5 Polar politics and commerce

> As a result of climate change, ice and cold in the polar regions are diminishing. This is particularly noticeable in the Arctic. Here shipping routes are opening up and mineral deposits are becoming accessible, arousing the attention of industry. In the Antarctic, too, ever more countries and companies are pursuing commercial interests. Here, however, the imperatives of environmental policy have kept commercial activities within bounds up to now.

The Arctic and Antarctic as political arenas

> Historically, cooperation and willingness to compromise have characterized the political agenda of the polar regions. Since the signing of the Antarctic Treaty in 1959, the southern polar region has been managed on a collective basis. The countries with a stake in the Arctic have since 1996 coordinated fundamental policy issues in the Arctic Council. Yet both dialogue forums face challenges as a result of climate change and global geopolitical developments. The more the ice retreats, the louder do calls for commercial exploitation of the polar regions become.

Paradigm shift and new geopolitical interests

The polar regions are currently undergoing a fundamental shift in their significance. With the advance of climate change and the growing sophistication of the technology behind ships, aircraft, buildings, information channels and communication methods, humans are becoming ever more successful at enlarging their range of activity in the Arctic and Antarctic. In both regions significantly more states and stakeholders are now active than was the case just a couple of decades ago – and each is pursuing its own interests. Climate change has set in motion something akin to a geopolitical chain reaction that is presenting both the countries surrounding the Arctic and the member states of the Antarctic Treaty System with new challenges.

5.1 > An icebreaker escorts tankers and cargo vessels through Russia's Arctic waters. This escort service is expensive yet is required by the Russian authorities: This is one of several reasons why shipping companies have until now made little or no use of the Northeast Passage as a route between Europe and Asia.

Easier access as the sea ice retreats

The shrinking of the sea ice makes it easier for people and ships to access the Arctic and Antarctic regions. In August 2014, for example, unusual ice conditions in the eastern central Arctic enabled the German cruise ship *Hanseatic* to reach a position 85° 41' North, thus setting a new record for passenger ships. According to observers, there are also large parts of the Antarctic that can no longer be regarded as remote and untouched. Decades of whale and seal hunting, the ozone hole caused by human activity and the many traces that scientists, fishermen and tourists have now left in the Antarctic provide confirmation of this statement.

5.2 > The buildings of a new military base erected by Russia on Alexandra Land, an Arctic island that forms part of Franz Josef Land, stand on stilts. The base, which covers 14,000 square metres, houses air-defence units.

Commercial interests

The larger the areas of water and land that are laid bare by the shrinking ice masses of the Arctic and Antarctic, the more eagerly do a whole range of commercially oriented stakeholders and interest groups – travel companies, fishing fleets, mineral exploration companies, shipping companies and the like – covet the newly emerging opportunities. For example, the United States Geological Survey (USGS) calculates that 22 per cent of the world's unconfirmed oil and gas reserves lie north of the Arctic Circle. Shipping companies such as the Danish conglomerate Mærsk are already testing the feasibility of using the Northeast Passage as a route for cargo vessels travelling between northern Europe and the Indo-Pacific – in the hope that this will one day save considerable time and money.

Security concerns

As the sea ice melts, the countries with an Arctic coastline are losing a natural barrier that some observers regard as having protected them from military invasion from the north. This new security situation is said to be causing the Nordic countries some concern: Alongside increasing economic activity in the Arctic there is also a growth in military operations and latent conflicts could re-erupt. For example, during the Cold War the Arctic was a key theatre of military confrontation between the two then superpowers, the USA and the Soviet Union. Both sides maintained large military bases and rocket launching pads north of the Arctic Circle. Almost all these sites were shut down under the policy of détente of the 1990s, but climate change and the current debate on sea routes and rights of passage could result in a renewed build-up of military presence in the northern regions of the countries bordering the Arctic.

Attracting international attention and research

At the same time, the extent of climate change in the Arctic and Antarctic is attracting the attention of scientists and environmentalists. With a constant stream of new research findings, scientists are making the public ever more aware of the state of the polar regions, while environmentalists worldwide are campaigning for their protection. Their core message is that it is in the Arctic and Antarctic that the future of our planet is being decided.

All these developments indicate that the polar regions – especially the Arctic – are becoming geopolitical arenas in which a growing number of stakeholders have ambitions and concerns. At the same time, the superpowers have resumed their competition for power and influence in these regions: This sometimes hampers what used to be extremely well-functioning international cooperation in both the Arctic and the Antarctic.

Munich Security Conference
The Munich Security Conference (MSC), a globally important forum for debate on international security policy, is held in Munich every February. It aims to promote peace through dialogue and provides politicians and representatives of business, industry and civil society with a platform for official and unofficial diplomatic initiatives. The main conference is accompanied by side events at which specific issues and regions are discussed. One such event is the Arctic Security Roundtable.

Who governs the Arctic?

The question of who has a political say has a different answer in the Arctic than in the Antarctic, which is managed collectively. The reason for this is once again the differing location of the two regions. The Arctic is geographically delimited by the Arctic Circle. Large parts of the Arctic region lie within the territory of eight counties: Canada, Russia, the USA (via the state of Alaska), Norway, Denmark (because of its close links with the actual Arctic state, Greenland), Iceland, Sweden and Finland.

Among these eight countries, Iceland, Sweden and Finland differ from the others in that they have no direct access to the Arctic Ocean. The only Arctic states in the narrower geographical sense – i.e. with direct access to the Arctic Ocean – are therefore Denmark (Greenland), Canada, Norway (Svalbard), Russia and the USA (Alaska). They are termed the Arctic Five, as distinct from the group of eight countries with territory inside the Arctic Circle.

Although the Arctic states are spread across three continents, all eight nations are part of a community of culture, norms and values and are linked in various ways – whether as a result of environmental and climate-related concerns, because of economic, security-related and social issues or on account of their indigenous populations in the Arctic territories. The nations therefore debate important matters of common interest in the Arctic Council: since the 1996 **Ottawa Declaration** this has been the leading intergovernmental forum for the Arctic and has promoted and coordinated cooperation among the Arctic states, the indigenous population and other inhabitants of the Arctic. In its work the Arctic Council focuses largely on sustainable development of the Arctic region and on environmental issues. Military and security issues are explicitly excluded from its agenda: these are instead discussed in forums such as the twice-yearly meetings of the Arctic Security Forces Roundtable (ASFR), at events of the Arctic Coast Guard Forum (ACGF) or at the Arctic Security Roundtable organized by the Munich Security Conference in collaboration with various partners.

In addition to the eight member states, six organizations that represent the interests of indigenous Arctic peoples have the status of Permanent Participants on the Council. Decisions require the approval of all members and involve close consultation with the Permanent Participants. However, the Council's guidelines and recommendations are not legally binding: implementation of any resolutions is entirely at the discretion of individual member states.

Many observers, though, regard the fact that the decisions of the Arctic Council are not legally binding as a strength rather than a weakness, since it allows for swift and flexible adaptation in a rapidly changing environment. Moreover, the Arctic Council has in the past initiated the signing of three legally binding multilateral agreements. In 2011 the Arctic states signed the Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic; this was followed two years later by the Agreement on Cooperation on Marine Oil Pollution Preparedness and Response and in 2017 by the Agreement on Enhancing International Arctic Scientific Cooperation.

Meetings of the Arctic Council are attended not only by representatives of the member states and the Permanent Participants but also by the spokespersons of the working groups, of which there are currently six. The working groups regularly draw up comprehensive and groundbreaking status reports on various social and environmental aspects of the Arctic. These provide the Arctic states with recommendations for action and are also used as an important source of information worldwide.

Representatives of 13 non-Arctic states, 14 intergovernmental organizations and twelve international non-governmental organizations are also permitted to attend the Council's sessions as observers. The countries with observer status currently include Germany, China, France, India, Poland, Japan and the United Kingdom. These observer states hope that their participation will increase their international visibility and give them direct access to information on Arctic issues. In return, the Arctic Council expects them to become involved in the various working groups and support their work.

For example, Germany now sends scientists and experts to all six of the Council's working groups and, with the Netherlands, it funds the post of coordinator of the bird conservation programme operated by the Conservation of Arctic Flora and Fauna (CAFF) working group. The observers are required to report regularly on their activities. On the basis of these reports, the eight members of the Arctic Council then decide whether or not a state's observer status should be retained. However, no state has yet had this status withdrawn.

A zone of peace

The founding of the Arctic Council in 1996 was to some extent due to the then General Secretary of the Central Committee of the Communist Party of the Soviet Union, Mikhail Gorbachev. In his famous speech in Murmansk in 1987 Gorbachev termed the Arctic a zone of peace and called for greater cooperation between the Arctic states.

This inspired Finland to get the Arctic states around a table and, in the course of several conferences held in 1991, persuade them to adopt the Arctic Environmental Protection Strategy (AEPS). The aim of the AEPS is to strengthen cooperation between the Arctic states on research into environmental protection issues, focusing in particular on pollution of the Arctic by oil, heavy metals and persistent organic pollutants. The initiators were also concerned about the effect of ocean noise pollution on marine creatures, about radioactivity and about acidification of the Arctic Ocean. Various working groups were set up to investigate these issues. They include:

- the Arctic Monitoring and Assessment Programme (AMAP),
- the Working Group on Protection of the Arctic Marine Environment (PAME),
- the Working Group on Emergency Prevention, Preparedness and Response (EPPR),
- the Working Group on the Conservation of Arctic Flora and Fauna (CAFF).

Other working groups have been added over time. Together they provide the basic structure of the Arctic Council and deliver input that underpins all the Council's discussions and decisions.

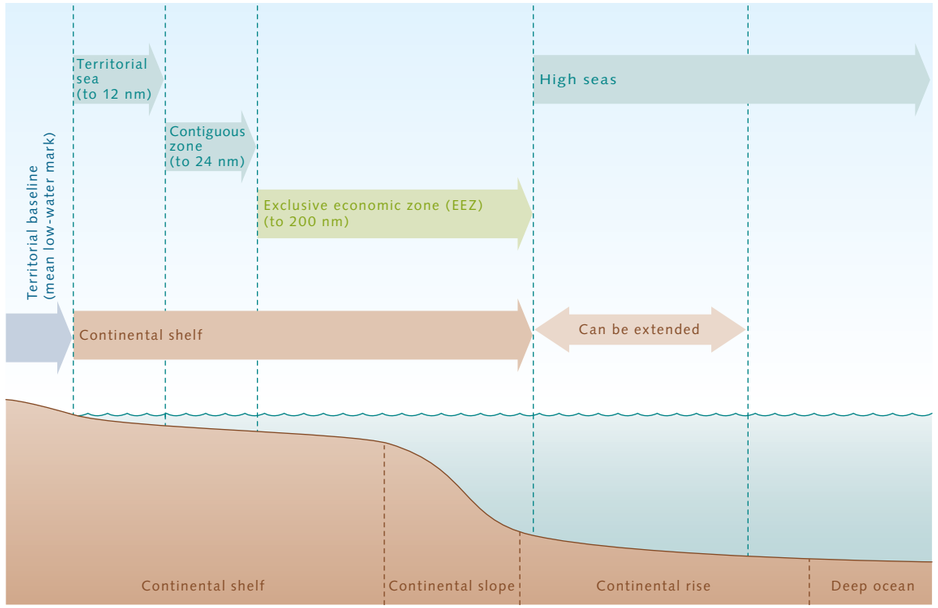
5.3 > Meeting of the Arctic Council in Rovaniemi, Finland, May 2019.

The issues on which the Arctic Council focuses are determined mainly by the programme of the member state that is chairing the Council. The chairmanship rotates among the eight Arctic states every two years. In May 2019 Finland handed the chairmanship of the forum over to Iceland, which has adopted "Together Towards a Sustainable Arctic" as the theme of its two-year term.

Some experts now consider that the basic principle of the Arctic Council, namely that it is a forum for discussing issues of common interest on the basis of scientific recommendations and agreeing uniform recommendations for action by all members states, is a success story. In January 2018 a group of political scientists and security experts even nominated the Arctic Council for the Nobel Peace Prize, arguing that in view of the international impact of the growing political tension between the superpowers, it is important to highlight the cooperation that the Arctic Council can achieve.

Defining boundaries in the Arctic

Despite the key position of the Arctic Council and its eight member states, there are areas of Arctic management and decision-making in which the five littoral states have a particular role. In particular, the United Nations Convention on the Law of the Sea (UNCLOS) gives them extensive sovereignty and jurisdiction over the coastal waters, the exclusive economic zones and large areas of the seabed on the Arctic continental shelf.



5.4 > The United Nations Convention on the Law of the Sea (UNCLOS) divides the sea into various legal zones, with the state's sovereignty decreasing with increasing distance from the coast. Adjacent to the internal waters is the territorial sea, also known as the 12-nautical-mile zone. In this region the sovereignty of the coastal state is already restricted, as ships of all states enjoy the right of innocent passage through it. In the exclusive economic zone (EEZ), which extends for up to 200 nautical miles from the coast, the coastal state has the exclusive right to explore and exploit living and non-living resources. This means that it is entitled to utilize any oil and gas fields, mineral resources and fish stocks found here. On the continental shelf, which is a natural prolongation of a country's land territory and may extend beyond the exclusive economic zone, the coastal state can explore and exploit the resources on the seabed. Beyond the exclusive economic zone is the maritime zone known as the high seas.

UNCLOS, which was concluded in 1982, is a comprehensive set of rules on the use and protection of the seas; for this reason it is sometimes called the "constitution of the seas". Of the five Arctic coastal states, only the USA has not yet ratified this convention. In May 2008, however, the US government signed the **Ilulissat Declaration**, thereby undertaking to settle all issues affecting the Arctic Ocean jointly and peacefully with the other Arctic coastal states on the basis of the law of the sea.

The UN Convention on the Law of the Sea sets out the definition of various maritime zones and the corresponding extent of certain sovereign rights of the coastal states. These zones are:

- internal waters and the territorial sea,
- the contiguous zone,
- the exclusive economic zone,
- the continental shelf and
- the high seas.

Internal waters and the territorial sea

Saline waters landward of the baseline or low-water mark are defined as internal waters. The territorial sea, by contrast, is on the seaward side of the baseline and extends for up to twelve nautical miles (one nautical mile is 1852 metres). States have complete sovereignty over their internal waters because – like the territorial sea – they form part of its territory. Nations also have wide-ranging sovereignty over their territorial sea; this includes rights to the airspace above, the water column, the seabed and the ground below the seabed. However, a coastal state may not prohibit the innocent passage of foreign ships through its territorial sea.

Passage is considered innocent if, while passing through the territorial sea, the ship in question does not use or threaten violence, does not spy on the coastal state and does not at any time pose a threat to the security of the coastal state in any other way. The UN Convention on the Law of the Sea defines potential threats in detail: for example, submarines must surface for the passage and hoist their flag. The Convention also prohibits unlawful discharges and other forms of marine pollution. The coastal state may designate shipping channels that must be used for passage and can levy charges if it provides services that enhance the safety of shipping. However, when designating shipping channels and traffic separation schemes, it must heed the recommendations of the International Maritime Organization (IMO).

Baseline
The baseline normally runs along the coastal low-water line and thus corresponds to the mean low-water line as marked on official charts.

Article 37 of the Convention on the Law of the Sea stipulates that the coastal state must grant foreign ships right of transit passage if the territorial sea is part of a strait or waterway that links parts of the high seas or different exclusive economic zones with each other and is used by international shipping. Coastal states have less scope for restricting the right of transit passage than for curbing innocent passage: in principle, transiting ships have the same freedom as on the high seas. Transit passage can be suspended or restricted only in the event of the threat or exercise of military force by the ship. Submarines can be submerged while passing through straits.

The question of whether foreign ships have a right to undisturbed transit passage is a regular source of dispute in the Arctic. This occurs, for example, in connection with the territorial waters of Canada's Arctic Archipelago, through which the Northwest Passage runs, and the waters off the Russian Arctic coast, where the Northeast Passage routes pass through. Ships wanting to traverse Russia's Arctic waters must comply with conditions laid down by the Russian government. The conditions that apply to foreign warships are particularly strict. For example, NATO military ships must notify their intention 45 days before the passage and must let a Russian pilot on board – something that, on account of security concerns, the US government categorically refuses to do. Washington argues that the law of the sea gives American warships the right to free, undisturbed (transit) passage. There is no sign of an end to this dispute.

The contiguous zone and exclusive economic zone

The contiguous zone adjoins the territorial sea, extending a maximum of 24 nautical miles beyond the low-water line. In this zone, coastal states may exercise certain powers of inspection and, for example, enforce customs regulations vis-à-vis third countries. Beyond the contiguous zone is the exclusive economic zone (EEZ), which can extend up to 200 nautical miles from the low-water line. This zone does not form part of the coastal state's sovereign territory. However, the coastal state has exclusive rights to fish in this area and to approve, erect and operate artificial islands and facilities such as oil drilling platforms and offshore wind farms. In this zone the coastal state has jurisdiction over marine conservation and marine research. This means that foreign states must obtain the consent of the coastal state if they wish to conduct scientific studies in the exclusive economic zone. However, a coastal state may not assert any territorial claims in its exclusive economic zone. Foreign nations have freedom of navigation in this area and may also lay submarine pipes and cables.

The Arctic states have defined the limits of the exclusive economic zones and have since the 1970s set out where they run in various bilateral and trilateral agreements. In only a few regions are these boundaries disputed. For example, Canada and the USA disagree about the precise course of their maritime boundaries in the Beaufort Sea.

The extended continental shelf

The United Nations Convention on the Law of the Sea sets out special rules on the continental shelf, which in large part lies below the exclusive economic zone. Like the exclusive economic zone, the continental shelf is an area of jurisdiction in which only the coastal state has the right to explore and exploit the natural resources. Under maritime law, any coastal state can declare the continental shelf in the exclusive economic zone of up to 200 nautical miles in width, even if in geological terms the shelf is narrower than this.

If the geological continental shelf extends beyond this 200-nautical-mile limit of the exclusive economic zone, the coastal state can under Article 76 of the Convention on the Law of the Sea extend the outer limit of the shelf. To do so it must make a submission to the Commission on the Limits of the Continental Shelf (CLCS), setting out the scientific data that show that the relevant part of the seabed and the ground beneath it constitute a natural extension of its land territory.

However, there are limits to this sort of extension: the new outer limit of the continental shelf must not be more than 350 nautical miles from the coastal state's baseline or more than 100 nautical miles from the 2500-metre isobath. A combination of the two methods is permitted.

The delimitation of boundaries in the Arctic is complicated by the fact that three underwater ridges – the Lomonosov Ridge, the Gakkel Ridge and the Alpha-Mendeleev Ridge – run along the floor of the Arctic Ocean and necessitate a special ruling in the Convention on the Law of the Sea. Article 76 of the Convention distinguishes between submarine ridges and submarine elevations.

Depending on whether a ridge or an elevation is joined to a coastal state's continental shelf, differing rules apply. If parts of the continental shelf run over a submarine ridge, only the 350-nautical-mile rule can be applied; the rule on the 2500-metre isobath cannot be invoked. However, if the continental shelf extends over a submarine elevation, both rules apply, since it can be assumed that the submarine elevation consists of the same material as the continental shelf. Submarine ridges, by contrast, usually consist of volcanic rock and are therefore of a material different from the continental shelf.

These complex rules in the Convention on the Law of the Sea make the work of the UN Commission on the Limits of the Continental Shelf more difficult. The Commission considers all submitted applications and makes a recommendation. If the coastal state adjusts the outer limit of its expanded economic zone in accordance with the recommendation, this outer limit is final and binding. What is not clear is what happens if a coastal state opposes the Commission's recommendation and sets an outer limit that is not in accordance with the recommendation. The

5.5 > A territorial bone of contention in the Arctic: both Denmark and Canada lay claim to Hans Island (in the middle of the picture). The island, 1.3 square kilometres in size, lies in the Kennedy Channel of the Nares Strait that separates Canada's Ellesmere Island from the north coast of Greenland.

5.6 > In the central Arctic there are overlapping claims from Arctic coastal states to areas of the seabed outside their 200-nautical-mile zones. There are just two small regions to which no country lays claim because they lie too far from the coasts for a claim to be made.

Commission is not a body with judicial powers: its purpose is only to ensure that the delimitation of boundaries complies with scientific standards.

The prospect of extending the continental shelf and with it the exclusive right to mineral deposits in the seabed has resulted in all the Arctic coastal states that are parties to the Convention on the Law of the Sea applying for extensions. Norway was granted an extension of parts of its continental shelf in 2009. Russia, Denmark and Canada have spent many years attempting to prove – on the basis of seismological studies – that the Lomonosov Ridge and the Alpha-Mendeleev Ridge are submarine elevations and hence natural geological continuations of their continental shelves. On 23 May 2019 Canada submitted to the UN Commission a 2100-page application in which it lays claim to an area of the sea covering 1.2 million square kilometres and including the geographical North Pole. Russia and Denmark had previously submitted similar-sounding claims in their applications. As yet, however, the Commission has not issued recommendations on any of the applications, because it takes several years to consider them and reach a decision.

Moreover, the Commission is not responsible for situations in which two coastal states with opposing or adjacent coastlines argue over the precise boundary of their continental shelves or over overlapping areas to which they lay claim. In such cases the Convention on the Law of the Sea requires the countries involved to conclude one or more boundary agreements. In other words, the states need to sort out these disputes among themselves. If this were to fail, the dispute could be settled by an international court such as the International Court of Justice or the International Tribunal for the Law of the Sea – provided that the countries involved recognize its legal authority.

In the past, the willingness of the Arctic coastal states to negotiate and compromise has enabled boundary disputes and border conflicts to be resolved. Thus in September 2010 Norway and Russia signed an agreement that put an end to four decades of argument over the boundary of their adjacent economic zones and continental shelves in the Barents Sea, which is rich in minerals and resources. The boundary that has been agreed upon gives equal weight to the claims of both countries. The two parties also agreed that any new, previously undiscovered resource deposits that straddle the boundary would be exploited jointly.

The high seas

The high seas commence at the outer limit of the exclusive economic zone. Here all states have the freedom of the high seas: ships have free passage and aircraft have the right to overfly. In addition, anyone can fish or conduct research in these areas. However, all activities must be peaceful in nature. By contrast, the seabed beyond the coastal states' continental shelf and all the resources it contains are part of the common heritage of mankind to which no state and no natural or judicial person can claim sovereign rights. This area and its resources are managed by the International Seabed Authority (ISA). In the Arctic, however, this status applies only to two small regions in the central Arctic Ocean; all other marine areas are claimed by one or more coastal states.

In addition, Svalbard plays a special role in Arctic agreements. The sovereignty of this archipelago east of Greenland is regulated in the Spitsbergen Treaty of 1920. While Svalbard is formally under the governance of Norway, all parties to the Spitsbergen Treaty have the same rights as the Norwegians to make peaceful use of the archipelago's resources and to work, trade and engage in shipping there. In addition, citizens of all treaty signatory countries enjoy free access to the archipelago. To date, 46 countries have signed the treaty. However, the situation with regard to the marine areas around Svalbard is unresolved. On the one hand, the exclusive economic zone around the archipelago is indisputably under the jurisdiction of Norway. On the other hand, there is as yet no answer to the question of whether the Spitsbergen Treaty, with its agreed principle of equal resource rights for all signatory states, also applies to this marine area. The question is an important one, especially with regard to the future use of the predicted oil and gas reserves in the northern Barents Sea. Oil companies do not yet have access to this region, but there is considerable long-term

interest in opening up the area for oil and gas exploration, which means that there is potential for conflict.

The club of the Antarctic nations

Unlike the Arctic region, the continent of Antarctica is a long way from the coasts and borders of any nation states. This is often used as a reason to portray the southern continent and the surrounding ocean areas as detached from international politics and commercial activities. Upon closer consideration, however, it quickly becomes clear that the southern polar region is indeed a political arena whose complex history must always be viewed against the backdrop of international politics – then as now.

The legal framework of Antarctica as a political arena is set out in the Antarctic Treaty System (ATS). This consists of the Antarctic Treaty itself, augmented by the Protocol on Environmental Protection to the Antarctic Treaty, and by two conventions dealing with the conservation of Antarctic seals and the conservation of Antarctic marine living resources. Negotiation of the Antarctic Treaty was prompted by the USA; the document was signed by twelve nations on 1 December 1959 and entered into force roughly 18 months later, on 23 June 1961. The twelve original signatories were Argentina, Australia, Belgium, Chile, France, Japan, New Zealand, Norway, the Union of South Africa, the United Kingdom, the United States and the USSR.

Conclusion of the treaty represented a historical breakthrough on two fronts. Firstly, in the middle of the Cold War that succeeded the Second World War, the Antarctic Treaty was the first international agreement to bring the divided and highly militarized eastern and western powers together around the negotiating table, where they agreed on joint use of the area south of 60° South for peaceful purposes and research. Both sides had previously threatened to station rockets and military personnel in Antarctica.

Secondly, to enable the treaty to come about, the United Kingdom, Norway, Australia, France, New Zealand, Chile and Argentina suspended their earlier territorial claims to Antarctica. The signing of the treaty therefore ended the smouldering territorial conflict in Antarctica and paved the way for peaceful cooperation among nations with very different interests. In addition, the Antarctic Treaty runs indefinitely. While some of the subsequent agreements can be renegotiated after a certain time, the Antarctic Treaty never expires. The signatory states undertake to protect Antarctica and ensure its peaceful use for ever.

The idea of joint management of Antarctica as a research continent isolated from the rest of world politics worked for decades. Since the treaty was signed, the region has been peaceful. Fifty-four nations have now joined the Antarctic Treaty System and have committed themselves to peaceful use of the southern polar region. The states that actively conduct research in the Antarctic are known as Consultative Nations; they each pursue their own national research programmes but they also cooperate on many levels. They share their findings, plan joint expeditions, collaborate on the very complex logistics involved in operating research stations on the southern continent and provide assistance in emergencies – regardless of any conflicts that may be keeping the states at loggerheads with each other elsewhere in the world.

However, the success of international cooperation in Antarctic research obscures the fact that the territorial conflicts of the past are still smouldering today. None of the seven nations with territorial claims have abandoned these claims since the treaty was signed. On the contrary: Norway and Australia, for example, have submitted applications to the Commission on the Limits of the Continental Shelf, requesting the relevant Antarctic territories to be assigned to them. It has been agreed that these applications will not be considered by the UN Commission until the Antarctic Treaty is one day terminated, but the mere fact that the applications have been made illustrates the seriousness with which the parties involved continue to pursue their national interests in the region south of 60° South.

The territorial claims also hinder international cooperation in the Antarctic, for example in connection with the negotiations on designating marine protected areas in the Southern Ocean. States with territorial claims have been involved in all the designated protected areas and proposals for protected areas to date; observers see this as an attempt to consolidate these claims. An exception is the proposal for a protected zone in the Weddell Sea put forward by Germany and the European Union. However, this proposal was opposed by Norway, which wants to pursue additional research in some of the potential protected areas east of the prime meridian (in the part of the Antarctic claimed by Norway) and draw up separate protection measures on the basis of this. Meanwhile Australian politicians are regarding with suspicion the fact that China has now established three of its four Antarctic research stations in the part of the eastern Antarctic that Australia is laying claim to.

Who invests has a say

The parties to the Antarctic Treaty System meet once a year to share information and discuss issues of common interest. These Antarctic Treaty Consultative Meetings (ATCMs) are attended by:

- representatives of the Consultative Nations, of which there are currently 29. These are countries that have signed the Antarctic Treaty and are actively pursuing substantial research in the Antarctic;
- representatives of the 25 non-consultative nations. These countries have joined the Antarctic Treaty System but generally do not pursue their own active research in the southern polar region;
- observer organizations such as the Scientific Committee on Antarctic Research (SCAR) and the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR);
- invited experts from the Antarctic and Southern Ocean Coalition (ASOC; a global alliance of environmental protection organizations) and the International Association of Antarctica Tour Operators (IAATO).

Decisions at ATCM meetings must be unanimous. Only the 29 Consultative Nations are entitled to vote: all the other

Rights from the age of whaling and exploration

The first territorial claims in the Antarctic were made in 1904, at a time when whalers were discovering the Southern Ocean as a hunting ground and the whaling nations were starting to compete for the best whaling sites.

That was the year in which the Norwegian whaler and captain Carl Anton Larsen hoisted the British flag on the newly built whaling station of Grytviken on South Georgia, the building having been partly financed with British capital. Until then the island had been regarded more or less as no man's land.

Shortly afterwards Britain officially staked a claim to South Georgia, and in 1908 the United Kingdom declared the entire Antarctic peninsula between the 20th and 80th meridians west of Greenwich to be British territory – and that was just the beginning.

In 1923, more than 80 years after the discovery of the Ross Sea by the Englishman James Clark Ross on 5 January 1841, the United Kingdom used his achievements and those of other British explorers as a basis for further claims.

Great Britain first annexed the sector of the Ross Sea between longitudes 160° East and 150° West, making it a dependency of its colony New Zealand. Three years later it laid claim to a further 40 per cent of the Antarctic continent (45° East to 160° East), this time in the eastern Antarctic. In 1933 this sector – with the exception of a small segment (136° East to 142° East) that France had already claimed as its property – was handed over to Australia, a former British colony.

Norway, which was then the biggest whaling nation, observed Britain's expansionist activities with great concern. The Norwegians feared that their ships would be prohibited from whaling off the coast of the annexed areas.

To prevent such a ban, they organized expeditions of their own in the Southern Ocean, giving the ships' crews clear instructions to annex any new land that was discovered. Two islands were initially annexed in this way. By 1939 Norwegian explorers had explored and annexed the entire Antarctic sector between 16° 30' West and 45° East, including the coastal waters, the interior of the territory and the geographic South Pole. This region, which is now called Queen Maud Land, covers an area of almost three million square kilometres.

Following Norway's example, the countries at the most southerly tip of the American continent – Chile (1940) and Argentina (1942) – then laid claim to Antarctic territory. The designated territories not only overlap but also include areas claimed by Britain, but all these territorial conflicts are suspended until the Antarctic Treaty is terminated.

parties present may participate in the preceding discussions but cannot vote. Because of this, critics accuse the Antarctic Treaty System of a lack of openness, fairness and transparency and call for reform. However, the Consultative Nations are assertive. In their view, countries should not be entitled to influence affairs in Antarctica unless they actively conduct research and contribute financially to the logistics and infrastructure that this requires. This is why international organizations such as the European Union and the United Nations are not represented at the meetings of the Antarctic Treaty states. Among the reasons put forward for their exclusion is the argument that these alliances would represent the interests of countries that have not yet joined the Antarctic Treaty System.

5.7 > At the start of each year the position of the geographic South Pole is recalculated and marked with a post and the flags of the twelve original signatories of the Antarctic Treaty. This has to be repeated annually because the ice moves by about ten metres a year.

International agreements on the protection of the Antarctic

The second pillar of the Antarctic Treaty System is formed by several international agreements on environmental protection in Antarctica, the provisions of which are legally binding on all member states. However, each member state implements these agreements through its own national legislation. The agreements include:

Agreed Measures for the Conservation of Antarctic Fauna and Flora

This first common set of measures to protect the Antarctic environment was agreed in Brussels in 1964 with the aim of strengthening international research and cooperation in connection with the conservation of Antarctic flora and fauna. It also established a system of special protected areas within the Antarctic. However, at the ATCM meeting in 2011 the Consultative Nations agreed that the measures would be replaced by the Environmental Protocol.

The Convention for the Conservation of Antarctic Seals (CCAS)

The Convention for the Conservation of Antarctic Seals was signed in 1972 in order to regulate the commercial slaughter of seals that was still taking place in Antarctica. The Convention entered into force in 1978 but it makes few demands on the signatories because seal hunting in the Antarctic has now ceased. All activities recorded under the CCAS are collated by the United Kingdom – the depository state of the CCAS – and reported at the annual ATCM meetings.

The Convention on the Conservation of Antarctic Marine Living Resources (CAMLR Convention)

The CAMLR Convention was adopted in 1980, after the then Soviet Union had severely overfished the marbled rockcod *(Notothenia rossii)* in just two fishing seasons and commercial interest in Antarctic krill had boomed. The Convention entered into force two years later and was the first marine convention to adopt an ecosystem approach to the conservation and management of marine living resources. This means that possible fishing plans and quotas are always evaluated in terms of the impact of this removal of fish and other marine resources on the related ecosystems.

The Convention covers all the marine organisms, including seabirds, living in the convention area; its aim is to conserve the marine ecosystems of the Antarctic. Fishing is not banned, but it must be sustainable. Implementation of the convention is coordinated and monitored by the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR), which is based in Hobart, Australia. Acting on the recommendations of a scientific committee, the Commission sets fishing quotas, places species under protection if necessary and is responsible for designating marine protected areas in the Southern Ocean. The Commission currently has 25 members, including the European Union. Commission decisions must be unanimous. The area to which the Convention applies is delimited by the **Antarctic Convergence,** which means that in some areas it extends to 50° South. The convention area represents around ten per cent of the Earth's oceans.

The Protocol on Environmental Protection to the Antarctic Treaty

The Environmental Protocol was concluded on 4 October 1991 in Madrid, Spain, and so is also known as the Madrid Protocol. According to the German Environment Agency, it is the strictest and most comprehensive set of rules for a region of the Earth ever enshrined in an international agreement. Since it entered into force in 1998 the Protocol has prohibited the mining of mineral resources in the Antarctic. The signatories are obligated to preserve the Antarctic as a nature reserve devoted only to peace and science (Article 2 of the Protocol).

Within the territory of the Antarctic Treaty, the Protocol regulates all activities that could have adverse impacts on the environment and dependent and associated ecosystems. It also sets out for all parties to the Protocol the procedures and rules governing the awarding of consent for an activity in the Antarctic. The regulations in the five annexes to the Protocol deal with the conducting of environmental impact assessments, the protection of Antarctic flora and fauna, the disposal and treatment of waste, the prevention of marine pollution (for example from the discharge of oil, harmful substances or sewage, or the disposal of waste), and the special protection and management of selected areas.

The Environmental Protocol can be renegotiated after 50 years – that is, in or after 2048. However, it does not expire automatically after 50 years but remains in force unless the contracting states agree to modify it. The prospect of the Environmental Protocol being renegotiated in 2048 is a matter of concern to environmental organizations. They fear that new negotiations might lift the mora-

torium on the mining of mineral resources in Antarctic waters. The exploration of Antarctic mineral deposits was already considered in the 1980s. In June 1988, after negotiations that continued for six years, 19 countries concluded a set of rules on the mining of mineral resources. However, the agreement – which was entitled the Convention on the Regulation of Antarctic Mineral Resource Activities (CRAMRA) – was rejected by some states. The Convention did not enter into force as planned in December 1988. This was largely because of opposition from France and New Zealand: both countries were of the view that the environmental provisions in the text as it then stood did not go far enough.

Negotiations on a comprehensive environmental protection agreement for Antarctica then commenced. The Environmental Protocol that is currently in force was drawn up in just four years. The discussions, occurring as they did shortly after the end of the Cold War, took place in an era of détente during which many participants displayed a new willingness to compromise on environmental issues.

At this time the countries represented in the United Nations negotiated and concluded not only the sustainable development action plan Agenda 21 but also the Convention on Biological Diversity (CBD), the United Nations Framework Convention on Climate Change (UNFCCC) and the United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa (UNCCD).

In negotiating the Environmental Protocol, the members of the Antarctic Treaty System agreed that their activities in Antarctica would be geared towards protecting the environment and that they would for the time being completely abandon the idea of exploiting resources there. This was a remarkable change, as present-day observers still note.

New players, new views

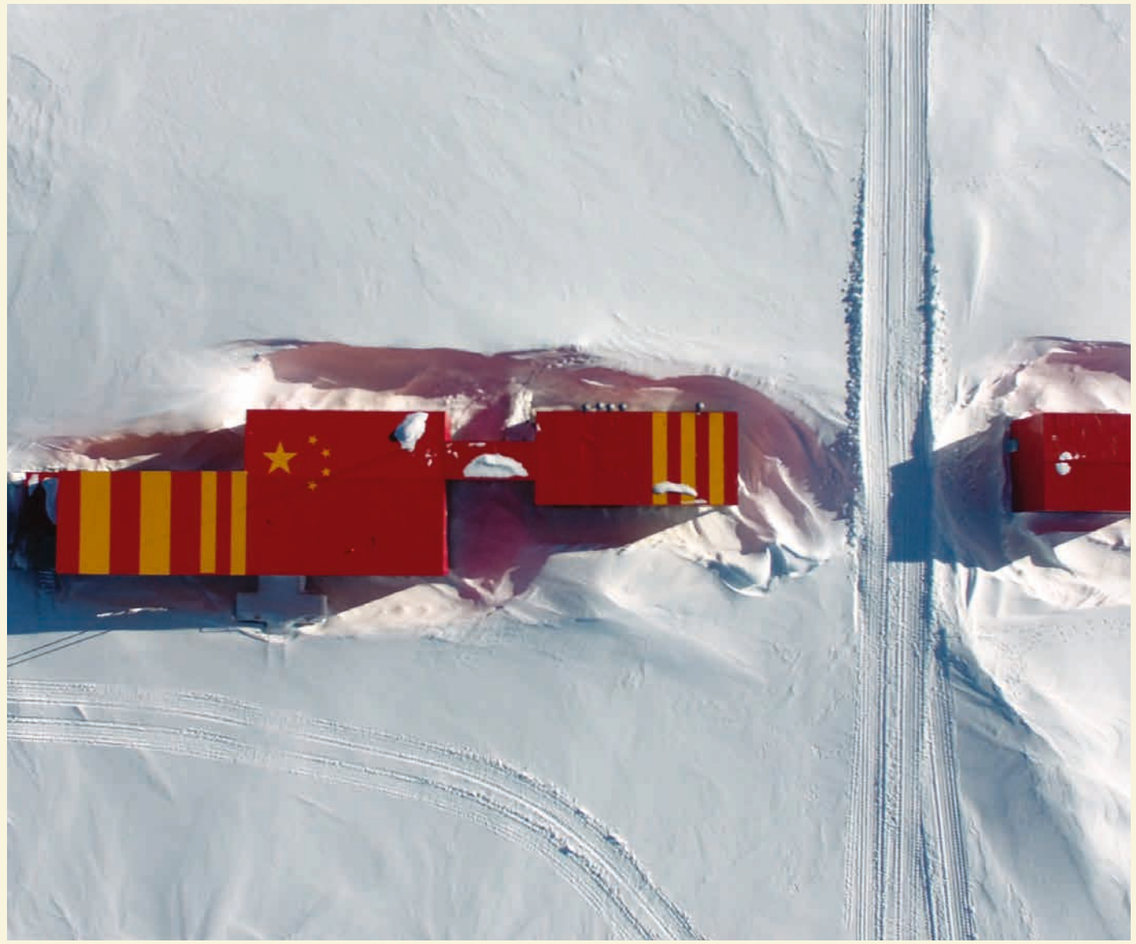
The era of détente is now past. Since the Environmental Protocol entered into force in 1998 there have been major changes not only in the extent of human activities in the Antarctic but also in the geopolitical world order. The superpowers are once again competing for power and influence. The economies of former developing and newly-industrializing countries such as China, India and South Korea are now sufficiently strong for these states to express their growing political and economic interests by boosting their research presence in the Antarctic. These countries are also increasing their involvement in important scientific and technical bodies such as the Scientific Committee on Antarctic Research (SCAR) and the Council of Managers of National Antarctic Programs (COMNAP). COMNAP is the international association which brings together all the national associations and institutes that pursue research in the Antarctic. It coordinates transport logistics and research projects and participates in the meetings of the Consultative Nations as an advisor.

Some of the original signatories of the Antarctic Treaty see this development as posing a geopolitical risk and suspect the emerging countries of acting primarily on the basis of strategic and commercial interests. However, all the western states, too, have in the past expressed interest in the Antarctic's resources and minerals. Political scientists therefore warn against stigmatizing the new arrivals on the scene, which could in the long term jeopardize peaceful cooperation in the Antarctic.

Instead, critics propose that the requirement for unanimity at important meetings such as those of the ATCM and CCAMLR be abolished and replaced by the principle of a democratic majority. This would have the advantage of enabling voting to take place on controversial issues (such as the designation of marine protected areas under CCAMLR) that have in the past been blocked by the veto of a small number of member states. However, an argument against this proposal is the fact that the decisions would have to be implemented in national law by member states. Countries that had voted against a measure would not be bound by the decision taken and would presumably have no interest in enshrining the corresponding requirements in their national legislation. There would thus be a risk that key players would not abide by the decisions.

5.8 > The Antarctic Treaty officially entered into force on 23 June 1961. Shortly afterwards, from 10 to 24 July 1961, representatives of the twelve original signatory states met in Canberra, Australia, for the first official meeting of the members of the Antarctic Treaty. These meetings are still held annually, although there are now significantly more members.

China’s growing interest in the polar regions



5.9 > Kunlun is a Chinese research station located about 1200 kilometres inland in East Antarctica and at an elevation of 4087 metres above sea level. It is occupied only during the Antarctic summer, when scientists take ice cores and record atmospheric and geophysical measurements.

January 2018 saw the publication of a strategy paper that had been long awaited by the countries most involved in Arctic and Antarctic affairs: China, the second-largest economic power in the world, was for the first time publishing an official Arctic strategy in which it sets out its aims and interests in the northern polar region. As a non-coastal state, China has no legal rights in the Arctic but must instead depend on bilateral cooperation with Arctic coastal states. It was not until 2011 that China started attending the meetings of the Arctic Council as an observer nation.

Nevertheless, China’s role in both the Arctic and the Antarctic has changed dramatically in the past ten years. The country sees itself as an emerging superpower with economic and strategic interests that extend far beyond the Asian-Pacific area. It wants to pursue these interests and play a part on the world stage. The polar regions are a key aspect of this.

In the Arctic, China is interested primarily in newly emerging shipping routes and the region’s rich resource deposits. China and Russia are negotiating the development of a polar Silk Road involving a number of different transport and communication routes that would give China access to the Arctic. Shipping routes are key to this and the focus is on the Northeast Passage routes through Russian waters. For ships travelling from the port of Rotterdam in the Netherlands to Dalian in China, this northern route is ten days shorter than the traditional southern route via the Suez Canal. Moreover, use of the Northeast Passage would enable oil and gas supplies to be shipped from virtually any Arctic port to China in ten to 14 days.

At present, most of the resources that China so urgently needs come from Russia: China has entered into long-term supply contracts worth hundreds of billions of US dollars with Russian oil companies. The Chinese oil giant CNPC and China’s Silk Road Fund also have stakes in Russia’s liquefied natural gas project Yamal LNG. The project is based in the north-east of the Yamal Peninsula in Siberia, where natural gas is extracted and then liquefied to enable it to be more easily shipped. The Chinese government is also strengthening relationships with other Arctic states. It concluded a free trade agreement with Iceland in 2014 and is currently negotiating with Norway. With Finland it is discussing the laying of a submarine telecommunications cable, and on Greenland it is interested in deposits of valuable metals and rare earths.

Furthermore, in April 2019 China and Russia signed a cooperative agreement that provides for the construction of a joint research centre in the Arctic. This will be the third Chinese research base in the Arctic. China has operated a station in the research village of Ny-Ålesund on the island of Spitsbergen since 2004. In October 2018 China and Iceland opened a jointly operated Arctic observatory in northern Iceland. And since 2003 China has regularly despatched its research icebreaker *Xue Long* (“Snow Dragon”) on scientific expeditions to the Arctic. A second polar research ship, *Xue Long 2*, was launched in September 2018 and is due to enter service before the end of 2019. China is thus actively involved in expanding its research infrastructure in the Arctic. However, it also stresses in its strategy paper that it wants to advance technical innovation in connection with resource mining, the use of renewable energies and environmental monitoring in the Arctic. China has also increased its involvement in the Arctic Council’s working groups. Independent experts consider these political and economic ambitions to be legitimate. Provided that China abides by all the international norms and regulations, its investment in the Arctic should be viewed as an opportunity and not as a threat.

In Antarctica, China has in recent years spent more money on the expansion of its research infrastructure than any other nation. The country, which signed the Antarctic Treaty in 1983 and has been a Consultative Nation since 1985, now has four research stations – one on the Antarctic Peninsula and three in the eastern Antarctic. A fifth station is currently being built on Inexpressible Island in the Ross Sea; it is expected to open in 2022 and will then be operated year-round.

In May 2017 China organized an ATCM meeting for the first time. It presented its first strategy paper on research in Antarctica on the same occasion. The government used the opportunity to emphasize the importance of partnership and its respect for the laws and standards of the Antarctic. Nevertheless, the country wants to be seen as a strong Antarctic nation. And if the Antarctic Treaty should one day lapse, China would be on hand – with at least five Antarctic bases and clearly articulated claims.

China is interested not only in mineral deposits but also in the marine living resources of the Antarctic. It became a member of the Convention on the Conservation of Antarctic Marine Living Resources (CAMLR) in 2006. The Chinese representatives are now vocal at the annual meetings of the associated commission, CCAMLR. They and the Russian representatives view the creation of marine protected areas as a threat to the future use of krill, the Antarctic toothfish and other living resources of the Southern Ocean. To preserve these economic interests, China accepted the Ross Sea as a marine protected area but then blocked all other CCAMLR proposals for protected areas.

An economic boom with side effects

> The polar regions have always been rich in raw materials and natural resources, and have always exerted a great fascination. In the past it has been difficult to make profit from them because ice and cold has hindered access. Due to the dramatic changes in climate, however, the gates are now opening for gold miners, investors and tourists, especially in the Arctic region. While the Arctic countries view this development as an opportunity, scientists and environmentalists are warning of grave consequences.

The great hunt

The first profitable ventures in the polar regions were those of seal hunters and whalers. Whales have been caught on a commercial scale in Arctic waters since the 17th century. For example, whaling began on Spitsbergen in the year 1612, only 16 years after the discovery of the Svalbard Archipelago by the Dutch seaman and explorer Willem Barents (1550–1597). In the early years, the hunters mainly stalked Greenland whales and the North Atlantic right whale. These species both have a thick fat layer and swim so slowly that the whalers could pursue them in rowboats and kill them with hand-held harpoons. Unlike humpback or blue whales, Greenland whales and North Atlantic right whales do not sink to the seabed after dying. Instead, their bodies float on the surface, making it easy for the whalers to retrieve their prey.

The blubber of the slain animals was boiled down and used in Europe as lamp oil and in the production of soaps. Corsets and parasols were made from the flexible whale baleen. At the end of the 17th century, the prospect of "liquid gold", as whale oil was then called, attracted 200 to 300 whaling ships to the waters east of Greenland from all the seafaring nations of Europe. It has been estimated that the Dutch whalers alone caught around 73,000 whales in the Arctic region between 1661 and 1823. It is therefore not surprising that the Arctic whale stocks were heavily depleted by the end of the 18th century.

At this time, the first reports of large seal populations in the South Atlantic were beginning to circulate. The ships set a southerly course and began to slaughter seals on South Georgia half a century before the discovery of the Antarctic continent. They started by hunting the Antarctic fur seal *(Arctocephalus gazella)*. There was a lot of money to be made from their valuable furs in North America, Asia and Europe. Soon afterward the elephant seals were added as prey. They were slain for their thick, oil-rich layer of fat.

During the next ten years, expanding from South Georgia, the seal hunters discovered new hunting grounds on the South Atlantic island groups, from the region of the Scotia Arc to as far as the South Shetland Islands near the tip of the Antarctic Peninsula. At the same time, in the southern Indian Ocean, the ships advanced to the Kerguelen and McDonald Islands, where they mainly hunted the Subantarctic fur seal *(Arctocephalus tropicalis)*. After 20 more years of radical hunting the most important hunting grounds for southern fur seals were practically depleted.

Nevertheless, the hunt for these animals did not cease until around 1900. Only a few hundred to a thousand of these two species survived in some inaccessible island bays. The hunt for elephant seals had already slackened 30 years earlier because the demand for seal oil had fallen with the introduction of petroleum as a preferred lamp oil.

Unlike the fur seals and elephant seals, the four seal species living in the pack ice of the Southern Ocean (crabeater seal, Weddell seal, Ross seal, and leopard seal) have rarely been hunted and thus have been spared commercial exploitation. The exact opposite has occurred with the large whales of the Antarctic seas. Their slaughter gained pace in 1904 when the first land-based station for whale corpse processing was constructed in South Georgia. The use of steam engines, and the invention and refinement of the harpoon gun by the Norwegian Svend Foyn (1809–1894) between 1864 and 1870, made it possible to kill and retrieve the faster rorquals such as the fin whale *(Balaenoptera physalus)*, the blue whale *(Balaenoptera musculus)*, the sei whale *(Balaenoptera borealis)* and the minke whale *(Balaenoptera acutorostrata)*, as well as humpback whales *(Megaptera novaeangliae)*. In addition, in 1925 the first shipboard cookers and stern slipways were employed. With the introduction of these factory ships it was no longer necessary to bring the whale corpses to land stations for processing.

Equipped with this technology, the whalers killed significantly more animals in less than 80 years of hunting in the Southern Ocean than were slain in 300 years of whaling in the Arctic Ocean. In the southern summer of 1930/1931 alone, whalers in the Antarctic seas killed and processed 14,923 blue whales, 28,009 fin whales, and 2079 humpback whales. The idea of protecting whales first began to slowly take hold only after the end of the Second World War. In December 1946, the International Convention for the Regulation of Whaling was signed and the International Whaling Commission was created.

However, it failed in its mission to effectively reduce whaling activity. Although the catch of blue whales declined due to a population collapse, whalers in the Antarctic waters began to hunt more fin whales and sei whales and, beginning in 1973, the much smaller minke whales.

Whaling for commercial purposes was not banned until 1982, when a moratorium was adopted for the protection of large whales in response to strong public pressure. It went into effect in 1986, but is being circumvented by countries such as Norway, Iceland, Japan and South Korea. Some indigenous peoples in Greenland, on the Siberian Chukchi Peninsula, in Alaska and the US state of Washington, as well as on the Caribbean islands of St. Vincent and the Grenadines, are permitted to kill a certain number of whales in consideration of their livelihood and culture.

Resource extraction in the polar regions

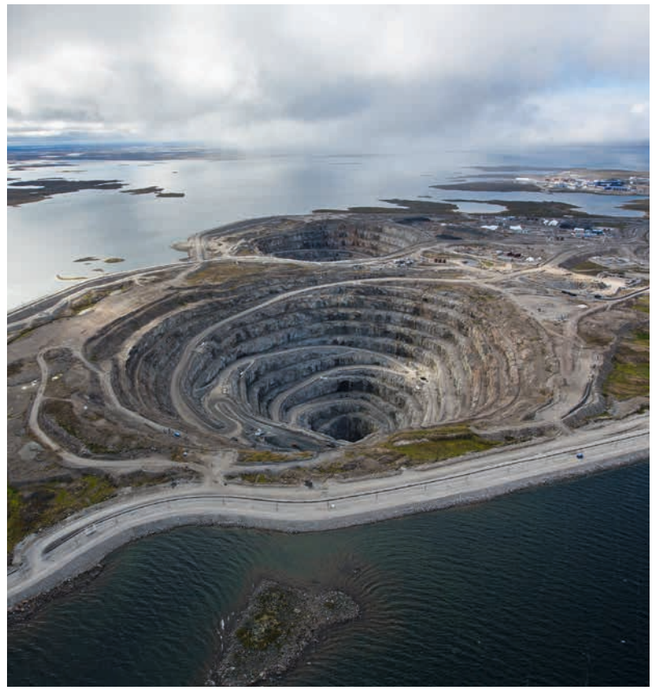
The more accessible the polar regions become for people, the more frequently questions arise about the deposits of raw materials there and how they can be used. Around the world the demand for oil and gas, metals and rare-earth elements is increasing, and with it the price and the willingness to invest more money in exploring for them, especially in the Arctic region.

However, resource extraction from areas that are poorly developed and difficult to access involves many incalculable factors that drive up costs and thus the investment risk, and which in the past have already led to the abandonment of extractive activities and plans. In 2015, for example, Shell Oil Company terminated its exploration activities in the Chukchi Sea because costs and benefits were disproportionate, and the company's reputation had suffered as a result of the project.

Incalculable factors relating to resource extraction in the Arctic include:

- Lack of infrastructure in the Arctic results in long development times: Up to 17 years can elapse between the discovery of a deposit and the start of production. And even then, the remoteness of mines or production platforms will continue to pose problems for companies. For example, Chinese mining companies investing in Greenland complained that they could only bring their employees to the site by helicopter, which increased operating costs enormously.
- Difficult climatic and weather-related conditions: Extreme temperatures, strong winds, mobile sea ice and the instable Arctic permafrost grounds are difficult to predict and require the use of special and expensive technology. Mines, streets, railways and buildings have to be protected against the thawing ground. Offshore facilities such as oil platforms and tankers must endure the constantly changing ice conditions.
- Long and sometimes difficult transport routes: The production sites are very far away from the consumers.
- High personnel costs for specialists willing to work in the inhospitable and remote areas.

- Shifts in the world market and fluctuating raw-material prices: The extraction of raw materials in difficult areas such as the Arctic is only profitable if there are correspondingly large markets and a sufficiently high price for the materials.
- Geopolitical developments: Raw-material exploration in the Arctic requires technology and expertise that a state alone cannot usually provide. Russia, for example, had to postpone some of its planned exploration projects when a number of countries imposed economic sanctions following its occupation of the Crimea.
- Environmental damage: Polar ecosystems react extremely sensitively even to minor fluctuations, and they regenerate very slowly after accidents. Because of the ice cover and the extremely low temperatures, at which oil residues break down much more slowly than in warmer regions, many experts consider the environmental risks to be inestimable.
- Public pressure: Complaints or campaigns by environmental organizations and the local populations can delay or even prevent the approval processes for exploration operations in the Arctic region. For instance, in April 2019 the Norwegian parliament withdrew approval of a planned oil and gas drilling project in the waters around Lofoten. The decision followed global campaigns by environmental organizations such as SeaLegacy, which warned of the consequences of resource extraction for the environment, fisheries and tourism.



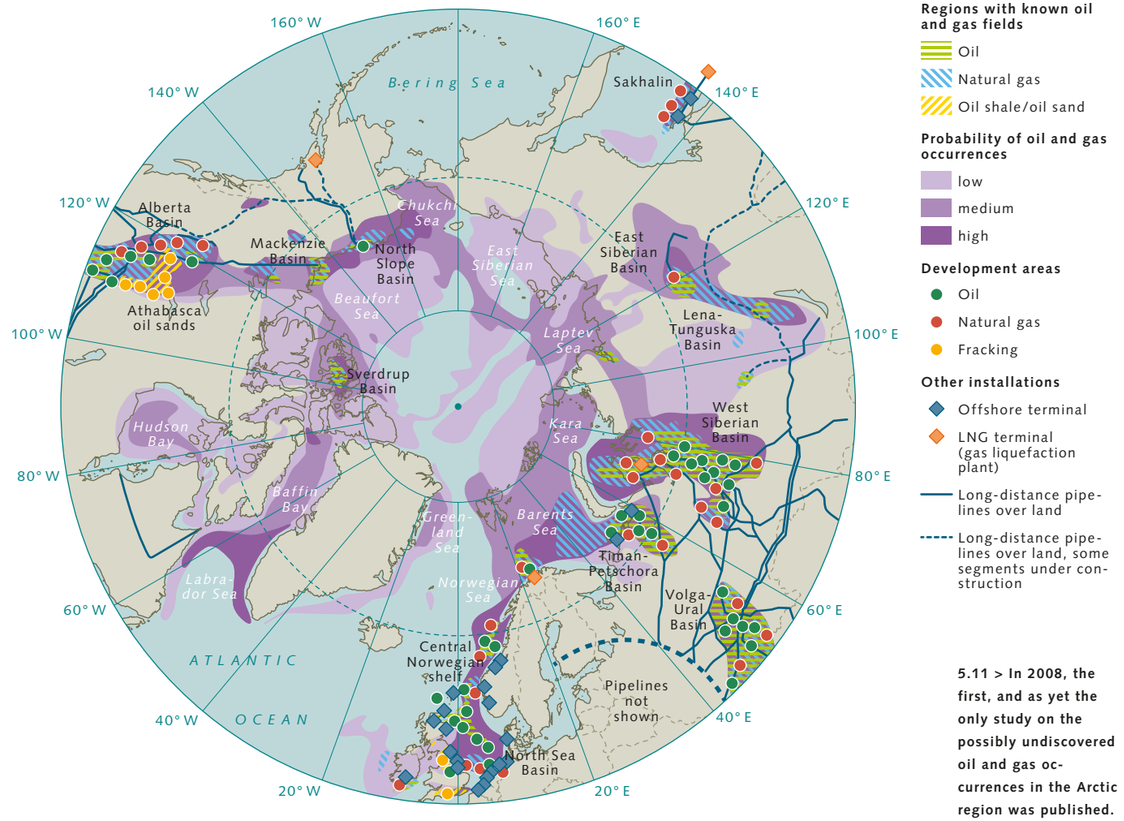
5.10 > In the Diavik diamond mine, located in the subarctic part of the Canadian Northwest Territories, high-quality diamonds for jewellery making have been mined since 2003. Since 2012 the mining has taken place entirely underground.

Geological conditions

Experts distinguish between mineral raw materials and hydrocarbon deposits, or energy resources. The former category includes metals and minerals such as iron ore, uranium, gold, diamonds and many others. The latter refers to natural gas and oil. The distribution of these raw-material deposits in a region depends primarily on the plate-tectonic history of the area. The three large and geologically very old Canadian, Baltic and Siberian continental shields, for example, are situated in the vicinity of the Arctic Ocean. These are composed primarily of crystalline rocks, but also contain some sediment series, and their ages range from one to 2.5 billion years. The prevailing geological conditions were conducive to the formation of mineral raw materials such as gold, copper, iron ore, molybdenum, lead, zinc, platinum, nickel, diamonds and rare-earth elements.

Oil and gas deposits, on the other hand, are more likely to be found in Arctic areas where rivers and seas once deposited sediments over millions of years, producing sediment layers several kilometres thick. This has taken place over the past 350 million years, primarily in the shelf regions. In some areas, the shelf layers contained abundant organic material, which is a necessary condition for the formation and concentration of oil and gas.

In contrast to the shallow, broad shelf seas of the Arctic region, the typically narrow shelf regions of Antarctica are only marginally suited for offshore oil and gas exploration. The weight of the ice cap forces the Antarctic continent downward, so that the sea floor of the continental shelf in large part lies at a depth of more than 500 metres. If production were allowed, oil companies would have to invest a great deal of time and effort in drilling for oil and gas there.



5.11 > In 2008, the first, and as yet the only study on the possibly undiscovered oil and gas occurrences in the Arctic region was published. It suggested that the largest deposits are located in the West Siberian Basin, in the Timan-Petschora Basin, in the North Slope Basin of Alaska, and in the central Norwegian shelf.

Energy resources in the Arctic

Oil and gas have been produced in the Arctic region for decades. Since the beginning of the search for these two resources in the mid-1930s, over 450 significant oil and gas deposits have been discovered north of the Arctic Circle, both on land and in the shelf areas. Around ten per cent of the oil and 25 per cent of the gas production worldwide is now taking place in the Arctic region, although it comes almost exclusively from deposits on land. For the Arctic states, the development of oil and gas reserves in their northern territories is already vital or is becoming an increasingly important economic sector. For example, Russian natural gas is being delivered to Germany, which receives a full one-third of its natural gas from Western Siberia.

In spite of the high production volumes, there are large portions of the Arctic that are still undeveloped, especially the offshore areas. Indeed, many possible deposits have not yet been discovered. In 2008, the United States Geological Survey (USGS) attempted to estimate the size of the probable undiscovered deposits of these

two resources in the Arctic in its major CARA study (Circum-Arctic Resource Appraisal). According to the calculations, around 30 per cent of all probable undiscovered natural gas reserves in the world and 13 per cent of the undiscovered oil reserves are located to the north of the Arctic Circle. A large proportion of these undiscovered fields are presumed to be located in the shallow shelf areas of the Arctic Ocean, in water depths less than 500 metres.

The USGS study investigated a total of 25 Arctic provinces. It found that 90 per cent of the probable reserves are located in only ten of these areas. The possible oil and gas deposits are thus concentrated in just a few regions. Furthermore, the amount of probable natural gas is three times as great as the expected amount of oil. The largest occurrences of energy resources are presumed to be in the West Siberian Basin, the Timan-Petschora Basin, Alaska's North Slope Basin and on the central Norwegian shelf (Barents Sea). Of these, the richest oil areas are off the north coast of Alaska and in the Arctic waters off Canada and Greenland. The largest natural gas reserves are presumed to be in Russia's West Siberian Basin, especially in the southern part of the Kara Sea.

The prognoses of the USGS clearly indicate that some Arctic states have especially large reserves. According to the study, two-thirds of the probable reserves lie in the Eurasian part of the Arctic region and the remaining one-third are in the North American part. Around 90 per cent of the reserves in the Eurasian Arctic are natural gas, while the deposits in the North American sector presumably have more oil. Russia is at the top of the ranking for the Arctic states richest in these resources, with about half of the yet undiscovered deposits. With Alaska's potential, the USA is in second place with one-fifth of the probable reserves, followed by Norway, Denmark/Greenland and Canada.

To date, the USGS study is still the only Arctic-wide survey of possible oil and gas reserves and, due to its methodology, it is fraught with large uncertainties. In many areas the estimates of the American scientists are based on very vague geological information. For many parts of the Arctic region there is simply not enough data. Researchers therefore expect the estimates to change significantly as new geological data become available.

Furthermore, the authors point out that their statistical calculations did not take into account either the technological and economic conditions or possible exploration risks. For this reason it is very likely that a substantial portion of the presumed reserves will never be developed or produced. Furthermore, detailed knowledge of a reservoir does not necessarily mean that it will be exploited. Throughout the Arctic region there are many reserves that have been known for 40 to 50 years but have not yet been developed for economic or environmental reasons. This is particularly true for deposits in the North American Arctic sector where oil and gas production is controlled exclusively by market demands, and thus purely by the price that can be expected.

In Russia, on the other hand, resource production also has strategic and political significance. A strategy paper by the Russian government considers resource exploitation in the Arctic to be an essential basis for the social and economic development of the country. The export of crude oil and products produced from it accounts for over 50 per cent of total Russian exports. In addition, resource development in the Arctic serves to build infrastructures in the northern regions and symbolically enhances Russia's self-image as an Arctic nation.

The Russian government is therefore promoting the exploitation of resources, for instance through tax incentives. Large state-owned corporations such as Gazprom and Rosneft dominate the industry. They produce natural gas and crude oil in far more areas than is done in North America, for example. The number of production facilities continues to increase. In April 2019, following a meeting with President Vladimir Putin, the Russian oil company Rosneft announced that it was planning to develop several oil and gas fields in the Russian Arctic, which would make it possible to recover 1.5 billion tonnes of oil. The project would also serve to expand the Northern Sea Route along the Russian Arctic coast. In order to realize these plans, Rosneft not only has to invest in new icebreakers and ice-capable tankers and construct an oil pipeline from its Vankor oil fields west of the Yenisei River to the Arctic

5.12 > With the help of the specially designed, ice-resistant oil drilling platform *Prirazlomnaya*, the Russian oil company Gazprom succeeded for the first time in producing oil from Arctic offshore deposits in 2013. The platform is still in operation today in the Prirazlomnoye oil field south of the island of Novaya Zemlya.

5.13 > The Russian company Novatek and its partners have built the Yamal LNG liquefied natural gas plant on the north-eastern shore of the Yamal Peninsula. In three production lines, natural gas is produced, liquefied and shipped to Europe and Asia via the port of Sabetta.

coast. It has also begun to build accomodation for the expected 20,000 workers. In addition, the company is seeking international partners who will invest in this large project in spite of all the risks and the uncertain price outlook for energy resources.

At almost the same time, the Russian Ministry for Natural Resources and Environment announced that it intends to fund more than a hundred projects for oil and gas production in the Arctic and for the expansion of infrastructure and tourism with a sum equivalent to 164.2 billion US dollars. These include major projects already underway such as large oil- and gas-production sites on the Yamal Peninsula and in eastern Siberia.

On the Gyda Peninsula on the eastern shore of the Gulf of Ob, for example, Russia's largest private petroleum company Novatek is currently building its second facility for the production and shipment of liquefied natural gas (Arctic LNG 2). Construction of the harbour terminal and the accompanying industrial facilities and buildings will cost around 21 billion US dollars, and additional funding is being provided in part by Saudi Arabia, the French oil company Total, and Japanese commercial companies. The industrial complex, with an annual capability of 19.8 million metric tonnes of liquefied gas, is scheduled to start operations in 2023 and supply liquefied gas to customers in Asia and Europe. The list of investors is indicative of the increasing international cooperation in the exploration and exploitation of raw materials in the Arctic region. Because oil and natural gas production in the northern polar region is technically difficult and involves enormous costs, even experienced players such as Rosneft, Gazprom and Novatek depend on cooperation with American, European and Asian companies.

In the USA, the Trump administration is now pushing ahead with the sale of oil-drilling licences in the once-protected coastal area (called the 1002 Area) of the Arctic National Wildlife Refuge – for example, by allowing the administration to carry out required studies on the impacts of oil exploration within a very short time. Caution would be advisable here. Because of its climatic and geographic situation, the Arctic is a high-risk region for economic activities, especially for major projects such as oil and gas production. Accidents and risks cannot be ruled out even when the mining and oil companies comply with environmental regulations and employ modern safety technology. There is always a danger of degrading the environment with oil pollution, garbage and noise, all of which are especially damaging in the Arctic. This is particularly so in the case of tanker accidents or pipeline leaks, because oil and other hydrocarbons remain in the ecosystem much longer due to the low temperatures.

Experts also agree that measures to remove oil slicks or spills in the Arctic are very difficult and protracted, if not impossible. They say that clean-up techniques that have proven useful in other regions are less effective or even useless in Arctic waters. Ice could clog the oil suction systems, or oil booms could freeze. During the polar night, darkness would also hamper any clean-up operations. Furthermore, many regions in the Arctic are only accessible by airplane, helicopter or ship. This means that there is a lack of the important infrastructure and personnel necessary to rapidly and effectively combat an oil spill in the event of an accident along the Arctic coast.

Mineral raw materials in the Arctic

While the mining of mineral raw materials is prohibited in Antarctica by the Protocol on Environmental Protection to the Antarctic Treaty, mineral resources such as coal, zinc, copper, gold, diamonds, platinum, nickel, palladium, iron ore and rare-earth elements constitute important economic branches in many regions of the Arctic, or they are considered to be a basis for future economic development, as in Greenland. Since the discovery of diamond deposits in the Northwest Territories, for example, Canada has become one of the top five diamond producers in the world. The largest zinc mine in the world, called Red Dog Mine, is located in Alaska. It has the largest known zinc deposits on Earth to date and alone accounts for ten per cent of the global production of this metal.

The development of mineral raw materials in the Arctic region has a long history. The iron ore mine in Malmberget, Sweden, in the Lapland region, opened in 1745 and is still the second largest in the world. In Greenland, minor amounts of copper, lead, zinc, silver, gold, marble, graphite, olivine and cryolite have been extracted since the middle of the 19th century. Beginning in 1896, the goldrush on the Klondike River attracted more than 100,000 gold prospectors to Alaska and flooded the world market with gold. Just two decades later Russia began construction of its largest mining and metallurgy complex in the Siberian Arctic (Norilsk mining district in the Krasnoyarsk region). Because of the unfiltered emissions from metallurgical plants, Norilsk was for a long time a city with one of the highest levels of air pollution in the world.

Today the mining of mineral raw materials in the Arctic still takes place exclusively on land and is therefore less affected by the consequences of climate change as it relates to diminishing Arctic sea ice. There are at present slightly over 20 mining operations that are extracting mineral resources. There are over a dozen in Russia alone, because the Russian Arctic region is rich in ferrous, non-ferrous and precious metals, rare-earth metals and fertilizer raw materials, as well as precious and semi-precious stones.

5.14 > One of the worst oil catastrophes of all time occurred on the night of 24 March 1989, when the tanker *Exxon Valdez* struck a reef in Prince William Sound in the Gulf of Alaska and lost 39,000 tonnes of crude oil. At least 400,000 birds and mammals died as a result of the oil spill, and fishing activity came to a standstill. The coast is still polluted with oil today.

5.15 > Researchers report that climate change could open up a new source of income for Greenland. When ice masses melt, the meltwater streams and rivers transport large amounts of sediment to the coasts where they are then deposited. As a raw material, sand is in demand worldwide, and its export could be economically viable if the mining can be carried out in an environmentally sustainable manner.

In conjunction with these activities, according to the Arctic Economic Council (AEC) there is a lot of prospecting taking place in the Arctic in order to find out exactly where, and especially how abundantly the raw materials occur. It has been known for years, for example, that there are very large deposits on Greenland. Of particular significance here are gold, platinum-group metals, rare-earth elements, uranium and celestine. Economic planners and a large proportion of the Greenland population hope that the mining of minerals will generate large revenues in the future, and that the island will become an important supplier in the long term. The necessary mining licenses have already been issued, including some to Chinese mining companies. But so far a number of factors have prevented profitable large-scale mining because Greenland, like other parts of the Arctic, still lacks important infrastructures like roads, railways, harbours and housing for the mine workers. The average temperatures on the icy island are so low that the extraction of mineral resources is only possible during the short summers. In addition, Arctic sea ice often blocks the paths of transport ships to mining sites such as the Citronen Fjord in the far north. Furthermore, the Arctic states have agreed in the Arctic Council to develop their Arctic territories as sustainably as possible. This means that every country now imposes requirements on mining companies with regard to environmental protection, occupational health and safety, and interaction with the local populations, all of which drive up exploration costs. Because of the low, or at least fluctuating world market prices for raw materials such as lead, zinc and rare-earth elements, most mining projects in Greenland are still in the planning or development phase.

There is presently only one producing mine. The Norwegian company Greenland Ruby has been extracting pink rubies in Aappaluttoq in southwest Greenland since May 2017 and selling them in the form of jewellery to Greenland tourists and on the Scandinavian market. The Canadian company Hudson Resources, Inc. is also apparently near the start of production. It intends to mine calcium-rich feldspar (anorthosite) in the White Mountain region of Kangerlussuaq Fjord in western Greenland and sell it to fibreglass producers. Production of the industrial mineral, however, will only be possible during the short summer, so it is questionable whether the mine will be profitable over the long term.

In other parts of the Arctic, on the other hand, the exploitation of natural resources and development of the necessary infrastructures are progressing rapidly. The opening of a new port terminal near the Russian port city of Murmansk is planned for the end of 2019, through which nine million tonnes of coal will be shipped annually. According to the plans, this volume will double when further construction phases are completed by 2023. In February 2019, the Norwegian government agreed to the construction of a copper mine in the Arctic municipality of Kvalsund despite protests by local fishermen and reindeer herders against the plans. The mine operator Nussir ASA estimates the copper deposits in the area at 72 million tonnes. There is no larger copper deposit known in Norway.

In southwestern Alaska, environmentalists and members of the indigenous population are currently challenging plans by the Canadian company Northern Dynasty Minerals to open a large gold and copper mine in the Bristol Bay region. The area, with its many lakes and rivers, is considered to be one of the most important spawning grounds for red salmon *(Oncorhynchus nerka)*. According to the mining company, however, it is also presumed to have the second largest copper deposits in the world as well as large amounts of gold, silver, molybdenum, palladium and rhenium.

Shipping in the Arctic

The drastic decline of Arctic sea ice, especially to the north of the Russian coasts and in Alaskan waters, is opening new shipping routes that may be of interest to operators from Arctic countries as well as to many companies from outside the Arctic region. In areas where the sea ice completely disappears, or where it is only present in winter, possibilities are opening up:

- Vessels can venture into previously untapped fishing grounds.

Mineral resources beneath the Antarctic ice

Antarctica is the only continent on the Earth where no mining has ever taken place. This unique situation is due on the one hand to the extreme temperatures and the extensive continental ice cover, which make geological investigations of the subsurface extremely difficult. And on the other hand, the Madrid Protocol on Environmental Protection to the Antarctic Treaty prohibits any commercial exploration activities south of 60° South latitude. However, drilling or sampling of rocks for research purposes is permitted.

The geology of the land masses in Antarctica is therefore sufficiently well known in some regions to make assumptions about the potential for raw materials. Researchers now know, for example, that there are coal deposits in the Transantarctic Mountains and iron ore deposits in the Prince Charles Mountains in eastern Antarctica. It would be logistically and technically very difficult to extract these, so from a practical point of view they are of no economic interest. In addition, there is little information available about the quality and total size of these deposits.

The presence of other mineral raw materials is presumed but so far has not been conclusively proven. These include metals such as nickel, copper and platinum. The presumptions are based on the knowledge that the coastal regions of Antarctica have strong geological similarities to the resource-rich margin areas of South America, Africa and Australia, all of which abutted the southernmost continent 250 million years ago. The gold-rich mountain range of Witwatersrand in South Africa, for example, may have the same geological features as some parts of Queen Maud Land in Antarctica. The Antarctic Peninsula is an extension of the South American Andes, where metals such as molybdenum, gold and silver are mined. Minor occurrences of these minerals have also been discovered on the peninsula. And in Dufek Massif in the Pensacola Mountains, a highland region in Queen Elizabeth Land in western Antarctica, researchers suspect the presence of platinum-group metals, chromium and other mineral resources like those mined in the geologically similar Bushveld complex in South Africa.

Oil and gas reserves are presumed to be present in the Antarctic shelf areas. The thick sediment layers necessary for the formation of these two resources could be present on the shelves of the Ross and Weddell Seas as well as in the Amundsen and Bellingshausen Seas. But possible deposits would very probably be too small to make production economically feasible. Moreover, in the shelf areas of Antarctica there are many floating icebergs, some of which are very large. These would present a serious danger for drill ships and platforms, and because of the huge masses of ice below the water surface, they could destroy technical installations on the seafloor without warning. The risk of spills and environmental pollution would be very high.

5.16 > At sites with no ice cover, there is evidence of the presence of mineral resources. The distinct black line at the bottom of this sandstone outcrop in the Transantarctic Mountains is a coal seam that was formed more than 250 million years ago.

- Drilling ships or platforms can exploit the marine gas and oil deposits that were previously not accessible.
- Trading and shipping companies can save considerable time and costs by shipping their goods from Northern Europe to North-East Asia via the shorter Arctic sea routes.
- Travel companies can attract new customers with cruises in the Arctic.

In the public discourse, however, the fact that shipping in the Arctic is not a new phenomenon at all is often overlooked. On the contrary, large parts of the northern polar region were developed by ship. Regular shipping connections were established more than a hundred years ago in ice-free Arctic marine regions like the western and northern coasts of Scandinavia, and wherever governments or companies had invested in Arctic sites and people needed supplies. This was the case, for example, in Svalbard, where coal mining began around 1900, and ships were the only possible way to bring machines and vehicles to the Arctic archipelago and to transport the coal off again.

In large parts of the Arctic today, shipping connections are still the lifelines for the local populations. The people built their settlements near the coasts because the sea route is the only way to receive essential goods. In many regions there are no streets or railways.

Regional instead of international

The Arctic waters are primarily utilized today for fishing, transporting extracted materials, supplying Arctic settlements and mining sites, passenger shipping, tourism, and polar and marine research. Most of these voyages are carried out in the summer or autumn, when large areas are ice-free and the risks are as small as possible. Many ships avoid the ice-covered regions. They operate mainly in the peripheral areas of the Arctic Ocean, for example along the Norwegian coast, in the largely ice-free Barents Sea, around Iceland and the Faroe Islands, to the southwest of Greenland, and in the Bering Sea.

Most Arctic shipping lines are operated by domestic or state-owned shipping companies. Along the Norwegian coast, for example, seven coastal vessels of the Hurtigruten shipping company transport freight and guests to 34 ports of call between Bergen in the southwest and Kirkenes in the northeast. On Greenland, the ship-based transport of goods and fuel is managed by the government-owned shipping company Royal Arctic Line. Its vessels sail between Greenland's 13 largest ports and also supply smaller settlements. In Russia, icebreakers commissioned by the government have been keeping the coastal waters between the Kola Peninsula and the mouth of the Yenisei River navigable year-round since 1979, enabling regular shipping in the region.

Shipping in the Arctic seas is therefore carried out rather more on a regional than international basis. However, when it comes to Arctic shipping, the general public is primarily interested in trans-Arctic routes. These are generally limited to two main routes. A third course, which runs directly across the Arctic Ocean, practically crossing the geographic North Pole, is not realistic considering the still prevailing ice and weather conditions in the central Arctic, and it is only discussed theoretically.

The Northwest Passage

The Northwest Passage comprises seven large routes between the Atlantic and Pacific Oceans. They run from the Bering Strait and the coastal areas of Alaska, through the island maze of the Canadian Arctic Archipelago, and finally through Baffin Bay and the Labrador Sea into the North Atlantic. The first documented crossing of the Northwest Passage was made by the Norwegian Roald Amundsen in the early 20th century. 80 years later the first passenger ship, the Swedish vessel *Lindblad Explorer*, crossed through the passage. This was followed in 2008 by the first container ship, and in 2017 by the first cruise liner.

Transarctic voyages through the Northwest Passage are still exceptional events, however. Firstly, this is because the approximately 36,000 islands in the far northern reaches of North America make navigation difficult, and secondly the sea ice in the Canadian Arctic Archipelago is generally thicker and, due to local conditions, it recedes in summer to a lesser extent than it does,

5.17 > Most ship movements in the Arctic are for regional transport in the coastal waters of the bordering states. Or they are tanker and freight transport to ports south of the Arctic Circle (destination-related transport).

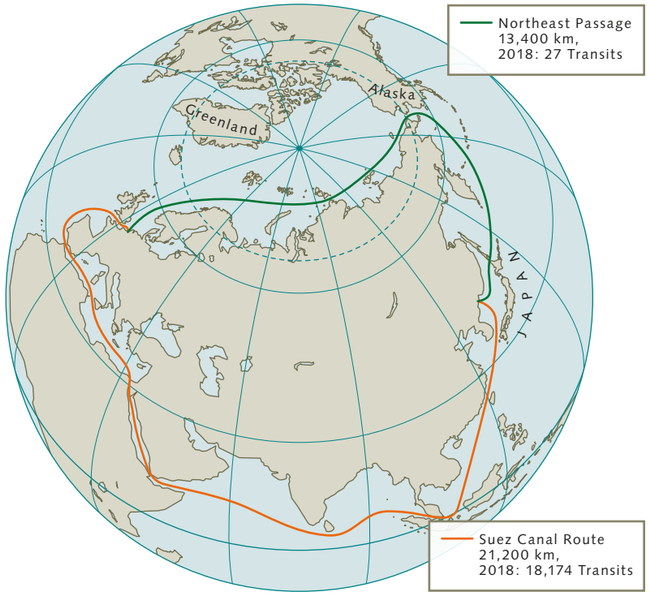
for example, in the Bering and Chukchi Seas. Ships that undertake this voyage are generally coast guard icebreakers or private yachts. The latter are taking a fairly high risk because the ice conditions in the Canadian Arctic are difficult to predict. For this reason, experts also believe that ship voyages in the Canadian Arctic Archipelago will continue to be high-risk in the coming decades. Nevertheless, several cruise operators are offering voyages through the Northwest Passage in the summer of 2020, including Hurtigruten of Norway and Hapag-Lloyd of Germany.

There has also been an increase in the traffic of fishing boats and cargo ships, at least in the Canadian portion of the passage. The latter transport goods to the Canadian north, or are loaded with raw materials in the Arctic ports. The Baffinland Iron Mines Corporation shipped five million tonnes of iron ore in 2018 alone from a new harbour on the north coast of Baffin Island – a record amount for the Canadian Arctic. Over the long term the company wants to increase its annual production to twelve million tonnes of ore. The diminishing sea ice could help it realize that goal. The season during which the waters around Baffin Island are navigable has already lengthened from four to five months.

The Northeast Passage

The Northeast Passage consists of several routes that lead from north-western Europe along the northern coasts of Scandinavia and Russia into the Bering Sea and then into the Pacific Ocean. A portion of this passage, from the Kara Strait to the Bering Strait, is also known as the Northern Sea Route. It passes through the Exclusive Economic Zone of Russia and is administered by the Russian Ministry of Transport. Until about 30 years ago, this sea route was prohibited for ships from countries outside the former Soviet sphere of influence. The Soviet Union used it for military purposes and developed it into an important supply line for its Arctic mining and oil industries.

Since 1 July 1991 the Northern Sea Route has been open for all countries. However, ships must register their passage and meet certain conditions, requirements that are criticised by the USA and other countries. They insist



that the routes of the Northeast Passage and the Northwest Passage be regarded as international straits through which all states have the right of transit. This would deprive the individual coastal states of the right to impose strict rules and conditions. The context of this demand is that of all three possible sea routes through the Arctic, the Northeast Passage is currently regarded as a particularly promising shipping route. Ice and wind conditions are favourable for the first permanently navigable channel to open along the northern coast of Russia.

5.18 > A voyage by ship from Rotterdam to Yokohama is much shorter through the Northern Sea Route than by the southern route. But because of the high costs and the unpredictable ice conditions in the Arctic seas, shipping companies still use the longer route through the Suez Canal.

Russia's plans

Russia is making a strong effort to develop the Northern Sea Route into one of the most important shipping routes in the world. In line with its stated transport and traffic strategy, the country intends to commission the construction of new nuclear-powered icebreakers, modernize ports along its Arctic coast, install search and rescue infrastructures, and establish a monitoring system for maritime traffic.

5.19 > The 300-metre-long liquid-gas tanker *Christophe de Margerie* is one of 15 double-acting tankers built by the operators of the Yamal LNG liquefied natural gas plant. It can run backwards through ice up to 2.1 metres thick and thus operate year-round without icebreaker support.

These investments are justified by the fact that cargo ships from northern and north-western Europe would save up to 40 per cent of the distance to Japan or China by travelling through the Northeast Passage instead of the classic southern route via the Suez Canal and Indian Ocean. In this way, ships would also avoid dangerous southern marine areas such as the Horn of Africa or the Strait of Malacca (Malaysia, Indonesia). In these two regions terrorism and piracy are considered serious threats for international shipping traffic.

But for now, the Northern Sea Route is only relatively safe for ships during the summer, and even then cargo ships must often be accompanied by icebreakers, a situation that significantly increases the costs of the transit and severely limits the current development potential for Arctic shipping. Like all commercial ventures this one, first and foremost, has to be economically feasible. Whether this is the case depends, among other things, on the possible saving in distance, the question of what freight is most suitable for the Arctic routes, time management, and the progress and development of the other major trade routes.

Experts warn against overestimating the potential of Arctic shipping and underestimating the risks. Trans-Arctic voyages such as those of the ice-class cargo ship *Venta Mærsk* in August 2018 had a high level of show appeal but were not economically profitable. Accordingly, the number of transit voyages through the Northern Sea Route has been minimal. After a boom between 2010 and 2013 they declined again in 2014, and since then the number of crossings has remained below expectations.

The lack of interest in the shipping industry is primarily due to the economics. In scientific surveys, shipping companies and merchant enterprises have specified that Arctic shipping entails major commercial risks. The risk factors stated by the companies include:

- high costs for the construction of high-ice-class ships, on-board equipment suited to polar conditions, ship insurance (20 to 100 per cent higher than standard prices), and trained personnel: To make matters worse, the ice-capable tankers and cargo ships are not commercially viable in other waters because their thicker hull means that they have an insufficient capacity;
- high costs for special fuel: Ships in the Arctic need a fuel that is suitable for cold temperatures. Moreover, fuel consumption increases enormously when the ship makes its way through sea ice;
- high charges for the escort by Russian icebreakers as well as the services of the Northern Sea Route Administration: Additionally, the ships may not be wider than 30 metres (the icebreaker's channel). On the southern route through the Suez Canal 60-metre-wide ships are possible;
- the limited number of available icebreakers: This complicates long-term planning for shipping on the Northern Sea Route;
- the risk of delays and associated penalties due to unpredictable ice conditions: For this reason, for container ships in particular, whose goods have to be delivered punctually, the Northeast Passage is still not an alternative to the classic southern route;
- the high probability of sea ice and extreme weather conditions, and the associated risks;
- the remoteness of the shipping route and absence of infrastructure for search and rescue measures;
- the restriction of the maximum draught to twelve metres: Because of the shallow water depth, ships often cannot be fully loaded, which lowers the profit margin for the companies and shipping lines;
- fluctuating world market prices for raw materials and fuels: If prices fall the expensive transit through the Arctic becomes less attractive for businesses than the proven southern route;
- upgrading of the Panama and Suez Canal systems is making the southern routes more economically attractive again for the shipping companies: Since June 2016, with the completion of ten years of improvement work (widening and deepening), the Panama Canal is navigable for 96 per cent of the world merchant fleet. The Suez Canal was also improved. Since August 2015, twice as many ships can cross through it as before.

New ship types, detailed traffic analyses

To increase the profitability of Arctic shipping, some companies are beginning to rely on new technology. This includes ice-strengthened cargo ships and double-acting ships.

The latter are a cross between icebreakers and traditional cargo ships. They have a conventional bow for navigating on the open sea and a stern that is equipped with an icebreaking function. In ice-free waters the ship cruises forward. But when sea ice is encountered the ship turns around and runs backward, with the ice-breaking stern leading the way.

These new types of ships are mainly used for transporting raw materials along the Russian coast. But these voyages are usually not included in the transit statistics. When analysing Arctic shipping traffic, experts distinguish between four categories of traffic:

- *Destination transport:* This category includes, for example, oil tankers that deliver oil or liquid gas from Norway or north-west Russia to harbours outside the Arctic.
- *Intra-Arctic transport:* This refers to shipping that connects two or more states within the Arctic region with each other.
- *Trans-Arctic transport:* This is ship transport that passes through the Arctic waters and delivers goods, for example, from a Pacific port city to a harbour on the Atlantic or on the North Sea.
- *Ship transport in the coastal waters of one state bordering on the Arctic Ocean:* This ship movement is also referred to as regional traffic, and includes the regular transport of raw materials in Russia between the port of Dudinka in the northern reaches of the West Siberian lowlands and the harbour city of Murmansk lying on the Kola Peninsula north of the Arctic Circle.

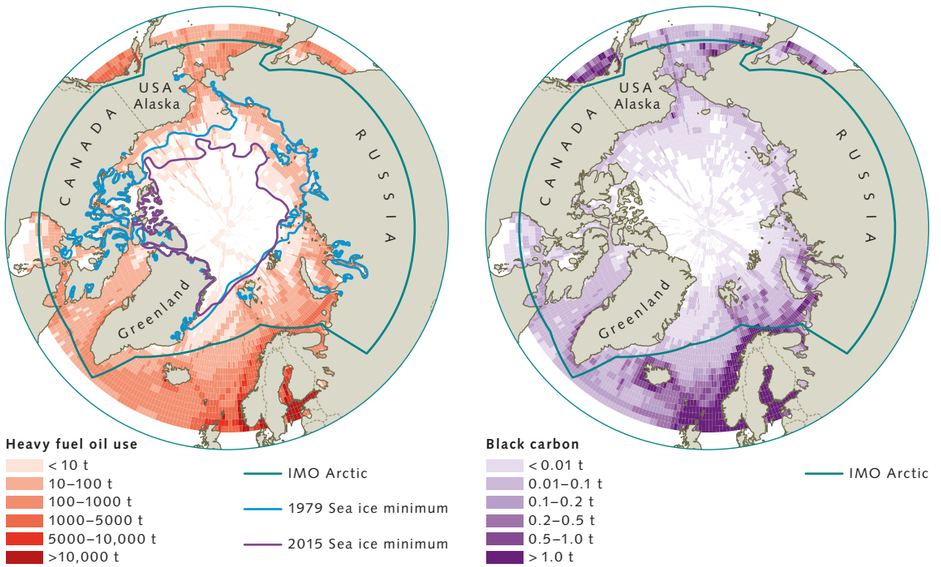
While transit traffic has fallen to a low level, regional and destination-related shipping in the Northern Sea Route is steadily increasing. In 2018, cargo and tanker ships transported 15 million tonnes of goods through this seaway within a period of only eleven months, to destinations in Europe, Asia and South America, among others. This was almost twice as much as in the previous year. Compared to 2014, the amount had increased by a factor of five. The growth can be attributed primarily to the rise in the exports of liquid gas, crude oil and coal from the Russian Arctic sector. The gas-producing company Novatek, for example, shipped more than seven million tonnes of liquid gas from its new Sabetta port in 2018. This is part of the large Yamal Project on the Yamal Peninsula that began operating in 2017.

According to predictions, the volume of freight will continue to increase in the Russian Arctic, boosted primarily by the growing coal production in the Taibass Basin on the northern tip of the Taymyr Peninsula. Coal producer VostokCoal is planning to extract up to 30 million tonnes of anthracite coal there annually beginning in 2025. This type of coal is especially carbon-rich. It is needed for metal production in particular, and is only mined in a few countries. The company is aiming to achieve an annual production goal of ten million tonnes by 2019, and all of it will be shipped via two newly built harbours near the port city of Dikson. By the year 2025, every second ship traveling on the Northern Sea Route could be a coal freighter from Dikson.

Like many other extractive companies, VostokCoal will use ice-strengthened freighters for the transport of coal. However, the Russian Ministry of Transport is considering relaxing the very strict conditions and safety requirements for shipping on the Northern Sea Route. Until now, only ships of ice class Arc7 and higher have been allowed to transverse the Northern Sea Route in winter. But since the gas producer Novatek, in particular, has not succeeded in equipping its fleet with the expensive ice-class ships, the ministry announced in November 2018 that it would ease the ice-class regulations. In the future ships with ice class Arc4 and Arc5 will be allowed to travel the coastal waters in winter, but only when accompanied by an icebreaker.

In view of this decision, critics accuse the ministry of placing economic interests above ship safety and environmental considerations, and of taking an unnecessary risk. Less sea ice does not mean less danger. On the contrary, thinner ice is more easily driven by the wind and thus moves faster. This makes ice predictions more difficult. In shallow shelf seas like the East Siberian Sea, just 52 metres deep, there is the added danger of ships running aground when adverse ice and weather conditions make navigation more difficult.

5.20 > In February 2018, on its way from South Korea to France, the liquid-gas tanker *Eduard Toll* was the first commercial ship to transit the Northern Sea Route in winter without the aid of icebreakers. It made a short stop in the harbour of Sabetta to load new liquefied gas.



5.21 > According to the International Council on Clean Transportation, around 57 per cent of all ships operating in the Arctic in 2015 were burning heavy fuel oil. About two-thirds of the black carbon emitted by ships can be attributed to this "dirty" fuel.

The environmental impacts of shipping

Like the extraction of resources, Arctic shipping also poses a number of known and possible threats for the sensitive Arctic environment. Should a tanker accident occur or a ship lose oil or fuel for any other reason, the effects of the pollution would last much longer in the cold Arctic than in warmer areas. Clean-up efforts would be very expensive and time-consuming and, according to some experts, certainly not adequate because there are still no known technical solutions that could be effectively applied. Permanent damage to the environment, plants and animals would be inevitable.

Unlike in the Antarctic, ships in the Arctic are still permitted to operate with heavy fuel oil containing sulphur. This fuel is a highly toxic, very viscous waste product from the oil industry that accounted for 57 per cent of marine fuel used in the Arctic region in 2015. If it is released through an accident, a leak or as a result of deliberate discharge and comes into contact with water, it spreads across the sea surface, emulsifies and assumes a multiple of its original volume. The mousse-like mass is then either deposited on the sea ice, where it freezes, or it is washed onto the coasts or sinks to the seabed. Because of its consistency, emulsified heavy oil can contaminate large regions. The Arctic Council has therefore concluded that this fuel poses the greatest risk by ships to the Arctic marine environment.

When heavy oil is burned in the ships' motors, in addition to large volumes of carbon dioxide, air pollutants like sulphur oxides, nitrogen oxides, particulates, and brown and black soot particles are emitted. When these dark particles are deposited on either snow or sea ice, the surface reflectivity is decreased. Both of these materials then absorb more solar radiation and melt faster.

Environmental organizations and the International Maritime Organization (IMO) are therefore advocating a ban on heavy fuel oil in Arctic waters. Negotiations are currently underway. The IMO has set a target to adopt the ban in 2021 and to implement it throughout the Arctic by 2023.

With increasing ship traffic, the danger that non-native animal and plant species traveling with the ships will immigrate to the northern polar region also increases. They may, for example, attach to the ship's hull or stow away in the ballast water. The more ships there are traveling in Arctic waters, the greater also is the danger that they will collide with whales or seals, or that they will disrupt the migrations of the marine mammals or disturb them with motor noise.

Sound waves travel further in cold than in warm water. This means that motor noises or the sound of exploration activity can be heard at greater distances underwater in the Arctic. In addition, with the loss of thick, perennial sea ice, a previously effective acoustic absorber is disappearing that once imbued large portions of the Arctic Ocean with silence.

As early as 1993, researchers reported observations from the waters of the Northwest Passage indicating that beluga whales were able to hear the sounds made by an icebreaker 85 kilometres away. As the ship approached the whales the animals broke out in a panic at a distance of 35 to 50 kilometres. They sounded alarms and fled from the area as a unified herd. Narwhals, on the other hand, fell silent at the noise of the ship and left the region individually.

Biologists from the United States, in a study from 2018, concluded that narwhals, walruses, bowhead whales and belugas are particularly threatened by the increasing ship traffic. The danger for ringed seals and polar bears is somewhat less critical because these animals spend a large amount of time on land in the summer, where the effects of ship traffic are less disruptive. In other studies, scientists are currently studying the impacts of cruise-ship tourism on the animals in the polar regions. Cruises to the Arctic and Antarctic have been a growing market in recent years.

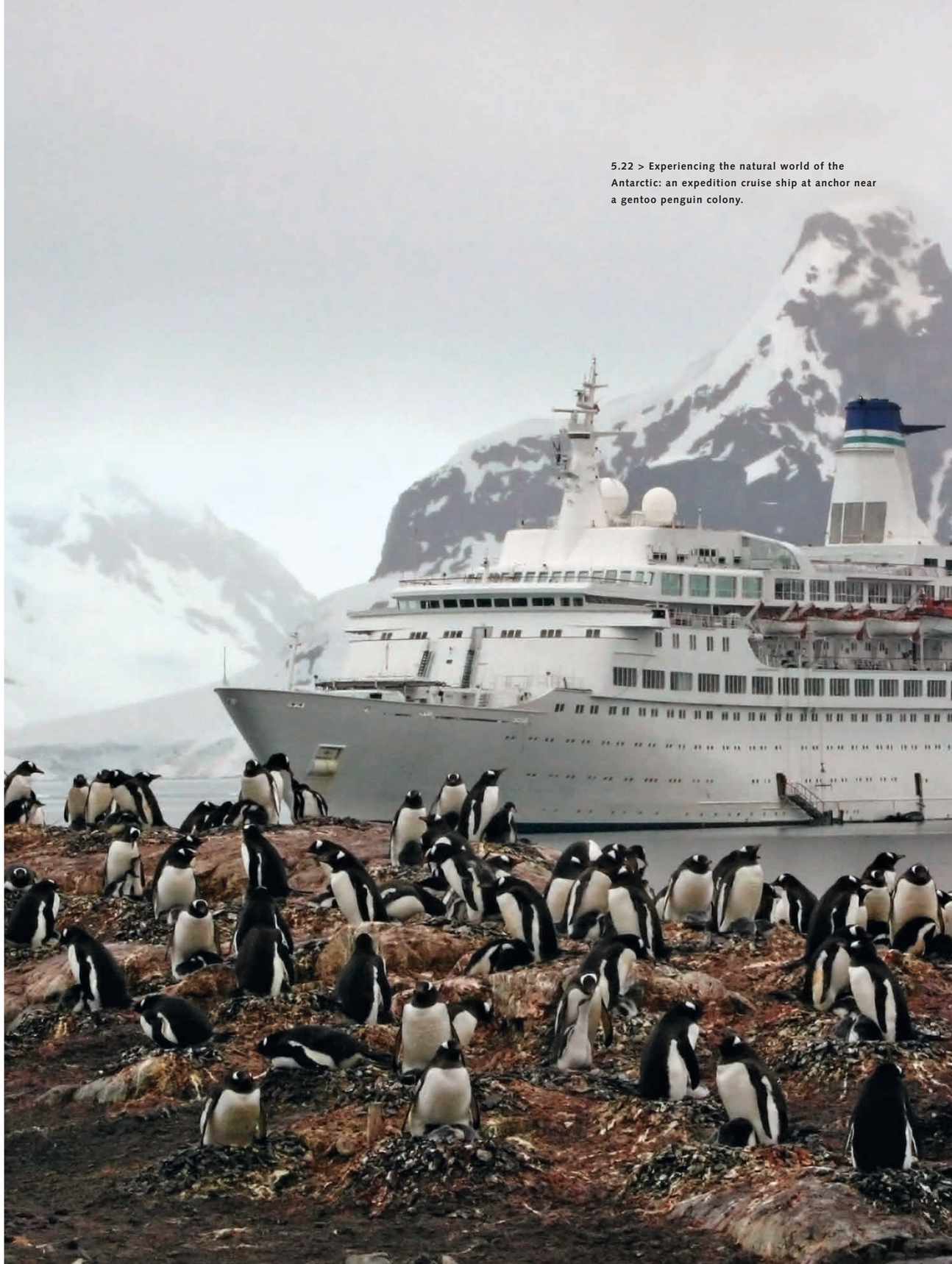
Polar tourism

The polar regions have become more attractive as holiday destinations, for three reasons. Firstly, rising temperatures and the resulting retreat of the sea ice, especially in the Arctic, make it easier to access many regions. Secondly, in view of these dramatic changes, many nature lovers and adventure tourists feel that they have to rush to see the icy landscapes of the Arctic and Antarctic for themselves before they are gone for good. Expert call this "last-chance" tourism. Antarctica – our planet's last wilderness – exerts a particular fascination for travellers who have already visited every other region of the world and now wish to experience what is surely the Earth's most inaccessible continent at the South Pole.

No wonder, then, that tourism in both polar regions has surged in recent decades. The number of cruises visiting Canada's Arctic Archipelago increased from 121 in 2005 to 416 in 2017. And according to experts, the number of tourists visiting Antarctica in the 2019/2020 summer season, mainly on smaller cruise ships carrying fewer than 500 passengers, is likely to exceed 78,000 for the first time – excluding shipboard staff on the total of 63 vessels registered. Figures from the International Association of Antarctica Tour Operators (IAATO) show that 56,168 tourists visited Antarctica in the previous season (2018/2019), compared with just 12,248 in 2000/2001.

Antarctic tourism has experienced just two brief downturns: the first during the global financial crisis, and the second after the International Maritime Organization (IMO) adopted a ban, in August 2011, on the use and carriage of heavy fuel oil on vessels operating in the sea area south of latitude 60° South. Since then, however, tour operators have calculated their fuel consumption so precisely that all the heavy fuel oil is used up before the ships reach Antarctic waters – and visitor numbers are rising again.

In Greenland and on Svalbard, the most popular regions for Arctic cruises, passenger numbers rose steadily until 2007/2008 and since then have levelled off at annual averages of around 24,000 (Greenland) and 40,000 (Svalbard).



5.22 > Experiencing the natural world of the Antarctic: an expedition cruise ship at anchor near a gentoo penguin colony.

Recorded Seaborne Tourism (based on data provided by companies who submitted Post Visit Report Forms and from other sources where available)					
Year	**Number of operators**	**Number of ships and yachts**	**Number of voyages**	**Number of passengers making landings**	**Number of cruise only passengers**
1992/1993	10	12	59	6704	
1993/1994	9	11	65	7957	
1994/1995	9	14	93	8098	
1995/1996	10	15	113	9212	
1996/1997	11	13	104	7322	
1997/1998	12	13*	92	9473	
1998/1999	15	15*	116	9857	
1999/2000	17	21*	154	13,687	936
2000/2001	15*	32*	131	12,109	0
2001/2002	19*	37*	117	11,429	2029
2002/2003	26*	47*	136	13,263	2424
2003/2004	31*	51*	180	19,369	4949
2004/2005	35*	52*	207	22,297	5027
2005/2006	47*	44*	249	25,167	4632
2006/2007	42*	47*	268	28,622	6930
2007/2008	48	55	308	32,637	13,015
2008/2009	44	53	290	26,921	10,652
2009/2010	44	51	239	21,622	15,020
2010/2011	41	47	223	19,065	14,373
2011/2012	36	41	234	21,131	4872
2012/2013	39	45	258	24,892	9070
2013/2014	42	51	283	27,374	9670
2014/2015	37	44	268	26,812	9459
2015/2016	38	48	286	29,960	8109
2016/2017	38	47	298	36,440	7475
2017/2018	44	50	344	42,576	9131
2018/2019	44	56	360	44,600	10,889
2019/2020	46*	63**	432**	59,367**	18,420**

* Includes non-IAATO operated yachts (sailing and motor) where the information was available.
** based on pre-season estimates not actual statistics.

5.23 > Cruise ship tourism in Antarctica is a booming business. According to IAATO, passenger numbers have increased almost twelve-fold since summer 1992/1993.

It is important to note that there are clear differences between the Arctic and the Antarctic where polar tourism is concerned. In the northern polar region, the development of the tourism sector and associated issues such as infrastructure and regulations governing entry and access to Arctic regions are a matter for the individual states. The regions visited most often are those which are easy for holiday-makers to reach, such as Iceland, Alaska and northern Scandinavia.

Norway's Arctic territory, for example, is well-developed and has been a popular holiday destination for decades. The first tourists to visit the Svalbard Archipelago by boat arrived in 1890. Nowadays, most of the archipelago's inhabitants work in tourism. The territory of Nunavut in northeast Canada, by contrast, even lacks a good road network. In this Arctic region, the tourism season is limited to the brief summer, when tourists explore mainly by cruise ship or yacht.

With survey methods varying from country to country and no clear demarcation line between the Arctic and subarctic regions, reliable statistics on visitor numbers and types of tourism for the Arctic as a whole are non-existent. Polar tourism organizations such as the Association of Arctic Expedition Cruise Operators (AECO) collect information on market trends and membership numbers, but focus mainly on the top travel regions, such as Svalbard and Norway, not on the Arctic as a whole.

With regard to cruise ship operations in Arctic waters, however, there will soon be greater clarity. The Arctic Council's Protection of the Arctic Marine Environment Working Group (PAME) launched a new database on shipping activity in the Arctic in February 2019. It collects data on all shipping traffic in the Arctic, including information on ship routes, ship speed, fuel consumption and emissions, the aim being to close existing knowledge gaps on ship traffic in the northern polar region. Representatives of the Arctic states and researchers can now monitor ship traffic trends across the Arctic and draw up appropriate safety and management recommendations on this basis. For all non-Arctic states, however, the database is password-protected and access charges apply.

Antarctica, by contrast, is international territory. Anyone can travel to Antarctica, provided that the tour operator or cruise ship operator has obtained a permit for the visit from an Antarctic Treaty Party. Tourism statistics are collected by IAATO, established in 1991 – in other words, by the tourism industry itself. Critics claim that IAATO often omits tourism industry personnel such as shipboard staff, camp employees and pilots from the statistics, thereby creating the impression that visitor numbers are much lower than they are in reality. Also missing from the IAATO statistics are all the cruise ships, private expedition vessels and yachts whose operators or owners are not IAATO members. For private expeditions to Antarctica, including the various forms of extreme tourism which have become more popular in recent years, there is currently no joint registration centre that would be responsible for data collection.

Instead, IAATO, which currently has 116 members – almost all the Antarctica tour operators – operates a booking system which regulates ship traffic in a way which minimizes the likelihood of encounters between individual cruise ships. The aim, firstly, is to continue to offer passengers a remote wilderness experience. Secondly, the system supports compliance with strict Antarctic Treaty rules, which stipulate that no more than 100 tourists are allowed on shore at one time. Coordination among the tour operators also ensures that there are no waiting times at the main tourist attractions along the Antarctic Peninsula. To maintain this situation despite the increase in ship traffic, IAATO is currently overhauling the booking system: the version previously in use has reached the limits of its capacity.

Unlike the situation in some areas of the Arctic that are both winter and summer holiday destinations, tourism in Antarctica is a highly seasonal business. The expedition ships that carry up to 500 passengers, although most have fewer than 200 on board, operate from the end of October to early March – summer in the Southern Hemisphere – and mainly cruise in the ice-free areas along the Antarctic Peninsula. Regions such as the Ross Sea and East Antarctica are visited only in isolated cases due to the challenging weather and ice conditions.

Expansion of tourism infrastructure

With glaciers, polar bears, the northern lights and so forth proving so attractive to tourists, the Arctic states are hoping that this will open the way for sustainable development of their polar regions. They are therefore promoting further growth in this sector by expanding the tourism infrastructure. In Greenland, for example, there are plans to build three new airports to facilitate tourists' access to the island's icy wastes. The new airports are being constructed in Nuuk, Ilulissat and Qaqortoq and are scheduled to open in 2023. Other drivers of polar tourism development include improvements in equipment and technologies, as well as better geographical knowledge of the Arctic regions based on more detailed nautical charts.

The growth of Antarctic tourism is due to tour operators' expansion of their polar fleets. In summer 2019/2020 alone, nine newly constructed ice-going cruise ships will begin shuttling between the southern tip of Argentina and the Antarctic Peninsula, increasing visitor numbers by 33 per cent. A further 40 or so cruise ships are scheduled for completion by 2023, including a luxury yacht that will carry passengers from Argentina to Antarctica and then – via South America and Europe – to the Arctic; the price per person will range from 51,000 to 146,000 euros.

More fly-in and individual tourism

Until 20 years ago, the Arctic travel industry differed significantly from Antarctic tourism in a number of respects: geographical, infrastructural and legal. In the southern polar region, nature watching, hiking and trips on inflatables were often the only activities available locally, whereas visitors to the Arctic have for many years had a range of options to choose from:

- mass tourism for travellers wishing to see the best-known attractions in maximum comfort;
- sports fishing and hunting tourism for amateurs wishing to pursue these leisure activities in largely unspoilt terrain;

- ecotourism for nature lovers wishing to see unique wildlife and experience the Arctic's natural beauty;
- adventure tourism for holiday-makers wishing to challenge themselves through sport or other physical activity;
- cultural tourism for travellers wishing to meet indigenous communities, learn more about historical events or places of cultural interest, or explore heritage sites in the Arctic.

Antarctica has no indigenous communities and therefore no cultural tourism offer. Nevertheless, the days when tour operators offered visitors to Antarctica nothing but nature watching are long gone. The Antarctica experience now includes helicopter rides, submarine dives, sub aqua, snorkelling, swimming, stand-up paddleboarding, camping, kayak tours, mountaineering, ski tours and snowboarding. Individual and extreme tourism, such as races and marathons, are also available. An increasing number of holiday-makers also book tours into the interior. During the 2015/2016 season, 409 people took up this offer, rising to 679 in 2018/2019 and 733 predicted for 2019/2020.

Six IAATO-affiliated tour operators and logistics services companies now offer tours into the heart of Antarctica as package deals. Depending on the programme and price (which in some cases may amount to more than 90,000 US dollars per person), they can include visits to the South Pole or a penguin colony, excursions in off-road vehicles, or extreme mountaineering and ski tours. However, the personnel and logistical input is immense. Landing strips have to be built and maintained, and camps set up and managed. Such a landing strip and camp, located to the north of the German Antarctic Research Station – Neumayer III, has existed for the past two summers. In the high season, a Basler BT-67 aircraft, modified for flying in polar conditions, now lands here ten to twelve times, bringing in tourists keen to visit the local emperor penguin colony. On its first visit, the plane landed on the sea ice next to the penguins, causing considerable disturbance to parts of the colony and to research activities taking place there.

According to experts, this fly-in and individual tourism in the polar regions seems set to increase, for although tourists have less time to travel nowadays, they are prepared to spend more on their vacations. Argentina's state-owned airline LADE, for example, has announced plans to start commercial flights in 2019 from Ushuaia on the southern tip of Argentina to the Marambio Base, the national research station on Seymour Island in the Weddell Sea. Ten per cent of the accommodation here will then be made available to tourists.

Growth in the number of cruises and short tours to the polar regions is a further emerging trend. Due to high demand, more ships – and larger ships – will be operating in the polar regions and new onshore infrastructure will be required. Some tour operators now carry out their passenger turnarounds in the polar regions – on Svalbard, for example – to spare the cruise ships the long arrival and departure journeys. However, this means that the ships must refuel and replenish their stocks of water and food locally, requiring the establishment of adequate depot and warehouse capacity in port.

The growth in tourism: the environmental risks

For Arctic communities, tourism development creates jobs. However, experts warn that the tourism boom also poses substantial social and environmental risks. They include:

- increased volumes of waste,
- air, soil and water pollution, caused by the increase in air and ship traffic,
- increased risk of accidents, particularly involving cruise ships,
- adverse impacts on local fauna, and
- potential conflicts between tourism and traditional hunting and fishing activities.

In light of these problems, the Arctic Council tasked its PAME Working Group with producing Best Practice Guidelines for sustainable Arctic marine tourism. The Guidelines, published in 2015, define sustainable tourism as "tourism that minimizes negative impacts and maximizes socio-cultural, environmental and economic benefits for residents of the Arctic".

In order to achieve this objective, close collaboration is required among tour operators, communities, government agencies, academia and other stakeholders, according to the document. The Working Group requests the Arctic Council, *inter alia*, to develop a standardized framework for the preparation of site-specific guidelines for conduct in near-shore and coastal areas of the Arctic. A range of topics is to be covered: from mitigating local safety and environmental risks, to educating visitors on ecological, cultural and historical features unique to a particular area, so that tourists arriving via marine vessels are fully informed. Furthermore, according to PAME, an information database on Arctic tourism, which should be publicly available and updated regularly, is required.

PAME also encourages the carriage of Automatic Identification System (AIS) technology on board all vessels engaged in Arctic marine tourism activities. This technology can provide information about a vessel's position, course and speed by satellite communications to maritime administrations, thus providing a more comprehensive picture of vessel traffic and assisting any necessary response or search and rescue (SAR) activity. AIS technology is already mandatory on board cargo and passenger ships above a specific size; smaller passenger ships carrying fewer than 12 passengers are currently exempt.

PAME encourages the Arctic states to streamline governmental marine tourism permitting and oversight processes, advocate publicly for operations to be conducted in a sustainable manner, to share maritime information, and to promote improved communications and regular engagement between vessel operators and the local coastal communities. However, the prerequisite for the latter, in PAME's view, is the designation, within communities, of pre-established onshore contact points for incoming vessels.

Due to a lack of reliable data, it is difficult for experts to make realistic assessments of the environmental impacts of tourism-related activities in Antarctica. The majority of tourists – around 95 per cent – visit the Antarctic Peninsula region. Because they offer cruise ship passengers superlative views of the Antarctic landscape, smaller boats are used for shore landings. There are around 200 landing stages in the region, but 68 per cent of all shore landings are concentrated at just 15 sites. In an extreme case, this means that thousands of tourists visit one and the same site – a penguin colony, say – in a single season.

If these groups of tourists are led by qualified staff who ensure that no one strays off the path or fails to keep the prescribed minimum distance from wildlife, the environmental impacts of these shore landings generally remain within reasonable limits. However, if environmental regulations are ignored, the impacts can be severe. For example, at popular landing sites such as Half Moon Island off the northern tip of the Antarctic Peninsula, it is not uncommon nowadays for large cruise ships with more than 500 passengers on board, which are not permitted to make landings, to come in as close as possible to the local chinstrap penguin colony and to remain at the site for around an hour with their engines running so that holiday-makers can indulge in nature watching. Similar scenarios are reported from well-known seal colonies along the Antarctic Peninsula.

The scale of the disturbance (noise, exhaust fumes, obstruction) becomes even more apparent given that the high season for tourism in Antarctica coincides with the time of year when seals and penguins come onshore in order to breed, suckle their young or moult. Birds in flight are known to avoid shipping areas. Unfortunately, the members of the Antarctic Treaty System have been unable to reach agreement on a joint programme to monitor and assess the impacts of tourism-related activities. A conservation plan for the Antarctic Peninsula is currently being developed by IAATO in collaboration with the Scientific Committee on Antarctic Research (SCAR). At present, however, information about the identified impacts is published solely by the tourism industry itself or by Oceanites, a US-based non-profit organization which, however, maintains close links with IAATO.

Shipping accidents pose a major threat to the polar environment in both hemispheres. In the northern polar

5.24 > In the Arctic, the eight Arctic states share responsibility for air and sea rescue operations. Each country is responsible for a specific sector, with the other countries providing incident support under the Agreement on Cooperation on Aeronautical and Maritime Research and Rescue in the Arctic (now known as the Arctic Search and Rescue Agreement), signed in 2011.

region, especially in the eastern section of the Northern Sea Route and in the Canadian Arctic, but also in the southern polar region, there is a lack of appropriate infrastructure for effective search, sea rescue and clean-up operations.

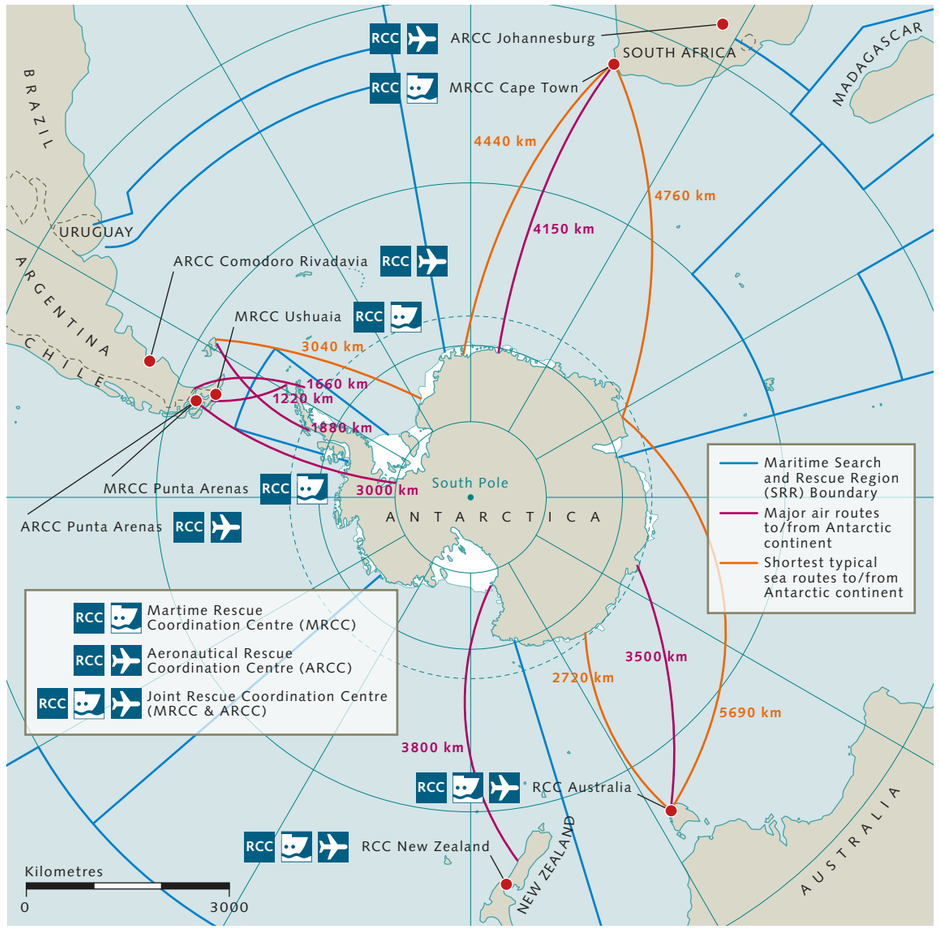
Furthermore, the Arctic regions of both Canada and Russia have only rudimentary satellite cover, making emergency communication much more difficult. Effective management of the impacts of an accident is therefore almost impossible.

The potential consequences of a shipping accident in the Antarctic were illustrated by the *Bahía Paraíso* disaster in 1989. This 131-metre vessel ran aground off the Antarctic Peninsula, spilling 645,000 litres of diesel across 30 square kilometres of sea. Although there were no human fatalities, the marine environment was badly damaged. The entire annual broods of birds such as skuas and blue-eyed shags were wiped out by oil pollution, and populations of Adélie penguins in the region collapsed.

Assistance in an emergency

In order to improve maritime safety in the Atlantic region of the Arctic, a consortium of maritime search and rescue centres, research institutes and public authorities from 13 countries formed the new Arctic and North Atlantic Security and Emergency Preparedness Network (ARCSAR) in September 2018. Their joint objective is to close gaps in the existing emergency response network and develop measures enabling the Arctic's search and rescue services to adjust to the increase in vessel traffic and passenger numbers. As air and sea rescue in the Arctic is often a coast guard responsibility, border guard units from the eight Arctic countries undertake joint incident preparedness training within the Arctic Coast Guard Forum and are involved in discussions to identify options for improving their collaboration.

The urgent need to expand emergency response capacities was demonstrated by the *Viking Sky* cruise ship incident off the west coast of Norway in March 2019. The



5.25 > Air and sea rescue in the Antarctic is managed by five maritime rescue coordination centres (MRCCs) located in Australia, New Zealand, Chile, Argentina and South Africa. However, local emergency assistance is often provided by other ships which interrupt their activities to respond to a vessel in distress.

A regulatory framework for greater safety in polar waters

In view of the increasing shipping traffic in the polar regions, the International Maritime Organization (IMO) has adopted new safety regulations. They are intended to minimize the risk of accidents and protect the environment and people in the Arctic and Antarctic regions from the adverse effects of shipping. The provisions of the International Code for Ships Operating in Polar Waters, also known as the Polar Code, have been in force since 1 January 2017 for all ships operating in the Arctic and Southern Oceans.

The code sets mandatory standards for (1) the construction of a ship, (2) its safety equipment, (3) its field of operations, (4) the qualification of the crew and (5) possible search and rescue operations, as well as establishing environmental protection precautions. It applies in addition to the International Convention for the Safety of Life at Sea, 1974 (SOLAS), which has previously regulated the safety standards for worldwide marine shipping.

To comply with the Polar Code, all ships operating in the Arctic and Antarctic seas must, for example, be equipped with technical equipment that enables them to access current weather and ice data at any time. Additional communication channels that can be used in case the satellite connection breaks down are also required, as are heated windows for good visibility on the ship's bridge, deck equipment that the crew can use to remove snow and ice (hammers, brooms, etc.), and enclosed-type lifeboats. All ships operating in the Arctic and Antarctic regions must also have enough warm survival suits on hand for every passenger, and fire-fighting equipment stored in locations that are protected from the cold and are ready for use at all times.

With regard to environmental protection, the Polar Code tightens the rules of the International Convention for the Prevention of Marine Pollution from Ships (MARPOL), which applies to all ships. The discharge of oil or liquids containing oil is strictly prohibited in the polar regions. All oil tankers must be equipped with a double hull to prevent oil leakage in the case of an accident. In addition, stricter guidelines regulate the handling of food waste, animal remains and other waste. In the polar regions, food waste may only be disposed of in the sea under certain conditions. All other waste material has to be collected and incinerated or disposed of on land at the next port call.

The regulations require ship crews to undergo special polar training. Masters, chief mates and deck officers, for example, must be trained in ship management and behaviour in marine areas with ice before they can work in the polar regions. Furthermore, the ship's command is required to always have an operation manual on hand describing exactly how the particular ship must and may be operated in polar waters. It includes, among other things, a notation of the designated polar class of the ship. The code distinguishes between three categories: A Class A certificate is issued to ships whose design permits use in areas with at least medium first-year ice, plus older ice inclusions (Polar ice classes 1 to 5). B-class ships are capable of independently breaking thin first-year ice without risk of damage (Polar ice classes 6 and 7). Class C ships can operate in polar waters where there is no ice or very little ice (with Baltic ice class or no ice reinforcement at all).

The initiators of the Polar Code touted the implementation of the new security requirements as a great success. After all, the new regulations had been in development and negotiation for almost 20 years. But the requirements do not go far enough for environmental organizations. The Polar Code does recommend using fuel in the Arctic region that is less toxic than heavy oil, but it does not yet prohibit its use. An acceptable regulation is currently being negotiated. In addition, recommendations for action regarding the handling of ballast water and organisms attached to the ship's hull are not legally binding. These are intended to prevent the ships from introducing invasive species into the Arctic.

Issues such as underwater noise, exhaust emissions and the handling of grey water have not been addressed in the new regulations. Grey water is waste water from the showers and bathrooms on board a ship. This water generally contains large amounts of chemicals (shampoo, soap), bacteria, microplastic particles (toothpaste, peeling products) and other pollutants. Cruise ships, for example, discharge a large proportion of their waste water into the sea. Environmental agencies in the USA estimate that an average ship passenger produces between 135 and 450 litres of grey water daily. In most areas of the Arctic Ocean this water may be directly discharged into the sea.

Conservationists further criticize that the rules of the Polar Code do not apply to fishing boats, private yachts with fewer than twelve passengers, and smaller cargo ships of less than 500 gross registered tonnes. Their potential damage to the environment may not be as great as if a large oil tanker were to crash. However, fishing boats make up a large proportion of the ships operating in the Arctic waters, and the number of private yachts is constantly increasing, at least in the area of the Northwest Passage.

5.26 > Although the Polar Code does not yet apply to fishing boats, it is hoped that its regulations regarding the handling of waste and garbage on ships will contribute to protecting the polar seas from increasing pollution.

ship, with 1373 people on board, found itself in distress after suffering engine problems during a storm and, as the bad weather continued, began drifting very close to the shore. The rescue service were able to evacuate around 470 people over a 19-hour period using six helicopters. The other passengers had no option but to remain on board while shipboard staff repaired the fault.

Luckily, this incident occurred close to the Norwegian coast in a region where helicopters could be scrambled and enough rescue personnel mobilized without delay. Further north – along the east coast of Svalbard, for example – it would have been almost impossible to mount this type of rescue operation as there are only two rescue helicopters stationed in the archipelago. According to media reports, however, more than 26 smaller expedition cruise ships and several large cruise ships carrying up to 1000 passengers will be operating around Svalbard in summer 2020 alone. Some of them will visit regions for which no detailed bathymetric charts exist. There is therefore a high risk of accidents.

In Antarctica, international cooperation on aeronautical and maritime search and rescue (SAR) is a more urgent necessity than anywhere else in the world. Rescue missions here, in the world's most remote region, are highly complex and therefore expensive. As there are no local rescue units, emergency assistance is generally provided by other vessels, such as station supply ships, fishing boats, cruise ships or research vessels, which then interrupt their activities in order to respond to a vessel in distress.

The five southernmost states – Australia, New Zealand, Chile, Argentina and South Africa – are responsible for coordinating aeronautical and maritime rescue in the five search and rescue areas in the Southern Ocean. They operate maritime rescue coordination centres (MRCCs) which manage any SAR operation that may be required; they also issue regular weather reports and provide other vital navigational aids for their respective SAR areas. The centres are located in Canberra (Australia), Wellington (New Zealand), Punta Arenas (Chile), Ushuaia (Argentina) and Cape Town (South Africa). Chile and Argentina also operate a joint coastal patrol (Patrulla Antártica Naval Combinada, PANC), set up in 1998. From November to March, coast guard vessels from the two countries patrol the Drake Passage and the congested waters along the Antarctic Peninsula and respond swiftly to distress calls and alerts. Their teams are trained to carry out search and rescue operations and should also take steps to protect the environment in emergencies. PANC units provided assistance, for example, during the firefighting and rescue mission when Brazil's Antarctic research station, Estação Antártica Comandante Ferraz, on King George Island burned down in February 2012.

In order to facilitate the work of the maritime rescue coordination centres, the Council of Managers of National Antarctic Programs (COMNAP) and IAATO share up-to-date shipping data with the centres. The Antarctic Treaty Parties also set up an SAR working group in 2012 and agreed to hold regular international SAR workshops, which are attended by maritime rescue coordination centre representatives, delegates from the national research programmes, spokespersons from IAATO, CCAMLR and the IMO, and commercial suppliers and service providers. Together, they discuss how aeronautical and maritime rescue can be improved and which lessons should be learned from previous operations.

Fishing in the Arctic

The Barents Sea is one of the Arctic regions in which fishing accounts for most of the ship traffic. According to the Arctic Council, up to 1600 different fishing vessels operate in the region annually. Deep-sea fishing is a key economic sector in both Norway and Russia, and a substantial proportion of the catch is exported. Obtaining precise figures on catch volumes in Arctic waters is difficult, however, as the Arctic Ocean lacks a clearly defined boundary.

The Food and Agriculture Organization of the United Nations (FAO) divides the world's seas into 19 major fishing areas, five of which cover Arctic waters. They are:

- Major Fishing Area 18 – Arctic Sea, excluding the Arctic marine waters between 40° West and 68° 30' East longitude;
- Major Fishing Area 21 – Northwest Atlantic, including the Davis Strait and Baffin Bay;
- Major Fishing Area 27 – Northeast Atlantic, including the Norwegian Sea, the Barents Sea and the waters of the central Arctic Ocean between 40° West longitude and the north island of Novaya Zemlya (to a point at 68° 30' East longitude);
- Major Fishing Area 67 – Northeast Pacific, including the eastern Bering Sea, and
- Major Fishing Area 61 – Northwest Pacific, including the western Bering Sea.

5.27 > Fishing in the cold Arctic waters has always involved hard physical labour in arduous conditions. Nowadays, however, many vessels use state-of-the-art fishing gear, making the industry much less labour-intensive.

The Northwest Pacific is one of the world's most productive maritime regions; it is also the Earth's most important fishing area, yielding a catch volume of more than 22 million tonnes of fish and shellfish annually. In the Northeast Pacific, the catch is just one-seventh of this amount (2016: 3.1 million tonnes). However, the Alaska fishing industry is an important economic sector in the North American Arctic, bringing in approximately 1.7 billion US dollars in revenues. The main species caught in the North Pacific are Alaska pollock *(Gadus chalcogrammus)*, Pacific cod *(Gadus macrocephalus)*, Pacific halibut *(Hippoglossus stenolepis)*, shrimp and Pacific salmon species such as red salmon *(Oncorhynchus nerka)*.

In Major Fishing Areas 21 and 27 in the North Atlantic, a total of 10.1 million tonnes of fish were caught in 2016, with Arctic fishing operations concentrated mainly in the ice-free coastal waters. In other words, fishing mainly took place in the exclusive economic zones (EEZs). The most important fishing grounds in the Atlantic region of the Arctic are located in the Barents Sea, the Norwegian Sea and around Greenland and Iceland. Species caught in these areas are Atlantic cod *(Gadus morhua)*, haddock *(Melanogrammus aeglefinus)*, Atlantic herring *(Clupea harengus)* and Arctic species such as capelin *(Mallotus*

The fishing ban in the central Arctic Ocean

The central Arctic Ocean is one of the few regions of the world without a commercial fishing industry. This situation will remain unchanged for the next 15 years, for in October 2018, the five nations with Arctic coastlines reached an agreement with Iceland, China, Japan, South Korea and the European Union to ban high seas fisheries in the international waters of the central Arctic.

The Agreement to Prevent Unregulated High Seas Fisheries in the Central Arctic Ocean (CAOF Agreement) protects an area roughly the size of the Mediterranean Sea from commercial fishing for an initial period of 16 years and includes the option of automatic extension every five years.

The signatory states thus aim to give the international scientific community sufficient time to study the region, covering 2.8 million square kilometres, to assess its fish stocks and to develop sustainable management strategies. Until recently, permanent ice cover on the high seas portion of the central Arctic Ocean made fishing in those waters impossible, and very little fisheries research was conducted. For that reason, little is known about the local fish populations: their size, their migration routes, habitats and predator-prey relationships. The same applies to the polar cod, which has already been heavily fished along the southern margins of its natural range.

The agreement on a fishing ban in the central Arctic Ocean was motivated primarily by the retreat of the sea ice, caused by climate change, which has led to an increase in human activity in the Arctic Ocean. Today, as much as 40 per cent of the central Arctic Ocean is ice-free in summer. This has opened up the area to shipping, and interest in fishing in the Arctic has increased.

villosus), Greenland halibut or Greenland turbot *(Reinhardtius hippoglossoides)*, northern prawn *(Pandalus borealis)* and polar cod *(Boreogadus saida)*.

In the subarctic regions of the Barents Sea and the Norwegian Sea, up to 20 species are caught, including northern krill and copepods. Fishing is of crucial economic importance for Iceland, Greenland and the Faroe Islands in particular. In the latter two cases, income from the sale of fishery products accounts for 20 per cent of gross domestic product (GDP) and almost 90 per cent of total export revenue. Arctic fishing is governed by a number of conventions and regulations, including:

- domestic legislation and regulations applicable to fishing within the various exclusive economic zones (EEZs),
- European Union fishing regulations (in the North Atlantic),
- bilateral or multilateral agreements between two or more countries with straddling fish stocks. The main fish stocks in the Barents Sea, for example, have been monitored by the Joint Norwegian-Russian Fisheries Commission since 1976. Catch quotas and fish sizes are agreed on a bilateral basis.
- measures adopted by the regional fisheries management organizations (RFMOs). In the North Atlantic, for example, the North East Atlantic Fisheries Commission (NEAFC) controls the high seas fishery and, in response to requests from Contracting Parties (Denmark, the EU, Iceland, Norway and the Russian Federation), makes recommendations on the management of stocks in the exclusive economic zones. The other RFMOs of relevance to areas of the Arctic Ocean are the Northwest Atlantic Fisheries Organization (NAFO) and the International Commission for the Conservation of Atlantic Tuna (ICCAT).
- international conventions such as the UN Fish Stocks Agreement, which entered into force in 2001 and complements the United Nations Convention on the Law of the Sea (UNCLOS). The UN Fish Stocks Agreement aims to ensure the long-term conservation and sustainable use of straddling and highly migratory fish stocks, based on a cooperative approach.

In all areas of the Arctic, catch limits and fishing periods are established and fishing licences are allocated on the basis of scientific recommendations made, for example, by the International Council for the Exploration of the Sea (ICES), specifically its Arctic Fisheries Working Group (AFWG). Every year, this Working Group performs assessments of the status of stocks of key importance for fisheries in the Barents Sea and Norwegian Sea and provides advice to the relevant management bodies, such as the Joint Norwegian-Russian Fisheries Commission.

Both national and transregional fisheries authorities with jurisdiction over Arctic waters comply with precautionary and sustainability principles. This means that the catch that can be taken from a species' stock within a specific period is such that the fish population is maintained with no decrease in productivity and no cause for concern about negative impacts on the ecosystem. There is also stringent monitoring of fish stocks; as a result, experts take the view that most fish stocks in Arctic waters are in a healthy state.

West Greenland cod is an exception, however. This stock was so heavily fished between 1950 and 1980 that the population became depleted in the 1980s and stocks have not recovered. Furthermore, over the past decade and more, Canadian and West Greenland snow crab fishers have observed a decline in catch figures. However, these decreases may be due to migration of snow crab further north as a consequence of climate change.

Also due to climate change, the habitats of many edible fish species are shifting northward towards the pole. In the Barents Sea, some Arctic fish stocks have already migrated out of reach of coastal fishers, who in consequence are now focusing on other species or merging to form deep-sea fishing consortia. In the Barents Sea region, scientists observed a good ten years ago that fewer fishers were putting to sea than previously, but the ships in operation were larger and using more up-to-date fishing gear.

Fish species composition in the Barents Sea changed during the period 2004 to 2012. Previously, it was mainly the Arctic species that ended up in the nets, such as bigeye sculpin *(Triclops nybelini)*, Greenland halibut or Greenland turbot *(Reinhardtius hippoglossoides)* and snailfish *(Liparis spp.)*. Today, the catch mainly consists of North Atlantic species that prefer somewhat warmer conditions, including the Atlantic cod, haddock and American plaice *(Hippoglossoides platessoides)*. Furthermore, non-native species such as Kamchatka crab (also known as the red king crab) *(Paralithodes camtschaticus)* and snow crab *(Chionoecetes opilio)* have spread in the Barents Sea and have proliferated to such an extent that crab fishing is now a profitable business.

Climate-related species migration is also filling the nets of fishers in Greenland, Newfoundland and Labrador with high-value edible fish from the Atlantic. Off the east coast of Greenland, mackerel fishers are now catching Atlantic bluefin tuna *(Thunnus thynnus)* as well. There has also been a substantial increase in the cod catch. In 2013, Greenland's deep-sea fishers caught 10,700 tonnes of cod, rising to 17,800 tonnes in 2017. This trend confirms scientific forecasts from 2014 that fishing revenues generated by Arctic states along the Atlantic seaboard will increase by 39 per cent from 2000 to 2050.

Spurred on by the prospect of a profitable cod and halibut fishery in future, government authorities and indigenous representatives in Canada's Nunavut territory are investing seven million Canadian dollars in fisheries research projects off the east coast of Baffin Island. Until now, the indigenous communities on Baffin Island engaged solely in small-scale subsistence fishing. A commercial fishing fleet, however, has the potential to create much-needed employment in the region. Fishing vessels from Newfoundland and Labrador are now achieving such high catch volumes off the Nunavut coast that their revenue soared from 38 million Canadian dollars in 2006 to 86 million in 2014.

While the southern Bering Sea is home to the world's most important fishing grounds, commercial fishing in the northern Bering Sea operates on a much smaller scale. Indeed, in 2009, the North Pacific Fishery Management Council, which is responsible for the US areas of the Chukchi and Beaufort Seas, imposed a ban on commercial fishing here in order to protect the fragile marine biotic communities from potentially adverse effects. Likewise, no commercial fishing is known to be taking place in the far north of Canada. In both these regions, communities are engaged in fishing solely for subsistence purposes, with fish being one of the main food sources for indigenous populations in Alaska and Canada's northern territo-

ries. Along the north coast of Canada, the main species caught are Arctic char *(Salvelinus alpinus)*, Atlantic salmon *(Salmo salar)* and broad whitefish *(Coregonus nasus)*. The total annual landed catch has amounted to approximately 800 to 900 tonnes since the mid-1990s.

Marine biologists are currently working intensively on new fisheries monitoring and management strategies as a basis for documenting species migration and climate-related population decline and for setting catch limits, including across fishing area boundaries. This reflects the fact that climate change is making sustainable management of fish stocks in Arctic and subarctic waters increasingly difficult.

Fishing in the Antarctic

Conserving and managing marine life, such as krill and fish, in the Southern Ocean is the responsibility of the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR). The sea area under its jurisdiction is bounded by the Antarctic Polar Front – the zone where the cold water of the Antarctic encounters the warmer sub-Antarctic waters – and in some places extends beyond the Antarctic Circle. It covers a total area of 35.7 million square kilometres, representing approximately ten per cent of the Earth's oceans.

The primary objective of the CAMLR Convention is the conservation of all marine living resources and ecosystems in the Southern Ocean. However, the Convention also states that the term "conservation" includes rational use of these resources. Fishing in the Southern Ocean is strictly regulated, and nature conservation should always take precedence over fishing interests. As one of the core pillars of the CAMLR Convention, the Commission establishes catch limits on the basis of scientific knowledge and applies a precautionary approach in this context. All CCAMLR members must act in accordance with the Convention and prevent the fragile marine species and ecosystems in the Southern Ocean from being damaged by fishing operations.

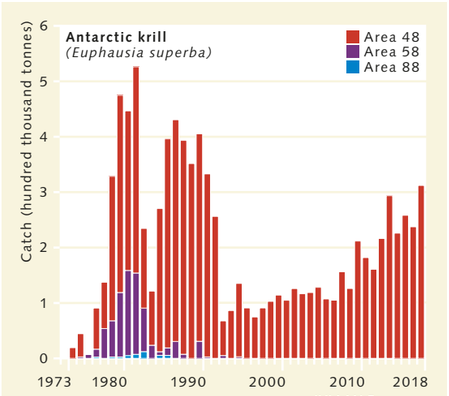
Within the CCAMLR region, there are neither fishing ports nor any indigenous populations that engage in subsistence fishing. The entire catch from Antarctic waters is landed outside the Convention Area. Fishing in Antarctica is currently limited to a small number of species, including Antarctic krill *(Euphausia superba)*, mackerel icefish *(Champsocephalus gunnari)*, Patagonian toothfish *(Dissostichus eleginoides)* and Antarctic toothfish *(Dissostichus mawsoni)*, also known as Antarctic cod. In addition, over the past year, Russia has been fishing for Antarctic king crabs *(Neolithodes yaldwini* and *Paralomis birsteini)* on a trial basis.

At present, Antarctic krill is caught almost entirely in the Atlantic sector of the Southern Ocean, more specifically in the waters west of the Antarctic Peninsula, around the South Orkney Islands and around South Georgia. The annual catch volume amounts to 200,000 to 300,000 tonnes, with Norwegian trawlers bringing in roughly 60 per cent, Chinese fishers accounting for 20 per cent and South Korean vessels landing 10 per cent. In 2017, eleven vessels were engaged in krill fishing. This decreased to nine vessels in 2018, but together, they increased the krill catch compared with the previous year. This year, the Norwegian company Aker BioMarine put a new ship into service. Custom-built for krill fishing, *Antarctic Endurance* is 130 metres in length and cost more than 140 million US dollars. It is equipped with state-of-the-art technologies that make the vessel's operation more environmentally sound and increase the efficiency of its krill harvesting.

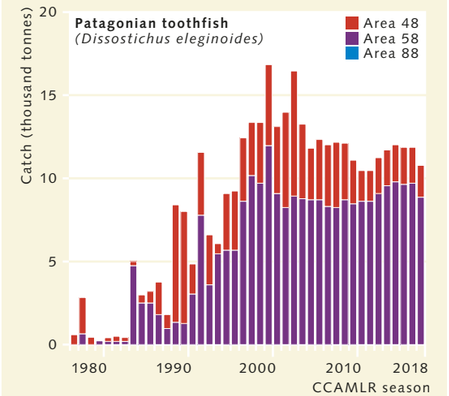
The total volume of the krill catch has been increasing for more than 20 years. In 2019, 312,989 tonnes of krill were caught – but this amount is still much lower than the catch limits set by by CCAMLR, i.e. 620,000 tonnes for the krill fishery in the Atlantic sector and 892,000 tonnes for the East Antarctic sector. At present, very little krill fishing is conducted in this latter sector. CCAMLR has been attempting for some years to revise these catch limits on the basis of new scientific data, also to take into account the potential impacts of climate change on Antarctic krill stocks.

Like krill, mackerel icefish is caught with nets. This is a target species for fishers on the shelf waters of South Georgia and Heard Island, whose annual catches of this

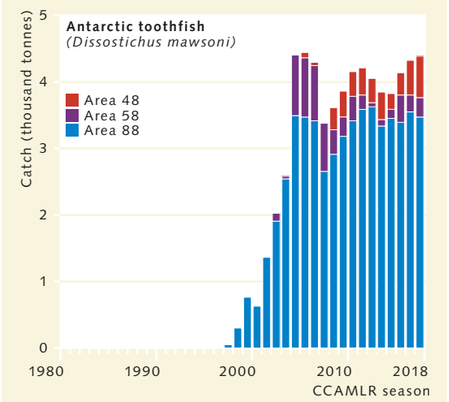
5.28 > Economic development in the Arctic regions is changing the lives of indigenous communities. Snowmobiles, cars and air travel are now just as much a part of their daily lives as traditional seal and snow goose hunting, as this wall hanging in the museum in Iqaluit, Canada, shows.



5.29 > Antarctic krill is mainly caught in the Atlantic sector of the Southern Ocean. Catch volumes have been rising continuously for some years, partly because the omega-3 fatty acids extracted from krill are used as a food supplement.



5.30 > Patagonian toothfish *(Dissostichus eleginoides)* are caught using bottom-set longlines in depths of 1200–1800 m. The fishery is strictly regulated and monitored by CCAMLR. The catch limit set for this species for 2018 was 2600 tonnes.



5.31 > The Antarctic toothfish *(Dissostichus mawsoni)* is a close relative of the Patagonian toothfish and is caught in exploratory fisheries in some regions. This means that catch limits are reviewed annually by CCAMLR's Scientific Committee and Working Group on Fish Stock Assessment.

species amount to 400 to 500 tonnes. The fishing vessels mainly come from Great Britain (57 per cent) and Australia (25 per cent).

Patagonian toothfish, on the other hand, is generally caught using longlines in depths of 1200 to 1800 metres. Longlines vary in length from three to ten kilometres and have thousands of baited hooks attached at intervals. French, British and Australian vessels set longlines around South Georgia and in several areas in the Indian sector. The total catch amounts to 11,000 to 12,000 tonnes per year. By contrast, the Antarctic toothfish catch is around a quarter of this figure. Antarctic toothfish is caught using longlines by fishers from Korea, New Zealand, Britain, Russia, Spain and Ukraine. The fishing grounds are located in the Atlantic and Indian sectors of the Southern Ocean and in the Ross Sea.

Both species of toothfish grow to up to two metres in length and reach 60 to 80 kilograms in weight. They are slow-growing species, only reaching sexual maturity at eight to ten years of age, and have a potential lifespan of 45 to 50 years. These characteristics make both species highly vulnerable to overfishing. With a temperature tolerance limit of just two degrees Celsius, the Antarctic toothfish is also endangered by climate-related warming of the Southern Ocean.

Russia is currently the only country to fish for king crabs *(Neolithodes yaldwini* and *Paralomis birsteini)* in the Pacific sector of the Antarctic. Although this takes the form of a small-scale trial, the damage to the environment is considerable. Like lobster, individuals are caught in pots, each measuring 1.5 metre in diameter. Some 120 of these pots are attached to a weighted line. To make it easier to pull in the line, buoys are attached at one end and drift on the water surface. These marker buoys can easily become snagged on icebergs or ice floes, which then drag the entire line, with the weights and pots attached, for many miles across the ocean floor, destroying the fragile biotic communities on the seabed. For this reason, Germany and other CCAMLR states are currently lobbying for CCAMLR to ban this fishery.

It is the Commission (CCAMLR), at its annual meetings in Hobart, Tasmania, that determines where and to what extent fishing operations are permitted in Antarctica. Decisions are adopted by consensus, which means that any CCAMLR member is in a position to veto measures, such as the establishment of marine protected areas (MPAs), that do not accord with its interests. Nevertheless, the Commission has introduced far more stringent controls on fishing in the Antarctic in recent years to monitor compliance with agreed catch limits and closures and reduce illegal fishing.

Closures include a seasonal restriction on longline fishing, which may only take place in winter (in certain fishing grounds), and special measures to reduce bycatch of seabirds such as albatrosses and petrels. The birds often follow the longline ships, swallow the baited hooks when the lines are being set and are then dragged under water, where they drown.

In the early days of Antarctic longline fishing in the 1980s and 1990s, so many seabirds died on the longlines that some populations declined by as much as 40 per cent. As a result, some species of albatross are now critically endangered.

The conservation measures agreed by CCAMLR are proving effective, however. Weighting the lines to propel them to greater depths more quickly, attaching fluttering ribbons to scare the birds away and requiring longlines to be set at night have resulted in a sharp drop in seabird bycatch. Compared with the early 1990s, when longline fishing in the Convention Area caused more than 6000 seabird deaths each year, the figure is now less than ten birds annually, even though the number of longlines and hooks in use in the Southern Ocean has increased in recent years.

In the 1990s, illegal fishing for Patagonian and Antarctic toothfish also increased. Illegal fishing generally involves the use of extremely damaging deep-sea gillnets, which are banned throughout the Convention Area. The market for Patagonian and Antarctic toothfish is highly lucrative: depending on supply and demand, prices can range from ten to 20 US dollars per kilogram, sometimes much more. Toothfish is marketed as Chilean sea bass, mainly in North and South America but also in some Asian and European countries.

The CAMLR Commission has introduced a rigorous reporting and monitoring system in order to curb illegal fishing – with some success. In 1996, an estimated 30,000 tonnes of toothfish were landed illegally, but this fell to less than 1500 tonnes in 2014. There are now only isolated signs of illegal fishing activity. However, researchers report that as a result of overfishing in the 1990s, some toothfish stocks became depleted and have not yet recovered. They mention the stocks around Prince Edward Islands, on the Kerguelen Plateau and on the Banzare Bank in the Indian sector of the Southern Ocean (58° 50' South and 77° East) as examples.

New tensions in the Arctic?

Economic development in the Arctic offers new opportunities for international cooperation, but according to some observers, it may also raise security concerns – for example, because some Arctic states are expanding their military presence here due to NATO members' growing scepticism towards Russia since its annexation of Crimea, or because the renewed trade dispute between the US and China makes negotiations on Arctic issues more difficult. Global politics, observers say, directly influences – and in some cases hinders – cooperation among the Arctic states.

Other researchers emphasize that there is no empirical evidence for this spillover effect. They point out that far fewer troops are stationed in the Arctic today than during the Cold War, and that the deployment of military units in the Arctic is not generally a response to a perceived threat to the coastal states' national security. The Arctic states, they say, are more concerned with guarding the length of the newly exposed border – previously well-protected by ice – especially since the number of Arctic actors and vessel operations have increased. They also point out that military personnel are involved in aeronautical and maritime search and rescue (SAR) missions and that for Russia, the deployment of military units is a way of supporting development of infrastructure in remote Arctic regions.

In recent years, the Russian government has invested substantial sums in constructing and expanding its mili-

tary bases along its Arctic coastline. A new army base has been established in Franz Josef Land, for example. According to a statement by the Russian government, the military is needed in the Arctic in order to protect shipping on the Northern Sea Route and other economic activities. However, the US government under President Donald Trump believes that US security interests are under threat from the presence of the Russian military in the Arctic and from the close economic cooperation between Russia and China. The US armed forces have announced plans to increase their naval patrols in Arctic waters. In 2020, the US also intends to modernize a military air base in Iceland, from which the US military withdrew in 2006 and which it now uses solely for occasional reconnaissance flights.

Despite these developments, German observers do not consider political cooperation in the Arctic to be at risk. In their view, Arctic cooperation is well-institutionalized and based on international rules that are recognized by all parties, and has proved to be extremely efficient and effective thus far. They consider that calls for new Arctic security institutions – voiced at the Roundtable on Arctic Security at the Munich Security Conference, for example, focus too much attention on the topic. As a result, the issue of security could ultimately overshadow existing cooperation formats, potentially giving impetus to the very factors of insecurity that should be resolved. In light of the dramatic changes taking place in the Arctic, international partnership and cooperation in the northern polar region are now more important than ever, observers say.

An example of what cross-border inter-alliance cooperation in the Arctic can look like was provided by Russia and Norway in May 2019, when coast guards and search and rescue units from these two neighbouring countries teamed up for a day of joint SAR training in the Barents Sea. The units practised finding people in distress at sea and conducted an oil-spill clean-up exercise.

5.32 > The Arctic states conduct joint air and sea search and rescue (SAR) exercises on a regular basis to ensure effective cross-border cooperation and optimal protection of human lives and the environment in emergencies.

Conclusion

Growing interest in the polar regions

Perceptions of the polar regions have changed fundamentally in recent decades. Once, these largely inaccessible regions mainly attracted seal hunters and whalers. Now, however, in the wake of climate change, there is growing international interest in exploring the Arctic and Antarctic and in tapping the potential of both polar regions for various forms of commercial exploitation. Consequently, membership of policy-making organizations is growing, along with the need for more regulation and consensus. Some traditional polar nations are adopting a more protectionist stance, making the process of reaching compromises more difficult in the Arctic and Antarctic alike.

In Antarctica, which is under the joint administration of the Consultative Parties, the principle guiding all activity is to preserve and protect the only region of the world dedicated to peaceful cooperation and research. The Antarctic Treaty and related environmental agreements restrict the use of Antarctica to research, sustainable and now strictly controlled fishing, and tourism.

The Arctic territories, by contrast, fall within the jurisdiction of the individual Arctic states. These states have a legitimate interest in promoting the economic development of the hitherto sparsely populated regions. Most Arctic nations, especially Russia, are now giving greater attention to resource extraction and shipping, for the Arctic is resource-rich: according to one study, the region north of the Arctic Circle holds approximately 22 per cent of the world's undiscovered oil and natural gas. Large deposits of coal, iron ore, rare earths and other minerals are also to be found here. The extraction of these resources will become more lucrative in future as demand for them increases and the retreat of the ice opens up access to the northern regions.

However, the very substantial resource wealth has also led to territorial disputes among the Arctic coastal states. These disputes have smouldered for decades in some instances and are still only partially resolved. The bounty of the polar regions is also attracting interest from distant non-Arctic countries, notably China. Such countries are attempting to secure access rights and to have a say over the future of the Arctic by entering into bilateral agreements with Arctic states. Their strategies further involve investing in resource extraction and greatly increasing their engagement in the Arctic Council.

Resource extraction is accompanied by an increase in shipping in Arctic coastal waters. In the tourism sector, the cruise industry is also experiencing growth, with the number of ships and trips rising steadily. In order to minimise the attendant risk of maritime accidents, all vessels operating in polar waters must comply with the Polar Code, which prioritises prevention. Shipping in both polar regions is, as ever, a high-risk business due to the low temperatures and rapidly changing ice and weather conditions. If a vessel gets into difficulty, it can take a very long time for help to arrive, especially in the Antarctic.

A precautionary approach, combined with sustainability principles, must be the benchmark for these and all other areas of human activity in the polar regions. The Arctic and, indeed, some areas of Antarctica are radically changing due to climate change, and this puts great stress on local biotic communities and natural processes. Humankind must therefore do all it can to minimize its footprint in these highly fragile regions, not increase it through the reckless pursuit of profits.