



Title: Marine Ecosystem Services in the Barents Sea and Lofoten Islands, a scoping assessment

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Short title: Marine Ecosystem Services in the Barents Sea and Lofoten Islands – a scoping assessment

Key Message: Ecosystem services provided by marine areas in the Barents Sea and Lofoten Islands have high socio-economic importance in the area. The commercial value of fisheries (including aquaculture) in the area has been estimated to be nearly 13 billion NOK (~ 1.65 billion EUR) in 2009 whereas the recreational fishing among people living in the area is estimated to range between NOK 270-800 million per year (~ 35 - 100 million EUR). The key question in the future will be how these, and several other ecosystem services, might be affected by potential oil and gas drilling developments in the area.

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What is the problem?

The Barents Sea area is a relatively pristine marine ecosystem, exposed to human impacts to a much lesser degree than, for example, the southern marine areas of Norway such as the North Sea – Skagerrak area. The key question regarding sustainable management of the Barents Sea ecosystem and its services, particularly the Lofoten Islands, is whether – and to what extent - sea drilling for oil and gas should be permitted in the area. The Lofoten area plays an invaluable role in maintaining commercial and recreational fisheries in the area, including supporting the recreational activities and tourism connected to fisheries and marine wildlife watching (see below).

Consequently, the debate surrounding the potential drilling developments has increasingly focused on the broader socio-economic importance and value of marine ecosystems and the foreseen local and regional effects of future petroleum activities, including negative impacts on ecosystem services in the area. Therefore, there is a need to improve understanding of the benefits associated with the Barents Sea ecosystem services in order to estimate the true costs and benefits of the planned drilling developments.

The aim of the scoping assessment was to identify and draw attention to the wide range of benefits provided by ecosystem services in the marine areas of the Barents Sea and Lofoten, supporting socio-economic welfare and people's wellbeing. The assessment, taking place in 2009-2010, was a

pioneering attempt to increase the understanding and knowledge based on the value of ecosystem services in Norway (Magnussen et al. 2010).

Which ecosystem services were examined and how?

One of the socio-economically most important ecosystem service in the Barents Sea and Lofoten area is - not surprisingly - **commercial fishing**. Areas around the Lofoten Islands play a crucial role for fisheries at the national level, functioning as important spawning and breeding areas for several commercially important species. The value of commercial fishing in the Barents Sea – Lofoten area was nearly 7 billion NOK (~ 0.9 billion EUR) in 2009¹, while the value of fish from commercial aquaculture in the area was more than 6 billion NOK (~ 0.75 billion EUR)² (Magnussen et al. 2010). At the moment, fisheries activities in the Barents Sea and Lofoten Islands are operating on a relatively sustainable basis however constant efforts should be made to keep the fish stocks in a continued good state, to safeguard these high socio-economic values.

The area, and particularly the Lofoten Islands, has also a long tradition for **recreational fishing and cultural ecosystem services**, mainly connected to fishing and hunting of sea birds, and these are other key values and benefits associated with marine ecosystems. A rough estimate (based on benefit transfer) suggests that people living in the Barents Sea – Lofoten area (the three northern counties of Norway) spend approximately one million days / year fishing in the sea. The value of this activity, estimated as consumer surplus ('the value of recreation days'), range from NOK 270-800 million per year³ (~ 35 - 100 million EUR).

Further, recreational fishing and other recreational and cultural values play an important role in creating revenue from **tourism** in the area. Lots of international tourists visit the coast of the Barents Sea in order to enjoy activities such as fishing, whale and seal safaris, canoeing, bird watching and nature photography. At the time of the assessment by Magnussen et al. (2010) no figures for the value of marine ecosystems for tourist sector (eg fishing tourism in the area) were available. However, later in 2011 Borch et al. (2011) estimated the economic effects of fishing tourism (direct and indirect effects) in the area (ie the three northern counties surrounding the Barents Sea) to be over 500 million NOK (over 60 million EUR) per year.

The scope of the Magnussen et al. 2010 assessment was broad, aiming to provide a full picture of the wide range of ecosystem services provided by marine areas. Therefore, a dedicated attention was also given to identify and highlight the importance of supporting and regulating services provided by the area, instead of only focusing on the more commonly known – and more 'visible' - provisioning and recreational services. For example, Barents Sea and the Lofoten Islands are important for CO₂ sequestration. As mentioned already above, spawning and breeding areas around Lofoten Islands (ie supporting services) form the basis for fisheries and related commercial and recreational activities in the area. Healthy fish populations are also important for a rich variety of sea birds that the coastal areas and their tourism are famous for. They also give a rise to a variety of sea mammals and these areas are important as breeding areas for many species. However, no monetised values (eg contingent valuation studies) were available for the significant biodiversity

¹ Gross values from fish catch statistics from the Norwegian Directorate for Fisheries

² Gross values from Aquaculture statistics tables from Statistics Norway

³ Based on Toivonen et al (2004), Magnussen et al (2010) roughly assumed that 50% of the population in the three counties bordering the Barents Sea – Lofoten area (aged 18-69) fish at least once per year. Based on the same study, the average number of fishing days per fisherman in Norway is 12,9, with 56% of the fishing days spent fishing in the sea (ie 7.2 days at sea / fisherman). Assuming that people in the three northern countries behave like the average Norwegian, these figures result in approximately 1 million fishing days by the sea for the population in the three counties. The recreation value per fishing day is assumed to be NOK 270 – 800, based on recreation values for fishing days in lakes and rivers in Norway (based on Navrud (2001)).

values of the area. Finally, there are also great expectations for area's potential (ie option value) related to bio-prospecting as organisms living in the area need special features to be able to survive the harsh weather conditions. However, no existing or easily available estimates for the socio-economic importance of these services are currently available.

Key identified gaps in knowledge

A range of studies were carried out in the Barents Sea and Lofoten area as part of the Norwegian authorities' work on the management plan for the area. Norway also has a long tradition on marine research, particularly with respect to commercially important fish. However, the results of Magnussen et al. 2010 assessment indicate that significant knowledge gaps still exists, making it difficult to assess and value ecosystem services in the area. Particularly, there is a lack of quantitative data that would allow making clear conclusions on the possible ecological and socio-economic consequences of future development on different ecosystem services. This underlines the importance of ecologists and economists working together in the future to define the most accurate research questions, data needs and analyses.

The assessment by Magnussen et al. (2010) did not include any new valuation studies. For marine fisheries and aquaculture market prices were used, with gross values being the only values available. It is considered that while gross values can be used to demonstrate the importance of commercial fisheries in the area they cannot be used to carry out broader benefit-cost analysis of different management options for the areas (eg conservation vs. drilling) or to develop policy measures for more sustainable fishing (eg suggest economic incentives). In order to carry out such studies, there is a need to know the net benefits received from these ecosystem services.

No primary valuation studies exist for non-market ecosystem services in the area. Consequently, basic benefit transfer was undertaken by Magnussen et al. (2010) in order to provide a rough estimate for recreational fishing and hunting of sea birds in the area, while other important ecosystem services, such as broader cultural values, could be described only in a qualitative manner.

Did the examination of ecosystem services generate impacts on decision-making or policies and, if so, how?

Following the scoping assessment, a benefit-cost analysis of oil and gas drilling activities in the area was carried out, building on a number of insights by Magnussen et al. (2010). However, the lack of existing information and analysis (qualitative, quantitative and monetary) limited the integration of ecosystem services into these benefit-cost assessments. Consequently, new studies, focusing on certain ecosystem services or particular marine areas have been initiated, with a view to be carried out in the near future. For example, a research project '*Arctic Games*' by Swedish, Norwegian and Russian researchers, a part of the Swedish research programme '*Mistra Arctic Futures in a Global Context*' and funded by MISTRA foundation (a foundation for strategic environmental research), is planning to carry out a further ecosystem services valuation study in the Lofoten area in 2012, including fisheries as one important ecosystem services. Furthermore, University of Tromsø is planning to undertake a valuation study of the unique cold water coral reefs along the Norwegian coast.

The discussion of petroleum activities in the Barents Sea – Lofoten area is still ongoing and it is hard to judge at the moment what the outcomes will be and which effect the ecosystem service assessments will have on the final decisions. However, it is hoped that the assessment by

Magnussen et al. (2010) has broadened the understanding and appreciation of the role marine ecosystems play in supporting the human welfare. As a consequence, a dedicated assessment of ecosystem services was also adopted as a mandatory element for the development of North Sea – Skagerrak area management plan (ongoing). Furthermore, partly inspired by the Magnussen et al. 2010 scoping assessment several sector authorities and NGOs have initiated studies to assess and value ecosystem services in other Norwegian marine areas. The scoping assessment is also foreseen to play a role in the future work of the Norwegian Ecosystem Service Expert committee, appointed by the Government in autumn 2011, tasked to lead the integration of ecosystem services into policy and decision-making in Norway.

Lessons learned

The study by Magnussen et al. (2010) show that ecosystem services assessment can provide an important tool for supporting decision-making in the context of marine environment. However, it also shows that significant gaps still exist in terms of information on the socio-economic role and value of marine ecosystem services. Finally, the assessment also highlights that some important values, such as the importance of supporting and regulating services and cultural values, are hard to capture via monetary valuation. Therefore, qualitative and quantitative assessments are foreseen as important tools for guaranteeing a comprehensive information base for decision-making.

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