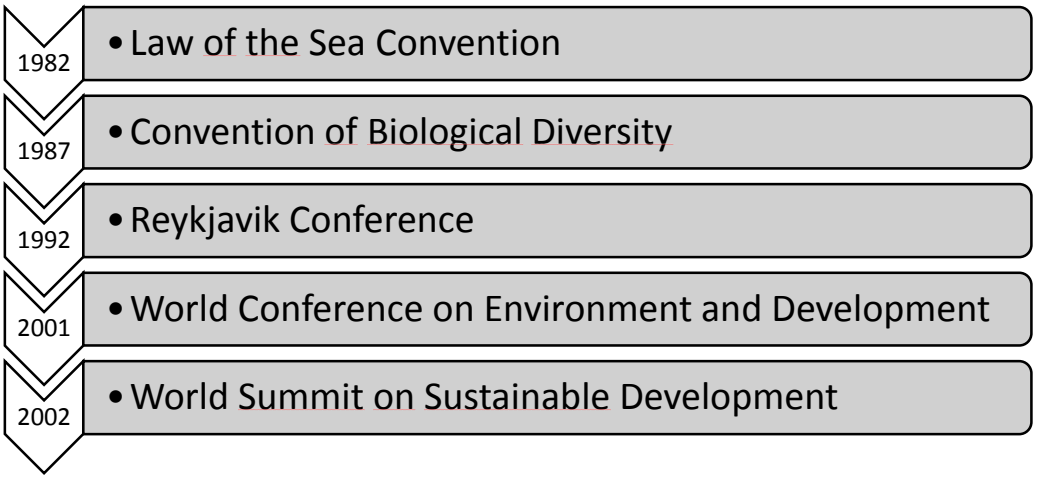

Figure 1 The EAF basis

The EAF is defined by Ward et al. (2002) as *"an extension of conventional fisheries management recognizing more explicitly the interdependence between human well-being and ecosystem health and the need to maintain ecosystems productivity for present and future generations, e.g. conserving critical habitats, reducing pollution and degradation, minimizing waste, protecting endangered species".*

The EAF can be characterized as a holistic approach, which takes into account ecosystem itself with all connections and interactions instead of individual stocks. In addition, it takes into account effect of pollution from human activities, environmental variability, and globalization processes.

There are four main forms of the EAF implementation (Morishita 2007). The first one is by-catch regulation. It is mainly done by modification of fishing gears and changes in fishing techniques. When by-catch of non-target species is high, area and season closures are implemented (for instance during the spawning period). The second form of the EAF is multi-species management, which takes into consideration prey-predator relationships. The main goal here is to set harvest levels of target species while maintaining the sustainability of other species through the prey-predator relationship and maximize the target species harvest controlling other species and components of the ecosystem. In addition, the EAF considers vulnerable ecosystems such as seamounts, cold-water coral, etc., using Marine Protected Area as a main tool in this case. Finally, one of the most complex form of the EAF is the Integrated Ecosystem Approach. It includes monitoring climate change parameters and impacts on oceanographic environments, such as ocean current fluctuations and it has been introduced as part of integrated and adaptive ecosystem management systems.

It can be confusing that two interrelated concepts are present in academic papers without any clear distinction given. Those concepts are the EAF (described earlier) and the Ecosystem-based Fisheries Management (EBFM).

The term EBFM is defined as

"*an approach that takes major ecosystem components and services - both structural and functional - into account in managing fisheries... It values habitat, embraces a multispecies perspective, and is committed to understanding ecosystem processes... Its goal is to rebuild and sustain populations, species, biological communities and marine ecosystems at high levels of productivity and biological diversity so as not to jeopardize a wide range of goods and services from marine ecosystems while providing food, revenues and recreation for humans"* (FAO, The ecosystem approach to Fisheries 2003, pp 6).

Both concepts are very similar and are used interchangeably in a number of academic works. In this work, the EAF considered to be a vaguer and broader concept, when EBFM is a more concrete one that involves the use of certain managing instruments. In general, the EAF includes the human dimension, while EBFM is more focused on the ecology, with humans

being an outside factor. The concepts are often used in an overlapping way, although in accordance with level of implementation, the concepts appear to have three levels of hierarchy, where Ecosystem Management (EM) is an umbrella term. In the table below, the concepts, which fall under the umbrella term, are specified in accordance with the level of implementation (Patrick og Link 2015). Regarding to the case of the NRC there are elements from both concepts actively used. This issue would be discussed more closely further, so for further description the EAF will be used as the broadest concept.

Table 1 Levels of ecosystem management (EM): The EAFM (ecosystem approaches to fisheries management), the EBFM (ecosystem-based fisheries management), and the EBM (ecosystem-based management) (Patrick and Link 2015)

Level of EM	**Definition**	**Focus of Management**	**Management framework**	**References**
EAFM	Inclusion of ecosystem factors into a (typically single species) stock focus to enhance our understanding of fishery dynamics and to better inform stock-focused management decisions	Fisheries stocks	Fishery Management Plan	Pitcher et al. 2009; Link and Browman 2014
EBFM	Recognizes the combined physical, biological, economic, and social tradeoffs for managing the fisheries sector as an integrated system, specifically addresses competing objectives and cumulative impacts to optimize the yields of all fisheries in an ecosystem	Fisheries systems	Fishery Ecosystem Plan	Link 2010; Link and Browman 2014
EBM	A multi-sectored approach to management that accounts for the interdependent components of ecosystems, and the fundamental importance of ecosystem structure and functioning in providing humans with a broad range of ecosystem services	All sectors, including fisheries	Regional Ocean Plan	MacLeod and Leslie 2009; Curtin and Prellezo 2010; Link and Browman 2014

To shift from current approaches, seven elements have been proposed. They are considered to be purely related to the EBFM (Marasco, et al. 2007):

1. Ensure that broader societal goals are taken into account

The EBFM acknowledges different uses of the ecosystem and its resources. Management and decision-making should take into account that fisheries industry is not the only users. Cooperation between industries is essential in a given geographic area. Thus, it calls for a broader participation of stakeholders.

2. Employ spatial representation

Spatial consideration is fundamental for understanding the population dynamic processes. It helps different industries (both fishing and non-fishing) co-exist and exploit resources, taking into account dynamics of the ecosystem.

3. Recognize the importance of climatic-ocean conditions

As it has been discussed previously, climate change and state of the ocean has undeniable effect on natural resources. Some regimes favour one species over the others influencing the distribution, etc. In the case of the Barents Sea, abnormal warm temperatures force cold-water stocks move further north. It has to be taken into account and closely studied to reduce the uncertainty of the outcome it might cause.

4. Emphasize food web interactions and pursue ecosystem modeling and research.

Food web interactions are among the most important components of the EBFM. For example, there have long been indications that harvesting species that are located low in the food chain has disproportionately larger impacts on species at the top of the food chain. In addition to that, selective harvesting towards top predators can lead to simplification of the stock structure, which, in turn, leads to a shift in the fishery towards lower and less valuable trophic levels. In order to not deplete stocks, fisheries managers must then consider the state not only of the target species, but also its connections in the ecosystem.

5. Incorporate improved habitat information (regarding the target and non-target species)

Knowledge about habitat is important for protecting both target and non-target species. However, it is only a small fraction needed to be understood. It also requires a close study and understanding of cumulative effects from both fishing and non-fishing activities (such as pollution, industrial development, and habitat alteration) on habitat and how it all affects productivity of species.

6. Expand monitoring

The EBFM monitoring mainly focuses on biological interactions between both target and non-target species. It considers not only the state of fishing stocks, but also the cumulative effect of impact from different industries. In addition, monitoring of climate change can reduce the uncertainty related to how it affects marine species. The main goal of the EBFM monitoring is to reduce the uncertainty and identification of critical data needs.

7. Acknowledge and respond to higher levels of uncertainty

As it has been mentioned before, dealing with uncertainty is a primary task within the EBFM concept. Many marine ecosystem models are rudimental and require some changes. Explicit probabilities should be incorporated in the decision-making process in order to include a certain standard for what is adequately precautionary.

Based on the discussion above I will use the EAF term, which understood as a mix between the two concepts of the EAF and the EBFM as the term in the continuation of the thesis.

In his work, T.J. Pitcher (2009) ranked 33 countries in terms of success rate of implementing the EAF. There were three criteria for research: overall principles, criteria for success, and implementation steps. These criteria were proposed by Ward et al. (2002) and based on the framework suggested by FAO Code of Conduct from 1990s. The score shows that the only countries that received a "good" mark (over 70% in rating) are Norway and the USA. Only four countries had an "acceptable" score, which is between 60% and 70%, namely Iceland, South Africa, Canada, and Australia. About half of the countries "failed," including Russia.

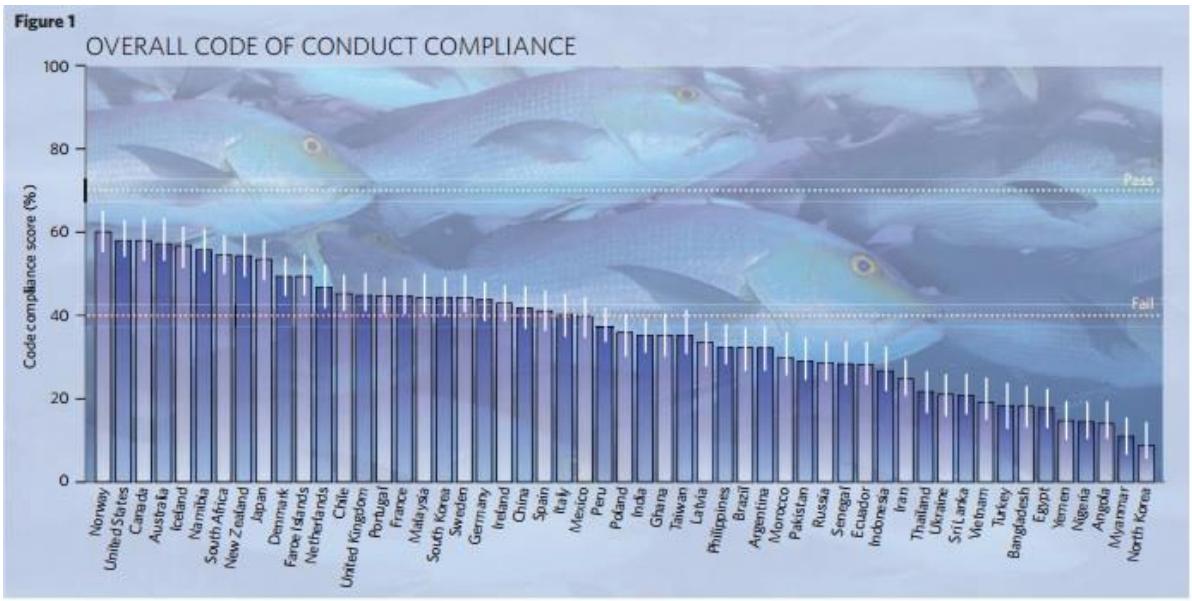

Figure 2 Evaluation of progress in implementing ecosystem-based management (Pitcher, et al 2009)

The study apparently shows that countries that spend significant amount of money on scientific research, like Norway, are at the top of the list. It means that implementation of the EAF is still a costly procedure, despite the effort of FAO to make it affordable for all countries. Although this research is criticized by many scientist, this is a good attempt of

evaluate the implementation results. Despite, Russia's low score, Norway is ranking on top makes it reasonable to expect that EAF/EBFM has had its impact in the NRC.

2.5 Method

In accordance with objectives of the thesis, qualitative methods of research were chosen, namely interviews and document studies. The qualitative research will help to get a deeper understanding of the EAF. The analysis of the reports and document have been conducting aiming at finding traces of EAF ideas and procedures in the reports. These traces may indicate that the EAF has had impact on the NRC procedures.

In addition, I have conducted a governability assessment of the Barents Sea system in order to explore how the NRC, as institution, contributes to the creation of governability. The main source here was information from the management plan (White paper 2010-2011) . To perform governability assessment the governability model was used (Figure 3.)

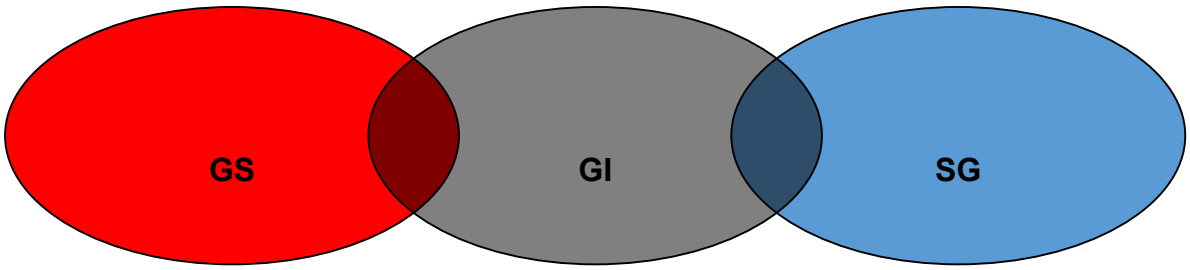

Figure 3 Governability model (Jentoft 2013)

GS: Governing System, SG: System-to-be-Governed, GI: Governing Interactions

Figure 3 shows the Governability Model, which is used to perform the assessment. In order do this, two systems, namely the Governing system (GS) and the System to be Governed, will be examined together with their interactions. The system properties in the governability assessment are diversity, complexity, dynamics, and scale.

According to S. Jentoft (2013) *diversity* can be expressed by the ways in which

The Systems components differ from each other. It generally deals with the components of the system and communication between them.

Dynamics refers to changes in the system itself and how these changes influence interactions inside the system. If the system-to-be-governed is highly dynamic, then the government system should adapt to those changes very fast. In this matter, social institutes (which represent the governing system) should be very flexible in order to respond to changing conditions.

Scale sets limits in order to formulate achievable goals for managers. It requires knowledge about boundary settings of the system.

After taking into account all those properties, the governability matrix (Figure 4.) was constructed (Jentoft 2013)

	Natural SG	Social SG	GS	GI
Diversity	C components	C components	C components	C components
Complexity	R relationships	R relationship	R relationships	R relationships
Dynamics	I interactions	I interactions	I interactions	I interactions
Scale	B boundaries	B boundaries	B boundaries	B boundaries

Figure 4 Governability matrix

This framework is applied to the case of Implementation Ecosystem Approach in the North-East Atlantic (Table 1.).

Table 2 Governability assessment of implementing the EAF

	Natural SG	**Social SG**	**GS**	**GI**	
Diversity	What are the components of the ecosystem?	Who are the main stakeholders? What is their interest?	What institutions represent GS? What power do they have?	What are the interactions?	**Components**

Complexity	How do ecosystem components connect with each other?	How interaction between stakeholders is organized? Cooperation or conflicts?	What are the governance goals?	How governing interactions influence on governance?	**Relationships**
Dynamics	What kind of changes affects biological and physical state of ecosystem?	How interactions between stakeholders are changed through the times?	How governing system changed since the beginning of cooperation Russia and Norway?	How those changes affected the other institutions on different levels?	**Interactions**
Scale	What is the natural boundary of the ecosystem?	What boundaries are among stakeholders?	What are the boundaries of the institutions? Local, regional, national?	What is the scale of interactions on different levels?	**Boundaries**

Questions from table 2. will be used to perform governability assessment of the EAF in the North-East Atlantic in terms of work the NRC. It will help answer the main questions:

What to look? Where will we examine the System to be governed (ecosystem of the region), the Governing system (institutions and authorities as a main driving forces of implementing the EAF) and the Governing Interactions (influence of GS and system-to-be governed on each other)?

What to look for? System parameters (Diversity, Complexity, Dynamics, Scale)

What to look at? Components, Relationships, Interactions, Boundaries.

In addition, it was decided to collect the data the semi-structured interviews. The informants were scientists from Institute of Marine Research in Tromsø: Per Arneberg and Knut Sunnanå, who worked closely with the concept of the EAF at both the national and international level within the NRC. A semi-structured format was chosen with the purpose to establish a two-ways communication, where it is possible to achieve a better understanding of the nature of the EAF, clarify necessary details, and discuss controversial aspects of the question.

Interviews became the main source of information about practical implementation the EAF in the North-East Atlantic. Such questions as "How would you estimate the results of implementation of EAF?" also provide a personal point of view on the question of practical implementation in addition to the information given in the academic literature. In addition to that I have got interesting insights and ideas for the thesis with information I got from Ann Kristin Jørgensen from Institute of Fridtjof Nansens , during informal meeting after lecture about Russian-Norwegian cooperation in University of Tromsø. In addition to protocols from the commission, and research published in English I also used available information in Russian, provided by Geir Hønneland through e-mail.

Limitations

My work on the paper was constrained by numerous limiting factors. First, investigation of such a broad question required narrowing the framework not only on terms of picking up a specific case and region, but also a level of implementation. That is why I chose to look at the work of the Russian-Norwegian Joint Commission. Shortage of time did not allow me to study it on national level closely. However, it leaves a room for further research, which can answer the following question: "Is there any traces of the EAF in regional policy in Russia and Norway?"

Another limitation was related to interviews. The initial plan was to interview scientist from PINRO, since they closely cooperate with IMR on ecosystem surveys and other projects, as well as actively participate in the NRC. However, during my visit in Russia, the experts who could provide me with information were not available for interviews. The original agreement was to make an interview via e-mail. Shortly after I came back from my field trip, I received a negative answer concerning my request. My attempts to establish further communication

were ignored. Neither official letter of cooperation, nor personal contacts were not helpful to establish any contact, Thus, primary and secondary information from the Russian side is scarce in this paper, due to failed interviews and almost complete absence of recently published academic work in open access. Hence, the information presented further may seem one-sided, because I was limited to the information from Norwegian sources. This can, however, be a start for further investigation as well.

3. Ecosystem, Fisheries, Governance structure and the EAF

3.1 Ecosystem

A monitoring system has been established to keep track of changes in the ecosystem. It is a part of the work on the management plans for natural resources. A set of indicators has been selected to provide information on the environmental status and trends. Reference values and action thresholds have been established for a number of the indicators to identify change that is significant enough for an action to be taken (White paper 2011).

The state of the ecosystem of the North-East Atlantic area is influenced by a number of external factors such as ocean acidification and climate change, interactions between species in the ecosystem, and human activities.

The key factors of environment

It is apparent that climate change can cause major changes in the ecosystem. In the past 30 years, water temperature has been rising, and extent of sea ice has been shrinking. "Ice-dependent species will be under increasing pressure. Southerly species are expected to shift northwards, and there will be a similar displacement northwards of the southern distribution limits of Arctic cold-water species" In addition, warmer water temperature will provide adult herring with favourable conditions for establishing in the Barents Sea. That, in turn, will lead to a permanently low level of the capelin stock (White paper 2011).

A combination of ocean acidification and higher temperatures could cause fundamental changes in the ecosystem. The impacts are difficult to predict, and projections for 2025 are yet uncertain, but climate change models indicate that there will be a rise in temperature,

which will cause further reduction of the ice cover. Such changes are expected to have impacts on the ecosystem.

Further, I will describe different components of the Barents Sea ecosystem.

Plankton

The primary production of ecosystem particularly depends on the quantity of *zooplankton*, especially through pelagic fish species. That makes it an important parameter for monitoring. Fluctuations in zooplankton level may affect fish stocks and other species that are dependent on it. However, harvesting fish stocks has some indirect influence on composition and size of the zooplankton population, and it should be taken into account in management plans.

Biomass production of *phytoplankton* in the Barents Sea varies between cold and warm years. This can be mainly explained by variation in the size of the ice-free area in winter. Thus, it is hard to trace any trends in production in the last years. A period of high water temperatures caused changes in distribution of phytoplankton, and it is closely linked to an increase in the inflow of nutrient-rich Atlantic waters. Due of the shortage of light, production in the polar front phytoplankton is limited. However, concentration of feeding fish and crustaceans in the zone is relatively high.

Phyto- and zooplankton is linked to plankton-feeding fish stocks. In recent years, with a help of ecosystem surveys, knowledge about role of plankton in the ecosystem has been improved and started to be included in the management plans. However, there is no good explanation of how variations in primary and secondary production affect other ecosystem components. At present, there is no answer to the question: "why there are still large fish stocks despite a reduction in the quantity of plankton?" (White paper 2011). '

Fish

Last year, the survey showed significantly high levels of key fish stocks of the Barents Sea ecosystem, namely cod, haddock, and saithe. Capelin, herring, and cod play a key role in ecosystem dynamics in the Barents Sea, and together with Greenland halibut, golden and beaked redfish and blue whiting they are used as indicator species in the monitoring system (White paper 2011).

Northeast Arctic cod

Cod is one of the most important predators in the Barents Sea ecosystem. The main preys for cod are capelin, juvenile cod, shrimp, krill, and haddock. The cod stock is distributed more to the north and east due to the raise of the water temperature and increased abundance (IMR/PINRO 2014).

As of today, the spawning stock is at the highest level observed since 1947, and was approximately estimated at over 1.14 million tonnes in 2010. In 2005, the spawning stock was 700,000 tonnes, which indicates a major improvement taking place nowadays due to the well-designed management regime (White paper 2011).

Haddock

The haddock stock has a full reproductive capacity; however, there still is a risk of a collapse in case of unsustainable harvest (IMR/PINRO 2014).

Herring and capelin

Low abundance of juvenile herring and high abundance of capelin in the Barents Sea in 2010 created favourable conditions for many species in the ecosystem. Recruitment of herring has been weaker in the last couple of years, and, as a result, the stock declined in 2010 from a peak in 2009. Since 1999, the herring stock as a whole has been managed in accordance with a management plan adopted by the coastal states.

Good condition of the capelin stock can be the reason for the growth of the Northeast Arctic cod stock. The management plan involves keeping the harvest below the precautionary level recommended by ICES, which is important in maintaining a stock with a high biomass.

Coastal cod

Cod in the Barents Sea, the Norwegian Sea, and the coastal areas dwells under variable environmental conditions. Taking into account some biological characteristics of cod in the coastal zone, it is possible to assess the Norwegian coastal cod stock separately from North-East Arctic cod. Both types appear together on the spawning grounds. Norwegian Coastal cod is distributed in the fjords and along the coast of Norway south from the Kola Peninsula. Spawning areas are located in fjords as well as offshore along the coast. Genetic studies

indicate that cod in some fjords may form separate stocks. An assessment of the combined stock is not likely to detect fluctuations of the smaller components, and thereby the current assessment approach involves some risk to local stocks. The stock complex is still not fully mapped, but the existence of local stocks also calls for special attention to protect genetic diversity and smaller components. A plan for rebuilding the stock was adopted in spring 2010 (ICES 2013)

Greenland halibut

Green halibut is in Norwegian Red List, but considered as a species of "Least concern". The spawning stock has shown a slight improvement in the past ten years. Before, a total ban of a direct fishery was in place, however, later a decision was made to set a three-year quota of 15,000 tonnes. This was possible due to a joint research effort that provided better knowledge of biology and distribution of the stock.

Golden and beaked redfish

Because of the historically low level of both stocks, ICES recommended a ban on all direct fisheries. In addition, both stocks require strict regulations, such as area closures and control of bycatches. Such measures were introduced with purpose to protect redfish larvae. Surveys showed reduction of reproductive capacity, and this situation is expected to remain the same for many years.

Blue whiting

There is no blue whiting fisheries in the Barents Sea, however it was included in the monitoring system as an indicator of climate change in 2006. The surveys show a decline of quantity of juvenile blue whiting over the past six years.

There are also various fish stocks of minor commercial importance in the Barents Sea. Some of these, for example several species of skate, are in poor condition. The blue skate is classified as critically endangered on the 2010 Norwegian Red List. There is no directed fishery for any of these vulnerable species. Commercial fish stocks are generally well studied. Knowledge about non-commercial fish species has some significant gaps, and should be strengthened. Monitoring of the commercial stocks is well established and provides good

information about the state and trends of the stocks. The annual ecosystem surveys provide a good basis for monitoring non-commercial species.

Projections for 2025

Considering present situation with the fish stocks, it is possible to say that main commercial stocks will remain healthy and at full reproductive capacity. In the future, the focus will be on rebuilding smaller stocks, such as the two redfish species and Greenland halibut.

A rise in water temperature is expected to result in larger quantity of fish, especially in the northern and north-eastern parts of the Barents Sea. Thus, the state of ice cover will change and impact the distribution of fish species. The marginal ice zone is moving northwards, and in the Barents Sea, it is already possible to see the trend that fish species that had traditionally been found further south are moving northwards. It means that in the near future new areas can be opened up for fisheries closer to the North Pole. However, various factors make it uncertain how ecosystems will respond to a warmer climate, and thus it is difficult to make a clear prediction about what fish species can be expected to dominate and the size of stocks in the future is going to be.

3.2 The Fisheries

Fisheries have existed in the Barents Sea region for over a thousand years and played a significant role in developing of coastal communities in both Russia and Norway.

The North East Arctic cod stock is potentially the largest cod stock in the world. Therefore, it is the main target species for a commercial fishery that is conducted both with an international trawler fleet and with coastal vessels. The major bycatch species are haddock and saithe, as well as two species of redfish, *Sebastes norvegicus* and *S. mentella*. A Norwegian coastal cod stock, which is found in the Norwegian fjords and Norwegian coastal zone out to 12 nml, plays a vital role for small-scale coastal fisheries. However, this stock is taken in combined catches together with the Northeast arctic cod. There is no way to separate them in catches or landings. The separation method is based on the microscopic analysis of differences in otoliths type and structure (John, Stephen, et al., Reassessment – Report for the Norway North East Arctic cod and haddock fishery 2015).

Main commercial species such as cod and haddock are fished by trawl, Danish seine, hand-line, and purse seine. When it comes to capelin, there is a difference in fishing gears in Russia and Norway. In Norway, it is mainly purse seine, whereas Russia usually uses pelagic trawl. In cod fisheries, Norway has chosen passive gear types: nets, hand- and longlines, and Danish seine, while in Russian cod is fished by demersal trawl (Hammer og Håkon Hoel 2012).

Cod fisheries in the northeast Arctic are shared between Norway, the United Kingdom, and Russia. With establishment of 200 nautical mile exclusive economic zones in the early 1980s, the fishery became dominated by Norway and Russia. Over the past fifteen years Norway has taken an average of 45% of the catch, Russia has taken 42%, and the remaining 13% have been fished by other countries (John, Stephen, et al., Reassessment – Report for the Norway North East Arctic cod and haddock fishery 2015).

Cod fisheries landings fluctuated over time 1946 to 2013 (Figure 5.)

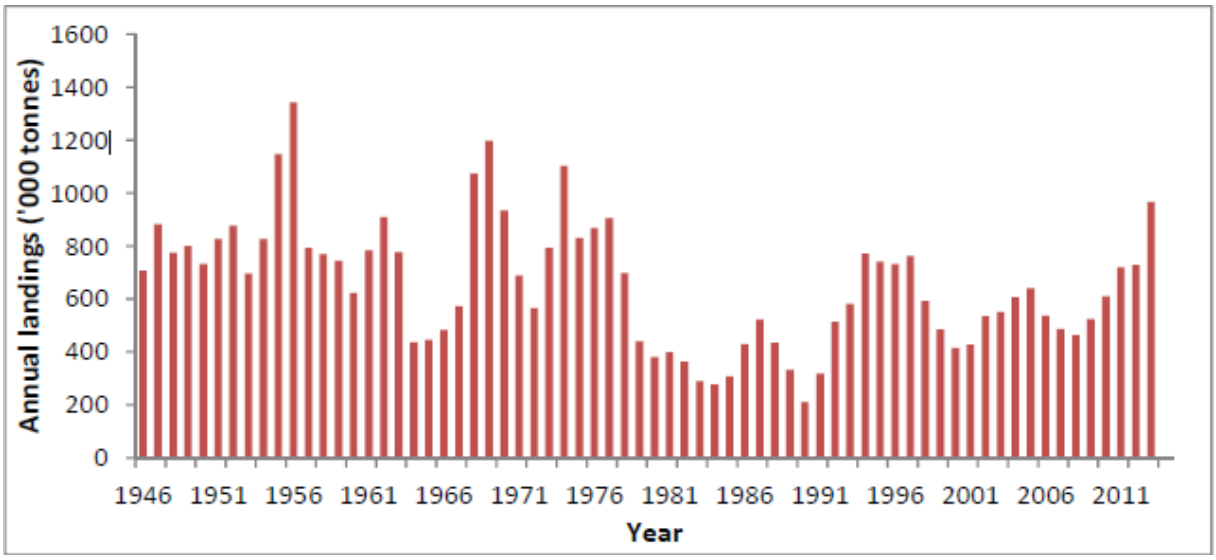

Figure 5 Annual (ICES) landings of Northeast Arctic Cod, in thousands of tonnes, over the period 1946 to 2013 (Data Source (ICES 2013))

The mean long-term level of cod catches from 1946 to 2002 was 700 thousand tonnes, but with variations. The average catch during the 1950s was 850 thousand tonnes (Hammer, 2012). Starting from the early 1960s landings were mainly between 600,000 and 800,000 tonnes. Over 1964 catches dropped to a very low of 438,000 tonnes after that started rapid

increasing until a point of over a million tonnes in 1968 and 1969. After this landings remained above half a million tonnes followed by steady decline to less than 300,000 tonnes in 1983. In 1990 the lowest recorded level of 212,000 tonnes was reached. In 2000s situation stabilised and landings were mainly between 500,000 tonnes and 700,000 tonnes but increased considerably in 2013 to 966,000t. This is the highest recorded since 1974 (ICES 2013).

The fishing industry has long been important to the economy for both Norway and Russia. For Russia, long coastline gave an access to marine resources in 12 seas in three oceans. It is subdivided in basins known as the Far Eastern, the Northern, the Western, the Caspian Sea, and the Azov and Black Sea basins. Recently, the sub-Arctic for the Russian fishing industry became important, in particular in the Northwest Russia, with most of this catch occurring in the Barents Sea (Glubokov, et al. 2014).

For Norway the coastal fishing, fleet plays a vital role, especially for coastal municipalities and accounts over 40% of the landed value. The most important fisheries in the Barents Sea have always been for Norwegian spring-spawning herring, Northeast Arctic cod, Northeast Arctic haddock, Northeast Arctic saithe, and capelin. Stocks have increased over the last 10 years, especially cod and haddock, and quotas have increased accordingly. In 2011 the Norwegian quota for cod was 319 000 tonnes, for haddock 148 000 tonnes, for saithe 173 000 tonnes, for Norwegian spring-spawning herring 602 680 tonnes and for capelin 275 000 tonnes (White paper 2011).

Because of the heavy depletion of the stock, started in 60s cooperation Russia and Norway in managing natural resources and scientific collaboration developed.

The North-East Atlantic is very productive region, dominated mostly by cold-water species. Due to the climate change, water temperature rising, what my cause changes in distribution of the stocks, assuming they would move to North-East direction. There are quite few species in that area compare to Sothern ecosystem, so management framework is quite simple with two states involved. Therefore, the potential for governability is quite high. In the next section, I will present the governability assessment, before I present the main instrument for governing the Barents Sea, the NRC.

4 Governability assessment

4. 1 Governability assessment the EAF in the North-East Atlantic.

As we have seen, the Barents Sea is a complex system. In this governability assessment, I will focus only on the fisheries components since the NRC is the institution in focus. Issues related to other sectors, such as oil, gas, etc. that are solved through other institutions are left out on purpose.

Diversity

Table 3 Diversity components of governability matrix

	Natural SG	**Social SG**	**GS**	**GI**	
Diversity	Ecosystem (cold water corals, some benthic species, fish stocks) Cod Haddock Greenland halibut Golden and beaked redfish Capelin Herring Saithe	Industrial Fisheries Researchers	Ministry of Fisheries and Coastal Affairs (Norway) Federal Fishing Agency (Russia) Regional authorities of Russia and Norway	Joint Norwegian-Russian Commission (The NRC)	**Components**

Norway, with the total export value of NOK 53,8 billion in 2010. For the Russian side, this is also a very important industry. According to the report of Federal Fishing agency (Results of the activities of the Federal Fishing agency in 2013 and projections for 2014 2013), in 2013

total catch in the North-East Atlantic was 610,8 thousand tonnes, which exceeds the total catch from last year by 7,8%.

The Social SG consists of stakeholders including the petroleum industry, industrial fisheries, travel and tourism agencies, and researchers (mainly from IMR and PINRO). The most important users, as it has been mentioned earlier, are the petroleum industry and commercial fishers.

Fisheries have existed in the Barents region for thousands of years and have had a great importance for both the Russian and Norwegian sides. The most economically important species are the North-East Atlantic Cod (*Gadus morhua*), haddock (*Melanogrammus aeglefinus*), and capelin (*Mallotus villosus*). All of them are shared between Russia and Norway (Eide, et al. 2012)

In this matter, GS is composed of authorities of Russia and Norway, who are responsible for exploitation of the natural resources.

The governing interactions are the interactions between the system to be governed and the governing system. In addition to that, in the given example GI also includes interactions between the two countries that share the stock. In 1976, Russia and Norway established the Joined Soviet-Norwegian Commission, which after 1991 became the Russian-Norwegian Commission (Aglen, et al. 2005). The objectives of the NRC are to utilize the living resources in the sea in a sustainable way, based on recommendation of ICES, set annual quotas for the joint fisheries, and coordinate scientific research (Eide, et al. 2012). The Soviet/Russian-Norwegian researcher interaction has been developed along a number of points of contact: joint scientists meeting, working group in ICES, and joint surveys, which later lead to friendly private relationships (Alekseev, et al. 2011).

Due to the fact that participation in the NRC is voluntary and open, it allows to stakeholders participate in decision-making process.

Complexity

The relationships of each component of system to be governed and governing system are shown in Table 4.

Table 4 Complexity components of governability matrix

	Natural SG	Social SG	GS	GI	
Complexity	High productivity of zooplankton is the base for rich provision of resources Capelin feeding on zooplankton Multi-species model (Cod-capelin relationship) Oil and gas resources	Cooperation Russia and Norway with annual meetings on Joint Commission Joint management of common stocks Coexistence of fisheries and petroleum industry	Management of the Barents Sea-Lofoten area will promote sustainable use of the area and its resources to the benefit of the region The management regime will facilitate economically viable commercial activities Living marine resources will be managed sustainably through the ecosystem approach Steps will be taken to facilitate the profitable production of oil and gas on the basis of health, environment and safety requirements	Close cooperation Russia and Norway helps to solve practical issues related to the fishing sector The agreement to fish in both nations' waters helps to optimize harvesting pattern The decisions made during Joint Commission meeting must be transferred into national and regional levels	**Relationships**

In the 1990s, ICES set the biological reference points in order to manage resources. The NRC uses them for governing natural resources. In 2002 regulation of the coastal cod was started to be implemented in accordance with the precautionary approach and ICES reference points. Later on, the EAF was adopted by the NRC. (G. Hønneland 2007)

Current goals stated in the (White paper 2010-2011) aim at promoting the following provisions:

- Management of the Barents Sea-Lofoten area should promote sustainable use of the area and its resources to the benefit of the region
- The management regime should facilitate economically viable commercial activities
- Living marine resources should be managed sustainably through the ecosystem approach
- Steps should be taken to facilitate profitable production of oil and gas while meeting health, environment, and safety requirements

As a result, of GI current situation of main commercial stocks can be characterized as good. It is uncertain whether it is due to the beneficial condition of the sea or a result of successful management cooperation between the two countries. Either way, the established management framework was based on a common understanding of the properties and dynamic of the resource and fishery with close joint monitoring of the natural system. Preserving and developing these institutions and long-lasting cooperation is of interest for both parties that aim to secure sustainable exploitation of the common resources. In addition, the political benefit may be the most successful part of this cooperation, which is very important to keep this way nowadays. (Eide, et al. 2012)

Dynamics

The changes in systems are shown in Table 5.

Table 5 Dynamics of the governability matrix

	Natural SG	Social SG	GS	GI	
Dynamics	Change of the ocean climate Acidification is increasing The water temperature is rising The extend of the sea ice is declining	Fisheries started over thousand years ago Petroleum activity in 1980 started Currently petroleum activity is low in this area	1979-1980 – Establishing the Norwegian and Soviet/Russian Economic Zones 1976 establishing the Joint Commission 1991 Termination of USSR, change of the economic system 2010 Reached final agreement about previously disputed area	Establishing EEZ changed the management system and lead to cooperation Due to change to market economy Russian fisheries became quality not quantity oriented, different stocks was given priority	**Interactions**

Joint IMR and PINRO studies show that climate change will have a significant impact on the North-East Atlantic Ecosystem, particularly ice-dependent species, which are going to be under increasing pressure. As stated in the (White paper 2010-2011), if the rising temperature allows adult herring to establish itself in the Barents Sea, the capelin stock will remain at a permanently low level. In addition, competition for food among predators may cause higher mortality among juvenile cod, due to cannibalism of this species. This could have major impacts on the ecosystem. On the other hand, high temperatures and shrinking sea ice have made most of the Barents Sea accessible to cod, which is probably a reason of the recent cod

stock growth. Knowledge about climate change and ocean acidification indicates its importance for ecosystem status and trends in the years ahead, and the pace of change will be more rapid. Therefore, it means that in cases where information for decision-making is lacking, the white paper suggests that precautionary approach must be used.

While evaluating GS and GI, two periods of cooperation between Russia and Norway can be singled out. The first period lasted from 1975 to 1991 (fall of the USSR), and is characterized as a cooperation of two countries with different economic systems. In a way, it determined the cooperation as a win-win situation with beneficial trade of quotas. Since Soviet strategy was quantity-oriented, the main interest was in low value on international market species, mainly blue whiting (G. Hønneland 2007). So, Norway managed to increase revenue on export, while the USSR could fulfill the plans of the central government (Eide, et al. 2012).

The second phase of the cooperation starts in 1992 and is characterized as not mutually beneficial. Due to the change of the Russian economic system from command to market economy, trade of quotas no longer takes place. Now, both countries mainly focus on the market value and economic performance. With this change, in 2002 the Commission agreed on a very important element, a new Harvest Control Rule (HCR) – Three Year Harvest Control Rule. This system introduces the indicators (assessed by ICES), which are reflecting the state of the stock. It has been designed to ensure that the overall approach will be precautionary. First, the HCRs associated with the first three tier levels are designed such that the risk level will be reduced successively as the tier level increases, corresponding to an increase in it (Smith, et al. 2007). There has been transition from former use of reference points to the system where it sets the ground for quota allocation. The HCR has developed in to a rather complex system, and might be the most advanced one currently in use (Eide, et al. 2012).

Scale

Scale in the governability assessment deals with boundaries of the systems.

Table 6 Dynamics of the governability matrix

	Natural SG	Social SG	GS	GI	
Scale	Consist of the Barents Sea and Lofoten area (physical limits) Number of components of ecosystem	Closed areas for some activities Coexisting of industries	Government institutions at national and regional level	Control of implementation the EAF at the national and regional level	**Boundaries**

In the Natural SG the boundaries are presented in physical limits, where the ecosystem approach can be implemented. In terms of monitoring of natural system it is seen quite challenging to cover the whole area. So mapping system is used, where particular parts of the territory are monitored and conclusions which are made spread on the entire North-East Atlantic. The MARENO programme is systematically mapping depth and topography, sediment conditions, pollutants on the seabed. By 2010, a total area of 67 600 km^2 had been mapped. The same situation is with ecosystem interactions. It is physically impossible to take into account all interactions and present it in management plan. So the key species has been chosen as indicators of the ecosystem condition, and conclusions about their state spread on the whole ecosystem (White paper 2011).

The boundaries of Social SG include the restrictions concerning both industries fisheries and petroleum. The most sensitive and vulnerable areas are closed for certain activities. It was discussed earlier the areas, where oil activities are restricted. As for the fisheries, there is a general prohibition on trawl fishing off the mainland areas less than 12 nm from baseline. In addition to protect larvae and vulnerable areas a number of trawl-free zones are permanently or temporary closed.

Boundaries regarding GS and GI mostly connected with implementation of the EAF at the national and regional levels. It is responsibility of the National and regional authorities to

control of implementation the EAF, which was made on the international level during the meeting of Russian-Norwegian Commission. So if one side is not fulfilling their obligation because of the lack of control, the other side can hardly do something, but consequences are concern of the both sides, due to shared resources. For instance the weak control from Russian side in the 1990s there was a heavy overfishing and disobey the fishery regulations such as mesh size and minimum catch size of the fish. That resulted in rapid decreasing of the stock size (Hønneland 2007).

By performing the governability assessment, the challenges and limitations in the case of the implementation the EAF in the North-East Atlantic were discussed. By examine the properties of natural system and system –to-be-governed it is possible to conclude, that in given region several elements of the EAF are implemented. The main tool is integrated ecosystem approach. It has a big importance for the NRC, constant surveys of IMR and PINRO helps to set the TACs., Now I will present the main instrument in the Barents Sea governance and main component in GS.

4.2 The joint Russian Norwegian fisheries governance system

The Barents Sea fishery is particularly interesting from the bilateral cooperation between Norway and Russia and establishment management regime. Over the years, management regime was developing through agreements, made on annual meetings of representatives from Russia and Norway. Agreements, based on the United Nations Convention on the Law of the Sea (UNCLOS), the UN Fish Stocks Agreement and the FAO Code of Conduct for Responsible Fisheries. Built framework relies on scientific advice from the International Council for the Exploration of the Sea (ICES) and annual ecosystem surveys performed by scientists of both countries and provide a model for governing shared natural resources (Glubokov, et al. 2014).

In 1976, the NRC was established. The objectives of the NRC were to exploit natural resources of the Barents Sea in sustainable way and perform scientific research to gain knowledge about ecosystem. Based on the recommendations from ICES, where both Norway

and Russia with their respective scientists are members,[2] the NRC allocate quotas for the fishing sector (Eide, et al. 2012).

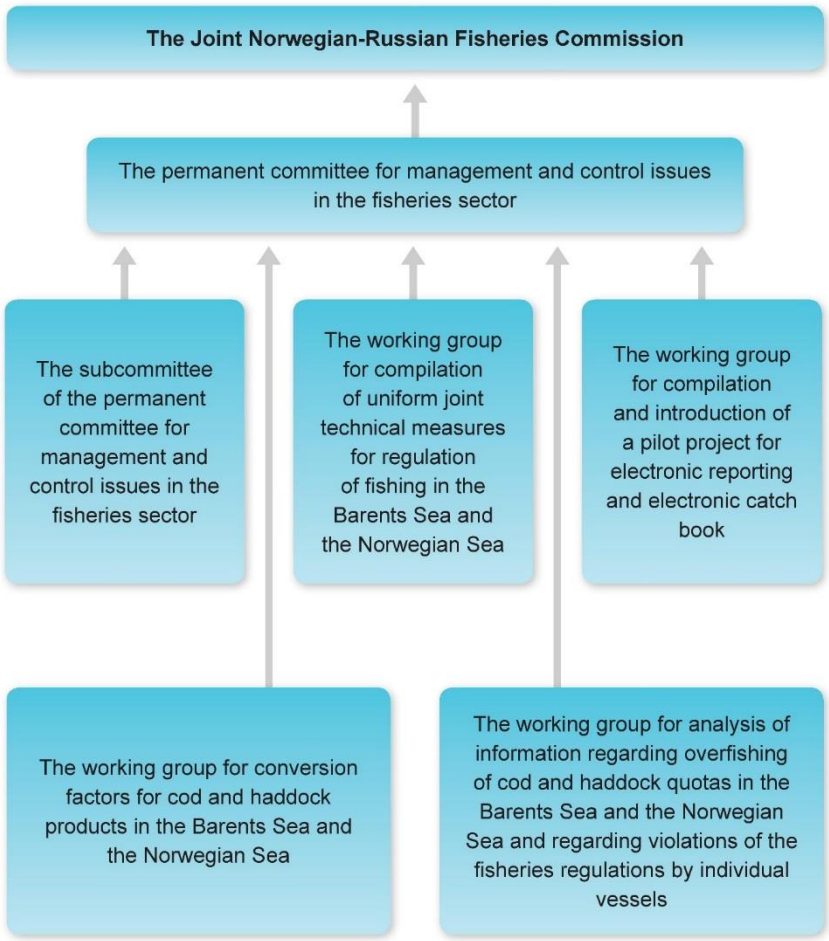

Figure 6 The organization of the Fisheries Commission. Source: (Joint Russian-Norwegian Fisheries Commission 2015)

The Commission sets total allowable catches (TACs) for the three fish stocks: cod, haddock, and capelin. Cod and haddock divided on a 50:50 basis, the capelin quota is shared 60:40 in Norway's favour. Represents countries in the Commission fishery authorities, other governmental agencies, marine scientists, and fishermen's organizations (G. Hønneland, Norway and Russia in the Barents Sea - Cooperation and conflict in Fisheries Management 2007).

In history of the Commission, there are two distinct periods of the Joint management:

[2] I left out interactions between ICES and the NRC, because this is to comprehensive topic to go into details in this master thesis

1. From 1975 – establishment of the Commission to 1991 - the termination of the Soviet Union, characterized by different economic regimes of two countries, which influenced the framework of management and quota allocations.
2. From 1992 up to today. Russia took obligations from USSR and continued cooperation in fisheries with Norway.

The reasons behind this quota allocation are biological: Russian (Soviet) EEZ is the main feeding grounds for juveniles, small cod, while Norwegian EEZ is a spawning, and feeding area for larger cod. Allowing to fish in both nations' waters optimise the proses of harvesting in terms of economic efficiency (Eide, et al. 2012).

The Soviet era 1976-1991

This period is characterised by traditional fishing gears, such as gill net, long line and hand-line. In addition, there was open access to fishing and different economic systems of countries. Primary questions for the Commission were size of total allowable catch (TAC) and regulations, regarding mesh size, minimum catch fish size. At this point two countries had different management interests. Norway insisted on increasing mesh size in trawl nets to strength minimum size regulations (because most of the juvenile cod was found on the Russian side so to let it grow and reach the maturity was in interest of the country). This would make cod more valuable in international market. The Soviet Unions' goal was to restrict catches of the spawning cod in Norwegian waters in order to maximise food production to consider all species in ecosystem. Reasons behind this covers in economic system of the country – command economy, so the catches went to domestic market and were quantity-oriented (Eide, et al. 2012).

The Soviet Union was not dependant on international market prices and was interested in other species, mainly blue whiting. Because of the different economic systems, countries managed to organise mutually beneficial trade of quotas where Norway received parts of the Soviet cod quotas, while USSR got blue whiting redfish, herring, and Greenland halibut instead. In this scenario Norway wins with highly priced in international market cod shares, while Russia fulfil the central plan from government (G. Hønneland 2007)

Post Soviet era 1992-nowadays

A new period of the Joint Commission started, when the Soviet Union collapsed in 1992. Russia took over all responsibilities from the Soviet and the cooperation with Norway continued. Although significant changes in the economic system and transition to market economy of Russia influenced on future negotiations with Norway.

The Russian economy was not quantity-oriented anymore, but could not keep up with international market prices for cod. In addition, for local market cod was still new and unattractive, so the Russian Federation introduced a new policy for landing catches in foreign harbours. Eventually, in 1993 100,000 tons of Russian cod was landed in Norway, boosting the local coastal economy (Eide, et al. 2012). However, problems occurred due to restructuring of the Russian economy, which also affected fishing industry. Former state-owned companies now split up and became private-owned. To keep out with brutal conditions of market economy new companies started to violate rules regarding the amount of catches.

Norwegian authorities became concerned about the situation with illegal, unreported and unregulated (IUU) fishing. In 1992 Norwegian fisheries authorities indicated overfishing in their report to Russian colleagues, where it was stated that catches were more than 100,000 tons (one quarter of the total 1992 cod quota) higher than supposed to. Violations of the regulations occurred not only in amount of cod, but in mesh size and minimum catch size of fish. Russia was not able to take the IUU fishing under control.

At the 21st session of the Joint Commission in 1992, the participants decided to make the appointment of a working group to consider the question of co-operation between the control bodies of the two states (G. Hønneland, Norway and Russia Bargaining Precautionary Fisheries Management in the Barents Sea 2014).

The Protocol from the session stated:

The Parties agree to appoint a joint working group consisting of experts in the fields of fisheries regulation, legislation, statistics and control. The working group shall within the first quarter of 1993 present proposals for concrete cooperative measures (Joint Norwegian–Russian Fisheries Commission 1993).

Created Expert Group consisted of four representatives from each country. From Norway, there were representatives from the Directorate of Fisheries. The Russian delegation was from "Sevryba." fisheries association. The enforcement body "Murmanrybvod", the research institute PINRO, and the federal Fisheries Committee were also represented. The Expert Group held three meeting during 1993. The aim of the meetings was to make Russia aware of the Norwegian enforcement system. One meeting took place in Murmansk, where the Russian system was presented to Norway and finally the last meeting was held in Bergen and its' purpose was to discuss co-operative measures. As a result, 18 proposals were presented and they were the following: two proposals aimed on respecting legislation, five of them were informative, and nine of them were presented as control measures and two others. Majority of proposals was related to coordination and exchange of procedures and information. In June 1993 when the 21st session of the NRC took place when work of the Expert Group was estimated and results of the cooperation were summed up. Work of the Group seemed to be fruitful as the Parties agreed on close cooperation, data, observers and law texts exchange, appointment of Permanent Russian–Norwegian Committee for Management and Enforcement Co-operation within the Fisheries Sector, which would take over from the Expert Group and would be aimed on discussing enforcement and management issues. Structure of the Committee was stable since 1993

In order to solve the issue of IUU the following measures took place. First, exchange of landing data between Russian and Norwegian authorities was established through various electronic systems and routines for informal exchange of data. In addition Norwegian Coast Guard started monitoring of fishery and port tickets on Russian vessels upon requests from Murmanrybvod as a result few vessels permitted to fish shrimps were detected in fishing cod in Norwegian waters.

As a result, Russia has a system for enforcement and fisheries management, which could contribute to implementation of new international obligations. Moreover, the abovementioned Committee succeeded in protecting cod stock in the interest of both Norway and Russia. As the core reason for IUU by Russian vessels was the fact that landing fish abroad did not necessarily had to be reported, outcomes of the cooperation and the fact that Russia was provided by information about activities of Russian vessels in Norwegian ports

and waters, lead to the situation when vessels could no longer report wrong information about species and amount of fish.

Even though it is provided that since the cooperation between two countries started, the level of IUU as it was registered in 1992 has never been repeated, which proves that measures taken and collaboration established was very efficient. The Permanent Committee has proved to be very effective when it comes to establishing solutions for existing problems, managing and enforcing problems and implementing tasks assigned by the NRC. Nevertheless the effectiveness of these measures has not been fully investigated regarding IUU and it still needs to be evaluated (G. Hønneland 2014)

Management solutions

The cooperation on management of natural resources between Norway and Russia may generally be characterised as well established and functioning.

Starting from late 1990s, a precautionary approach has been gradually implemented in the management of the most important fisheries (Bjørndal 2011). The core of the precautionary approach is that lack of scientific knowledge should not be used as a reason for taking chances with management measures, in which scientists are not sure. Failing in management decisions could lead to degradation of the environment or the depletion of common-pool resources. Such measure could be taken, only with high degree of certainty that the environment or resources basis would be damaged without such interference. In other words, preventive measures should be postponed or omitted only when there was full scientific certainty that they were not necessary (G. Hønneland 2014).

The reason behind this decision was condition of the main stocks. Several years in a row, ICES estimates of stock size were incorrect and too high, compare to the reality. The management measures were clearly ineffective and required some major changes (Korsbrekke, et al. 2001)

In 2002, the NRC has decided to implement multi-annual quotas based on a precautionary approach. Scientists from Arctic Fisheries Working Group (in ICES) designed Harvest Control Rule (HCR) consisted with Norwegian and Russian Scientists, which was approved in 2005 by ICES (Hylen, Nakken og Nedreaas 2008). It should be noted, that pure scientific cooperation was completely out of political context. Because of joint effort knowledge about

biological processes in the Barents Sea and its' ecosystem was developed and lead to creating effective management strategy (Eide, et al. 2012).

A new management strategy ensures that TACs for any 3-year period shall be in line with the precautionary reference values provided by ICES. Two main indicators used in HCR: estimated spawning biomass and calculated mortality rate of the previous year. Those values indicates the state of the stock. Regulations regarding minimum mesh size, fish size are also stands (Smith, et al. 2007)

Transition to the new system was rather smooth, because same reference points were incorporated in the new HCR. As predefined rules quota setting can become automated, based on simple algorithm. In future the concept might be developed and include social and economic considerations. However, it has not been done yet. Despite this fact, HCR still developed North-East Atlantic cod fishery in a complex system, currently the most advanced in use (Eide, et al. 2012).

Because of the joint researches of scientists from IMR and PINRO and annual ecosystem surveys it was decided to "add entire ecosystem" in the objectives. It gave start to the implementation of the ecosystem approach in the management plan in 2004 (Commission, Joint Norwegian–Russian Fisheries 2004). Several new components were added to research: climate change, pollution with purpose to investigate further effect on the ecosystem; research on the benthos and consequences of bottom-trawling. Focus of the scientists shifted on the connections in ecosystem and got more of the holistic angle. In this matter HCR for quota settings and Precautionary approach and some improvements in gears have contributed to rebuilding main stocks, and gave start to a new management regime.

Development of the management of the economically important stocks in the EBFM framework has three directions:

"● increase the economic output through improvements in exploitation patterns and reduction in all forms of incidental and unwanted mortality on target species from fishing;

● further optimize the long-term economic yield through possible revisions of management strategies and harvest control rules; and

● as new scientific knowledge becomes available, additional ecosystem considerations is gradually incorporated into management measures including: multispecies interactions; effects of fishing on benthic habitats; and the effects of bycatch of fish, seabirds and marine mammals" (Gilman, Passfield og Nakamura 2014).

4.3 Is the Ecosystem approach in the Barents Sea?

The information is based on my notes from interviews with scientists from institute of Marine Research in Tromsø and based on the two personal interviews with Per Arneberg and Knut Sunnanå.

General understanding of the EAF is different among the scientists. I was offered two ways of looking at the concept:

1. The EAF as management organized within the ecosystem. This includes activities besides fisheries (Oil and gas activities, transportation etc). As an example the Barents Sea ecosystem, the North Sea ecosystem, the Norwegian Sea ecosystem can be named.
2. The EAF as knowledge. That includes knowledge about how the ecosystem is functioning and based on it to make an assessment. I will now discuss these two approaches.

4.3.1 Management organized in relation to ecosystem

A new element in the practical management of the Barents Sea is the area-based management for different types of exploration and resource exploitation. In relation to the elements of the EAF certain goals are set. The goals are formulated in the plan for Integrated Management of the Marine Environment of the Barents Sea and the Sea Areas off the Lofoten Islands (Integrated Management of the Marine Environment of the Barents Sea and the Sea Areas of the Lofoten Islands 2005-2006). The plan is based on a comprehensive assessment of the state of ecosystem in the Barents Sea. The gathered information is seen in relation to the goals and used to give advice on the basis of change of the status of ecosystem. For example, through this process, valuable and vulnerable areas have been defined and use of some areas is restricted in order to protect habitats (Figure 7). A joint Russian-Norwegian working group

for the Barents Sea under ICES leadership performs the integrated assessments. On the national level in Norway, there are two advisory groups one on monitoring and the other synthesizing group. In both groups, many institutions work together with purpose of giving a joint advice. In addition, several directorates are involved: oil and gas exploration, fisheries, protection of the environment and research institutes. Discussion and giving advice is a challenging process. To agree upon results may be even more challenging when several research institutes are involved, especially when not only scientific results influence the discussion, but also the position these institutes have matters. Nevertheless, the work with the integrated management plan can be seen as a success story of the EAF, since all institutes managed to give a joint advice to the government. There are still some differences, but agreement is reached upon the main points. What is not working, that given advice not used in ministries, managing authorities.

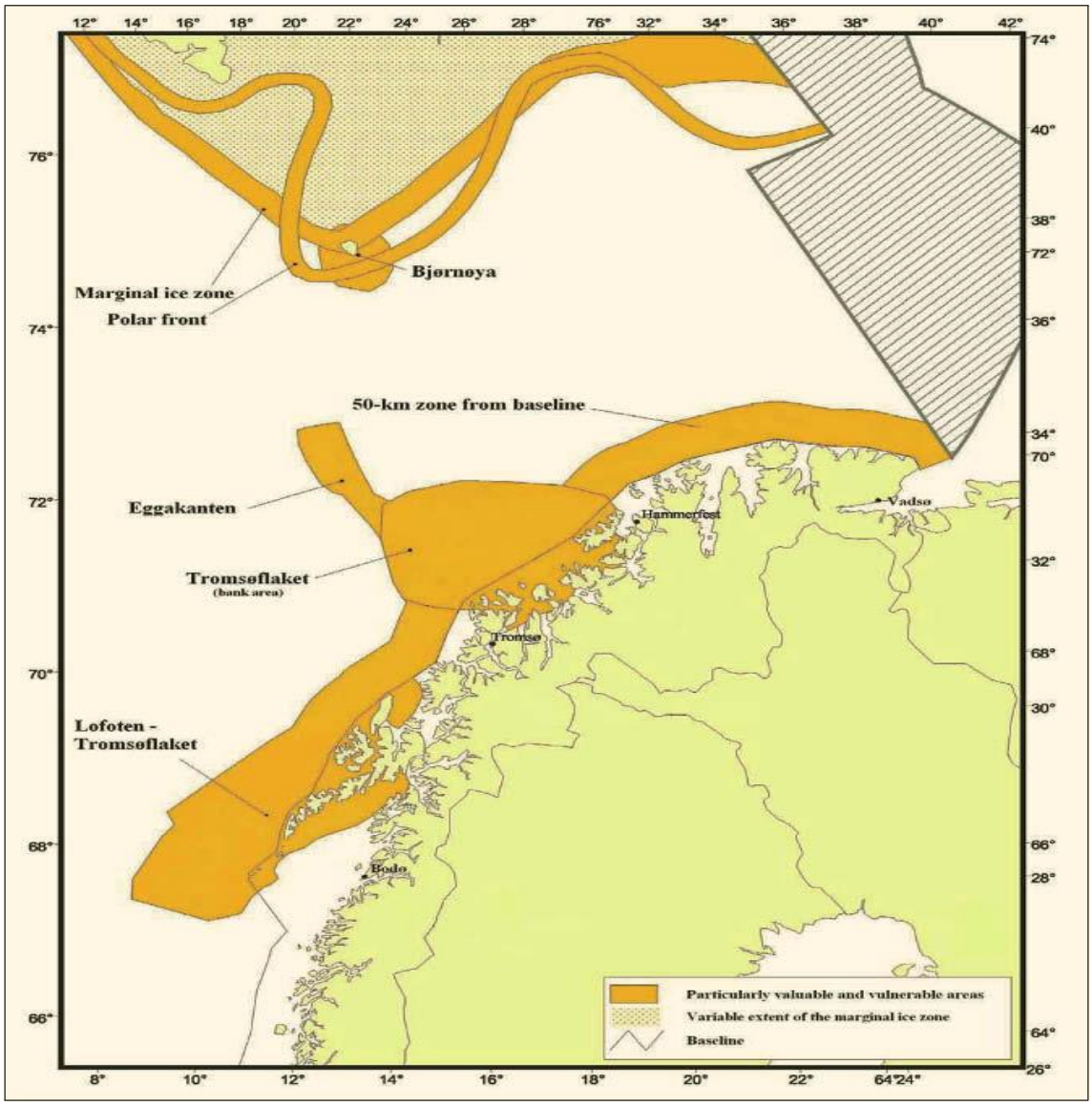

Figure 7 Particularly valuable and vulnerable areas in the area covered by the management plan. Source: Integrated Management of the Marine Environment of the Barents Sea and the Sea Areas off the Lofoten Islands (White paper 2010,-2011)

4.3.2 The EAF as knowledge

Seen from a knowledge perspective, the shift towards the EAF was triggered by the situation, where single-species model was not coping with reality anymore. Simple production models challenged single - species models without any input of temperature and production where it was possible to add temperature and production. Multi-species models are more flexible and include additional parameters, what makes them more precise and allows predicting

development in the ecosystem. On the other side, the multi-species models do not have enough input. In the 1980s and 90s there was an effort to use multi-species model as assessment tool, assuming it is possible to include ecosystem function in those models. To some extend it is possible, but models are still under development and still not precise enough to give advice. Therefore, due to the complexity, it may take years for managers to get a precise advice from the comprehensive ecosystem models. There is a process going on to develop integrated assessment that presents some basic trends in stock development. This may provide the NRC with a framework to help set the quotas. It resulted in larger freedom in decision-making process about following directly quota advice or not. In case when fishermen want higher quotas, it allows scientists to evaluate the trends and connections in the ecosystem and if possible recommend to increase the quota. This is a simple way of considering the ecosystem in quota advisory process. For the time being, the spawning stock size for cod has tipped the top and it is expected to go down because of the poorer recruitment and temperature change. Thus, based on the evaluation of the level, an advice to reduce the quota will be given to the NRC. However, because of the complexity of the model and lack of fundamental theory about how the marine ecosystem work, it is possible to say that from a knowledge perspective we cannot talk about a full implementation of the EAF. Despite of this limitation, the two Norwegian scientists agreed upon the fact that the current management system uses elements from the ecosystem based fisheries management and the ecosystem approach to fisheries. As mentioned before one element used in the Barents Sea management is a multi-species model. In this model, a temperature parameter is used as a proxy for many estimates. The assessment also includes measurements of the amount of plankton organisms. The biomass of plankton is used to estimate the state in primary and secondary production in the ocean and is seen as an indicator of food availability in the ecosystem. These two parameters, temperature and plankton biomass, are input to the growth model.

4.4 Integration of the EAF elements in advice and management in Norway and Russia

Integration of the elements of the EAF in Russia and Norway has been parallel, but steps are not the same on the both sides. Due to different steps in integrating process, there is a challenge in organizing joint work. Although, now it is possible to say that the same working system is established between two researches instituted. Advice for the management process is given from scientists, but they are not legally binding authorities. The different management authorities can choose to follow the scientific advice or not. According to the scientists, with exception from the management of the oil industry, the Norwegian authorities has too little extent followed the advices that have been given in relation to the management plan. Another example is the problem with bottom trawling affecting of benthic life and where the impact can be substantial. Management actions should be taken in this matter; however, this fact is still ignored by authorities.

It is too early to know what would be a long-term result of the EAF. Since the implementation and until now it has been a learning period. Fish stocks have been growing; temperature has been increasing, so was the production, although it has been fluctuating. The fisheries have been easy to manage, because the stocks has been increasing. If the situation change, it will be harder to cope with this. The pressure for setting high quotas may increase. The scientific advice may be to reduce quotas rapidly, that will probably result in critic and unsatisfied fishermen. Because of there is information about an ecosystem on the tipping point within present regime, but with little information about stocks in the decline, it is an uncertain situation that may effect of the implementation the EAF. In the fishery, management HCR are in use. They regulates this kind of situation, but it is not seen by the scientists as an ecosystem based management element. However, the HCRs are the way of coping with unknown condition to avoid too big fluctuations in the quotas and therefore they consider ecosystem-society relations. Whether the HCRs should be followed or not in changing situations, is an aspect that has not yet been discussed in relation to the EAF.

Discussions in the NRC are based on advice given by ICES. The recommendations from ICES already include ecosystem considerations.

The scientists claim that the EAF has not changed the decision-making processes in Norway. Decisions are still made in sectoral ministries and directorates. Despite of the process with the integrated plan, decision-making has still not been integrated, because there is no legal binding in Norway to follow the integrated plan. It is possible to say, that there is a resistance among directorates about attaching the EAF as it is represented in the management plan to legal framework.

However, in practice, all the directorates seem to cooperate more with each other after the planning process, and thus it has had some impact. From a knowledge perspective the EAF a main goal would be to change people's mind and way of thinking. In practice, it is hard to discover such changes in the short run. If it is not made legally binding, it may take time before it get real substantial impact.

On the other side, the processes have resulted in new areas for scientific advice, which has not been given before, for example on the impact of fisheries on benthic communities.

To apply the ecosystem approach in high north is actually possible, due to the fact that the ecosystem of this region is not that diverse, compared to the southern ecosystems with thousands of species. In the south, it is almost impossible to investigate all components and relations in the ecosystem.

4.5 Summary of main findings after analysis

By performing, the governability assessment and the input from the interviews the challenges and limitations in the case of the implementation the EAF in the North-East Atlantic have been displayed. By examining the properties of natural system and system–to-be-governed it is possible to conclude, that in the given region several elements of the EAF are implemented.

If we focus more specifically on the fishery management, the implementation seems to be quite successful. According to Report to the Storting (White paper 2011), the management targets of viable populations has been achieved for cod, haddock, capelin and herring. Other fish stocks, such as golden and beaked redfish, Greenland halibut and coastal cod still not at a

sufficient level. In addition, IUU fishing has been significantly reduced due to the close cooperation among the countries. Cooperation between Norway and Russia is characterized as successful with well-established arrangements. This includes determining total allowable catches, setting gear restrictions and adoption of harvest control rule to ensure sustainable fishery. ICES have evaluated it as being in accordance with precautionary approach. However, uncertainties in dynamics of Natural system may change the whole situation.

Such improvement in main stocks condition is a certain illustration that governing system comprehends many complex interactions of the Natural system. What allows answering the main question: the implementation of ecosystem approach is actually makes natural system easier to govern. It allows managers to look not at the single element, but to see a more complete picture and to see fish stocks and society in relation to each other with implementation of the EAF, it is possible to take into account human activities and evaluate the impact on the ecosystem from them. In addition, it helps to design management with account of other industries and their future coexistence.

5 Discussion

In my work, the NRC is seen in prospective of the attempt to solve Hardin's tragedy of the commons. Common resources control falls under state ownership with establishing 200 nm EEZ with full responsibility for state of ecosystem. Since Russia and Norway share common stocks, their relationship can be seen in the framework of more formalized version of Hardin's model, Prisoners dilemma (Figure 8.).

		Actor 1	
		I comply with the agreement	I don't comply with the agreement
Actor 2	I comply with the agreement	Both actors receive environmental benefit	Actor 1 pollutes, Actor 2 and Actor 1 receive environmental disbenefits
	I don't comply with the agreement	Actor 2 pollutes, Actor 1 and Actor 2 receive environmental disbenefits	Environmental Catastrophe!

Figure 8 Prisoner's dilemma. Source: environmentalgovernance.wordpress.com

It can be suggested that both sides considered all the options in accordance with figure 8 and chose a path of cooperation and mutual agreement to extract benefits from natural resource. However, there are plenty examples, where a simple agreement is not sufficient to maintain rational withdraw of resources. Ostrom pointed out oversimplification of Hardin's model and stated that institutions are key factor in governing natural resources. Principles, characterising successful institutions were described earlier in the thesis. The question is whether NRC fulfils eight principles of successful institute.

Well-defined boundaries

Boundaries of marine ecosystem are challenging to define compare to terrestrial ecosystems. With establishing EEZ parties identified the territories and closed the access to common resources. However, in 1978 the two countries did agree on establishing a Gray Zone in place of disputed area and agreed upon terms for activities in this area. Discussion about determination of the border continued until 2011, when agreement was finally reached. Establishing the NRC in 1976 also allowed to determine participants, who would share responsibilities for sustainability of the stock. So, boundaries can be also seen as responsibilities for fish stocks, shared between the users. The most economically important species are the North-East Atlantic, cod, haddock and capelin are shared between Russia and Norway, and that is the boundary of the management framework.

Congruence between appropriation and provision rules and local conditions

As it was described before, the NRC discusses issues related to gears and mesh size as well as allocating quotas. The NRC definitely fulfills its' role to provide equal possibilities for harvesting. Although the NRC does not allocate benefits from the harvesting and does not serve to this purpose. This issue is resolved on the national level.

Collective-Choice Arrangements

The NRC consists of representatives from the industry, authorities and scientists. It is open for participation of all interested parties with purpose of discussion operational rules.

Collective-Choice Arrangements

Participants of the NCR have the right to participate in negotiations and influence on terms of agreement. For instant, the scientific advice to authorities from research groups of IMR and

PINRO is taken into account in decision about allocating quotas. So the NRC can be seen as collective-choice arrangements between countries and between parties in the committee.

Monitoring

The NRC is responsible for monitoring the state of the ecosystem, establishing joint working groups together with ICES and performing ecosystem surveys. It does not have in its task to control rule-breaking level. Audition is made on the national level and performed by a coast guard. However, when massive overfishing problem occurred from the Russian side this issue was brought up on the NRC meeting with the discussion of resolving the problem jointly.

Conflict-Resolution Mechanisms

The NRC can be seen as a platform for discussion for parties. It is hard to specify specific conflict resolution methods used during the annual meetings. This principle falls also under jurisdiction of national authorities. However, results of the decision-making process are fed back to the NRC and being retracted between participants.

The Minimal Recognition of Rights to Organise, Nested Enterprises and Graduated Sanctions are presented in certain extend as well, however, due to lack of inside information about all procedures and mechanism of the NRC, those principals are hard to discuss as an indicators of success.

Beyond Ostrom qualities the NRC can be characterize as a scientific-technocratic institution, and not political. All the work, which had been done during past 40 years was sheltered from political influence and had been based on scientific connections of two parties.

The governance structure in the Barents Sea is a result of well-established long-running cooperation of two parties, which are managed to set goals to achieve through the cooperation in the NRC framework. Existing terms of the work of the NRC made it possible to start transition towards the EAF.

The adoption of the EAF/EBFM is rather evolutionary; it is not changing entirely management system, but applying some elements and developing current fisheries management. It is done through modifications to existing biological reference points and harvest control rules that incorporate ecosystem considerations. However, scientists argue

about harvest control rule being a part of the EBFM, and see it as a precautionary approach, regulating stock at the low point.

Regarding to the case I was offered two ways of looking at the concept: as a management concept and as a knowledge.

The EAF as management is organized within the ecosystem. This includes activities besides fisheries (oil and gas activities, transportation etc.). From this point of view, the concept matches to the EBFM (Table 1), the holistic concept, and addresses sector-specific issues, more than just species of interests.

The EAF as knowledge includes knowledge about how the ecosystem is functioning and based on it, assessment is made. It corresponds to the EAF, which had better information for stock-focused management decisions.

There is no strict distinction between those concepts. Both imply new knowledge to work this in fisheries management framework. In practice, it is a mixture, where it is hard to separate one from the other. For the same reason it is hard to distinguish the EAF from the EBFM and in current management framework of the North-East Atlantic there are elements of both concepts.

It is possible to trace back four main forms of the EAF implementation. Such as by-catch regulation, being discussed during the NRC and implementing decision about mandatory sorting gears in order to avoid by-catch of juvenile cod. It is mainly done by modification of fishing gears and changes in fishing techniques. Multi-species model is not fully implemented yet, but attempt to include cod-capelin model in management plan is a step towards that. Scientists already spoke their concerns about cold-water corals, considering them as a vulnerable species, so in nearest future the protecting mechanism can be developed. All this leads to integrated ecosystem approach, which can be seen as an ultimate goal. Therefore, without any doubts, the NRC is implementing certain practices, more of a mix between the EAF and the EBFM. Though even framework is very advanced, it still requires development as well as suitable platform. The NRC could be a perfect fit for this purpose; however since it is still working under single-species model, it might require some changes as a social institute. One of the options is upscale development as subcommision under the Barents Sea implementation of the ecosystem approach. The reason why it could not stay at

the same state is change of objectives. New objectives would define new boundaries, not just single-species stocks. That could be territory, state or multi-species model, unless the development of the EAF would come that far by this time. Unpredictable role will play climate change. The outcome of ongoing processes in climate is unknown. It can only be guessed whether it will affect stock distribution, which will trigger quite changes in political sphere, regarding changes in quota allocation.

6. Concluding remarks

The EAF is not implemented as a radical redesign of the NRC, but more through small, incremental steps that gradually change some practices (ex HCR that makes quota setting into something automatic) and a slight change towards seeing some stocks in relation to each other. A point here is that the advisory process in ICES is still based on the single stock approach and therefor NRC cannot change their approach completely.

However, the HCR is an example that the NCR made a procedural change that later impacted ICES, where ICES actually started to revise and evaluate HCRs for several stocks instead of giving advice for a specific quota level. Thus, saying that implementation of the EAF is used, as a tool to govern natural system is rather unfair. First, in the North-East Atlantic applied mix between the EAF and the EBFM, and only certain elements embedded in management system. Establishing framework with ecosystem considerations implemented through the NRC might play the key role in future, due to the unpredictable outcome of climate change. Ecosystem monitoring helps to identify the impact, though there is a big risk that climate change would entirely change the stock distribution, what would influence political situation and whole procedure of quota allocation. In this case, the NRC should protect pure scientific cooperation, free from political games. The NRC proven to be successful institute with a long story and set an example on international cooperation. I tried to identify successful institute with Ostrom's principles in order to see how it will fit in theoretical model. In this case, it is important for other institute arrangements to well function. The NRC would develop further into something new and more efficient to uncertain natural conditions.

Regarding to the EAF/EBFM; there are many studies made with purpose to identify and describe more precisely the concept, divide one from another, when in fact they are almost

interchangeable. However, it has been a while in fisheries management framework, enough to start evaluate the results of an outcome. That was just one attempt, but for future research, I find it interesting to follow the implementation traces from the international to national and even local level. There are certain differences in the way of implementing on different levels, though it is essential to know what makes this concept work or not work in different settings, rather than just identify the term itself.

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