IASS STUDY

Institute for Advanced Sustainability Studies (IASS)

Marine Conservation in the Norwegian Arctic

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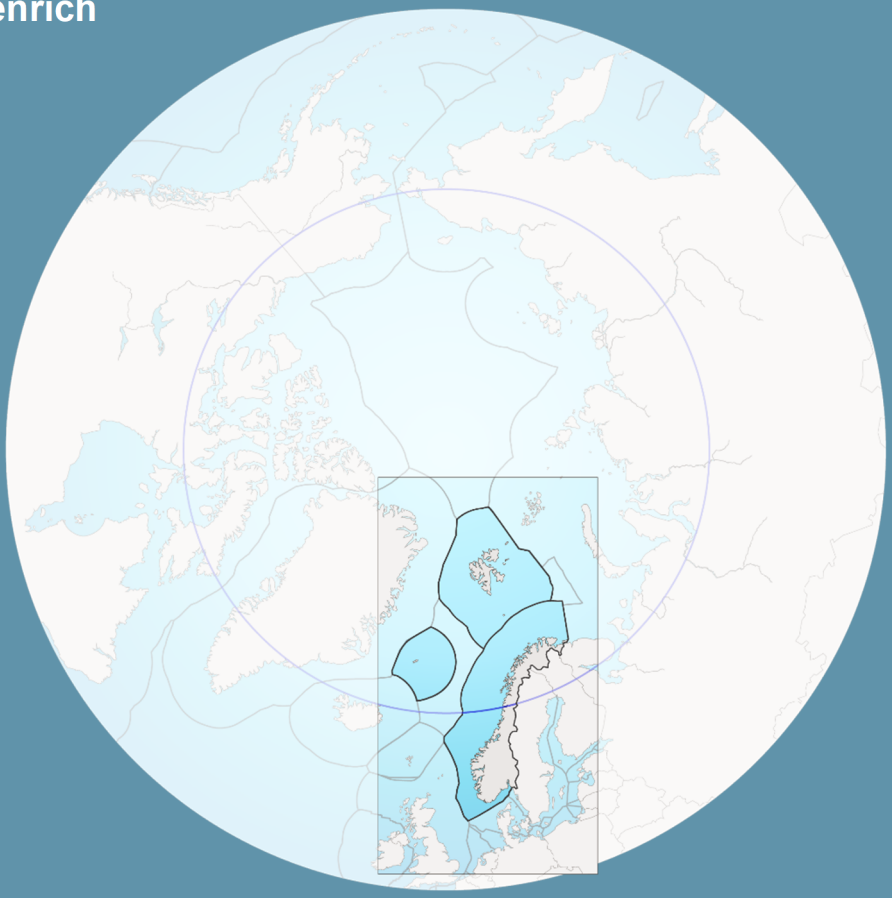

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Acknowledgements

Cover Graphic

The exclusive economic zone of Norway (highlighted) and other coastal states on the map of the Arctic region. The blue line indicates the Arctic circle. IASS visualisation based on Flanders Marine Institute (2019), GRID-Arendal (2019).

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Note on Covid-19

This report was mainly prepared and written in 2020 and 2021 when the Covid-19 pandemic was spreading across the world, also affecting Arctic communities and economies.

Covid-19 affected the Arctic blue economy in several ways. The pandemic initially limited shipping, and with it imports of fuel, food, and equipment as well as exports of oil, natural gas, minerals, and fish (Arctic Council, 2020). After this initial phase, the cargo transportation corridors continued operations and shipments through the Northern Sea Route actually saw an increase of 2.9% in the first 10 months of 2020 compared to the same period in 2019 (Staalesen, 2020a). However, tourist vessels and especially cruise ships were mainly absent from Arctic waters in 2020, and it is expected to take several years for the tourism and gastronomic industries in the Arctic to return to 2019 levels (Arctic Council, 2020). In a similar manner, most marine research expeditions were either cancelled or reduced in 2020. While remote data collection could continue, pandemic-related cancellations of polar research expeditions have interfered with research typically carried out during the summer Arctic surveys (Alaska Fisheries Science, 2020).

In the fisheries sector, labour shortages as well as Covid-19-related safety measures on board fishing vessels created new challenges and costs. At the same time, the role of hunting and fishing activities has increased in some areas and engagement in subsistence expanded because of the pandemic (Arctic Council, 2020). Finally, the downturn in oil prices led to a reduction of oil and natural gas production in the Arctic. In Norway for example, the government decided to lower Norwegian oil production through June to December 2020 (Norwegian Ministry of Petroleum and Energy, 2020).

While some of the impacts can now be detected, much uncertainty remains regarding how extensive the economic downturn due to Covid-19 will be and how fast the different sectors will recover. What is becoming clear already is that the decreases in vessel traffic led to a significant decrease in shipping noise during the first half of 2020. In addition, pandemic-related safety concerns and economic slowdowns also decreased a multitude of other activities that generate ocean noise and other impacts, including fishing, aquaculture, seismic exploration, oil drilling, military exercises, offshore construction, and dredging activity for at least some portion of the pandemic (Carr, 2021).

Zusammenfassung

Die Arktis erwärmt sich substanziell schneller als der globale Durchschnitt. Der rasche Temperaturanstieg verändert die Arktis bereits tiefgreifend - und wird dies auch weiterhin tun - mit noch unbekannten Folgen für die Region und die ganze Welt. Gleichzeitig mit dem Rückgang des Meereises und der sich verändernden Verteilung der lebenden Meeresressourcen hat eine Zunahme des wirtschaftlichen Interesses an der Region zu Bedenken hinsichtlich der Nachhaltigkeit der wirtschaftlichen Aktivitäten in der Arktis geführt.

Um Wege zu finden, wie der Schutz und die nachhaltige Nutzung der arktischen Meeresumwelt gewährleistet werden können, ist ein umfassendes Verständnis der Meeresumwelt, der sie beeinflussenden Belastungen und der relevanten Regulierungen und Managementmaßnahmen erforderlich. Das Ecologic Institut und das Institute for Advanced Sustainability Studies haben sich zum Ziel gesetzt, durch eine Reihe von Berichten zum Meeresschutz in der Arktis einen Überblick über die relevanten Informationen zu geben. Die Berichte konzentrieren sich auf die fünf arktischen Anrainerstaaten: Kanada, Dänemark (durch Grönland), Norwegen, die Russische Föderation und die Vereinigten Staaten. Darüber hinaus gibt ein regionaler Bericht einen umfassenden Überblick und fasst die einschlägigen internationalen und regionalen Vorschriften zusammen.

Der vorliegende Bericht behandelt die für den Meeresschutz in der norwegischen Arktis relevanten Informationen. Der Bericht deckt vier Hauptthemen ab: Er beginnt mit der Beschreibung der wichtigsten Merkmale der Meeresumwelt der norwegischen Arktis. Anschließend werden wesentlichen Belastungen untersucht, die sich auf die marine Biodiversität in der Region auswirken, gefolgt von einer Untersuchung der soziokulturellen und wirtschaftlichen Rolle sowie der Umweltauswirkungen der wichtigsten meeresbezogenen menschlichen Aktivitäten in der norwegischen Arktis. Der letzte Teil des Berichts gibt einen Überblick über die relevanten nationalen Institutionen sowie über Regulierungen, Vorschriften und Instrumente, die zum Schutz der norwegischen arktischen Meeresbiodiversität und zur Gewährleistung ihrer nachhaltigen Nutzung eingesetzt werden oder eingesetzt werden könnten.

Hinweis: Die in diesem Bericht präsentierten Informationen wurden hauptsächlich während der weltweiten Covid-19-Pandemie und vor dem russischen Einmarsch in die Ukraine im Jahr 2022 zusammengetragen. Die (weiteren) politischen und wirtschaftlichen Auswirkungen dieser Ereignisse und die sich daraus ergebenden Veränderungen in der Arktis-Governance sind zum jetzigen Zeitpunkt nicht absehbar, und es ist zu erwarten, dass sich einige der in diesem Bericht dargestellten Entwicklungen und Trends erheblich ändern werden.

Die Kernbotschaften des Berichts finden sich unter der folgenden englischen Zusammenfassung.

Summary

The Arctic is warming three times faster than the global average. These rapidly increasing temperatures are already profoundly changing the Arctic, and will continue to do so, with yet unknown consequences for the region as well as worldwide. The diminishing sea ice extent and the changing distribution of marine living resources have led to an increase in economic interest in the region as well as concerns about the sustainability of economic activities in the Arctic.

In order to identify ways in which conservation and sustainable use of the Arctic marine environment can be ensured, a broad understanding of the marine environment, the pressures affecting it, and the relevant regulations is needed. Ecologic Institute and the Institute for Advanced Sustainability Studies aim to provide an overview of relevant information through a series of reports on marine conservation in the Arctic. The reports focus on the five Arctic coastal states: Canada, Denmark (by virtue of Greenland), Norway, the Russian Federation, and the United States. In addition, a regional report is providing a broader overview and summarises relevant international and regional regulations.

This current report presents an overview of information relevant to marine conservation in the Norwegian Arctic. The report covers four main issues: it starts with the description of the key characteristics of the Norwegian Arctic marine environment. Then it examines significant pressures impacting marine biodiversity in the region, followed by exploring the socio-cultural and economic role as well as the environmental impact of the main sea-based human activities in the Norwegian Arctic. The last part of the report describes the Norwegian ocean governance system and provides an overview of relevant national institutions as well as rules, regulations and tools which are, or could be, employed to protect Norwegian Arctic marine biodiversity and ensure its sustainable use.

NB: The information presented in this report was mainly collated during the global Covid-19 pandemic and prior to the 2022 Russian invasion of Ukraine. The (further) political and economic impacts of these events and resulting changes in Arctic governance cannot be foreseen at this point in time and it can be expected that some of the developments and trends presented in this report may change substantially.

The following key messages are derived from the assessment:

The Norwegian Arctic Marine Environment

- The Norwegian Arctic marine environment is characterised by high biological productivity and biodiversity.
- The area roughly includes the northern part of the Norwegian Sea, parts of the Greenland Sea around Svalbard and Jan Mayen and the Norwegian part of the Barents Sea.
- Highly productive frontal zones exist where Atlantic water meets Arctic water (called the “polar front”), at the edge of the continental shelf and at the transitional zone between the open sea and the sea ice (the “marginal ice zone”).
- The most abundant fish species in Norwegian waters are Norwegian spring-spawning herring, Northeast Atlantic mackerel and blue whiting.

- In the Barents Sea, large stocks of capelin, Atlantic cod, polar cod, haddock, Greenland halibut, saithe, Atlantic herring, northern shrimp, and long-rough dab have been found.
- 31 species of marine mammals exist in Norwegian waters, eight of which are globally recognised as vulnerable or endangered.
- Several of the marine mammals present in Norway are dependent on the annual sea ice and are thus negatively affected by the overall diminishing extent and the delayed formation of ice caused by climate change.
- The Barents Sea supports large concentrations of seabirds.
- Many seabird populations in the Norwegian Sea have declined severely since the early 1980s.
- Benthic species including corals, sponges, sea cucumbers and urchins exist in large numbers in the waters of the Norwegian Arctic.
- The polar front presents a boundary for benthic communities, which can be divided into a more southerly and a more northerly benthic community.

Climate Change and Pollution: Key Pressures Affecting the Norwegian Arctic Marine Environment

- Climate change is considered to be the main cause of changes in the composition and distribution of species and ecosystems in the Norwegian Arctic.
- Rising sea temperatures affect the distribution of many marine species in the Barents Sea, with the overall trend being northerly and north-easterly shifts.
- Hazardous substances detected in the Norwegian Sea and the Barents Sea originate mostly in other regions and have been transported into the area by air and ocean currents.
- While levels of hazardous substances in sediments and the water column are generally low, high levels were detected among certain species at the top of the food chain, giving cause for concern about adverse effects at the individual level.
- Marine litter has been detected in large quantities and presents a threat to marine life as it may e.g. be ingested or lead to injuries and entanglement.

Sea-based Human Activities in the Norwegian Arctic

- Marine living and non-living resources are a strong pillar of the Norwegian economy. Based on value added, the offshore oil and gas industry is the largest industry in Norwegian waters, followed by maritime transport, the seafood industry and tourism.
- Climate change-related changes in sea ice extent coupled with technological advances are expected to make additional areas of the Norwegian Arctic accessible to (increased) socio-economic activities.
- Offshore oil and gas activities have moved further north as well as into deeper water in recent years. The risk of related spills is expected to increase in the coming years due to the ageing of installations and the greater infrastructure volume.
- Vessel traffic in the Norwegian Arctic is highest along the mainland coast. Another area with elevated activity is the area south and west of Svalbard.
- Vessel traffic in the Norwegian Arctic consists mainly of large oil and gas tankers from the Russian Federation and Norway, bulk carriers transporting other freight, fishing vessels and cruise and passenger vessels.
- Fisheries are an important part of the culture of coastal communities in Norway and have presented a main source of income for hundreds of years.
- The areas with the highest fishing activities in Norway are the North Sea, the coastal area of the Norwegian Sea and parts of the Barents Sea.

- Catches of the main target species have remained relatively stable in the past years and stocks are supposed to be relatively fully utilised.
- Aquaculture sites are located along all the mainland coast of Norway and have seen an increase in the Norwegian Arctic in recent years.
- In 2018, almost 800,000 cruise passengers visited Norway; a quarter of them travelled in northern coastal Norway and Svalbard.
- The expansion of tourism activities in general, and cruise tourism in particular, is expected to continue.
- Offshore wind energy developments have recently started in Norway. While technical and cost-related challenges persist, these may partially be compensated for by better wind conditions offshore, and the possibility to build larger wind turbines.
- Norway's interest in exploiting its potential seabed mineral resources has increased in recent years. An act regulating the exploration and exploitation of minerals on the Norwegian Continental Shelf entered into force in 2019.

Governance of the Norwegian Arctic Marine Environment

- Marine policies receive much attention in the domestic debate due to their implications for the Norwegian economy.
- Both the preparation and implementation of public policies typically involves participation of organised interests, such as economic interest groups, environmental non-governmental organisations, regional political bodies, and Indigenous groups.
- The Norwegian government aims at reaching targets related to nature conservation by combining species-based and area-based measures.
- Regional management plans exist for all Norwegian marine areas, including the Barents Sea, the Norwegian Sea, and the North Sea. They were adopted by the Norwegian parliament and lay down the overall framework and guidelines for the management of Norwegian waters across economic sectors.

Contents

List of Abbreviations

AECO	Arctic Expedition Cruise Operators
EEA	European Economic Area
EEZ	Exclusive Economic Zone
EU	European Union
GDP	Gross Domestic Product
GVA	Gross Value Added
ICES	International Council for the Exploration of the Sea
IMO	International Maritime Organization
IUCN	International Union for Conservation of Nature
JNRFC	Joint Norwegian-Russian Fisheries Commission
LNG	Liquefied Natural Gas
MARPOL	International Convention for the Prevention of Pollution from Ships
MPA	Marine Protected Area
NASCO	North Atlantic Salmon Conservation Organization
NEAFC	North East Atlantic Fisheries Commission
OSPAR Convention	Convention for the Protection of the Marine Environment of the North East Atlantic
Polar Code	International Code for Ships Operating in Polar Waters
Sm^3 o.e.	Standard cubic metres of oil equivalents
SOLAS	International Convention for the Safety of Life at Sea
TAC	Total Allowable Catch

1 Introduction

Global interest and activity in the Arctic have increased greatly in recent decades. The Arctic is warming three times faster than the global average. These rapidly increasing temperatures are already profoundly changing – and will continue to change – the Arctic with yet unknown consequences for the people, environment, and economy in the region as well as worldwide (SDWG, 2021).

The diminishing sea ice extent and the changing distribution of marine living resources have led to an increase in economic interest in the region as well as concerns about the sustainability of economic activities in the Arctic (Raspotnik et al., 2021). The challenge now is to identify development pathways that can ensure the sustainable use and conservation of the Arctic marine environment (SDWG, 2021).

In order to identify ways in which conservation and sustainable use of the Arctic marine environment can be ensured, a broad understanding of the marine environment, the pressures affecting it, and the relevant regulations is needed.

Ecologic Institute and the Institute for Advanced Sustainability Studies aim to provide an overview of relevant information through a series of reports on marine conservation in the Arctic. The reports focus on the five Arctic coastal states: Canada, Denmark (by virtue of Greenland), Norway, the Russian Federation, and the United States. In addition, a regional report is providing a broader overview and summarises relevant international and regional regulations. The reports were published in 2022 and are available for download on the websites of the Ecologic Institute and the Institute for Advanced Sustainability Studies.

This current report presents an overview of information relevant to marine conservation in the Norwegian Arctic. The Arctic is commonly referred to as “the sea and land areas between the North Pole and the Arctic Circle”. This definition is also used by the Norwegian government, e.g. in its white paper on Arctic policy (Norwegian Ministry of Foreign Affairs, 2021: Introduction). Following this definition, more than two thirds of the waters under Norwegian jurisdiction are Arctic waters, including parts of the Greenland Sea, the Norwegian Sea and the Norwegian part of the Barents Sea. As it is challenging to access and compile data specifically for this area of the Norwegian waters, this report partly presents broader data for all of Norway and provides more detailed information for the Norwegian Sea and the Barents Sea whenever feasible. Data for the Norwegian and the Barents Seas are largely sourced from government reports which delimit these areas as shown in Figure 1 below (see management areas outlined in yellow).

The report covers four main issues: it starts with the description of the key characteristics of the Norwegian Arctic marine environment. Then it examines significant pressures impacting marine biodiversity in the region, followed by an exploration of the socio-cultural and economic role as well as the environmental impact of the main sea-based human activities in the Norwegian Arctic. The last part of the report describes the Norwegian ocean governance system and provides an overview of relevant national institutions as well as rules, regulations and tools which are, or could be, employed to protect the Norwegian Arctic marine biodiversity and ensure its sustainable use. An overview of relevant international and regional agreements and frameworks is provided in the regional report that forms part of this series of reports.

The content of this report is entirely based on publicly available data, articles and reports, with much of the information coming from reports published by the Norwegian government. Where data on gross value added (GVA) and employment generated by sea-based human activities is presented, it always refers to data for all of Norway, if not stated otherwise.

The information presented in this report was mainly collated during the global Covid-19 pandemic and prior to the 2022 Russian invasion of Ukraine. The (further) political and economic impacts of these events and resulting changes in Arctic governance cannot be foreseen at this point in time and it can be expected that some of the developments and trends presented in this report may change substantially.

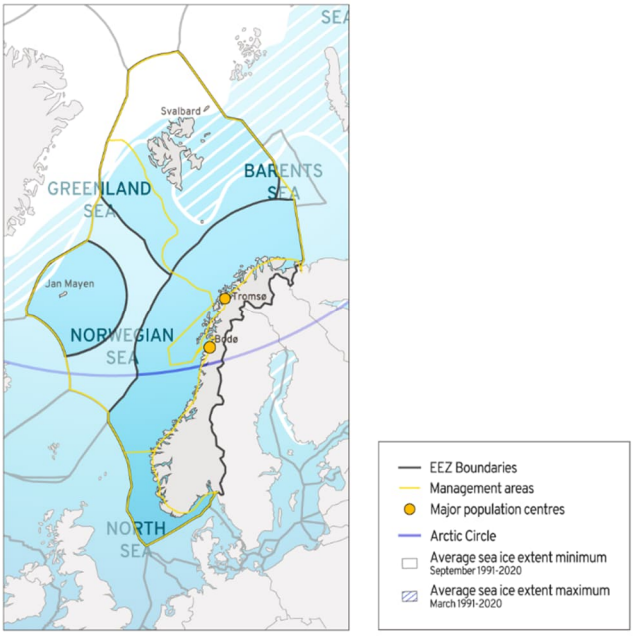

Figure 1: The exclusive economic zone of Norway and the Norwegian management areas (yellow). The blue line indicates the Arctic circle. IASS visualisation based on Flanders Marine Institute (2019), GRID-Arendal (2019).

2 The Norwegian Arctic Marine Environment

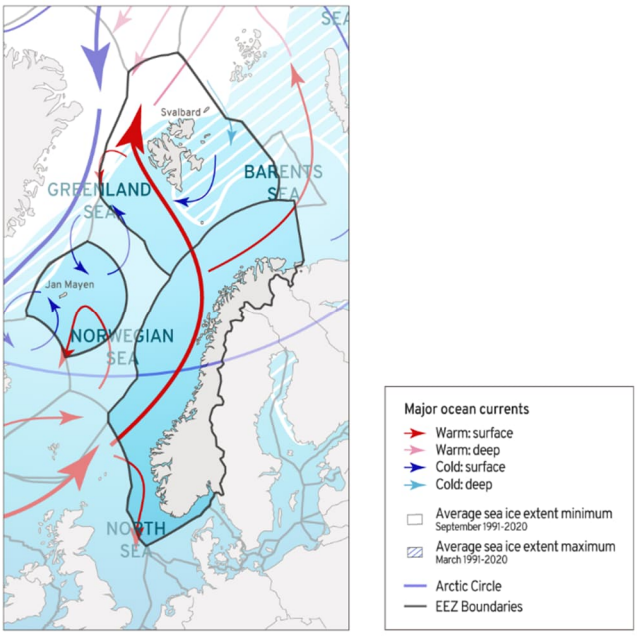

Figure 2: Main oceanic currents and Arctic sea ice extent with a focus on Norwegian EEZ. IASS visualisation based on Copernicus Climate Change Service/ECMWF (2021a, 2021b), Flanders Marine Institute (2019), GRID-Arendal (2019), Hunt et al. (2016).

The Norwegian Arctic marine environment is characterised by high biological productivity and biodiversity (Norwegian Ministry of Climate and Environment, 2016; Norwegian Ministry of Climate and Environment, 2017). The area roughly includes the northern part of the Norwegian Sea, parts of the Greenland Sea around Svalbard and Jan Mayen and the Norwegian part of the Barents Sea. The Norwegian Sea is a deep ocean basin which reaches depths of 3,000- 4,000 metres (PAME, 2018b). The Barents Sea is a large shelf area with an average water depth of about 230 metres. It falls partly under Norwegian and partly under Russian jurisdiction and contains a central area which is beyond national jurisdiction and therefore classified as high seas (Figure 2; Norwegian Ministry of Climate and Environment, 2016).

The northernmost part of the Mid-Atlantic Ridge extends across the Norwegian Sea and features mud volcanoes, hydrothermal vents and methane hydrates as well as related deep-sea fauna, creating a distinctive marine ecosystem. On the continental shelf, several coral reef complexes have been discovered, though not much information exists on habitat types and species in deep-sea areas (Norwegian Ministry of Climate and Environment, 2017).

The Norwegian Sea is supplied with relatively warm Atlantic water flowing in through the North Atlantic Drift, resulting in a more gentle climate than at equivalent latitudes in North America (Hoel, 2009). These relatively mild conditions also prevail in the southern part of the Barents Sea, while cold Arctic water is predominant in the northern part of the Barents Sea (PAME, 2018a). Where Atlantic water meets the Arctic water, a highly productive oceanographic front called the 'polar front' is formed. Other highly productive frontal zones exist at the edge of the continental shelf and at the transitional zone between the open sea and the sea ice, called the 'marginal ice zone'. The frontal zones support large algae blooms, thus attracting zooplankton, which, in turn, is preyed upon by fish, seabirds and marine mammals (Norwegian Ministry of Climate and Environment, 2016).

Great variations of physical factors, such as sea temperature and ice conditions over the year as well as from year to year, produce significant ecosystem effects in the Barents Sea. Biomass typically increases greatly due to intense phytoplankton blooms lasting from spring to summer and is higher in warmer years with reduced sea ice (Norwegian Ministry of Climate and Environment, 2016).

The main challenges identified by Norwegian authorities for the Norwegian Sea and the Barents Sea are related to the effects of climate change, overfishing of certain fish populations, the decline of seabird populations, pollution, the appearance of new benthic species and the protection of coral habitats (Norwegian Ministry of Climate and Environment, 2016, 2017).

Fish Species

The most abundant fish species in Norwegian waters are Norwegian spring-spawning herring, Northeast Atlantic mackerel and blue whiting (PAME, 2018b). These pelagic fish stocks are very mobile and cover large distances in search of food (Norwegian Ministry of Climate and Environment, 2017). In the Barents Sea especially large stocks of capelin, Atlantic cod, polar cod, haddock, Greenland halibut, saithe, Atlantic herring, northern shrimp, and long-rough dab have been found (PAME, 2018a). Many of these species spawn at the Norwegian coast, especially near the Lofoten and Vesterålen Islands. The eggs and larvae then drift into the Barents Sea, where the fish mature (Norwegian Ministry of Climate and Environment, 2016). Most commercial stocks are estimated to be in generally good condition except for Norwegian coastal cod and golden redfish, which are in poor condition (Norwegian Ministry of Climate and Environment, 2020). Populations of Northeast Arctic cod and haddock have increased in the Barents Sea as a result of rising sea temperatures, which have enabled these species to expand further east and north (Norwegian Ministry of Climate and Environment, 2016).

Marine Mammals

According to the International Union for Conservation of Nature (IUCN) Red List, 31 species of marine mammals exist in Norwegian waters, 14 of which are present in the Arctic Sea area of the Norwegian waters. Eight of the marine mammals present in Norwegian waters are globally recognised as vulnerable, endangered, or critically endangered[1] (IUCN, 2022; Annex 1, Table 1). Furthermore, the Svalbard-Barents Sea stock of bowhead whales is critically endangered (PAME, 2018a). Several of the marine mammals present in Norwegian waters are dependent on the annual sea ice (PAME, 2018a) and are thus being negatively affected by the diminishing extent as well as the delay in formation of the ice. The impacts have been observed most clearly in the fjords around Svalbard, where the pup mortality of ringed seals has risen due to poor breeding conditions (Norwegian Ministry of Climate and Environment, 2016). Other negative impacts affecting marine mammals in the Norwegian Arctic include unintentional bycatch, high levels of persistent, bioaccumulative and toxic substances among

[1] The IUCN Red List threat category relates to the species as a whole, not necessarily to the population(s) in Norway.

some top predators, and underwater noise from seismic surveys, sonar and shipping (Norwegian Ministry of Climate and Environment, 2020).

Seabirds

The Norwegian Arctic supports large concentrations of seabirds. In the Barents Sea alone, an estimated 20-25 million seabirds are feeding annually (PAME, 2018a) and the breeding population is expected to amount to approximately 12 million individuals (Norwegian Ministry of Climate and Environment, 2016). The Norwegian Sea also represents an important feeding and wintering area for an estimated population of 9.5 million seabirds, which stay in the area for parts of the year. Important breeding habitats are found along the rocky coast of Norway and on the volcanic island Jan Mayen (PAME, 2018b).

Due to the shallowness and high productivity of the Barents Sea, seabirds are distributed widely along the coast and offshore areas. While in general terms, more species breed and winter along the mainland coast, some species can only be found in areas with an ice cover, several of which are threatened or endangered (Norwegian Ministry of Climate and Environment, 2016).

Many seabird populations in the Norwegian Sea have experienced a strong decline since the early 1980s, when most monitoring programmes began. Declines in populations amount to as much as 99% (common guillemot), 78% (kittiwake) and 75% (puffins). Contrary to this general trend, the gannet population has increased greatly since the early 1990s, with its breeding population having more than tripled (Norwegian Ministry of Climate and Environment, 2017).

It is assumed that certain species' reproduction and survival capacities are, amongst other factors, negatively affected by climate change, changes in food supply, unintentional bycatch, as well as high levels of persistent, bioaccumulative and toxic substances (Norwegian Ministry of Climate and Environment, 2020). Seabirds are also particularly at risk from marine litter, as they can mistake plastic for food (Norwegian Ministry of Climate and Environment, 2017).

Benthic Species

Different benthic species, including corals, sponges, sea cucumbers and urchins, can be found in the Norwegian Arctic marine environment. The polar front presents a clear boundary for benthic communities, which can be divided into a more southerly benthic community and a more northerly one (Norwegian Ministry of Climate and Environment, 2016). In the northern part of the Barents Sea, a large number of benthic species and a generally high benthic biomass were found (Norwegian Ministry of Climate and Environment, 2020).

Two invasive benthic organisms, which have been spreading in the Barents Sea in recent years, are the king crab and the snow crab. While the population of red king crab is located close to the mainland coast and has declined since 2004, the population of snow crabs has grown, raising concern that this species may have a significant impact on the benthic ecosystem in the Barents Sea (Norwegian Ministry of Climate and Environment, 2016).

Other impacts on benthic species in the Norwegian Arctic include northward shifts related to increasing sea temperatures as well as damages due to bottom trawling and installations related to petroleum activities (Norwegian Ministry of Climate and Environment, 2020).

3 Climate Change and Pollution: Key Pressures Affecting the Norwegian Arctic Marine Environment

3.1 Climate Change

Status

Climate change is considered to be the main cause of changes in the composition and distribution of species and ecosystems in the Norwegian Arctic. The Barents Sea is among those areas of the Arctic in which both the long-term sea ice extent and thickness are declining most rapidly due to climate change, resulting in major changes in the marine ecosystem. Observations have shown that the sea temperature has risen especially rapidly in the southern part of the Barents Sea, where relatively warm Atlantic water flows in. Measurements there indicate a sea temperature rise of about 1.5°C between 1977 and 2013 (Norwegian Ministry of Climate and Environment, 2016).

Related Impacts

The rising sea temperatures affect the distribution of many benthic species as well as fish species and whales in the Barents Sea, with the overall trend being a northerly and north-easterly shift. These changes partly reduce the availability of food for some species of seabirds, thus negatively impacting their populations. Negative effects for sea ice-dependent marine mammals, such as polar bears and seals, have also been observed (Norwegian Ministry of Climate and Environment, 2016).

Trends

It is expected that the distribution and composition of habitats and species will continue to change because of climate change impacts, leaving some key habitats unsuitable for certain species, while new areas may become more significant. In general terms, more southerly species are expected to progressively displace Arctic species and further warming is projected to bring about more far-reaching changes, impacting ever more species (Norwegian Ministry of Climate and Environment, 2016). While invasive alien species are currently mostly found along the Norwegian mainland coast, warmer sea temperatures pose a greater risk of invasive alien species spreading and establishing themselves in more northern areas (Norwegian Ministry of Climate and Environment, 2016).

In the longer term, ocean acidification is also expected to have major impacts on the structure and functioning of marine ecosystems, as it may affect plankton and other key species, which build their shells and skeletons from calcium carbonate (Norwegian Ministry of Climate and Environment, 2016).

3.2 Pollution

Status

In general, the levels of hazardous substances in the water column and in sediments in open sea areas of the Norwegian Sea and in the Barents Sea area are low and originate mainly from substances transported into the area by winds and ocean currents (Norwegian Ministry of Climate and Environment 2016, 2017). An exception to this is oil pollution in the Norwegian Sea, which is mainly due to local shipping and petroleum activities (Norwegian Ministry of Climate and Environment, 2017).

In recent years, large quantities of marine litter have been detected in the Norwegian Arctic marine environment. Plastics, including micro- and nano- plastics, make up the greatest part of marine litter and originate from sea-based sources including ships' paint, aquaculture installations, and fishing activities, as well as from several land-based sources. While it is very uncertain just how much marine litter enters the marine environment from these different sources, recordings of litter along the mainland coast and the coast of Svalbard indicate that consumer waste is the main source of litter in the southern part of Norway, while sea-based sources of marine litter are predominant further north and around Svalbard (Norwegian Ministry of Climate and Environment, 2020).

Related Impacts

Despite the generally low levels of hazardous substances in sediments and the water column, bioaccumulation processes can lead to high levels of hazardous substances in species at the top of the food chain. Studies have found high concentrations of some organic pollutants and mercury in several fish species, crab, seabirds and marine mammals, giving cause for concern about adverse effects at the individual level (Norwegian Ministry of Climate and Environment, 2017). High levels of persistent, bioaccumulative and toxic substances were for example detected among ivory gulls and polar bears in Svalbard. These high levels may affect the reproduction and survival of individuals and lead to uncertain effects at the population level (Norwegian Ministry of Climate and Environment, 2016).

An additional threat to marine life is presented by marine plastic litter as it may, for instance, be ingested or lead to injuries and entanglement. A steep rise in the proportion of fulmars with plastic debris in their stomachs could for example be observed in Svalbard, where one study detected plastic in the stomachs of 88% of the 40 fulmars analysed (Norwegian Ministry of Climate and Environment, 2016). In addition to the direct effects of the plastics, the chemical additives and chemical contaminants on the plastics can have adverse effects, and pathogens and alien species attached to plastics may be spread to new areas by ocean currents (Norwegian Ministry of Climate and Environment, 2020).

Trends

In general, the levels of internationally regulated persistent organic pollutants are declining, while levels of unregulated or recently regulated substances are stable or rising. However, levels of mercury have remained relatively stable despite heavy regulation and a great reduction in releases caused by human activity in Europe and North America (Norwegian Ministry of Climate and Environment, 2016).

With regard to marine litter, the Norwegian government has introduced various measures to reduce marine litter and is promoting international cooperation to address the problem. Progress is difficult to evaluate though as the current monitoring of marine litter is inadequate and knowledge gaps remain with regard to the amount and sources of marine litter in the Norwegian Arctic marine environment (Norwegian Ministry of Climate and Environment, 2020).

4 Sea-based Human Activities in the Norwegian Arctic

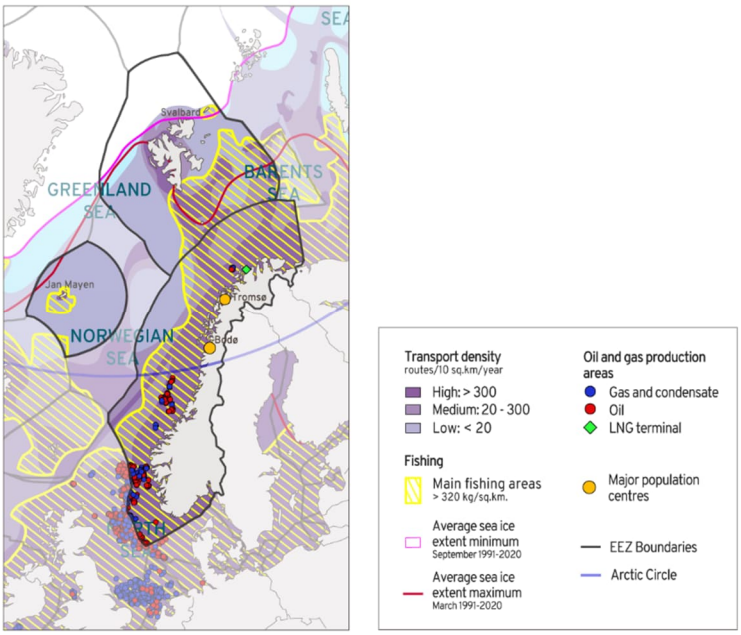

Figure 3: Overview of the major sea-based human activities in Norwegian exclusive economic zone (except tourism and aquaculture). IASS visualisation based on Copernicus Climate Change Service/ECMWF (2021a, 2021b), Flanders Marine Institute (2019), GRID-Arendal (2019), Löschke & Lehmköster (2019), MarineTraffic (2021), OSPAR (2017), Pauly et al. (2020).

Norway has a long history of marine resource use. The fisheries sector in particular is an important part of the culture of coastal communities in Norway and has been a main source of food and income for hundreds of years. Indigenous Sami fisherman, for example, engage in fisheries of historical importance to their communities, and catch lumpfish and cod (Hoel, 2009; Østhagen et al., 2022).

Norway is also an oil and gas-producing nation with offshore oil production in the Norwegian part of the North Sea dating back to the 1970s. Other important ocean uses are shipping, tourism and marine aquaculture, all of which are highly developed industries in Norway. Emerging ocean industries in Norwegian waters are offshore wind energy and seabed mining.

In terms of the contribution of marine-related sectoral activities to the Norwegian gross domestic product (GDP), the petroleum industry is the largest industry in Norwegian waters, followed by maritime transport, the seafood industry and tourism (Figure 4). In the past years, oil and gas exploration and exploitation activities, maritime transport and tourism have all increased, while fishing activities have

remained at rather constant high levels (Norwegian Ministry of Climate and Environment, 2017). Tourism is a significant sector, contributing at least 0.4% to the national GVA (Figure 4).[2]

Changes in sea ice extent coupled with technological advances are expected to make additional areas of the Norwegian Exclusive Economic Zone (EEZ) in the Arctic accessible to (increased) socio-economic activities (Norwegian Ministry of Climate and Environment, 2016). In the future, Norway is planning to expand value creation in its sea areas by increasing the production of seafood, offshore energy, mineral extraction and maritime traffic (Norwegian Ministry of Climate and Environment, 2017).

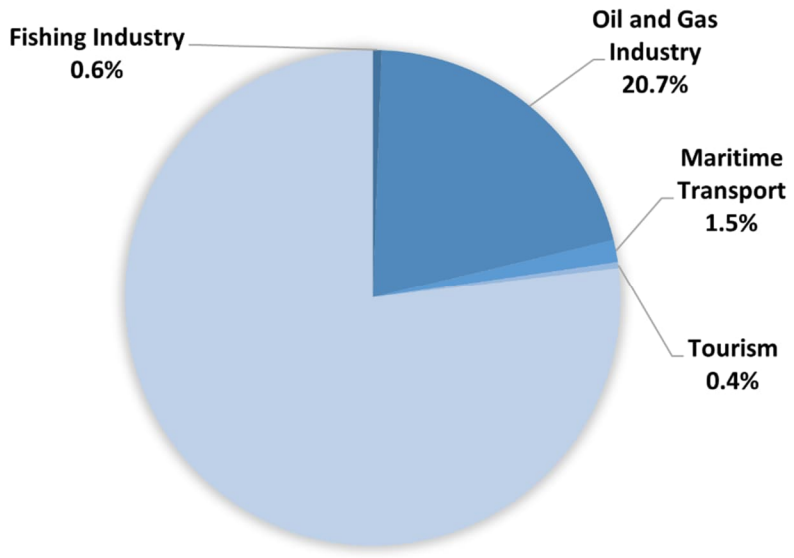

Figure 4: Contribution of selected marine related sectoral activities to 2018 Norwegian GDP. IASS visualisation based on Eurostat (2022a, 2022b, 2022c, 2022d, 2022e), Statistics Norway (2022a, 2022b). Methodology and categorisations based on European Commission (2018).

[2] These numbers are approximate. Due to data and methodological challenges, these numbers are calculated as all income from hotels, holiday accommodation, camping grounds, and other accommodation. As such, they do include all tourism accommodation in Norway and are not restricted to accommodation associated with the blue economy. Also, the numbers do not capture other income arising from tourism, e.g. from providing food at restaurants and activities such as tours.

4.1 Offshore Oil & Gas Exploration and Exploitation

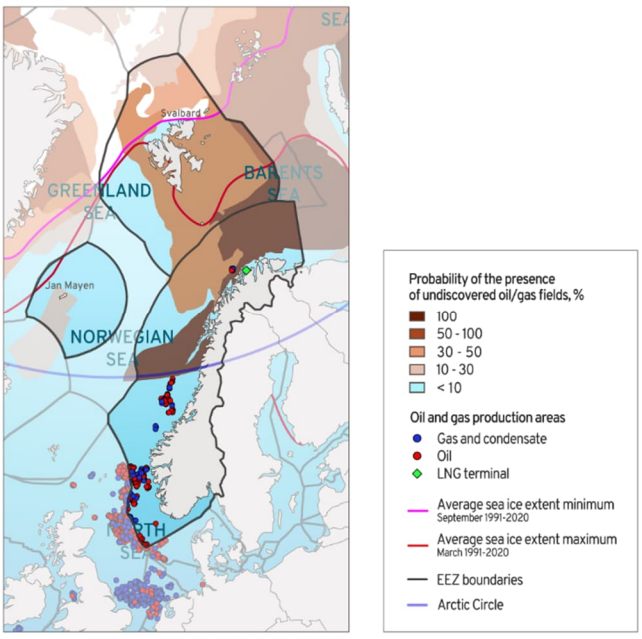

Figure 5: Current oil and gas production areas and probability of the presence of at least one undiscovered oil and/or gas field with recoverable resources greater than 50 million barrels of oil equivalent according to 2008 USGS assessment. IASS visualisation based on Copernicus Climate Change Service/ECMWF (2021a, 2021b), Flanders Marine Institute (2019), GRID-Arendal (2019), Löschke & Lehmköster (2019), OSPAR (2017), Bird et al. (2008).

Quick Facts on Offshore Oil and Gas Exploration and Exploitation in Norway[3]

- Oil and gas fields in production: 90
- Main areas for production: North Sea and Norwegian Sea
- Production volume in million Sm^3 o.e.:
- Gas: 112,268,845 (2020)
- Oil: 97,915,173 (2020)
- Liquefied natural gas: 16,766,579 (2020)
- Condensate: 1,282,324 (2020)
- Main areas for exploration: North Sea, Norwegian Sea, and Barents Sea
- Active exploration wells: 1
- Summary & Trend: Significant activity likely to continue in the future with activities moving further north and into deeper waters

[3] Sources: Norwegian Ministry of Climate and Environment (2020), Norwegian Petroleum (2021a, 2021b)

Socio-cultural and Economic Relevance

Oil and gas activities are Norway's largest industry in terms of GVA, export value and investments, as well as the most significant blue economy sector. In 2018, the sector generated 20.7% of Norway's total national income (Figure 4) and employed 56,587 people, accounting for 2.1% of employment in Norway (Eurostat, 2022d, 2022f).

From the 1970s to 2000, oil production was clearly predominant, whereas from 2000 onwards, gas production grew significantly and topped oil production from 2010 onwards (Norwegian Petroleum, 2021f).

Main Areas

Oil production in Norway started in the 1970s in the North Sea, where activities for both oil and gas production remain highest today (Figure 6). Oil and gas exploration in the Norwegian Sea and the Barents Sea started around 1980. In 1993, the first field started production in the Norwegian Sea and in 2007, the first offshore development plant in the Barents Sea started production. Both exploration and exploitation activities have moved further north as well as into deeper waters in recent years. In 2020, a total of 90 fields were producing oil, gas and liquified natural gas (LNG) on the Norwegian shelf, 21 of which were in the Norwegian Sea and two in the Barents Sea (Figure 5; Norwegian Petroleum, 2021e).

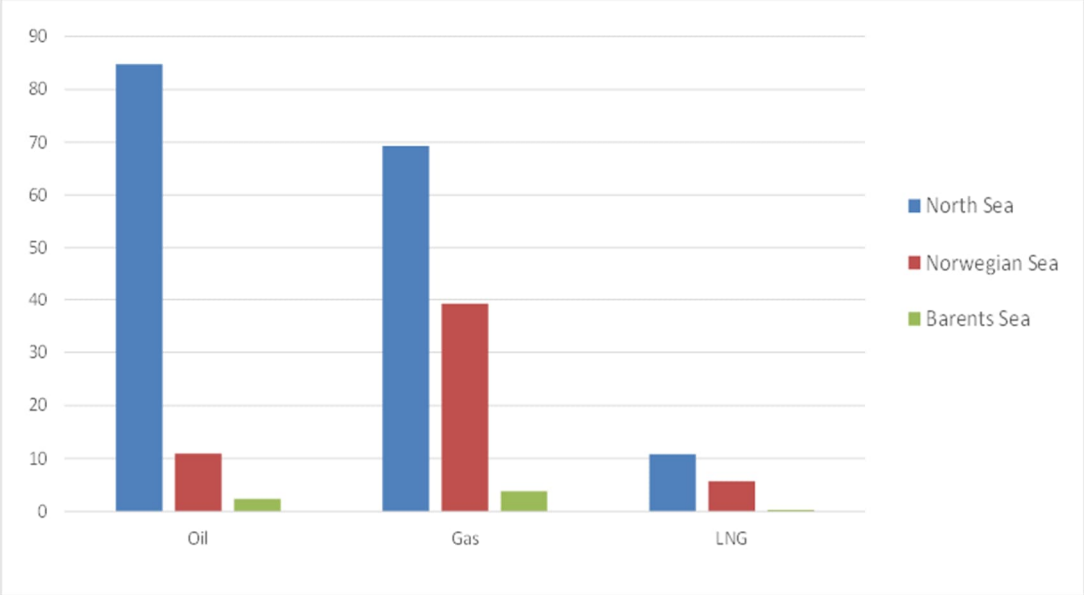

Figure 6: Total Annual production of oil, gas, and LNG in 2020 as per region. Numbers in million Sm^3 o.e. IASS visualisation based on Norwegian Petroleum Directorate (2021c).

Related Impacts

The environmental impacts of offshore oil and gas operations depend on the activities being carried out during the main phases of exploration, production, and decommissioning.

As part of the exploration phase, seismic surveys are conducted as a starting point to understand the geology and identify potential hydrocarbon reservoirs. Impacts of seismic surveys include loud

underwater sound and light emissions as well as increased vessel activity. Impact assessments of acoustic disturbance have so far principally focused on marine mammals; Reported effects include the disruption of normal behaviour related to feeding, breeding, resting, migration, masking of sounds, as well as hearing damage. The effects on fish and invertebrates are not well studied, but may be considerable (Cordes et al., 2016).

If promising reservoirs are detected, one or more exploration wells are drilled to gain more insights into the nature of the reservoir. The drilling leads to the release and disposal of waste such as drill cuttings, excess cement, fluids (drilling mud), contaminated water, and other chemicals which may be damaging to the marine environment (Cordes et al., 2016).

The actual extraction process is likely the single greatest human-induced contributor to pollution locally because of its releasing of toxic compounds and occasional accidents related to production (CAFF, 2017). Environmental monitoring studies indicate that the contaminated area around petroleum installations in the Norwegian Sea, as well as the average area where impacts on benthic fauna are noted, decreased from 80 km² in 2006 to around 44 km² in 2015 and from 0.7 km² in 2006 to around 0.4km2 in 2015 respectively (Norwegian Ministry of Climate and Environment, 2017).

Chemical spills are the most common type of spills on the Norwegian shelf, accounting for 80% of all spills with a volume greater than one cubic metre. The number of crude oil spills has dropped in recent years. However, this has not translated into a reduced annual spill volume. A factor which is likely to increase the risk of major spills from petroleum operations in the coming years is the ageing of surface and subsea installations and infrastructure (Norwegian Ministry of Climate and Environment, 2017).

Analyses conducted during the planning process for exploration drilling in the Barents Sea indicate that the environmental risk of the operations is strongly related to the existence of areas where seabirds gather in the open sea or, in the case of activities closer to the coast, the presence of seabird colonies on land. In addition, analyses for the most northerly sites where exploration drilling has been conducted indicate the possibility of impacts in the marginal ice zone in the case a major oil spill at these sites during certain times of the year. Knowledge gaps remain regarding the impacts that oil pollution would have on the ecosystem in the marginal ice zone. However, its vulnerability is considered to be high, as oil frozen into the ice will be transported with the drifting ice and be a long-lasting source of pollution where the ice melts (Norwegian Ministry of Climate and Environment, 2016).

Lastly, decommissioning can have direct impacts on the seafloor and may introduce contaminants into the environment (Cordes et al., 2016).

Trends

The Norwegian government seems to be determined to expand oil and gas activities in the Arctic. At the end of 2020, a total of six additional fields were approved for production. Among these are three fields in the North Sea, two fields in the Norwegian Sea and one field in the Barents Sea (Norwegian Petroleum, 2021e). Production of the Bauge oil field in the Norwegian Sea is planned to start in late 2022 (Norwegian Petroleum, 2021b), while the Fenja gas field in the Norwegian Sea and the Johan Castberg oil field in the Barents Sea are expected to commence in 2023 and 2024 respectively (Norwegian Petroleum, 2021c, 2021d). Over the next five to 25 years, an increasing trend might be the production of LNG, which presents significant potential for growth as an alternative fuel (AlaskaNOR, 2020).

Furthermore, the government has granted several new production licences in so-called mature regions (where geological knowledge of the area and/or relevant infrastructure is available) in its waters. In February 2021, 61 new production licences were issued, amongst them three in the Barents Sea and

24 in the Norwegian Sea (Norwegian Ministry of Petroleum and Energy, 2021). In June 2021, four production licences were awarded in the 'numbered licensing rounds', which cover previously unexplored frontier areas of the country's continental shelf. Three of them are in the Barents Sea and one in the Norwegian Sea (Norwegian Petroleum Directorate, 2021a). In January 2022, 53 new production licences were awarded, amongst them five in the Barents Sea and 20 in the Norwegian Sea (Fasoulis, 2021; Norwegian Ministry of Petroleum and Energy, 2022).

Despite the general trend of exploration and exploitation activities moving further north and into deeper water, it remains uncertain how exactly oil and gas activities on the Norwegian continental shelf will develop. The development of oil and gas in the Barents Sea and deep-sea areas in the Norwegian Sea is generally more costly than in the North Sea. Low oil and energy prices may thus slow down developments in these areas. Indeed, plans for drillings and field developments have recently been delayed or even postponed due to the economic crisis spurred by the Covid-19 pandemic (Staalesen, 2020b).

In addition, exploration drillings may prove disappointing. In the Norwegian Sea, for example, the volumes discovered during exploration drillings were smaller than anticipated and mainly comprised gas resources (Norwegian Ministry of Climate and Environment, 2017). Similarly, a series of exploration drillings in the Barents Sea only discovered dry wells (Staalesen, 2019).

Last but not least, as the long-term health of the Arctic will depend on the drastic reduction of greenhouse gas emissions, the future of oil and gas exploration and exploitation in the Arctic needs to be reassessed in light of the 1.5°C target set out in the 2015 Paris agreement.

Environmental concerns related to expanding activities in the Barents Sea may also halt activities. In 2016, Nature and Youth, Friends of the Earth Norway, Grandparents Climate Campaign and Greenpeace Nordic took legal action against the Norwegian government, claiming that new oil drilling in the Barents Sea was not in line with the constitutional right to a healthy environment.[4] The case is currently being reviewed by the European Court of Human Rights (ECHR) after three courts in Norway, including the Supreme Court, ruled in favour of the government (Adomaitis, 2021).

[4] Article 112 reads: "Every person has the right to an environment that is conducive to health and to a natural environment whose productivity and diversity are maintained. Natural resources shall be managed on the basis of comprehensive long-term considerations which will safeguard this right for future generations as well. In order to safeguard their right in accordance with the foregoing paragraph, citizens are entitled to information on the state of the natural environment and on the effects of any encroachment on nature that is planned or carried out. The authorities of the state shall take measures for the implementation of these principles."

4.2 Shipping

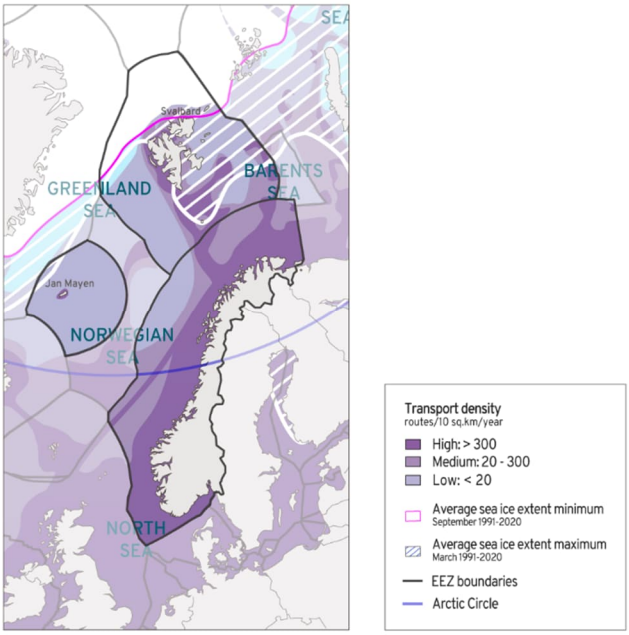

Figure 7: Transport density in Norwegian exclusive economic zone. IASS visualisation based on Copernicus Climate Change Service/ECMWF (2021a, 2021b), Flanders Marine Institute (2019), GRID-Arendal (2019), Marine Traffic (2021).

Quick Facts on Shipping in Norway

- Main areas: Majority of activities along the mainland coast, elevated activity south and west of Svalbard
- Summary & Trend: Significant activity likely to increase further as a result of diminishing sea ice coverage along the Northern Sea Route and expected increased activity related to gas and petroleum exports from the Russian Federation)

Socio-cultural and Economic Relevance

Norway has historically had a large merchant ship fleet and role in international maritime transport, holding more than 10% of the world's fleet in the 1960s (Tenold, 2019). While Norway's proportion of global merchant ship tonnage has since fallen, the absolute size of the merchant fleet has steadily increased in recent years and amounted to 22,101 registered vessels in 2020. Similarly, the volume of shipping increased up to a maximum of 21,452,105 gross tonnes in 2020 (Statistics Norway, 2022).

Maritime transport still remains a significant activity in Norway. In 2018, maritime transport constituted the second most important blue economy sector in terms of GVA, contributing 1.5% to Norway's total (Figure 4). The maritime transport industry employed 20,867 people in 2018, with an additional 29,231 people working in related industries, including ports, warehousing, shipbuilding, and repair.

Taken together, these industries accounted for 1.8% of total employment and added 6,878 million euros GVA to the Norwegian economy in 2018 (Eurostat, 2022c, 2022d, 2022f, 2022g).

Until recently, vessel traffic consisted mainly of large tankers transporting oil and gas from the Russian Federation and Norway as well as bulk carriers transporting other types of freight. Furthermore, there is considerable traffic by fishing vessels as well as cruise and passenger vessels (Centre for the Ocean and the Arctic, 2019a).

Main Areas

No major changes could be observed with regard to the main areas frequented by shipping over the past years. Shipping density is highest along the mainland coast and somewhat increased in the area south and west of Svalbard (Figure 7). Since the introduction of traffic separation schemes in 2007, oil and chemical tankers as well as other vessels with a gross tonnage above 5,000 sail at a greater distance from the coast (Norwegian Ministry of Climate and Environment, 2015).

Related Impacts

In 2016, the government published a white paper on maritime safety and the preparedness and response system for acute pollution containing an analysis of maritime accidents, the probability of accidents, and the environmental risks associated with shipping in Norwegian waters (Norway, 2018). Accident statistics indicate that maritime accidents in Norwegian waters occur irregularly, a small number of them resulting in acute pollution. The events of acute pollution related to maritime activities have been declining slightly over the past years in terms of the annual number of maritime accidents as well as the total volume of spills (Norwegian Ministry of Climate and Environment, 2017). The decline is partly attributed to the introduction of preventive measures improving maritime safety, such as the ban on heavy fuel oil around Svalbard, apart from vessels calling Longyearbyen and Svea (Centre for the Ocean and the Arctic, 2019a; Norwegian Ministry of Climate and Environment, 2017).

However, the increasing maritime traffic brings with it an increased risk of accidents, highlighting the need for a sound system for oil spill preparedness and response. This is all the more important in areas where sea ice is present, since practical experience with oil spill response operations has shown a lack of effective response methods in waters where ice is present (Norwegian Ministry of Climate and Environment, 2016).

Operational discharges from shipping are thought to have little impact on the Norwegian Sea environment (Norwegian Ministry of Climate and Environment, 2017).

Shipping-related sources of underwater noise are related to propellers and sonar equipment used by naval frigates. The propeller noise lies within the frequency range that can be heard by both fish and marine mammals. Sonar equipment emits intense sound pulses that are within the hearing range of marine mammals but less audible to fish. Correspondingly, temporary scare effects have been observed among different species of marine mammals, including minke whales, porpoises, and white-beaked dolphins, suggesting that responses differ from one species to another. In general, the impacts of underwater noise on fish and marine mammals are considered to be minor, but more knowledge is needed to draw clear conclusions (Norwegian Ministry of Climate and Environment, 2017).

Trends

The diminishing sea ice extent in Norwegian Arctic waters is expected to lead to increased ship traffic along the Northern Sea Route (NSR) (Centre for the Ocean and the Arctic, 2019a; Norwegian Ministry of Climate and Environment, 2016). Forecasts carried out by the Norwegian Coastal Administration predict sailing distance to increase significantly by 2040. The anticipated increase is strongest for the Norwegian Sea (49%), followed by the North Sea (43%) and the Barents Sea (around 30%) (Norwegian Ministry of Climate and Environment, 2020). The strongest growth is expected for the activity of gas carriers and container ships, followed by cruise ships. Predicted increases in the number of tankers are largely due to gas and petroleum exports from the Russian Federation and the expected intensification of oil and gas activities in the Barents Sea, whereas a reduction in vessel activity is anticipated for fishing vessels (Norwegian Ministry of Climate and Environment, 2016, 2017). These predictions were made prior to the 2022 Russian invasion of Ukraine and will need to be revisited in the light of current events.

Norway aims to reduce its emissions from domestic shipping and fishing vessels by half by 2030 by promoting the use of zero and low-emission solutions for all types of vessels (Norwegian Ministry of Climate and Environment, 2020). A transition from traditional oil-based fuels to LNG-fuelled ships is expected to take place (AlaskaNOR, 2020).

4.3 Fishing and Aquaculture

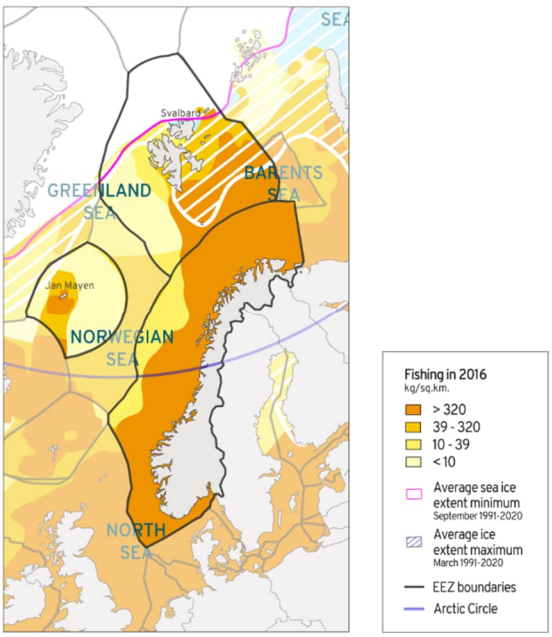

Figure 8: Fishing effort in Norwegian waters. IASS visualisation based on Copernicus Climate Change Service/ECMWF (2021a, 2021b), Flanders Marine Institute (2019), GRID-Arendal (2019), Pauly et al. (2020).

Quick Facts on Fishing in Norway

- Capture in tonnes (2020): 2,454,440[5]
- Main areas: North Sea, the coastal area of the Norwegian Sea, and parts of the Barents Sea
- Summary & Trend: Fishing activities likely to remain stable; stocks of main target species estimated to be fully utilised; resources at lower trophic levels receive increasing interest

Quick Facts on Aquaculture in Norway

- Production in tonnes (2019): 1,452,928[6]
- Main areas: Coastal areas of central Norway
- Summary & Trend: Aquaculture activities likely to remain stable; moderate potential for increasing production in the Norwegian Arctic; trials are being conducted for raising new species and using new concepts

[5] Source: Norway Directorate of Fisheries (2020)

[6] Source: Statistics Norway (2021)

Socio-cultural and Economic Relevance

Fisheries are an important part of the culture of coastal communities in Norway and have presented a main source of food and income for hundreds of years. Fisheries, aquaculture, and businesses processing and selling their products employed 31,706 people in 2018, accounting for 1.2% of total employment (Eurostat, 2022b, 2022d, 2022f; Statistics Norway, 2022a, 2022b). These industries added 1,900 million euros of GVA to the Norwegian economy in 2018 (Eurostat, 2022b, 2022d, 2022e; Statistics Norway, 2022a,2022b), making the industry the third most significant blue economy sector in Norway in terms of GVA (Figure 4).

Large-scale fisheries target primarily Atlantic cod, herring, Atlantic mackerel, haddock, saithe, and capelin (Figure 9). Cod is the economically most important fish stock in the Barents Sea (Norway, 2018). While the total catch for the Norwegian EEZ has declined by around 25% over the last 20 years, landings in the three northernmost counties (Nordland, Troms and Finnmark) have remained rather stable and represented.

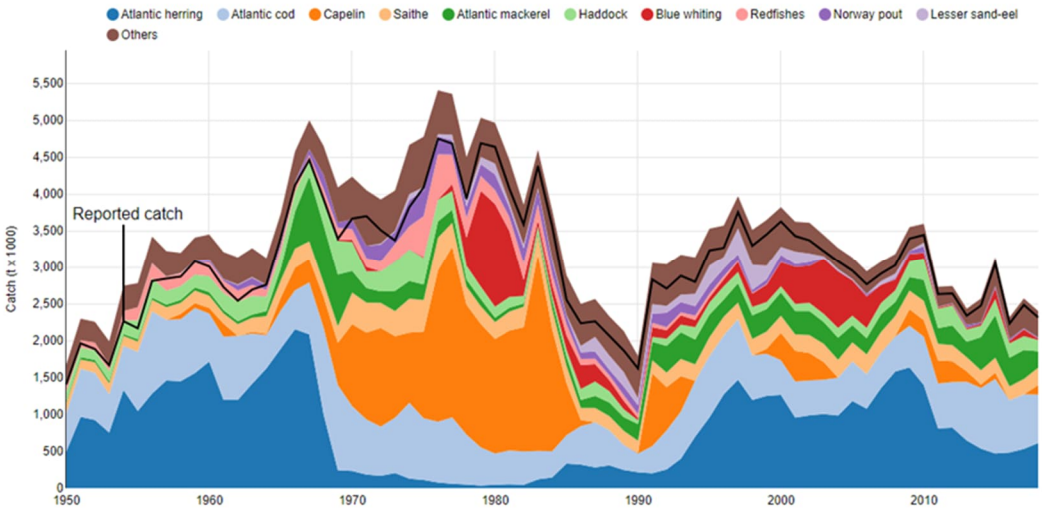

Figure 9: Catch reconstruction from 1950 to 2018 for the Norwegian EEZ including Svalbard and Jan Mayen. Source: Chu et al. (2020), Noël et al. (2020), Pauly et al. (2020).

Fishing techniques vary according to the target species, ranging from purse seiners and pelagic trawlers used to capture Norwegian spring-spawning herring and capelin to larger trawlers and vessels using long lines and gill nets to harvest cod, haddock, redfish, Greenland halibut and prawns (Norwegian Ministry of Climate and Environment, 2016).

Norway has a modern fishing fleet, which has seen a decline in the number of fishing vessels in recent years in favour of an increased average boat size (Norwegian Ministry of Climate and Environment, 2017).

Small-scale fisheries provide important opportunities for coastal residents, particularly Sami, who historically fish for species including lumpfish and cod (Hoel, 2009; Østhagen et al., 2022).

Commercial whaling in Norway has been banned for most species and is now only permitted for minke whales. The yearly quota for 2020 remained unchanged from 2019 and was set at 1,278 individuals (High North News, 2019). This quota has not been fully used in recent years (IWC, 2022).

Aquaculture production in the Norwegian EEZ has grown significantly since the mid-1980s and has stabilised at a production level of around 1,300,000 tonnes from 2012 onwards (Figure 10). Today, it is a largely industrial, modern and highly competitive sector. Production is dominated by Atlantic salmon farmed in marine cages in coastal areas. Other important farmed species include rainbow trout and Atlantic cod (Centre for the Ocean and the Arctic, 2019a; FAO, 2022).

Direct employment in the aquaculture sector amounted to approximately 3,000 people in 2018 (Centre for the Ocean and the Arctic, 2019a).

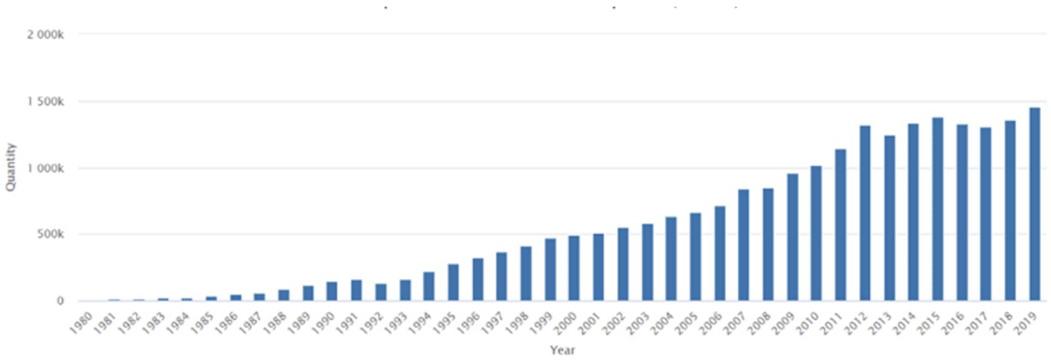

Figure 10: Aquaculture production in tonnes in Norway from 1980 to 2019. Source: FAO (2022)

Main Areas

The areas with the most fishing activities in Norway are the North Sea, the coastal area of the Norwegian Sea and parts of the Barents Sea (Norwegian Ministry of Climate and Environment, 2020). Aquaculture farming sites are located along all the mainland coast of Norway and have increased in numbers in the Norwegian Arctic in recent years. In 2018, 393 aquaculture production sites were located in the two northernmost counties of Nordland and Troms og Finnmark (Centre for the Ocean and the Arctic, 2019a).

Related Impacts

The most direct impact of fishing is the mortality of the target species (CAFF, 2017). In the past, golden redfish, lobster and coastal cod were overfished. While measures have been put in place to improve population levels of coastal cod, the stock is still low and is expected to remain at low levels for several years. In the case of lobster harvesting, strict regulations such as the closure of certain areas to lobster trapping have been introduced. Frequent breaches of the rules occurred in the past, leading to greater control and enforcement at sea (Norway, 2018).

The indirect impacts of fishing activities, which depend greatly on the species targeted and the gear employed, include bycatch, habitat loss and disturbance of the seabed. Bycatches of threatened or endangered species including European eel, blue ling, golden redfish, and spiny dogfish as well as certain species of whales, sharks, skates and rays, for example, continues to pose a threat to several of the populations (Norway, 2018). In addition, unintentional bycatches of seals, porpoises and seabirds have been documented (Norwegian Ministry of Climate and Environment, 2017).

Initiatives mapping the seabed, such as the MAREANO programme, have found that bottom trawling has had a very negative impact on benthic ecosystems in certain areas of the Norwegian EEZ (Norwegian Ministry of Climate and Environment, 2017). However, in past years, trawl hours and trawled

areas have decreased substantially, and technological improvements in trawling gear have been made, resulting in less environmental impact and reduced pressure on benthic habitats (Norway, 2018).

Apart from these impacts, fishing vessels, like all ships, contribute to underwater noise and may contribute to overall pollution through the loss of gear, emissions, and discharges (see Chapter 4.2).

The main issues associated with aquaculture facilities are the spread of sea lice, escapes of farmed fish and related genetic impacts on wild fish, and discharges of waste, including nutrients and organic material, as well as hazardous substances including copper and delousing agents (Norwegian Ministry of Climate and Environment, 2020). Especially the impacts of sea lice infection, as well as the interbreeding of cultured and wild salmon have caused great concern about the environmental implications of further growth in salmon aquaculture (Østhagen et al., 2022).

Furthermore, investigations are ongoing regarding the possible impact of the wear of feed pipes as a source of microplastic pollution (Centre for the Ocean and the Arctic, 2019a). These impacts are observed in coastal aquaculture activities and are expected to be similar in offshore aquaculture activities (Norwegian Ministry of Climate and Environment, 2020).

Trends

In general terms, the Norwegian government aims to further advance ecosystem-based fisheries regulations with a special focus on sustainable management of the key species in the area. It further states that international cooperation will remain a high priority as this is crucial in making sure that shared stocks are fished sustainably (Norway, 2018).

Catches of the main target species have remained relatively stable in the past years and are supposed to be rather fully utilised in the Norwegian EEZ (Centre for the Ocean and the Arctic, 2019a). No big changes in fishing activities of these species are expected, with the exception of a possible increase in snow crab harvesting (Norwegian Ministry of Climate and Environment, 2020). Moreover, the commercial harvesting of smaller, mesopelagic fish species and copepods is expected to grow in the coming years, as several of these species could be used as feed in aquaculture operations (Norwegian Ministry of Climate and Environment, 2017). As larger sea areas are predicted to become ice-free in summer and autumn and climate-induced range shifts of different fish species occur, alterations in fishing activities may follow (Norwegian Ministry of Climate and Environment, 2016).

In the case of aquaculture production, discussions regarding the profitability and environmental impact of coastal aquaculture have already led to the stalling of new licences in some areas (Centre for the Ocean and the Arctic, 2019a).[7] Against this backdrop, the Norwegian Arctic has received increased interest since cold water is expected to reduce aquaculture production challenges related to sea lice and diseases. Indeed, most of the future growth in Norwegian aquaculture is expected to come from the Norwegian Arctic, and some companies have already started production in more exposed locations, applying marine construction technology developed by the offshore oil and gas and maritime industries (Centre for the Ocean and the Arctic, 2019a; SalMar, 2021; McDonagh, 2021).

The Directorate of Fisheries has recently proposed a strategic environmental assessment of aquaculture production plans for 11 offshore areas that have been identified as suitable for aquaculture, supplemented by 12 areas that may be included later. Having said that, generally, offshore aquaculture is not expected to replace existing coastal aquaculture production, but rather to complement it (Norwegian

[7] The Tromsø Municipality decided in 2018 that it would only accept land-based fish farming concepts for new production sites

Ministry of Climate and Environment, 2020).

In addition, trials are being conducted for farming other species and using new concepts. Cod farming, for example, has been tested in the past, but complications related to both production and demand have led to declining activities. The farming of macroalgae (seaweed and kelp) is becoming more widespread. By November 2017, licences had been issued for the cultivation of macroalgae at 47 sites, covering a total planned area of 465 hectares. There is also ongoing research on combining kelp and salmon farming since kelp can make use of dissolved nutrients from salmon production (Norwegian Ministry of Climate and Environment, 2020).

4.4 Tourism

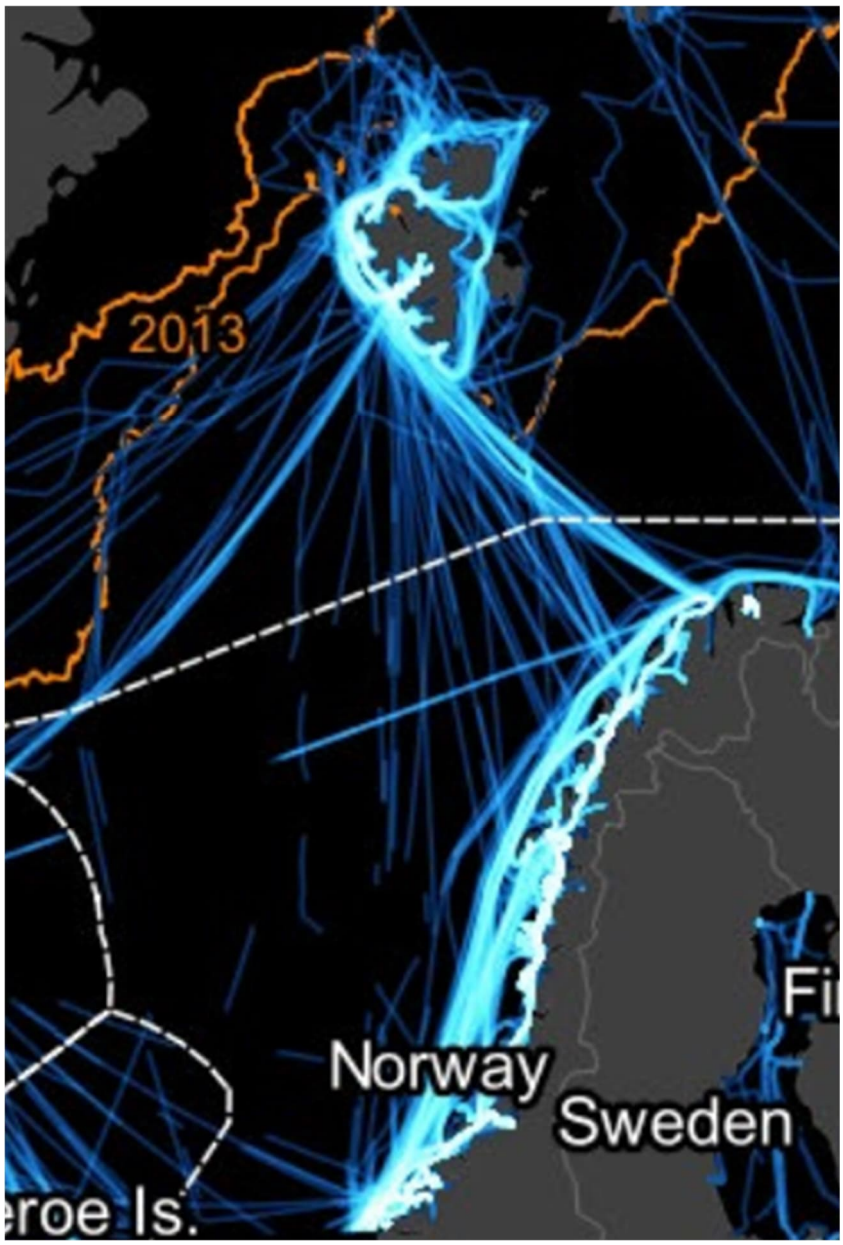

Figure 11: Tracks of all tourism vessels in the Norwegian Arctic in 2019. Source: PAME (2021)

Quick Facts on Cruise Tourism in Norway

- Number of cruise passengers (2018): Around 800,000[8]
- Main areas: Along the mainland coast, Svalbard, and Jan Mayen
- Summary & Trend: Tourism activities likely to increase further; explorer cruises are becoming increasingly popular

[8] Source: AlaskaNOR (2020)

Socio-cultural and Economic Relevance

Tourism is a significant and growing employer, responsible for 35,642 jobs, or 1.3% of total Norwegian employment in 2018. Employment in this sector grew by 19% between 2014 and 2018 (Eurostat, 2022c, 2022f). Tourists engage in many activities related to the marine environment, such as recreational fishing, consuming fresh seafood, observing marine mammals and seabirds or going on cruises (Norwegian Ministry of Climate and Environment, 2017).

Passenger transport accounts for the largest part of the tourism industry in terms of value creation. In 2015, it generated almost 60% of value creation in the tourism industry (Centre for the Ocean and the Arctic, 2019a). Cruise ship tourism has increased significantly and amounted to a total of 511,000 passengers in 2015, an increase of 29% compared to 2009 (Norwegian Ministry of Climate and Environment, 2017).

Main Areas

In 2018, almost 800,000 cruise passengers visited Norway, a quarter of them travelling throughout northern coastal Norway and Svalbard (AlaskaNOR, 2020). In the same year, Longyearbyen in Svalbard received 27 cruise ships carrying almost 46,000 cruise passengers (Centre for the Ocean and the Arctic, 2019a).

Related Impacts

Cruise vessels present many of the same environmental pressures as shipping, including local pollution, greenhouse gas emissions and noise pollution to sea and air. Norway is pioneering the first hybrid-powered cruise ship, which might potentially lower environmental risks associated with cruise ships (Centre for the Ocean and the Arctic, 2019b).

On sites such as Svalbard, the most important effects of tourism can be witnessed on land, but the marine environment may also be affected, for example through the disturbance of seabird nesting areas and moulting and birthing sites for seals (Hoel, 2009).

Recreational fishing is popular among tourists in Norway and has seen an increase over the last years, leading to a substantial harvest of coastal species (Norwegian Ministry of Climate and Environment, 2017).

Trends

The expansion of tourism is expected to continue. Cruise traffic in particular is expected to grow, as with explorer cruises becoming increasingly popular. New vessels specifically equipped for cold weather operations are being constructed to cater for the increasing demand (Centre for the Ocean and the Arctic, 2019a). These vessels will operate in the marginal ice zone, where ice floes, icebergs and associated wildlife are of interest for tourists. This is a challenging environment and there is an increased risk of accidents and other emergencies (Palma et al., 2019).

4.5 Emerging Activities

4.5.1 Offshore Wind Energy

According to mappings conducted in 2007 and 2008 by the Norwegian Water Resources and Energy Directorate, the offshore wind conditions in most areas off the Norwegian coast are excellent from a resource perspective. The development of offshore wind farms have, however, so far been challenged by the depths of the continental shelf, among other things (Østhagen et al., 2022).

Figure 12: Areas considered for offshore wind power in Norway. Green: Category A; Yellow: Category B; Red: Category C. Source: Norwegian Water Resources and Energy Directorate (2013).

As a starting point for developing offshore energy in Norway, a working group identified 15 suitable areas for offshore wind power under the lead of the Norwegian Water Resources and Energy Directorate in 2020 (Figure 14; Norwegian Ministry of Climate and Environment, 2017). The Directorate conducted a strategic environmental assessment for the identified areas and grouped them into categories based on the assessment of environmental and economic interests associated with the areas and their suitability in technological and economic terms. Based on the assessment, five priority areas for offshore wind power developments were identified (Figure 12, Category A areas) (Norwegian Ministry of Climate and Environment, 2015).

Two of the indicated areas in the North Sea were opened in June 2020 for offshore renewables, including offshore wind energy development. Licence applications for offshore wind power projects in these areas can now be submitted to the Ministry of Petroleum and Energy, which houses the licence authority. A proposal to open the area 'Sandskallen-Sørøya Nord' in the Barents Sea has been met by stiff resistance, amongst others from fisheries associations, and the area has still not been opened (Ministry of Petroleum and Energy, 2020).

The Offshore Energy Act also enables the granting of licences for smaller demonstration projects without the area having been opened beforehand (Norwegian Ministry of Climate and Environment, 2017). Using this possibility, the Ministry of Petroleum and Energy has approved the plans for developing and operating the floating offshore wind farm Hywind Tampen in the North Sea, which is meant to supply the Snorre and Gullfaks platforms with power from the end of 2022 onwards (World Oil, 2020).

Related Impacts

Environmental pressures associated with offshore wind farm development are in general associated with infrastructure (cables, anchors, etc.), the possibility of collisions of vessels with wind turbines, possible barrier effects for seabirds, and noise. During the construction work and maintenance operations, vessel operations and the use of explosives produce physical disturbance and noise. During the operational phase, wind turbines present a permanent source of noise (Norwegian Ministry of the Environment, 2009).

As part of the strategic environmental assessment required under the Offshore Energy Act, the Water Resources and Energy Directorate deliberated on possible effects of the proposed areas for offshore wind power on seabirds, marine mammals, and benthic communities. The strategic environmental assessment concluded that impacts on seabirds and migrating birds are small to moderate in all areas. The smallest impact is expected in areas far away from bird colonies and with low overall bird density (Norwegian Ministry of Climate and Environment, 2017). The strategic environmental assessment furthermore estimated impacts on fish to be small, with the exception of areas where construction may affect blue lings, haddocks and sandeels. This is the case for the area 'Sørlige Nordsjø II', which overlaps with spawning areas for sandeel. It was also found that killer whales may be prevented from hunting in an area of eight kilometres around the construction sites due to elevated noise levels. Impacts on benthic organisms vary depending on the wind turbine foundations but are in general expected to be small to moderate in the assessed areas (Norwegian Water Resources and Energy Directorate, 2013).

Trends

The limited availability of suitable onshore sites is expected to result in increasing offshore development in the future. While technical and cost-related challenges persist, these can partially be compensated with better wind conditions offshore, and the possibility of building larger wind turbines. Especially projects integrating wind power with petroleum developments might have considerable potential in the future (Norwegian Ministry of Climate and Environment, 2017). While many of the best wind conditions are in the Norwegian Arctic, their development is not as likely as further south since it would require a significant rise in consumption or an increased network capacity (Centre for the Ocean and the Arctic, 2019a).

4.5.2 Seabed Mining

Currently, no minerals are being extracted from the seabed in any of the areas under Norwegian jurisdiction. However, Norway's interest in exploiting its potential seabed resources has increased substantially in recent years. The Norwegian Petroleum Directorate has been systematically mapping seabed minerals in the deep sea on the Norwegian continental shelf since 2018 (Schjødt, 2021).

The mineral deposits which have been discovered to date are mainly linked to the occurrence of hydrothermal vent fields. Several active and inactive vent fields have been found, especially around Jan Mayen and along the Mid-Atlantic Ridge. Some areas contain deposits of manganese crust rich in a number of metals, for which a growing commercial interest is expected (Norwegian Ministry of Climate and Environment, 2017). In addition, gold, silver, copper and zinc deposits have been discovered on sea floor areas between Svalbard and Jan Mayen (Berglund, 2020) and two new sulphide fields were discovered at the Mohns Ridge in the Norwegian Sea in 2018 and 2019 (Schjødt, 2021).

A new Act on Mineral Activities on the Continental Shelf entered into force on 1 July 2019. The act regulates the exploration and exploitation of minerals on the Norwegian Continental Shelf. It contains requirements aimed at avoiding damage to the marine environment and seabed cultural heritage, including the requirement for impact assessments before areas are opened to mining activities, both before project implementation and when ending mining activities (Norwegian Petroleum Directorate, 2021b). Existing Norwegian legislation applying to the Continental Shelf, such as the Pollution Control Act, will regulate any future mineral activity (Norway, 2018).

Related Impacts

The environmental impacts associated with mining the seafloor depend among others on the type of deposit, its physical and chemical properties, the geographic location, and the extraction technologies used. Ferromanganese crusts for example are complicated to extract as they are strongly attached to the rock substrate. Their removal will negatively affect the species inhabiting the crust, such as corals, anemones, and sponges and cause long-term damage to the seafloor. If the crusts are covered by a thin layer of sediment, its suspension and redeposition would also affect the benthic communities in the area (Koschinsky et al., 2018).

Sulphide deposits located at active vent fields typically provide habitats for hydrothermal vent species, many of which are endemic. The peripheral fauna found at inactive vent fields is typically composed of long-lived, slow-growing species such as sponges, corals, and anemones. It is likely that the fauna associated with inactive vents would be destroyed by mining and that it may take centuries for mature corals and other species to recolonise a mined area. In the case of active vent fields, mining sulphide deposits leads to habitat loss, and may alter the distribution of venting activity up to hundreds of metres. In addition to the direct impacts on the sea floor, mining may also affect the midwater column because of the transportation of the mined minerals or the possible release of discharge water containing metal-rich particles from the crusts or sulphides which could be ingested by organisms. Other environmental impacts of seabed mining are related to the impact from the mining vessel, which is comparable to other shipping-related impacts (Koschinsky et al., 2018).

5 Governance of the Norwegian Arctic Marine Environment

A range of institutions and agreements were developed internationally, regionally, and nationally to regulate human activities and ensure the conservation and sustainable use of marine biodiversity. The institutions and agreements in place either holistically aim to contribute to the sustainable use and conservation of marine biodiversity, address specific sectors/pressures, or focus on specific marine species.

In this chapter, an overview of relevant national rules, regulations and procedures governing sea-based human activities as well as the establishment of conservation tools in Norway, including marine protected areas (MPAs), will be provided.

The main international and regional agreements and frameworks with implications for the conservation and sustainable use of marine biodiversity in Norwegian waters, while highly relevant, are only briefly mentioned in this report, and are explained in further detail in the regional overview report which is published as part of this report series.

Main International and Regional Agreements and Frameworks

The conservation and sustainable use of marine biodiversity in waters is based on the 1982 United Nations Convention on the Law of the Sea (UNCLOS), which is complemented by other instruments, frameworks and agreements, such as those established under the Convention on Biological Diversity (CBD), the Food and Agriculture Organization of the United Nations (FAO), the International Maritime Organization (IMO), the United Nations Environment Programme (UNEP), the Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention), the UNESCO World Heritage Convention, and the International Whaling Commission (IWC). In addition, regional mechanisms and agreements, such as the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention), the European Union (EU), the Arctic Council, and several regional fisheries bodies affect the conservation and sustainable use of marine biodiversity in Norwegian waters.

The Arctic Council is the only Arctic-specific forum for cooperation between the governments of the eight Arctic states (Canada, Denmark (by virtue of Greenland), Finland, Iceland, Norway, the Russian Federation, Sweden, and the United States) and representatives of Arctic Indigenous Peoples. The Arctic Council promotes sustainable development and environmental protection in the Arctic by providing assessments and recommendations. The secretariat of the Arctic Council is based in Tromsø, Norway. At the time of writing this report, work within the Arctic Council was suspended indefinitely by the Arctic countries due to the Russian invasion of Ukraine, leading to uncertainties about the future of circumpolar cooperation (Dickie & Gardner, 2022).

OSPAR covers parts of the Barents Sea, the Norwegian Sea and the Greenland Sea including areas beyond national jurisdiction within its ‘Region I’ (OSPAR, 2022a). As an OSPAR contracting party,

Norway is bound to a set of mandatory rules as well as recommendations aimed at protecting the marine environment of the North-East Atlantic when carrying out activities in the convention area. The OSPAR Commission, inter alia, addresses marine pollution from the offshore industry and land-based sources of pollution, as well as non-polluting human activities that can adversely affect the sea.

Norway is furthermore cooperating with the EU through the European Economic Area (EEA) Agreement. The EEA Agreement guarantees equal rights and obligations within the Internal Market and thus also provides for the inclusion of EU legislation in Norway. The EU common agriculture and fisheries policies are, however, not covered by the agreement except for provisions on trade in agricultural and fish products (Mission of Norway to the EU, 2017).

Main National Rules, Regulations and Procedures

The basis for the ocean governance regime in Norway was laid down in 1976 through the Economic Zone Act, which extended jurisdiction over living marine resources to 200 nautical miles (Hoel, 2009). The Office of the Prime Minister exercises the executive power of Norway, with little authority being transferred to the regions. The work of the prime minister is supported by several ministries as well as their incorporated departments, agencies, and other establishments. The most relevant ministries in terms of the governance of the Norwegian waters are the Ministry of Climate and Environment, the Ministry of Petroleum and Energy, the Ministry of Trade, Industry and Fisheries, the Ministry of Transport, and the Ministry of Foreign Affairs. These ministries play a significant role in determining Norway's ocean governance regime, inter alia by issuing regulations and strategies known as 'white papers' (Fasoulakis, 2021). White papers are typically reports which present work carried out in a particular field and recommendation for future policy to the Storting (the parliament). The white papers and the subsequent discussion of them in the Storting frequently lay the basis for a draft resolution or bill.

Marine policies receive much attention in the domestic debate due to their substantial economic implications and typically involve the active participation of organised interests, such as economic interest groups, environmental non-governmental organisations, regional political bodies, and Indigenous groups, in both the preparation and implementation of public policies (Hoel, 2009). For the Sami in Norway, their elected assembly, the 'Sámediggi' acts as a consultative body to the Norwegian government (Norwegian Ministry of Climate and Environment, 2020).

Regional management plans lay down the overall framework and guidelines for the management of marine areas across economic sectors. The Norwegian government aims to facilitate sustainable use of natural resources while ensuring that the productivity and diversity of the ecosystems are maintained. This is done by combining the protection of areas under the Nature Diversity Act with sectoral measures, such as prohibiting certain fishing gear in specific areas (e.g. coral reefs). Both species-based measures and area-based measures have been introduced and will be employed in the future (Norway, 2018).

The development of the management plans is led by the Ministry of Climate and Environment and coordinated by the Interministerial Steering Committee for Integrated Management of Norway's Sea Areas. The Forum for Integrated Marine Management and the Advisory Group on Monitoring provide the scientific basis for the management plans (Norwegian Ministry of Climate and Environment, 2017). In order to evaluate progress on the goals set in the management plans, a system with a representative set of indicators has been established for the coordinated monitoring of environmental status (Norwegian Ministry of Climate and Environment, 2020).

Regional management plans exist for all of Norway's EEZ. The EEZ is divided into three management plan areas: the Barents Sea-Lofoten, the Norwegian Sea, and the North Sea-Skagerrak. In 2020, a

white paper was published that brought together the management plans for all three areas, including the revised plan for the Barents Sea-Lofoten area and updated management plans for the Norwegian Sea and the North Sea and Skagerrak. While management plans have previously been published separately, the new approach of merging them into one white paper is meant to facilitate tackling specific topics across all three management plan areas (Norwegian Ministry of Climate and Environment, 2020).

The management plans provide a framework for sectoral activities in specific geographical areas. As such, the activities are regulated based on existing legislation for the different sectors involved (Norwegian Ministry of Climate and Environment, 2017). Management of the waters closest to the coast (up to one nautical mile from the baseline) is subject to the rules of the Planning and Building Act, which regulates planning and public consultation processes and environmental impact assessments. This provides these areas with an advanced system for coordination, cooperation and participation of all interested parties (Norwegian Ministry of Climate and Environment, 2020).

5.1 Marine Protected Areas and Other Effective Area-based Conservation Measures

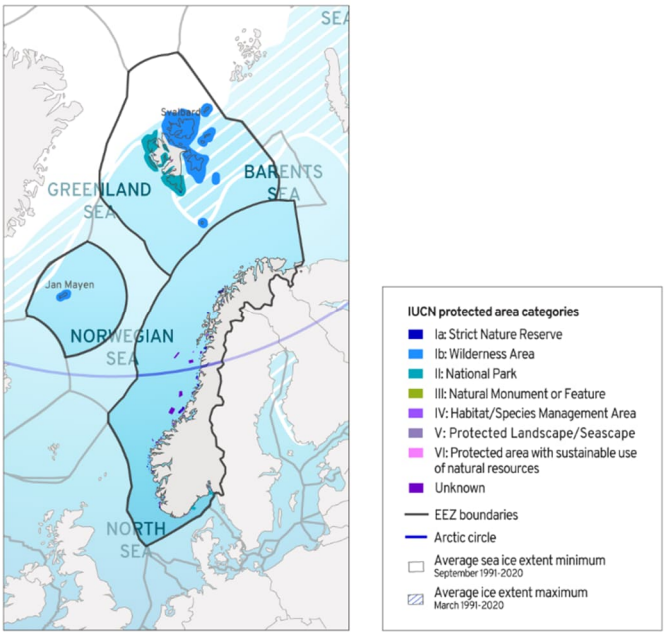

Figure 13: Marine protected areas in Norway. IASS visualisation based on Copernicus Climate Change Service/ECMWF (2021a, 2021b), Flanders Marine Institute (2019), GRID-Arendal (2019), UNEP-WCMC and IUCN (2022).

Quick Facts on Marine Protected Areas in Norway[9]

- Percentage of marine area designated as MPAs: 4.5%
- Protected area in km²: 91,104 km²
- Number of implemented MPAs: 695[10]
- Proposed MPAs: 3

The legal foundation for the designation, establishment and management of protected areas in Norway can be found in the Nature Conservation Act of 1970 and its amendment (The Royal Norwegian Ministry of the Environment, 2003). The Norwegian Ministry of Climate and Environment is the national authority in charge of protected areas and the Nature Conservation Act.

Following the Nature Conservation Act, the aims of and procedures for protecting areas have been further developed through several white papers. Especially important in this regard are the white paper 'Protection of Norwegian Nature' (Report No. 12 (1980–1981) to the Storting), which for the first time provided a cohesive outlook on nature protection policy in Norway, and the white paper 'Protecting the Riches of the Sea' (Report No. 12 (2001–2002) to the Storting), which laid the basis for integrated,

[9] Source: Marine Conservation Institute (2022)

[10] Apart from areas designated as MPAs under Norwegian jurisdiction, this count includes designations of national parks, nature reserves, protected landscapes, wildlife conservation areas, botanical conservation areas, natural monuments, sites of community importance, and zoological protection of species.

ecosystem-based management of Norway's sea areas in the form of regional management plans (Hoel, 2009).

MPAs in Norway may be established under the Nature Diversity Act, the Marine Resources Act, and, around Svalbard, under the Svalbard Environmental Protection Act (Norwegian Ministry of Climate and Environment, 2020).

The Nature Diversity Act was adopted in 2009 and aims "to protect biological, geological and landscape diversity and ecological processes through conservation and sustainable use, and in such a way that the environment provides a basis for human activity, culture, health and well-being, now and in the future, including a basis for Saami culture" (object clause). The act applies only to Norway's territorial waters, which extend up to 12 nautical miles from the baseline. Quality norms as well the designation as a priority species/selected habitat are introduced as possible management tools for species or habitats which require special safeguards. So far, the provisions on quality norms have only been used once in the case of wild salmon stocks. The Ministry of Climate and Environment will continue monitoring programmes in order to gain a better understanding of the effects of designation as a priority species/selected habitat type. The designation of dwarf eelgrass as a priority species will be used as a basis for evaluating which other threatened marine species should be protected in the same manner (Norway, 2018). As of April 2020, Norway established six MPAs and four national parks including substantial marine areas under the Nature Diversity Act (Figure 13; Norwegian Ministry of Climate and Environment, 2020).

The Marine Resources Act was adopted in 2009, replacing the Sea Water Fisheries Act of 1983. The act unites the relevant provisions for the management, harvesting and other utilisation of wild living marine resources, including marine genetic material. It furthermore lists a range of approaches and concerns which should form the basis of fisheries management in Norway, such as the precautionary principle, ecosystem-based management, transparency in decision-making, and respect for the Saami culture. MPAs with provisions only applying to fishing activities can be established under the Marine Resources Act in all Norwegian waters and on the Norwegian continental shelf (Norwegian Ministry of Climate and Environment, 2017). As of 2020, Norway had established 18 MPAs including coral reefs under the Marine Resources Act (Norwegian Ministry of Climate and Environment, 2020).

The Svalbard Environmental Protection Act came into force in 2001, supplementing the Svalbard Act of 1925. According to its introductory provisions, the purpose of the act is "to preserve a virtually untouched environment in Svalbard with respect to continuous areas of wilderness, landscape, flora, fauna and cultural heritage" (Section 1, Svalbard Environmental Protection Act). The act lays the framework for the conservation of the land area of Svalbard and its territorial waters by regulating a wide range of issues, including activities that may have an environmental impact, the protection of flora and fauna, local pollution and waste management, and hunting and fishing (Norway, 2018). To date, 65% of Svalbard's land areas, and 86% of its territorial waters are protected areas under the Svalbard Environmental Protection Act, providing a high level of protection against environmental pressures (Norway, 2018).

Apart from the designation of MPAs, marine areas may also be protected when other conservation areas such as national parks, nature reserves, protected landscapes, wildlife conservation areas, botanical conservation areas, natural monuments, sites of community importance, or zoological protection of species are established.

5.2 Sector-based Regulations

5.2.1 Offshore Oil & Gas Exploration and Exploitation

Various ministries, directorates and supervisory authorities are involved in developing and implementing policies related to offshore oil and gas exploration and exploitation. The Norwegian Ministry of Petroleum and Energy, for example, receives advice from the Norwegian Petroleum Directorate. In addition, institutions including the Petroleum Safety Authority Norway and the Norwegian Coastal Administration are responsible for technical and operational safety and oil spill preparedness respectively (Østhagen et al., 2022).

The Petroleum Act and its adjunct regulations provide the legal basis for the licensing system. Licences can be issued for the exploration, production, and transport of petroleum. Operators need permits during all phases of their petroleum activities, from exploration to decommissioning (Østhagen et al., 2022).

Production licences are generally granted through licensing rounds for blocks which were previously announced by the Norwegian government. Production licences are granted by the Norwegian Ministry of Petroleum and Energy based on the submitted applications (Østhagen et al., 2022).

Before new areas are opened for oil and gas-related activities, field development projects commence¬. When fields finish production and installations are disposed of, operators need to conduct impact assessments. Based on the results of the impact assessments, restrictions may apply to oil and gas-related activities. These restrictions may concern, for example, drilling, seismic surveys, or the discharges permitted, and aim to protect biodiversity or combine oil and gas activities with other socio-economic activities (Norwegian Ministry of Climate and Environment, 2017, 2020).

Before the commencement of petroleum activities, operators must also acquire a permit under the Pollution Control Act. The permits contain provisions related to discharges and preparedness and the response to acute pollution. The general objective is to produce zero discharges or minimal discharges of elements that could cause environmental harm (Norwegian Ministry of Climate and Environment, 2017). Specific provisions vary according to the vulnerability of the area concerned and available technology and may, for example, apply in areas where corals or other vulnerable benthic fauna, seabird populations, or spawning fish stocks are present (Norway, 2018).

Specific rules also exist regarding oil and gas-related activities in areas where sea ice is present or close by. For example, no new petroleum activities may be initiated in areas where sea ice is found on 15% of the days in April, based on sea ice extent data for the period from 1988 to 2017. This restriction will apply until any changes are made as part of the management plans update, which will take place in 2024 at the earliest. In areas less than 50 kilometres away from observed sea ice, exploration drilling in oil-bearing formations will not be permitted in the period from 15 December to 15 June (Norwegian Ministry of Climate and Environment, 2017, 2020).

International and regional governance frameworks which influence the applicable Norwegian rules and regulations for offshore oil and gas activities include the OSPAR commission and the work of the Arctic Council.

Under the OSPAR commission, contracting parties agreed on a range of legally binding decisions as well as recommendations and guidelines related to offshore installations and discharges. It is for instance forbidden to dispose of and abandon offshore installations at sea, unless national decommissioning permits allow so under predefined conditions (OSPAR, 2022b).

Under the Arctic Council, guidelines as well as several other soft-law instruments with relevance to offshore oil and gas activities in the Arctic were developed. In addition, the Arctic Council has served as a basis for exchange by the Arctic states on the legally binding regional governance instruments on Aeronautical and Maritime Search and Rescue (2011) and Marine Oil Pollution Preparedness and Response (2013) (Østhagen et al., 2022). Norway and the Russian Federation furthermore signed a bilateral agreement on combating oil spills in the Barents Sea in 1994. Under the agreement, both nations drafted a joint contingency plan and conduct annual joint exercises (Norwegian Ministry of Climate and Environment, 2016).

5.2.2 Shipping

Various acts and regulations exist in Norway regarding shipping. They cover a range of relevant aspects, such as liability, passenger claims, sea lane regulations and technical standards (Østhagen et al., 2022). The Norwegian Maritime Code of 1994 is the principal act addressing issues like collision and pollution (Østhagen et al., 2022).

Specific environmental regulations apply for shipping around Svalbard and include a general ban on heavy fuel oil, except for vessels calling Longyearbyen and Svea (Centre for the Ocean and the Arctic, 2019a).

Norway's Act Relating to Ports and Navigable Waters contains provisions on the use of navigable waters, aids to navigation and port activities as well as what must be taken into account when reviewing applications for permits for works related to ports and navigation such as quays, bridges, aquaculture facilities, cables, pipelines, dredging and dumping (Norwegian Ministry of Climate and Environment, 2015).

Norway's National Transport Plan 2014–2023 defines that the principles laid down in the Nature Diversity Act must be adhered to when planning, constructing and operating transport infrastructure. Inter alia, large-scale developments commonly require the implementation of environmental impact assessments (Norway, 2018).

Several preventive measures have been adopted to improve maritime safety, including traffic separation schemes and the recommendation of route systems (Norwegian Ministry of Climate and Environment, 2017). In addition, monitoring systems for shipping in Norwegian waters have improved in recent years. The Vardø VTS Centre monitors shipping throughout Norway's EEZ with a focus on high-risk traffic. Automatic identification system satellites enable Norwegian authorities to detect vessels far out at sea, thus facilitating rapid response if incidents occur (Norwegian Ministry of Climate and Environment, 2016). The emergency response system for pollution is operated by the Coastal Administration (Hoel, 2009). The navy has introduced guidelines for the use of sonar in Norwegian waters which aims to reduce the impact of underwater noise (Norwegian Ministry of Climate and Environment, 2017).

International treaties and instruments with relevance to shipping activities in Norway were principally established under the IMO. The IMO is responsible for developing international standards for ship safety and security and for the protection of the marine environment and the atmosphere from harmful shipping impacts. To fulfil this mandate, the IMO has adopted several international agreements and a wide range of measures to prevent and control pollution by ships and to mitigate the possible effects of maritime operations and accidents (IMO, 2021a).

Two key conventions adopted under the IMO are the International Convention for the Safety of Life at Sea (SOLAS), which lays down rules on navigation and safety, and the International Convention

for the Prevention of Pollution from Ships (MARPOL), which establishes regulations to prevent pollution by oil and other hazardous substances resulting both from accidental pollution and routine operations (IMO, 2021b; IMO, 2021c). The International Code for Ships Operating in Polar Waters (Polar Code) is mandatory under both SOLAS and MARPOL and pertains to passenger and cargo ships of 500 gross tonnes or more operating in polar areas. The Polar Code includes mandatory as well as recommended measures regarding safety and pollution prevention, including the recommendation not to use or carry heavy fuel oil in the Arctic (IMO, 2021d).

On that point, an amendment to MARPOL Annex I was approved in 2021, introducing prohibition of the use and carriage of heavy fuel oil for use as fuel in Arctic waters starting 1 July 2024. Exemptions were established, inter alia, for vessels engaged in securing the safety of ships, search and rescue operations, and oil spill preparedness and response activities. In addition, MARPOL parties with a coastline bordering Arctic waters can exempt their vessels when operating in their waters until 1 July 2029 (IMO, 2021e).

Regionally, guidelines and assessments with regard to shipping were, for instance, developed under the Arctic Council. In addition, the previously mentioned legally binding regional governance instruments on Aeronautical and Maritime Search and Rescue (2011) and Marine Oil Pollution Preparedness and Response (2013) are also relevant to shipping in the Arctic (Østhagen et al., 2022).

5.2.3 Fishing and Aquaculture

Regulations Pertaining to Fishing

The legal basis for fisheries management in Norway is set out in the 2008 Marine Resources Act and its secondary legislation, along with numerous other acts. The Marine Resources Act and its secondary legislation are relevant to all catch and use of marine resources, including their genetic material. The central rules are set out in the Regulation on the Execution of Marine Fisheries, which is updated annually. It contains rules on e.g. mesh sizes, the use of specific gear, seasonal restrictions, bycatch, minimal fish sizes, protection of coral reefs, the marking of vessels and gear, and fish welfare (Østhagen et al., 2022).

Other significant regulations are laid down in the 1999 Act on the Right to Participate in Fisheries, the 2015 Act on First-Hand Sales of Wild Catch of Marine Resources, the 2016 Regulation on Participation in Fisheries, the 2016 Regulation on Licensing and the 2016 Regulation on Landing and Sales Notes. All regulations are continuously being adapted through ‘J-orders’ (Østhagen et al., 2022).

The main governmental body in charge of fisheries policy is the Ministry of Trade, Industry and Fisheries, with the Directorate of Fisheries serving as its advisory and executive body. Scientific policy advice is provided by several marine research institutions, the most important being the Institute of Marine Research (Østhagen et al., 2022).

Furthermore, governmental agencies consult and closely cooperate with user-group organisations, such as the Norwegian Fishermen’s Association and the fishermen’s sales organisations. Regulatory meetings are held several times throughout the year and provide an opportunity for user-group organisations and non-governmental organisations to voice their concerns and opinions. Technical regulatory measures are to a great extent decided upon in consultations between authorities and user groups at the Regulatory Meetings. In this way, the Norwegian Fishermen’s Association, for example, has a significant impact on the way in which the Ministry or Directorate allocates the national quota between different gear types and fishing fleets. The Sami Parliament is formally consulted in the management of fisheries which are of historical importance to the Sami, such as lumpfish (Østhagen et al., 2022).

Monitoring, control and surveillance in Norwegian fisheries is shared between the Directorate of Fisheries, the Coast Guard and the regional sales organisations. The Directorate of Fisheries monitors the catch of individual vessels, different vessel groups and by other States based on electronic reports supplied by the fishing fleet. Norwegian vessels are obliged to have Electronic Reporting Systems and supply this data in real-time to the Directorate of Fisheries (Østhagen et al., 2022). The enforcement of fisheries regulations is carried out by the Coast Guard at sea, and by sales organisations buying the fish and the Directorate of Fisheries upon landing the catch (Hoel, 2009). The Coast Guard forms part of the Royal Norwegian Navy and is in charge of monitoring commercial fishing activities and carrying out regular inspections. Monitoring activities are supported by satellites, aircrafts and helicopters (Norwegian Ministry of Climate and Environment, 2016).

As a reaction to the adverse impacts of bottom trawling, coral habitats have been closed to bottom trawling since 1999, and several additional areas were added in past years. In 2011, regulations were introduced banning bottom fishing in areas with a water depth of more than 1,000 metres, with the exception of experimental fisheries (Norwegian Ministry of Climate and Environment, 2017).

The management of wild salmon stocks in Norway is based on the management principles adopted by the North Atlantic Salmon Conservation Organization (NASCO). NASCO aims to conserve, restore, and manage wild Atlantic salmon. Under NASCO, targeted fisheries for Atlantic salmon are prohibited in most areas of the North Atlantic beyond 12 nautical miles from the coast, thus creating a large area which is free of directed salmon fisheries (NASCO, 2021). In Norway, national salmon rivers and fjords have been designated, providing roughly 75% of Norway's salmon stocks special protection. New regulations pertaining to fishing for anadromous salmonids were introduced in 2017 which focus on sustainability and value creation (Norway, 2018).

Since most of the fish stocks targeted by Norway are shared with other countries, international cooperation plays an important role in resource management. In the North Sea, as well as Skagerrak, for example, the terms for international management are set out in the EU-Norway agreement. In the Norwegian Sea, the big pelagic fisheries targeting mackerel, herring and blue whiting are regulated through international agreements among the coastal states in the region (Østhagen et al., 2022). In the Barents Sea, the Joint Norwegian-Russian Fisheries Commission (JNRFC) provides the basis for the cooperative management of living marine resources shared by Norway and the Russian Federation. The parties of the JNRFC meet annually to agree on technical aspects and procedures as well as to set the total allowable catches (TACs) for the major shared stocks and to allocate the quota among Norway, the Russian Federation and third parties (the EU, Iceland, Greenland and the Faeroe Islands). So far, TACs have been established for Northeast Arctic cod, haddock, Barents Sea caplin, Greenland halibut, and beaked redfish based on recommendations by the International Council for the Exploration of the Sea (ICES). Efforts undertaken by the JNRFC to eliminate overfishing and illegal, unreported and unregulated fishing have been vital in improving the state of the Northeast Arctic cod in the area to sustainable levels (Norwegian Ministry of Climate and Environment, 2017).

Another relevant regional fisheries management organisation is the North East Atlantic Fisheries Commission (NEAFC), whose regulatory area includes areas beyond national jurisdiction in the Norwegian Sea and the Barents Sea. Within the NEAFC regulatory area, fishing is regulated by the current management measures and the NEAFC Scheme of Control and Enforcement on the basis of scientific advice from ICES (NEAFC, 2021).

Regulations Pertaining to Aquaculture

The Aquaculture Act provides the regulatory basis for aquaculture operations in Norway. It applies to aquaculture of any aquatic organism and includes regulations on issues such as coastal area management, emissions and pollutants, animal health and the genetic effects of escaped fish on wild

populations. The Ministry of Trade, Industry and Fisheries is the main government body in charge of the act and the Directorate of Fisheries is assigned to enforce its regulations (Østhagen et al., 2022).

Other acts relevant to aquaculture operations include the Pollution Control Act, the Food Safety Act, and the Act Relative to Prevention of Cruelty to Animals (Østhagen et al., 2022).

Before starting aquaculture activities, operators need to receive a licence through an allocation round. The licenses are granted by the Directorate of Fisheries and may be limited due to environmental considerations or denied because other permits required to obtain the licence were not approved. Recently, the category 'Development Permits' was introduced. Operators planning large-scale demonstration projects with innovative environmental technology can apply for such a licence (Østhagen et al., 2022).

Once production starts, several acts and regulations on issues such as disease control, animal welfare, feed and drugs, fish movement and water and wastewater apply (Østhagen et al., 2022).

As a reaction to the increased spread of sea lice, the government introduced stricter regulations regarding the amounts of sea lice and medical treatments permitted from 2012 onwards. Furthermore, a traffic light system was introduced in 2017. Under this new system, production volumes are subject to sea lice pressure, which is monitored in the respective water bodies (Østhagen et al., 2022).

The government is currently developing a legal framework for offshore aquaculture with the aim to enable further growth in the sector in an environmentally sustainable manner (Norwegian Ministry of Climate and Environment, 2020).

Regional governance instruments which developed regulations with relevance to aquaculture activities in Norway are inter alia NASCO, OSPAR and the EU. NASCO has for example adopted measures to protect wild stocks from the effects of aquaculture, and OSPAR has issued recommendations regarding the reduction of inputs of potentially toxic chemicals from aquaculture operations (Østhagen et al., 2022). Under the EEA Agreement, Norway is furthermore obliged to comply with EU legislation on aquaculture-related issues such as veterinary inspection, aquatic animal health and food hygiene (Østhagen et al., 2022).

5.2.4 Tourism

Vessel-based tourism in Norway is largely subject to the same regulations as shipping. In addition, certain restrictions on tourism activities were introduced under the Marine Resources Act in order to minimise conflicts with fishing operations. They include a ban on whale-watching vessels sailing closer than 370 metres, as well as on people swimming, diving or canoeing and kayaking closer than 750 metres to fishing vessels or fixed fishing gear (Norwegian Ministry of Climate and Environment, 2020).

While fishing tourism in Norway is not subject to specific quotas or fees, fishing gear used by foreign tourists is restricted to rods and handlines. On 1 January 2018, new regulations came into force stipulating the registration of fishing tourism businesses and the reporting of catch (Norwegian Ministry of Climate and Environment, 2017, 2020).

In addition to tourism-specific regulations, some voluntary initiatives have been introduced. Members of the Association of Arctic Expedition Cruise Operators (AECO), for instance, agreed to operate in accordance with AECO by-laws and guidelines which go beyond national and international laws and regulations. The AECO by-laws and guidelines have been developed based on contributions from,

among others, the Governor of Svalbard, the Norwegian Polar Institute, WWF's Arctic Programme Office, Visit Greenland and Greenland's Ministry of Nature and Environment (Østhagen et al., 2022). In addition, the largest cruise destinations in Norway, including Tromsø and Nordkapp, signed an agreement in 2019, outlining 14 environmental requirements associated with the cruise industry (Centre for the Ocean and the Arctic, 2019a). Furthermore, a label called 'Sustainable Destination' has been developed by Innovation Norway, allowing tourism destinations to systematically assess their sustainability based on criteria and indicators linked to nature, culture, environment, social values and economic viability. Developments are measured through yearly performance counts. Svalbard, amongst other regions, has been awarded the label (Centre for the Ocean and the Arctic, 2019a).

6 Annex

Table 1: Marine mammals present in Norway, Svalbard and Jan Mayen and their IUCN Red List categories. Source: IUCN, 2022.

Common Name	Scientific Name	Red List Category	Assessment Date	Arctic Sea
North Atlantic Right Whale	Eubalaena glacialis	Critically Endangered	2020-01-01	
Sei Whale	Balaenoptera borealis	Endangered	2018-06-25	
Blue Whale	Balaenoptera musculus	Endangered	2018-03-16	Present
Fin Whale	Balaenoptera physalus	Vulnerable	2018-02-04	Present
Hooded Seal	Cystophora cristata	Vulnerable	2015-06-07	
Walrus	Odobenus rosmarus	Vulnerable	2016-02-05	Present
Sperm Whale	Physeter macrocephalus	Vulnerable	2008-06-30	
Polar Bear	Ursus maritimus	Vulnerable	2015-08-27	Present
Northern Bottlenose Whale	Hyperoodon ampullatus	Near Threatened	2020-10-20	
False Killer Whale	Pseudorca crassidens	Near Threatened	2018-07-23	
Killer Whale	Orcinus orca	Data Deficient	2017-06-20	Present
Bowhead Whale	Balaena mysticetus	Least Concern	2018-01-01	Present
Common Minke Whale	Balaenoptera acutorostrata	Least Concern	2018-03-16	Present
Beluga Whale	Delphinapterus leucas	Least Concern	2017-06-22	Present
Common Dolphin	Delphinus delphis	Least Concern	2020-10-20	
Bearded Seal	Erignathus barbatus	Least Concern	2016-02-17	Present
Long-finned Pilot Whale	Globicephala melas	Least Concern	2018-06-18	
Risso's Dolphin	Grampus griseus	Least Concern	2018-02-21	
Grey Seal	Halichoerus grypus	Least Concern	2016-03-01	
Atlantic White-sided Dolphin	Lagenorhynchus acutus	Least Concern	2019-04-01	
White-beaked Dolphins	Lagenorhynchus albirostris	Least Concern	2018-03-18	
Humpback Whale	Megaptera novaeangliae	Least Concern	2018-03-24	Present
Sowerby's Beaked Whale	Mesoplodon bidens	Least Concern	2020-08-23	
Narwhal	Monodon monoceros	Least Concern	2017-07-03	Present

Harp Seal	Pagophilus groenlandicus	Least Concern	2015-06-06	Present
Harbor Seal	Phoca vitulina	Least Concern	2016-01-04	
Harbor Porpoise	Phocoena	Least Concern	2020-05-19	Present
Ringed Seal	Pusa hispida	Least Concern	2016-01-16	Present
Striped Dolphin	Stenella coeruleoalba	Least Concern	2018-04-19	
Common Bottlenose Dolphin	Tursiops truncatus	Least Concern	2018-05-13	
Cuvier's Beaked Whales	Ziphius cavirostris	Least Concern	2018-10-04	

Retrieved from IUCN using the following search query:

- Type: Species
- Taxonomy: Animalia -> Chordata -> Mammalia
- Land Regions: Europe -> Norway; Svalbard and Jan Mayen
- Habitats: 10. Marine Oceanic
- *Marine Regions: Arctic Sea (only for the data in the last column ‘Arctic Sea’)

Source: IUCN. (2022). IUCN red list of threatened species. www.iucnredlist.org (Accessed: 13.07.2022)

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Institute for Advanced Sustainability Studies e.V. (IASS)

Funded by the ministries of research of the Federal Republic of Germany and the State of Brandenburg, the Institute for Advanced Sustainability Studies (IASS) aims to identify and promote development pathways for a global transformation towards a sustainable society. The IASS employs a transdisciplinary approach that encourages dialogue to understand sustainability issues and generate potential solutions in cooperation with partners from academia, civil society, policymaking, and the business sector. A strong network of national and international partners supports the work of the institute. Its central research topics include the energy transition, emerging technologies, climate change, air quality, systemic risks, governance and participation, and cultures of transformation.

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