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# The International Northern Sea Route Programme (INSROP): applicable lessons learned

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ABSTRACT. The ecosystem-management approach laid down in the *Arctic Council Marine Strategic Plan* (AMSP) was not started on an empty purse. Some of the integrative (interdisciplinary) concepts of the International Northern Sea Route Programme developed during the period 1993–99 may prove useful in making the AMSP a document of operational utility and significance. The INSROP analysis was designed around two counterveiling variable: obstacles to and promoting factors of increasing navigation. These variables were applied for analysis to interactive relationships such as ice conditions and commerciality, ship design and depth conditions, sailing season and ice conditions, regional development and transit trade, environmental challenges and economic activities, military and economic activities, international ocean law and the NSR, insurance and navigation, and native cultures and navigation. The analysis of these relationships gave rise to integrative concepts like aggregated hot spots, issue-specific hot spots, cool spots, socio-biodiversity, single-value navigation, and multi-value navigation, all of which have a bearing on the realisation of the overarching aim of AMSP: to minimize the impact of navigation on the environment by integrative approaches across environmental, socio-economic, political, cultural, and other sectoral realms.

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## Introduction

In discussions of the multi-faceted challenges of future Arctic marine transport, three categories of lessons gained from the International Northern Sea Route Programme (INSROP) should require careful consideration. The first, relates to the planning, funding, and implementation process of the program, spanning the period from 1988 to 1993; the second deals with the conduct, premises, substance, and outcome of research in the period 1993–99; and the third addresses the interaction of science and politics in the post-Cold War Arctic from 1988 to 1999 (Østreng, in press). Any of these contains significant lessons of relevance to the ongoing development of an Arctic Marine Strategic Plan (AMSP), the AMAP Oil and Gas Assessment, and the proposed PAME-led Arctic Shipping Assessment.

Due to restrictions of space, a brief depiction of the outcome and premises of research is addressed here and assessed in light of the guiding principles of the third draft of the *Arctic Council Marine Strategic Plan* (Arctic Council 2004). To put the focus of this paper into its proper context, a brief presentation of the INSROP-programme is given.

## The beginning of INSROP

On 1 October 1987, Secretary General Michael Gorbachev made a speech in Murmansk in which he spoke in favour of promoting international collaboration in the Arctic. He specifically mentioned the possibility of inviting international shipping to ply the traditionally guarded and monitored waters of the Northern Sea Route (NSR) on certain political preconditions. The following year, Soviet authorities acted upon Gorbachev's invitation and asked the Fridtjof Nansen Institute in Norway to organise an international research program on the navigational challenges of the NSR. Five years later — in 1993 — the Central Marine Research and Design Institute (CNIIMF) in St Petersburg, the Ship and Ocean Foundation (SOF) in Tokyo, and the Fridtjof Nansen Institute (FNI) signed an 'Agreement for Research Cooperation.' The purpose of this was to build up a scientifically based foundation of specialised and integrated knowledge encompassing all relevant aspects related to navigating the NSR, so as to enable public authorities and private interests to make rational decisions based in scientific insight.

To this end, INSROP was organized as a five-year multidisciplinary and multi-national research programme split into four sub-programmes: I. Natural Conditions and Ice Navigation; II. Environmental Factors and Challenges; III. Trade and Commercial Shipping; and IV. Political, Legal, Cultural, and Military-Strategic Factors (Fig. 1). These sub-programmes were subsequently split into104 different projects conducted by 318 researchers from 69 different institutions in 10 countries on three continents. Altogether a total of 167 working papers — 14,500 pages of scientific text — were published and peer-reviewed by 85 independent polar specialists. Special mention should be made of the production of a *Dynamic environmental atlas for the Northern Sea Route* and a *Geographical*

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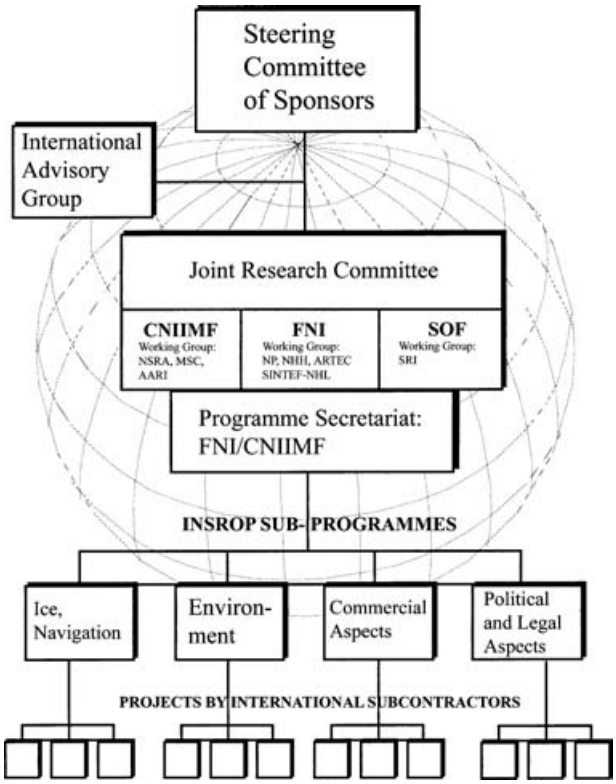



Fig. 1. INSROP organisational chart. Source: Østreng 1999a.

*information system* CD, containing information from all four sub-programmes, including a software program to present and integrate the information in a manner relevant to the users (INSROP Secretariat 1999). To keep the program on track and to secure scientific quality and user relevance of research, an International Evaluation Committee (IEC) was appointed in 1995 to provide critical advice and guidance (International Evaluation Committee 1996). The same year, INSROP received the runner-up award in the category of 'innovation' at the annual Sea Trade Awards Ceremony in London. At the completion of the programme in 1999, the total bill amounted to something in the vicinity of NOK 70 million, funded by the Nippon Foundation/Ship and Ocean Foundation; several Norwegian sponsors, including the Norwegian Research Council and the Royal Norwegian Ministry of Foreign Affairs; and the Russian Federation.

## The outcome and premises of INSROP research

INSROP took historic winter conditions — not the extraordinary retreat and weakening of sea ice in recent decades — as a prime parameter in assessing the navigational future of the NSR. This worst-case approach was chosen to avoid lingering uncertainties still associated with the question of whether the changes in the sea ice regime are caused by global anthropogenic warming, natural cyclical variations, sun activities, or combinations of any of the former. On this backdrop, INSROP was designed around two opposing variables: (1) obstacles to increasing utilisation and (2) factors that promote increasing utilisation. The following are some of the relationships identified and analysed.

### Ice conditions, transit speed, and commerciality

Calculations have indicated that if ships can maintain an average speed of 11–13 knots, this will, under certain preconditions, make the NSR economically competitive with the Suez and Panama canals for transit voyages between the Atlantic and Pacific and visa versa (Wergeland 1992).

*Obstacles*: By late winter, 62–86% of the areas of all regions of the route are covered with thick first-year ice. In January, ice mean thickness in all NSR regions is 150 cm or less. The prototype NSR ship, SA-15, can operate continuously in 80 cm level ice at a speed of 5 knots, but in thicker ice it can maintain no more than 2 knots astern of *Arktika*-class nuclear icebreakers. The simulation study undertaken by INSROP shows that the three projected new ship designs (25,000 dwt, 40,000 dwt, and 50,000 dwt bulk/containers, respectively) can make an average speed in winter of 4–7 knots (INSROP 1999). Unless speed can be increased substantially, this will rule out the NSR as an economically feasible alternative to the Suez and Panama canals for transit voyages.

*Promoting factors*: In the early 1980s, a Japanese design study of a 200,000 dwt icebreaking supertanker was made for transporting crude oil from the Arctic to Japan on a year-round basis. This tanker was designed to operate at 5 knots in 6 feet of ice (Fujita and others 1986). Kværner Masa Yards has designed a 90,000 dwt Double Acting Tanker (DAT) that offers at least the same efficiency as any non-Arctic tanker with the exception of the high icebreaking capability, and that can be used throughout the NSR (Kværner Masa Yards 2000). The speed data have not been published, but experts assume it to be in the range of 10 knots in thick first-year ice. In winter 2003, the DAT was tested in ice ridges 15 m deep without aving problems getting through (Brigham and Ellis 2005). Improvements in ice-breaking technology have allowed relatively small icebreakers (9500 horsepower) to move through 1.2 meters of ice with a speed of 8 knots without having to stop. Developments in ship design certainly suggest speeds approaching what would be required to make the NSR a worthy competitor on a year-round basis to the Suez and Panama canals.

### Ship design and depth conditions

The broad and shallow continental shelves of the NSR present, along with winter ice conditions, unique constraints to marine transportation in the Arctic.

*Obstacles*: INSROP studies indicate that if a cargo vessel is required to call at NSR ports, draught and breadth will be limited to 9 m and 30 m, respectively, with cargo capacity probably restricted to 20,000 dwt. For a more northerly route (without port calls), a maximum draught of 12.5 m and a breadth of 30 m can yield a maximum cargo capacity of 50,000 dwt. These ships are approximately one-third the size of those sailing the Suez Canal. This is thus an obstacle related to transit sailings alone.

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*Promoting factors*: To improve on and eventually overcome the ice and depth limitations of the route, two options are available: intensified dredging to achieve better depth conditions, or building bigger ships than those anticipated in INSROP studies, with draughts adopted to existing depths. The Japanese Ship Research Institute in Tokyo conducted trials in the 1980s applying available shipbuilding technology to construct an icebreaking oil tanker of 200,000 dwt, possessing a cargo capacity of 240,000 $m^3$ with a draught of 20 m and a breadth moulded at waterline of 52 m (Fujita and others 1986). This ship can technically be built with a draught of only 11 m (H. Kitagawa, personal correspondence 1991). In comparison, the draught of Russian nuclear icebreakers — operating in all NSR regions — is about 12.5 m, whereas the USCG Polar Class icebreaker has a draught of 9.7 m.

**Sailing season and ice conditions**

For the NSR to be an attractive commercial transit alternative to other routes and modes of transportation, year-round sailings seem a prerequisite to justify the extra investments in ice-class ships.

*Obstacles*: At best, the whole route can only be employed for up to six summer months a year due to heavy ice conditions. In terms of navigability, the eastern part of the NSR is a more complicated and extreme ice system than the one in the western region. Year-round navigation has been achieved only in the Kara Sea since 1978.

*Promoting factors*: If reductions of sea ice are caused by global warming — which scientifically cannot be excluded, albeit not yet absolutely confirmed — navigational conditions in the eastern section will improve. As an illustration, since 1980, the September sea-ice extent in the Beaufort and Chukchi seas has been 25% below the prior minimum value over a 45-year period (Huntington 2000). That said, improvements in ship design and associated activities represent the only safe course of action for extending the sailing season. As has been concluded: 'Improved sea-ice monitoring and communications will continue to enhance operations along the NSR' (Brigham and others 1999). Improvements in ice breaking are another option. An example: Thyssen Nordseewerke constructed a new bow for the Soviet icebreaker *Mudyug* as early as in 1986. After this, *Mudyug* managed to move through 1.2 meters of ice at 8 knots without having to stop. This result exceeded what the Germans and the Soviets had expected. Two notes of caution should be mentioned, however. First, this bow construction is more effective against fast ice than pack ice. Second, *Mudyug* was equipped with an engine providing 9500 horsepower as against 75,000 horsepower for the giant nuclear icebreakers. Russian plans are to increase the force of a new generation of icebreakers to 110 megawatts, that is, 165,000 hp. The effect of the combination of brute force and new bow and hull construction, combined with air-bubble systems and hosing of the cutting edge, is not yet fully known. But most probably, major icebreaking advantages can be gained. In the late 1980s the expectation was that an increase of at least 20% in the current ice-breaking capacity was within realistic reach (Kjerstad 1990). Western experts assume today that new innovations in icebreaking technology are more important to the future of Arctic navigation than the brute force alternatives relied on thus far (Brigham and Ellis 2005).

**Regional development and transit trade**

All-year utilisation of the NSR may stem both from regional exploitation of resources and transit trade.

*Obstacles*: Trade along the NSR has fallen far short of expectations about the potential of the region. While transit time via the NSR is shorter in summer and time-related costs are thus lower than on alternative routes, its attraction to shippers are offset by other factors. Low costs, albeit desirable, are not necessarily as important to many shippers (especially line operators) as logistical effectiveness, that is, reliability and punctuality of service. According to INSROP researchers, punctuality and reliability cannot be guaranteed for the time being (Tamvakis and others 1999). The application and uncertainty around tariffs is another key issue identified to which the investment criteria and financial gains must be balanced (Ramsland 1999). Furthermore, large-scale use of the NSR will not develop on the basis of single nations and fleets, but will most probably need the interaction of governments, the shipbuilding industry, and the shipping market itself to be realised. Such an international pooling of resources and a reliable and stable political and legislative framework are lacking, as are a reliable operational environment.

*Promoting factors*: INSROP-researchers indicate that there are private interests outside of Russia that could take the initiative to invest in projects along the NSR, provided the necessary frameworks and operational environments were in place. Moreover: 'given the right conditions, [the NSR] can provide the shrewd investor with considerable profit-making opportunities' (Tamvakis and others 1999). As has been concluded: 'The resources are there, the technology is available, but the remoteness and extremities of the NSR can only be tackled by a state that is ready to contemplate and support strategic projects' (Tamvakis and others 1999).

**Environmental challenges and economic activities**

To preserve the uniquely fragile Arctic environment is one of the most compelling challenges associated with an increasing utilisation of the NSR.

*Obstacles*: The Arctic environment is exposed to contaminants and stresses in various modes, from inside and outside of the region. It is the cumulative effect — the sum of the stresses from individual sources — that provides the overall impact and significance to the environment. The organisms and ecosystems of the Arctic are not necessarily more vulnerable than those of other regions. Their adaptations have made them robust and resilient to natural disturbances and harsh climatic conditions. Their

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vulnerabilities lie primarily in the fact that several of the very adaptations that function successfully in their natural environment also render Arctic organisms particularly sensitive to certain human impacts. Increased sailing frequency will inevitably increase the risk of ship accidents and large-scale oil spills, which will have deleterious impacts on the marine environment. The most vulnerable period is assumed to be during the most productive season, that is, late spring/summer, which also corresponds to the most frequent sailing period. In this period, vulnerable natural resources are spread all over the NSR area. This makes winter navigation an attractive option.

*Promoting factors*: Except for ports, harbours, shipyards etc, there is no historical evidence that navigation itself has a significant impact on the marine environment. Although sailings along the NSR have been carried out for decades, there is no evidence that the large-scale trends of some declining ecosystem component populations have been caused directly by ships. The Arctic, including the NSR, is still a relatively clean environment. This means that developments in the Arctic today are offered a unique opportunity to plan for environmental concerns in advance. Several measures have been suggested, among them: the implementation of recommendations on mitigating measures stemming from the checklist of the World Bank, monitoring radioactive pollution in line with international conventions, complying with IMO guidelines for preventing the introduction of unwanted aquatic organisms, implementation of a vessel traffic-management system for ports and loading facilities, vessels keeping clear of nature conservation areas, and avoiding the use of anti-fouling paint containing organotin compounds. In addition to all of these, the NSR Environmental Assessment and Planning System for environmental screening should be applied (Moe and Semanov 1999). The same goes for the environmental measures of Particularly Sensitive Sea Areas to be applied in cooperation between the International Maritime Organization (IMO) and coastal Arctic states (Roberts and others 2005).

## Military and economic activities

*Obstacles*: Throughout the Cold War, a persistent and widespread belief was that the NSR served three important military purposes for the Soviet Union: first, as a transfer link of naval units between the Atlantic and the Pacific and vice versa; second, as a station area for strategic submarines (SSBNs); and third, as a militarised surveillance area. Since issues of high politics (national security) usually take precedence over those of low politics (other areas of national politics), the former ruled the day and acted to impede foreign access to the route. This was the case throughout the Cold War. Economic activity yielded to military–strategic needs whenever a collision was perceived. The obstacles in this respect were not the actual use of the route, but the perceived use of it.

*Promoting factors*: When it comes to naval transfers between the Pacific and Atlantic fleets, Russian sources admit that ice-conditions along the route rule out year-round operations of warships and that 'the transference of Russian warships . . . has nearly stopped.' This is because limitations to navigation in ice are greater for warships than for civilian cargo vessels that are ice-strengthened. Warships are constructed with thin hulls due to speed requirements. During the Cold War, every third warship, while on route, had to be repaired due to damage of ice pressure, and non-manoeuvrable ice conditions forced the ships of every fifth naval convoy to spend the winter in Arctic waters (Yakovlev and others 1997). This explains why the NSR was never used for operation and battle training by Soviet surface warships. These facts indicate that naval convoys transiting the route reduced rather than enhanced the overall naval effectiveness and military preparedness of the USSR.

Submarines experience severe limitations in manoeuvring ability through the restricted underwater spaces between deep extending ice and the extremely shallow waters covering the continental shelf off Siberia. The latest generations of SSBNs (Delta and Thypoon) are simply too large to operate in most of these areas. The operational space needed for SSBNs between the surface (ice) and the sea floor has been estimated to approximately 180–200 m. The Kara, East Siberian, and Chuckchi seas all have average depths less than 100 m. In these seas, a modern strategic submarine resting on the sea floor will have its tower protruding above sea level. Thus, in the Arctic Ocean the most suited year-round deployment areas for strategic and cruise missile submarines are the deep Marginal Ice Zones and the Central Arctic Basin with depths of thousands of metres.

The militarization of land areas adjacent to the NSR following the outbreak of the Cold War might, indirectly, have affected the freedom of navigation along portions of the route. As indicated by a Russian INSROP-researcher: 'The militarization of the Arctic inevitably posed serious obstacles for multinational use of the NSR' (Granberg 1991). According to this assessment, the military kept a close eye on civilian economic activity and multi-national use of the route. Fear of espionage and collisions of interests were the driving forces behind this vigilance. Today this fear has no substance, in that military satellites are better platforms of espionage than the decks of civilian vessels passing through these waters. In all these instances, the NSR holds a civilian, not a military potential. This is also why the NSR was opened up to international shipping 1 July 1991. Thus, military–strategic interests cannot be evoked convincingly as a valid and reliable impediment to increasing civilian and international use of the NSR in the future (Østreng and others 1997).

## International ocean law and the legal status of the NSR

The AMSP is supposed to reflect the internationally accepted principles of the United Nations Third Convention

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on the Law of the Sea of 1982 (LOS Convention)(Arctic Council 2004). This despite the fact that only one article — Article 234 — out of a total of 320, deals explicitly with ice-infested waters. The legal status of sea ice has achieved no exact or explicit clarification in the LOS Convention, apart from being referred to as an object warranting the coastal states the right to unilaterally adopt and enforce environmental provisions in ice-covered areas of the Exclusive Economic Zone (EEZ).

*Obstacles*: The legal status of the NSR has for decades been one of the most contentious political issues in US–Soviet/Russian Arctic relations. The United States labels the ice-covered straits of the route international and subject to the right of 'transit passage,' while Russia claims that they are internal waters under several theories, including historic waters closed by straight baselines (Brubaker and Østreng 1999). Legally speaking, the two states apparently are on opposite extremes, not least when it comes to the interpretation of Article 234 of the LOS Convention. Russia invoke article 234 as an additional measure justifying its claims to control over its maritime waters, whereas the United States views the article only as a means of providing protection for the marine environment. Both parties invoke national security as a prime justification for their respective stands, and lean on the fact that the legal status of sea ice remains undecided in international ocean law (Olenicoff 1972), making article 234 an easy bone of contention.

*Promoting factors*: In the assessment of INSROP researchers, the US has maintained its opposition towards the Russian position not because of potential naval usefulness of the route, but because it relates 'to global macro-strategic interests in regions far removed from the NSR itself.' It is not the NSR that bothers the US government, but the Russian regime that may create precedence and impede naval mobility in strategically more important southern waters. In this perspective the Arctic has become a display field of interests extending beyond the region itself. What would make sense in this perspective is that the parties enter into a tacit agreement, whereby the US maintains its official opposition to the regime, but tacitly agree to comply with Russian regulations and laws (Østreng 1999c). Such regimes have been established and are still in function in Arctic waters, serving useful purposes of conflict reduction and coexistence.

**Insurance and navigation**

The risks associated with Arctic shipping are unique. Marine insurance to cover these risks has developed somewhat, but not to the point where ice risks are a matter of routine in an insurance policy. The NSR is largely an unknown frontier to the western insurance industry, which leads to higher, across-the board, per-unit premiums (Torrens 1993).

*Obstacles*: When it comes to marine insurance, there was little indication at the time of INSROP that international shipping companies were considering the use of the NSR, particularly for high-value vessels. Such vessels are generally not constructed for navigation in ice. Furthermore, the shipping industry had yet to carry out its own economic analyses of the actual economic advantages of the route. Although limited low-value, bulk-cargo operations may have been considered, it was unlikely that even such operations would take place on a year-round basis. It was also likely that marine insurers would require ice-strengthening for navigating the NSR at any time.

*Promoting factors*: A main conclusion drawn by INSROP on marine insurance is that the international insurance market will be willing and able to underwrite NSR risks. Marine insurers have time and again proven their innovativeness and responsiveness to the demands and requirements of the shipping industry. In that respect NSR risks will be treated no differently, but the insurers will require further development of the database assembled by INSROP. Among other things, marine insurers will require their own studies undertaken by the Salvage Association and instructed by the Joint Hull Committee of the Institute of London Underwriters. In other words: if shipping wants to use the NSR, insurers will provide the necessary risk coverage (Gold 1996).

**Native cultures and navigation**

Increasing shipping along the NSR will be associated with resource extraction on land and in the sea, and with two-way commodity flows between the Atlantic and Pacific. The industrial costumers of the NSR are southerners. There are many examples of modern market economies impacting negatively on subsistence economies. In the Russian north, there are already traces of radioactive pollution of pastureland, loss of pastureland areas, cutting off of reindeer migration routes, depletion of wildlife, pollution from industry and mining activities, and increasing likelihood of ship accidents and ocean pollution. History has shown that industrial preferences are likely to gain the upper hand in any conflict of interests with the subsistence cultures (Dallmann 1997).

*Promoting factors*: Despite the likelihood of clashes between the two principal economies, native communities may also benefit from increasing shipping. First, it may give native products (fish, fur, reindeer products, and handicrafts) better access to commercial markets — local, national, and even international. Second, it may channel some of the revenue accruing from NSR transportation to subsidise the more remote areas of the north, for instance in supplying heating, electricity, and goods. The overall challenge is to strike a balance between the interests of the two cultures, with the aim of sustaining both, not least through positive interactions (Boyakova and others 1997). The following steps were suggested to correct the situation: first, new and extended legislation with considerable respect to indigenous land use (Sokolova and Yakovlev 1996), and, second, effective law enforcement and implementation of environmental regulations. Most important of all, the indigenous societies need to be part of the process of creating the framework for development,

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Table 1. Qualitative assessment of the geographical location of various spots along the NSR. Numbers in parentheses reflect the parameters involved in navigation.

| Spot | | Kara Sea | Laptev Sea | East Siberian Sea | Chukchi Sea |
|---|---|---|---|---|---|
| Cool spots | | Area between polynyas in the south and 75°N (ice massifs) | Area north of the polynyas and southeast of the Taymyr ice massif | Seasonal | |
| Issue-specific Hot spots | Accessible | Polynyas – ice edges<br>Sheltered bays and gulfs<br>Southwest coast<br>Indigenous homelands<br>Reindeer migration routes across rivers | Polynyas – ice edges<br>Estuary of Khatanga<br>Shoreline west of Ust-Olenëk<br>Indigenous homelands<br>Reindeer migration routes across rivers | Eastward-facing shoreline of the New Siberian Islands<br>Wrangel Island | Chukchi ports<br>Bering Strait (summer)<br>Indigenous homelands |
| | Inaccessible | Novaya Zemlya ice massif<br>Severnaya Zemlya ice massif<br>North Kara ice massif | Taymyr ice massif<br>Yanskiy ice massif | Wrangel ice massif<br>Ayonskiy ice massif<br>New Siberian ice massif | Wrangel ice massif |
| Aggregrated hot spots | Accessible | Matochkin Shar Strait (2) (summer)<br>Vilkitskiy Strait (3) (summer)<br>Kara Gate Strait (3) (all year)<br>Yugorskiy Shar Strait (3) (all year)<br>Kara ports (3) (all year) | Sannikov Strait (4) (summer)<br>Laptev Strait (3) (summer)<br>Ports (3) (summer) | Long Strait (3) (summer)<br>East Siberian ports (3) (summer)<br>Shoreline from the Laptev Strait to the Long Strait (2) | Southern part of the sea (2) |
| | Inaccessible | Vilkitskiy Strait (4) (winter)<br>Matochkin Shar Strait (2) (winter)<br>Fast ice area from Dikson To Vilkitskiy Strait (2) (winter) | Sannikov Strait (4) (winter)<br>Laptev Strait (4) (winter) | Long Strait (3) (winter)<br>East Siberian ports (3) (winter) | Bering Strait (2) (winter) |

Table 2. Ranking of spots in terms of number and types of parameters involved in navigation.

| Spots | Type of spots | Number of Parameters | Types of parameters | Content of parameters |
|---|---|---|---|---|
| Vilkitsky Strait | Aggr. hot | 4 | Natural and societal | Ice, depths, environmental, legal/political |
| Sannikov Strait | Aggr. hot | 4 | Natural and societal | Ice, depths, environmental, legal/political |
| Laptev Strait | Aggr. hot | 4 | Natural and societal | Ice, depths, environmental, legal/political |
| Kara Gate Strait | Aggr. hot | 3 | Natural and societal | Ice, depths, legal/political |
| Yugorskiy Shar Strait | Aggr. hot | 3 | Natural and societal | Ice, depths, legal/political |
| Matochkin Shar Strait | Aggr. hot | 3 | Natural and societal | Narrowness, ice, environment |
| NSR ports | Aggr. hot | 3 | Natural | Depths, environment, technical |
| Long Strait | Aggr. hot | 3 | Natural and societal | Ice, environmental, legal/political |
| Fast ice area from Dikson to Vilkitsky | Aggr. hot | 2 | Natural | Ice, environment |
| Shoreline from Laptev Strait to Long Strait | Aggr. hot | 2 | Natural | Ice, environment |
| Bering Strait | Aggr. hot | 2 | Natural and societal | Ice, indigenous peoples |
| Ice massifs | Issue-sp. hot | 1 | Natural | Ice |
| Polynyas/ice edges | Issue-sp. hot | 1 | Natural | Environment |
| Indigenous homelands | Issue-sp. hot | 1 | Societal | Culture/subsistence economy |
| Shoreline west of Ust-Olenëk | Issue-sp. hot | 1 | Natural | Environment |
| Estuaries | Issue-sp. hot | 1 | Natural | Environment |
| Reindeer migration routes | Issue-sp. hot | 1 | Natural | Environment |
| Areas between polynyas and 75°N in Kara Sea | Cool | 1 | Natural | Ice |
| Area north of polynyas and southeast of Taymyr Ice Massif | Cool | 1 | Natural | Ice |

and their premises need to be viewed and treated on an equal basis with those of the industry (Anderson 1995).

## The principles of AMSP and the approach of INSROP

The Arctic Council recognises that human activities affecting the Arctic marine environment should be managed in a way that promotes marine conservation and protection, biological diversity, and sustainable development. This is, according to the Council, 'best done through an ecosystem-based management approach which includes the consideration of several key features such as: multiple scales, long-term perspectives, humans as an integral part of ecosystems, adaptive management, and sustaining production potential for goods and services' (Arctic Council 2004: 7). The ecosystem approach and integrated management system depicted in the third draft of the AMSP, 'requires that development takes place in a way that minimizes the impact on the environment and integrates thinking across environmental, socio-economic, political and sectoral realms' (Arctic Council 2004: 7). The third draft of the AMSP is thus built on the principles and approaches adopted at the Earth Summit in 1992 and reconfirmed at the World Summit on Sustainable Development in 2002.

The INSROP approach reflects some of the same objectives as those laid down in the third draft of the AMSP and contains a set of interdisciplinary concepts construed to achieve integrative management across sectors. As illustrated above, the analysis was designed around two opposing variables: obstacles to and promoting factors of increasing navigation. These variables were broken down into two parameters: natural and societal. The natural parameters — ice, shoals, climatic conditions etc — are, with certain modifications, basically inflexible. That is, they have no ability of their own to adjust to changing circumstances. At the outset, these factors represent conditioned obstacles to increasing utilisation, in that they have only partly been outwitted by the application of adequate technology, know-how, and operational navigational experience. By contrast, the societal parameters — military, legal, political, administrative conditions — are manifestations of governmental decisions, which in principle can be altered and/or replaced by new political decisions. As such, they are flexible in character and possess to a certain extent the ability to adjust to changing circumstances.

INSROP sought to link the natural and societal parameters so as to better address the complexity, distribution, variability, interactional pattern, and value composition of the navigational challenges facing the NSR. This, the programme did by aggregating the above findings, aiming

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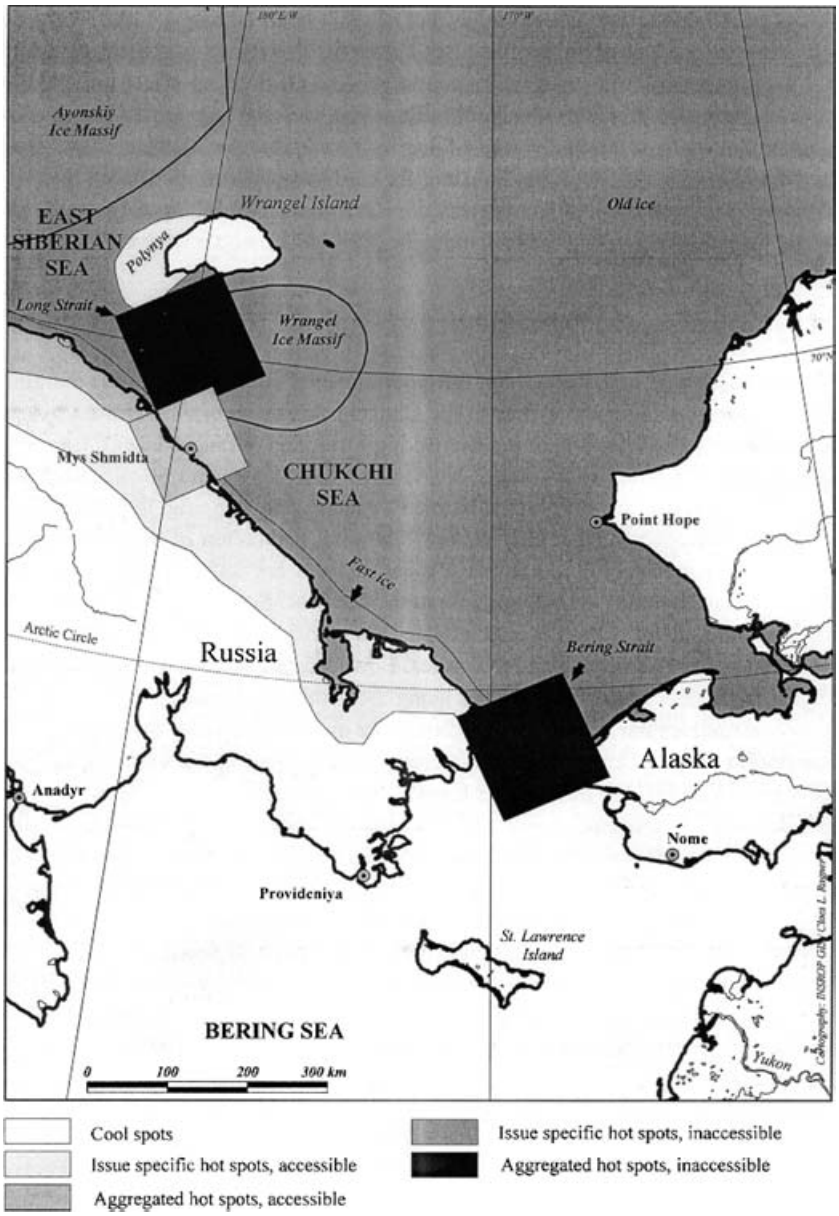



Fig. 2. Geographical spots of varying navigability in the Chukchi Sea during winter. Source: Østreng 1999a.

to identify geographical areas of the route where the parameters multiply, mix, interact, and cluster together, making the passage of ships a complex, multi-faceted challenge. INSROP called those areas the 'aggregated hot spots' of the NSR.

These hot spots have their counterparts in the 'cool spots' of the route — areas that host just one single navigational parameter (for instance sea ice) to be overcome without violating significantly the values of the parameter in question. The cool spots are uni-dimensional in two ways: both in the number of impediments to navigation involved, and in the number of parameters affected by navigation. This uni-dimensionality reduces the complexity of passage and navigation. On the other hand, geographical areas involving just a single parameter should not automatically be rated cool spots. Some such areas may host a parameter with a particularly high societal or natural value. Those areas were classified as 'issue-specific hot spots.'

The differences between the various categories of 'spots' should not be misinterpreted to mean that the cool spots are the only ones that permit navigation. The likelihood of passage will depend solely on the robustness of the parameter(s), whether they occur singly or in clusters. A single ice massif will more than suffice to block effectively the safe passage of any ship, whilst the combined effects of political, legal, and cultural factors at work in an aggregated hot spot may not be robust enough to impede passage. This implies that aggregated and issue-specific hot spots may appear in two different versions: both as areas accessible to navigation, and inaccessible to navigation. On the basis of these integrative concepts,

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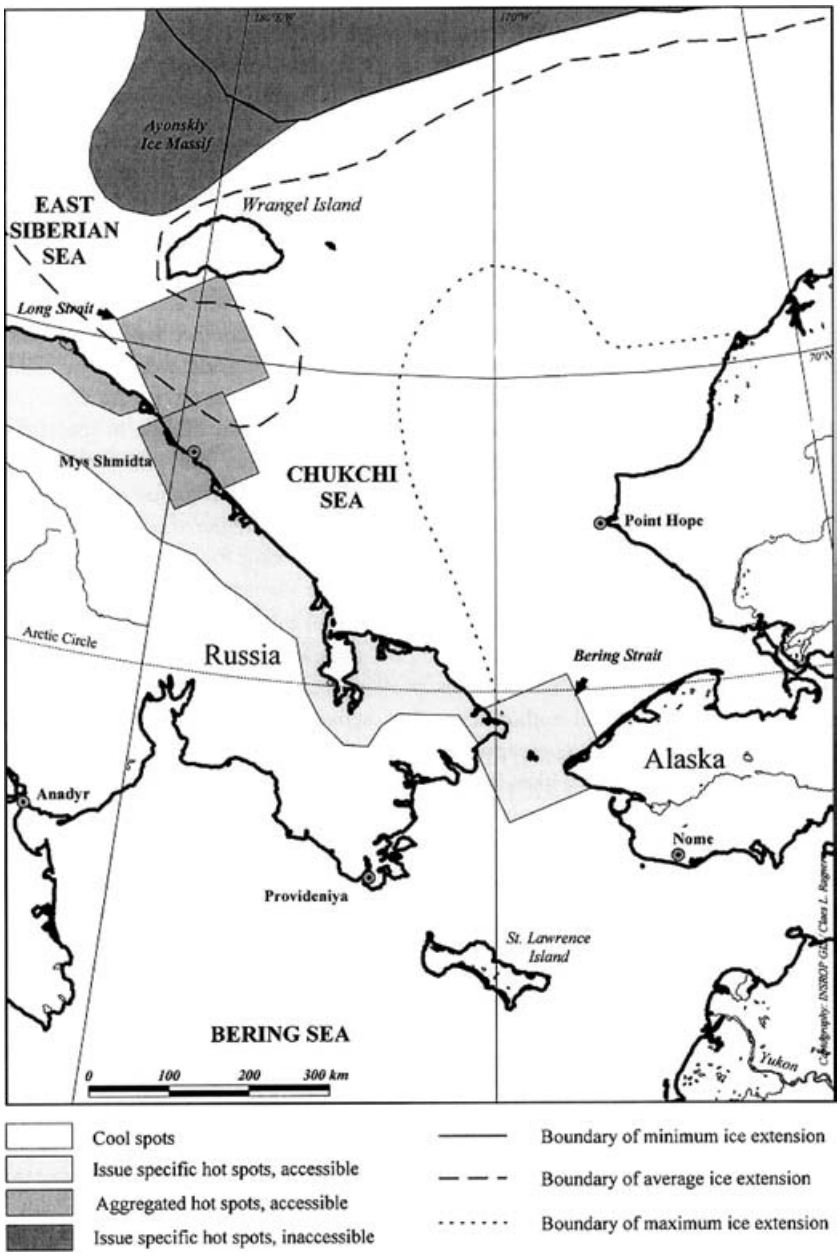



Fig. 3. Geographical hot spots of varying navigability in the Chukchi Sea during summmer. Source: Østreng 1999a.

the research findings for each of the marginal seas of the NSR are summarised in Table 1.

The concept of aggregated hot spots is introduced to highlight the number, quality, and value composition of parameters affected by navigation in a specific geographical area. Thus, an aggregated hot spot hosts a diversity of values/interests — societal and natural — clustering together into what could be termed 'socio-biodiversity,' all of which should be treated in a sustainable manner in order to reduce the likelihood of negative political reactions to increasing navigation. The sustainability of the socio-biodiversity of these areas may, in the course of time, prove mandatory to the longevity of Arctic navigation. Or, expressed in another way: these are the spots from where it can be determined if sustainability is part of the scheme of utilisation or not (Table 2; Fig. 2).

In the aggregated hot spots, the socio-biodiversity of the NSR is the most compound and the sustainability the most intricate. To cope, the extraordinary skills required to navigate in ice-infested waters must be supplemented with an operational insight into the workings of all aggregated hot spots. Thus, the craft of Arctic navigation will need to be extended and implemented with due regard for and understanding of the environmental values, legal obligations, political interests, sensitivities of national security, cultural needs, biological requirements etc, that are affected — and that may be at stake — due to the passage of ships through these complex hot spots.

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To preserve the socio-biodiversity of these spots, two preconditions have to be fulfilled: first, all the individual values/interests clustering together should be rendered the same degree of worthiness regarding preservation. This is to say that even if some of the parameters are more negatively affected by navigation than others, the ultimate goal should be that none should be harmed beyond repair and reestablishment. Second, the first precondition calls for a new and extended kind of navigation: 'multi-value navigation,' as opposed to 'single-value navigation.' The former will address both the economy involved in navigation and the sustainability of the socio-biodiversity of the aggregated hot spots, whilst the latter is basically preoccupied with meeting economic objectives. In this day and age, any attempts to apply the nineteenth-century 'Klondyke approach' to economic utilisation of these waters is likely to fail, and will most certainly be reported to the outside world by watchdog partisan organisations. There is a need for a new breed of sea-ice captains and crews to meet the integrated requirements of multi-value navigation in Arctic waters (Fig. 3) (Østreng 1999b).

## Conclusions

The ecosystem management approach laid down in the AMSP was not started on an empty purse. The integrative concepts of INSROP — although in need of further elaboration — may prove useful in the efforts to make the AMSP an operational document. The challenge of the twenty-first century is to conquer the aggregated hot spots of Arctic waterways in a sustainable manner, so as to preserve their socio-biodiversity by multi-value navigation on a year-round basis. The likelihood is that this is the century of the Northern Sea Route, marking its take-off in international all-year utilization. This may come early or late, but indications are that it will happen. The overall conclusions of INSROP support this assumption, saying that the technological and environmental challenges of the NSR 'are no longer absolute obstacles to commercial shipping (even in winter time), and that the route has a considerable commercial potential, which however is dependent on Russia's ability to accommodate the needs and requirements of international shipping' (Ragner 2000). If the extraordinary retreat and weakening of the sea ice-regime in recent decades are due to anthropogenic warming, such a conclusion gets additional validity.

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