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The Arctic: a race for resources or sustainable ocean development

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Abstract
The Arctic Ocean is a semi-enclosed sea surrounded by five coastal states: Canada, Denmark (Greenland), Norway (Svalbard), the Russian Federation and the United States of America (Figure 1). Since the planting of a Russian flag on the sea-bed at the North Pole in August 2007 there have been renewed efforts by the other Arctic Ocean littoral states to reinforce their claims in the region. This, combined with the dramatic decrease in the extent of summer sea-ice, means that the Arctic has become a focus of global media, scientific and government attention. Much of this Arctic narrative has been decidedly alarmist, not to say misleading, featuring tales of a 'scramble' or 'race' for the Arctic, and talk of an Arctic 'land-grab' or 'gold rush'. Underlying the expectation of resource-driven competition between nations staking claims in the Arctic is the perception that the Arctic represents a potential scene for geopolitical confrontation or the basis for a new Cold War.

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The Arctic

A Race for Resources or Sustainable Ocean Development?

Tavis Potts and Clive Schofield

The Arctic Ocean is a semi-enclosed sea surrounded by five coastal states: Canada, Denmark (Greenland), Norway (Svalbard), the Russian Federation and the United States of America (Figure 1). Since the planting of a Russian flag on the sea-bed at the North Pole in August 2007 there have been renewed efforts by the other Arctic Ocean littoral states to reinforce their claims in the region. This, combined with the dramatic decrease in the extent of summer sea-ice, means that the Arctic has become a focus of global media, scientific and government attention. Much of this Arctic narrative has been decidedly alarmist, not to say misleading, featuring tales of a ‘scramble’ or ‘race’ for the Arctic, and talk of an Arctic ‘land-grab’ or ‘gold rush’. Underlying the expectation of resource-driven competition between nations staking claims in the Arctic is the perception that the Arctic represents a potential scene for geopolitical confrontation or the basis for a new Cold War.

Current activities in the Arctic

Despite its remote location, the Arctic has long been affected by a variety of human influences, including exploitation of its resources (notably hunting and fishing, reindeer husbandry, forestry and mining), and activities such as dumping and navigation. Hunting of species such as whales, seals, walrus and polar bears has been practised by indigenous communities and people from outside the Arctic for hundreds of years. Arctic and especially sub-Arctic waters are known for their highly productive fisheries, with several important fish stocks exploited for commercial gain since the mid-20th century. Europe remains an important market for Arctic fisheries, with stocks of Arctic cod, herring, capelin, haddock and shrimp of commercial importance. Perhaps surprisingly, about half the fish consumed in the EU comes from the European Arctic.

In recent decades, oil and gas resources have also been exploited in the Arctic, though predominantly onshore north of 60° latitude in Russia, Alaska, Canada and Norway; there will be a concerted move offshore as technological advances facilitate the exploitation of sea-bed resources in deeper waters and harsher environments. Mining has been a significant activity in the terrestrial Arctic, for gold, nickel, lead, zinc, diamonds and coal. Mining and associated infrastructure has led to increased wealth and investment in remote parts of Canada, Alaska, Russia and Svalbard, but has had a range of environmental and social impacts.

Because of its proximity to human populations, the Arctic has long been a recipient of hazardous material. Pollutants such as radionuclides, heavy metals and persistent organic pollutants are transported over long distances to the Arctic in air masses originating over Europe, Russia and North America. Most pollutants result from the manufacture, use and storage of industrial agricultural chemicals or are by-products of industrial activity.

Pollutants are present in a range of Arctic flora and fauna. Indigenous communities are particularly susceptible to pollutants, and public health concerns have been identified, particularly for communities who have a traditional diet based on fish and marine mammals at the top of the food chain, which bio-accumulate pollutants.

Arctic jurisdiction and governance

Arctic maritime claims

The key international legal framework governing ocean affairs, including maritime jurisdictional claims and the delimitation of maritime boundaries, exploration for and exploitation of marine resources, navigation, and preservation of the marine environment, is provided by the 1982 United Nations Convention on the Law of the Sea (UNCLOS). UNCLOS came into force in 1994 and has gained widespread international acceptance. Four of the five Arctic coastal states are parties. The exception to the rule is the United States. The US does, however, generally regard UNCLOS as reflecting customary international law and therefore pursues a policy in accordance with it.
All the Arctic coastal states have made 200 n.m. maritime claims but a large area of the central Arctic Ocean lies seaward of these claims.

Figure 1 Map showing maritime claims, agreed maritime boundaries and theoretical equidistance lines in the Arctic region. A large area in the central part of the Arctic Ocean lies beyond the 200 n.m. limits of the maritime claims of the coastal states. Two areas beyond 200 n.m. from the coast - the so-called 'Loophole' and 'Banana Hole' - also exist in the Barents Sea and Norwegian Sea. Most of the sea-bed of these areas is likely to be subject to submissions to the Commission on the Limits of the Continental Shelf (CLCS) on the part of the relevant coastal states (see Box opposite). However, the two grey-shaded 'donut holes' in the central Arctic Ocean are likely to lie beyond national jurisdiction and form part of the International Seabed Area. (Note that the breadths of territorial seas and EEZs are generally measured from the low-water line as marked on large-scale charts officially recognized by the relevant coastal state (UNCLOS, Article 5). However, where the coastline is deeply indented or there is a fringe of islands along the coast, states may instead use straight baselines, such as around Norway's northern coastline.)

All of the Arctic littoral states, including the US, have advanced claims consistent with UNCLOS, notably 12 n.m.*-breadth territorial seas, within which states have complete sovereignty subject to the right of 'innocent passage' on the part of foreign vessels, and 200 n.m. exclusive economic zones (EEZs), within which states have specific sovereign rights and obligations in relation to living and non-living marine resources (see Figure 1). Otherwise, however, high seas freedoms, for instance over navigational rights, are retained within claimed EEZs. Under UNCLOS, states may also be able to establish sovereign rights over areas of 'outer' or 'extended' continental shelf, seaward of the 200 n.m. EEZ limit (see Box, p. 25).

Wherever the maritime claims of the Arctic coastal states overlap, there is a potential maritime boundary. By no means all the maritime boundaries in the Arctic have been agreed, and there are a number of overlapping claims and boundary disputes, notably between Canada and the US in the Beaufort Sea, between Canada and Denmark (Greenland) in the Lincoln Sea, and between Norway and Russia over the status of the waters around Svalbard (Figure 1) and over maritime delimitation in the Barents Sea. Such disputes are hardly remarkable and reflect the incomplete nature of the maritime delimitation picture worldwide, with under 50% of potential maritime boundaries agreed. In fact, the Arctic region generally lacks major territorial disputes.

The relatively minor (and arguably curious) exception is the dispute between Canada and Denmark over possession of Hans Island. Hans Island is a tiny (1 km²) island located roughly midway between Canada's Ellesmere Island and Greenland. Although sovereignty over the island is disputed, the parties managed to define a sea-bed boundary through the strait by means of the innovative expedient of ignoring the island for the purposes of constructing the delimitation line of the continental shelf line; the boundary line stops just short of the island to the south and then continues from a point located just off the island's northern coast.

Article 76 of UNCLOS lays down a complex series of formulae through which the coastal state can define the outer limits of its continental shelf areas lying seaward of the 200 n.m. limit (see Box). In order to establish entitlement to outer continental
shelf areas in accordance with Article 76 a coastal state is required to gather information related to the morphology of its continental margin as well as its geological characteristics and bathymetric information. This information is then submitted to a specialised United Nations technical body – the Commission on the Limits of the Continental Shelf (CLCS) – for assessment (see later). Arctic coastal states are therefore busy gathering the complex datasets needed to formulate submissions relating to their outer continental shelf claims.

The changing Arctic
In 2004, the Arctic Climate Impact Assessment (ACIA) project observed changes in the Arctic climate over recent decades and investigated a range of future impacts on the natural and socio-economic structure of the region. The ACIA highlights that the Arctic is sensitive to climate changes, and observed temperatures show that despite evidence of cooling in southern Greenland, the Labrador Sea and the North Atlantic, for the Arctic as a whole the trend is for substantial warming. Between 1954 and 2003, the mean annual surface air temperature rose by 2-3°C in Alaska and Siberia with winter rises averaging 4°C. Interestingly, the ACIA reports that indigenous perceptions and experiences of climatic warming in the Arctic match scientific observations, particularly as regards changes in biodiversity and ecology of Arctic flora and fauna, weather patterns, sea-ice and impacts on indigenous cultures.

The ACIA developed predictions for a range of future climate scenarios in the Arctic. The predictions were constructed on the basis of composites of five ACIA climate models based on the Intergovernmental Panel on Climate Change (IPCC) B2 scenario (global development on a path of environmental sustainability – a conservative emissions scenario). From 1990 to 2090, projected annual temperatures show a uniform warming of up to 4°C. However, projected surface air temperatures in winter may rise by 4-5°C over land and potentially up to 8-10°C over the Arctic Ocean and its coasts – a cause for serious concern.

In September 2007, the European Space Agency reported that the area covered by sea-ice had shrunk to its smallest summer extent since the initiation of satellite measurements 30 years ago. The United States National Snow and Ice Data Center (NSIDC) reported that the average five-day mean sea-ice extent in September 2007 was 4.13 km² million, compared to the 1979-2000 average of 6.74 km² million. The record 2007 sea-ice reduction followed the 2005 record minima of 5.32 km² million. The recent 2008 summer ice extent was closely monitored by the NSIDC and the media. The average September summer extent was recorded as 4.67 km² million, making it the second lowest on record. Compounding the issue of summer sea-ice extent is the thinning of winter sea-ice. Overall, the mean ice thickness within the central Arctic Ocean was reduced by 40% between the periods of two submarine ice-draft climatologies, for 1958-1976 and 1993-1997, as identified in Rothrock et al. 1999 (see Further Reading).

Where law, geoscience (and politics) meet

Defining the limits of the outer continental shelf

Article 76 of UNCLOS states that the continental shelf of a coastal state consists of ‘the seabed and subsoil of submarine areas’ and extends beyond its territorial sea either:

- to a distance of 200 n.m. from relevant baselines (usually the low-water line, or, under certain conditions, straight baselines) (cf. Fig. 1); or
- ‘throughout the natural prolongation of its land territory to the outer edge of the continental margin’.

Where a coastal state is contiguous to a broad continental margin that extends beyond the 200 n.m. limit, Article 76 provides two entitlement formulae through which it can establish that such continental margin extends beyond the 200 n.m. limit. Both of these formulae are measured from the foot of the continental slope, i.e. where the steep continental slope becomes the more shallow continental rise, a point defined as ‘the point of maximum change of gradient’ unless there is evidence to the contrary’. They give rise to:

- The Gardner Line – based on the thickness of sedimentary rocks overlying the continental crust; or
- The Heiberg Line – a line no more than 60 n.m. from the foot of the continental slope.

Once the existence of continental shelf beyond the 200 n.m. limit has been established, two maximum constraint or ‘cut-off’ lines are then applied:

- 350 n.m. from the relevant baselines; or,
- 100 n.m. from the 2500 m isobath.

The coastal state has the option of applying whichever of these entitlement formulae and constraints are most advantageous to it.

The outer limits of a coastal state’s outer continental shelf are to be defined by ‘straight lines not exceeding 60 nautical miles in length, connecting fixed points defined by coordinates of latitude and longitude’.

The problem of ridges

Article 76 also states that the 350 n.m. cut-off applies to ‘submarine ridges’ but that this constraint does not apply to ‘submarine elevations that are natural components of the continental margin, such as plateaux, rises, caps, banks and spurs’, which are sometimes described as ridges. Distinguishing between the various types of ‘ridge’ has proved to be problematic and contentious and has provoked considerable debate. Ridge issues are highly relevant to the outer continental shelf claims of the Arctic states. For example, Canada, Denmark and Russia in particular are keen to demonstrate that the Lomonosov Ridge is composed of continental crust, linked to their respective continental margins and thus legitimately part of their natural prolongations and outer continental shelf entitlements.

This dramatic loss can be viewed in the context of reductions in summer sea-ice cover over the last 10 years of approximately 100,000 km² per year, on average. Forecast models of summer sea-ice extent show a continuing downward trend, but scientific debate continues over how long it will be before the Arctic will be ice-free in summer. It remains to be seen whether the present summer sea-ice regime is part of a long-term cycle, or the system has switched into a new state of decline; however on the basis of the 2008 record, the NSIDC noted that the implications of the declining trend were ‘enormous’. The increase in temperatures, reduction of sea-ice and altered hydrology arguably presages a ‘step change’ in the nature of impacts on ecosystems and communities within the Arctic. The impacts on the environment include the shifting of vegetation zones and ecosystem-scale changes to Arctic habitats.
and species. Changes to migration and breeding behaviour, foraging ecology and the introduction of invasive species will lead to altered diversity, distribution and abundance of species. For the four million indigenous and non-indigenous residents, impacts from a warming climate include damage to infrastructure from melting permafrost, increased coastal erosion, impacts on health, water and food supply and economies. In addition, changes in species distribution, landscape, and a shift in economic drivers, will mean indigenous communities will have to adapt to a changed way of life and loss of traditional cultural practices.

**Arctic opportunities**
What of emerging and future uses of the Arctic Ocean? A substantial debate has been developing in the relevant literature regarding the range and extent of economic activity in the Arctic. While the extent and mix of socio-economic activities is open to conjecture and will differ at sub-regional scales, it is likely that in the Arctic, economic activity will grow as warming patterns evolve.

**Fabled sea routes**
While there is little doubt that navigation in Arctic waters is on the rise, led by developments in the oil and gas sector, increasingly in respect of fisheries and, particularly, through tourism, these developments are regional in character rather than involving inter-oceanic transit. Thus, for example, offshore oil and gas activities are concentrated in the Barents and Kara Sea, while ship-based 'adventure cruising', which has expanded considerably, tends to be focussed on the Nordic Arctic, especially Svalbard, although it has also been increasing rapidly in the eastern Canadian Arctic.

Nevertheless, the reduction in sea-ice has re-awakened dreams of the opening up of long-sought navigational routes across the ‘roof of the world’: the North-West Passage (aptly termed the ‘Arctic Grail’) and the Northern Sea Route (formerly known as the North-East Passage), both of which are a series of intertwined passages rather than a single route (Figure 2). There may also even be a transpolar route.

Satellite imagery from September 2007 shows the North-West Passage completely ice-free and the Northern Sea Route partially blocked. In 2008, the September minimum recorded by the NSIDC showed both the Northern Sea Route and North-West passage as open. Indeed, in October 2008 the research vessel *Polarstern* returned to its homeward port of Bremerhaven having completed a double transit of both the North-West Passage and Northern Sea Route without having to break any ice.

The prospect of the opening up of shipping routes in the Arctic, linking Europe to Asia, is certainly an enticing one for the shipping sector. Purely in terms of distances to be travelled, if navigable, the North-West Passage would offer a 9000 km (4860 n.m.) saving on the route between Europe and Asia via the Panama Canal, whilst the Northern Sea Route would entail distance savings of almost 40% on the transit between northern Europe and north-east Asia via the Suez or Panama...
Canal. The distance savings involved in a trans-Arctic 'over-the-top' route are, unsurprisingly, even more dramatic with, for example, a voyage between Hamburg, Germany, and Kobe, Japan, being cut from 11,225 n.m. (via Suez) to around 5,000 n.m. – a saving of approximately 6,225 n.m., or 55% of the distance involved. Small wonder then that possible navigation via Arctic routes has been the subject of considerable excitement and speculation.

However, pure distance savings do not tell the whole story. Even with reductions in ice-cover, increasing access and lengthening of the navigational window, ice will remain a hazard to shipping in Arctic waters. It is highly probable that there will still be some cold summers with, inevitably, heavy sea-ice conditions. Navigation through the Arctic will therefore necessitate the use of ice-strengthened vessels, which are significantly more costly to build, maintain and operate than conventional shipping. Additionally, the threat of sea-ice will in all probability translate to slow and cautious passages which may well require ice-breaker assistance (Figure 3) – all of which serve to undermine any savings in transit times and navigational costs implied by the enormous distance savings. It is also the case that finding insurance for ships and cargos undertaking Arctic navigation is likely to prove highly problematic given the inherent risks involved in navigating Arctic waters.

With regard to the North-West Passage, there are grounds for suggesting that even with a rise in temperature there will be only a marginal lengthening in the summer sailing season and, more alarmingly, that navigation through the North-West Passage may become considerably more hazardous rather than less. This is because the Canadian Arctic Archipelago, especially the Queen Elizabeth Islands, and the first-year ice that forms in the channel between these islands, tends to shield the North-West Passage from the concentrations of older and considerably harder sea-ice that builds up in the central Arctic Ocean (Figure 4). The melting of first-year sea-ice therefore has the potential to lead to a greater intrusion of multi-year ‘old ice’ from the Arctic Ocean proper into the North-West Passage (cf. Figure 4). This tends to replace the ice that has melted, in effect ‘filling up’ the Passage with thicker ice and thus restricting any lengthening in the summer sailing season. This is likely to make navigation through these waters considerably more hazardous, even for ice-strengthened vessels and ice-breakers, especially as old ice is extremely hard, durable and potentially lethal for a vessel in the event of a collision. Furthermore, there are indications that the melting of first-year ice may result in the southern migration of pack ice in the Beaufort Sea, potentially blocking, or hampering access to the western entry/exit to the North-West Passage.

In contrast, the Northern Sea Route has, officially at least, been open for business since 1991. While this route, or series of routes, has certainly provided a crucial link to the outside world for Russia’s Arctic settlements and allowed, for example, the export of ores and processed metals from the region, the Northern Sea Route’s role as a potential transit route linking the Atlantic and

Figure 3 A Russian ice-breaker operated by the Murmansk Shipping Company, photographed in the Viliktsky Strait which links the Laptev Sea and the Kara Sea (and so is part of the Northern Sea Route)

Photo by courtesy of Ben Powell.

Pacific Oceans is more questionable. It is perhaps significant that although the route has on occasion been used, for example by vessels such as the above-mentioned Polarstern, thus far there have been no regular commercial transits by non-Russian vessels.

The key obstacle to the use of the Northern Sea Route as an alternative to traditional navigational routes is that there are size restrictions on the shipping that can use it. These size restrictions are a function, particularly, of the shallow nature of a number of the straits lying between the mainland

Figure 4 Melting sea-ice in Viliktsky Strait. The thinner flat ice is first-year ice, the hummocks are the remains of old ice that over the years has been pushed together, rafted layer upon layer. Given that about 90% of the ice-volume is below the ice-surface, sailing through such an area of sea is very dangerous, even for ice-breakers.

Photo by courtesy of Ben Powell.

Waters infested with sea-ice are dangerous, especially if some of the ice is old, hard ice.
and islands offshore the Siberian coast, which restricts the draft of ships using the Northern Sea route to 12.5 m. Although, such depth limitations can be overcome by following a higher-latitude ‘outer’ route, this alternative is, inevitably, more ice-prone and thus hazardous and unreliable. Furthermore, the need for ice-breaker assistance due to unpredictable ice conditions along the route means that there is a requirement that shipping not be broader in the beam than the ice-breaker it needs to follow, which translates to a beam restriction of 30 m.

In combination, these draft and beam restrictions mean that the maximum size of vessel capable of using the Northern Sea Route is around 50,000 dead-weight-ton (d.w.t.). This compares unfavourably with the size of vessels plying the traditional Suez route which may be at least four times the size (currently ‘Suezmax’ class ships can be up to 200,000 d.w.t. with a draft of up to 19 m, but the canal is being widened and deepened in order to accommodate 350,000 d.w.t. vessels). This factor alone undermines the logic of using the Northern Sea Route because despite the impressive potential distance savings involved, the option makes little sense if three or four transits are needed to deliver the same volume of cargo as could be achieved by one voyage via a traditional route.

The Northern Sea Route might retain some attraction for the transport of smaller, high-value cargos, but another issue of concern is punctuality. Unpredictable sea-ice conditions allied to uncertainty over the availability of assistance from the large but ageing Russian ice-breaker fleet is likely to impact on punctuality – an issue of serious concern in an era when reliable, just-in-time deliveries are increasingly considered essential in international commerce. Despite these seemingly compelling drawbacks, it has nonetheless been reported that the German shipping company Elbella plans unassisted sailing using the Northern Sea Route from the summer of 2009.

Increasing navigation in the Arctic also equates to increased risks of maritime accidents, and brings into question the capacity of coastal states to deal with such an eventuality, both in terms of rescuing those involved and addressing the environmental impacts of, for example, a major oil spill. A recent series of accidents, involving tourist operations in both polar regions, serves to highlight the issue. In August 2007, the collapse of a glacier onto the Alexey Maryshev resulted in injuries to 46 tourists off Svalbard. In November 2007, the MS Explorer sank in the Antarctic, necessitating the emergency evacuation of 154 passengers and crew. Two more cruise ships, the MV Ushuaia and the Ocean Nova, ran aground off the Antarctic Peninsula in December 2008 and February 2009, respectively. While the Ocean Nova, carrying 106 passengers and crew, was freed by high tides, the 89 passengers and crew of the Ushuaia had to be rescued. It is clear that ‘expedition cruising’ in remote and potentially hazardous waters is growing, and it can be reasonably anticipated that this growth will continue.

Consequently, the coastal states are increasingly moving to assert their jurisdiction over navigation in Arctic areas. Article 234 of UNCLOS allows coastal states to adopt and enforce non-discriminatory provisions with the objective of preventing, reducing and controlling maritime pollution from vessels in ice-covered areas of their EEZs, where severe climatic conditions and the presence of ice cover ‘for most of the year create obstructions or exceptional hazards to navigation’. While Russia has long relied on Article 234 to justify its jurisdiction over the Northern Sea Route – requiring prior notice for vessels intending to use the Northern Sea Route and the submission of an application and set payment for services in support of passage (often termed the ‘ice-breaker fee’) – Canada has only recently signalled its intent to apply a similarly compulsory regime.

In August 2008, Canada announced that it would be extending the application of its Arctic Waters Pollution Prevention Act from 100 n.m. to 200 n.m. and would also be making use of its Arctic marine traffic scheme, NORDREG, mandatory. These moves – the logic of which seems self-evident given the risk of a major shipping accident in hazardous high-latitude waters, with the attendant threat to the fragile Arctic environment – are likely to prompt a renewed round of exchanges between Canada and the US in their long-standing dispute over the legal status of the North-West Passage. Indeed, in one of his final acts, outgoing US President George W. Bush signed a National Security Presidential Directive on 9 January 2009. The Directive notes the US’s ‘broad and fundamental’ national security interests in the Arctic region, including in respect of freedom of navigation and overflight rights – something the Directive termed a ‘top national priority’. For the first time the US also explicitly asserted that straits used for international navigation in both the North-West Passage and the Northern Sea Route are seaways to which the non-suspendable right of ‘transit passage’,* open to vessels of all nations, applies. The interpretation and application by states of Article 234 in the face of increasing shipping is therefore likely to remain a source of future legal debate.

**Sea-bed resources – the ‘last frontier’?**

The Arctic has been portrayed as a major potential source, or ‘last frontier’, of sea-bed energy resources and, from a US perspective, as a potential ‘strategic energy reserve’. The authority often cited to support this view is the United States Geological Survey’s (USGS) 2000 estimate that the Arctic may hold as much as 25% of the world’s undiscovered hydrocarbon resources. This view was elaborated and largely reinforced with the publication of the USGS’s May 2008 CircumArctic Resource Appraisal. This assessment noted the existence of over 7 million km² of Arctic continental shelf areas under less than 500 m of water and advanced the view that these shallow continental shelf areas ‘may constitute the geographically largest unexplored prospective area for petroleum remaining on Earth’. The USGS report went on to conclude that overall the Arctic may hold around 22% of ‘undiscovered, technically recoverable’ resources globally, potentially consisting of 90 billion barrels of oil (13% of global undiscovered oil), 1669 trillion cubic feet of natural gas (30% of undiscovered gas), and 44

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*Under UNCLOS, transit passage permits the exercise ... of the freedom of navigation ... solely for the purpose of continuous and expeditious transit between one area of the high seas or an exclusive economic zone and another ..."*
billion barrels of natural gas liquids (20% of undiscovered liquids). Significantly, the USGS appraisal suggested that 84% of potential resources were located offshore and that for most of the Arctic basins, it is about three times more likely that gas will be found than oil. Russian estimates regarding the potential energy resources of the Arctic have been similarly optimistic. On the basis of these figures it seems clear that the Arctic is potentially an enormously significant source of sea-bed oil and, particularly, gas.

There are, however, a number of factors that suggest that an Arctic hydrocarbon bonanza is unlikely, at least in the short term. There has been little serious exploration (i.e. very little in the way of seismic activities, let alone drilling) in Arctic waters proper (especially in the central Arctic Ocean) due to the presence of sea-ice coupled with severe environmental conditions. Indeed, as a consequence of the sparsity of available data, the 2008 USGS appraisal based its findings on a ‘probabilistic’ analytical methodology, emphasizing the inherent uncertainties associated with estimates of undiscovered oil and gas (Figure 5). A more conservative view is consistent with a recent (November 2007) report employing detailed geoscientific analysis of individual Arctic basins, backed by oil industry data on exploration wells and existing discoveries, the findings of which were considerably less optimistic than the estimates outlined above (3 million barrels of oil per day and 5 million barrels of gas equivalent per day at peak production).

The conclusion contained in both this analysis and the 2008 USGS appraisal that the Arctic is predominantly ‘gas-prone’ has significant implications because gas is considerably harder to transport to markets, and the technologies that are required to achieve this aim (especially offshore) are still in their infancy, meaning that exploitation of a large portion of Arctic sea-bed resources is likely to be delayed until 2050 at least. Overall, the November 2007 report concluded that its findings were ‘disappointing from a world oil resource base perspective’ and call into question the long-considered view that the Arctic represents one of the last great oil and gas frontiers and a strategic energy supply cache for the US.’

A further important point to note is that most if not all of the Arctic oil- and gas-bearing sedimentary basins that have been analyzed fall within 200 n.m. of the coast and thus within the declared EEZs of the Arctic littoral states (cf. Figure 1). This situation is at odds with the prevailing perception of a resource-driven race to the Pole in respect of potentially overlapping claims to outer continental shelf areas in the central Arctic Ocean.

This is not, however, to discount the idea that major oil and gas finds will be made in the Arctic – they will just not necessarily be on the same scale or in such a swift time-frame as some.

**Figure 5**  Map showing the likelihood of oil/gas being found in various areas of the Arctic Ocean, taken from the USGS’s May 2008 Circum-Arctic Resource Appraisal. For each sedimentary basin, the intensity of the grey tone shows the probability that the basin contains at least one oil and/or gas field with recoverable reserves equivalent to > 50 million barrels of oil. Comparison with Figure 1 shows that the basins with a high probability of containing hydrocarbons fall mainly within the EEZs of the Arctic littoral states, rather than in the more contentious outer continental shelf areas.

By courtesy of the US Geological Survey.

*It is likely that most offshore hydrocarbon deposits discovered will fall within the EEZs of Arctic littoral states.*
optimistic reports may suggest. Furthermore, the strong perception that such sea-bed riches may exist is in itself a powerful factor in motivating claims to maritime jurisdiction. For example, in the above-mentioned US National Security Directive of January 2009, it is stated explicitly that ‘energy development in the Arctic region will play an important role in meeting growing global energy demand’ on account of the ‘substantial portion’ of global undiscovered energy resources thought to exist there.

It has also been suggested that the sea-bed of the Arctic Ocean may harbour substantial reserves of gas hydrates, which may be exploited in the future. While the potential may well be very large, the technologies required to exploit these resources, especially from such remote areas and in such hostile conditions, mean that their exploitation currently remains over the horizon.

**Arctic living resources and biodiversity**

The Arctic is a highly productive marine ecosystem and represents one of the few regions where fish stocks remain in a relatively healthy state (Figure 6). Fishing presents one of the more significant threats to Arctic marine biodiversity in the short and medium term. While the Arctic is host to several globally significant fisheries in the Bering and Barents Seas, there are potential opportunities and concerns relating to new fisheries in previously inaccessible areas, and changes in existing grounds. Key causes of concern include potential impacts from fishing gear, and from vessels that are able to exploit stocks in deep water, particularly in the case of high seas bottom trawling.

Climate-induced migration and population changes may further complicate fisheries management arrangements. The ACIA report notes how a changing Arctic environment will force major changes in species distributions, diversity and ranges, with consequences for dependent and associated species. For example, the 1987 climate-related collapse of the capelin stock in the Barents Sea had major impacts on seabirds in the region. Changes to ice algae and related changes in food-web dynamics are likely to impact on fisheries, but the extent of impacts are at this stage relatively unknown. Climate change may also prove to be positive factor in increasing the productivity of certain stocks. Moderate warming may increase the productivity of herring and cod stocks through providing increased habitat and increased productivity of prey. However, Arctic ecosystems are complex and not well understood in the context of changing climatic, ecological and oceanographic conditions, and while productivity may increase in some species, decreases could occur in other dependent and associated species.

**Implications for fisheries**

The migration of stocks is a factor that could complicate ecological relationships between stocks and their management. The migration, overfishing, collapse and rebuilding of the Norwegian herring fishery in the 1950s to the 1990s illustrates how the twin influences of climatic changes and management regimes are critical in determining fisheries sustainability. Recent studies have shown that populations of a number of commercially important fish species are shifting northwards as water temperatures increase. The ACIA reports that rising bottom-water temperatures in the Bering Strait are resulting in a northward shift in some fish stocks seeking colder and deeper waters, and this is affecting predator-prey relationships. In the North Atlantic, it has been reported that cod and haddock have shifted 60–70 km northwards.

Whether it is new stocks that migrate into Arctic waters and displace, or compete with, existing Arctic stocks, or shifts in the ranges of indigenous species, management arrangements for fisheries will become increasingly complicated. Fishing fleets may need to change gears and methods in order to catch new species, or may need to travel to new fishing grounds. It has been reported, for example, that Icelandic fishermen have been exploiting cod stocks in the Barents Sea ‘loop-hole’ (an area of high seas surrounded by EEZs: see Figure 1), in response to shifts in stock from

*Figure 6*  Kittiwakes and humpback whales feeding off Bear Island, between Svalbard and Norway, at the western entrance to the productive Barents Sea.

*By courtesy of Finlo Cottier.*
their home waters. This raises the challenge that from a management perspective, stocks could move across or straddle borders, prompting calls for the development and implementation of joint management regimes under the 1995 UN Fish Stocks Agreement. In light of the depletion of stocks elsewhere, especially in waters beyond the national jurisdiction of coastal states – the so-called ‘tragedy of the commons’ – new fishing opportunities in an ice-free Arctic will require strict management if they are not to be short-lived. This may require the extension of existing agreements such as the Norwegian–Russian Fisheries Commission or the North-East Atlantic Fisheries Commission. However, in light of broader ecosystem changes and pressures in the Arctic, and the critical importance of Arctic fisheries for European markets, consideration could be given to an Arctic Ocean-wide management regime. A possible model is the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR) in the Southern Ocean which has developed a wide-ranging ecosystem-based precautionary approach to fisheries. The key issue, however, is one of state sovereignty, and the political will necessary to negotiate regime reform. Despite this, in the future three things are relatively certain – there will be changes in the distribution and abundance of fish species, shifts in effort and capacity, and new players.

Genetic resources

In view of the region’s unique environmental conditions, the Arctic may also prove to be a source of useful genetic material, raising issues about the preservation of biodiversity and the management of bioprospecting. A recent report from the United Nations University (see Further Reading) highlights the growing interest and commercial significance of bioprospecting for genetic resources in the Arctic. The report identified 43 commercially active companies that are engaged in research on, and exploitation of, biotechnology based on Arctic resources, as well as 31 patents on specific Arctic genetic resources. These resources are providing development potential for a range of commercial applications including anti-freeze proteins, bio-remediation, pharmaceuticals, dietary supplements, other health applications, and cosmetics.

Arctic governance: challenges for a sustainable Arctic

It is clear that, in the Arctic, mineral resources are of strategic importance and under the jurisdiction of Arctic states. However, as this article has discussed, the extent of resource reserves and operational capacity is highly uncertain. Any future development must proceed with the mitigation of environmental impacts as its highest priority, and as part of a shared vision of the Arctic states. Considering the uncertainty over governance, impact mitigation, and the high stakes of any potential accident, it would seem appropriate to apply the precautionary principle to Arctic development.

The geopolitical aspects of claims to areas of outer continental shelf should not be discounted. Even though senior Russian officials have emphasized that Russia acted in accordance with international law, there is no doubt that the symbolic planting of the Russian flag at the North Pole served to alarm Russia’s Arctic neighbours. It also did the Russian government no harm at home, as the flag-planting event was accompanied by a great fanfare in the domestic political context and was taken to represent a sign of Russia’s more robust posture internationally.

A race to the Pole

Concerning the question over a ‘race to the pole’ the answer is a highly qualified ‘Yes’... but mostly ‘No’. Clearly a large area in the central Arctic Ocean lies beyond the 200 n.m. limits of the EEZ claims of the littoral states. It is in respect of this area that much has been written, especially following Russia’s North Pole flag-planting escapade. However, while all the coastal states are engaged in a ‘race’ of sorts to gather scientific information on areas beyond their 200 n.m. EEZs, all have stated that they are doing so in strict accordance with the terms of UNCLOS.

Submissions will then be put to the UN Commission on the Limits of the Continental Shelf (CLCS; see earlier), which will provide recommendations on the basis of which coastal states will be in a position to declare final and binding outer continental shelf limits. For coastal states that were parties to UNCLOS prior to 13 May 1999, the deadline for submission to the CLCS is 13 May 2009, although in light of this looming deadline, the terms for meeting this requirement were considerably relaxed in June 2008. Both Russia (2001) and Norway (2006) have made submissions, and the CLCS has asked for additional supporting information from Russia. The deadline for submission from Canada is 2013, and for Denmark it is the following year. As a non-party to UNCLOS, no deadline has been set for the US.

A key uncertainty in this context, however, is how the Commission will deal with the question of ridges (see Box on p.25). This will be an issue of great concern to the Arctic coastal states given the presence of major ridges in the central Arctic Ocean, notably the Alpha, Lomonosov and Arctic ridges (Figure 1). Nonetheless, it has been suggested that the vast majority of the central Arctic sea-bed, perhaps with the exception of two ‘donut holes’ beyond national jurisdiction (dark grey in Figure 1), may be claimed by one or other of the Arctic coastal states. It is important to acknowledge, though, that the CLCS is a technical rather than a legal body. The Commission will therefore not resolve questions of overlapping claims. If such scenarios emerge, as appears likely, it will be up to the Arctic coastal states themselves to resolve them, either through cooperative approaches or, perhaps, by settling their maritime boundaries for areas beyond 200 n.m., with one another and then approaching the CLCS.

In fact, very little is known about the resource potential of the sea-bed in the central Arctic, though when queried about the resource potential of the North Pole area itself, USGS scientists have observed that the area did not appear ‘very interesting’. Key factors likely to prevent the central Arctic yielding substantial oil and gas riches in the near to medium term include the fact that for the foreseeable future ice-cover is likely to linger in these
areas, at least for much of the year, as well as the
great depth of the waters involved – Russia used an
unmanned deep-sea submersible to plant its flag in
over 4200 m of water. Both these factors are likely
to seriously compromise energy resource explo-
ration and, particularly, exploitation activities in the
central Arctic Ocean for the foreseeable future.

Resolving Arctic governance
UNCLLOS clearly provides the international legal
framework for maritime jurisdictional claims in the
Arctic. Arguably, the same applies to the broader
issues of governance in the Arctic. This appears to
be the position of the Arctic coastal states.

In May 2008 Ministers from all five Arctic coastal
states met in Greenland and issued the Ilulissat
Declaration. This document emphasizes the ‘sov-
ereignty, sovereign rights and jurisdiction’ of the
five Arctic coastal states over ‘large areas’ of the
Arctic Ocean and the ‘unique position’ this puts
them in to address Arctic issues. The Arctic littoral
states went on to note the existence of an ‘exten-
sive international legal framework’ applicable to
the Arctic Ocean including, notably, UNCLLOS,
which provides a ‘solid foundation for responsible
management through national implementation
and application of relevant provisions’.

The five Arctic coastal states went on to emphasize
their commitment to ‘this legal framework and
to the orderly settlement of any possible overlapp-
ing claims’ that might arise. Furthermore, they
acknowledged their ‘stewardship responsibilities
and agreed to cooperate amongst themselves to
share information and to enhance search-and-
rescue infrastructure. They also committed to
continuing to work through existing ‘soft law’
mechanisms such as the Arctic Council but foresaw
‘no need to develop a new comprehensive inter-
national legal regime to govern the Arctic Ocean’.

Interestingly, other non-littoral Arctic states and
indigenous groups such as the Inuit Circumpolar
Council (ICC) were not included in discussions
over the content of the declaration. The ICC
responded in a recent press release claiming that
the Ilulissat Declaration ‘completely ignores the
rights Inuit have gained through international law,
land claims and self-government processes’.

This national sovereignty and sovereign rights-
oriented approach is at odds with the views
expressed by leading environmental NGOs such as
the World Wildlife Fund which has suggested that
by itself UNCLLOS ‘is not enough’. More recently,
in October 2008, the European Parliament passed
a resolution calling on the European Commission
to take a ‘proactive role’ in the Arctic, for instance
by taking up permanent observer status on the Arctic
Council. More controversially, the resolution went
on to call for the initiation of international nego-
tiations with the objective of the adoption of an
international treaty for the protection of the Arctic,
‘having as its inspiration the Antarctic Treaty’.

Following the EU Parliamentary resolution, the EU
Commission released a communication on the
Arctic. The communication dropped any reference
to adoption of an ‘Arctic Treaty’ but outlined a
policy of systematic engagement in Arctic
environmental protection, human rights, research
and monitoring, sustainable resource development,
and multilateral governance. Clearly the EU will
be a significant player in Arctic affairs in the years
to come.

These comments by the EU Commission fit an
overall pattern of debate over the future of the
Arctic and its mode of governance, and are con-
cerned with whether the existing regime is suffi-
cient to protect and manage the Arctic, or whether
a new regime is required in the face of multiple
pressures. Despite this debate, the paradigm in
the Arctic is one of state sovereignty and coopera-
tion via regional agreements – as evidenced by
the Ilulissat Declaration. In the medium term, it
is likely that future economic activity driven by
Arctic environmental changes will operate within
this existing legal framework.

Domestic laws control development and environ-
mental management in areas under national
jurisdiction, but these laws are influenced by
international pressures and commitments. Interna-
tional legal regimes concerning climate change,
biodiversity, fisheries, trade and environmental
protection are enacted by some or all of the Arctic
states, but their application remains patchy, and
many of the problems, such as climate change,
require solutions stretching far beyond the Arctic.
As Arctic states have opted to pursue a ‘soft law’
voluntary regime focussing on the coordination
of scientific research, environmental management
and sustainable development, efforts to protect
and manage the Arctic can suffer from a ‘lowest
common denominator’ effect, where a lack of
action by one or more states can undermine or
hinder the effective action of others. On the other
hand, the current regionalist approach character-
ized by the Arctic Council has been moderately
successful and realistic, although potentially due
for reform as greater international attention is
focussed in the region and external factors become
increasingly important.

Possible future scenarios
We identify three possible scenarios for future
 governance: an existing or ‘status quo’ regime;
a mixed reform regime; or a new binding inter-
national regime. The continuation of the existing
and successful soft law regime in the Arctic is
a likely scenario, particularly as Arctic coastal
states are unlikely to relinquish their sovereignty to a
binding international regime. The divergence of
political opinion over the future use of the Arctic,
together with continued geopolitical position-
ing, render establishment of a binding agreement
difficult and lead to the idea of progressing within
existing political frameworks. A ‘flexible approach
to norm building’ within existing frameworks
would appear to be a likely way to move for-
ward on difficult issues and continue to improve
regional environmental governance on issues such
as monitoring and impact assessment, coordi-
nating and harmonizing regulations, promoting
cleaner production and reducing pollution.

A mixed reform regime would seek to reform
the existing governance approach identified above.
It would actively seek to address the inefficiencies
of, and gaps in, the existing ‘unambitious regime’
and move toward addressing Arctic ‘sectoral’
issues where reform is needed (e.g. shipping,
search-and-rescue). This could be a likely scenario where Arctic coastal states and other states with interests in the region move ahead on an issue-by-issue basis under international frameworks such as UNCLOS, particularly in the context of Article 123 on regional cooperation in enclosed and semi-enclosed seas. This approach would retain the principle of sovereign control in the Arctic but increase cooperation and move forward on difficult and emerging multilateral issues such as fisheries management and straddling and high seas stocks. Building in improved mechanisms to deliver ecosystem-based and precautionary based strategies, using existing instruments that are operational in the Arctic such the Convention on Biodiversity, would evolve under this scenario.

The final scenario of a comprehensive binding international regime, i.e. an ‘Arctic Treaty’, is an unlikely outcome. Reform is needed within the existing Arctic system, particularly clearly thought-out reform with established targets and the ability to address emerging transboundary problems. However, it is yet to be demonstrated that Arctic states have the political will or desire to move in this direction. It is therefore anticipated that efforts are more likely to be focussed on voluntary approaches. Several ideas have been discussed during consideration of a binding pan-Arctic Treaty mechanism loosely based on the ‘Antarctic’ model, but in the short term this is a highly unlikely development, despite the EU parliamentary resolution and lobbying on the part of some NGOs on the desirability of seeking such a treaty.

Overall, the future of the Arctic is subject to uncertainty and change. Change is coming from many directions — from the underlying physical and biological system driven by climatic warming, from geopolitical stances by the Arctic states, and in a resurgent interest in the potential or actual living and Arco-living resources of the region. Best international practice would develop and apply a precautionary and multilateral approach to the issues, backed by scientific research, an Arctic vision or Charter, and the political will to act on identified issues of concern, such as resource sustainability, ecosystem-based management and maritime jurisdictional claims. Whether the legal and governance regime in the Arctic evolves via a continuation of the status quo, through a mixed reform approach, or a new international regime, it is hoped that the future of the Arctic is one of sustainable development, peace and international cooperation.

Further Reading


NB The IPCC Report notes that this conservative projection does not include the possibility of rapid changes in ice flow from the Greenland or Antarctic ice-sheets.


See also the Norwegian Government fisheries website for a summary of concerns about the sustainability of North East Arctic Cod: www.fiskerise.no/fiskestokke/fish_stocks/cod/north_east_arctic_cod.htm

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