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II. ECONOMIC POTENTIAL

Kathrin Keil

The increasing accessibility of the Arctic Ocean due to rapidly shrinking sea ice (as outlined in the previous chapter) has sparked growing interest in exploiting the region's natural resources. These concern predominantly:

- the conventional offshore oil and gas resources located on the continental shelves of the five Arctic coastal states; and
- the development of new fishing grounds in established northern fishing areas in Arctic countries' exclusive economic zones (EEZ), and potentially also in hitherto untapped areas in the international waters of the high Arctic Ocean.

The projected economic development of the region also has major implications for the possibility of using new shipping routes along northeastern and northwestern Arctic routes (for trade and tourism purposes).

Although this looks like a straightforward cause-and-effect equation – the decreasing Arctic sea ice leads to an expansion of economic activity in the region – the reality is much more complex and requires a thorough investigation of the economic potential of Arctic energy, shipping and fisheries options, including the role and influence of global actors and interests. This chapter outlines the recent developments, trends, prospects and challenges concerning the economic viability of these three domains. It argues that the shrinking Arctic sea ice cover is only one among many critical drivers of transformations currently underway in the Arctic that needs to be considered as external actors seek to unlock the region's economic potential.

The Arctic's oil and gas resources

The potential of the Arctic's oil and gas resources mean that the region has become a prime focus of attention and the object of 'great expectations' regarding an eagerly anticipated future Arctic economic bonanza. In order to gain a clear picture of the prospects of Arctic oil and gas exploration and development, we need to look carefully at the following factors:

- the estimates as to what quantity of Arctic oil and gas companies can expect to find;
- the limitations and uncertainties related to these expectations;
- the competitiveness of Arctic oil and gas resources within Arctic countries, since most Arctic states only have a part of their land and water masses

located in the Arctic. This also reveals significant political differences between Arctic countries when it comes to promoting investment and development of Arctic oil and gas resources; and

- relevant global trends determining the economic potential of Arctic oil and gas resources.

The most frequently cited source for the estimates of undiscovered Arctic oil and gas resources is a 2008 study by the United States Geological Survey Study.[1] According to this study, the Arctic holds about 22% of the world's undiscovered conventional oil and natural gas resources, which amounts to about 13% of the world's undiscovered oil and 30% of the world's undiscovered natural gas. Of these resources, 84% are expected to be offshore and located mostly in shallower waters on the five Arctic coastal states' continental shelves. While this study undoubtedly constitutes one of the most exhaustive existing surveys assessing the economic viability of the Arctic, it is by now seven years old and no update has been published since. In the meantime, in some areas oil and gas discoveries have been made (and the resources are thus no longer 'undiscovered') while in other areas no findings have yet been reported despite expectations raised by the USGS study.

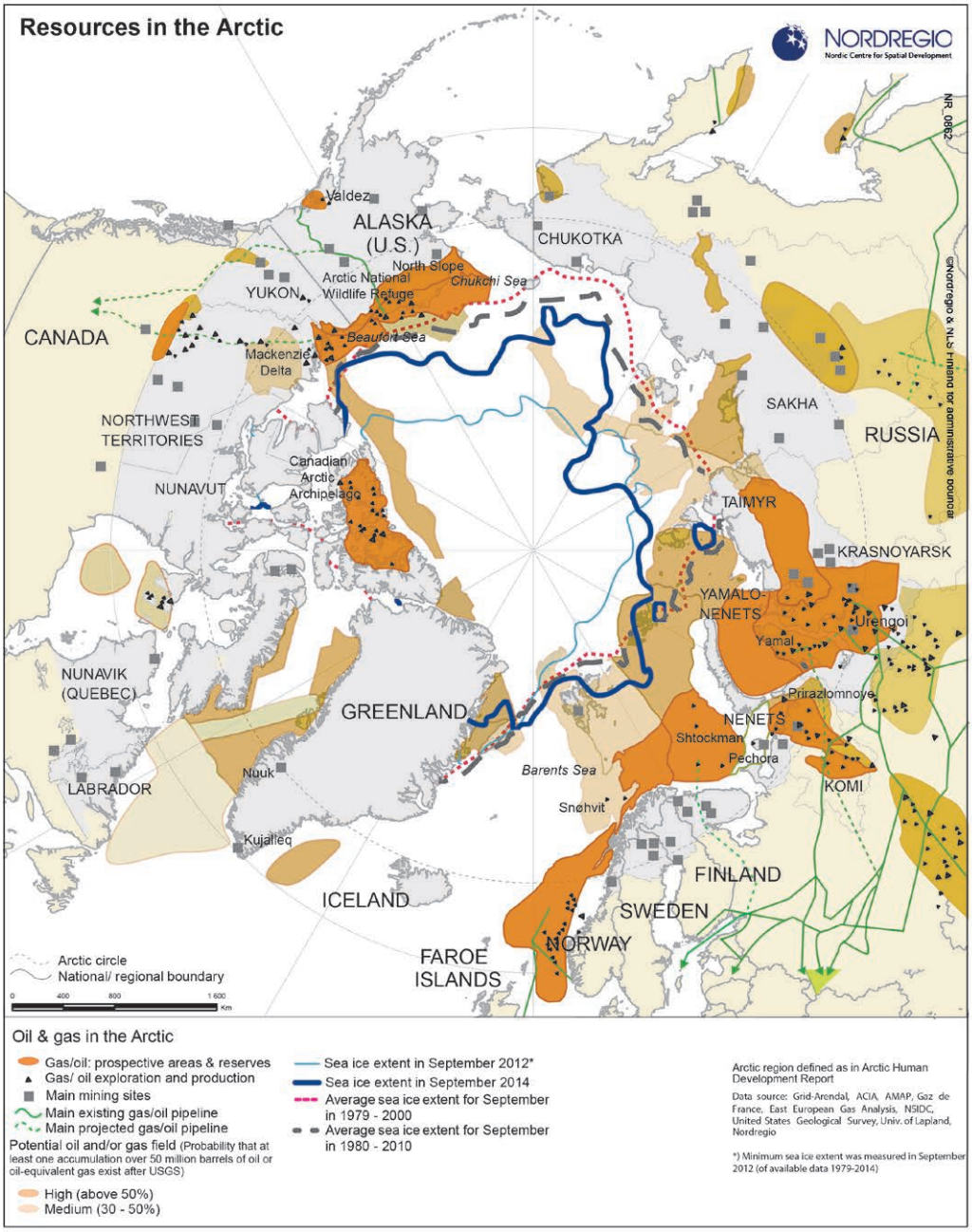
Furthermore, while these numbers look impressive, there are some significant limitations and uncertainties linked to them, which are acknowledged by the USGS but usually omitted in the public debate. The most important ones are as follows:

- USGS figures and statistics are subject to considerable uncertainty because they are based on geological probabilities and not actual finds;
- The USGS study is based on a number of simplifications. For example, they do not take account of technological or economic risks, while resources are assumed to be recoverable even in harsh conditions such as the presence of sea ice or oceanic water depths. Moreover, the results did not take the costs of exploration and development into consideration;
- Estimates are often based on very scant geological information, and our understanding of Arctic resources will certainly change as more data become available.

Another important piece of the puzzle in understanding Arctic oil and gas potential concerns the competitiveness of these resources within the Arctic. Canadian and US Arctic oil and gas resources are relatively uncompetitive domestically. Most proven and expected Canadian oil and gas resources are located outside of Canada's Arctic region, predominantly in the Western Canadian Sedimentary Basin that extends from southwestern Manitoba to southern Saskatchewan, Alberta, north-eastern British Columbia and the southwest corner of the Northwest Territories.

1. Kenneth J. Bird et al., 'Circum-Arctic Resource Appraisal: Estimates of Undiscovered Oil and Gas North of the Arctic Circle', US Department of the Interior, *US Geological Survey*, 2008. Available at: http://pubs.usgs.gov/fs/2008/3049/fs2008-3049.pdf.

Figure 1: Distribution of Arctic oil and gas resources



Source: Nordregio, 2014.

This area is also the major Canadian hub for oil and gas production, especially the oil sands in Alberta. Alaskan natural gas production is currently not commercially feasible because it is too remote from possible consumption markets with no adequate transportation infrastructure in place. Furthermore, the so-called 'shale gas boom' has swamped the US market with cheap gas, most of which is found in Texas, Louisiana, North Dakota and in the eastern US. Also, in terms of oil, Alaska only plays a minor role overall. While the state has long been the second-ranked oil-producing state, production at Prudhoe Bay has declined by more than two-thirds since its peak in 1988, when it accounted for 25% of US production. Today, the Gulf of Mexico and thus Texas are the most important oil-producing regions for the US.

In contrast, most of Russia's oil and gas reserves are located in Russia's north, especially in Western Siberia, making Arctic resources the country's most important hydrocarbon resources. Western Siberia is also Russia's most prolific oil and gas-producing region, and the bulk of expected oil and gas resources are on Russia's Arctic continental shelf, especially in the Barents and Kara Seas.

While most of Norwegian hydrocarbon exploitation is still taking place outside Arctic waters, future prospects and recent findings indicate that the Barents Sea will play a major role in Norway's future hydrocarbon production. As in Russia, the oil and gas sector is extremely important for Norway's overall economy and by far the biggest revenue and export sector.

As of today, Greenland has no proven oil or gas resources. The importance of oil and gas resources to Greenland lies in the *potential* of future development and realisation of profits from licensing and extraction. The official Arctic strategy[2] estimates that significant oil and gas deposits lie offshore Greenland's coasts. No hydrocarbon development industry exists (yet) and activities are so far limited to issuing licences.

While intra-Arctic resource competitiveness is a crucial factor, Arctic economic potential is further determined by broader, global trends. Three recent developments especially stand out as setting the tone for the future of Arctic oil and gas development. These are:

- the shale gas boom in the US;
- the oil price slump that occurred in the latter half of last year; and
- the economic sanctions imposed on Russia in the wake of the Crimea and Ukraine crises.

The 'shale gas revolution' needs to be seen in a broader perspective, reflecting the fact that oil and gas development activities generally depend on international political factors, which are however subject to great variation and uncertainty.

2. Government of Greenland, *Greenland's Oil and Mineral Strategy 2014-2018*, 2014. Available at: http://www.govmin.gl/media/com_acymailing/upload/greenland_oil_and_mineral_strategy_2014-2018_eng.pdf.

For example, for Russia and Norway the further development of climate and energy policies in the European Union generally and, in the case of Germany, the policy of *Energiewende*, is of crucial importance for their long-term plans, since these markets have traditionally been their major export destinations. Market diversification eastwards to Asia is also high on Russia's energy agenda, as the May 2014 deal on Russian gas deliveries to China indicates. Then again, competitors from elsewhere, such as strong liquefied natural gas (LNG) export countries like Qatar and Australia, are also eyeing the Asian market.

Moreover, shale gas might not be here to stay. Some critical voices emphasise that the shale gas revolution and unconventional oil and gas resources generally may turn out to be a relatively short-term 'bubble', especially because of the limited number of high-productivity shale gas fields, high decline rates and accordingly required high levels of capital input, low net energy yields in comparison to conventional fossil fuels, and severe collateral environmental damage. So it is entirely possible that in the mid-term future the US market might become available again for foreign producers, offering a new impetus notably to the Shtokman gas field in the Russian part of the Barents Sea, development of which was put on hold in 2012, partly because of the disappearance of the US as a major market.

The oil price has dropped by around 40% since summer 2014, at times to below $50 a barrel. While almost everyone agrees that the oil price is one of the most important factors determining oil investment decisions generally, the reality is as always more complex and the picture is not so black and white, including in the Arctic. By no means all companies are pulling out of Arctic energy projects. Industry voices emphasise the long-term character of Arctic projects, with decades intervening between exploratory drilling and production, which is linked to the hope and expectation of a resurgent oil price. For example, the Italian multinational Eni still aims to bring the Goliat oil field in the Norwegian Barents Sea into production this year. On the other hand, Statoil has announced its intention to reduce investments in Arctic fields and lay off many workers employed on its offshore projects. In Greenland, no company currently has drilling plans but many licenses have been sold and the government plans to sell even more. On the US side, Shell has announced that it intends to resume drilling in the Chukchi Sea this summer. In sum, similar to the effects of the economic sanctions on Russia, we will see a slowdown in drilling activities and production starts, but there will not be a complete cessation of activities.

The economic sanctions against Russia affect plans to develop offshore oilfields in the Russian Arctic. Russia has embarked on several joint venture projects with international energy companies over the last few years, for example with Exxon, Eni, Total and Statoil. Due to the restrictive measures and the falling oil price, offshore oil projects in the Arctic may not make much progress in the near future. The EU and US restrictive measures on equipment, technology and related services for use in Arctic offshore oil projects and for shale oil projects, as well as the financial restrictions

on Russia, are expected to have an adverse impact on Russian offshore Arctic oil projects, especially if these measures remain in force over the mid- to long-term future. While it has been suggested that other countries, such as China, could be possible substitutes for American and European technology supply, many observers doubt this at least in the short term, also because the companies from these countries rely themselves on cooperation with Western companies for offshore development. While it is likely that Russian Arctic offshore oil projects will slow down significantly, other onshore projects and one offshore project are already in operation.

Arctic shipping – new ways to connect East and West?

To assess the economic potential of Arctic shipping and relevant trends, three key questions need to be addressed:

- Where in the Arctic can we expect increasing shipping activity, i.e. more on northwestern or on northeastern routes?
- When is Arctic shipping likely to become large-scale, taking into account the still significant uncertainties regarding the retreat of Arctic sea ice?
- For which kinds of shipping are Arctic routes relevant?

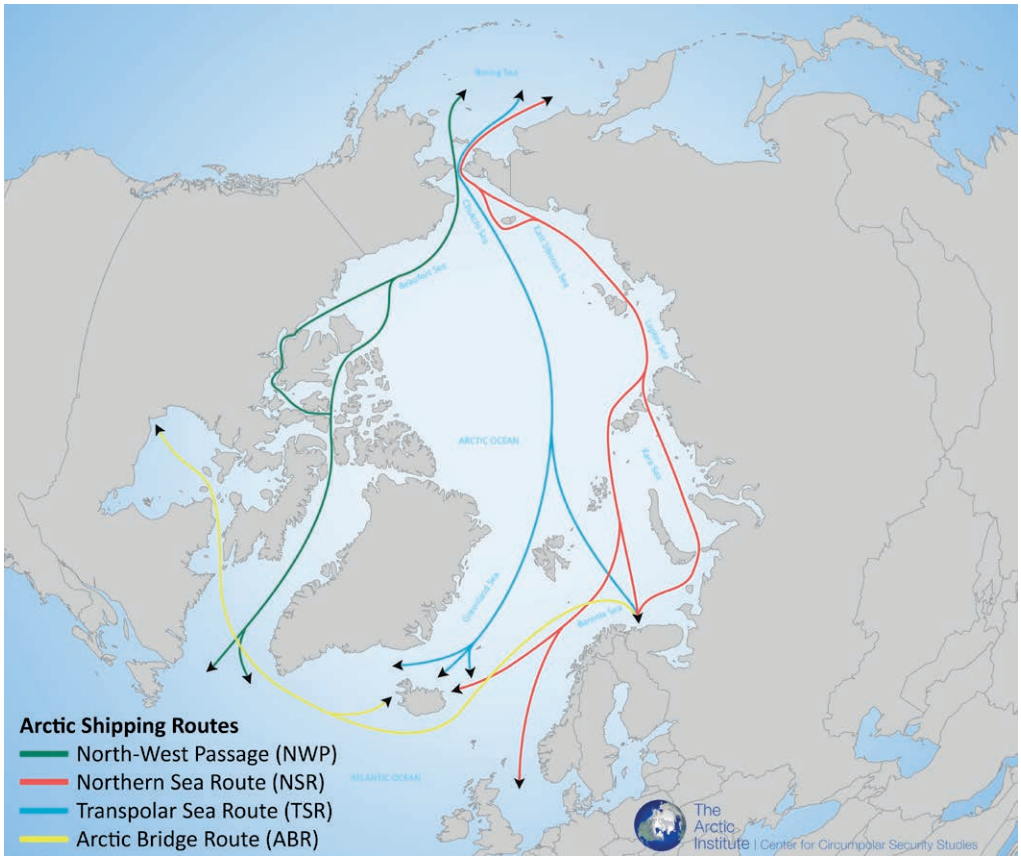
The latter point highlights the necessity of differentiating between the regional and international relevance of Arctic shipping routes when trying to assess the economic potential and likely future evolution of these routes. This includes attention to different kinds of Arctic shipping, such as destinational shipping (which is either from one specific place in the Arctic to destinations further south or vice versa), intra-Arctic shipping, and ships transiting the Arctic from the Atlantic to the Pacific Ocean and vice versa. Furthermore, we have to consider for which commodities or economic activities Arctic shipping routes are a sensible option, e.g. for raw materials which are developed in the north and exported, for bringing in supplies to oil and gas platforms and fisheries, or for general cargo or container shipping.

The key Arctic shipping routes are the Northwest Passage (NWP) with various routes through Canada's archipelago and along Alaska's northern shores, the Northern Sea Route (NSR) with different routes along Russia's and Norway's coast, as well as the transpolar sea route right through the high Arctic Ocean (see Figure 2).

While all three passages have been praised for offering substantial distance and time savings, there is a higher likelihood that northeastern routes will be more viable in the foreseeable future. There are a number of reasons for this. First, the phenomenon of decreasing sea ice has been especially extensive north of the Russian coast, and considerably less so within Canadian waters. Second, northeastern routes offer sufficient cargo potential – mostly Russian oil, gas, iron ore and nickel, and potentially also more and more LNG – to make the route viable. Third, the infrastructure situation is generally better in the Eurasian Arctic, although

significant investments and overhaul are also necessary, especially in Russia. Fourth, Russia has made a big leap forward in facilitating the administrative procedure for using the NSR, with the recently (2013) implemented 'Rules of navigation on the water area of the NSR'.

Figure 2: Arctic shipping routes



Source: Malte Humpert, The Arctic Institute, Washington D.C.

International usage and relevance of Arctic shipping

Russia is clearly advertising the NSR to encourage stronger international and transit usage, and with recent reforms has reduced the costs and administrative burden involved in using it. However, icebreaking fees and potentially shorter routes are not the only or even the decisive factors which would relocate maritime trade from the established routes through the Suez and Panama Canals. Trading patterns are at least equally important.

Many trading routes for dry cargo are located too far south for northern routes to be viable transport options. Gibraltar and Singapore are seen as the geographical 'break-even points' with the northern route impracticable for any traffic south of these places. Container ships – the backbone of international trade and the most important type of international shipping – often operate in networks of routes calling at a number of ports, especially at key transhipment ports located in Singapore, India, the Middle East and the Mediterranean. Arctic maritime routes frequently do not turn out to be any shorter due to the required stopoffs at these transhipment hubs. More generally, trade patterns can change substantially within the timespans currently used to project a seasonally ice-free Arctic, usually up to 2100. The rising markets are located in Southeast Asia, South America and India and for reaching these markets northern routes are not relevant.

Crucially, all Arctic routes are confronted with the general challenge of the remaining uncertainty about the year-to-year sea ice cover variations (see previous chapter), leaving significant doubt as to the possibility and extent of time savings for ships using Arctic routes. Even in summer months, the uncertainty of ice and weather conditions can affect the reliability of shipping services making it especially difficult to stick to tight timetables. While for bulk shipping some variability in transit time can be acceptable, container shipping is a 'just-in-time' business, so delays are very costly. Arctic routes are thus not suitable for container shipping because reliability, consistency and schedule integrity are far more important for this kind of shipping than on average shorter and faster routes, which are however subject to considerable variability around this average. Furthermore – and this holds for all Arctic shipping except icebreaker-supported voyages – Arctic routes are and will remain seasonal routes because sea ice is still extensive during winter, meaning that ship operators have to adjust their schedules twice a year if using northern routes.

Nevertheless, substantial savings, especially in terms of time charter rates and bunker fuel costs, are possible when transporting for example iron ore, coal and LNG along the NSR. The time charter costs in particular for LNG vessels are very high and thus time savings can make a big economic difference. But this reinforces the necessity to look at the specific commodities for which Arctic shipping could be relevant, i.e. for energy and cargo shipments but much less so for container shipping.

Next to these general considerations, a look at the usage statistics of international shipping transiting through the NSR over the last few years since the record minimum in 2012 is revealing (Table 1). So far, the NSR is only used by a small number of cargo vessels in comparison to the thousands of ships using the Suez and the Panama Canals each year. In 2012, 46 vessels travelled through the NSR, 42 of which crossed both the western and eastern NSR boundary, while four did not cross the eastern boundary in the Bering Strait, i.e. they stayed within or close to Russian waters.[3] While media reports highlighted the 71 ships that transited the NSR in 2013, the statistics reveal that in

3. The NSR is defined in Russian law as a set of marine routes from Kara Gate, south of Novaya Zemlaya, in the west to the Bering Strait in the east.

fact only 46 crossed both boundaries. Even if taking the whole 71 as NSR transits, this is only a small fraction of the total 635 permits granted to vessels for transiting through the waters of the NSR. This points to a much stronger usage of Arctic waters for regional, destinational, and in fact mostly Russian shipping than for transit.

Furthermore, although the number of vessels transiting through the NSR increased from 46 in 2012 to 71 in 2013, the volume of cargo has only increased by 7.5%. Also, the number of foreign flagged vessels actually declined from 28 in 2012 to 25 in 2013, indicating that the growth in vessel numbers is entirely due to increased Russian usage of the route. Finally, when adding the numbers from 2014, a drop in full transits to 31, in foreign-flagged ships to only 6, and an 80% reduction in cargo volumes can be observed, partly because of more challenging ice conditions in summer 2014. So there is no constant increase or even large increase discernible in the usage of the NSR.

Table 1: Northern Sea Route transit statistics 2012-2014

Year	Transits	Change compared to previous year (full transits)	Foreign-flagged ships	Russian-flagged ships	Cargo (in tons)	Change compared to previous year
2012	42 full,[1] 4 partly[2]	-	28	18 (14 full, 4 partly)	1,261,545	-
2013	46 full, 25 partly	+9.5%	25	46 (21 full, 25 partly)	1,355,897	+7.5 %
2014	31 full, 22 partly	-32.6%	6	47 (25 full, 22 partly)	274,000	-79.8 %

[1] Vessels which crossed both the western and eastern NSR boundary

[2] Vessels which crossed the western NSR boundary but not the eastern boundary

Source: Data from Northern Sea Route Information Office, Transit Statistics (http://www.arctic-lio.com/nsr_transits).

Regional usage and relevance of Arctic shipping

Regionally, most Arctic voyages so far take place on the periphery of the Arctic Ocean, chiefly along the Norwegian coast, the Barents Sea, around Iceland and the Faroe Islands, southwest Greenland and in the Bering Sea. While transit usage of the NSR is still rather limited as outlined above, it is likely that in the mid- to long-term future we will see increasing Arctic shipping on a regional level, and in particular destinational shipping, due to the fact that the Eurasian Arctic is becoming a hub of economic activity. This is attested for example by the construction of the port of Sabetta at the Ob Delta on the Yamal Peninsula, which is being built in the context of the Yamal LNG project, where production is expected to start in 2016.

But here also the bigger picture must be kept in mind: shipping traffic has been passing through the western NSR and Barents Sea for a long time and we are nowhere near the peak tonnage numbers from Soviet days. The total volume of cargo transported via the NSR peaked at around 7 million tons in 1987, then declined to 1.5 million tons in the late 1990s, and has only recently started to rise again (with ups and downs as outlined above).

Arctic fishing: new opportunities?

Arctic fish stocks support extensive subsistence and commercial fisheries in many Arctic countries. However, fishing currently takes place exclusively in territorial waters and in the EEZs of the five Arctic coastal states. No commercial fishing activities are currently taking place in the High Arctic Ocean.

Processes of climate change accompanied by receding sea ice, warmer ocean water and changing levels of salinity have been raising hopes that at least some fish stocks that occur in sub-Arctic regions and in the Arctic periphery will move into more northerly areas, possibly extending fishing opportunities also for non-Arctic fishing actors. The Arctic Climate Impact Assessment (ACIA) study found that it is indeed likely that due to reduced sea-ice cover conditions for some of the most important commercial fish stocks such as Atlantic cod, herring and walleye pollock, stocks will improve through expansion of habitat areas and enhanced production levels.[4] Some studies have already found that changes in the distribution and abundance of fish are happening, most prominently in the Arctic and northeast Atlantic. These changes manifest themselves in the form of northward shifts or in the deepening of distribution.

However, significant uncertainty about the prospects of new fishing opportunities in the Arctic remains due to the dearth of research about the ongoing climatic changes and their effects on fish species, stocks, distribution and ecosystems. Thus, only very tentative predictions about Arctic fisheries in a changing climate are possible. What we know already is that while a movement into the high Arctic Ocean, and thus into international waters, would benefit not only coastal states – since on the high seas the principle of the 'freedom of the seas' (Art. 78 UNCLOS) applies – few species are in fact likely to move that far north for reasons of depth and temperature. The deep central Arctic Ocean does not provide the right conditions for groundfish like cod and haddock in terms of water temperatures, bottom topography and available spawning grounds. Rather, cod and haddock tend to be concentrated in the shallow areas of the continental shelf, such as in the Barents and North Sea, which are almost exclusively confined to sea areas within the coastal states' EEZs.

4. Hjálmar Vilhjálmsson and Alf Håkon Hoel, 'Fisheries and Aquaculture', Chapter 13 in *Arctic Climate Impact Assessment* (Cambridge University Press: 2004, p. 692, Available at: http://www.acia.uaf.edu/PDFs/ACIA_Science_Chapters_Final/ACIA_Ch13_Final.pdf.

Furthermore, while colonisation of new species could thus result in new opportunities for fisheries, the colonising species could also lead to the addition of new stressors to the ecosystem, new predators, enhanced competition and new parasites. Finally, migrating fish populations can lead to more but also to less voluminous stocks in different parts of the Arctic, due in part to reduced salinity as a consequence of fresh water influx from melting sea and glacial ice and increased acidification of the world's oceans due to increasing uptake of CO_2.

Future prospects

In sum, when assessing the potential for the future commercial utilisation of Arctic resources, the picture that emerges is quite complex and it is obvious that the declining extent of sea-ice cover is by no means the only relevant factor that needs to be analysed. Arctic energy resources and demand for Arctic shipping both depend on intra-Arctic policies, subsidy structures and competitiveness with other resources and regions, as well as on non-Arctic systems, processes and actors, not least because many Arctic commodities are destined for markets in mid-latitudes. The future of Arctic fishing opportunities, especially beyond the traditional fishing areas in Arctic coastal states' EEZs, is surrounded by a lot of uncertainty. Future research will hopefully shed more light on the economic potential of Arctic commodities and especially also on the need for all human activities in the Arctic to respect the principle of sustainable development and comply with environmental protection standards.